PRCTI20250324

PUYALLUP PUBLIC SAFETY BUILDING: BENAROYA TENANT IMPROVEMENT

PUYALLUP WA 98374

Project 2170269.07

Project Manual

PERMIT / BID SET

MARCH 04 2025

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SECTION 00 01 07
SEALS PAGE

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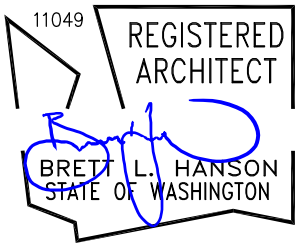

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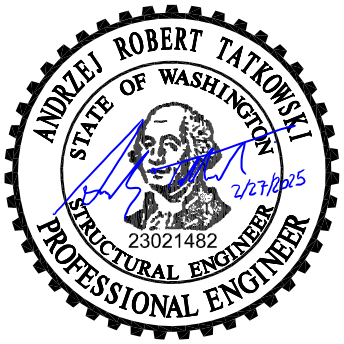

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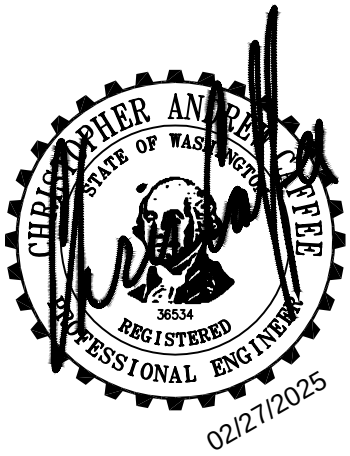

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SECTION 01 10 00
SUMMARY

PART 1 GENERAL

1.01 PROJECT

A. Project Name: Puyallup Public Safety Bldg TI (2170269.07)

B. Owner's Name: City of Puyallup

C. Building Owner's Name: Benaroya Group

D. Architect's Name: Mackenzie.

E. The Project consists of the construction of interior and exterior improvements to a ground floor TI space within an existing building.. Exterior improvements include but are not limited to the addition of three canopies, exterior doors, ballistic glazing provisions, new rooftop mechanical equipment, new rooftop antenna, new emergency generator, site improvements, and the provision of a secure ground level parking lot. Interior improvements include but are not limited to interior tenant improvement of primarily business office use, assembly training and classroom space, institutional temporary holding and support function storage space.

1.02 CONTRACT DESCRIPTION

A. Contract Type: A single prime contract based on a Stipulated Price as defined by Benaroya Group.

1.03 DESCRIPTION OF ALTERATIONS WORK

A. Scope of demolition and removal work is indicated on drawings and specified in Section 02 41 00.

B. Scope of alternates work is indicated on drawings, specifications and specified in Section 01 23 00.

C. Alter existing systems and add new constrcution as indicated on drawings and specifications.

1.04 WORK BY OWNER

A. Items noted NIC (Not in Contract) will be supplied and installed by Owner before Date of Substantial Completion.

1. Furniture (City of Puyallup vendor - Catalyst). General contractor and subcontractors required to coordinate with Owner vendor for sequencing and scheduling of material delivery, install, contractor electrical/telecom connection, and cleaning. In place furniture to be protected by general contractor from construction activities upon install.

2. Lockers, Mobile Shelving, Storage Solutions (Benaroya vendor - SW Solutions). General contractor and subcontractors required to coordinate with Owner vendor for sequencing and scheduling of material delivery, install, contractor electrical/telecom connection, and cleaning. In place materials to be protected by general contractor from construction activities upon install.

3. Fitness Equipment (City of Puyallup vendor - TBD). General contractor and subcontractors required to coordinate with Owner vendor for sequencing and scheduling of furniture delivery, install, and cleaning. In place equipment to be protected by general contractor from construction activities upon install.

4. Interview Room Systems (City of Puyallup vendor - Axon). General contractor and subcontractors required to coordinate with Owner vendor for sequencing and scheduling of interview rooms equipment installation. In place equipment/systems to be protected by general contractor from construction activities upon install.

5. Radio Systems (City of Puyallup vendor - Ron Taylor Fidelity Soluitons). Radio Systems including equipment, antenna wiring, and connections. General contractor and subcontractors required to coordinate with Owner vendor for sequencing and scheduling of radio systems equipment installation. In place equipment/systems to be protected by general contractor from construction activities upon install.

6. Server Systems (City of Puyallup - IT). General contractor and subcontractors required to coordinate with Owner IT for sequencing and scheduling of select server equipment installation and patching by Owner. In place equipment/systems to be protected by general contractor from construction activities upon install.

7. IT Equipment (City of Puyallup- IT). General contractor and subcontractors required to coordinate with Owner IT for sequencing and scheduling of IT equipment including by not limited to, copiers, printers, phones, computers, monitors, and records counter iPad. In place equipment/systems to be protected by general contractor from construction activities upon install.

8. Evidence Room Equipment (City of Puyallup). General contractor and subcontractors required to coordinate with Owner vendor for sequencing and scheduling of evidence room equipment installation including fingerprint hood and drying cabinet. In place equipment/systems to be protected by general contractor from construction activities upon install.

B. Owner will supply the following for installation by General Contractor:

1. Wifi devices and enclosures.

2. AED recessed cabinets and AED devices.

3. First aid cabinet.

4. Records counter iPad stand and credit card readers.

5. Two (2) signage plaques (dedication and time capsule)

6. Time capsule. Contractor to coordinate leaving cleanly cut opening in denoted wall (per drawings) with City of Puyallup. Upon installation of time capsule items Contractor to complete wall construction and finish to final condition.

1.05 OWNER OCCUPANCY

A. Owner intends to occupy the Project upon Substantial Completion.

B. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.

C. Schedule the Work to accommodate Owner occupancy.

1.06 CONTRACTOR USE OF SITE AND PREMISES

A. Provide access to and from site as required by law and by Building Owner: Benaroya Group

B. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.

C. Follow and abide by all restrictions stipulated by Building Owner: Benaroya Group

END OF SECTION 01 10 00

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SECTION 01 23 00
ALTERNATES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Description of Alternates.

B. Procedures for pricing Alternates.

C. Documentation of changes to Contract Sum and Contract Time.

1.02 RELATED REQUIREMENTS

1.03 ACCEPTANCE OF ALTERNATES

A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at Owner's option. Accepted Alternates will be identified in the Owner-Contractor Agreement.

B. Coordinate related work and modify surrounding work to integrate the Work of each Alternate.

1.04 SCHEDULE OF ALTERNATES

A. Alternate No. 1 - Ballistic Curtain Wall Assembly:

1. Base Bid Item: Section 08 80 00 Glazing and Drawing number A3.21 including A2.10, A3.22.

a. Summary: Base bid ballistic improvements includes ballistic laminate film system as specified at locations identified in drawings. Base bid new glazing system includes new storefront with ballistic laminate film system applied. Provide flashing, sealant, and weather barrier as required.

2. Alternate Item: Section 08 80 00 Glazing and Drawing number A3.21 including A2.10, A3.22.

a. Summary: Alternate 1 includes selective demolition of existing exterior windows in entirety located at the ground level slated for ballistic rated improvements as indicated on drawings. Provide ballistic rated curtain wall assembly including doors with ballistic rated lites per drawings . Provide flashing, sealant, and weather barrier as required.

B. Alternate No. 2A&2B - Additional Access Controls Future Proofing (2A), Full Installation (2B):

1. Base Bid Item: Section 08 71 00 Door Hardware and Drawing number A6.10 including Electrical & Telecom drawings.

a. Base Bid Summary: Refer to Construction Documents and Door Hardware specificaitons locations receiving card readers and associated electrical access hardware.

2. Alternate Item: Section 01 23 00 Alternates and Drawing number N/A including N/A.

a. Alternate 2A Summary: Provide conduit from above the ceiling space with pull strings to each door identified. Conduit to be included as necessary to support future installation of card reader access control system, door position switch and electrified door hardware at the following doors: B1006, B1007, B1008, A1013, A1014, A1015, A1016, A1017, A1018, A1024, A1025, A1026, A1027, A1028, A1029, A1032, A1033, A1034, A1036, A1039, A1040, A1041, A1042, A1043, A1044, A1045, A1046, A1047, A1048, A1049, A1050, A1051, A1052, A1053, A1054, A1055, A1059, A1060, A1079, A1080, A1081, A1082, A1083, A1084, A1085, A1086, A1087.

b. Alternate 2B Summary: Provide infrastructure and full installation of card reader access control system, door position switch and electrified door hardware for a fully functioning system at the following doors: B1006, B1007, B1008, A1013, A1014, A1015, A1016, A1017, A1018, A1024, A1025, A1026, A1027, A1028, A1029, A1032, A1033, A1034, A1036, A1039, A1040, A1041, A1042, A1043, A1044, A1045, A1046, A1047, A1048, A1049, A1050, A1051, A1052, A1053, A1054, A1055, A1059, A1060, A1079, A1080, A1081, A1082, A1083, A1084, A1085, A1086, A1087.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 01 23 00

SECTION 01 25 00
SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedural requirements for proposed substitutions.

1.02 RELATED REQUIREMENTS

A. Section 01 30 00 - Administrative Requirements: Submittal procedures, coordination.

B. Section 01 60 00 - Product Requirements: Fundamental product requirements, product options, delivery, storage, and handling.

1.03 DEFINITIONS

A. Substitutions: Changes from Contract Documents requirements proposed by General Contractor to materials, products, assemblies, and equipment.

1. Substitutions for Cause: Proposed due to changed Project circumstances beyond General Contractor's control.

a. Unavailability.

b. Regulatory changes.

c. Reduction in contract time.

d. Reduction in contract sum.

1.04 REFERENCE STANDARDS

A. CSI/CSC Form 1.5C - Substitution Request (During the Bidding/Negotiating Stage).

B. CSI/CSC Form 13.1A - Substitution Request (After the Bidding/Negotiating Phase).

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. A Substitution Request for products, assemblies, materials, and equipment constitutes a representation that the submitter:

1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system.

2. Agrees to provide the same warranty for the substitution as for the specified product.

3. Agrees to provide same or equivalent maintenance service and source of replacement parts, as applicable.

4. Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Owner.

5. Waives claims for additional costs or time extension that may subsequently become apparent.

6. Agrees to reimburse Owner and Architect for review or redesign services associated with re-approval by authorities.

B. A Substitution Request for specified installer constitutes a representation that the submitter:

1. Has acted in good faith to obtain services of specified installer, but was unable to come to commercial, or other terms.

C. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.

1. Note explicitly any non-compliant characteristics.

D. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.

1. Forms indicated and included in the Project Manual are adequate for this purpose, and must be used.

E. Limit each request to a single proposed substitution item.

1. Submit an electronic document, combining the request form with supporting data into single document.

3.02 SUBSTITUTION PROCEDURES DURING PROCUREMENT

A. Submittal Time Restrictions:

1. Owner will consider requests for substitutions only if submitted at least ____ calendar days prior to the date for receipt of bids.

B. Submittal Form (before award of contract):

1. Submit substitution requests by completing CSI/CSC Form 1.5C - Substitution Request. See this form for additional information and instructions. Use only this form; other forms of submission are unacceptable.

3.03 SUBSTITUTION PROCEDURES DURING CONSTRUCTION

A. Submittal Form (after award of contract):

1. Submit substitution requests by completing CSI/CSC Form 13.1A - Substitution Request (After Bidding/Negotiating). See this form for additional information and instructions. Use only this form; other forms of submission are unacceptable.

B. Submit request for Substitution for Cause within 14 calendar days of discovery of need for substitution, but not later than 14 calendar days prior to time required for review and approval by Architect, in order to stay on approved project schedule.

C. Substitutions will not be considered under one or more of the following circumstances:

1. When they are indicated or implied on shop drawing or product data submittals, without having received prior approval.

2. Without a separate written request.

3. When acceptance will require revisions to Contract Documents.

3.04 RESOLUTION

A. Architect may request additional information and documentation prior to rendering a decision. Provide this data in an expeditious manner.

B. Architect will notify General Contractor in writing of decision to accept or reject request.

1. Architect's decision following review of proposed substitution will be noted on the submitted form.

3.05 ACCEPTANCE

A. Accepted substitutions change the work of the Project. They will be documented and incorporated into work of the project by Change Order, Construction Change Directive, Architectural Supplementary Instructions, or similar instruments provided for in the Conditions of the Contract.

3.06 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

B. Include completed Substitution Request Forms as part of the Project record. Include both approved and rejected Requests.

END OF SECTION 01 25 00

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SECTION 01 30 00
ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General administrative requirements.

B. Electronic document submittal service.

C. Preconstruction meeting.

D. Site mobilization meeting.

E. Progress meetings.

F. Construction progress schedule.

G. Coordination drawings.

H. Submittals for review, information, and project closeout.

I. Number of copies of submittals.

J. Requests for Information (RFI) procedures.

K. Submittal procedures.

L. Electronic Data Transfer.

1.02 RELATED REQUIREMENTS

A. Section 01 40 00 - Quality Requirements.

B. Section 01 60 00 - Product Requirements: General product requirements.

C. Section 01 70 00 - Execution and Closeout Requirements: Additional coordination requirements.

D. Section 01 78 00 - Closeout Submittals: Project record documents; operation and maintenance data; warranties and bonds.

1.03 GENERAL ADMINISTRATIVE REQUIREMENTS

A. Comply with requirements of Section 01 70 00 - Execution and Closeout Requirements for coordination of execution of administrative tasks with timing of construction activities.

B. Make the following types of submittals to Architect:

1. Requests for Information (RFI).

2. Requests for substitution.
3. Shop drawings, product data, and samples.
4. Test and inspection reports.
5. Design data.
6. Manufacturer's instructions and field reports.
7. Applications for payment and change order requests (concurrent to Building Owner review)
8. Progress schedules.
9. Coordination drawings.
10. Correction Punch List and Final Correction Punch List for Substantial Completion.
11. Closeout submittals.

1.04 PROJECT COORDINATOR

A. Project Coordinator: Construction Manager (Building Owner - Benaroya Group)

B. Cooperate with the Project Coordinator in allocation of mobilization areas of site; for field offices and sheds, for site and building access, traffic, and parking facilities.

C. During construction, coordinate use of site and facilities through the Project Coordinator.

D. Comply with Project Coordinator's procedures for intra-project communications; submittals, reports and records, schedules, coordination drawings, and recommendations; and resolution of ambiguities and conflicts.

E. Comply with instructions of the Project Coordinator for use of temporary utilities and construction facilities. Responsibility for providing temporary utilities and construction facilities is identified in Section 01 10 00 - Summary.

F. Coordinate field engineering and layout work under instructions of the Project Coordinator.

G. Make the following types of submittals to Architect through the Project Coordinator:

1. Applications for payment and change order requests.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 ELECTRONIC DOCUMENT SUBMITTAL SERVICE

A. All documents transmitted for purposes of administration of the contract are to be in electronic (PDF, MS Word, or MS Excel) format, as appropriate to the document, and transmitted via an Internet-based submittal service that receives, logs and stores documents, provides electronic stamping and signatures, and notifies addressees via email.

1. Besides submittals for review, information, and closeout, this procedure applies to Requests for Information (RFIs), progress documentation, contract modification documents (e.g. supplementary instructions, change proposals, change orders), applications for payment, field reports and meeting minutes, General Contractor's correction punchlist, and any other document any participant wishes to make part of the project record.

2. General Contractor and Architect are required to use this service.

3. It is General Contractor's responsibility to submit documents in allowable format.

4. Subcontractors, suppliers, and Architect's consultants are to be permitted to use the service at no extra charge.

5. Users of the service need an email address, internet access, and PDF review software that includes ability to mark up and apply electronic stamps (such as Adobe Acrobat, www.adobe.com, or Bluebeam PDF Revu, www.bluebeam.com), unless such software capability is provided by the service provider.

6. Paper document transmittals will not be reviewed; emailed electronic documents will not be reviewed.

7. All other specified submittal and document transmission procedures apply, except that electronic document requirements do not apply to samples or color selection charts.

B. Submittal Service: The selected service is:

1. Procore (tel: 1-866-477-6267): www.procore.com.

C. Project Closeout: Architect will determine when to terminate the service for the project and is responsible for obtaining archive copies of files for Owner.

3.02 PRECONSTRUCTION MEETING

A. Project Coordinator will schedule a meeting after Notice of Award.

B. Attendance Required:

1. Owner.
2. Architect.
3. Project Coordinator
4. General Contractor.
5. Major Subcontractors.

C. Agenda:

1. Execution of Owner-General Contractor Agreement.
2. Submission of executed bonds and insurance certificates.
3. Distribution of Contract Documents.
4. Submission of list of subcontractors, list of products, schedule of values, and progress schedule.
5. Submission of initial Submittal schedule.
6. Designation of personnel representing the parties to Contract.
7. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
8. Scheduling.

D. General Contractor will record minutes and distribute copies within two calendar days after meeting to participants, with two copies to Project Coordinator, Architect, Owner, participants, and those affected by decisions made.

3.03 SITE MOBILIZATION MEETING

A. Project Coordinator will schedule meeting at the Project site prior to General Contractor occupancy.

B. Attendance Required:

1. General Contractor.
2. Owner.
3. Project Coordinator.
4. General Contractor's superintendent.
5. Major subcontractors.

C. Agenda:

1. Use of premises by Owner and General Contractor.
2. Building Owner's requirements.
3. Construction facilities and controls provided by Building Owner.
4. Temporary utilities provided by Building Owner.
5. Survey and building layout.
6. Security and housekeeping procedures.
7. Schedules.
8. Application for payment procedures.
9. Procedures for testing.
10. Procedures for maintaining record documents.
11. Requirements for start-up of equipment.
12. Inspection and acceptance of equipment put into service during construction period.

D. General Contractor will record minutes and distribute copies within two calendar days after meeting to participants, with two copies to Project Coordinator, Architect, Owner, participants, and those affected by decisions made.

3.04 PROGRESS MEETINGS

A. General Contractor, in coordination with Project Coordinator, will make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.

B. Attendance Required:

1. General Contractor.
2. Owner.
3. Architect.
4. General Contractor's superintendent.
5. Project Coordinator.
6. Major subcontractors as required.

C. Agenda:

1. Review minutes of previous meetings.

2. Review of work progress.
3. Field observations, problems, and decisions.
4. Identification of problems that impede, or will impede, planned progress.
5. Review of submittals schedule and status of submittals.
6. Review of RFIs log and status of responses.
7. Review of off-site fabrication and delivery schedules.
8. Maintenance of progress schedule.
9. Corrective measures to regain projected schedules.
10. Planned progress during succeeding work period.
11. Maintenance of quality and work standards.
12. Effect of proposed changes on progress schedule and coordination.
13. Other business relating to work.

D. General Contractor will record minutes and distribute copies within two calendar days after meeting to participants, with two copies to Project Coordinator, Architect, Owner, participants, and those affected by decisions made.

3.05 CONSTRUCTION PROGRESS SCHEDULE

A. Within 10 calendar days after date of the Agreement, submit preliminary schedule defining planned operations for the first 60 days of work, with a general outline for remainder of work.

B. If preliminary schedule requires revision after review, submit revised schedule within 5 calendar days.

C. Within 10 calendar days after review of preliminary schedule, submit draft of proposed complete schedule for review.

1. Include written certification that major contractors have reviewed and accepted proposed schedule.

D. Within 10 calendar days after joint review, submit complete schedule.

E. Submit updated schedule with each Application for Payment.

3.06 COORDINATION DRAWINGS

A. If a conflict occurs, the Contractor is deemed to have bid the more expensive method of performing the work.

B. General Contractor to coordinate data/electrical outlet locations with final furniture plan.

3.07 REQUESTS FOR INFORMATION (RFI)

A. Definition: A request seeking one of the following:

1. An interpretation, amplification, or clarification of some requirement of Contract Documents arising from inability to determine from them the exact material, process, or system to be installed; or when the elements of construction are required to occupy the same space (interference); or when an item of work is described differently at more than one place in Contract Documents.

B. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.

1. Prepare a separate RFI for each specific item.

a. Review, coordinate, and comment on requests originating with subcontractors and/or materials suppliers.

b. Do not forward requests which solely require internal coordination between subcontractors.

2. Prepare using software provided by the Electronic Document Submittal Service.

C. Reason for the RFI: Prior to initiation of an RFI, carefully study all Contract Documents to confirm that information sufficient for their interpretation is definitely not included.

1. Unacceptable Uses for RFIs: Do not use RFIs to request the following::

a. Approval of submittals (use procedures specified elsewhere in this section).

b. Approval of substitutions (see Section - 01 60 00 - Product Requirements)

c. Changes that entail change in Contract Time and Contract Sum (comply with provisions of the Conditions of the Contract).

d. Different methods of performing work than those indicated in the Contract Drawings and Specifications (comply with provisions of the Conditions of the Contract).

2. Improper RFIs: Requests not prepared in compliance with requirements of this section, and/or missing key information required to render an actionable response. They will be returned without a response, with an explanatory notation.

3. Frivolous RFIs: Requests regarding information that is clearly indicated on, or reasonably inferable from, Contract Documents, with no additional input required to clarify the question. They will be returned without a response, with an explanatory notation.

a. The Owner reserves the right to assess the General Contractor for the costs (on time-and-materials basis) incurred by the Architect, and any of its consultants, due to processing of such RFIs.

D. Content: Include identifiers necessary for tracking the status of each RFI, and information necessary to provide an actionable response.

1. Official Project name and number, and any additional required identifiers established in Contract Documents.

2. Discrete and consecutive RFI number, and descriptive subject/title.

3. Issue date, and requested reply date.

4. Reference to particular Contract Document(s) requiring additional information/interpretation. Identify pertinent drawing and detail number and/or specification section number, title, and paragraph(s).

5. Annotations: Field dimensions and/or description of conditions which have engendered the request.

6. General Contractor's suggested resolution: A written and/or a graphic solution, to scale, is required in cases where clarification of coordination issues is involved, for example; routing, clearances, and/or specific locations of work shown diagrammatically in Contract Documents. If applicable, state the likely impact of the suggested resolution on Contract Time or the Contract Sum.

E. Attachments: Include sketches, coordination drawings, descriptions, photos, submittals, and other information necessary to substantiate the reason for the request.

F. RFI Log: Prepare and maintain a tabular log of RFIs for the duration of the project.

1. Indicate current status of every RFI. Update log promptly and on a regular basis.

2. Note dates of when each request is made, and when a response is received.

3. Highlight items requiring priority or expedited response.

G. Review Time: Architect will respond and return RFIs to General Contractor within seven calendar days of receipt. For the purpose of establishing the start of the mandated response period, RFIs received after 12:00 noon will be considered as having been received on the following regular working day.

1. Response period may be shortened or lengthened for specific items, subject to mutual agreement, and recorded in a timely manner in progress meeting minutes.

H. Responses: Content of answered RFIs will not constitute in any manner a directive or authorization to perform extra work or delay the project. If in General Contractor's belief it is likely to lead to a change to Contract Sum or Contract Time, promptly issue a notice to this effect, and follow up with an appropriate Change Order request to Owner.

1. Response may include a request for additional information, in which case the original RFI will be deemed as having been answered, and an amended one is to be issued forthwith. Identify the amended RFI with an R suffix to the original number.

2. Do not extend applicability of a response to specific item to encompass other similar conditions, unless specifically so noted in the response.

3. Upon receipt of a response, promptly review and distribute it to all affected parties, and update the RFI Log.

4. Notify Architect within seven calendar days if an additional or corrected response is required by submitting an amended version of the original RFI, identified as specified above.

3.08 SUBMITTAL SCHEDULE

A. Submit to Architect for review a schedule for submittals in tabular format.

1. Submit at the same time as the preliminary schedule specified in Section - 01 32 16 - Construction Progress Schedule.

2. Coordinate with General Contractor's construction schedule and schedule of values.

3. Arrange information to include scheduled date for initial submittal, specification number and title, submittal category (for review or for information), description of item of work covered, and role and name of subcontractor.

3.09 SUBMITTALS FOR REVIEW

A. When the following are specified in individual sections, submit them for review:

1. Product data.

2. Shop drawings.

3. Samples for selection.

4. Samples for verification.

B. Submit to Architect for review for the limited purpose of checking for compliance with information given and the design concept expressed in Contract Documents.

C. Samples will be reviewed for aesthetic, color, or finish selection.

D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01 78 00 - Closeout Submittals.

3.10 SUBMITTALS FOR INFORMATION

A. When the following are specified in individual sections, submit them for information:

1. Design data.
2. Certificates.
3. Test reports.
4. Inspection reports.
5. Manufacturer's instructions.
6. Manufacturer's field reports.
7. Other types indicated.

B. Submit for Architect's knowledge as contract administrator or for Owner.

3.11 SUBMITTALS FOR PROJECT CLOSEOUT

A. Submit Correction Punch List for Substantial Completion.

B. Submit Final Correction Punch List for Substantial Completion.

C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 01 78 00 - Closeout Submittals:

1. Project record documents.
2. Operation and maintenance data.
3. Warranties.
4. Bonds.
5. Other types as indicated.

D. Submit for Owner's benefit during and after project completion.

3.12 NUMBER OF COPIES OF SUBMITTALS

A. Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.

B. Documents for Project Closeout: Make one reproduction of submittal originally reviewed. Submit one extra of submittals for information.

C. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.

1. After review, produce duplicates.

2. Retained samples will not be returned to General Contractor unless specifically so stated.

3.13 SUBMITTAL PROCEDURES

A. General Requirements:

1. Sequentially identify each item. For revised submittals use original number and a sequential numerical suffix.

2. Identify: Project; General Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.

3. Apply General Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.

a. Submittals from sources other than the General Contractor, or without General Contractor's stamp will not be acknowledged, reviewed, or returned.

4. Deliver each submittal on date noted in submittal schedule, unless an earlier date has been agreed to by all affected parties, and is of the benefit to the project.

a. Upload submittals in electronic form to Electronic Document Submittal Service website.

5. Schedule submittals to expedite the Project, and coordinate submission of related items.

a. For each submittal for review, allow 15 calendar days excluding delivery time to and from the General Contractor.

b. For sequential reviews involving Architect's consultants, Owner, or another affected party, allow an additional 7 calendar days.

c. For sequential reviews involving approval from authorities having jurisdiction (AHJ), in addition to Architect's approval, allow an additional 30 calendar days.

6. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.

7. Provide space for General Contractor and Architect review stamps.

8. When revised for resubmission, identify all changes made since previous submission.

9. Distribute reviewed submittals. Instruct parties to promptly report inability to comply with requirements.

10. Incomplete submittals will not be reviewed, unless they are partial submittals for distinct portion(s) of the work, and have received prior approval for their use.

11. Submittals not requested will not be recognized or processed.

B. Product Data Procedures:

1. Submit only information required by individual specification sections.

2. Collect required information into a single submittal.

3. Do not submit (Material) Safety Data Sheets for materials or products.

C. Shop Drawing Procedures:

1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.

2. Do not reproduce Contract Documents to create shop drawings.

3. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.

D. Samples Procedures:

1. Transmit related items together as single package.

2. Identify each item to allow review for applicability in relation to shop drawings showing installation locations.

E. Transmit each submittal with approved form.

F. Deferred Submittals as identified in the drawings and individual specification sections are the responsibility of the General Contractor.

1. The General Contractor is responsible for submitting deferred submittals to the A/E for review to determine compliance with design intent.

2. The General Contractor is responsible for ensuring required deferred submittals are stamped by a Licensed Engineer in the state where the project is located prior to submission to the Architect.

3. After receipt of A/E review, the Architect will submit the deferred submittal to the AHJ (Authority Having Jurisdiction) for review and approval.

4. The Client is responsible for all fees associated with deferred submittals.

3.14 SUBMITTAL REVIEW

A. Submittals for Review: Architect will review each submittal and stamp them with direction for action as appropriate.

1. Submittals for review by other Licensed Professionals (Consultants) will be reviewed by Architect after Consultants have completed their review and stamped with their review comments attached to the submittal. The review by Architect will be for coordination and architectural content only. Once the Architect has completed the review, Architect will dual stamp the submittal.

B. Submittals for Information: Architect will acknowledge receipt and review. See below for actions to be taken.

C. Architect's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.

1. Notations may be made directly on submitted items and/or listed on appended Submittal Review cover sheet.

D. Architect's and consultants' actions on items submitted for review:

1. Authorizing purchasing, fabrication, delivery, and installation:

a. "No exceptions noted", or language with same legal meaning.

b. "Make corrections noted", or language with same legal meaning.

1) At General Contractor's option, submit corrected item, with review notations acknowledged and incorporated.

2. Not Authorizing fabrication, delivery, and installation:

a. "Revise and Resubmit".

1) Resubmit revised item, with review notations acknowledged and incorporated.

2) Non-responsive resubmittals may be rejected.

b. "Rejected".

1) Submit item complying with requirements of Contract Documents.

E. Architect's and consultants' actions on items submitted for information:

1. Items for which no action was taken:

a. "Received" - to notify the General Contractor that the submittal has been received for record only.

2. Items for which action was taken:

a. "Reviewed" - no further action is required from General Contractor.

3.15 ELECTRONIC DATA TRANSFER

A. General: The Drawings contained in the contract documents were prepared in part or in their entirety, on computers using Computer Aided Design software.

B. Contractor's Use of Electronic Media: Architect may make Site Plans, Floor Plans, and Reflected Ceiling Plans available to Contractor as Electronic Media, after the contract is executed, to help expedite preparation of required submittal documents.

C. Conditions of use: In order to receive electronic files, Contractor must make a written or request to Architect. Data transfer protocol will include an electronic document release.

D. Status of Electronic Media: Electronic Media are NOT part of the contract. Contractor assumes full liability for information and conclusions made from them.

END OF SECTION 01 30 00

SECTION 01 40 00
QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Submittals.

B. Quality assurance.

C. References and standards.

D. Testing and inspection agencies and services.

E. Control of installation.

F. Mock-ups.

G. Defect Assessment.

1.02 RELATED REQUIREMENTS

A. Section 01 30 00 - Administrative Requirements: Submittal procedures.

B. Section 01 60 00 - Product Requirements: Requirements for material and product quality.

1.03 REFERENCE STANDARDS

A. IAS AC89 - Accreditation Criteria for Testing Laboratories.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Test Reports: After each test/inspection, promptly submit electronic copies of report to Architect and to General Contractor.

1. Include:

a. Date issued.

b. Project title and number.

c. Name of inspector.

d. Date and time of sampling or inspection.

e. Identification of product and specifications section.

f. Location in the Project.

g. Type of test/inspection.

h. Date of test/inspection.

i. Results of test/inspection.

j. Compliance with Contract Documents.

k. When requested by Architect, provide interpretation of results.

2. Test report submittals are for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.

C. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

1.05 QUALITY ASSURANCE

A. Testing Agency Qualifications:

1. Prior to start of work, submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.

2. Qualification Statement: Provide documentation showing testing laboratory is accredited under IAS AC89.

1.06 REFERENCES AND STANDARDS

A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Comply with reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.

C. Obtain copies of standards where required by product specification sections.

D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.

E. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.

F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect shall be altered from Contract Documents by mention or inference otherwise in any reference document.

1.07 TESTING AND INSPECTION AGENCIES AND SERVICES

A. Building Owner will employ and pay for services of an independent testing agency to perform specified testing.

B. Employment of agency in no way relieves General Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

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

B. Comply with manufacturers' instructions, including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.

D. Comply with specified standards as minimum quality for the work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Have work performed by persons qualified to produce required and specified quality.

F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.

G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.02 MOCK-UPS

A. Accepted mock-ups establish the standard of quality the Architect will use to judge the Work.

B. Tests shall be performed under provisions identified in this section and identified in the respective product specification sections.

C. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.

D. Architect will use accepted mock-ups as a comparison standard for the remaining Work.

E. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed, protect mock-up throughout construction, remove mock-up and clear area when directed to do so by Architect.

3.03 TESTING AND INSPECTION

A. Testing Agency Duties:

1. Provide qualified personnel at site. Cooperate with Architect and General Contractor in performance of services.

2. Perform specified sampling and testing of products in accordance with specified standards.

3. Ascertain compliance of materials and mixes with requirements of Contract Documents.

4. Promptly notify Architect and General Contractor of observed irregularities or non-compliance of Work or products.

5. Perform additional tests and inspections required by Architect.

6. Submit reports of all tests/inspections specified.

B. Limits on Testing/Inspection Agency Authority:

1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.

2. Agency may not approve or accept any portion of the Work.

3. Agency may not assume any duties of General Contractor.

4. Agency has no authority to stop the Work.

C. General Contractor Responsibilities:

1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.

2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.

3. Provide incidental labor and facilities:

a. To provide access to Work to be tested/inspected.

b. To obtain and handle samples at the site or at source of Products to be tested/inspected.

c. To facilitate tests/inspections.

d. To provide storage and curing of test samples.

4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.

5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by General Contractor beyond specified requirements.

6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by General Contractor beyond specified requirements.

D. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.

E. Re-testing required because of non-compliance with specified requirements shall be paid for by General Contractor.

F. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by Architect. Payment for re-testing will be charged to the General Contractor by deducting testing charges from the Contract Price.

3.04 DEFECT ASSESSMENT

A. Replace Work or portions of the Work not complying with specified requirements.

END OF SECTION 01 40 00

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SECTION 01 50 00
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary Controls: Barriers, enclosures, and fencing.

B. Security requirements.

C. Waste removal facilities and services.

D. Removal of utilities, facilities and controls.

1.02 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

B. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

1.03 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

B. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building.

C. Provide protection for plants designated to remain. Replace damaged plants.

D. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.04 FENCING

A. Provide 6 foot high fence around construction site; equip with vehicular and pedestrian gates with locks.

1.05 INTERIOR ENCLOSURES

A. Provide temporary partitions and ceilings as indicated to separate work areas from Owner-occupied areas, to prevent penetration of dust and moisture into Owner-occupied areas, and to prevent damage to existing materials and equipment.

B. Construction: Framing and reinforced polyethylene sheet materials with closed joints and sealed edges at intersections with existing surfaces:

1. STC rating of 35 in accordance with ASTM E90.

2. Maximum flame spread rating of 75 in accordance with ASTM E84.

1.06 SECURITY

A. Coordinate security with Building Owner's operations from unauthorized entry, vandalism, or theft.

1.07 VEHICULAR ACCESS AND PARKING

A. Coordinate access and haul routes with Building Owner.

B. Provide and maintain access to fire hydrants, free of obstructions.

C. Not used.

D. Not used.

1.08 WASTE REMOVAL

A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.

B. Provide containers with lids. Remove trash from site periodically.

C. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.

D. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 01 50 00

SECTION 01 60 00
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General product requirements.

B. Re-use of existing products.

C. Transportation, handling, storage and protection.

D. Product option requirements.

E. Substitution limitations.

F. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 RELATED REQUIREMENTS

A. Section 01 25 00 - Substitution Procedures: Substitutions made during procurement and/or construction phases.

B. Section 01 40 00 - Quality Requirements: Product quality monitoring.

C. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions: Requirements for VOC-restricted product categories.

D. Section 01 74 19 - Construction Waste Management and Disposal: Waste disposal requirements potentially affecting product selection, packaging and substitutions.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements.

B. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

C. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

D. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.

1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

PART 2 PRODUCTS

2.01 EXISTING PRODUCTS

A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by Contract Documents.

B. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the Owner, or otherwise indicated as to remain the property of the Owner, become the property of the General Contractor; remove from site.

2.02 NEW PRODUCTS

A. Provide new products unless specifically required or permitted by Contract Documents.

B. Use of products having any of the following characteristics is not permitted:

1. Made of wood from newly cut old growth timber.

2. Containing lead, cadmium, or asbestos.

C. Where other criteria are met, General Contractor shall give preference to products that:

1. If used on interior, have lower emissions, as defined in Section 01 61 16.

2. If wet-applied, have lower VOC content, as defined in Section 01 61 16.

2.03 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

2.04 MAINTENANCE MATERIALS

A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.

B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 SUBSTITUTION REQUESTS

A. See Section 01 25 00 - Substitution Procedures.

3.02 TRANSPORTATION AND HANDLING

A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.

B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.

C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.

D. Transport and handle products in accordance with manufacturer's instructions.

E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.

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

G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.

H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.03 STORAGE AND PROTECTION

A. Provide protection of stored materials and products against theft, casualty, or deterioration.

B. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. See Section 01 74 19.

C. Store and protect products in accordance with manufacturers' instructions.

D. Store with seals and labels intact and legible.

E. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.

F. For exterior storage of fabricated products, place on sloped supports above ground.

G. Provide off-site storage and protection when site does not permit on-site storage or protection.

H. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.

I. Comply with manufacturer's warranty conditions, if any.

J. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

K. Prevent contact with material that may cause corrosion, discoloration, or staining.

L. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

M. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION 01 60 00

SECTION 01 61 16
VOLATILE ORGANIC COMPOUND (VOC) CONTENT RESTRICTIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for Indoor-Emissions-Restricted products.

B. Requirements for VOC-Content-Restricted products.

1.02 DEFINITIONS

A. Indoor-Emissions-Restricted Products: All products in the following product categories, whether specified or not:

1. Interior paints and coatings applied on site.
2. Interior adhesives and sealants applied on site, including flooring adhesives.
3. Flooring.
4. Composite wood.
5. Products making up wall and ceiling assemblies.
6. Thermal and acoustical insulation.

B. VOC-Content-Restricted Products: All products in the following product categories, whether specified or not:

1. Interior paints and coatings applied on site.
2. Interior adhesives and sealants applied on site, including flooring adhesives.

C. Interior of Building: Anywhere inside the exterior weather barrier.

D. Adhesives: All gunnable, trowelable, liquid-applied, and aerosol adhesives, whether specified or not; including flooring adhesives, resilient base adhesives, and pipe jointing adhesives.

E. Sealants: All gunnable, trowelable, and liquid-applied joint sealants and sealant primers, whether specified or not; including firestopping sealants and duct joint sealers.

F. Inherently Non-Emitting Materials: Products composed wholly of minerals or metals, unless they include organic-based surface coatings, binders, or sealants; and specifically the following:

1. Concrete.
2. Clay brick.

3. Metals that are plated, anodized, or powder-coated.
4. Glass.
5. Ceramics.
6. Solid wood flooring that is unfinished and untreated.

1.03 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency.

B. ASTM D3960 - Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings.

C. CARB (SCM) - Suggested Control Measure for Architectural Coatings; California Air Resources Board.

D. SCAQMD 1113 - Architectural Coatings.

E. SCAQMD 1168 - Adhesive and Sealant Applications.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: For each VOC-restricted product used in the project, submit evidence of compliance.

1.05 QUALITY ASSURANCE

A. VOC Content Test Method: 40 CFR 59, Subpart D (EPA Method 24), or ASTM D3960, unless otherwise indicated.

1. Evidence of Compliance: Acceptable types of evidence are:

a. Report of laboratory testing performed in accordance with requirements.

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

PART 2 PRODUCTS

2.01 MATERIALS

A. VOC-Content-Restricted Products: VOC content not greater than required by the following:

1. Adhesives, Including Flooring Adhesives: SCAQMD 1168 Rule.
2. Joint Sealants: SCAQMD 1168 Rule.

3. Paints and Coatings: Each color; most stringent of the following:

    a. 40 CFR 59, Subpart D.

    b. SCAQMD 1113 Rule.

    c. CARB (SCM).

PART 3 EXECUTION

3.01 FIELD QUALITY CONTROL

A. Owner reserves the right to reject non-compliant products, whether installed or not, and require their removal and replacement with compliant products at no extra cost to Owner.

B. Additional costs to restore indoor air quality due to installation of non-compliant products will be borne by General Contractor.

END OF SECTION 01 61 16

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SECTION 01 70 00
EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.

B. Pre-installation meetings.

C. Cutting and patching.

D. Surveying for laying out the work.

E. Cleaning and protection.

F. Demonstration and instruction of Owner personnel.

G. Closeout procedures, including General Contractor's Correction Punch List, except payment procedures.

H. General requirements for maintenance service.

1.02 RELATED REQUIREMENTS

A. Section 01 10 00 - Summary: Limitations on working in existing building; continued occupancy; work sequence; identification of salvaged and relocated materials.

B. Section 01 30 00 - Administrative Requirements: Submittals procedures, Electronic document submittal service.

C. Section 01 40 00 - Quality Requirements: Testing and inspection procedures.

D. Section 01 50 00 - Temporary Facilities and Controls: Temporary exterior enclosures.

E. Section 01 50 00 - Temporary Facilities and Controls: Temporary interior partitions.

F. Section 01 78 00 - Closeout Submittals: Project record documents, operation and maintenance data, warranties, and bonds.

G. Section 01 79 00 - Demonstration and Training: Demonstration of products and systems to be commissioned and where indicated in specific specification sections

H. Section 07 84 00 - Firestopping.

1.03 REFERENCE STANDARDS

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

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.

1. On request, submit documentation verifying accuracy of survey work.

2. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in compliance with Contract Documents.

3. Submit surveys and survey logs for the project record.

C. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:

1. Structural integrity of any element of Project.

2. Integrity of weather exposed or moisture resistant element.

3. Efficiency, maintenance, or safety of any operational element.

4. Visual qualities of sight exposed elements.

5. Work of Owner or separate Contractor.

1.05 QUALIFICATIONS

A. For surveying work, employ a land surveyor registered in Project Location State and acceptable to Architect. Submit evidence of surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate. Employ only individual(s) trained and experienced in collecting and recording accurate data relevant to ongoing construction activities,

1.06 PROJECT CONDITIONS

A. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.

B. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

C. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.

D. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.

E. Rodent Control: Provide methods, means, and facilities to prevent rodents from accessing or invading premises.

F. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

1.07 COORDINATION

A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

B. Notify affected utility companies and comply with their requirements.

C. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

D. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

E. In finished areas conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

F. Coordinate completion and clean-up of work of separate sections.

G. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

A. New Materials: As specified in product sections; match existing products and work for patching and extending work.

B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.

C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.

B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.

D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.

E. Verify that utility services are available, of the correct characteristics, and in the correct locations.

F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

D. Prepare surfaces and remove surface finishes to provide for proper installation of new work and finishes.

3.03 PREINSTALLATION MEETINGS

A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.

B. Require attendance of parties directly affecting, or affected by, work of the specific section.

C. Notify Architect four days in advance of meeting date.

D. Prepare agenda and preside at meeting:

1. Review conditions of examination, preparation and installation procedures.

2. Review coordination with related work.

E. General Contractor to record minutes and distribute copies within two days after meeting to participants, with two copies to Project Coordinator, Architect, Owner, participants, and those affected by decisions made.

3.04 LAYING OUT THE WORK

A. Verify locations of survey control points prior to starting work.

B. Promptly notify Architect of any discrepancies discovered.

C. Protect survey control points prior to starting site work; preserve permanent reference points during construction.

D. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.

E. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.

F. Utilize recognized engineering survey practices.

G. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:

1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations; and _____.

2. Grid or axis for structures.

3. Building foundation, column locations, ground floor elevations, and _____.

H. Periodically verify layouts by same means.

I. Maintain a complete and accurate log of control and survey work as it progresses.

3.05 GENERAL INSTALLATION REQUIREMENTS

A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.

B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.

C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.

D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.

E. Make neat transitions between different surfaces, maintaining texture and appearance.

3.06 ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.

1. Verify that construction and utility arrangements are as indicated.

2. Report discrepancies to Architect before disturbing existing installation.

3. Beginning of alterations work constitutes acceptance of existing conditions.

B. Keep areas in which alterations are being conducted separated from other areas that are still occupied.

1. Provide, erect, and maintain temporary dustproof partitions of construction as required by Building Owner .

C. Remove existing work as indicated and as required to accomplish new work.

1. Remove items indicated on drawings.

2. Relocate items indicated on drawings.

3. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.

4. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.

D. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.

1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.

2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.

3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.

a. Disable existing systems only to make switchovers and connections; minimize duration of outages.

b. Provide temporary connections as required to maintain existing systems in service.

4. Verify that abandoned services serve only abandoned facilities.

5. Remove abandoned pipe, ducts, conduits, and equipment , including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.

E. Protect existing work to remain.

1. Prevent movement of structure; provide shoring and bracing if necessary.
2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
3. Repair adjacent construction and finishes damaged during removal work.

F. Adapt existing work to fit new work: Make as neat and smooth transition as possible.

G. Where removal of partitions or walls results in adjacent spaces becoming one, rework floors, walls, and ceilings to a smooth plane without breaks, steps, or bulkheads.

H. Where a change of plane of 1/4 inch or more occurs in existing work, submit recommendation for providing a smooth transition for Architect review and request instructions.

I. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.

J. Refinish existing surfaces as indicated:

K. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.

L. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.

M. Clean existing systems and equipment.

N. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.

O. Do not begin new construction in alterations areas before demolition is complete.

P. Comply with all other applicable requirements of this section.

3.07 CUTTING AND PATCHING

A. Whenever possible, execute the work by methods that avoid cutting or patching.

B. See Alterations article above for additional requirements.

C. Perform whatever cutting and patching is necessary to:

1. Complete the work.
2. Fit products together to integrate with other work.
3. Provide openings for penetration of mechanical, electrical, and other services.
4. Match work that has been cut to adjacent work.

5. Repair areas adjacent to cuts to required condition.

6. Repair new work damaged by subsequent work.

7. Remove samples of installed work for testing when requested.

8. Remove and replace defective and non-complying work.

D. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.

E. Employ skilled and experienced installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces. Original installer is preferred and/or may be required by Building Owner.

F. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

G. Restore work with new products in accordance with requirements of Contract Documents.

H. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

I. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 84 00, to full thickness of the penetrated element.

J. Patching:

1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

2. Match color, texture, and appearance.

3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.08 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.09 PROTECTION OF INSTALLED WORK

A. Protect installed work from damage by construction operations.

B. Provide special protection where specified in individual specification sections.

C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

F. Protect work from spilled liquids. If work is exposed to spilled liquids, immediately remove protective coverings, dry out work, and replace protective coverings.

G. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

H. Prohibit traffic from landscaped areas.

I. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.10 DEMONSTRATION AND INSTRUCTION

A. See Section 01 79 00 - Demonstration and Training.

B. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.

3.11 ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.

3.12 FINAL CLEANING

A. Execute final cleaning prior to final project assessment.

B. Use cleaning materials that are nonhazardous.

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

D. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.

E. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.

F. Clean casework fully, including all surfaces, drawers and tops of cabinets.

G. Clean Owner installed items identified to be installed before Substantial Completion.

H. Clean filters of operating equipment.

I. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, and drainage systems.

J. Clean site; sweep paved areas, rake clean landscaped surfaces.

K. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.13 CLOSEOUT PROCEDURES

A. Make submittals that are required by governing or other authorities.

1. Provide copies to Building Owner.

2. Provide copies to Architect.

3. Provide copies to Owner.

B. Accompany Project Coordinator, Architect and Owner on preliminary inspection to determine items to be listed for completion or correction in the General Contractor's Correction Punch List for General Contractor's Notice of Substantial Completion.

C. Notify Architect when work is considered ready for Architect's Substantial Completion inspection.

D. Submit written certification containing General Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's Substantial Completion inspection.

E. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and General Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.

F. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.

G. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.

H. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

3.14 MAINTENANCE

A. Provide service and maintenance of components indicated in specification sections.

B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.

C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.

D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.

E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.

END OF SECTION 01 70 00

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SECTION 01 78 00
CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Project record documents.

B. Operation and maintenance data.

C. Warranties and Bonds.

1.02 RELATED REQUIREMENTS

A. Section 01 30 00 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.

B. Section 01 70 00 - Execution and Closeout Requirements: Contract closeout procedures.

C. Individual Product Sections: Specific requirements for operation and maintenance data.

D. Individual Product Sections: Warranties required for specific products or Work.

1.03 SUBMITTALS

A. Project Record Documents: Submit documents to Project Coordinator/Building Owner and Architect with claim for final Application for Payment.

B. Operation and Maintenance Data:

1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review draft and return one copy with comments.

2. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten calendar days after acceptance.

3. Submit one copy of completed documents 15 calendar days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.

4. Submit two sets of revised final documents in final form within 10 calendar days after final inspection.

C. Warranties and Bonds:

1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 calendar days after acceptance.

2. Make other submittals within 10 calendar days after Date of Substantial Completion, prior to final Application for Payment.

3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 calendar days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:

1. Drawings.

2. Specifications.

3. Addenda.

4. Change Orders and other modifications to the Contract.

5. Reviewed shop drawings, product data, and samples.

6. Manufacturer's instruction for assembly, installation, and adjusting.

B. Ensure entries are complete and accurate, enabling future reference by Owner.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress.

E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:

1. Manufacturer's name and product model and number.

2. Product substitutions or alternates utilized.

3. Changes made by Addenda and modifications.

F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:

1. Field changes of dimension and detail.

2. Details not on original Contract drawings.

3.02 OPERATION AND MAINTENANCE DATA

A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.

B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

A. For Each Product, Applied Material, and Finish:

1. Product data, with catalog number, size, composition, and color and texture designations.

2. Information for re-ordering custom manufactured products.

B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.

C. Additional information as specified in individual product specification sections.

D. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

A. For Each Item of Equipment and Each System:

1. Description of unit or system, and component parts.

2. Identify function, normal operating characteristics, and limiting conditions.

3. Include performance curves, with engineering data and tests.

4. Complete nomenclature and model number of replaceable parts.

B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

C. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.

D. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

E. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

F. Provide servicing and lubrication schedule, and list of lubricants required.

G. Include manufacturer's printed operation and maintenance instructions.

H. Include sequence of operation by controls manufacturer.

I. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

J. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

K. Include test and balancing reports.

L. Additional Requirements: As specified in individual product specification sections.

3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

A. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.

B. Where systems involve more than one specification section, provide separate tabbed divider for each system.

C. Prepare instructions and data by personnel experienced in maintenance and operation of described products.

D. Prepare data in the form of an instructional manual.

E. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with durable plastic covers; 2 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.

F. Electronic Copy: PDF format. Create hyperlinks from the Table of Contents to the individual Divisions and Sections of the document.

G. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.

H. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, General Contractor and subcontractors, with names of responsible parties.

I. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.

J. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.

K. Text: Manufacturer's printed data, or typewritten data on 24 pound paper.

L. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

M. Arrangement of Contents: Organize each volume in parts as follows:

1. Project Directory.

2. Table of Contents, of all volumes, and of this volume.

3. Operation and Maintenance Data: Arranged by system, then by product category.

    a. Source data.

    b. Product data, shop drawings, and other submittals.

    c. Operation and maintenance data.

    d. Field quality control data.

    e. Photocopies of warranties and bonds.

N. Arrange content by systems under section numbers and sequence of Table of Contents of this Project Manual.

O. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, in three parts as follows:

1. Part 1: Directory, listing names, addresses, and telephone numbers of Architect, General Contractor, Subcontractors, and major equipment suppliers.

2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:

    a. Significant design criteria.

    b. List of equipment.

    c. Parts list for each component.

    d. Operating instructions.

    e. Maintenance instructions for equipment and systems.

    f. Maintenance instructions for special finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.

3. Part 3: Project documents and certificates, including the following:

    a. Shop drawings and product data.

    b. Photocopies of warranties and bonds.

3.06 WARRANTIES AND BONDS

A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 calendar days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.

B. Verify that documents are in proper form, contain full information, and are notarized.

C. Co-execute submittals when required.

D. Retain warranties and bonds until time specified for submittal.

E. Manual: Bind in commercial quality 8-1/2 by 11 inch three D side ring binders with durable plastic covers.

F. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of General Contractor and equipment supplier; and name of responsible company principal.

G. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.

H. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

END OF SECTION 01 78 00

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SECTION 01 79 00
DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.01 SUMMARY

A. Demonstration of products and systems to be commissioned and where indicated in specific specification sections.

1.02 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures; except:

1. Make all submittals specified in this section, and elsewhere where indicated for commissioning purposes, directly to the Commissioning Authority.

2. Submit one copy to the Commissioning Authority, not to be returned.

3. Make commissioning submittals on time schedule specified by Commissioning Authority.

4. Submittals indicated as "Draft" are intended for the use of the Commissioning Authority in preparation of overall Training Plan; submit in editable electronic format, Microsoft Word 2003 preferred.

B. Draft Training Plans: Owner will designate personnel to be trained; tailor training to needs and skill-level of attendees.

1. Submit to Commissioning Authority for review and inclusion in overall training plan.

2. Submit not less than four weeks prior to start of training.

3. Revise and resubmit until acceptable.

4. Provide an overall schedule showing all training sessions.

5. Include at least the following for each training session:

a. Identification, date, time, and duration.

b. Description of products and/or systems to be covered.

c. Name of firm and person conducting training; include qualifications.

d. Intended audience, such as job description.

e. Objectives of training and suggested methods of ensuring adequate training.

f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.

g. Media to be used, such a slides, hand-outs, etc.

h. Training equipment required, such as projector, projection screen, etc., to be provided by General Contractor.

C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.

1. Include applicable portion of O&M manuals.

2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.

3. Provide one extra copy of each training manual to be included with operation and maintenance data.

1.03 QUALITY ASSURANCE

A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.

1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.

2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 DEMONSTRATION - GENERAL

A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Owner.

B. Demonstrations conducted during Functional Testing need not be repeated unless Owner personnel training is specified.

C. Demonstration may be combined with Owner personnel training if applicable.

D. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.

1. Perform demonstrations not less than two weeks prior to Substantial Completion.

2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

E. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.

1. Perform demonstrations not less than two weeks prior to Substantial Completion.

3.02 TRAINING - GENERAL

A. General Contractor will prepare the Training Plan based on draft plans submitted.

B. Conduct training on-site unless otherwise indicated.

C. Owner will provide classroom and seating at no cost to General Contractor.

D. Do not start training until Functional Testing is complete, unless otherwise specified or approved by the Commissioning Authority.

E. Provide training in minimum two hour segments.

F. The Owner is responsible for determining that the training was satisfactorily completed.

G. Training schedule will be subject to availability of Owner's personnel to be trained; re-schedule training sessions as required by Owner; once schedule has been approved by Owner failure to conduct sessions according to schedule will be cause for Owner to charge General Contractor for personnel "show-up" time.

H. Review of Facility Policy on Operation and Maintenance Data: During training discuss:

1. The location of the O&M manuals and procedures for use and preservation; backup copies.

2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.

3. Typical uses of the O&M manuals.

I. Product- and System-Specific Training:

1. Review the applicable O&M manuals.

2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.

3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.

4. Provide hands-on training on all operational modes possible and preventive maintenance.

5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
6. Discuss common troubleshooting problems and solutions.
7. Discuss any peculiarities of equipment installation or operation.
8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
9. Review recommended tools and spare parts inventory suggestions of manufacturers.
10. Review spare parts and tools required to be furnished by General Contractor.
11. Review spare parts suppliers and sources and procurement procedures.

J. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

END OF SECTION 01 79 00

SECTION 02 41 00
DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Selective demolition of built site elements.

B. Selective demolition of building elements for alteration purposes.

1.02 RELATED REQUIREMENTS

A. Section 01 10 00 - Summary: Limitations on General Contractor's use of site and premises.

B. Section 01 10 00 - Summary: Description of items to be salvaged or removed for re-use by General Contractor.

C. Section 01 50 00 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.

D. Section 01 60 00 - Product Requirements: Handling and storage of items removed for salvage and relocation.

E. 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.

F. Section 31 23 23 - Fill: Fill material for filling holes, pits, and excavations generated as a result of removal operations.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Site/buidling Plan:

1. Vegetation to be protected.

2. Indicated areas for temporary construction and field offices.

3. Areas for temporary and permanent placement of removed materials.

C. Demolition Plan: Submit demolition plan as required by OSHA and local AHJs.

1. Indicate extent of demolition, removal sequencing, bracing and shoring, and location and construction of barricades and fences.

2. Summary of safety procedures.

3. Demolition firm qualifications.

D. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

PART 2 PRODUCTS -- NOT USED

PART 3 EXECUTION

3.01 DEMOLITION

A. Remove paving and curbs required to accomplish new work.

B. Remove manholes and manhole covers, curb inlets and catch basins.

C. Remove fences and gates as indicated.

D. Remove other items indicated in drawings and specifications, for demolition, salvage, relocation, recycling, and reuse.

E. 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. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.

5. Conduct operations to minimize effects on and interference with adjacent structures and occupants.

6. Do not close or obstruct roadways or sidewalks without permits from authority having jurisdiction.

7. 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.

8. 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 SELECTIVE DEMOLITION FOR ALTERATIONS

A. Existing construction and utilities indicated on drawings are based on casual field observation and existing record documents only.

1. Verify construction and utility arrangements are as indicated.

2. Report discrepancies to Architect before disturbing existing installation.

3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.

B. Maintain weatherproof exterior building enclosure, except for interruptions required for replacement or modifications; prevent water and humidity damage.

C. Remove existing work as indicated and required to accomplish new work.

1. Remove items indicated on drawings.

D. Services including, but not limited to, HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications: Remove existing systems and equipment as indicated.

1. Maintain existing active systems to remain in operation, and maintain access to equipment and operational components.

2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.

3. Verify that abandoned services serve only abandoned facilities before removal.

4. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings. Remove back to source of supply where possible, otherwise cap stub and tag with identification.

E. Protect existing work to remain.

1. Prevent movement of structure. Provide shoring and bracing as required.

2. Perform cutting to accomplish removal work neatly and as specified for cutting new work.

3. Repair adjacent construction and finishes damaged during removal work.

4. Patch to match new work.

3.05 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 02 41 00

SECTION 03 10 00
CONCRETE FORMS AND ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Formwork for cast-in-place concrete, with shoring, bracing and anchorage.

B. Openings for other work.

C. Form accessories.

D. Form stripping.

E. Special considerations for Exposed Architectural Concrete.

1.02 RELATED REQUIREMENTS

A. Section 03 20 00 - Concrete Reinforcement.

B. Section 03 30 00 - Cast-in-Place Concrete.

C. Section 05 12 00 - Structural Steel Framing: Placement of embedded steel anchors and plates in cast-in-place concrete.

1.03 REFERENCE STANDARDS

A. ACI CODE-318 - Building Code Requirements for Structural Concrete and Commentary.

B. ACI PRC-347 - Guide to Formwork for Concrete.

C. ACI SPEC-301 - Specifications for Concrete Construction.

1.04 DEFINITIONS

A. Exposed Architectural Concrete: Concrete prominently exposed to public view, and concrete bearing special textures, reveals or patterns of tie cone pockets defined in the Drawings.

1.05 DESIGN REQUIREMENTS

A. Formwork design is the responsibility of the General Contractor.

B. Design, engineer and construct formwork, shoring and bracing to conform to code requirements; resultant concrete to conform to required shape, line and dimension. Provide rigidity and stability sufficient for conformance to tolerance limits of ACI 117.

1.06 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 347, ACI 301, and ACI 318.

1. Maintain one copy of standards on project site.

1.07 MOCK-UPS

A. Construct a mock-up of formwork for exterior plaza walls, 2 feet long by 9 feet wide.

B. Locate mock-up where directed.

C. Mock-up may remain as part of the Work.

PART 2 PRODUCTS

2.01 FORMWORK - GENERAL

A. Provide concrete forms, accessories, shoring, and bracing as required to accomplish cast-in-place concrete work.

B. Design and construct concrete that complies with design with respect to shape, lines, and dimensions.

C. Comply with applicable state and local codes with respect to design, fabrication, erection, and removal of formwork.

D. Comply with relevant portions of ACI CODE-318, ACI PRC-347, and ACI SPEC-301.

2.02 WOOD FORM MATERIALS

A. Forms for Flat Exposed Smooth Concrete:

1. APA High Density Overlay (HDO) Plyform, Class I & II.

2. APA Plyform, Class I & II or APA Structural I Plyform.

B. Forms for Flat Concealed Smooth Concrete:

1. Form Materials: At the discretion of the General Contractor.

2.03 FORMWORK ACCESSORIES

A. Form Ties for Exposed Concrete: Removable type, factory fabricated, galvanized steel, fixed length, cone type, with waterproofing washer, 1" inch back break dimension, free of defects that could leave holes larger than 1 inch in concrete surface.

B. Form Ties for Concealed Concrete: Removable or snap-off type, factory-fabricated, galvanized steel or bare steel, fixed or adjustable length.

C. Form Release Agent: Chemically reactive (versus "barrier type"), non-staining formulation for exposed concrete where clean stripping and compatibility with finishes, caulks, sealants or coatings is desired. Form release agent shall be selected by the Contractor, compatible with the form material used final finish required. The following manufacturers specialize in form release agents and have different products for different form material (surfaces) and various conditions. Contractor shall select their products as best suited for the conditions and finishes of this project. The Manufacturers are:

1. Cresset Chemical Company.

2. Nox-Crete Product Group.

3. Approved substitution.

    a. Other manufactures including Dayton Superior (Conspec), Tamms Industries, W.R. Meadows and L&M Construction Chemicals, Inc. possibly manufacture chemically active products for limited form surfaces. Contractor may use chemically reactive products from these manufacturers only with personnel experience of prior use of the proposed chemicals by the form work providers of this project and approval of a submitted Substitution Request Form.

D. Corners: Chamfered, wood strip type; 1/2" x 1/2" size; maximum possible lengths. Provide Sylvan wood chamfer strip manufactured by Sylvan Industries Incorporated, or equal.

E. Form Joint Tape: Closed-cell PVC foam with pressure-sensitive adhesive on one side.

F. Embedded Anchor Shapes, Plates, Angles and Bars: As specified in Section 05 12 00.

G. Waterstops: Rubber type, COE CRD-C 513, minimum 2,000 psi tensile strength, minimum minus 50 degrees F to plus 175 degrees F working temperature range, 8" wide, maximum possible lengths, ribbed profile, preformed corner sections, heat welded jointing.

H. Concrete Joint Filler:

1. Interior Use Expansion and Isolation Joint Filler: Granulated cork in a synthetic resin binder, ASTM D 1752, Type II, 1/2" thick or as specified in the drawings.

2. Exterior Use Expansion and Isolation Joint Filler: Granulated cork in a synthetic resin binder, ASTM D 1752, Type II, 1/2" thick or as specified in the drawings.

I. Crack Control Joint Former: Continuous plastic strips with T-shaped cross section consisting of arrow-shaped stem approximately 1/8" thick by not less than 1 inch deep and 1 inch wide detachable crossbar at top. Provide Zipstrip by White Cap or approved.

J. Construction Joint Devices: Integral galvanized steel, height as required, formed to tongue and groove keyway profile, knockout holes spaced at 6 inches, ribbed steel spikes with tongue to fit top screed edge.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

3.02 EARTH FORMS

A. Permitted only for footings and where the earth is capable of maintaining its shape during concrete placement. Horizontal dimensions of the the footing shall be increased 1 inch at every vertical surface.

3.03 ERECTION - FORMWORK

A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI SPEC-301.

B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.

C. Align joints and make watertight. Keep form joints to a minimum. Provide solid blocking behind joints.

D. Obtain approval before framing openings in structural members that are not indicated on drawings.

E. Coordinate this section with other sections of work that require attachment of components to formwork.

3.04 FORMS FOR EXPOSED ARCHITECTURAL CONCRETE

A. Appearance shall be free of bugholes

B. Accurately lay out holes for ties in accordance with shop drawings.

C. Use forms free from wood end grain, patches and rust.

D. Seal form joints and penetrations with form joint tape.

3.05 INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Provide formed openings where required for items to be embedded in passing through concrete work.

B. Locate and set in place items that will be cast directly into concrete.

C. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other work.

D. Install accessories in accordance with manufacturer's instructions, so they are straight, level, and plumb. Ensure items are not disturbed during concrete placement.

E. Install waterstops in accordance with manufacturer's instructions, so they are continuous without displacing reinforcement. Heat seal joints so they are watertight.

3.06 FORM CLEANING

A. Clean forms as erection proceeds. Remove foreign matter within forms.

B. Clear formed cavities of debris prior to placing concrete.

3.07 FORMWORK TOLERANCES

A. Construct formwork to maintain tolerances required by ACI 117. Use Class C surface tolerances for typical offsets between adjacent pieces of formwork facing material. Use Class A surface tolerances for offsets between adjacent pieces of formwork facing material for concrete exposed to view.

3.08 FORM REMOVAL

A. Do not remove forms or bracing until concrete has gained specified 28 day strength or sufficient strength to carry its own weight and superimposed loads per the applicable provisions of ACI 347.

B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

3.09 WASTE MANAGEMENT

A. Place materials defined as hazardous or toxic waste in designated containers.

B. Use trigger operated spray nozzles for water hoses.

END OF SECTION 03 10 00

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SECTION 03 20 00
CONCRETE REINFORCEMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Reinforcing steel for cast-in-place concrete.

B. Supports and accessories for steel reinforcement.

1.02 RELATED REQUIREMENTS

A. Section 03 10 00 - Concrete Forms and Accessories.

B. Section 03 30 00 - Cast-in-Place Concrete.

1.03 REFERENCES

A. ACI 117 - Specification for Tolerances for Concrete Construction and Materials.

B. ACI 315 - Details and Detailing of Concrete Reinforcement, American Concrete Institute International.

C. ACI SPEC-301 - Specifications for Concrete Construction.

D. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.

E. ASTM A706/A706M - Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement.

F. ASTM A82 - Specification for Steel Wire, Plain, for Concrete Reinforcement.

G. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.

H. AWS D1.1/D1.1M - Structural Welding Code - Steel.

I. AWS D1.4/D1.4M - Structural Welding Code - Steel Reinforcing Bars.

J. CRSI (DA4) - Manual of Standard Practice.

K. ICC (IBC) - International Building Code.

1.04 DESIGN REQUIREMENTS

A. General Contractor is responsible for reinforcing support accessory selection and design.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Comply with the requirements of ACI 315, making reference to ACI SP-66. Include bar schedules, shapes of bent bars, spacing of bars and locations of splices.

C. Obtain, and maintain on file, until receipt of a certificate of occupancy, mill test reports and other documentation demonstrating that reinforcing steel and accessories supplied for this project meet or exceed specified requirements.

1.06 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI SPEC-301.

B. Notify testing agency and Architect well in advance of concrete placement. Do not place concrete prior to completion of testing agency's or Architect's representative's review of reinforcement placement.

C. Provide continuos inspection of all welded reinforcement in accordance with AWS D1.1/D1.1M and Chapter 17 of the current version of the ICC (IBC).

PART 2 PRODUCTS

2.01 REINFORCEMENT

A. Reinforcing Steel: ASTM A615/A615M Grade 60 (420).

1. Deformed billet-steel bars.

2. Unfinished.

B. Reinforcing Steel for Welded Assemblies, Frame Members Resisting Earthquake-Induced Forces, and Structural Wall Boundary Elements: ASTM A706/A706M , deformed low-alloy steel bars or ASTM A615/A615M Grade 60 steel complying with ACI 318-14 Section 20.2.2.5.

1. Unfinished.

C. Steel Welded Wire Reinforcement (WWR): Galvanized, deformed type; ASTM A1064/A1064M.

D. Reinforcement Accessories:

1. Tie Wire: ASTM A82, double annealed, minimum 16 gage.

2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.

3. Provide plastic or plastic coated steel components for placement within 1-1/2 inches of weathering surfaces.

2.02 FABRICATION

A. Fabricate concrete reinforcing in accordance with CRSI (DA4) - Manual of Standard Practice.

B. Welding of reinforcement is permitted only as shown in the drawings or with the specific approval of Architect. Perform welding in accordance with AWS D1.4/D1.4M.

C. Locate reinforcing splices not indicated on drawings at point of minimum stress, unless shown otherwise in the drawings.

PART 3 EXECUTION

3.01 PLACEMENT

A. Place, support and secure reinforcement against displacement. Do not deviate from required position. Comply with tolerance requirements of ACI 117.

B. Correct placement of reinforcement as directed by testing agency or Architect's representative prior to concrete placement.

C. Clean reinforcement, removing dirt, oil, grease, paint, rust, form release agent and other materials which would impair bond strength, prior to concrete placement.

D. Comply with applicable code for concrete cover over reinforcement.

3.02 FIELD QUALITY CONTROL

A. An independent testing agency, as specified in Section 01 40 00 - Quality Requirements, will inspect installed reinforcement for compliance with contract documents before concrete placement.

3.03 WASTE MANAGEMENT

A. Coordinate with suppliers on reducing packing material, and backhauling of reuse or recycling.

B. Fold up metal banding, flatten, and place in designated area.

END OF SECTION 03 20 00

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SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 +SECTION INCLUDES

A. Concrete footings and grade beams.

B. Concrete slabs-on-grade.

C. Concrete walls and pilasters.

D. Miscellaneous concrete elements, including equipment pads, equipment pits, light pole bases, flagpole bases, thrust blocks, and manholes.

1.02 RELATED REQUIREMENTS

A. Section 03 10 00 - Concrete Forms and Accessories: Forms and accessories for formwork.

B. Section 03 20 00 - Concrete Reinforcement.

C. Section 03 35 11 - Concrete Floor Finishes: Densifiers, hardeners, applied coatings, and polishing.

D. Section 07 90 05 - Joint Sealers: Products and installation for sealants for saw cut joints and isolation joints in slabs.

1.03 REFERENCE STANDARDS

A. ACI CODE-318 - Building Code Requirements for Structural Concrete and Commentary.

B. ACI PRC-211.1 - Selecting Proportions for Normal-Density and High Density-Concrete - Guide.

C. ACI PRC-302.1 - Guide to Concrete Floor and Slab Construction.

D. ACI PRC-304 - Guide for Measuring, Mixing, Transporting, and Placing Concrete.

E. ACI PRC-305 - Guide to Hot Weather Concreting.

F. ACI PRC-306 - Guide to Cold Weather Concreting.

G. ACI SPEC-301 - Specifications for Concrete Construction.

H. ANSI/CEA 709.1.D - Control Network Protocol Specification.

I. ASTM C289 - Standard Test Method for Potential Alkali-Silica Reactivity of Aggregates (Chemical Method).

J. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field.

K. ASTM C33/C33M - Standard Specification for Concrete Aggregates.

L. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

M. ASTM C595/C595M - Standard Specification for Blended Hydraulic Cements.

N. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.

O. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 50 mm [2 in.] Cube Specimens).

P. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete.

Q. ASTM C150/C150M - Standard Specification for Portland Cement.

R. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.

S. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete.

T. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete.

U. ASTM C618 - Standard Specification for Coal Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.

V. ASTM C827/C827M - Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures.

W. ASTM C845/C845M - Standard Specification for Expansive Hydraulic Cement.

X. ASTM C881/C881M - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.

Y. ASTM C1059/C1059M - Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete.

Z. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).

AA. ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures.

BB. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete.

CC. ASTM C989/C989M - Standard Specification for Slag Cement for Use in Concrete and Mortars.

DD. ASTM E1155M - Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers (Metric).

EE. 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.

FF. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Mix Design Data: Submit two copies of a mix design formula to the project to the Architect/Engineer at least 14 calendar days prior to the delivery of concrete to the site. Indicate location for each mix design.

C. Samples: Submit samples of underslab vapor retarder to be used.

D. Test Reports: Submit report for each test or series of tests specified.

1.05 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI SPEC-301 and ACI CODE-318.

B. Follow recommendations of ACI PRC-305 when concreting during hot weather.

C. Follow recommendations of ACI PRC-306 when concreting during cold weather.

PART 2 PRODUCTS

2.01 FORMWORK

A. Comply with requirements of Section 03 10 00.

2.02 REINFORCEMENT MATERIALS

A. Comply with requirements of Section 03 20 00.

2.03 CONCRETE MATERIALS

A. Blended, Expansive Hydraulic Cement: ASTM C845/C845M, Type K.

B. Portland Cement: ASTM C150/C150M, Type I or Type II with maximum equivalent alkalis not to exceed 0.60 percent.

C. Blended Hydraulic Cement: ASTM C595/C595M, Type 1L - Portland-limestone cement.

D. Normal Weight Fine and Coarse Aggregates: ASTM C 33. Alkali reactivity shall be "innocuous" as determined by ASTM C289.

E. Fly Ash: ASTM C618, Class F. Use only fly ash obtained from sources known to produce a uniform product consistently resulting in satisfactory concrete.

F. Slag: ASTM C989/C989M, Class 100. Use only slag obtained from sources known to produce a uniform product consistently resulting in satisfactory concrete.

G. Silica Fume: ASTM C1240, proportioned in accordance with ACI PRC-211.1.

H. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.

2.04 ADMIXTURES

A. Chemical admixtures shall be of types that increase the workability and reduce the water demand of concrete, but do not increase shrinkage or promote bleeding of mix water.

B. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.

C. Air Entrainment Admixture: ASTM C260/C260M.

D. High Range Water Reducing and Retarding Admixture: ASTM C494/C494M Type G.

E. High Range Water Reducing Admixture: ASTM C494/C494M Type F.

F. Water Reducing and Retarding Admixture: ASTM C494/C494M Type D.

G. Water Reducing Admixture: ASTM C494/C494M Type A.

H. Shrinkage Compensating Admixture: For on site production of concrete with ASTM C845/C845M, Type K cement.

I. Shrinkage Compensating Admixture with Fiber Reinforcement: For on site production of concrete with ASTM C845/C845M, Type K cement with integral fiber reinforcement.

2.05 ACCESSORY MATERIALS

A. Underslab Vapor Retarder:

1. Sheet Material: ASTM E1745, Class A; stated by manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs. Single-ply polyethylene is prohibited.

2. Accessory Products: Vapor retarder manufacturer's recommended tape, adhesive, mastic, prefabricated boots, etc., for sealing seams and penetrations.

3. Products:

a. ISI Building Products; Viper VaporCheck II 15-mil (Class A): www.isibp.com/#sle.

b. Stego Industries, LLC; Stego Wrap 15-Mil: www.stegoindustries.com/#sle.

c. Substitutions: See Section 01 60 00 - Product Requirements.

B. Non-Shrink Cementitious Grout: Premixed compound consisting of nonmetallic aggregate, cement, water reducing and plasticizing agents.

1. Grout: Comply with ASTM C1107/C1107M or manufacture to warrant that grout has expansive properties.

2. Height Change, Plastic State; when tested in accordance with ASTM C827/C827M:

   a. Maximum: Plus 4 percent.

   b. Minimum: Plus 0.3 percent.

3. Minimum Compressive Strength at 48 Hours, ASTM C109/C109M: 2,000 pounds per square inch.

4. Minimum Compressive Strength at 28 Calendar Days, ASTM C109/C109M: 5,000 pounds per square inch.

2.06 BONDING AND JOINTING PRODUCTS

A. Latex Bonding Agent for Dry Locations: Redispersable acrylic latex, complying with ASTM C1059/C1059M, Type I.

   1. Use of these products is restricted to interior work not subject to immersion in water or high humidity

B. Latex Bonding Agent for Wet Locations: Non-redispersable acrylic latex, complying with ASTM C1059/C1059M, Type II.

   1. Use of these products is required in areas subject to high humidity or immersion in water and is permitted in other areas. Areas subject to high humidity or immersion in water include basement walls; retaining walls; exterior walls and grade beams; slabs-on-grade; parking structure walls, slabs, beams and columns; tanks and basins.

   2. Products:

      a. Euclid Chemical Company; AKKRO-7T: www.euclidchemical.com/#sle.

      b. SpecChem, LLC; Strong Bond Acrylic Bonder: www.specchemllc.com/#sle.

      c. W. R. Meadows, Inc; ACRY-LOK: www.wrmeadows.com/#sle.

C. Epoxy Bonding System:

   1. Complying with ASTM C881/C881M and of Type required for specific application.

D. Slab Isolation Joint Filler: 1/2-inch thick, height equal to slab thickness, with removable top section forming 1/2-inch deep sealant pocket after removal.

E. Comply with requirements of Section 03 10 00.

2.07 PATCHING COMPOUND

A. Two-Component Compound:

1. Composition: Cement base with acrylic polymer additive

2. Compressive Strength: 5,000 psi at 28 calendar days.

3. Acceptable Patching Compounds:

a. Re-Crete 20 Minute Patch by Dayton Superior used with Day-Chem Ad Bond latex additive by Dayton Superior.

b. Substitutions: See Section 01 60 00 - Product Requirements.

2.08 CURING MATERIALS

A. Evaporation Reducer: Liquid thin-film-forming compound that reduces rapid moisture loss caused by high temperature, low humidity, and high winds; intended for application immediately after concrete placement.

1. Products:

a. Euclid Chemical Company ; EUCOBAR: www.euclidchemical.com/#sle.

b. SpecChem, LLC; SpecFilm Concentrate or SpecFilm: www.specchemllc.com/#sle.

c. W. R. Meadows, Inc; Evapre or Evapre-RTU: www.wrmeadows.com/#sle.

d. Substitutions: See Section 01 60 00 - Product Requirements.

B. Water: Potable, not detrimental to concrete.

2.09 CONCRETE MIX DESIGN

A. Proportioning Normal Weight Concrete: Comply with ACI PRC-211.1 recommendations.

B. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience, as specified in ACI 301 Article 4.2.3. Submit documentation for review.

1. Submit a separate mix design for each class, type, or strength of concrete.

C. Ensure that maximum aggregate sizes used in concrete comply with the ACI 318 based on the member dimensions and clear distances shown in the Drawings and in the reinforcement shop drawings. For each class of concrete, use the maximum practical aggregate size consistent with this requirement up to 1 1/2 inch.

D. Admixtures: Add acceptable admixtures as recommended in ACI PRC-211.1 and at rates recommended or required by manufacturer.

E. Normal Weight Concrete:

1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 calendar days: As indicated on drawings.

2. Fly Ash Content: Maximum 25 percent of cementitious materials by weight.

3. Slag Content: a maximum 50 percent of cementitious materials by weight.

4. Silica Fume Content: Maximum 5 percent of cementitious materials by weight.

5. Water-Cement Ratio: Maximum 50 percent by weight or as indicated on drawings.

6. Total Air Content: Except as noted in the drawings. For concrete exposed to the elements, percentage air content to be in accordance with 2018 International Building Code Section 1904.2 and ACI 318 Table 19.3.2.1 for F1 exposure, measured per ASTM C173/C173M. Maximum water to cement ratios and minumum concrete strength to be in accordance with ACI 318 Table 19.3.3.1 for same exposure.

2.10 MIXING

A. 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. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning with steel brush and applying bonding agent 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.

B. Interior Slabs on Grade: Install vapor retarder under interior slabs on grade. Comply with ASTM E1643. Lap joints minimum 6 inches. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions. Repair damaged vapor retarder before covering.

3.03 PLACING CONCRETE

A. Place concrete in accordance with ACI PRC-304.

B. Place concrete for floor slabs in accordance with ACI PRC-302.1.

C. Notify Architect not less than 24 hours prior to commencement of placement operations.

D. Do not place concrete until a representative of the Independent Testing Laboratory has examined the formwork and reinforcing steel.

E. Do not place concrete in footing forms until Geotechnical Engineer has examined the compacted soil and aggregate base materials within the forms.

F. Ensure reinforcement, inserts, waterstops, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.

G. Place concrete continuously without construction (cold) joints wherever possible; where construction joints are necessary, before next placement prepare joint surface by removing laitance and exposing the sand and sound surface mortar, by sandblasting or high-pressure water jetting.

H. Finish floors level and flat, unless otherwise indicated, within the tolerances specified below.

3.04 SLAB JOINTING

A. Locate joints as indicated on drawings.

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.

D. Do not place concrete on dry, soft, muddy, or frozen subgrade. Remove ice and standing water from footing trenches and formed surfaces.

3.05 FLOOR FLATNESS AND LEVELNESS TOLERANCES

A. An independent testing agency, as specified in Section 01 40 00, will inspect finished slabs for compliance with specified tolerances. Notify agency 24 hours in advance of placing slab concrete.

B. Minimum overall F(F) Floor Flatness and F(L) Floor Levelness Values:

1. Exposed to View and Foot Traffic: F(F) of 20; F(L) of 15, on-grade only.

2. Under Thick-Bed Tile: F(F) of 20; F(L) of 15, on-grade only.

3. Under Carpeting: F(F) of 25; F(L) of 20, on-grade only.

4. Under Thin Resilient Flooring and Thinset Tile: F(F) of 35; F(L) of 25, on-grade only.

5. Warehouse Floors On Grade: F(F) of 35; F(L) of 25.

C. Measure F(F) Floor Flatness and F(L) Floor Levelness in accordance with ASTM E1155 (ASTM E1155M) using a optical or laser level, within 16 hours after slab installation; report both composite overall values and local values for each measured section within 8 hours after testing, to contractor. Include a formal notice of acceptance or rejection of the work with testing results.

D. The Test Section used to determine Minimum Local values shall not be greater than any bay defined by column lines.

E. Correct the slab surface if composite overall value is less than specified and if local value is less than two-thirds of specified overall value, specified minimum local value, or less than F(F) 13/F(L) 10.

F. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified by the Owner. The particular method of correction to be employed shall be determined by the Owner. Re-measure corrected areas by the same process.

3.06 CONCRETE FINISHING

A. Repair visible surface defects, including tie holes, immediately after removing formwork with an approved patching compound.

B. Verify that floor surfaces are acceptable to receive the work of this section.

C. Concrete Slabs: Finish to requirements of ACI PRC-302.1 and as follows:

1. Surfaces to Receive Thick Floor Coverings: "Wood float" as described in ACI PRC-302.1; thick floor coverings include quarry tile, ceramic tile, and Portland cement terrazzo with full bed setting system.

2. Surfaces to Receive Thin Floor Coverings: "Steel trowel" as described in ACI PRC-302.1; thin floor coverings include carpeting, resilient flooring, seamless flooring, resinous matrix terrazzo, thin set quarry tile, and thin set ceramic tile.

3. Other Surfaces to Be Left Exposed: Trowel as described in ACI PRC-302.1, minimizing burnish marks and other appearance defects.

a. Chemical Hardener: See Section 03 35 11.

D. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains at 1:100 nominal.

E. Concrete Polishing: See Section 03 35 11.

3.07 CURING AND PROTECTION

A. Comply with requirements of ACI 308R and with the recommendations of ACI 305R and ACI 306R. 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.

C. Surfaces Not in Contact with Forms:

1. Initial Curing: Start as soon as free water has disappeared and before surface is dry. Unless otherwise directd by ACI 305R, 306R, 308R, keep continuously moist for not less than three calendar days by water ponding, water-saturated sand, water-fog spray, or saturated burlap.

2. Final Curing: Begin after initial curing but before surface is dry.

3.08 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. Compressive Strength Tests: ASTM C39/C39M, for each test, mold and cure three concrete test cylinders. Obtain test samples for every 100 cubic yards or less of each class of concrete placed.

E. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.

F. Perform one slump test for each set of test cylinders taken, following procedures of ASTM C143/C143M.

G. Perform one air content test for each set of compressive strength specimens, complying ASTM C31/C31M.

3.09 INADEQUATE OR DEFECTIVE CONCRETE

A. Test Results: The testing agency shall report test results in writing to Architect and General Contractor within 24 hours of test.

B. Defective Concrete: Concrete not complying with required lines, details, dimensions, tolerances or specified requirements.

C. Architecturally Defective Concrete: Concrete deviating from the approved mock-up to a degree that is not acceptable to the Architect.

D. Repair or replacement of defective concrete will be determined by the Architect. The cost of additional testing shall be borne by General Contractor when defective concrete is identified.

E. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect for each individual area.

3.10 PROTECTION

A. Do not permit traffic over unprotected concrete floor surface until fully cured.

B. Structurally Inadequate Concrete:

1. Remove and replace, at no cost to the owner, concrete work rejected by the Engineer as lacking adequate structural quality. The cost of additional testing shall be borne by General Contractor when structurally inadequate concrete is identified. Possible causes for rejection may include the following:

a. Failure to achieve specified minimum compressive strength.

b. Excessive plastic shrinkage cracking.

c. Slab curling or warping.

d. Surface crazing.

e. Irreparable or widespread surface damage or weakness including rain damage or scaling.

f. Excessive rock pockets or honeycombing.

g. Inadequate member size.

h. Partial or complete formwork failure.

i. Incorrect reinforcement.

3.11 WASTE MANAGEMENT

A. Place materials defined as hazardous or toxic waste in designated containers.

B. Use trigger operated spray nozzles for water hoses.

END OF SECTION 03 30 00

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SECTION 03 35 11
CONCRETE FLOOR FINISHES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface treatments for concrete floors and slabs.

B. Clear coatings.

C. Color coatings.

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 09 67 00 - Fluid-Applied Flooring.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with concrete floor placement and concrete floor curing.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative 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.

D. Warranty Documentation: Manufacturer warranty; ensure that forms have been completed in Owner's name and registered with manufacturer.

E. Specimen Warranty: Manufacturer warranty.

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 above the floor surface over each 20 foot square area of floor being finished.

B. Maintain ambient temperature of 50 degrees F minimum.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Correct defective work within a two-year period commencing on the Date of Substantial Completion.

PART 2 PRODUCTS

2.01 COATINGS

A. Clear Coating: Clear coating recommended by manufacturer for finishing concrete floors and slabs.

1. Gloss: Matte.

2. Color(s): As selected by Architect from manufacturer's standard range.

3. Type: High solids epoxy; two-component.

a. Products:

1) SureCrete Design Products: www.surecretedesign.com/#sle.

2) Substitutions: See Section 01 60 00 - Product Requirements.

B. Natural Aggregate: Finely ground stone for addition to coatings for slip resistance.

1. Type: Aluminum Oxide Broadcast or Polypropelene silicate additve: SUREGRIP, Non-Slip Additive & Broadcast by SureCrete.

a. Products:

1) SureCrete Design Products; www.surecretedesign.com/#sle.

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 03 35 11

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SECTION 03 35 19
Integrally Colored Concrete Finishing

PART 1 - GENERAL

1.1 SUMMARY

A. Perform all work required for a complete system, as indicated by the Contract Documents. Furnish all items necessary for the proper installation of the system.

B. System shall consist of integrally colored finishes for sitecast concrete. If this section conflicts with Related Sections:

   a. This section takes precedence for matters that affect concrete appearance. Related sections take precedence for matters that do not affect concrete appearance.

C. Related Sections:

   a. Section 31 22 00-Grading
   b. Section 31 23 23-Fill
   c. Section 32 11 23-Aggregate Base Courses
   d. Section 32 13 13-Concrete Paving
   e. Section 03 30 00 – Cast in Place Concrete

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM)

ASTM C33	Concrete Aggregates
ASTM C39	Concrete Compressive Strength
ASTM C144	Aggregate for Masonry Mortar
ASTM C150	Portland cement
ASTM C595	Standard Specification for Blended Hydraulic Cements
ASTM C642	Water Absorption, Density, Voids in Hardened Concrete
ASTM C666	Rapid Freeze/Thaw Resistance of Concrete
ASTM C979	Pigments for Integrally Colored Concrete
ASTM C1028	Coefficient of Friction
ACI 303.1	Cast in Place Concrete
ACI 305.1	Hot Weather Concreting

ACI 306.1 Cold Weather Concreting
ACI 308R Curing Concrete

1.3 SUBMITTALS

A. Product Data:
   a. Color additives
   b. Curing products
   c. Samples for verification. On sample chip of specified color with Davis name
   d. Color options for fine and coarse aggregate.
   e. Qualification Data: For installer. Provide images of three projects with similar size, scale and complexity.
   f. Cleaning and Maintenance Instruction

1.4 SUBSTITUTIONS

A. Refer to Section 016000 for procedures.

B. Proposed substitutions: No known equal.

1.5 QUALITY ASSURANCE

A. Compliance with Regulations: Comply with requirements of state and local building codes and with rules and regulations relating to building accessibility.

B. Qualifications of Manufacturer: Company specializing in the manufacture of precast concrete paving units with a minimum of 10 continuous years of documented experience.

C. Qualifications of Subcontractor: Subcontractor shall submit evidence of skill and not less than 5 years of experience in this product type.

D. Pre-installation Conference: One week prior to mockup, at a minimum.

A. Mock-up
   a. Install a 3 ft x 3 ft minimum area, for each color used.
   b. Mock-up area to be used to determine joint sizes, lines, laying pattern, color(s) and texture of the job. Mock-up area to be the standard from which the work will be judged. Construct at least one month before start of other concrete work

to allow concrete to cure before observation.

c. At location acceptable to Architect, demonstrate methods used for construction, including forming and finishing conditions required for Project using materials, workmanship, joint treatments and curing methods to be used throughout Project.
d. Mock up may remain as part of Work if acceptable.

1.6 DELIVERY, STORAGE AND HANDLING:

A. Color Additive: Deliver, store and handle in accordance with manufacturer's instructions.

B. Concrete: Schedule delivery to provide consistent mix times from time color additive is placed in mixture until placement of integrally colored concrete.

PART 2 - PRODUCTS

1.1 MANUFACTURER

Davis Colors www.daviscolors.com
3700 E. Olympic Boulevard
Los Angeles, CA 90023
800-356-4848 Free
323-269-7311 In California
323-269-1053 Fax

1.2 MATERIALS

A. Cements:

1. Types: as specified in related sections.
2. Supplementary Cementitious Materials, and aggregates as specified in related sections.
3. Admixture: Do not use calcium chloride admixtures.

B. Type:

1. Type: Concentrated pigments specially processed for mixing into concrete and complying with ASTM C979.
2. Color additives containing carbon black are not acceptable.

1.3 COLOR ADDITIVES

A. Colors: Integral color shall be throughout entire product.
    a. Graphite 860
    b. San Diego Buff 5237
    c. Outback 677

1.4 ACCESSORIES

A. Joint sealants:
    a. Provide type specified in Division 07
    b. Color to match integrally colored concrete

B. Mixes
    a. Slump: 4 inches if greater slump is required, use water reducing or super plasticizing admixture; do no add water.
    b. Color Additives: Mix in accordance with manufacturer's instructions. Mix until color additives are uniformly dispersed throughout mixture and disintegrating bags, if used, have disintegrated.
    c. Do not retemper mix or add water in field.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not place integrally colored concrete where standing water is present.

3.2 INSTALLATION – GENERAL

A. Comply with color admixture manufacturer's recommendations unless otherwise specified in this Section.
    1. Match sample finish. Contractor must reproduce a mockup of the sample finish on an area at least100 square feet.
    2. Surface Tolerance: ACI 347:
        a. Class B (+1/4 inch maximum irregularities).
    3. Curing and Stripping:
        a. Curing: Cure for 28 days. Maintain concrete between 65° and 85°F during curing.
        b. Leave forms in place for as long as practical, and do not strip until concrete has reached a consistent age.
        c. Stripping: If forms are removed before required curing duration, apply curing compound for formed surfaces. To extent practical, integrally colored concrete throughout project should be cured using the same methods and for the same durations.

4. Repair:
   a. Fill holes and defects in concrete surface within 48 hours of form removal.
   b. Make patches with stiff mortar made with materials from same sources as concrete. Adjust mortar mix proportions so dry patch matches dry adjacent concrete. Add white cement to mortar mix if necessary to lighten it.

3.3 APPEARANCE TOLERANCES

A. Minor variations in appearance of integrally colored concrete that are similar to natural variation in color and appearance of uncolored concrete are acceptable.

3.4 CLEANING

B. Efflorescence: remove efflorescence as soon as practical after it appears and as part of final cleaning.
C. Do not use muriatic or hydrochloric acid on integrally colored concrete.

END OF SECTION

SECTION 04 29 00
ENGINEERED UNIT MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete block.

B. Mortar and grout.

C. Reinforcement and anchorage.

D. Accessories.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

A. ASTM A706/A706M - Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement.

B. ASTM C91/C91M - Standard Specification for Masonry Cement.

C. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.

D. ASTM C140/C140M - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.

E. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar.

F. ASTM C150/C150M - Standard Specification for Portland Cement.

G. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes.

H. ASTM C270 - Standard Specification for Mortar for Unit Masonry.

I. ASTM C404 - Standard Specification for Aggregates for Masonry Grout.

J. ASTM C476 - Standard Specification for Grout for Masonry.

K. ASTM C1019 - Standard Test Method for Sampling and Testing Grout for Masonry.

L. ASTM C1072 - Standard Test Methods for Measurement of Masonry Flexural Bond Strength.

M. ASTM C1314 - Standard Test Method for Compressive Strength of Masonry Prisms.

N. ASTM E518/E518M - Standard Test Methods for Flexural Bond Strength of Masonry.

O. AWS D1.4/D1.4M - Structural Welding Code - Steel Reinforcing Bars.

P. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for masonry units, fabricated wire reinforcement, and mortar and grout.

C. Shop Drawings: Indicate bar sizes, spacings, reinforcement quantities, bending and cutting schedules, reinforcement supporting and spacing devices, and accessories.

1.05 QUALITY ASSURANCE

A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.

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.

1.07 FIELD CONDITIONS

A. Cold Weather Requirements: Comply with recommendations ACI 530.1 Section 1.8.

B. Hot Weather Requirements: Comply with recommendations of ACI 530.1 Section 1.8.

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 and nominal depths as indicated on the drawings for specific locations.

2. Special Shapes: Provide non-standard blocks configured for corners.

a. Provide bullnose units for outside corners.

3. Load-Bearing Units: ASTM C90, medium weight.

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.

1. Hydrated Lime: ASTM C207, Type S.

2. Mortar Aggregate: ASTM C144.

3. Grout Aggregate: ASTM C404.

C. Water: Clean and potable.

2.03 REINFORCEMENT AND ANCHORAGE

A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi) yield strength.

1. Deformed billet-steel bars.

2. Unfinished.

B. Reinforcing Steel: ASTM A706/A706M, deformed low-alloy steel bars.

1. Unfinished.

2.04 ACCESSORIES

A. Cleaning Solution: Not harmful to masonry work or adjacent materials.

1. Manufacturers:

a. EaCo Chem; NMD 80 New Masonry Detergent: www.eacochem.com.

b. Prosoco; Sure Klean: www.prosoco.com.

c. Substitutions: See Section 01 60 00 - Product Requirements.

2.05 MORTAR MIXES

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

2.06 MORTAR MIXING

A. Thoroughly mix mortar ingredients using mechanical batch mixer, in accordance with ASTM C270 and in quantities needed for immediate use.

B. Maintain sand uniformly damp immediately before the mixing process.

C. Do not use anti-freeze compounds to lower the freezing point of mortar.

D. If water is lost by evaporation, re-temper only within two hours of mixing.

2.07 GROUT MIXES

A. Engineered Masonry: Provide strength per the Structural General Notes. Provide premixed type self-consolidating grout meeting the requirements of ASTM C476.

2.08 GROUT MIXING

A. Mix grout in accordance with ASTM C94/C94M.

B. Thoroughly mix grout ingredients in quantities needed for immediate use in accordance with ASTM C476 for fine and coarse grout.

C. Add admixtures in accordance with manufacturer's instructions; mix uniformly.

D. Do not use anti-freeze compounds to lower the freezing point of grout.

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. Clean reinforcement of loose rust.

C. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

D. For areas where high-lift grouting will be employed, provide cleanout openings as follows:

1. Hollow Masonry: Not less than 8 inches high at the bottom of each cell to be grouted, formed by cutting out face shell of masonry unit.

3.03 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.

3. Mortar Joints: Concave.

3.04 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 as work progresses.

E. Interlock intersections and external corners, except for units laid in stack bond.

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.

H. Cut mortar joints flush where wall tile is scheduled or resilient base is scheduled.

3.05 REINFORCEMENT AND ANCHORAGE

A. Reinforcement Bars: Secure at locations indicated and to avoid displacement during grouting. Minimum spacing between bars or to masonry surfaces shall be one bar diameter.

B. Reinforced Hollow Unit Masonry: Keep vertical cores to be grouted clear of mortar, including bed area of first course.

1. Bond Beams: At bond beams or other locations for horizontally reinforced masonry, provide special masonry units or saw to accommodate reinforcement.

3.06 GROUTING

A. Grout placement heights to be in accordance with TMS 402/602 Specification Section 3.5 using self-consolidating grout.

3.07 CONTROL AND EXPANSION JOINTS

A. Do not continue horizontal joint reinforcement through control or expansion joints.

B. Form control joint with a sheet building paper bond breaker fitted to one side of the hollow contour end of the block unit. Fill the resultant core with grout fill. Rake joint at exposed unit faces for placement of backer rod and sealant.

C. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.

D. Size control joints as indicated on drawings; if not indicated, 3/4 inch wide and deep.

E. Form expansion joint as detailed on drawings.

3.08 BUILT-IN WORK

A. As work progresses, install built-in metal door frames and other items to be built into the work and furnished under other sections.

B. Install built-in items plumb, level, and true to line.

C. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout.

D. Do not build into masonry construction organic materials that are subject to deterioration.

3.09 TOLERANCES

A. Maximum Variation from Alignment of Columns: 1/4 inch.

B. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.

C. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.

D. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.

E. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.

F. Maximum Variation of Joint Thickness: 1/8 inch in 3 ft.

G. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.

3.10 CUTTING AND FITTING

A. Cut and fit for chases. Coordinate with other sections of work to provide correct size, shape, and location.

B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.11 FIELD QUALITY CONTROL

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

B. Test and evaluate concrete masonry units in accordance with ASTM C140/C140M procedures and the provisions of the TMS 402/602. Strength to be in accordance with Table 1 or 2 as applicable of the TMS 402/602. For strength requirements for the wall assemble (f'm) see Structural General Notes. Sampling 5 randomly chosen units for each 5,000 sq. ft. of wall.

C. Prism Tests: At contractor's option, Prism Tests in accordance with TMS 402/602 can be completed in lieu of the Unit Strength Method. Test masonry and mortar panels for compressive strength in accordance with ASTM C1314, and for flexural bond strength in accordance with ASTM C1072 or ASTM E518/E518M; perform tests and evaluate results as specified in individual masonry sections. Perform test for each 5,000 sq ft of wall.

3.12 CLEANING

A. Remove excess mortar and mortar smears as work progresses.

B. Replace defective mortar. Match adjacent work.

C. Clean soiled surfaces with cleaning solution.

D. Use non-metallic tools in cleaning operations.

3.13 PROTECTION

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

END OF SECTION 04 29 00

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SECTION 04 73 00
MANUFACTURED STONE MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Adhered manufactured stone masonry veneer (AMSMV).

B. Mechanically attached lightweight synthetic stone veneer.

C. Installation materials.

D. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 04 05 11 - Masonry Mortaring and Grouting: Site-mixed mortars.

B. Section 04 20 00 - Unit Masonry: Through-wall masonry flashings.

C. Section 07 92 00 - Joint Sealants: Sealing control and expansion joints.

D. Section 09 22 36 - Lath: Lathing and accessories for scratch coat.

1.03 REFERENCE STANDARDS

A. ANSI A118.4 - American National Standard Specifications for Modified Dry-Set Cement Mortar.

B. ASTM C140/C140M - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.

C. ASTM C270 - Standard Specification for Mortar for Unit Masonry.

D. ASTM C847 - Standard Specification for Metal Lath.

E. ASTM C926 - Standard Specification for Application of Portland Cement-Based Plaster.

F. ASTM C1670/C1670M - Standard Specification for Adhered Manufactured Stone Masonry Veneer Units.

G. ASTM C1714/C1714M - Standard Specification for Preblended Dry Mortar Mix for Unit Masonry.

H. ASTM C1780 - Standard Practice for Installation Methods for Cement-Cased Adhered Masonry Veneer.

I. ICC-ES AC51 - Acceptance Criteria for Adhered Manufactured Stone Masonry Veneer.

J. NCMA (AMSV) - Installation Guide and Detailing Options for Compliance with ASTM C1780 for Adhered Manufactured Stone Veneer.

K. NCMA TEK 20-01 - Key Installation Checkpoints for Manufactured Stone Veneer.

L. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for AMSMV units, lightweight synthetic stone veneer, mortar, lath, rainscreen drainage material, and water-resistive barrier, including:

C. Shop Drawings: Submit detail drawings depicting proper installation and flashing techniques. Coordinate locations with those found on drawings.

D. Verification Samples: For each finish product specified, two samples, minimum size 12 inches square, representing actual product, color, patterns and texture.

E. Manufacturer's Qualification Statement.

F. Installer's Qualification Statement.

G. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

H. Specimen Warranty.

1.06 QUALITY ASSURANCE

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

B. Installer Qualifications: Company specializing in performing work of type specified, with at least five years of documented experience.

1.07 MOCK-UPS

A. Construct mock-up panel 2 feet long by 4 feet high; include AMSMV, lightweight synthetic stone veneer, mortar, accessories, substrate, and representative wall openings.

B. Locate where directed.

C. Mock-up may remain as part of the work.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Protect products from precipitation combined with freezing temperatures. Do not install products with visible frozen moisture.

C. Protect Portland cement based materials from moisture and humidity. Store under cover off the ground in a dry location.

1.09 FIELD CONDITIONS

A. Cold and Hot Weather Requirements: Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

1.10 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Correct defective work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Adhered Manufactured Stone Masonry Veneer (AMSMV):

1. Eldorado Stone; (800) 925-1491: www.eldoradostone.com/#sle.

2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ADHERED MANUFACTURED STONE MASONRY VENEER (AMSMV)

A. AMSMV: Cast masonry units using a mixture of cement, lightweight aggregates, concrete additives and color pigments to replicate appearance of natural stone and designed to be applied with a cementitious mortar to a backing surface, complying with ASTM C1670/C1670M and ICC-ES AC51.

1. Style: As indicated on drawings.

2. Style: Coursed ashlar.

3. Color, Texture, Range, Special Shapes: As indicated on drawings.

B. AMSMV Trim: Provide wall caps and drip ledges.

2.03 MORTAR APPLICATIONS

2.04 MORTAR MIXES

A. 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 specified strength in accordance with ASTM C270 with addition of water only.

1. Type: Type S.
2. Color: Standard gray.
3. Water-repellent mortar for use with water-repellent masonry units.
4. Manufacturers:
    a. Amerimix, an Oldcastle brand; Water Repellent Mix AMX WRM 410 (RB): www.amerimix.com/#sle.
    b. Substitutions: See Section 01 60 00 - Product Requirements.

2.05 ACCESSORIES

A. Lath: See Section 09 22 36.

B. Metal Lath with Rainscreen Drainage Material: Factory-assembled combination of mesh drainage material and metal lath.

1. Manufacturers:
    a. Mortar Net Solutions; LathNet: www.mortarnet.com/#sle.
    b. Substitutions: See Section 01 60 00 - Product Requirements.

C. Cleaning Solution: Non-acidic, not harmful to AMSMV work or adjacent materials, approved by AMSMV manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that backup wall system construction complies with AMSMV manufacturer's instructions, NCMA (AMSV), NCMA TEK 20-01, ASTM C1780 and ICC-ES AC51.

B. Verify that substrates to receive mortar scratch coat or setting bed comply with AMSMV manufacturer's instructions, NCMA (AMSV), NCMA TEK 20-01, ASTM C1780 and ICC-ES AC51:

1. Metal Lath and Accessories: Verify lath is flat, secured to substrate, and joint and surface perimeter accessories are in place.

C. Verify that built-in items are in proper location, and ready for installation of AMSMV.

3.02 PREPARATION

A. Dampen masonry surfaces to reduce excessive suction.

B. Clean concrete surfaces of foreign matter using approved acid solutions, solvents, or detergents, and then rinse surfaces thoroughly with clean water.

C. Apply dash bond coat to solid bases and moist cure for at least 24 hours before applying setting bed.

3.03 INSTALLATION - WATER-RESISTIVE BARRIER

A. Where required by AMSMV manufacturer's instructions, NCMA (AMSV), NCMA TEK 20-01, ASTM C1780 or ICC-ES AC51, install 2 layers of water-resistive barrier in accordance with water-resistive barrier manufacturer's instructions. Integrate water-resistive barrier with all flashing accessories, adjacent water-resistive barriers, doors, windows, penetrations, and cladding transitions.

3.04 INSTALLATION - SCRATCH COAT

A. Apply mortar scratch coat of 1/2 inch nominal to cover metal lath in accordance with ASTM C926. Scratch surface when somewhat firm. If scratch coat dries before applying setting bed mortar and AMSMV, moisten scratch coat by misting it with water.

3.05 INSTALLATION - AMSMV

A. Install AMSMV with a cementitious mortar setting bed to a scratch coat backing surface, in accordance with AMSMV manufacturer's instructions, NCMA (AMSV), NCMA TEK 20-01, ASTM C1780 and ICC-ES AC51.

B. Mortar Joints: Concave.

C. Caps: Install capstones where located on drawings.

3.06 INSTALLATION - 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.

3.07 CONTROL AND EXPANSION JOINTS

A. Form joints as detailed on drawings.

3.08 CUTTING AND FITTING

A. Cut and fit for pipes, conduit, and electrical boxes for clean trim out. Coordinate with other sections of work to provide correct size, shape, and location.

3.09 CLEANING

A. Remove excess mortar and mortar smears as work progresses.

B. Replace defective mortar. Match adjacent work.

C. Clean soiled surfaces with cleaning solution.

END OF SECTION 04 73 00

SECTION 05 12 00
STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Steel columns, base plates and anchor bolts, with nuts and washers.

B. Steel purlins, beams and girders.

C. Steel edge angles, closures, stiffeners, continuity plates and shear tabs.

D. Other steel framing and accessories.

E. Shop and field welding.

F. Field bolting.

G. Grouting beneath steel base plates.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Grout beneath steel base plates.

B. Section 05 21 00 - Steel Joists.

C. Section 05 31 00 - Steel Decking: Support framing for small openings in deck.

D. Section 05 50 00 - Metal Fabrications: Steel fabrications affecting structural steel work.

1.03 REFERENCE STANDARDS

A. AISC (MAN) - Steel Construction Manual.

B. AISC S348 - Specification for Structural Joints Using ASTM A325 or A490 Bolts; 2004.

C. AISC S303 - Code of Standard Practice for Steel Buildings and Bridges.

D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.

E. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.

F. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

G. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

H. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.

I. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

J. ASTM A563/A563M - Standard Specification for Carbon and Alloy Steel Nuts (Inch and Metric).

K. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.

L. ASTM A992/A992M - Standard Specification for Structural Steel Shapes.

M. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).

N. ASTM E164 - Standard Practice for Contact Ultrasonic Testing of Weldments.

O. ASTM E709 - Standard Guide for Magnetic Particle Testing.

P. ASTM F436/F436M - Standard Specification for Hardened Steel Washers Inch and Metric Dimensions.

Q. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.

R. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength.

S. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.

T. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification.

U. AWS A5.10/A5.10M - Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding; American Welding Society.

V. AWS A5.17-A5.17M - Specification for Carbon Steel Electrodes and Fluxes for Submerged Arc Welding; American Welding Society.

W. AWS A5.20 - Specification for Carbon Steel Electrodes for Flux Cored Arc Welding; American Welding Society.

X. AWS A5.23-A5.23M - Specification for Low Alloy Steel Electrodes and Fluxes for Submerged Arc Welding; American Welding Society.

Y. AWS A5.29 - Specification for Low Alloy Steel Electrodes for Flux Cored Arc Welding; American Welding Society.

Z. AWS A5.10/A5.10M - Specification for Bare Aluminum and Aluminum-Alloy Welding Electrodes and Rods.

AA. AWS D1.1/D1.1M - Structural Welding Code - Steel.

BB. AWS D1.8/D1.8M - Structural Welding Code-Seismic Supplement.

CC. RCSC (HSBOLT) - Specification for Structural Joints Using High-Strength Bolts; Research Council on Structural Connections.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:

1. Indicate profiles, sizes, spacing, locations of structural members, openings, attachments, and fasteners.

2. Submit the entire structural steel submittal package at one time. Exceptions can be requested by the contractor prior to the first submittal to expedite the construction schedule by sub-dividing the submittal package.

3. 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' Qualification Statement: Provide a statement that welders' certificates are in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.

E. Quality Assurance Plan (QAP): For the Seismic Force Resisting System (SFRS) and Demand Critical Welds indicated in the drawings submit a QAP in accordance with AWS D1.8/D1.8M.

1.05 QUALITY ASSURANCE

A. Fabricate structural steel members in accordance with AISC (MAN) "Steel Construction Manual."

B. Comply with Section 10 of AISC S303 "Code of Standard Practice for Steel Buildings and Bridges" for architecturally exposed structural steel.

C. Welding of Demand Critical welds indicated in the drawings to be in accordance with AWS D1.8/D1.8M.

D. Fabricator: Company specializing in performing the work of this section with minimum 3 years of documented experience.

E. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and no more than 12 months before start of scheduled welding work.

F. Erector: Company specializing in performing the work of this section with minimum 3 years of documented experience.

G. Design connections not detailed on drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in Project Location State.

PART 2 PRODUCTS

2.01 MATERIALS

A. Steel Framing

1. See Structural General Notes in Drawings for specification and grade of framing members.

B. Fasteners, Anchor Bolts, Threaded Round Bars and Connectors:

1. Carbon Steel Bolts and Nuts: ASTM A 307, Grade A galvanized to ASTM A 153/A 153M, Class C, bolts with ASTM A 563, Grade A nuts .A 307 bolts are not the normal.

2. High-Strength Structural Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, with matching compatible ASTM A563/A563M nuts and ASTM F436/F436M washers.

3. Tension Control Bolts: Twist-off type; ASTM F3125/F3125M, Grade F1852 bolts.

C. Accessory Materials:

1. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

a. Use electrodes and fluxes conforming to AWS A5.1, AWS A5.5, AWS A5.17, AWS A5.20, AWS A5.23 or AWS A5.29.

b. Use prequalified base metal/filler metal combinations in accordance with AWS D1.1.

c. Use filler metals classified for nominal 70 ksi tensile strength and complying with the following minimum mechanical property requirements for welds on members comprising the Seismic-Force-Resisting System.

1) Minimum Charpy V-Notch toughness of 20 foot-pounds at 0 degrees Fahrenheit, using AWS A5 classification test methods.

2) Minimum Charpy V-Notch toughness of 40 foot-pounds at 70 degrees Fahrenheit, using the test procedures prescribed in Appendix A of Part I of FEMA 353.

3) Minimum yield strength of 58 ksi using both the AWS A5 classification test (for E70 classification electrodes) and the test procedures prescribed in Appendix A of Part I of FEMA 353.

4) Minimum tensile strength of 70 ksi using both the AWS A5 classification test (for E70 classification electrodes) and the test procedures prescribed in Appendix A of Part I of FEMA 353.

5) Minimum elongation of 22 percent using both the AWS A5 classification test (for E70 classification electrodes) and the test procedures prescribed in Appendix A of Part I of FEMA 353.

2. Bolted members comprising the Seismic-Force-Resisting System to use pretensioned high-strength bolts. All faying surfaces shall be prepared as required for Class A or better Slip-Critical Joints. Use twist off tension control bolts.

3. Members comprising the Seismic-Force-Resisting System include:

   a. Beams and columns of ordinary moment-resisting frames.

   b. Beams and columns of special moment-resisting frames.

   c. Beams, columns and braces of ordinary concentric braced frames.

   d. Beams, columns and braces of special concentric braced frames.

   e. Beams, columns and braces of eccentric braced frames.

   f. Beams, columns and braces of buckling restrained brace frames.

4. Grout: See Section 03 30 00 - Cast-in-Place Concrete.

5. Shop and Touch-Up Primer: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.

6. 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.

2.03 FINISH

A. Exterior Steel Finish: All exterior steel to be galvanized unless noted otherwise. Plug galvanized holes with aluminum plugs.

B. Interior Steel Finish: Shop prime coat, unless noted otherwise.

C. Shop prime interior structural steel members. Do not prime surfaces that will be field welded, in contact with concrete, or high strength bolted.

D. Galvanize structural steel members to comply with ASTM A123/A123M. Provide minimum 1.7 oz/sq ft galvanized coating. Touch up of galvanized surfaces in the shop or field in accordance with ASTM A780/A780M using one of the three approved methods.

2.04 SOURCE QUALITY CONTROL

A. Welded Connections: Visually inspect all shop-welded connections and test at least 100 percent of full penetration welds using one of the following:

1. Ultrasonic testing performed in accordance with ASTM E164.

2. For Demand Critical Welds indicated in the drawings testing to be performed in accordance with ASTM E164 and AWS D1.8/D1.8M.

3. Magnetic particle inspection performed in accordance with ASTM E709.

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 S303 "Code of Standard Practice for Steel Buildings and Bridges"..

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. Use carbon steel bolts only for temporary bracing during construction, unless otherwise specifically permitted on drawings. Install high-strength bolts in accordance with RCSC (HSBOLT) "Specification for Structural Joints Using High-Strength Bolts".

D. Do not field cut or alter structural members without approval of Architect or Engineer.

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 per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

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.

B. Welded Connections: Visually inspect all field-welded connections and test at least 100 percent of full penentration welds using one of the following:

1. Ultrasonic testing performed in accordance with ASTM E164.
2. For Demand Criitical welds, provide testing performed in accordance with ASTM E164 and AWS D1.8/D1.8M.
3. Magnetic particle inspection performed in accordance with ASTM E709.

END OF SECTION 05 12 00

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SECTION 05 12 13
ARCHITECTURALLY-EXPOSED STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Additional requirements for structural steel members designated as architecturally-exposed structural steel (AESS).

1.02 RELATED REQUIREMENTS

A. Section 05 12 00 - Structural Steel Framing: General requirements for structural steel members, including AESS framing specified in this section.

B. Section 09 91 13 - Exterior Painting: Finish coat requirements and coordination with primer and surface preparation specified in this section.

C. Section 09 91 23 - Interior Painting: Finish coat requirements and coordination with primer and surface preparation specified in this section.

D. Section 09 96 00 - High-Performance Coatings: Finish coat requirements and coordination with primer and surface preparation specified in this section.

1.03 DEFINITIONS

A. Architecturally-Exposed Structural Steel: Structural steel complying with designated AESS category as defined in AISC 303.

1.04 REFERENCE STANDARDS

A. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges.

B. AISC 360 - Specification for Structural Steel Buildings.

C. ASTM A6/A6M - Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling.

D. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

E. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.

F. ASTM A1085/A1085M - Standard Specification for Cold-Formed Welded Carbon Steel Hollow Structural Sections (HSS).

G. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.

H. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification.

I. AWS D1.1/D1.1M - Structural Welding Code - Steel.

J. SSPC-SP 6/NACE No.3 - Commercial Blast Cleaning.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product data for each type of product specified. Submit paint systems in accordance with Section 09 91 13.

C. Shop Drawings: Detailing for fabrication of AESS components.

1. Provide erection documents clearly indicating which members are AESS members and the AESS category of each part.

2. Include details that clearly identify AESS requirements found in this specification. Provide connections for AESS consistent with concepts shown on drawings.

3. Indicate welds by AWS A2.4 symbols, distinguishing between shop and field welds, and show size, length and type of each weld. Identify grinding, finish and profile of welds as defined by the designated AESS category.

D. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.

E. Qualification data for fabricator and erector to demonstrate their capabilities and experience. Include lists of completed projects names and address, names and addresses of architects and owners, photographs showing detail of installed AESS, and other information specified.

1.06 QUALITY ASSURANCE

A. Fabricator Qualifications: In addition to those qualifications listed in Section 05 12 00, engage an AISC Certified Fabricator, experienced in fabricating AESS similar to that indicated for this project with a record of successful in-service performance, as well as sufficient production capacity to fabricate AESS without delaying the work.

B. Welder Qualifications: Welding processes and welding operators qualified within previous 12 months in accordance with AWS D1.1/D1.1M and dated no more than 12 months before start of scheduled welding work..

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground by using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration. Use special care in handling to prevent twisting or warping of AESS members.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Comply with Section 05 12 00, except as amended in this section for aesthetic purposes.

2.02 FABRICATION

A. Fabricate and assemble AESS in shop to greatest extent possible. Locate field joints in AESS assemblies at concealed locations or as approved by Architect. Detail AESS assemblies to minimize field handling and expedite erection.

B. Permissible tolerances for member depth, width, out of square, and camber and sweep to be as specified in ASTM A6/A6M, ASTM A500/A500M, and ASTM A1085/A1085M.

C. Use special care in handling and shipping of AESS both before and after shop painting to minimize damage to any shop finish. Use nylon-type slings or softeners when using chains or wire rope slings.

D. Fabricate AESS in accordance with categories defined in AISC 303, as follows:

2.03 PAINT SYSTEM

A. Compatibility: All components/procedures of AESS paint system to comply with coating system specified, submitted, and approved per Sections 09 91 13, 09 91 23, and 09 96 00. As a minimum, identify required surface preparation, primer, intermediate coat (if applicable), and finish coat. Primer, intermediate coating, and finish coating to be from a single manufacturer combined in a system documented by manufacturer with adequate guidance for fabricator to procure and execute.

B. Primer: Organic, epoxy/zinc rich meeting class B surface requirements for slip critical connections, as found in AISC 360. Primer to comply with all federal standards for VOC, lead and chromate levels.

C. Finish Coating: Field apply intermediate and top coats per Sections 09 91 13, 09 91 23, and 09 96 00.

2.04 SHOP PRIMING

A. Surface Preparation:

1. Comply with SSPC-SP 6/NACE No.3.

2. Remove weld spatter, slivers and similar surface discontinuities.

3. Ease sharp corners resulting from shearing, flame cutting or grinding.

B. Shop prime structural steel members. Do not prime surfaces that will be fireproofed, field welded, in contact with concrete, or high strength bolted with slip-critical connections.

2.05 SOURCE QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Erector to check all AESS members upon delivery for twist, kinks, gouges or other imperfections which may result in rejection of appearance of member. Coordinate remedial action with fabricator prior to erecting steel.

3.02 PREPARATION

A. Provide connections for temporary shoring, bracing and supports only where noted on approved fabrication documents. Temporary connections not shown are to be made at locations not exposed to view in final structure or as approved by Architect.

B. Handle, lift and align pieces using nylon straps or chains with softeners required to maintain appearance of AESS through process of erection.

3.03 ERECTION

A. AESS 1 and 2: Basic elements; feature elements not in close view:

1. Employ special care to handle and erect AESS. Erect finished pieces using nylon straps or chains with softeners such that they are not damaged.

2. Place weld tabs for temporary bracing and safety cabling at points concealed from view in completed structure or where approved by Architect during pre-installation meeting. Obtain Architect approval of methods for removing temporary devices and finishing AESS members prior to erection.

3. AESS Erection Tolerances: Erect to standard frame tolerances for structural steel per Chapter 7 of AISC 303.

4. Set AESS accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.

5. Remove blemishes or unsightly surfaces resulting from temporary braces or fixtures.

6. Remove all backing and run out tabs.

7. When temporary braces or fixtures are required to facilitate erection, take care to avoid any blemishes, holes or unsightly surfaces resulting from use or removal of such temporary elements.

8. Welded Connections: Comply with AWS D1.1/D1.1M and Section 05 12 00. Appearance and quality of welds to be consistent. Employ methods that will maintain alignment of members without warp exceeding tolerance of this section.

9. Remove weld spatter exposed to view.

10. Grind off projections larger than 1/16 inch at field butt and plug welds.

11. Continuous Welds: Where continuous welding is noted on drawings, provide continuous welds of a uniform size and profile.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Structural Requirements:

1. Comply with quality control requirements per AISC 360, Chapter N and AISC 303, Section 10. Refer to Section 05 12 00 for additional requirements.

3.05 CLEANING

A. Touch-up Painting: Complete cleaning and touch-up painting of field welds, bolted connections, and abraded areas of shop paint to blend with adjacent surfaces of AESS. Perform touch-up work in accordance with manufacturer's instructions and as specified in Section 09 91 13, 09 91 23, and 09 96 00.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas. Repair galvanized surfaces in accordance with ASTM A780/A780M.

END OF SECTION 05 12 13

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SECTION 05 40 00
COLD-FORMED METAL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Formed steel stud exterior wall and interior wall framing.

B. Formed steel joist and purlin framing and bridging.

1.02 RELATED REQUIREMENTS

A. Section 01 40 00 - Quality Requirements.

1.03 DEFINITIONS

A. Connector: A device used to transmit forces between cold-formed steel structural members or between a cold-formed steel structural member and another structural element.

1.04 REFERENCE STANDARDS

A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members.

B. AISI S240 - North American Standard for Cold-Formed Steel Structural Framing.

C. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures.

D. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.

E. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members.

F. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories.

G. ASTM C 1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories; 2004.

H. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel.

I. ICC (IBC) - International Building Code.

J. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer.

K. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic).

1.05 SYSTEM DESCRIPTION

A. Horizontal Deflection: Design to permit maximum deflection of 1/180 of span.

B. Vertical Deflection: Design non-axial loadbearing framing to accommodate not less than 1/2 in vertical deflection.

C. Design wall system to provide for movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperature ranges.

D. Design system to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.

1.06 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on standard framing members; describe materials and finish, product criteria, limitations . Provide documentation relating proposed framing members to corrusponding project wall type/location per Drawings.

C. Product Data: For lateral-force resisting systems, provide product data sheets on hold-down, showing compliance with requirements.

D. Shop Drawings: Indicate component details, framed openings, and accessories or items required of related work.

1. Indicate stud and ceiling joist layout.

2. Describe method for securing studs to tracks and for bolted framing connections.

E. Steel Framing Industry Association (SFIA) Certification:

1. Design Data:

a. Design calculations sufficient to demonstrate compliance with design criteria; signed and sealed by a professional structural engineer.

1.07 QUALITY ASSURANCE

A. Designer Qualifications: Design framing system under direct supervision of a professional structural engineer experienced in designing this work and licensed in Project Location State.

B. Calculate structural properties of framing members in accordance with requirements of AISI North American Specification for the Design of Cold-Formed Steel Structural Members.

1.08 PROJECT CONDITIONS

A. Verify that field measurements are as indicated on the drawings.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Structural Framing:

1. ClarkDietrich; _____: www.clarkdietrich.com/#sle.
2. SCAFCO Corporation; _____: www.scafco.com/#sle.
3. MiTek Industries, Inc: www.mii.com.
4. The Steel Network, Inc; _____: www.SteelNetwork.com/#sle.
5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Connectors:

1. Same manufacturer as metal framing.
2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

A. Design Requirements: Design cold-formed framing systems, components and connectors to withstand specified design loads in compliance with ICC (IBC), ASCE 7, AISI S100, and AISI S240.

2.03 MATERIALS

A. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S240.

2.04 STRUCTURAL FRAMING COMPONENTS

A. Wall Studs and Track Sections: AISI S240; c-shaped studs and u-shaped track sections in stud-matching nominal width and compatible height.

1. Structural Grade: As required to meet design criteria.
2. Corrosion Protection Coating Designation: CP 60 in accordance with AISI S240.
3. Thickness and Depth: As indicated on drawings.

B. Purlins: AISI S240; manufactured c-shaped sections.

1. Structural Grade: As required to meet design criteria.

2. Corrosion Protection Coating Designation: CP 60 in accordance with AISI S240.

3. Thickness and Depth: As indicated on drawings.

2.05 MISCELLANEOUS CONNECTIONS

A. Welding: Comply with AWS D1.1/D1.1M.

2.06 ACCESSORIES

A. Bracing, Furring, Bridging: Formed sheet steel, thickness determined for conditions encountered; finish to match framing components.

B. Galvanizing Repair: Touch up bare steel with zinc-rich paint in compliance with ASTM A780/A780M.

C. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20 Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.07 SHOP FABRICATED ASSEMBLIES

A. Shop fabricate metal framing to the greatest extent possible.

B. Fabricate assemblies of framed sections of sizes and profiles required; with framing members fitted, reinforced, and braced to suit design requirements.

C. Fit and assemble in largest practical sections for delivery to site, ready for installation.

PART 3 EXECUTION

3.01 EXAMINATION

3.02 INSTALLATION - GENERAL

A. Install structural members and connections in compliance with ASTM C1007.

3.03 INSTALLATION OF STUDS

A. Construct corners using minimum of three studs. Install double studs at wall openings, door and window jambs.

B. Install load-bearing studs full length in one piece. Splicing of studs is not permitted.

C. Install load-bearing studs; brace, and reinforce to develop full strength and achieve design requirements.

D. Coordinate placement of insulation in multiple stud spaces made inaccessible after erection.

E. Install intermediate studs above and below openings to align with wall stud spacing.

F. Provide deflection allowance in stud track, directly below horizontal building framing at non-loadbearing framing.

G. Attach cross studs to studs for attachment of fixtures anchored to walls.

H. Install framing between studs for attachment of mechanical and electrical items, and to prevent stud rotation.

I. Touch-up field welds and damaged corrosion protected surfaces with primer.

3.04 INSTALLATION OF JOISTS AND PURLINS

A. Set floor and ceiling joists parallel and level, with lateral bracing and bridging.

B. Locate joist end bearing directly over load-bearing studs or provide load distribution on top of stud track.

C. Provide web stiffeners at reaction points.

D. Touch-up field welds and damaged primed surfaces with primer.

3.05 FIELD QUALITY CONTROL

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

B. Welded Connections: Visually inspect all field-welded connections.

3.06 TOLERANCES

A. Maximum Variation from True Position: 1/2 inch.

B. Maximum Variation of any Member from Plane: 1/2 inch.

END OF SECTION 05 40 00

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SECTION 05 50 00
METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

1.02 SYSTEM DESCRIPTION

A. Structural Requirements

1. Design handrails and railings to resist design load of 200 pounds in any direction at any point on railing or 50 pounds per lineal foot which ever is greater without deflection in excess of L/180 and without permanent member deformation.

2. Use AISC, Manual of Steel Construction, latest edition for structural requirements.

1.03 RELATED REQUIREMENTS

A. Section 05 52 13 - Pipe and Tube Railings.

B. Section 09 91 13 - Exterior Painting: Paint finish.

1.04 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.

B. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

C. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.

D. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.

E. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

F. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.

G. ASTM A780 - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings; 2001.

H. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength.

I. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination.

J. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification.

K. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic).

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative 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. Prepare shop drawings from field measurements where possible.

2. Allow for field trimming where taking field measurements will delay work.

3. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

C. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.

D. Provide anchor and bolt templates for attachment of metal fabrications concrete, structural steel and similar components.

1.06 QUALITY ASSURANCE

A. Shop Weld Inspections:

1. Assist with shop weld inspections by Independent Testing Laboratory.

B. Welder Qualifications: Use welders certified by American Welding Society for structural welding.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Transport, handle, store, and protect products to with special custom wrapping and handling procedures to protect and touch-up shop primers at every stage of shipping.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

A. Steel Sections: ASTM A36/A36M

B. Round Steel Tubing: ASTM A500, Grade B cold-formed structural tubing.

1. Round Tubing: Fy = 42 = KSI.

C. Plates: ASTM A283/A283M.

D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish, Type E at concealed locations and Type S at exposed locations, Fy = 35 KSI.

E. Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, plain.

F. Fastener Materials:

1. Standard Bolts: ASTM A307, Grade A.

2. High Strength Bolts: ASTM F3125/F3125M, Grade A 325 N.

3. Electrodes: AWS A5.1, E60XX or AWS A5.1 or A5.5, E70XX.

4. Concrete Anchors: Kwik-Bolt or Sleeve Anchor by Hilti, Red Head Wedge Anchors by Phillips, Trubolt or Dynabolt by Ramset, Rawl-Bolt or Rawl-Stud by Rawlplug, Parabolt by U.S.M.

5. Masonry Anchors: Sleeve Anchor by Hilti, Red Head Sleeve Anchor by Phillips.

6. Machine Screws: Steel, FS FF-S-92.

7. Plain Washers: Round steel FS FF-W-92.

8. Masonry Expansion Shields: FS FF-S-325.

9. Lock Washers: Helical spring, FS FF-W-84

G. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION

A. Comply with AISC Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings and AISC Specifications for Architecturally Exposed Structural Steel.

B. Fabricate items to dimensions required by field measurements.

C. Comply with shop drawings and referenced standards.

D. Use welds for shop connections and use bolts for field connections, except where indicated otherwise on Drawings.

E. Fit and shop assemble items in largest practical sections, for delivery to site.

F. Mark assembled components for field assembly and coordinated installation.

G. Use materials of size and thickness indicated or, if not indicated, as required to produce strength and durability in finished product for use intended.

H. Work to dimensions shown or accepted on shop drawings, using proven details of fabrication and support.

I. Use type of materials indicated or specified for various components of work.

J. Work to dimensions shown or accepted on shop drawings, using proven details of fabrication and support.

K. Fabricate items with joints tightly fitted and secured.

L. Use type of materials indicated or specified for various components of work.

M. 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.

N. Form exposed connections with flush hairline joints.

O. Bolted Connections:

1. Provide anchor bolts for connecting to other work.

    a. Drill and tap steel as required to receive bolted connections.

    b. Make bolt holes 1/16 inch larger than nominal bolt diameter.

2. Do not furnish bolts with threads within sheer plane of the bolt.

3. Provide anchor bolts for connecting to other work.

    a. Drill and tap steel as required to receive bolted connections.

        1) Make bolt holes 1/16 inch larger than nominal bolt diameter.

    b. Do not furnish bolts with threads within sheer plane of the bolt.

2.03 FABRICATED ITEMS

A. Fabrication of Structural Framing:

1. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

2. Fabricate units from steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.

    a. Fabricate units from slotted channel framing where indicated.

b. Furnish inserts if units are installed after concrete is placed.

3. Fabricate supports for operable partitions from continuous steel beams of sizes indicated with attached bearing plates, anchors, and braces as indicated. Drill bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.

B. Fabrication of Steel Pipe and Tube Columns.

1. Fabricate columns to lengths required with welded connections.

2. Fabricate steel plate framing connectors and bearing plates adjacent to steel columns as detailed on Drawings.

3. Shop galvanize exterior columns and connectors after fabrication.

C. Fabrication Antenna Masts: Steel tubing; galvanized finish.

1. Diameter:3 1/2 inch

2. Height: 6 to 9 feet - Refer to drawings.

D. Stainless Steel Detention Bench:

E. Stainless Steel Interview Table with Restraint Rings:

1. 12 Gauge 304 Stainless Steel.

2. 16 Gauge 304 Stainless Steel

3. Anchor to building structures as requirements by manufacturer.

a. Product: KM-FWB-72in Manufactured by KryptoMax; www.KryptoMax.com

b. Product: KM-TBL-INT-304830 Manufactured by KryptoMax; www.KryptoMax.com

4. Anchor to building structures as requirements by manufacturer.

F. Steel Weld Plates and Angles:

1. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with not less than two integrally welded steel strap anchors for embedding in concrete.

G. Miscellaneous Steel Trim:

1. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

2. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

    a. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

3. Galvanize exterior miscellaneous steel trim and interior miscellaneous steel trim, where indicated. All other miscellaneous trim shall be primed with zinc-rich primer.

H. Bollards: Steel pipe, concrete filled, crowned cap, as detailed; galvanized finish.

1. Grind exposed end smooth.

2. Galvanize surfaces which will not be embedded in concrete.

3. Finish steel bollards with prime coat.

2.04 FINISHES - STEEL

A. Exterior Steel Finish: All exterior steel to be galvanized. Plug galvanized holes with aluminum plugs.

B. Interior Steel Finish: Shop prime coat, unless noted otherwise.

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.

3.03 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Install items plumb and level, accurately fitted, free from distortion or defects.

C. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws, and other connectors.

D. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

E. Field weld components as indicated on drawings.

F. Obtain approval prior to site cutting or making adjustments not scheduled.

3.04 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified in "Installing Bearing and Leveling Plates" Article.

1. Grout baseplates of columns supporting steel girders after girders are installed and leveled.

3.05 INSTALLING BEARING AND LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.

1. Use nonshrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations, unless otherwise indicated.

2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.06 TOUCH-UP PAINTING AND GALVANIZATION REPAIR

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 05 50 00

SECTION 06 10 00
ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sheathing.

B. Preservative treated wood materials.

C. Fire retardant treated wood materials.

D. Communications and electrical room mounting boards.

E. Roofing cant strips.

F. Concealed wood blocking, nailers, and supports.

1.02 RELATED REQUIREMENTS

A. Section 05 12 00 - Structural Steel Framing: Prefabricated beams and columns for support of wood framing.

B. Section 05 50 00 - Metal Fabrications: Miscellaneous steel connectors and support angles for wood framing.

C. Section 07 62 00 - Sheet Metal Flashing and Trim: Sill flashings.

1.03 REFERENCE STANDARDS

A. AFPA (NDS) - National Design Specification for Wood Construction.

B. APA E30 - Engineered Wood Construction Guide.

C. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.

D. ASTM D3498 - Standard Specification for Adhesives for Field-Gluing Plywood to Lumber Framing for Floor Systems.

E. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

F. ASTM F1667 - Standard Specification for Driven Fasteners: Nails, Spikes, and Staples.

G. AWPA U1 - Use Category System: User Specification for Treated Wood.

H. PS 1 - Structural Plywood.

I. PS 2 - Performance Standard for Wood Structural Panels.

J. PS 20 - American Softwood Lumber Standard.

K. WCLIB (GR) - Standard Grading Rules for West Coast Lumber No. 17.

L. WWPA G-5 - Western Lumber Grading Rules.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Structural Composite Lumber: Submit manufacturer's published structural data including span tables, marked to indicate which sizes and grades are being used; if structural composite lumber is being substituted for dimension lumber or timbers, submit grading agency structural tables marked for comparison.

1.05 QUALITY ASSURANCE

A. Lumber: Comply with PS 20 and approved grading rules and inspection agencies.

1. Acceptable Lumber Inspection Agencies: WCLB and WWPA.

B. Sheathing Regulatory Requirements:

1. Comply with applicable recommendations in APA E30, Design/Construction Guide-Residential and Commercial.

2. Comply with PS 2 or, for products not manufactured under PS 2 provisions, with applicable APA Performance Standard for type of panel indicated.

3. Furnish laminated wood panels graded by American Plywood Association (APA).

1.06 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. Sheathing acceptance at Site: Examine panels upon delivery and reject panels which are delivered with broken corners of edges crushed by bundling straps or other means.

C. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, and installation.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.

1. 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.

2. 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.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

A. Grading Agency: West Coast Lumber Inspection Bureau; WCLIB (GR).

B. Grading Agency: Western Wood Products Association; WWPA G-5.

C. Sizes: Nominal sizes as indicated on drawings, S4S.

D. Moisture Content: S-dry or MC19.

E. Stud Framing (2 by 2 through 2 by 6):

1. Species: Douglas Fir-Larch, or as indicated in the Drawings.

2. Grade: No. 2.

F. Miscellaneous Furring:

1. Wood Panel Furring:

a. Industry Standard: APA, Construction and Industrial Softwood Plywood, PS 1.

b. Sheathing Furring: 1/2 inch thick, Index 24/0, exterior glue, square edges, and APA Rated.

2.03 STRUCTURAL COMPOSITE LUMBER

A. Structural Composite Lumber: Factory fabricated beams, headers, and columns, of sizes and types indicated on drawings; structural capacity as published by manufacturer.

2.04 CONSTRUCTION PANELS

A. Plywood Wall Sheathing: 15/32 inch thick, C-D Interior with exterior glue, Index 24/0, square edges, APA Rated Struct 1.

B. OSB Wall Sheathing: 15/32 inch thick, Oriented Strand Board, Index 24/0, exterior glue, square edges, APA Rated Struct 1.

C. Wall Sheathing: Oriented strand board structural wood panel with factory laminated water-resistive barrier layer.

1. Sheathing Panel: PS 2, Exposure 1.

a. Size: 4 feet wide by 8 feet long.

b. Grade: Sheathing.

c. Performance Category: 7/16 PERF CAT.

d. Span Rating: 24/16.

e. Edge Profile: Square edge.

2.05 ACCESSORIES

A. Fasteners (Nails, Staples & Sheathing Screws):

1. Industry Standard for Nails and Staples: ASTM F1667, Standard Specification for Driven Fasteners: Nails, Spikes, and Staples.

2. Nails for Framing, Plywood Floor Sheathing and Underlayment: Common; Submit alternate nailing types to A/E for review of type and spacing.

3. Exterior, Wet Area and Preservative Treated Wood: Hot Dip Galvanized Common wire nails, except as indicated otherwise.

4. Interior Dry Area Wood: Cadmium plated Common wire nails, except as indicated otherwise.

5. Fastener Lengths: As indicated in minimum nailing schedule and of size which will not penetrate framing members which will be exposed or will receive finish materials.

6. Staples for Wood Sheathing and Underlayment: 14 gage steel.

7. Screws: Bugle head screws, Type S or Type W, in size recommended by sheathing manufacturer for thickness of sheathing and type of framing.

B. Joist Hangers and Strapping: Hot dipped galvanized steel for wet, high humidity, and treated wood locations; Cadmium plated elsewhere. Size to suit framing conditions.

1. For connectors in contact with preservative treated wood, provide connectors that have finish treatment that is compatible with the type of preservative treatment used.

2. Size to suit framing conditions

3. Manufacturer: Simpson Strong Tie

C. Steel Framing Connectors:

1. Indicated Manufacturer: Numbers indicated on Drawings are from Simpson Strong-Tie Company, Inc.

2. Other Manufacturers: Submit request for approval of equivalent.

3. Finish for Connectors to be Installed in Exterior and Wet Interior Locations: Hot-Dip galvanized to comply with ASTM A153/A153M.

4. Finish for Connectors to be Installed in Dry Interior Locations: Manufacturer's standard rust inhibitive prime coating or zinc coating.

D. Bolts, Nuts, Washers, and Screws:

1. Lag Screws and Lag Bolts: FS FF-B-561, square or hex head.

2. Wood Screws: FF-S-11D, flat head carbon steel.

3. Bolts: FS FF-B-575.

4. Nuts: FS FF-N-836.

5. Machine Screws: FS FF-S-92, cadmium plated steel.

6. Plain Washers: FS FF-W-92, round carbon steel.

7. Lock Washers: FS FF-W-84, helical spring carbon steel.

8. Expansion Shields: FS FF-S-325.

9. Toggle Bolts: FS FF-B-588, tumble wing type.

E. Powder Driven Fasteners and Anchors:

1. Acceptable Fasteners: Powder Driven Fasteners by Hilti or Ramset.

2. Concrete and Masonry Anchors: As indicated on the drawings.

F. Foundation Anchor Bolts:

1. Type: ASTM A307, Grade A, hexagon head.

2. Size: As indicated on Drawings.

3. Minimum Size for Single Story Buildings: 1/2 inch diameter, not less than 12 inches long.

4. Minimum Size for Two Story Buildings: 5/8 inch diameter, not less than 14 inches long.

G. Anchor Finish & Type:

1. Metal and Finish: Hot-dipped galvanized steel per ASTM A153/A153M for high humidity locations. Use fasteners and connectors that have finish treatment that is compatible with the type of preservative treatment used at preservative-treated wood locations. Use unfinished steel elsewhere.

2. Drywall Screws: Bugle head, hardened steel, power driven type, length three times thickness of sheathing.

3. Anchors: Expansion shield and lag bolt type for anchorage to solid masonry or concrete.

H. Construction Adhesives:

1. Industry Standard: APA, AFG-01.

2. Industry Standard: ASTM D3498.

I. Sill Flashing: See Section 07 62 00.

2.06 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. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.

B. Preservative Pressure Treatment of Lumber Above Grade: AWPA U1, Use Category UC3B, Commodity Specification A using waterborne preservative.

1. Kiln dry lumber after treatment to maximum moisture content of 19 percent.

2. Treat lumber in contact with roofing, flashing, or waterproofing.

3. Treat lumber in contact with masonry or concrete.

4. Treat lumber less than 18 inches above grade.

C. Preservative Pressure Treatment of Lumber in Contact with Soil: AWPA U1, Use Category UC4A, Commodity Specification A using waterborne preservative.

1. Preservative for Field Application to Cut Surfaces: As recommended by manufacturer of factory treatment chemicals for brush-application in the field.

2. Restrictions: Do not use lumber or plywood treated with chromated copper arsenate (CCA) in exposed exterior applications subject to leaching.

PART 3 EXECUTION

3.01 PREPARATION

A. Where wood framing bears on cementitious foundations, install full width sill flashing continuous over top of foundation, lap ends of flashing minimum of 4 inches and seal.

B. Install sill gasket under sill plate of framed walls bearing on foundations; puncture gasket cleanly to fit tightly around protruding anchor bolts.

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 FRAMING INSTALLATION

A. Set structural members level, plumb, and true to line. Discard pieces with defects that would lower required strength or result in unacceptable appearance of exposed members.

B. Make provisions for temporary construction loads, and provide temporary bracing sufficient to maintain structure in true alignment and safe condition until completion of erection and installation of permanent bracing.

C. Install structural members full length without splices unless otherwise specifically detailed.

D. Comply with member sizes, spacing, and configurations indicated, and fastener size and spacing indicated, but not less than required by applicable codes and AFPA (NDS).

E. Construct double joist headers at floor and ceiling openings and under wall stud partitions that are parallel to floor joists; use metal joist hangers unless otherwise detailed.

F. Frame wall openings with two or more studs at each jamb; support headers on cripple studs.

3.04 ROOF-RELATED CARPENTRY

A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.

B. Install joists and rafters at not more than 24 inches on center and at spacing indicated on Drawings.

C. Install studs at not more than 16 inches on center and at spacing indicated on Drawings.

D. Install single bottom plates and double top plates, except where indicated otherwise.

E. Single top plates may be installed at interior nonload bearing walls.

F. Overlap top plates at corners, intersections, and ends.

G. Triple studs at corners and wall intersections.

H. Install framing with 1/4 inch maximum deviation from indicated alignment.

I. Do not splice structural framing members between supports.

3.05 INSTALLATION OF HEADERS OVER WALL OPENINGS

A. Set headers on edge and support ends on jamb studs.

B. At non-bearing walls, install double-jamb studs and headers not less than 4 inches deep for openings 3 feet and less in width, and not less than 6 inches deep for wider openings.

C. At load-bearing walls, install double-jamb studs for openings 6 feet and less in width, and triple-jamb studs for wider openings.

D. Install headers of depth shown, or if not shown, as recommended by N.F.P.A. "Manual for House Framing".

3.06 INSTALLATION OF BLOCKING

A. Install 2 inch nominal thick blocking as indicated and as required to support toilet accessories, cabinets, toilet compartments, plumbing, fire protection, mechanical, and electrical equipment.

B. Install blocking for wall mounted door stops in wood framed walls.

C. Install solid blocking between joists and rafters at bearing walls and beams.

D. Install blocking between studs at wood-framed walls and partitions at floor and ceiling lines.

E. Install smoke stop blocking at double stud wood-framed walls and partitions at maximum horizontal intervals of 10 feet.

F. Install smoke stop blocking along and in line with the run of each stairway in adjacent wood stud walls and partitions.

G. Install smoke stop blocking at all similar combustible blind spaces exceeding 10 feet in any dimension to the effect that a barrier to the passage of flame is provided at maximum intervals, both vertical and horizontal, of 10 feet.

H. Anchor wood blocking and bridging to substrates to support applied loads.

I. Install 2 inch nominal thick by width of stud blocking at mid-height of single story walls over 8 feet high and at mid-height of multistory walls.

3.07 INSTALLATION OF BRIDGING

A. Install code-required bridging between structural joists, rafters and trusses.

3.08 INSTALLATION OF STEEL CONNECTORS FOR WOOD FRAMING

A. Install connectors indicated with nails or bolts of sizes and types specified by manufacturer of connector.

3.09 NAILING AND BOLTING

A. Minimum nailing in accordance with IBC Table 2304.9.1, and as indicated in minimum nailing schedule and on Drawings.

B. Install washers under nuts and under bolt heads bearing on wood.

C. Soap threads of lag bolts prior to installing.

D. Install fasteners for plates to foundation using anchor bolts at not more than 48 inches on center or powder driven fasteners at not more than 32 inches on center.

E. Drill Lag Bolt Holes 9/16 inch diameter for 3/4 inch bolts and 1/2 inch diameter for 5/8 inch bolts.

F. Drill Machine Bolt Holes 1/16 inch larger than bolt diameter.

G. Furnish bolts with threads for nuts not bearing on wood.

H. Enlarge lag bolt holes to shank diameter for length of unthreaded shank.

I. Do not drive lag screws, wood screws, and lag bolts.

J. Predrill nail holes and screw holes when required to prevent wood splitting.

3.10 INSTALLATION OF TEMPORARY SUPPORT

A. Adequately brace structure for wind and earthquake forces until roof and wall panels have been secured.

3.11 INSTALLATION OF CONSTRUCTION PANELS

A. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using nails or screws.

1. Provide solid edge blocking between sheets.

2. Nail panels to framing; staples are not permitted.

3. Eliminate sheathing pieces less than 1 foot wide with adjustments in layout.

4. Space sheathing panels as recommended by sheathing manufacturer

B. Provide miscellaneous panels for electrical and mechanical items as may be required by their manufacturer's and authorities having jurisdiction.

3.12 MINIMUM FASTENING SCHEDULE

A. Wood Sheathing and Underlayment Fastening:

1. Fasten sheathing per the drawings with a minimum of 8d at 6" oc panel edges and 12" oc interior supports.

B. Wood Panel Blocking:

1. Blocking at Steel Framing: Screw wood panels to steel studs and runners with bugle head screws at 8 inches on center.

2. Blocking at Wood Framing: Screw wood panels to wood studs and joists with bugle head screws at 8 inches on center

3.13 SITE APPLIED WOOD TREATMENT

A. Apply preservative treatment compatible with factory applied treatment at site-sawn cuts, complying with manufacturer's instructions.

B. Allow preservative to dry prior to erecting members.

3.14 TOLERANCES

A. Framing Members: 1/4 inch from true position, maximum.

B. Variation from Plane, Other than Floors: 1/4 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

3.15 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.

3.16 COMPLETION

A. Remove split and warped framing prior to installation of sheathing and gypsum wall panels.

B. Adjust framing to comply with location and deflection requirements of National Design Specifications.

C. Adjusting Defective Work: Remove and replace defective sheathing and underlayment panels and panels with edges split or damaged by fasteners.

D. Daily Cleaning: Remove excess wood, sawdust, and loose fasteners from the site.

E. Final Cleaning: Remove fasteners, gypsum dust, wood sawdust, and unused panel pieces from the site.

END OF SECTION 06 10 00

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SECTION 06 20 00
FINISH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wood door frames, glazed frames.

B. Wood casings and moldings.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Support framing, grounds, and concealed blocking.

B. Section 06 41 00 - Architectural Wood Casework: Shop fabricated custom cabinet work.

C. Section 09 91 13 - Exterior Painting: Painting of finish carpentry items.

D. Section 09 91 23 - Interior Painting: Painting of finish carpentry items.

E. Section 09 93 00 - Staining and Transparent Finishing: Staining and transparent finishing of finish carpentry items.

1.03 REFERENCE STANDARDS

A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition.

B. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards.

C. BHMA A156.9 - Cabinet Hardware.

D. NEMA LD 3 - High-Pressure Decorative Laminates.

E. NHLA G-101 - Rules for the Measurement and Inspection of Hardwood and Cypress.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with plumbing rough-in, electrical rough-in, installation of associated and adjacent components, and time capsule.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.

1. Provide information as required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).

2. Include certification program label.

C. Samples: Submit two samples of wood trim 6 inch long.

1.06 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.

1. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.

B. Quality Certification:

1. Provide labels or certificates indicating that 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.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect from moisture damage.

B. Handle materials and products to prevent damage to edges, ends, or surfaces.

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. Surface Burning Characteristics: Provide materials having fire and smoke properties as required by applicable code.

C. Interior Woodwork Items:

1. Moldings, Bases, Casings, and Miscellaneous Trim: Traditional Walnut; factory finish.

2. Suspended Wood Ceiling System: "FR-S" treated. Refer to Section 09 51 00.

2.02 LUMBER MATERIALS

A. Hardwood Lumber: Walnut species, TBD sawn, maximum moisture content of 6 percent ; with vertical grain , of quality suitable for transparent finish.

1. Grading: In accordance with NHLA G-101 Grading Rules; www.nhla.com.

2.03 PLASTIC LAMINATE MATERIALS

A. Plastic Laminate: NEMA LD 3; Color as indicated on drawings; finish as selected.

B. Low Pressure Laminate: Melamine; White color and matte surface texture.

C. Laminate Backing Sheet: NEMA LD 3, BKL; undecorated plastic laminate.

2.04 FASTENINGS

2.05 HARDWARE

A. Hardware: Comply with BHMA A156.9.

B. Countertop Support Brackets: Fixed, L-shaped, face-of-wall mounting.

1. Material: Steel; T-shape cross-section.

a. Finish: Manufacturer's standard, factory-applied, powder coat.

b. Color: Black.

c. Height: As indicated on drawings.

d. Support Length: As indicated on drawings.

2. Products:

a. Federal brace; www.federalbrace.com.

C. Vanity Brackets: Hidden, ADA-Compliant, side-of-stud mounting.

1. Material: Steel; formed compound shapes.

a. Finish: Manufacturer's standard, factory-applied, powder coat.

b. Color: Black.

2. Height: As indicated on drawings.

3. Support Length: As indicated on drawings.

4. Products:

a. Federal brace; www.federalbrace.com.

D. Countertop Brackets: Hidden, ADA-Compliant, side-of-stud mounting.

1. Material: Steel; formed compound shapes.

a. Finish: Manufacturer's standard, factory-applied powder coat.

b. Color: Black.

c. Height: As indicated on drawings..

d. Support Length: As indicated on drawings.

2. Products:

a. Federal brace; www.federalbrace.com.

2.06 FABRICATION

A. Shop assemble work for delivery to site, permitting passage through building openings.

B. Cap exposed plastic laminate finish edges with material of same finish and pattern.

C. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

D. Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs.

E. Apply laminate backing sheet to reverse face of plastic laminate finished surfaces.

2.07 SHOP FINISHING

A. Apply wood filler in exposed nail and screw indentations.

B. On items to receive transparent finishes, use wood filler that matches surrounding surfaces and is of type recommended for the applicable finish.

C. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:

1. Transparent:

a. System - 9, UV Curable, Acrylated Epoxy, Polyester or Urethane.

b. Sheen: Flat.

D. Stain, seal, and varnish exposed to view surfaces. Brush apply only.

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. Do not use additional overlay trim to conceal larger gaps.

3.03 SITE APPLIED WOOD TREATMENT

A. Apply preservative treatment in accordance with manufacturer's instructions.

B. Brush apply one coats of preservative treatment on wood in contact with cementitious materials. Treat site-sawn cuts.

C. Allow preservative to dry prior to erecting members.

3.04 PREPARATION FOR SITE FINISHING

A. Set exposed fasteners. Apply wood filler in exposed fastener indentations. Sand work smooth.

B. Site Finishing: See Section 09 91 13 and 09 91 23.

3.05 TOLERANCES

A. Maximum Variation from True Position: 1/16 inch.

B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch.

END OF SECTION 06 20 00

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SECTION 06 41 00
ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hardware.

B. Wood furring, sheet metal furring, blocking, shims, and hanging strips.

1.02 RELATED REQUIREMENTS

A. Section 08 80 00 - Glazing: Glass for casework.

B. Section 12 36 00 - Countertops.

1.03 REFERENCE STANDARDS

A. ANSI A208.1 - American National Standard for Particleboard.

B. ANSI A208.2 - Medium Density Fiberboard (MDF) for Interior Applications.

C. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition.

D. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards.

E. BHMA A156.9 - Cabinet Hardware.

F. AWI/AWMAC (QSI) - Architectural Woodwork Quality Standards Illustrated; Architectural Woodwork Institute and Architectural Woodwork Manufacturers Association of Canada; 2005, 8th Ed., Version 2.0.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.

C. Shop Drawings: Indicate materials, component profiles and elevations, assembly methods, joint details, fastening methods, accessory listings, hardware location and schedule of finishes.

D. Product Data: Provide data for hardware accessories.

E. Certification: Contractor shall register the project, pay the fee.

1.05 QUALITY ASSURANCE

A. Quality Certification:

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.

B. Perform cabinet construction in accordance with AWI/AWMAC Architectural Woodwork Quality Standards Illustrated as follows:

1. All Cabinets: Custom quality.

C. Manufacturer Qualifications: Shall be listed in the specifications as an approved manufacturer either at the original printing or as a

D. Quality Certification: Provide inspection and quality certification of completed custom cabinets in accordance with AWI/AWMAC Quality Certification Program.

1. Contractor shall register the project with AWI, pay for the fee associated with it (0.5% of cabinet contract or $250.00, which ever is more).

a. Submit proof of registration at the beginning of the project.

b. Submit acceptance of the project by AWI at the time of project close-out.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect units from moisture damage.

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

2.02 CABINETS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

B. Plastic Laminate Faced Cabinets: Custom grade.

C. Cabinets at As in indicated on drawings.:

2.03 WOOD-BASED COMPONENTS

A. Wood fabricated from old growth timber is not permitted.

2.04 PANEL MATERIALS

A. Particleboard: ANSI A208.1; medium density industrial type as specified in AWI/AWMAC Architectural Woodwork Quality Standards Illustrated, composed of wood chips bonded with interior grade adhesive under heat and pressure; sanded faces; thickness as required; use for components indicated on drawings.

1. Manufactured with minimal formaldehyde by Roman Industries; Div. of Fiberesin Industries or as may be otherwise available.

B. Medium Density Fiberboard (MDF): ANSI A208.2; type as specified in AWI/AWMAC Architectural Woodwork Quality Standards Illustrated; composed of wood fibers pressure bonded with moisture resistant adhesive to suit application; sanded faces; thickness as required.

1. Use for painted components, components not indicated as another material, and door and drawer panels as well as countertops.

2. Use as backing for plastic laminate unless otherwise indicated.

3. Manufactured with minimal formaldehyde by Willamette's "Premier Plus" or as may be otherwise available.

C. Hardboard: AHA A135.4; Pressed wood fiber with resin binder, Class 1 - Tempered, 1/4 inch thick, smooth two sides (S2S); use for locations approved as manufacturer's standard and dust panels.

2.05 LAMINATE MATERIALS

A. Manufacturers:

1. Formica Corporation: www.formica.com/#sle.

2. Panolam Industries International, Inc: www.panolam.com/#sle.

3. Wilsonart LLC: www.wilsonart.com/#sle.

4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Provide specific types as indicated.

1. Where color are scheduled substitutions must match colors exactly, subject to the Architect's approval.

2.06 COUNTERTOPS & QUARTZ GUN RAIL

A. Countertops: See Section 12 36 00.

B. Quartz gun rail: As indicated in drawings.

2.07 ACCESSORIES

A. Adhesive: Type recommended by fabricator to suit application.

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. Grommets: Standard plastic, painted metal, or rubber grommets for cut-outs, in color to match adjacent surface.

2.08 HARDWARE

A. Hardware: BHMA A156.9, types as recommended by fabricator for quality grade specified.

B. Adjustable Shelf Supports: Standard side-mounted system using recessed metal shelf standards or multiple holes for pin supports and coordinated self rests, satin chrome finish, for nominal 1 inch spacing adjustments.

C. Drawer and Door Pulls: "U" shaped wire pull, steel with chrome finish, 4 inch centers.

D. Cabinet Catches and Latches:

E. Drawer Slides:

1. Type: Extension types as indicated.

2. Static Load Capacity: Commercial grade.

3. Mounting: Side mounted.

4. Stops: Integral type.

5. Features: Provide self closing/stay closed and _____ type.

6. Manufacturers:

a. Accuride International, Inc; 3932 Medium-Duty Full Extension Slides: www.accuride.com/#sle.

b. Accuride International, Inc; Heavy-Duty Drawer Slides: www.accuride.com/#sle.

c. _____.

F. Hinges: European style concealed self-closing type, steel with nickel-plated finish.

G. Keyboard Tray: Integral ball-bearing slides; adjustable tilt, gel palm rest, storage compartments, cable management, and mouse pad.

1. Manufacturers:

    a. Accuride International, Inc; CBERGO-TRAY 300: www.accuride.com/#sle.

    b. Substitutions: See Section 01 60 00 - Product Requirements.

2.09 FABRICATION

A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.

B. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.

C. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs.

1. Cap exposed plastic laminate finish edges with material of same finish and pattern.

D. Provide cutouts for plumbing fixtures. Verify locations of cutouts from on-site dimensions. Prime paint cut edges.

2.10 SHOP FINISHING

2.11 FACTORY FINISHING

A. Sand work smooth and set exposed nails and screws.

B. For opaque finishes, apply wood filler in exposed nail and screw indentations and sand smooth.

C. On items to receive transparent finishes, use wood filler matching or blending with surrounding surfaces and of types recommended for applied finishes.

D. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify location and sizes of utility rough-in associated with work of this section.

3.02 INSTALLATION

A. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.

B. Use fixture attachments in concealed locations for wall mounted components.

C. Use concealed joint fasteners to align and secure adjoining cabinet units.

D. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.

E. Secure cabinets to floor using appropriate angles and anchorages.

F. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.

G. Site glaze glass materials using Interior Dry method; see Section 08 80 00.

3.03 ADJUSTING

A. Adjust installed work.

B. Adjust moving or operating parts to function smoothly and correctly.

3.04 CLEANING

A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

END OF SECTION 06 41 00

SECTION 07 19 00
WATER REPELLENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water repellents applied to exterior stone and concrete surfaces.

B. Pressure washing.

1.02 RELATED SECTIONS

A. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 03 30 00 - Cast-in-Place Concrete.

C. Section 04 26 13 - Masonry Veneer.

1.03 REFERENCE STANDARDS

A. ASTM D3960 - Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings.

B. ASTM D5095 - Standard Test Method for Determination of the Nonvolatile Content in Silanes, Siloxanes and Silane-Siloxane Blends Used in Masonry Water Repellent Treatments.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide product description, details of tests performed, limitations, and chemical composition.

C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention; cautionary procedures required during application.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Manufacturer's Field Reports: Report whether manufacturer's "best practices" are being followed; if not, state corrective recommendations. Email report to Architect the same day as inspection occurs; mail report on manufacturer's letterhead to Architect within 2 calendar days after inspection.

1.05 QUALITY ASSURANCE

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

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

1.06 MOCK-UPS

A. Prepare representative surface 36 by 36 inches in size using specified materials and preparation and application methods on surfaces identical to those to be coated; approved mock-up constitutes standard for workmanship.

1.07 PRE-INSTALLATION MEETING

A. Convene a meeting at least one week prior to starting work; require attendance of affected installers; invite Architect and Owner.

1.08 FIELD CONDITIONS

A. Protect liquid materials from freezing.

B. Do not apply water repellent when ambient temperature is lower than 50 degrees F or higher than 100 degrees F.

1.09 EXTRA MATERIALS

A. See Section 01 60 00 - Product Requirements, for additional provisions.

B. Provide two gallons of water repellent.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Silane, Siloxane, Silane-Siloxane Blend, and Siliconate Water Repellents:

1. BASF Construction Chemicals: www.buildingsystems.basf.com.

2. PROSOCO, Inc: www.prosoco.com.

3. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MATERIALS

A. Water Repellent: Non-glossy, colorless, penetrating, water-vapor-permeable, non-yellowing sealer, that dries invisibly leaving appearance of substrate unchanged.

1. Applications: Vertical surfaces and non-traffic horizontal surfaces.

2. Number of Coats: One.

3. VOC Content: See Section 01 61 16.

4. Water-based siloxane, silane, or blend that reacts chemically with concrete and masonry.

    a. Manufacturers:

        1) BASF Construction Chemicals; Enviroseal 7: www.buildingsystems.basf.com/#sle.

        2) PROSOCO, Inc; Sure Klean Weather Seal H40: www.prosoco.com/#sle.

        3) Fabrikem; Fabrisheild 907.

        4) Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify joint sealants are installed and cured.

C. Verify surfaces to be coated are dry, clean, and free of efflorescence, oil, or other matter detrimental to application of water repellent.

3.02 PREPARATION

A. Protection of Adjacent Work:

1. Protect adjacent landscaping, property, and vehicles from drips and overspray.

2. Protect adjacent surfaces not intended to receive water repellent.

B. Prepare surfaces to be coated as recommended by water repellent manufacturer for best results.

C. Pressure wash surfaces to be coated.

D. Allow surfaces to dry completely to degree recommended by water repellent manufacturer before starting coating work.

3.03 APPLICATION

A. Apply water repellent in accordance with manufacturer's instructions, using procedures and application methods recommended as producing the best results.

B. Apply at rate recommended by manufacturer, continuously over entire surface.

C. Apply one coat, minimum.

D. Remove water repellent from unintended surfaces immediately by a method instructed by water repellent manufacturer.

E. Provide manufacturer's field service representative to inspect preparation and application work continuously during entire application period to ensure that manufacturer's "best practices" for preparation and application are being followed.

END OF SECTION 07 19 00

SECTION 07 21 00
THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Batt insulation and vapor retarder in exterior wall, ceiling, and roof construction.

B. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.

C. Insulating coating.

D. Interior acoustical batt insulation.

1.02 RELATED REQUIREMENTS

A. Section 07 26 00 - Vapor Retarders: Separate vapor retarder materials.

B. Section 07 27 00 - Air Barriers: Separate air barrier materials.

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.

B. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

C. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.

D. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.

E. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.

F. ASTM C726 - Standard Specification for Mineral Wool Roof Insulation Board.

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

H. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 Degrees C.

I. ASTM E2357 - Standard Test Method for Determining Air Leakage Rate of Air Barrier Assemblies.

J. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components.

1.05 QUALITY ASSURANCE

A. Air Barrier Association of America (ABAA) Quality Assurance Program (QAP); www.airbarrier.org/#sle:

1. Installer Qualification: Use accredited contractors, certified installers, evaluated materials, and third-party field quality control audit.

2. Manufacturer Qualification: Use evaluated materials from a single manufacturer regularly engaged in air barrier material manufacture. Use secondary materials approved in writing by primary material manufacturer.

B. Air Barrier Association of America (ABAA) Evaluated Materials Program (EAP); www.airbarrier.org/#sle: Use evaluated materials from a single manufacturer regularly engaged in air barrier material manufacture. Use secondary materials approved in writing by primary material manufacturer.

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 in Metal Framed Walls: Batt insulation with separate vapor retarder.

B. Insulation Above Lay-In Acoustical Ceilings: Batt insulation with no vapor retarder.

2.02 FOAM BOARD INSULATION MATERIALS

A. Expanded Polystyrene (EPS) Board Insulation: Comply with ASTM C578.

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. Complies with fire resistance requirements indicated on drawings as part of an exterior non-load-bearing exterior wall assembly when tested in accordance with NFPA 285.

4. Board Size: 48 inch by 96 inch.

5. Board Thickness: 1-1/2 inch.

6. Board Edges: Square.

7. Water-Resistive Barrier: Integrated film facer on insulation.

8. Products:

   a. Atlas Molded Products, a Division of Atlas Roofing Corporation; ThermalStar EPS Wall Insulation Board: www.atlasmoldedproducts.com/#sle.

   b. Diversifoam Products; _____: www.diversifoam.com/#sle.

   c. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 MINERAL FIBER BOARD INSULATION MATERIALS

A. Mineral Wool Block, Board, or Blanket Thermal Insulation: Complying with ASTM C612 or ASTM C553.

1. Smoke Developed Index: 0 (zero), when tested in accordance with ASTM E84.

2. Board Size: 16 by 48 inches.

3. Thermal Resistance: R-value of 4.2 per inch at 75 degrees F, minimum, when tested in accordance with ASTM C518.

4. Maximum Density: 8 pcf, nominal.

5. Products:

   a. ROCKWOOL; CAVITYROCK: www.rockwool.com/#sle.

6. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 MINERAL FIBER BLANKET INSULATION MATERIALS

A. Flexible Glass Fiber Blanket Thermal Insulation: Preformed insulation, complying with ASTM C665; friction fit.

1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.

2. Smoke Developed Index: 450 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. Facing: Unfaced.
6. Products:
    a. CertainTeed Corporation: www.certainteed.com.
    b. Johns Manville: www.jm.com.
    c. Owens Corning Corporation; EcoTouch PINK FIBERGLAS Insulation: www.ocbuildingspec.com/#sle.
7. Substitutions: See Section 01 60 00 - Product Requirements.

B. Sound Attenuation Insulation: Complying with ASTM C665; friction fit.

1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
3. Facing: Unfaced
4. Thickness: Install maximum thickness that will fit into framing assembly.
5. Formaldehyde Content: Zero.

C. Mineral Wool Blanket Thermal Insulation: Flexible or semi-rigid preformed insulation, complying with ASTM C665.

1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
3. Products:
    a. Johns Manville; MinWool Sound Attenuation Fire Batts: www.jm.com/#sle.
    b. ROCKWOOL; COMFORTBATT: www.rockwool.com/#sle.
    c. ROCKWOOL; AFB: www.rockwool.com/#sle.
    d. ROCKWOOL; AFB evo™: www.rockwool.com/#sle.
    e. Substitutions: See Section 01 60 00 - Product Requirements.

4. Surface Burning Characteristics: Flame Spread/Smoke development index of 25/450, when used in accordance with ASTM E84.

2.05 INSULATING COATING MATERIALS

A. Acrylic Insulating Coating: Fluid-applied, acrylic insulating coating that when applied to various substrates provides thermal protection and corrosion resistance.

1. Substrate: As indicated on drawings.

2. Primer: As recommended by coating manufacturer for applied substrate.

3. Number of Coatings: Two.

4. Dry Film Thickness (DFT): 30 to 40 mil, 0.030 to 0.040 inch, minimum, per coat.

5. Surface Burning Characteristics: Smoke developed index of 450 or less, and flame spread index of 25 or less, Class A, when tested in accordance with ASTM E84.

6. Temperature Resistance, Fully Cured: At least 325 degrees F in coordination with type of substrate and primer being used.

2.06 ACCESSORIES

A. Sheet Vapor Retarder: See Section 07 26 00.

B. Sheet Vapor Retarder: Black polyethylene film for above grade application, 10 mil, 0.010 inch thick.

C. Interior Vapor Retarder: Modified polyethylene/polyacrylate (PE/PA) film reinforced with polyethylene terephthalate (PET) fibers, 12 mil, 0.012 inch thick.

1. Width: 4.9 feet.

D. Tape: Reinforced polyethylene film with acrylic pressure sensitive adhesive.

1. Application: Sealing of interior circular penetrations, such as pipes or cables.

2. Width: Are required for application.

3. Temperature Resistance: Range of minus 40 to 212 degrees F.

4. Products:

a. SIGA Cover Inc; SIGA-Rissan: www.siga.swiss/global_en/#sle.

b. Substitutions: See Section 01 60 00 - Product Requirements.

E. Flashing Tape: Special reinforced film with high performance adhesive.

1. Application: Window and door opening flashing tape.

2. Width: As required for application.

3. Primer: Tape manufacturer's recommended product.

4. Products:

a. Protecto Wrap Company; Protecto Super Stick Building Tape: www.protectowrap.com/#sle.

b. Protecto Wrap Company; Protecto Seal 45 Butyl: www.protectowrap.com/#sle.

c. Protecto Wrap Company; Protecto Seal PW 100/40: www.protectowrap.com/#sle.

F. Sill Plate Sealer: Closed-cell foam tape with rubberized adhesive membrane; bridges gap between foundation structure and sill plate or skirt board.

1. Width: 3-1/2 inches.

2. Ultraviolet (UV) and Weathering Resistance: Approved in writing by manufacturer for up to 30 days of weather exposure.

G. Liquid Flashing: Single-component, nonsag flashing and weather barrier sealant.

1. Products:

a. Rmax Inc; R-SEAL 2000 LF: www.rmax.com/#sle.

b. Substitutions: See Section 01 60 00 - Product Requirements.

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, irregularities, or materials or substances that may impede adhesive bond.

3.02 BOARD INSTALLATION AT EXTERIOR WALLS

A. Adhere 6 inches wide strip of polyethylene sheet over expansion joints with double beads of adhesive each side of joint.

1. Tape seal joints between sheets.

2. Extend sheet full height of joint.

B. Apply adhesive to back of boards:

1. Three continuous beads per board length.

2. Full bed 1/8 inch thick.

C. Install rigid insulation directly to steel studs or exterior grade sheathing at 16 inches on center with manufacturer recommended mechanical fasteners, and tape joints with manufacturer's minimum 4 inches wide sealant tape; comply with ASTM E2357.

D. Install boards horizontally on walls.

E. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

F. Tape insulation board joints.

3.03 BATT INSTALLATION

A. Install insulation and vapor retarder in accordance with manufacturer's instructions.

B. Install in exterior wall and roof spaces without gaps or voids. Do not compress insulation.

C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

E. At metal framing, place vapor retarder on warm side of insulation; lap and seal sheet retarder joints over face of member

F. Tape seal tears or cuts in vapor retarder.

G. 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.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Coordination of Air Barrier Association of America (ABAA) Tests and Inspections:

1. Provide testing and inspection required by ABAA Quality Assurance Program (QAP).

2. Notify ABAA in writing of schedule for air barrier work, and allow adequate time for testing and inspection.

3. Cooperate with ABAA testing agency.

4. Allow access to air barrier work areas and staging.

5. Do not cover air barrier work until tested, inspected, and accepted.

3.05 PROTECTION

A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION 07 21 00

SECTION 07 26 00
VAPOR RETARDERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Vapor retarders in wall assemblies.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Vapor retarder under concrete slabs on grade.

1.03 DEFINITIONS

A. Vapor Retarder: Airtight barrier made of material that is relatively water vapor impermeable, to degree specified, with seams and joints sealed to adjacent surfaces.

B. Vapor Retarder Class: A measure of a material or assembly's ability to limit the amount of moisture that passes through that material or assembly. Vapor retarder class is defined using Procedure A, Desiccant Method at 73 degrees F and 50 percent Relative Humidity (RH), in accordance with ASTM E96/E96M and ICC (IBC)-2018, as follows:

1. Class I: 0.1 perm or less.
2. Class II: Greater than 0.1 perm to 1.0 perm.
3. Class III: Greater than 1.0 perm to 10 perms.
4. Vapor Permeable: 5 perms or greater.

1.04 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

B. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials.

C. ICC (IBC)-2018 - International Building Code.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on material characteristics, performance criteria, and limitations.

1.06 QUALITY ASSURANCE

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

B. 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. Locate where directed.

C. Mock-up may remain as part of work.

1.08 FIELD CONDITIONS

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

PART 2 PRODUCTS

2.01 VAPOR RETARDERS

A. Underslab Vapor Retarders: See Section 03 30 00.

B. Vapor Retarder Sheet: Polyimide, clear color.

1. Thickness: 45 mil, 0.045 inch.

2. Water Vapor Permeance: 1.0 perm, maximum dry cup, when tested in accordance with ASTM E96/E96M.

3. Water Vapor Permeance: 10.0 perm, minimum wet cup, when tested in accordance with ASTM E96/E96M

4. Seam Lap and Perimeter Adhesive: Elastomeric, same composition as sheet or other compatible material.

5. Fire Hazard Classification in accordance with ASTM E84:

    a. Maximum Flame Spread Index; 20.

    b. Maximum Smoke Developed Index; 55.

6. Products:

    a. CertainTeed MemBrain; https://www.certainteed.com.

b. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ACCESSORIES

A. Sealants, Tapes, and Accessories for Sealing Vapor Retarder and Adjacent Substrates: As indicated, complying with vapor retarder manufacturer's installation instructions.

B. Thinners and Cleaners: As recommended by vapor retarder manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and conditions comply with requirements 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 installation instructions.

3.03 INSTALLATION

A. Install materials in accordance with manufacturer's installation instructions.

B. Vapor Retarders: Install continuous airtight barrier over surfaces indicated, with sealed seams and sealed joints to adjacent surfaces.

C. Apply sealants and adhesives within recommended temperature range in accordance with manufacturer's installation instructions.

D. Mechanically Fastened Sheets - Vapor Retarder On Interior:

1. When insulation is installed within assembly, install vapor retarder over insulation.

2. Seal seams, laps, perimeter edges, penetrations, tears, and cuts with self-adhesive tape, providing an airtight seal.

3. Locate laps at framing members; at laps fasten one sheet to framing member then tape overlapping sheet to first sheet in shingle fashion to shed water.

4. Seal entire perimeter to structure, window and door frames, and other penetrations.

5. Where conduits, pipes, wires, ducts, outlet boxes, and other items are installed within insulation cavity, pass vapor retarder sheet behind these items and over insulation to maintain airtight seal.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Owner's Inspection and Testing: Cooperate with Owner's testing agency.

1. Allow access to work areas and staging.

2. Notify Owner's 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 vapor retarders until required inspections have been completed.

D. Obtain approval of installation procedures from vapor retarder manufacturer based on a mock-up installed in place, prior to proceeding with remainder of installation.

E. Take digital photographs of each portion of installation prior to covering up vapor retarders.

3.05 PROTECTION

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

END OF SECTION 07 26 00

SECTION 07 27 00
AIR BARRIERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Air barriers.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Air barrier under exterior cladding.

B. Section 07 62 00 - Sheet Metal Flashing and Trim: Metal flashings installed in conjunction with air barriers.

C. Section 09 21 16 - Gypsum Board Assemblies: Air barrier under exterior cladding.

1.03 DEFINITIONS

A. Air Barrier: Airtight barrier made of material that is virtually air impermeable but water vapor permeable, both to amount as specified, with sealed seams and sealed joints to adjacent surfaces.

1.04 REFERENCE STANDARDS

A. AATCC Test Method 127 - Test Method for Water Resistance: Hydrostatic Pressure.

B. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.

C. ASTM E779 - Standard Test Method for Determining Air Leakage Rate by Fan Pressurization.

D. ASTM E1827 - Standard Test Methods for Determining Airtightness of Buildings Using an Orifice Blower Door.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

F. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials.

G. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials.

H. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on material characteristics, performance criteria, and limitations.

C. ABAA Manufacturer Qualification: Submit documentation of current evaluation of proposed manufacturer and materials.

D. ABAA Installer Qualification: Submit documentation of current contractor accreditation and current installer certification; keep copies of each contractor accreditation and installer certification on site during and after installation, and present on-site documentation upon request.

E. Manufacturer's qualification statement.

F. Installer's qualification statement.

G. Testing agency qualification statement.

1.06 QUALITY ASSURANCE

A. Contractor to obtain certified, independent, third party testing to perform a whole building Air Barrier Test in compliance with the ASHRAE 90.1-2019 Section 5.4.3.1.1. The air leakage of the completed building shall not exceed 0.40 cfm/ft2 at a pressure differential of 0.3 inches water gauge (2.0 L/s x m2 at 75 Pa) at the upper 95 percent confidence interval in accordance with ASTM E779 / ASTM E1827 or an equivalent method approved by the code official. A report that includes the tested surface area, floor area, air by volume, stories above grade, and leakage rates shall be submitted to the building owner and the code official.

1. Where the measured air leakage rate exceeds 0.40 cfm/ft2 but does not exceed 0.60 cfm/ft2, a diagnostic evaluation, such as a smoke tracer or infrared imaging shall be conducted while the building is pressurized, and any leaks noted shall be sealed if such sealing can be made without destruction of existing building components. In addition, a visual inspection of the air barrier shall be conducted, and any leaks noted shall be sealed if such sealing can be made without destruction of existing building components. An additional report identifying the corrective actions taken to seal leaks shall be submitted to the code official and the building owner and shall be deemed to satisfy the requirements of this section.

2. Test shall be accomplished by pressurization and depressurization.

B. Air Barrier Association of America (ABAA) Quality Assurance Program (QAP); www.airbarrier.org/#sle:

1. Installer Qualification: Use accredited contractor, certified installers, evaluated materials, and third-party field quality control audit.

C. Air Barrier Association of America (ABAA) Evaluated Air Barrier Assemblies; www.airbarrier.org/#sle: Use evaluated materials from a single manufacturer regularly engaged in air barrier material manufacture, and use secondary materials approved in writing by primary material manufacturer.

D. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience.

E. Manufacturer Qualification: Use evaluated materials from a single manufacturer regularly engaged in air barrier material manufacture, and use secondary materials approved in writing by primary material manufacturer.

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

1.07 PRE-INSTALLATION MEETING

A. See Section 01 30 00 - Administrative Requirements

B. Convene a pre-installation conference, a minimum of two weeks prior to start of air barrier installation. Attendees shall include Contractor, Architect, installer, subcontractors that will interface with the air barrier, and air barrier manufacturer's designated field representative.

C. Review all related project requirements and submittals, status of substrate work and preparation, areas of potential conflict and interface, availability of air barrier system materials and components, installer's training requirements, equipment, facilities and scaffolding. Coordinate methods, procedures and sequencing requirements for full and proper installation, integration and protection.

D. Review requirements for sequencing of installation of air barrier system with installation of windows, doors, louvers and metal flashings to provide a air-tight barrier system. Schedule installation of exterior cladding within three months of air barrier system installation.

1.08 MOCK-UPS

A. Locate where directed.

B. Mock-up may remain as part of work.

1.09 FIELD CONDITIONS

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

PART 2 PRODUCTS

2.01 AIR BARRIER MATERIALS (AIR IMPERMEABLE AND WATER VAPOR PERMEABLE)

A. Air Barrier Sheet, Mechanically Fastened:

1. Air Permeance: 0.004 cfm/sq ft, maximum, when tested in accordance with ASTM E2178.

2. Water Vapor Permeance: 10 perms, minimum, when tested in accordance with ASTM E96/E96M using Procedure A - Desiccant Method, at 73.4 degrees F.

3. Water Penetration Resistance: Withstand a water head of 21 inches, minimum, for at least 5 hours, when tested in accordance with AATCC Test Method 127.

4. Ultraviolet (UV) and Weathering Resistance: Approved by manufacturer for up to 90 calendar days of weather exposure.

5. Surface Burning Characteristics: Flame spread index of 25 or less, and smoke developed index of 50 or less, Class A, when tested in accordance with ASTM E84.

6. Seam and Perimeter Tape: Polyethylene self-adhering type, 2-1/2 inches wide, compatible with sheet material; unless otherwise indicated.

7. Products:

    a. DuPont de Nemours, Inc; Tyvek Construction Wrap with Tyvek Fluid Applied Flashing - Brush Formulation, Tyvek Fluid Applied Flashing and Joint Compound, FlexWrap, StraightFlash, VersaFlange, Tyvek Wrap Caps, and Tyvek Tape: building.dupont.com/#sle.

    b. Henry Company; VP 160: www.henry.com/#sle.

    c. SIGA Cover Inc; SIGA-Majvest 200: www.siga.swiss/global_en/#sle.

    d. VaproShield, LLC; RevealShield IT - Integrated Tape: www.vaproshield.com/#sle.

    e. Soprema; Stick VP: www.soprema.us.

    f. Substitutions: See Section 01 60 00 - Product Requirements.

B. Air Barrier Sheet, Self-Adhered:

1. Air Permeance: 0.004 cfm/sq ft, maximum, when tested in accordance with ASTM E2178.

2. Water Vapor Permeance: 10 perms, minimum, when tested in accordance with ASTM E96/E96M using Procedure A - Desiccant Method, at 73.4 degrees F.

3. Ultraviolet (UV) and Weathering Resistance: Approved by manufacturer for up to 90 calendar 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. Comply with NFPA 285 requirements for wall assembly.

6. Seam and Perimeter Tape: As recommended by sheet manufacturer.

7. Products:

    a. Dorken Systems Inc; DELTA-VENT SA: www.dorken.com/#sle.

    b. Henry Company; Blueskin VP160: www.henry.com/#sle.

    c. SIGA Cover Inc; SIGA-Majvest 500 SA: www.siga.swiss/global_en/#sle.

d. Soprema, Inc; SOPRASEAL Stick VP: www.soprema.us/#sle.

e. VaproShield, LLC; WrapShield SA - Self-Adhered: www.vaproshield.com/#sle.

f. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ACCESSORIES

A. Sealants, Tapes, and Accessories for Sealing Air Barrier and Adjacent Substrates: As indicated or in compliance with air barrier manufacturer's installation instructions.

B. Foil-Faced Self-Adhering Flashing: Membrane consisting of cross-laminated high-density polyethylene facer laminated to ultraviolet (UV) and weather-resistant exterior aluminum foil facer, using nonasphaltic, butyl-based adhesive to self-adhere to substrate.

1. Thickness: 45 mil, 0.045 inch, minimum.

2. Roll Size: 50 feet long by 4 inches wide.

3. Products:

a. Henry Metal Clad.

C. Flexible Flashing: Self-adhesive sheet flashing complying with ASTM D1970/D1970M, except slip resistance requirement waived if not installed on roof.

1. Width: 4 inches.

2. Ultraviolet (UV) and Weathering Resistance: Approved by manufacturer for up to 30 calendar days of weather exposure.

3. Products:

a. DuPont de Nemours, Inc; DuPont FlexWrap: www.dupont.com/building/#sle.

b. DuPont de Nemours, Inc; DuPont StraightFlash: www.dupont.com/building/#sle.

c. DuPont de Nemours, Inc; DuPont VersaFlange: www.dupont.com/building/#sle.

d. Henry Company; FortiFlash: www.henry.com/#sle.

e. Henry Company; FortiFlex Butyl: www.henry.com/#sle.

f. Henry Company; FortiFlash Butyl: www.henry.com/#sle.

g. SIGA Wigluv 2.4” (60mm), or wider 4” (100mm), 6” (150mm) , 9”(230mm).

h. SIGA Fentrim 430 grey 4” (100mm), or wider 6” (150mm) , 9”(230mm)

i. SIGA Fentrim 230 grey 3” (75mm), or wider 4” (100mm), 6” (150mm)

j. SIGA Fentrim® IS 20 3" (75mm), or wider 4" (100mm), 6" (150mm)

k. Substitutions: See Section 01 60 00 - Product Requirements.

D. Preformed Transition Membrane: Semirigid silicone or polyester composition, tapered edges, tear resistant.

1. Products:

a. Dow; DOWSIL Silicone Transition Strip and System: www.dow.com/#sle.

b. Tremco Commercial Sealants & Waterproofing; ProGlaze ETA System 1: www.tremcosealants.com/#sle.

c. Substitutions: See Section 01 60 00 - Product Requirements.

E. Stainless Steel Flashing: Flexible flashing with 2 mil, 0.002 inch thick Type 304 stainless steel sheet, 8 mil, 0.008 inch of butyl adhesive and siliconized release liner.

1. Roll Length: 50 feet long.

2. Width: 6 inches wide.

3. Products:

a. Momentive Performance Materials, Inc/GE Silicones; GE Elemax SS Flashing: www.siliconeforbuilding.com/#sle.

b. Henry Metal Clad.

c. Protecto Wrap PS45 & PS45 Butyl.

d. Soprema Soprasolin HD.

e. VaproShield Vapro-SS Flashing.

F. Liquid Flashing: One part, fast curing, nonsag, elastomeric, gun grade, trowelable.

1. Products:

a. Henry AirBloc Liquid Flashing.

b. VaproShield Vaproliqui-Flash.

c. Soprema Sopraseal Liquid Flashing.

G. Thinners and Cleaners: As recommended by material manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and conditions are ready for work of this section.

B. Where existing conditions are responsibility of another installer, notify Architect of unsatisfactory conditions.

C. Do not proceed with this work until unsatisfactory conditions have been corrected.

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 installation instructions.

3.03 INSTALLATION

A. Install materials in accordance with manufacturer's installation instructions.

B. Air Barriers: Install continuous airtight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.

C. Apply sealants and adhesives within recommended temperature range in accordance with manufacturer's installation instructions.

D. Mechanically Fastened Sheets - On Exterior:

1. Install sheets shingle fashion to shed water, with seams generally horizontal.

2. Overlap seams as recommended by manufacturer, 6 inches, minimum.

3. Overlap at outside and inside corners as recommended by manufacturer, 12 inches, minimum.

4. For all applications, seal seams, laps, penetrations, tears, and cuts with self-adhesive tape; use only large-headed, gasketed fasteners as recommended by manufacturer.

5. Install air barrier underneath jamb flashings.

6. Coordinate window wrap details, install self-adhering vapor permeable membrane at jambs and heads.

7. 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.

E. Self-Adhered Sheets:

1. Prepare substrate in accordance with sheet manufacturer's installation instructions; fill and tape joints in substrate and between dissimilar materials.

2. Lap sheets shingle fashion to shed water and seal laps airtight.

3. Once sheets are in place, press firmly into substrate with resilient hand roller; ensure that laps are firmly adhered with no gaps or fishmouths.

4. Use same material, or other material approved by sheet manufacturer, to seal to adjacent substrates, and as flashing.

5. At wide joints, provide extra flexible membrane allowing joint movement.

F. Fluid-Applied Coatings or Membranes:

1. Prepare substrate in accordance with manufacturer's installation instructions; treat joints in substrate and between dissimilar materials as indicated.

2. Use flashing to seal to adjacent construction and to bridge joints in coating substrate.

G. Openings and Penetrations in Exterior Air Barriers:

1. Coordinate window wrap details, install self-adhering vapor permeable membrane at jambs and heads.

2. Install flashing over sills, covering entire sill frame member, extending at least 5 inches onto air barrier and at least 6 inches up jambs; mechanically fasten stretched edges.

3. At openings 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 wide; do not seal sill flange.

4. At openings with nonflanged frames, seal air barrier to each side of framing at opening using flashing at least 9 inches wide, and covering entire depth of framing.

5. At head of openings, install flashing under air barrier extending at least 2 inches beyond face of jambs; seal air barrier to flashing.

6. At interior face of openings, seal gap between window/door frame and rough framing, using joint sealant over backer rod.

7. Service and Other Penetrations: Form flashing around penetrating item and seal to air barrier surface.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Coordination of ABAA Tests and Inspections:

1. Provide testing and inspection required by ABAA QAP.

2. Notify ABAA in writing of schedule for air barrier work, and allow adequate time for testing and inspection.

3. Cooperate with ABAA testing agency.

4. Allow access to air barrier work areas and staging.

5. Do not cover air barrier work until tested, inspected, and accepted.

C. Do not cover installed air barriers until required inspections have been completed.

D. Obtain approval of installation procedures from air barrier manufacturer based on a mock-up installed in place, prior to proceeding with remainder of installation.

E. Take digital photographs of each portion of installation prior to covering up air barriers.

3.05 PROTECTION

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

END OF SECTION 07 27 00

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SECTION 07 46 23
WOOD SIDING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wood siding with boards for walls.

1.02 RELATED REQUIREMENTS

A. Section 07 25 00 - Weather Barriers: Water-resistive barrier under siding.

B. Section 07 62 00 - Sheet Metal Flashing and Trim: Product requirements for metal flashings and trim associated with wood siding for placement by this section.

1.03 REFERENCE STANDARDS

A. APA PRP-108 - Performance Standards and Qualification Policy for Wood Structural Panels (Form E445).

B. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturer's data on materials, component profiles, fastening methods, jointing details, sizes, surface texture, finishes, and accessories; showing compliance with requirements, including:

1. Physical characteristics of components shown on shop drawings.
2. Storage and handling requirements and recommendations.
3. Installation instructions and recommendations.

C. Shop Drawings: Indicate dimensions, layout, joints, construction details, support clips, and methods of anchorage.

D. Samples: Submit two samples 12 by 12 inches in size illustrating surface texture.

E. Manufacturer's qualification statement.

F. Installer'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.

B. Installer Qualifications: Company specializing in installing products of the type specified in this section with minimum three years of documented experience.

1.06 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Extended Correction Period: Correct defective work within 2-year period commencing on Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Wood Siding:

1. Centennial Woods LLC: www.centennialwoods.com/#sle.

2. Nova USA Wood Products: www.novausawood.com/#sle.

3. Thermory USA; Benchmark Ash: www.thermoryusa.com/#sle.

4. UFP Industries; UFP-Edge Wood Siding: www.ufpi.com/#sle.

5. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

A. Comply with local wind load resistance requirements of ASCE 7.

B. Plywood Sheathing: Comply with APA PRP-108 grade or type standards and labeled by APA certified grading agency.

2.03 WOOD SIDING RAINSCREEN SYSTEM

A. Rainscreen System Siding Support Clips: Configured to fit manufacturer's wood siding boards, and to allow board expansion and contraction.

1. Rainscreen Wood Siding: Edges configured to fit manufacturer's support clips.

a. Species: Walnut.

b. Size: 1 by 6 inches, nominal.

c. Grade: Clear.

2. Clip Material:

a. Glass-fiber-reinforced nylon 6/6.

3. Products:

    a. Nova USA Wood Products; ExoClad QuickClip and Rainscreen Siding: www.novausawood.com/#sle.

    b. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 ACCESSORIES

A. Support for Cladding and Continuous Insulation: Thermal clip and rail.

1. Thermal Clips: Pultruded fiberglass resin allowing field adjustment and alignment of rails.

2. Thermal Clips: Extruded aluminum, with thermal spacer at base and slot at top to allow field adjustment and alignment of rails.

3. Fasteners: Provide support system and cladding attachment fasteners as recommended by system manufacturer in accordance with requirements.

B. Wood Sealer: Factory-applied, water-based polymer, water repellant sealer that reacts chemically with untreated, natural wood surfaces.

1. Products:

    a. Nova USA Wood Products; Exoshield: www.novausawood.com/#sle.

    b. Substitutions: See Section 01 60 00 - Product Requirements.

C. Nails: Corrosion resistant type; nonstaining, of size and strength to securely and rigidly retain the work; prefinished to match siding finish.

D. Flashing: Galvanized steel; see Section 07 62 00.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install siding, batten strips, and trim in accordance with manufacturer's instructions.

B. Fasten siding securely in place, level and plumb.

1. Arrange for orderly nailing pattern, blind nail except over trim.

2. Install siding for natural shed of water.

3. Position cut ends over bearing surfaces, and sand cut edges smooth and clean.

C. Seal exposed wood substrates exposed to weather to prevent water accumulation and moisture intrusion.

1. Seal penetrations.

2. Seal exposed cuts of siding and trim; use of field-applied coatings is not permitted.

D. Install metal flashings at internal and external corners, sills, heads of wall openings, and horizontal joints of sheet materials.

E. Sand work smooth and set exposed nails and screws.

3.02 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 07 46 23

SECTION 07 54 00
THERMOPLASTIC MEMBRANE ROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Mechanically attached system with thermoplastic roofing membrane.

B. Vapor retarder.

C. Deck sheathing.

D. Flashings.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Wood cant strips.

1.03 REFERENCE STANDARDS

A. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.

B. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.

C. ASTM D1149 - Standard Test Methods for Rubber Deterioration-Cracking in an Ozone Controlled Environment.

D. ASTM D1204 - Dimensional Stability.

E. ASTM D2137 - Standard Test Method for Rubber Property - Brittleness Point of Flexible Polymers and Coated Fabrics.

F. ASTM D4263 - Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.

G. ASTM D471 - Standard Test Method for Rubber Property--Effect of Liquids.

H. ASTM D6878/D6878M - Standard Specification for Thermoplastic Polyolefin-Based Sheet Roofing.

I. ASTM E1980 - Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces.

J. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.

K. FM (AG) - FM Approval Guide.

L. NRCA (RM) - The NRCA Roofing Manual.

M. NRCA (WM) - The NRCA Waterproofing Manual.

N. UL (FRD) - Fire Resistance Directory.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one month 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 30 00 - Administrative Requirements for submittal procedures.

B. Manufacturer's qualification statement.

C. Installer's qualification statement.

D. Testing firm's qualification statement.

E. 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 written verification that installation complies with warranty conditions for waterproof membrane.

3. Provide a schedule of inspections, name and phone numbers of the manufacturer's representative that will inspect the roof (for warranty purposes).

1.06 QUALITY ASSURANCE

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

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

C. Testing Firm Qualifications: Company specializing in performing work of the type specified and approved by manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original containers, dry and undamaged, with seals and labels intact, unless otherwise indicated.

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. Comply with roofing manufacturer's temperature and other environmental requirements for the installation of the roofing components.

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 78 00 - Closeout Submittals for additional warranty requirements.

B. 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.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Thermoplastic Polyolefin (TPO) Membrane Roofing Materials:

1. Carlisle SynTec Systems; Sure-Weld TPO: www.carlisle-syntec.com/#sle.

2. Elevate; UltraPly 60 mil: www.holcimelevate.com/#sle.

3. GAF; EverGuard TPO 60 mil: www.gaf.com/#sle.

4. Johns Manville; JM TPO - 60 mil: www.jm.com/#sle.

5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Insulation:

2.02 ROOFING - UNBALLASTED APPLICATIONS

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

B. Roofing Assembly Requirements:

1. Solar Reflectance Index (SRI): Minimum of 64 based on three-year aged value; if three-year aged data is not available, minimum of 82 initial value.

a. Calculate SRI in accordance with ASTM E1980.

b. Field applied coating may not be used to achieve specified SRI.

2. Roof Covering External Fire Resistance Classification: UL (FRD) Class A.

3. Insulation Thermal Resistance (R-Value): 3 per inch, minimum; provide insulation of thickness required.

C. Acceptable Insulation Types - Constant Thickness Application: Any type that meets requirements and is approved by membrane manufacturer for application.

1. Minimum 2 layers of polyisocyanurate board.

D. Acceptable Insulation Types - Tapered Application: Any type that meets requirements and is approved by membrane manufacturer for application.

1. Tapered polyisocyanurate board.

2. Tapered polyisocyanurate board covered with uniform thickness polyisocyanurate board.

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 scrims.

a. Thickness: 60 mil, 0.060 inch, minimum.

2. Sheet Width:

a. Adhered Application: Limit width to 120 inches, maximum, when ambient temperatures are less than 40 degrees F for extended period of time during installation.

3. Color: White.

4. Physical Properties: Test to meet the minimum standards.

a. Brittleness: ASTM ASTM D2137 at -45 degrees C; pass.

b. Water Absorption: ASTM D471, 7 days at 158 degrees f, typical absorption 2.5% or less.

c. Ozone Resistance: ASTM D1149, 70 hours at 100 degrees F; Pass.

d. Dimensional Stability: ASTM D1204, 6 hours at 176 degrees F; +/-0.3% typical.

B. Seaming Materials: As recommended by membrane manufacturer.

C. Membrane Fasteners: As recommended and approved by membrane manufacturer.

D. Vapor Retarder: Material approved by roof manufacturer complying with requirements of fire rating classification; compatible with roofing and insulation materials.

1. Fire-retardant adhesive.

E. Flexible Flashing Material: Same material as membrane.

1. Be included in the roof warranty.

2. Meet the written recommendation of the manufacturer and be supplied or recommended by the roofing membrane manufacturer.

2.04 DECK SHEATHING

A. Sheathing shall be acceptable to roofing manufacturer for warranty.

B. Deck Sheathing: Glass-mat faced gypsum panels complying with ASTM C1177/C1177M.

2.05 INSULATION

A. Insulation shall be approved by roofing membrane manufacturer for roof warranty.

B. Polyisocyanurate (ISO) Board Insulation: Rigid cellular foam, complying with ASTM C1289.

1. Classifications:

2. Board Size: 48 by 96 inches.

3. Board Thickness: 1.5 inches.

2.06 ACCESSORIES

A. Conductive Primer for Electronic Leak Detection (ELD): Enables ELD of conventional roofing assemblies by providing required conductive substrate directly below roofing membrane.

1. Apply primer directly under roofing membrane on nonconductive surface in accordance with manufacturer's requirements.

2. Products:

a. Detec Systems; TruGround Conductive Primer: www.detecsystems.com/#sle.

b. Substitutions: See Section 01 60 00 - Product Requirements.

B. Cant Strips: Wood, pressure preservative treated; see Section 06 10 00.

C. Sheathing Joint Tape: Paper type, ____ inches wide, self adhering.

D. Insulation Joint Tape: Glass fiber reinforced type as recommended by insulation manufacturer, compatible with roofing materials; 6 inches wide; self adhering.

E. Membrane Adhesive: As recommended by membrane manufacturer.

F. Roofing Nails: Galvanized, hot-dipped type, size and configuration as required to suit application.

G. Walkway Pads: Suitable for maintenance traffic, contrasting color or otherwise visually distinctive from roof membrane.

1. Composition: Asphaltic with mineral granule surface.

2. Surface Color: White.

3. Products:

a. W. R. Meadows, Inc; Whitewalk: www.wrmeadows.com/#sle.

b. Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 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 are in place.

3.02 PREPARATION - WOOD DECK

A. Verify flatness and tightness of joints in wood decking; fill knot holes with latex filler.

B. Confirm dry deck by moisture meter with 12 percent moisture maximum.

3.03 PREPARATION - CONCRETE DECK

A. Fill surface honeycomb and variations with latex filler.

B. Do not begin work until elevated concrete substrate has cured at least 28 days and moisture content is five percent or less.

1. Test as Follows:

a. Concrete Moisture Content: No beading water under plastic after 16 hours when tested in accordance with ASTM D4263.

b. Relative Humidity in Concrete: Not greater than 75 percent when tested in accordance with ASTM F2170.

3.04 PREPARATION - METAL DECK

A. 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.

3.05 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 cold or wet weather conditions.

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.

3.06 INSTALLATION - VAPOR RETARDER AND INSULATION, UNDER MEMBRANE

A. Install vapor retarder to deck surface 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.

B. Cover Boards: Mechanically fasten cover boards in accordance with roofing manufacturer's instructions and FM (AG) Factory Mutual requirements.

C. Lay subsequent layers of insulation with joints staggered minimum 6 inches from joints of preceding layer.

D. Place tapered insulation to the required slope pattern in accordance with manufacturer's instructions.

E. On metal deck, place boards parallel to flutes with insulation board edges bearing on deck flutes.

F. Lay boards with edges in moderate contact without forcing. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.

G. Tape joints of insulation in accordance with roofing and insulation manufacturers' instructions.

H. Do not install more insulation than can be covered with membrane in same day.

3.07 INSTALLATION - MEMBRANE

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 heat welding, minimum 3 inches. Seal permanently waterproof. Apply uniform bead of sealant to joint edge.(If required by the membrane manufacturer)

D. Mechanical Attachment: Install membrane and mechanical attachment devices in accordance with manufacturer's instructions.

E. At intersections with vertical surfaces:

1. Extend membrane up a minimum of 4 inches 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 drains and sumps and related flashings.

3.08 CLEANING

A. See Section 01 70 00 - Execution and Closeout Requirements for additional requirements.

B. Remove bituminous markings from finished surfaces.

C. 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.

D. Repair or replace defaced or damaged finishes caused by work of this section.

3.09 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 07 54 00

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SECTION 07 62 00
SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fabricated sheet metal items, including flashings, counterflashings, gutters, downspouts, sheet metal roofing, exterior penetrations, _____, and other items indicated in Schedule.

1.02 REFERENCE STANDARDS

A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix).

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

C. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

D. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

E. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.

F. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free.

G. CDA A4050 - Copper in Architecture - Handbook.

H. SMACNA (ASMM) - Architectural Sheet Metal Manual.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

1.04 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 five years of documented experience.

PART 2 PRODUCTS

2.01 SHEET MATERIALS

A. Pre-Finished Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24-gauge, 0.0239-inch thick base metal, shop pre-coated with PVDF coating.

1. Polyvinylidene Fluoride (PVDF) Coating: Superior performing organic powder coating, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system.

2. Color: As selected by Architect from manufacturer's full colors.

B. Anodized Aluminum: ASTM B209/B209M, 3005 alloy, H12 or H14 temper; 20 gauge, 0.032 inch thick; anodized finish to match aluminum window frame color.

C. Stainless Steel: ASTM A666, Type 304 alloy, soft temper, 28 gauge, 0.0156 inch thick; smooth No. 4 - Brushed finish.

2.02 FABRICATION

A. Form sections true to shape, accurate in size, square, and free from distortion or defects.

B. Form pieces in longest possible lengths.

C. Hem exposed edges on underside 1/2 inch; miter and seam, and seal corners.

D. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

E. Fabricate corners from one piece with minimum 18-inch long legs; seam for rigidity, seal with sealant.

F. Fabricate vertical faces with bottom edge formed outward 1/4 inch (6 mm) and hemmed to form drip.

2.03 GUTTERS AND DOWNSPOUTS

A. Downspouts: Profile as indicated.

B. Gutters and Downspouts: Size for rainfall intensity determined by a storm occurrence of 1 in 10 years in accordance with SMACNA (ASMM).

C. Accessories: Profiled to suit gutters and downspouts.

D. Seal metal joints.

2.04 ACCESSORIES

A. Fasteners: Galvanized steel, with soft neoprene washers.

B. Primer Type: Zinc chromate.

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; translucent.

E. Asphalt Roof Cement: ASTM D4586/D4586M, Type I, asbestos-free.

PART 3 EXECUTION

3.01 INSTALLATION

A. Parapet Wall Flashing and Counterflashing: SMACNA Architectural Sheet Metal Manual, figure 3-9 and construction documents.

1. Install 6 inch wide back up plates behind coping at butt expansion joints spaced at 30 feet on center to comply with SMACNA Table 3-1, Detail J2.

2. Install sealant between back up plate and coping panel.

3. Form standing seam cross joints to comply with SMACNA Table 3-1, Detail J8.

4. Fabricate drive seams to comply with SMACNA Table 3-1, Detail J9.

5. Miter, seam and seal corners of coping with solder.

B. Gutter: SMACNA Architectural Sheet Metal Manual, figure 1-13 and construction documents.

C. Roof Penetration Flashing: SMACNA Architectural Sheet Metal Manual, figure 4-14 and construction documents.

D. Downspouts: SMACNA Architectural Sheet Metal Manual, figure 1-32 and construction documents.

E. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted..

F. Apply plastic cement compound between metal flashings and felt flashings.

G. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.

H. Secure gutters and downspouts in place with concealed fasteners.

I. Slope gutters 1/4 inch per foot minimum.

END OF SECTION 07 62 00

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SECTION 07 84 00
FIRESTOPPING

PART 1 GENERAL

1.01 PERFORMANCE REQUIREMENTS

A. General: For penetrations through the following fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.

1. Fire-resistance-rated walls including fire walls, fire partitions, fire barriers, and smoke barriers.

2. Fire-resistance-rated horizontal assemblies including floors, floor/ceiling assemblies, and ceiling membranes of roof/ceiling assemblies.

B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per ASTM E 814 or UL 1479.

1. Provide through-penetration firestop systems with F rating not less than that equaling or exceeding fire-resistance rating of constructions penetrated.

C. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.

1.02 REFERENCE STANDARDS

A. UL (FRD) - Fire Resistance Directory.

1.03 SUBMITTALS

A. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number of the proposed penetration.

B. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

C. Certificate from authority having jurisdiction indicating approval of applicator and materials (if available from the jurisdiction) used.

D. Installer's qualification statement.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section and:

1. Licensed by authority having jurisdiction. If licensing not available, then proof "approval" in whatever form available including proof of prior experience and acceptance of previous work by the jurisdiction.

PART 2 PRODUCTS

2.01 MATERIALS

A. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.

2.02 FIRESTOPPING SYSTEMS

A. Firestopping: Any material meeting requirements.

1. Fire Ratings: See drawings for required ratings.

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.

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.

END OF SECTION 07 84 00

SECTION 07 92 00
JOINT SEALANTS

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 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions: Additional requirements for sealants and primers.

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.

B. ASTM C794 - Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants.

C. ASTM C834 - Standard Specification for Latex Sealants.

D. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications.

E. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.

F. ASTM C1087 - Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems.

G. ASTM C1193 - Standard Guide for Use of Joint Sealants.

H. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants.

I. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness.

J. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension.

K. SCAQMD 1168 - Adhesive and Sealant Applications.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative 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. Backing material recommended by sealant manufacturer.

4. Substrates that product is known to satisfactorily adhere to and with which it is compatible.

5. Substrates the product should not be used on.

C. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.

D. Samples for Verification: Where custom sealant color is specified, obtain directions from Architect and submit at least two physical samples for verification of color of each required sealant.

E. Sustainable Design Documentation: For sealants and primers, submit VOC content and emissions documentation; see Section 01 61 16.

F. Preconstruction Laboratory Test Reports: Submit at least four weeks prior to start of installation.

G. Executed warranty.

1.05 QUALITY ASSURANCE

A. Preconstruction Laboratory Testing: Arrange for sealant manufacturer(s) to test each combination of sealant, substrate, backing, and accessories.

1. Adhesion Testing: In accordance with ASTM C794.

2. Compatibility Testing: In accordance with ASTM C1087.

3. Allow sufficient time for testing to avoid delaying the work.

4. Deliver sufficient samples to manufacturer for testing.

5. Report manufacturer's recommended corrective measures, if any, including primers or techniques not indicated in product data submittals.

6. Testing is not required if sealant manufacturer provides data showing previous testing, not older than 24 months, that shows satisfactory adhesion, lack of staining, and compatibility.

1.06 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide 10 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.

C. Extended Correction Period: Correct defective work within 5 year period commencing on Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Nonsag Sealants:

1. Dow: www.dow.com/#sle.
2. Pecora Corporation: www.pecora.com/#sle.
3. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Self-Leveling Sealants:

1. Dow: www.dow.com/#sle.
2. Pecora Corporation: www.pecora.com/#sle.
3. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.

2.02 JOINT SEALANT APPLICATIONS

A. Scope:

1. Exterior Joints:
   a. Seal open joints except open joints indicated on drawings as not sealed.
2. Interior Joints:
   a. Do not seal interior joints indicated on drawings as not sealed.
   b. Seal the following joints:
      1) Joints between door frames, window frames, and other frames and adjacent construction.
      2) In sound-rated wall and ceiling assemblies, gaps at electrical outlets, wiring devices, piping penetrations, and other openings.

3) In sound-rated wall and ceiling assemblies, seal joints between wall assemblies and ceiling assemblies; between wall assemblies and other construction; between ceiling assemblies and other construction.

3. Do Not Seal:

a. Intentional weep holes in masonry.

b. Joints indicated to be covered with expansion joint cover assemblies.

c. Joints where sealant is specified to be furnished and installed by manufacturer of product to be sealed.

d. Joints where sealant installation is specified in other sections.

e. Joints between suspended ceilings and walls.

B. Exterior Joints: Use nonsag nonstaining silicone sealant, unless otherwise indicated.

1. Lap Joints in Sheet Metal Fabrications: Butyl rubber, noncuring.

2. Lap Joints between Manufactured Metal Panels: Butyl rubber, noncuring.

3. Control and Expansion Joints in Concrete Paving: Self-leveling polyurethane traffic-grade sealant.

C. Interior Joints: Use nonsag polyurethane sealant, unless otherwise indicated.

1. Wall and Ceiling Joints in Nonwet Areas: Acrylic emulsion latex sealant.

2. Wall and Ceiling Joints in Wet Areas: Nonsag polyurethane sealant for continuous liquid immersion.

3. Joints between Tile in Wet Areas and Floors, Walls, and Ceilings: Mildew-resistant silicone sealant; match tile grout color.

4. In Sound-Rated Assemblies: Acrylic emulsion latex sealant.

5. Narrow Control Joints in Interior Concrete Slabs: Self-leveling epoxy sealant.

6. Other Floor Joints: Self-leveling polyurethane traffic-grade 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.

F. Areas Where Tamper-Resistance is Required: Holding 1104, Holding 1105, Restroom 1106.

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: As indicated on drawings.

2.04 NONSAG JOINT SEALANTS

A. Nonstaining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.

1. Movement Capability: Plus 100 percent and minus 50 percent, minimum.

2. Nonstaining to Porous Stone: Nonstaining to light-colored natural stone when tested in accordance with ASTM C1248.

3. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.

4. Color: Match adjacent finished surfaces.

5. Products:

a. Dow: www.dow.com/#sle.

b. Pecora Corporation: www.pecora.com/#sle.

c. Sika Corporation: www.usa.sika.com/#sle.

d. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.

e. Substitutions: See Section 01 60 00 - Product Requirements.

B. Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.

1. Movement Capability: Plus 100 percent, minus 50 percent, minimum.

2. Hardness Range: 15 to 35, Shore A, when tested in accordance with ASTM C661.

3. Color: Match adjacent finished surfaces.

4. Service Temperature Range: Minus 65 to 180 degrees F.

C. 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: To be selected by Architect from manufacturer's standard range..

D. 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 100 percent, minus 50 percent, minimum.

2. Hardness Range: 20 to 35, Shore A, when tested in accordance with ASTM C661.

3. Color: Match adjacent finished surfaces.

E. Polyurethane Sealant for Continuous Water Immersion: ASTM C920, Grade NS, Uses M and A; single or multicomponent; explicitly approved by manufacturer for continuous water immersion; suitable for traffic exposure when recessed below traffic surface.

1. Movement Capability: Plus and minus 35 percent, minimum.

2. Color: Match adjacent finished surfaces.

F. Acrylic Emulsion Latex: Water-based; ASTM C834, single component, nonstaining, nonbleeding, nonsagging; not intended for exterior use.

1. Color: Standard colors matching finished surfaces, Type OP (opaque).

2. Products:

a. Hilti, Inc: www.us.hilti.com/#sle.

b. Sherwin-Williams Company: www.sherwin-williams.com/#sle.

G. Noncuring Butyl Sealant: Solvent-based, single component, nonsag, nonskinning, nonhardening, nonbleeding; nonvapor permeable; intended for fully concealed applications.

2.05 SELF-LEVELING JOINT SEALANTS

A. Self-Leveling Polyurethane Sealant: ASTM C920, Grade P, Uses M and A; single or multicomponent; explicitly approved by manufacturer for traffic exposure; not expected to withstand continuous water immersion .

1. Movement Capability: Plus and minus 25 percent, minimum.

2. Color: To be selected by Architect from manufacturer's standard range.

B. Self-Leveling Polyurethane Sealant for Continuous Water Immersion: Polyurethane; ASTM C920, Grade P, Uses M and A; single component; explicitly approved by manufacturer for traffic exposure and continuous water immersion.

1. Movement Capability: Plus and minus 25 percent, minimum.

2. Color: Gray.

C. Semi-Rigid Self-Leveling Epoxy Joint Filler: Epoxy or epoxy/polyurethane copolymer; intended for filling cracks and control joints not subject to significant movement; rigid enough to support concrete edges under traffic.

1. Composition: Multicomponent, 100 percent solids by weight.

2. Durometer Hardness: Minimum of 85 for Type A or 35 for Type D, after seven days when tested in accordance with ASTM D2240.

3. Color: Concrete gray.

4. Joint Width, Minimum: 1/8 inch.

2.06 ACCESSORIES

A. Sealant Backing Materials, General: Materials placed in joint before applying sealants; assists sealant performance and service life by developing optimum sealant profile and preventing three-sided adhesion; type and size recommended by sealant manufacturer for compatibility with sealant, substrate, and application.

B. Overlay Extrusion for Glazing System Joint Protection: Rubber profiled extrusions placed over joints in glazing system and provided with watertight seal.

1. Profile: As required to match existing metal glazing cap requirements.

2. Color: As selected by Architect..

3. Durometer Hardness, Type A: 65, minimum, when tested in accordance with ASTM D2240.

4. Tensile Strength: 1,139 psi, in accordance with ASTM D412.

C. Preformed Extruded Silicone Joint Seal: Pre-cured low-modulus silicone extrusion, in sizes to fit applications indicated on drawings, combined with a neutral-curing liquid silicone sealant for bonding joint seal to substrates.

1. Size: ___ inch wide, in rolls 100 feet long.

2. Thickness: 0.78 inch, with ridges along outside bottom edges for bonding area.

3. Color: As selected by Architect.

4. Durometer Hardness, Type A: 26 to 32, minimum, when tested in accordance with ASTM D2240.

5. Tensile Strength: 218 psi, in accordance with ASTM D412.

6. Elongation at Break: 554 percent, in accordance with ASTM D412.

D. Preformed Extruded Polyurethane Joint Seal: Medium-modulus, preformed polyurethane extrusion used to bridge joints under elastomeric wall coatings, in sizes to fit applications indicated on drawings, combined with polyurethane sealant for bonding joint seal to substrates.

1. Size: ___ inch wide, in rolls 100 feet long.
2. Thickness: 0.051 inch, with ridges along outside bottom edges for bonding area.
3. Color: Light gray.
4. Durometer Hardness, Type A: 55, minimum, when tested in accordance with ASTM D2240.
5. Tensile Strength: 532 psi, in accordance with ASTM D412.
6. Elongation at Break: 690 percent, in accordance with ASTM D412.

E. Masking Tape: Self-adhesive, nonabsorbent, nonstaining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.

F. Joint Cleaner: Noncorrosive and nonstaining type, type recommended by sealant manufacturer; compatible with joint forming materials.

G. 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.

E. Concrete Floor Joints That Will Be Exposed in Completed Work: Test joint filler in an inconspicuous area to verify that it does not stain or discolor slab.

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 width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.

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.

I. Concrete Floor Joint Filler: After full cure, shave joint filler flush with top of concrete slab.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Perform field quality control inspection/testing as specified in PART 1 under QUALITY ASSURANCE article.

C. Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.

3.05 POST-OCCUPANCY

A. Post-Occupancy Inspection: Perform visual inspection of entire length of project sealant joints at a time that joints have opened to their greatest width, i.e., at low temperature in thermal cycle. Report failures immediately and repair them.

END OF SECTION 07 92 00

SECTION 08 11 13
HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Non-fire-rated hollow metal doors and frames.

B. Hollow metal frames for wood doors.

C. Fire-rated hollow metal doors and frames.

D. Thermally insulated hollow metal doors with frames.

E. Sound-rated hollow metal doors and frames.

F. Commercial security hollow metal doors and frames.

G. Detention security hollow metal doors and frames.

H. Bullet-resistant hollow metal doors and frames.

1.02 RELATED REQUIREMENTS

A. Section 08 34 73 - Sound Control Door Assemblies.

B. Section 08 71 00 - Door Hardware.

C. Section 08 80 00 - Glazing: Glass for doors and borrowed lites.

1.03 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design.

B. ANSI/SDI A250.3 - Test Procedure and Acceptance Criteria for Factory Applied Finish Coatings for Steel Doors and Frames.

C. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors.

D. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100).

E. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.

F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

G. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable.

H. 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.

I. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete.

J. ASTM C476 - Standard Specification for Grout for Masonry.

K. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

L. ASTM E413 - Classification for Rating Sound Insulation.

M. ICC A117.1 - Accessible and Usable Buildings and Facilities.

N. ITS (DIR) - Directory of Listed Products.

O. NAAMM HMMA 840 - Guide Specifications for Receipt, Storage and Installation of Hollow Metal Doors and Frames.

P. NFPA 80 - Standard for Fire Doors and Other Opening Protectives.

Q. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives.

R. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies.

S. UL (DIR) - Online Certifications Directory.

T. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies.

U. UL 752 - Standard for Bullet-Resisting Equipment.

V. UL 1784 - Standard for Air Leakage Tests of Door Assemblies.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative 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.

1.05 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 MANUFACTURERS

A. Hollow Metal Doors and Frames:

1. Ceco Door, an Assa Abloy Group company: www.assaabloydss.com.

2. Steelcraft, an Allegion brand: www.allegion.com/#sle.

3. Substitutions: See Section 01 60 00 - Product Requirements.

B. Sound-Rated Hollow Metal Doors and Frames:

1. AMBICO Limited: www.ambico.com/#sle.

2. Overly Door Company: www.overly.com/#sle.

3. Krieger Specialty Products: www.kriegerproducts.com.

4. Substitutions: See Section 01 60 00 - Product Requirements.

C. Bullet-Resistant, Commercial Security, and Detention Security Hollow Metal Doors and Frames:

1. AMBICO Limited: www.ambico.com/#sle.

2. Krieger Specialty Products; Bullet Resistant Doors: www.kriegerproducts.com/#sle.

3. Overly Door Company: www.overly.com/#sle.

4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

A. Requirements for Hollow Metal Doors and Frames:

1. Steel Sheet: Comply with one or more of the following requirements; galvannealed 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. Typical Door Face Sheets: Flush.

4. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings. Style: Manufacturer's standard.

B. 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.

2.03 HOLLOW METAL DOORS

A. Door Finish: Factory primed and field finished.

B. Exterior Doors: Thermally insulated.

1. Grade: ANSI A250.8 Level 3, physical performance Level A, Model 2, seamless.

2. Core Material: Polystyrene, 1 lbs/cu ft minimum density.

3. Door Thermal Resistance: R-Value of 6.0 minimum, for installed thickness of polystyrene.

4. Door Thickness: 1-3/4 inches, nominal.

5. Weatherstripping: Refer to Section 08 71 00.

C. Interior Doors, Non-Fire Rated:

1. Grade: ANSI A250.8 Level 3, physical performance Level A, Model 2, seamless.

2. Door Thickness: 1-3/4 inches, nominal.

D. Fire-Rated Doors:

1. Grade: ANSI A250.8 Level 3, physical performance Level A, Model 2, seamless.

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.

c. Smoke and Draft Control Doors (Indicated with letter "S" on Drawings and/or Door Schedule): Self-closing or automatic closing doors in accordance with NFPA 80 and NFPA 105, with fire-resistance-rated wall construction rated the same or greater than the fire-rated doors, and the following;

1) Maximum Air Leakage: 3.0 cfm/sq ft of door opening at 0.10 inch w.g. pressure, when tested in accordance with UL 1784 at both ambient and elevated temperatures.

2) Gasketing: Provide gasketing or edge sealing as necessary to achieve leakage limit.

3) Label: Include the "S" label on fire-rating label of door.

4) Doors include: 1103B

3. Door Thickness: 1-3/4 inches, nominal.

E. Sound Control Door Assemblies:

F. Sound-Rated Interior Doors:

1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).

a. Level 3 - Extra Heavy-duty.

b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.

c. Model 1 - Full Flush.

d. Door Face Metal Thickness: 16 gauge, 0.053 inch, minimum.

2. Sound Transmission Class (STC) Rating of Door and Frame Assembly: STC of 50, minimum, calculated in accordance with ASTM E413, and tested in accordance with ASTM E90.

3. Door Core Material: Manufacturer's standard construction as required to meet acoustic requirements indicated.

4. Door Thickness: 1-3/4 inch.

5. Door Finish: Factory primed and field finished.

G. Detention Security and Bullet-Resistant Doors; Interior:

1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).

a. Level 4 - Maximum-duty.

b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.

c. Model 2 - Seamless.

d. Door Face Metal Thickness: 14 gauge, 0.067 inch, minimum.

2. Bullet Resistance: UL 752, Threat Level Rating - Level 3.

3. Door Core Material: Manufacturers standard core material/construction in compliance with requirements.

4. Door Thickness: 1-3/4 inch.

5. Door Finish: Factory primed and field finished.

6. Hinge Rail and Reinforcement: Non-beveled edge, reinforced with continuous steel channel, 12 gauge, 0.093 inch minimum metal thickness, welded at 5 inch on center maximum, and compatible with 4-1/2 inch full mortise template and continuous geared hinges.

2.04 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: Same as hollow metal door.

C. Exterior Door Frames: Full profile/continuously welded type.

1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness.

2. Frame Metal Thickness: 16 gage, 0.053 inch, minimum.

3. Weatherstripping: Separate, see Section 08 71 00.

D. Interior Door Frames, Non-Fire Rated: Knock-down type.

1. Frame Metal Thickness: 16 gauge, 0.053 inch, minimum.

2. Frame Finish: Factory primed and field finished.

E. Door Frames, Fire-Rated: Knock-down type.

1. Fire Rating: Same as door, labeled.

2. Frame Metal Thickness: 16 gauge, 0.053 inch, minimum.

3. Frame Finish: Factory primed and field finished.

F. Sound-Rated Door Frames: Knock-down type.

1. Frame Metal Thickness: 16 gauge, 0.053 inch, minimum.

2. Frame Finish: Factory primed and field finished.

G. Bullet-Resistant Door Frames: Comply with UL 752, with same level of bullet resistance as door; face welded construction, ground smooth, fully prepared and reinforced for hardware installation.

H. Commercial and/or Detention Security-Resistant Door Frames: With same security resistance as door; full profile/continuously welded construction, ground smooth, fully prepared and reinforced for hardware installation.

1. Frame Metal Thickness: 14 gauge, 0.067 inch, minimum.

2. Frame Finish: Factory primed and field finished.

2.05 FINISHES

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

B. Factory Finish: Complying with ANSI/SDI A250.3, manufacturer's standard coating.

1. Color: As indicated on drawings.

2.06 ACCESSORIES

A. Glazing: As specified in Section 08 80 00, factory installed.

B. Grout for Frames: Mortar grout complying with ASTM C476 with maximum slump of 4 inches as measured in accordance with ASTM C143/C143M for hand troweling in place; plaster grout and thinner pumpable grout are prohibited.

C. 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.

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. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.

E. Install door hardware as specified in Section 08 71 00.

F. Comply with glazing installation requirements of Section 08 80 00.

G. Coordinate installation of electrical connections to electrical hardware items.

H. Touch up damaged factory finishes.

3.03 ADJUSTING

A. Adjust for smooth and balanced door movement.

B. Adjust sound control doors so that seals are fully engaged when door is closed.

END OF SECTION 08 11 13

SECTION 08 14 16
FLUSH WOOD DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flush wood doors; flush and flush glazedconfiguration; fire rated, non-rated, and acoustical.

B. Solid Core

1.02 REFERENCE STANDARDS

A. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

B. ASTM E413 - Classification for Rating Sound Insulation.

C. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition.

D. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards.

E. NFPA 80 - Standard for Fire Doors and Other Opening Protectives.

F. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies.

G. UL 752 - Standard for Bullet-Resisting Equipment.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative 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. Samples: Submit two samples of door veneer, 8-1/2 by 11 inch in size illustrating wood grain, stain color, and sheen.

E. Test Reports: Show compliance with specified requirements for the following:

1. Sound-retardant doors and frames; sealed panel tests are not acceptable.

2. Bullet resistant doors and frames.

F. Warranty, executed in Owner's name.

1.04 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.

1.05 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 areas where sunlight might bleach veneer; seal top and bottom edges with tinted sealer if stored more than one week, and break seal on site to permit ventilation.

1.06 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide manufacturer's warranty on interior doors for the life of the installation. Complete forms in Owner's name and register with manufacturer.

1. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

C. Provide warranty for the following term:

1. Interior Doors: Life of installation.

PART 2 PRODUCTS

2.01 DOORS AND PANELS

A. Doors: See drawings for locations and additional requirements.

1. Quality Level: Custom Grade, Heavy Duty performance, in accordance with AWI/AWMAC/WI (AWS).

2. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.

3. Not used

B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.

1. Provide solid core doors at all locations.

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. Smoke and Draft Control Doors: Tested to ratings indicated on drawings in accordance with International Building Code; UL labeled if required by applicable code; provide gasketing as specified by listing.

4. Sound-Rated Doors: Minimum STC of 50, calculated in accordance with ASTM E413, tested in accordance with ASTM E90.

5. Bullet Resistant Doors: UL 752, Level 3.

6. Wood veneer facing for field transparent finish as indicated on drawings.

2.02 DOOR AND PANEL CORES

A. Non-Rated Solid Core and 20 Minute Rated Doors: Type PC, particleboard core, plies and faces as indicated above.

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.

C. Sound-Rated Doors: Equivalent to type, with particleboard core (PC) construction as required to achieve STC rating specified; plies and faces as indicated above.

D. Bullet Resistant Doors: Equivalent to type, with bonded particleboard core (PC); rating; plies and faces as indicated above.

2.03 DOOR FACINGS

A. Veneer Facing for Transparent Finish: Walnut, veneer grade in accordance with quality standard indicated, quarter cut, with book match between leaves of veneer, running match of spliced veneer leaves assembled on door or panel face.

1. Vertical Edges: Any option allowed by quality standard for grade.

2. "Pair Match" each pair of doors; "Set Match" pairs of doors within 10 feet of each other when doors are closed.

B. Veneer Facing for Opaque Finish: Medium density overlay (MDO), in compliance with indicated quality standard.

2.04 DOOR CONSTRUCTION

A. Fabricate doors in accordance with door quality standard specified.

B. Cores Constructed with stiles and rails:

C. Provide solid blocks at lock edge for hardware reinforcement.

1. Provide solid blocking for other throughbolted hardware.

D. Fit door edge trim to edge of stiles after applying veneer facing.

E. Fit door edge trim to edge of stiles after applying veneer facing.

F. Glazed Openings: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.

G. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions. (Coordinate with hardware schedule and shop drawings to factory prepare doors for installation of hardware).

H. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.

1. Exception: Doors to be field finished.

I. Provide edge clearances in accordance with the quality standard specified.

2.05 FINISHES - WOOD VENEER DOORS

A. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:

1. Transparent:

a. System - 4, Latex Acrylic, Water-based.

b. Stain: As selected by Architect.

c. Sheen: Flat.

B. Factory finish doors in accordance with approved sample.

C. Seal door top edge with color sealer to match door facing.

2.06 ACCESSORIES

A. Glazing: See Section 08 80 00.

B. Glazing Stops: Wood, of same species as door facing, butted corners; prepared for countersink style tamper proof screws.

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 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.

F. Install door louvers plumb and level.

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.

C. Under cut 3/8 inch at sills and 3/4 inch where no sills are installed.

3.04 ADJUSTING

A. Adjust doors for smooth and balanced door movement.

B. Adjust closers for full closure.

3.05 SCHEDULE

A. See Door and Frame Schedule appended to this section.

END OF SECTION 08 14 16

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SECTION 08 31 00
ACCESS DOORS AND PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Ceiling-mounted access units.

B. Wall- and ceiling-mounted access units.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.

C. Manufacturer's Installation Instructions: Indicate installation requirements.

D. Determine specific locations and sizes for access panels needed to gain access to concealed equipment and indicate on schedule specified under submittals article.

E. Access panels to gain access to equipment specified in Division 15 and 16 and where panels are not shown on drawings are to be provided by applicable subcontractor and in compliance with this section.

PART 2 PRODUCTS

2.01 ACCESS DOORS AND PANELS ASSEMBLIES

A. Ceiling-Mounted Units:

1. Location: As indicated on drawings.

2. Panel Material: Aluminum extrusion with gypsum board inlay.

3. Size - Lay-In Grid Ceilings: To match module of ceiling grid.

4. Size - Other Ceilings: 12 by 12 inches.

2.02 WALL- AND CEILING-MOUNTED ACCESS UNITS

A. Manufacturers:

1. Activar Construction Products Group, Inc. - JL Industries: www.activarcpg.com/#sle.

a. Multipurpose Access Panel: Activar/JL Industries TM.

2. ACUDOR Products Inc: www.acudor.com/#sle.

3. Best Access Doors: www.bestaccessdoors.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. Material: Steel.

2. Style: As indicated on drawings.

3. Door Style: Single thickness with rolled or turned in edges.

4. Steel Finish: Primed.

5. Primed and Factory Finish: Polyester powder coat; color as selected by Architect from manufacturer's standard colors.

6. Hardware:

a. Hinges for Non-Fire-Rated Units: Concealed, constant force closure spring type.

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 08 31 00

SECTION 08 43 13
METAL-FRAMED ENTRANCES AND STOREFRONTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aluminum-framed storefront, with vision glass.

B. Aluminum doors and frames.

C. Weatherstripping.

1.02 RELATED REQUIREMENTS

A. Section 08 71 00 - Door Hardware: Hardware items other than specified in this section.

B. 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.

B. AAMA 503 - Voluntary Specification for Field Testing of Newly Installed Storefronts, Curtain Walls and Sloped Glazing Systems.

C. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum.

D. 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.

E. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.

F. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.

G. 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.

H. NFRC 100 - Procedure for Determining Fenestration Product U-factors.

I. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence.

J. ASHRAE Handbook of Fundamentals - Chapter 15,Table No. 4 and No. 10 - definitions of U-value and Solar Heat Gain Coefficient (SHGC)

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, 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.

D. Manufacturer's Certificate: Certify the product's overall U-factor and Solar Heat Gain Coefficient (SHGC), as determined in accordance with NFRC 100 and NFRC 200. The temporary label attached to fenestration products must not be removed prior to inspection.

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.

1.05 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 Project Location State.

B. Manufacturer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

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

1.06 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.

1.07 WARRANTY

A. Correct defective Work within a five year period after Date of Substantial Completion.

B. 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.

C. 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 Storefronts Manufacturers:

1. Arcadia, Inc: www.arcadiainc.com/#sle.
2. Total Security Solutions : https://www.tssbulletproof.com/
3. Kawneer North America: www.kawneer.com/#sle.
4. Oldcastle BuildingEnvelope: www.oldcastlebe.com/#sle.
5. 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.
3. Finish: Class I natural anodized.
    a. Factory finish all surfaces that will be exposed in completed assemblies.
4. Finish Color: Dark bronze.
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 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.

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. 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.

3. Air Leakage: 0.06 cfm/sq ft maximum leakage of storefront wall area when tested in accordance with ASTM E283/E283M at 1.57 psf pressure difference.

4. Overall U-value Including Glazing: 0.34, maximum .

5. Overall Solar Heat Gain Coefficient (SHGC) Including Glazing: 0.38, maximum.

6. Overall Visible Transmittance (VT) / SHGC: 1.10 minimum.

7. Movement: Accommodate movement between storefront and perimeter framing and deflection of lintel, without damage to components or deterioration of seals.

8. Air Infiltration: Limit air infiltration through assembly to 0.3 cu ft/min/sq ft of fenestration area, measured at specified differential pressure across assembly in accordance with ASTM E283.

9. 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.

10. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.

2.03 COMPONENTS

A. Aluminum Framing Members: Tubular aluminum sections, drainage holes and internal weep drainage system.

1. Framing members for interior applications need not be thermally broken.

2. Glazing Stops: Flush.

B. Aluminum Framing Members: Tubular aluminum sectionsALTERNATE 1 - Ballistic rated aluminum frame, drainage holes and internal weep drainage system.

1. Framing members for interior applications need not be thermally broken.
2. Basis of Design: Total Security Solutions TSS 650 Thermal Bullet-resistant aluminum frame.
3. U.L. Level: 3-8
4. Cross-Section: 2-1/2" x 6 1/2" nominal dimension.

C. Glazing: See Section 08 80 00 for Basebid and Alternate(s).

D. Swing Doors: Glazed aluminum.

1. Thickness: 1-3/4 inches.
2. Top Rail: 5 inches wide.
3. Vertical Stiles: 5 inches wide.
4. Bottom Rail: 12 inches wide.
5. Glazing Stops: Square.
6. Finish: Same as storefront.
7. U-value: 0.60 maximum

E. Swing Doors: ALTERNATE 1 - Ballistic rated glazed aluminum.

1. Thickness: 2 3/8 inches.
2. Top Rail: 5 inches wide.
3. Vertical Stiles: 5 inches wide.
4. Bottom Rail: 10 inches wide.
5. Glazing Stops: Square.
6. Finish: Same as storefront.
7. U-value: 0.60 maximum
8. Ballistic Rating: Level 3 Minimum

F.

2.04 FINISHES

A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.

B. Color: Dark bronze.

2.05 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.

F. Not used.

2.06 FABRICATION

A. Fabricate components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.

B. Accurately fit and secure joints and corners. Make joints flush, hairline, and weatherproof.

C. Prepare components to receive anchor devices. Fabricate anchors.

D. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.

E. Arrange fasteners and attachments to conceal from view.

F. Reinforce framing members for imposed loads.

G. Finishing: Apply factory finish to all surfaces that will be exposed in completed assemblies.

1. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.

2.07 DISSIMILAR METAL PROTECTION

A. Apply 3-M Scotchrap 50, 10 mil, black vinyl corrosion resistant tape to separate dissimilar metals. Locate so as to be concealed after installation.

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. Set thresholds in bed of sealant and secure.

J. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 FIELD QUALITY CONTROL

A. Provide field testing of installed storefront system by independent laboratory in accordance with AAMA 503 and/or ASTM E1105 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.

3. Field test for water penetration in accordance with ASTM E1105 with uniform static air pressure difference (Procedure A) not less than 6 psf (2/3 (two thirds) of the lab test pressure).

a. Maximum allowable rate of water penetration in 15-minute test is 0.5 ounce that is not contained in an area with provisions to drain to exterior, or collected on surface of interior horizontal framing member.

b. Zero water penetration tolerance.

c. Any additional tests that have to be done due to the failure is at contractor's expense.

3.04 ADJUSTING

A. Adjust operating hardware and sash for smooth operation.

3.05 CLEANING

A. Remove protective material from pre-finished aluminum surfaces.

B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths, and take care to remove dirt from corners and to wipe surfaces clean.

3.06 PROTECTION

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

END OF SECTION 08 43 13

SECTION 08 44 35
PROTECTIVE FRAMED GLAZING ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior protective framed glazing assembly.

1.02 RELATED REQUIREMENTS

A. Section 07 25 00 - Weather Barriers: Sealing framing to water-resistive barrier installed on adjacent construction.

B. Section 08 71 00 - Door Hardware: Hardware installation requirements.

C. Section 08 71 00 - Door Hardware.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide evidence of compliance with fire performance criteria and manufacturer's published product data on framing components, glazing, anchorage and fasteners, and doors, if any.

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.

D. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.

E. Warranty Documentation: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Handle products of this section in accordance with AAMA CW-10.

B. Protect finished surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to substrate when exposed to sunlight or weather.

1.05 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

PART 2 PRODUCTS

2.01 INTERIOR PROTECTIVE FRAMED GLAZING ASSEMBLIES

A. Manufacturers:

1. SAFTIFIRST, a division of O'Keeffe's Inc; GPX Architectural Series: www.safti.com/#sle.
2. Technical Glass Products; Fireframes Designer Series: www.fireglass.com/#sle.
3. Substitutions: See Section 01 60 00 - Product Requirements.

B. Provide factory fabricated, with glazing and related flashings, anchorage and attachment devices.

1. Finish: As indicated in finish schedule.

C. Fire Performance: Provide hourly fire-resistance-rating as indicated; tested as an assembly including glazing in compliance with ASTM E119 or UL 263 and requirements of local authorities having jurisdiction.

1. Acceptable evidence of compliance includes listing by UL (DIR), ITS (DIR), or testing agency acceptable to authorities having jurisdiction.

2.02 COMPONENTS

A. Framing Members: Formed steel structural members with aluminum cladding and non-combustible thermally-resistive material as required for fire rating.

1. 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 imposed loads.

2.03 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

2.04 DOORS AND HARDWARE

A. Doors: Glazed aluminum.

1. Type: Manual swinging.
2. Thickness: 1-3/4 inches.
3. Top Rail: 5 inches wide.
4. Vertical Stiles: 5 inches wide.
5. Bottom Rail: 12 inches wide.
6. Glazing Stops: Square.
7. Finish: Same as framing.

B. Door Hardware:

1. Types: See Section 08 71 00.

2.05 FINISHES

A. Finishing: Apply factory finish to surfaces that will be exposed in completed assemblies.

1. Touch-up surfaces cut during fabrication so that no natural metal surfaces are visible in completed assemblies, including joint edges.

B. Aluminum Finish: Class I natural anodized.

1. Apply factory finish to surfaces that will be exposed in completed assemblies.

2. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.

C. Color: As selected by Architect from manufacturer's standard range.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other work.

B. Verify that wall openings and adjoining water-resistive barrier materials are ready to receive work of this section; see Section 07 25 00 for additional information.

C. Verify that anchorage devices have been properly installed and located.

3.02 INSTALLATION

A. Install wall system in accordance with limitations of fire rating and 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. Install door hardware using templates provided.

1. See Section 08 71 00 for hardware installation requirements.

F. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES

A. Maximum Variation from Plumb: 1/16 inch every 3 feet non-cumulative or 1/2 inch per 100 ft, whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

C. Sealant Space Between Mullions and Adjacent Construction: Maximum of 3/4 inch and minimum of 1/4 inch.

3.04 ADJUSTING

A. Adjust doors for smooth operation.

3.05 CLEANING

A. Remove protective material from pre-finished surfaces.

B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.

3.06 PROTECTION

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

END OF SECTION 08 44 35

SECTION 08 56 59
SERVICE AND TELLER WINDOW UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Service and teller window units.

B. Service and teller window units with pass-through device.

1.02 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Submit manufacturer's product data for specified products indicating materials, operation, glazing, finishes, and installation instructions.

C. Shop Drawings: Indicate configuration, sizes, rough-in, mounting, anchors and fasteners, and installation clearances.

D. Manufacturer Qualification Statement.

E. Installer Qualification Statement.

F. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with at least ten years documented experience, and with ability to provide test reports showing that their standard manufactured products meet the specified requirements.

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

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver units in manufacturer's original packaging and unopened containers with identification labels intact.

B. Store units in area protected from exposure to weather and vandalism.

1.05 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Provide manufacturer's warranty agreeing to repair or replace units and their components that fail in materials or workmanship within five years from Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Service and Teller Transaction Window Systems:

1. Total Security Solutions; www.tssbulletproof.com.

2. Armortex; www.armortex.com

3. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 BAFFLE TRANSACTION WINDOW

A. Location: Built within interior wall, as indicated on drawings.

B. Type of Use: Walk-up.

C. Window Type: Type 1A and 1B as indicated on drawings.

1. Mounting: Flush with wall surface.

2. Window Size: Custom window. As indicated on drawings.

3. Size of Counter Space: As indicated on drawings.

a. Counter Material: Custom quartz counter w/ recessed deal tray.

4. Framing Material: Aluminum. UL Rated Level 3.

a. Finish: Clear anodized.

5. Jamb/Header/Sill: Manufacturer's standard type.

D. Window Type: Type 16 as indicated on drawings.

1. Mounting: Flush with wall surface.

2. Window Size: As indicated on drawings.

3. Size of Counter Space: Manufacturer's standard size fitting.

a. Counter Material: Stainless steel.

4. Framing Material: Aluminum, UL Rated Level 3

a. Finish: Clear andodized

5. Jamb/Header/Sill: Manufacturers standard type.

E. Glazing: Single (monolithic), clear.

1. Ballistic Resistant Glazing (UL 752 Rated - Level 3)

F. Communication: Natural voice baffle system.

G. Accessories:

1. Stainless steel richochet resistant deal tray, quantity and location as indicated in drawings.

a. 16-ga stainless steel with #3 satin brush finish

b. Size: 10" x 12"

2.03 ASSEMBLY COMPONENTS

A. Windows: Factory-fabricated, finished, and glazed, with extruded aluminum frame and glazing stops; complete with hardware and anchors.

1. Provide window units that are re-glazable from the secure side without dismantling the non-secure side of framing.

2. Rigidly fit and secure joints and corners with internal reinforcement. Make joints and connections flush, hairline, and weatherproof. Fully weld corners.

3. Apply factory finish to exposed surfaces.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that window openings are ready for installation of windows.

B. Verify that correct embedded anchors are in place and in proper location; repair or replace anchors as required to achieve satisfactory installation.

C. Notify Architect if conditions are not suitable for installation of units; do not proceed until conditions are satisfactory.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install units in correct orientation (inside/outside or secure/non-secure).

C. Anchor units securely in manner so as to achieve performance specified and required by the manufacturer.

D. Remove and replace defective work.

3.03 CLEANING

A. Remove protective material from factory finished surfaces.

B. Clean exposed surfaces promptly after installation without damaging finishes.

3.04 PROTECTION

A. Provide temporary protection to ensure that service and teller windows are without damage upon Date of Substantial Completion.

END OF SECTION 08 56 59

SECTION 08 65 00
GLAZED CANOPIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Glazed canopy system.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Concrete foundation.

B. Section 05 12 00 - Structural Steel Framing: Steel support framing for system.

C. Section 05 50 00 - Metal Fabrications: Fabricated steel attachment devices.

D. Section 07 62 00 - Sheet Metal Flashing and Trim: Canopy counterflashing.

E. Section 07 92 00 - Joint Sealants: Sealing joints between glazed canopy frames and adjacent construction.

1.03 REFERENCE STANDARDS

A. 29 CFR 1910.23 - Ladders.

B. ASTM E72 - Standard Test Methods of Conducting Strength Tests of Panels for Building Construction.

C. ASTM E108 - Standard Test Methods for Fire Tests of Roof Coverings.

D. UL (DIR) - Online Certifications Directory.

E. UL 790 - Standard for Standard Test Methods for Fire Tests of Roof Coverings.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturer's product data, including installation details, descriptions of materials, profiles and finishes of canopy components.

C. Shop Drawings: Include plans, elevations and details.

D. Selection Samples: Include full range of aluminum finish samples for Architect's color selection.

1. Samples: Two for each exposed finish required, in same thickness and material as indicated for this work and in size as indicated below; when finishes involve normal color variations, include set of samples consisting of two or more units showing expected full range of variations.

a. Glazed Canopy Panels: 12- by 12-inch units with specified edge treatment.

E. Where structural silicone joints are required, report on sealant compatibility, approval of sealant joint design, and application procedures from the sealant manufacturer.

F. Where weatherseal silicone joints are required, submit application procedures from the sealant manufacturer.

G. Design Calculations: Provide structural analysis data signed and sealed by qualified professional engineer responsible for their preparation.

H. Manufacturer's Certificate: Certify that products supplied meet or exceed specified requirements.

I. Warranty Documentation: Manufacturer warranty; ensure that forms have been completed in Owner's name and registered with manufacturer.

J. Manufacturer's qualification statement.

K. Installer's qualification statement.

1.05 QUALITY ASSURANCE

A. Designer Qualifications: Design glazed canopy system under direct supervision of professional engineer experienced in design of system type specified and licensed in Project Location State.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with not fewer than three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver panel system, components and materials in manufacturer's standard protective packaging.

B. Store panels on long edge above ground, blocked and under cover in accordance with manufacturer’s storage and handling instructions.

C. Handle products in accordance with manufacturer's written instructions.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Correct defective work, including excessive deflection, deterioration of finish on metal in excess of normal weathering, and defects in accessories within five year period after Date of Substantial Completion.

C. Extend the silicone manufacturer's warranty four years for a total of five years (5) years.

1. Submit all warranties in conformance with the General and Supplementary Conditions.

2. Extend the manufacturer's material warranty four years for a total of five (5) years on all canopy components agreeing to repair or replace any part of the canopy that exhibits defects in workmanship or performance.

1.08 EXTEND THE INSTALLER WARRANTY FOUR YEARS FOR A TOTAL OF FIVE (5) YEARS ON THE INSTALLATION OF ALL CANOPY COMPONENTS AGREEING TO REPAIR OR REPLACE ANY PART OF THE CANOPY THAT EXHIBITS DEFECTS IN WORKMANSHIP OR PERFORMANCE. SILICONE BUTT JOINTS ARE TO BE WATERTIGHT, BUT INCIDENTAL WATER ON THE WALKWAYS CAUSED BY WATER RUNNING DOWN THE FACE OF THE BUILDING IS NOT CONSIDERED A DEFECT.

A. Extend laminated glass warranty four years for a total of five (5) years against defects including delamination, visual obstructions in the field of the glass.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Glazed Canopies:

1. DeaMor Solutions, https://deamor.com/

2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

A. Manufacturer is responsible for configuration and fabrication of complete canopy panel system.

B. Structural Loads: Provide canopy system capable of handling the following loads:

1. Live Load: 20 psf

2.03 PANEL CONSTRUCTION

A. Provide sandwich panels of flat fiberglass reinforced translucent face sheets laminated to grid core of mechanically interlocking I-beams with straight adhesive bonding line that covers entire width of I-beam with neat, sharp edge.

1. Thickness: 1 1/2" inch overall.

B. Deflection: Comply with local requirements established by authorities having jurisdiction, when tested in accordance with ASTM E72.

C. Canopy Flammability: Class A, when tested in accordance with ASTM E108.

D. Fire Test: Provide UL (DIR) listed Class A roof canopy system in accordance with UL 790 test methods.

E. Fall Protection: Comply with general industry fall protection standards of 29 CFR 1910.23.

2.04 MATERIALS

A. METAL

1. Point, stand-off and spider fittings: Type 316 stainless steel, with caps that swivel as required to accommodate the design and installation requirements. Provide the profiles indicated or an equivalent design engineered for the application.

2. Sheet and plate aluminum is to be 5052 alloy for flashing, trim, closures and accessories. Flashings to be minimum .040 inch thick or as required to maintain flatness; plate thickness to be as engineered for structural adequacy.

3. All fasteners are to be non-magnetic, 300 series, stainless steel, engineered as required.

B. GLASS AND GLAZING

1. Provide tempered laminated glass engineered for loads and spans, accommodating the stresses at hole locations.

2. Thickness as engineered for the loads and conditions of the project.

3. Laminated glass to consist of (2) layers of minimum ¾" tempered glass laminated to a minimum .060" thick WHITE PVB interlayer.

4. Glass color to be Clear both lights.

C. EDGE TREATMENT

1. Provide flat polished with aris on all exposed glass edges of laminated glass.

2.05 DISSIMILAR METAL PROTECTION

A. Shop apply 3-M "Scotchrap 50", 10 mil, black vinyl corrosion resistant tape to separate dissimilar metals. Locate so as to be concealed after installation.

PART 3 EXECUTION

3.01 FIELD DIMENSIONS

A. Obtain field dimensions as soon as possible and prior to fabricating the system, but do not delay the project if dimensions can be determined accurately without field dimensions.

3.02 EXAMINATION

A. Examine substrates, supporting structure and installation conditions.

B. Do not proceed with panel installation until unsatisfactory conditions have been corrected.

3.03 PREPARATION

A. Metal Protection:

1. At locations where aluminum contacts dissimilar metals, protect against galvanic action by painting contact surfaces with primer or applying sealant or tape as recommended by manufacturer for this purpose.

2. At locations where aluminum contacts concrete, masonry, or pressure treated wood, protect against corrosion by painting contact surfaces with bituminous paint or method recommended by manufacturer.

3.04 INSTALLATION

A. Install glazed canopies in accordance with manufacturer's installation instructions and approved shop drawings.

1. Anchor component parts securely in place by permanent mechanical attachment system.

2. Accommodate for thermal and mechanical movements.

B. Install joint sealants at perimeter joints and within panel system in accordance with manufacturer's installation instructions.

1. See Section 07 92 00 for additional requirements.

3.05 CLEANING

A. Upon completion of installation, immediately clean canopy system interior and exterior surfaces in accordance with manufacturer's instructions.

END OF SECTION 08 65 00

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SECTION 08 71 00
– DOOR HARDWARE

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus.

B. BHMA A156.3 - Exit Devices.

C. BHMA A156.4 - Door Closers and Pivots.

D. BHMA A156.19 - Power Assist and Low Energy Power Operated Swinging Doors.

E. BHMA A156.28 - Standard for Recommended Practices for Mechanical Keying Systems.

F. ISO 9000 - Quality Management Systems -- Fundamentals and Vocabulary.

G. NFPA 80 - Standard for Fire Doors and Other Opening Protectives.

H. NFPA 101 - Life Safety Code.

I. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives.

J. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies.

1.02 SUMMARY

A. Work under this section includes the complete finish hardware requirements for the project. Quantities listed are for the contractor's convenience only and are not guaranteed. Items not specifically mentioned, but necessary to complete the work shall be furnished, matching the items specified in quality and finish.

B. Related Sections:

1. Section 08 Hollow Metal Doors and Frames
2. Section 08 Wood Doors
3. Section 08 Aluminum Entrances and Storefronts
4. Section 28 Electronic Security and Safety

1.03 QUALITY ASSURANCE

A. Product Qualification:

1. To assure a uniform high quality of materials for the project, it is intended that only specified items be furnished.

2. Hardware to be new, free of defects, blemishes and excessive play. Obtain each kind of hardware (Mechanical latch and locksets, exit devices, hinges and closers) from one manufacturer except where specified.

3. Fire-Rated opening in compliance with NFPA 80. Hardware UL 10C/UBC-7-2 (positive pressure) compliant for given type/size opening and degree of label. Provide proper latching hardware, non-flaming door closers, approved bearing hinges and smoke seal. Furnish openings complete.

B. Supplier Qualifications:

1. Hardware supplier will be a direct factory contract supplier who employs a certified Architectural Hardware Consultant (AHC) available at all reasonable times during the work for project hardware consultation to owner, architect and contractor.

2. Supplier will be responsible for detailing, scheduling and ordering of finish hardware.

3. Conduct pre-installation conference at jobsite. Initiate and conduct with supplier, installer and related trades. Coordinate materials and techniques and sequence complex hardware items and systems installation.

4. Key Conference shall be initiated and conducted with owner to determine system, keyway(s) and structure.

C. Installer Qualifications:

1. Installer to have not less than 3 years' experience specializing in installation of work in this section. Company must maintain qualified personnel trained and experienced in installing hardware.

1.04 REFERENCES

A. IBC – International Building Code

B. Washington State Building Code

C. Seattle Building Code

D. NFPA 80 – Fire Doors and Windows

E. NFPA 101 – Life Safety Code

F. NFPA 105 – Smoke and Draft Control Door Assemblies

G. ANSI A117.1 - Accessible and Usable Buildings and Facilities

H. BHMA – Builders Hardware Manufacturers Association

I. DHI – Door Hardware Institute

1.05 SUBMITTALS

A. Hardware schedule: Submit digital copies of schedule. Organize vertically formatted schedule into Hardware Sets with index of doors and headings, indicate complete designations of every item required for each door or opening. Include the following:

1. Type, style, function, size, quantity and finish of hardware items.

2. Name, part number and manufacture of each item.

3. Fastenings and other pertinent information.

4. Explanation of abbreviations, symbols and codes contained in schedule.

5. Door and frame sizes, materials and degrees of swing.

B. Product Data: Submit digital copies for each product indicated.

C. Templates: Obtain and distribute templates for doors, frames, and other works specified to be prepared for installing door hardware.

D. Wiring/Riser diagrams: As required for electric hardware indicated.

E. Maintenance Data: For each type of door hardware to include in maintenance manuals specified in Division 1.

F. Keying Schedule: Prepared by or under the supervision of supplier, after receipt of the approved finish hardware schedule, detailing Owner's final keying instructions for locks.

G. Samples: Upon request submit material samples.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, handle and protect products to project site under provisions of Division 1 and as specified herein.

B. Tag each item or package separately, with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver keys to Owner by registered mail.

1.07 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Years from date of Substantial Completion, for durations indicated.

a. Closers: Thirty years

b. Automatic operators: Two years

c. Exit Devices, Electrical: Three years

d. Exit Devices, Mechanical: Ten years

e. Locksets, Electrical: Three years

f. Locksets, Mechanical, Cylindrical: Ten years

g. Locksets, Mechanical, Mortise: Ten years

1.08 MAINTENANCE

A. Extra Materials:

1. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

B. Maintenance tools:

1. Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

PART 2 PRODUCTS

2.01 MATERIAL AND FABRICATION

A. Provide all door hardware for complete work, in accordance with the drawings and as specified herein.

B. Provide items and quantities not specifically mentioned to ensure a proper and complete operational installation.

2.02 MANUFACTURERS

A. Products deviating from those listed in the hardware sets must be approved through a substitution request as described in Division 01.

B. Approval of alternate manufacturers and/or products other than those listed as "Scheduled Manufacturer" or "Acceptable Manufacturers" in the individual article for the product category are only to be considered by official substitution request in accordance with section 012500. Prior bid approval by Architect/Owner.

Item	Scheduled Manufacturer	Acceptable Manufacturer
Hinges	Ives (IVE)	By Approval Only
Flush Bolts & Coordinators	Ives (IVE)	By Approval Only
Locksets & Deadlocks	Schlage (SCH)	By Approval Only

Exit Devices & Mullions	Von Duprin (VON)	By Approval Only
Electric Strikes	Von Duprin (VON)	By Approval Only
Power Supplies	Von Duprin (VON)	By Approval Only
Cylinders & Keying	Best (Best)	Owner Standard
Door Closers	LCN (LCN)	By Approval Only
Automatic Operators	LCN (LCN)	By Approval Only
Door Trim	Ives (IVE)	By Approval Only
Protection Plates	Ives (IVE)	By Approval Only
Overhead Stops	Glynn-Johnson (GLY)	By Approval Only
Thresholds & Weatherstrip	Zero (ZER)	By Approval Only

2.03 HANGING

A. Conventional Hinges: Hinge open width minimum, but of sufficient throw to permit maximum door swing. Steel or stainless-steel pins:

1. Three hinges per leaf to 7 feet, 6-inch height. Add one for each additional 30 inches in height or any fraction thereof.

2. Provide standard-weight 4 ½ x 4 ½ for 1 ¾" thick doors up to 3'5". Provide heavy-weight 5 x 4 ½ on doors 36" and over.

3. Exterior outswing doors to have non removable (NRP) pins.

4. Pin tips, flat button, finish to match leaves.

5. Interior doors over 36" – Heavy weight.

6. Interior doors up to 36" – Standard weight.

2.04 LOCKSETS, LATCHSETS, DEADBOLTS

A. Heavy Duty Mortise Locks and Latches: Schlage L9000 Series

1. Provide mortise locks certified as ANSI A156.13, Grade 1 Operational, Grade 1 Security.

2. Provide lock case that is multi-function and field reversible for handing without opening case, and manufactured from heavy gauge steel, containing components of steel with a zinc dichromate plating for corrosion resistance.

3. Provide locks with standard 2-3/4 inches backset with full 3/4 inch throw stainless steel mechanical anti-friction latchbolt. Provide deadbolt with full 1 inch throw, constructed of stainless steel.

4. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.

5. Provide electrified options as scheduled in the hardware sets.

6. Lever Trim: Solid brass, bronze, or stainless steel, cast or forged in design specified, with wrought roses and external lever spring cages. Provide thru-bolted levers with 2-piece spindles.

    a. Lever Design: Schlage 17A

B. Extra Heavy Duty Cylindrical Locks and Latches: Schlage ND Series

1. Provide cylindrical locks conforming to ANSI A156.2 Series 4000, Grade 1.

2. UL listed for A label and lesser class single doors up to 4ft x 8ft.

3. Meets A117.1 Accessibility Codes.

4. Provide solid steel rotational stops to control excessive rotation of lever.

5. Provide completely refunctionable lockset that allows lock function to be changed to over twenty other common functions by swapping easily accessible parts.

6. Provide locks with standard 2-3/4 inches backset, unless noted otherwise, with 1/2 inch latch throw. Provide proper latch throw for UL listing at pairs.

7. Provide locksets with separate anti-rotation thru-bolts, and no exposed screws.

8. Provide independently operating levers with two external return spring cassettes mounted under roses to prevent lever sag.

9. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.

10. Lever Trim: Solid cast levers without plastic inserts and wrought roses on both sides.

    a. Lever Design: Schlage Sparta

C. Auxiliary Locks: Schlage B500 Series & Falcon D200 Series

1. Provide deadbolt series conforming to ANSI/BHMA A156 and function as specified.

2. Provide deadbolts with standard 2-3/4 inches backset. Provide 2-3/8 inches where noted or if door or frame detail requires. Provide deadbolt with full 1 inch throw, constructed of steel alloy.

3. Provide manufacturer's standard strike.

2.05 EXIT DEVICES

A. Panic and Fire Rated Exit Devices: Von Duprin 98 & 35 Series

1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1, and UL listed for Panic Exit or Fire Exit Hardware.

2. Provide touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.

3. Touchpad: Extend minimum of one half of door width. Provide compression springs in devices, latches, and outside trims or controls; tension springs also acceptable.

4. Provide exit devices with deadlatching feature for security and for future addition of alarm kits and/or other electrified requirements.

5. Provide exit devices with manufacturer's approved strikes.

6. Provide exit devices cut to door width and height. Locate exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Architect.

7. Mount mechanism case flush on face of doors or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.

8. Removable Mullions: 2 inches x 3 inches steel tube. Where scheduled as keyed removable mullion that is removed by use of a keyed cylinder, which is self-locking when re-installed.

9. Provide UL labeled fire exit hardware for fire rated openings.

10. Provide factory drilled weep holes for exit devices used in full exterior application, highly corrosive areas, and where noted in hardware sets.

11. Provide electrified options as scheduled.

12. Where lever handles are specified as outside trim for exit devices, provide heavy-duty lever trims with forged or cast escutcheon plates. Provide vandal-resistant levers that will travel to 90-degree down position when more than 35 pounds of torque are applied, and which can easily be re-set.

    a. Lever Style: Match lever style of locksets.

2.06 KEYS, KEYING, AND KEY CONTROL

A. See Keying Requirements in this section

2.07 CLOSERS

A. Surface Closers: LCN 4040XP Series

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.

2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.

3. Cylinder Body: 1-1/2 inch diameter with 3/4 inch diameter double heat-treated pinion journal.

4. Hydraulic Fluid: Fireproof, passing requirements of UL 10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees Fahrenheit to -30 degrees Fahrenheit.

5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.

6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck.

7. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers.

8. Pressure Relief Valve (PRV) Technology: Not permitted.

9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI Standard A156.4 and ASTM B117, or has special rust inhibitor (SRI).

10. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.08 AUTOMATIC OPERATORS

A. Electro-Hydraulic Automatic Operator: LCN 4600 Series

1. Provide low energy automatic operator units with hydraulic closer complying with ANSI/BHMA A156.19.

2. Hydraulic Fluid: Fireproof, passing requirements of UL 10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees Fahrenheit to -30 degrees Fahrenheit.

3. Provide units with conventional door closer opening and closing forces unless power operator motor is activated. Provide door closer assembly with adjustable spring size, back-check, and opening and closing speed adjustment valves to control door

4. Provide units with on/off switch for manual operation, motor start up delay, vestibule interface delay, electric lock delay, and door hold open delay.

5. Provide units with conventional door closer opening and closing forces unless power operator motor is activated. Provide door closer assembly with adjustable spring size, back-check valve, sweep valve, latch valve to control door.

6. Provide drop plates, brackets, or adapters for arms as required for details.

7. Provide hard-wired actuator switches for operation as specified.

8. Provide weather-resistant actuators at exterior applications.

9. Provide key switches with LED's, recommended and approved by manufacturer of automatic operator as required for function described in operation description of hardware group below. Cylinders: Refer to "KEYING" article, herein.

10. Provide complete assemblies of controls, switches, power supplies, relays, and parts/material recommended and approved by manufacturer of automatic operator for each individual leaf. Actuators control both doors simultaneously at pairs. Sequence operation of exterior and vestibule doors with automatic operators to allow ingress or egress through both sets of openings as directed by Architect. Locate actuators, key switches, and other controls as directed by Architect.

11. Provide units with vestibule inputs that allow sequencing operation of two units, and SPDT relay for interfacing with latching or locking devices.

2.09 OTHER HARDWARE

A. Door stops: Provide stops to protect walls, casework or other hardware.

1. Except as otherwise indicated, provide stops (wall, floor or overhead) at each leaf of every swinging door leaf.

2. Where wall or floor stops are not appropriate, provide overhead holders.

B. Weatherstrip and Gasket

1. Provide continuous weather-strip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated or scheduled.

2. Provide non-corrosive fasteners as recommended by the manufacturer for application indicated.

C. Thresholds

1. Except as otherwise indicated, provide standard metal threshold unit of type, size and profile as detailed or scheduled.

D. Silencers

1. Interior hollow metal frames, 3 for single doors, 2 for pairs of doors.

E. Kickplates

1. Four beveled edges, .050 inches minimum thickness, height and width as scheduled. Sheet-metal screws of bronze or stainless steel to match other hardware.

2.10 HARDWARE FINISH

A. Provide the following finishes unless noted differently in hardware groups:

Hinges	630 Stainless Steel, 652 Dull Chrome
Locksets	626 Dull Chrome
Exit Devices	626 Dull Chrome
Closers	689 Aluminum
Kickplates	630 Stainless Steel
Other Hardware	626 Dull Chrome
Thresholds	Aluminum
Weatherstrip/Sweeps	Aluminum

2.11 KEYING REQUIREMENTS

A. All keyed cylinders shall be subject to a Best Cormax Masterkey system.

B. Provide a factory registered keying system, complying with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.

C. Furnish cylinders with construction cores. Following construction supply permanent keyed cores.

D. Cylinders to be furnished with visual key control with key code. Stamped on the face of the keys and marked on the back or side of the cylinders.

E. Initiate and conduct key conference with Owner to determine correct keyway(s) and structure. Owners written approval required prior to ordering product.

F. Key Quantities

1) 6 EA Master Keys

2) 4 EA Control Keys

3) 2 EA Construction Control Keys

4) 10 EA Construction Keys

5) 3 EA Change Keys per keyed alike group

PART 3 EXECUTION

3.01 PREPARATION

A. Ensure that walls and frames are square and plumb before hardware installation.

B. Locate hardware per SDI-100 and applicable building, fire, life-safety, accessibility, and security codes. Notify Architect of any code conflicts before ordering materials.

3.02 INSTALLATION

A. Do not install surface mounted items until finishes have been completed on substrate. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate for proper installation and operation.

B. Locate floor stops not more than 4 inches from the wall.

C. Drill pilot holes for fasteners in wood doors and/or frames.

3.03 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

B. Occupancy Adjustment: Approximately three to six months after date of Substantial Completion, Installer's Architectural Hardware Consultant must examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors and door hardware.

3.04 DEMONSTRATION

A. Demonstrate electrical, electronic and pneumatic hardware system including adjustment and maintenance procedures.

3.05 PROTECTION/CLEANING

A. Cover installed hardware, protect from paint, cleaning agents, weathering, carts/barrows, etc. Remove covering materials and clean hardware just prior to substantial completion. Clean adjacent wall, frame and door surfaces soiled from installation/reinstallation process.

3.06 DOOR HARDWARE SCHEDULE

A. The intent of the hardware specification is to specify the hardware for interior and exterior doors, and to establish a type, continuity, and standard of quality. However, it is the door hardware supplier’s responsibility to thoroughly review existing conditions, schedules, specifications, drawings, and other Contract Documents to verify the suitability of the hardware specified.

B. Discrepancies, conflicting hardware, and missing items are to be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application.

C. Hardware items are referenced in the following hardware schedule. Refer to the above specifications for special features, options, cylinders/keying, and other requirements.

3.07 HARDWARE SETS:

LEGEND: V7

LINK TO CATALOG CUT SHEET

~ELECTRIFIED OPENING

HARDWARE GROUP NO. 01

FOR USE ON DOOR #(S):

A1013	A1017	A1018	A1024	A1025	A1026
A1032	A1033	A1034	A1035	A1036	A1039
A1043	A1044	A1045	A1046	A1047	A1048
A1049	A1050	A1051	A1052	A1053	A1059
A1079	A1080	A1081	A1082	A1083	A1084
A1086	A1087	B1001	B1002	B1005	B1006
B1007	B1008				

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
4	EA	HINGE	5BB1 4.5 X 4.5			652	IVE
1	EA	STOREROOM LOCK	ND80BDC SPA			626	SCH
1	EA	CYLINDER	BEST CORMAX SFIC AS REQ'D				BES
1	EA	WALL STOP	WS406/407CVX			US26D	IVE
1	EA	GASKETING	488SBK PSA			BK	ZER

HARDWARE GROUP NO. 02

FOR USE ON DOOR #(S):

A1023	A1064	A1070	A1072		

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
4	EA	HINGE	5BB1 4.5 X 4.5			652	IVE
1	EA	PASSAGE SET	ND10S SPA			626	SCH
1	EA	WALL STOP	WS406/407CVX			US26D	IVE
1	EA	GASKETING	488SBK PSA			BK	ZER

HARDWARE GROUP NO. 03

FOR USE ON DOOR #(S):

A1011A	A1014	A1027	A1028B	A1029	A1040
A1041	A1055	A1085	A1113	A1115	A1123
A1124					

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
4	EA	HINGE	5BB1 4.5 X 4.5	□		652	IVE
1	EA	STOREROOM LOCK	ND80BDC SPA	□		626	SCH
1	EA	CYLINDER	BEST CORMAX SFIC AS REQ'D				BES
1	EA	SURFACE CLOSER	4040XP RW/PA	□		689	LCN
1	EA	WALL STOP	WS406/407CVX	□		US26D	IVE
1	EA	GASKETING	488SBK PSA	□		BK	ZER

HARDWARE GROUP NO. 04

FOR USE ON DOOR #(S):

A1007B	A1008B	A1008C	A1011B	A1012	A1028A
A1071	A1074	A1076	A1088	A1116A	A1116B
A1118	A1120	A1120	A1125A	A1126	A1127B
A1132	B1009				

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
4	EA	HINGE	5BB1HW 4.5 X 4.5	□		652	IVE
1	EA	POWER TRANSFER	EPT10 CON	□	~	689	VON
1	EA	EU STOREROOM LOCK	ND80BDCEU SPA RX CON 12V/24V DC	□	~	626	SCH
1	EA	CYLINDER	BEST CORMAX SFIC AS REQ'D				BES

1	**EA**	**SURFACE CLOSER**	**4040XP RW/PA**			**689**	**LCN**
1	**EA**	**KICK PLATE**	**8400 10" X 2" LDW B-CS**			**630**	**IVE**
1	**EA**	**WALL STOP**	**WS406/407CVX**			**US26D**	**IVE**
1	**EA**	**GASKETING**	**488SBK PSA**			**BK**	**ZER**
1	**EA**	**WIRE HARNESS**	**CON-192P AS REQ**		**~**		**SCH**
1	**EA**	**WIRE HARNESS**	**CON-6W**		**~**		**SCH**
			POWER SUPPLY - WORK OF DIVISION 28				
1			**CARD READER - WORK OF DIVISION 28**				
			DOOR CONTACT(S) - WORK OF DIV. 28 COORDINATE WITH SECURITY- PREP DOOR(S) AND FRAME		**~**		

VERIFY DOOR THICKNESS

DOOR NORMALLY CLOSED AND LOCKED.
PRESENT CREDENTIAL TO CARD READER FOR ENTRY OR BY KEY OVERRIDE.
RX IN INSIDE LEVER TO SHUNT DOOR POSITION SWITCH UPON EGRESS.
FREE EGRESS AT ALL TIMES.
DOOR TO REMAIN LOCKED, FAIL SECURE DURING POWER FAILURE.

HARDWARE GROUP NO. 04.2

FOR USE ON DOOR #(S):

A1112	**A1125B**				

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
4	**EA**	**HINGE**	**5BB1 4.5 X 4.5**			**652**	**IVE**

1	**EA**	**POWER TRANSFER**	**EPT10 CON**	□	**~**	**689**	**VON**
1	**EA**	**EU STOREROOM LOCK**	**ND80BDCEU SPA RX CON 12V/24V DC**	□	**~**	**626**	**SCH**
1	**EA**	**CYLINDER**	**BEST CORMAX SFIC AS REQ'D**				**BES**
1	**EA**	**SURFACE CLOSER**	**4040XP RW/PA**	□		**689**	**LCN**
1	**EA**	**WALL STOP**	**WS406/407CVX**	□		**US26D**	**IVE**
1	**EA**	**GASKETING**	**488SBK PSA**	□		**BK**	**ZER**
1	**EA**	**WIRE HARNESS**	**CON-192P AS REQ**		**~**		**SCH**
1	**EA**	**WIRE HARNESS**	**CON-6W**		**~**		**SCH**
1	**EA**	**DESK MOUNT BUTTON**	**660-PB**	□	**~**	**628**	**SCE**
			POWER SUPPLY - WORK OF DIVISION 28				
			DOOR CONTACT(S) - WORK OF DIV. 28 COORDINATE WITH SECURITY- PREP DOOR(S) AND FRAME		**~**		

DOOR BELL BY OTHER

DOOR NORMALLY CLOSED AND LOCKED. DESK MOUNTED BUTTON REMOTELY UNLOCKS LEVER.
PRESENT CREDENTIAL TO CARD READER FOR ENTRY OR BY KEY OVERRIDE.
RX IN INSIDE LEVER TO SHUNT DOOR POSITION SWITCH UPON EGRESS.
FREE EGRESS AT ALL TIMES.
DOOR TO REMAIN LOCKED, FAIL SECURE DURING POWER FAILURE.

HARDWARE GROUP NO. 05

FOR USE ON DOOR #(S):

A1005	**A1008A**	**A1009**	**A1038A**	**A1038B**	**A1042**

A1054	**A1058**	**A1060**	**A1063**	**A1111**	**A1119**
A1128					

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
4	EA	HINGE	5BB1HW 4.5 X 4.5	□		652	IVE
1	EA	PASSAGE SET	ND10S SPA 2" EO	□		626	SCH
1	EA	SURFACE CLOSER	4040XP RW/PA	□		689	LCN
1	EA	WALL STOP	WS406/407CVX	□		US26D	IVE
1	EA	GASKETING	488SBK PSA	□		BK	ZER

HARDWARE GROUP NO. 06

FOR USE ON DOOR #(S):

A1057	**A1065B**	**A1077**			

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	□		652	IVE
1	EA	POWER TRANSFER	EPT10 CON	□	~	689	VON
1	EA	EU STOREROOM LOCK	ND80BDCEU SPA CON 12V/24V DC	□	~	626	SCH
1	EA	CYLINDER	BEST CORMAX SFIC AS REQ'D				BES
1	EA	SURFACE CLOSER	4040XP RW/PA	□		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	□		630	IVE
1	EA	WALL STOP	WS406/407CVX	□		US26D	IVE
1	EA	GASKETING	488SBK PSA	□		BK	ZER
1	EA	WIRE HARNESS	CON-192P AS REQ		~		SCH
1	EA	WIRE HARNESS	CON-6W		~		SCH
			POWER SUPPLY -				

			WORK OF DIVISION 28				
1			**CARD READER - WORK OF DIVISION 28**				

DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL MOMENTARILY UNLOCKS LOCKSET. LOCK IS UNLOCKED ON FIRE OR LOSS OF POWER. FREE EGRESS AT ALL TIMES.

HARDWARE GROUP NO. 06.1

FOR USE ON DOOR #(S):

A1066	**A1067**	**A1068**	**A1069**		

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		**DESCRIPTION**	**CATALOG NUMBER**			**FINISH**	**MFR**
3	**EA**	**HINGE**	**5BB1 4.5 X 4.5**	□		**652**	**IVE**
1	**EA**	**POWER TRANSFER**	**EPT10 CON**	□	**~**	**689**	**VON**
1	**EA**	**EL STOREROOM LOCK**	**ND80BDCEL SPA CON 12V/24V DC**	□	**~**	**626**	**SCH**
1	**EA**	**CYLINDER**	**BEST CORMAX SFIC AS REQ'D**				**BES**
1	**EA**	**SURFACE CLOSER**	**4040XP HCUSH**	□		**689**	**LCN**
1	**EA**	**KICK PLATE**	**8400 10" X 2" LDW B-CS**	□		**630**	**IVE**
1	**EA**	**WALL STOP**	**WS406/407CVX**	□		**US26D**	**IVE**
1	**EA**	**GASKETING**	**488SBK PSA**	□		**BK**	**ZER**
1	**EA**	**WIRE HARNESS**	**CON-192P AS REQ**		**~**		**SCH**
1	**EA**	**WIRE HARNESS**	**CON-6W**		**~**		**SCH**
			POWER SUPPLY - WORK OF DIVISION 28				
1			**CARD READER - WORK OF DIVISION 28**				

DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL MOMENTARILY UNLOCKS LOCKSET. LOCK IS UNLOCKED ON FIRE OR LOSS OF POWER. FREE EGRESS AT ALL TIMES.

HARDWARE GROUP NO. 06.2

FOR USE ON DOOR #(S):

A1075					

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	□		652	IVE
1	EA	POWER TRANSFER	EPT10 CON	□	~	689	VON
1	EA	EU STOREROOM LOCK	ND80BDCEU SPA CON 12V/24V DC	□	~	626	SCH
1	EA	CYLINDER	BEST CORMAX SFIC AS REQ'D				BES
1	EA	OH STOP	100S	□		630	GLY
1	EA	SURFACE CLOSER	4040XP REG ST-1630 X 4040XP - 18TJ	□		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	□		630	IVE
1	EA	GASKETING	488SBK PSA	□		BK	ZER
1	EA	WIRE HARNESS	CON-192P AS REQ		~		SCH
1	EA	WIRE HARNESS	CON-6W		~		SCH
			POWER SUPPLY - WORK OF DIVISION 28				
1			CARD READER - WORK OF DIVISION 28				

DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL MOMENTARILY UNLOCKS LOCKSET. LOCK IS UNLOCKED ON FIRE OR LOSS OF POWER. FREE EGRESS AT ALL TIMES.

HARDWARE GROUP NO. 06.3

FOR USE ON DOOR #(S):

A1065A					

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	□		652	IVE
1	EA	POWER TRANSFER	EPT10 CON	□	~	689	VON
1	EA	EL STOREROOM LOCK	ND80BDCEL SPA CON 12V/24V DC	□	~	626	SCH
1	EA	CYLINDER	BEST CORMAX SFIC AS REQ'D				BES
1	EA	SURFACE CLOSER	4040XP RW/PA	□		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	□		630	IVE
1	EA	WALL STOP	WS406/407CVX	□		US26D	IVE
1	EA	GASKETING	488SBK PSA	□		BK	ZER
1	EA	WIRE HARNESS	CON-192P AS REQ		~		SCH
1	EA	WIRE HARNESS	CON-6W		~		SCH
			POWER SUPPLY - WORK OF DIVISION 28				
1			CARD READER - WORK OF DIVISION 28				

DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL MOMENTARILY UNLOCKS LOCKSET. LOCK IS UNLOCKED ON FIRE OR LOSS OF POWER. FREE EGRESS AT ALL TIMES.

HARDWARE GROUP NO. 07

FOR USE ON DOOR #(S):

A1131					

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
4	EA	HINGE	5BB1 4.5 X 4.5			652	IVE
1	EA	POWER TRANSFER	EPT10 CON		~	689	VON
1	EA	EL STOREROOM LOCK	ND80BDCEL SPA 2" EO CON 12V/24V DC		~	626	SCH
1	EA	CYLINDER	BEST CORMAX SFIC AS REQ'D				BES
1	EA	SURFACE CLOSER	4040XP RW/PA			689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS			630	IVE
1	EA	WALL STOP	WS406/407CVX			US26D	IVE
1	EA	GASKETING	488SBK PSA			BK	ZER
			POWER SUPPLY - WORK OF DIVISION 28				
1			CARD READER - WORK OF DIVISION 28				
			DOOR CONTACT(S) - WORK OF DIV. 28 COORDINATE WITH SECURITY- PREP DOOR(S) AND		~		

			FRAME				

DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL WILL MOMENTARILY RELEASE LEVER. DOOR CONTACT MONITORS DOOR POSITION. FREE EGRESS AT ALL TIMES.

HARDWARE GROUP NO. 08

FOR USE ON DOOR #(S):

A1004A	**A1004B**	**A1007A**			

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
4	EA	HINGE	5BB1 4.5 X 4.5 NRP	□		652	IVE
1	EA	POWER TRANSFER	EPT10 CON	□	~	689	VON
1	EA	ELEC FIRE EXIT HARDWARE	98-L-F-M996-17-FSE-CON	□	~	US26D	VON
1	EA	CYLINDER	BEST CORMAX SFIC AS REQ'D				BES
1	EA	SURFACE CLOSER	4040XP EDA	□		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	□		630	IVE
1	EA	FIRE/LIFE WALL MAG	SEM 7850	□	~	689	LCN
1	EA	GASKETING	488SBK PSA	□		BK	ZER
1	EA	WIRE HARNESS	CON-6W		~		SCH
			POWER SUPPLY - WORK OF DIVISION 28				
1			CARD READER - WORK OF DIVISION 28				

DOOR NORMALLY CLOSED AND LOCKED UNLESS HELD OPEN BY MAG HOLDS
PRESENT CREDENTIAL TO CARD READER FOR ENTRY OR BY KEY OVERRIDE.
FREE EGRESS AT ALL TIMES.
DOOR TO REMAIN LOCKED, FAIL SECURE DURING POWER FAILURE.

HARDWARE GROUP NO. 09

FOR USE ON DOOR #(S):

A1019B	**A1114A**				

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
4	EA	HINGE	5BB1 4.5 X 4.5			652	IVE
1	EA	PANIC HARDWARE	98-L-BE-17			630AM	VON
1	EA	SURFACE CLOSER	4040XP EDA			689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS			630	IVE
1	EA	WALL STOP	WS406/407CVX			US26D	IVE
1	EA	GASKETING	488SBK PSA			BK	ZER

HARDWARE GROUP NO. 10

FOR USE ON DOOR #(S):

A1021					

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
4	EA	HINGE	5BB1 4.5 X 4.5			652	IVE
1	EA	CLASSROOM LOCK	ND70BDC SPA			626	SCH
1	EA	CYLINDER	BEST CORMAX SFIC AS REQ'D				BES
1	EA	SURFACE CLOSER	4040XP RW/PA			689	LCN
1	EA	WALL STOP	WS406/407CVX			US26D	IVE
1	EA	GASKETING	488SBK PSA			BK	ZER
1	EA	DOOR BOTTOM	364AA			AA	ZER
1	EA	THRESHOLD	545A			A	ZER

HARDWARE GROUP NO. 10.1

FOR USE ON DOOR #(S):

A1020					

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
4	EA	HINGE	5BB1 4.5 X 4.5	□		652	IVE
1	EA	CLASSROOM LOCK	ND70BDC SPA	□		626	SCH
1	EA	CYLINDER	BEST CORMAX SFIC AS REQ'D				BES
1	EA	SURFACE CLOSER	4040XP RW/PA	□		689	LCN
1	EA	WALL STOP	WS406/407CVX	□		US26D	IVE
1	EA	GASKETING	488SBK PSA	□		BK	ZER
1	EA	DOOR BOTTOM	364AA	□		AA	ZER
1	EA	THRESHOLD	545A	□		A	ZER
1	EA	VIEWER	U700	□		626	IVE

HARDWARE GROUP NO. 11

FOR USE ON DOOR #(S):

A1002	**A1003**				

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
4	EA	HINGE	5BB1 4.5 X 4.5	□		652	IVE
1	EA	CLASSROOM DEADBOLT	B563BDC	□		626	SCH
1	EA	CYLINDER	BEST CORMAX SFIC AS REQ'D				BES
1	EA	PUSH PLATE	8200 4" X 16"	□		630	IVE
1	EA	PULL PLATE	8303 10" 4" X 16" CFT	□		630	IVE

1	EA	SURFACE CLOSER	4040XP RW/PA			689	LCN
1	EA	GASKETING	488SBK PSA			BK	ZER
1	EA	DOOR BOTTOM	364AA			AA	ZER
1	EA	THRESHOLD	545A			A	ZER

THUMBTURN ONLY RETRACTS DEADBOLT TO PREVENT ACCIDENTAL LOCK-INS

HARDWARE GROUP NO. 12

FOR USE ON DOOR #(S):

A1089					

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
4	EA	HINGE	5BB1 4.5 X 4.5			652	IVE
1	EA	PASSAGE SET	ND10S SPA 2" EO			626	SCH
1	EA	SURFACE CLOSER	4040XP RW/PA			689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS			630	IVE
1	EA	WALL STOP	WS406/407CVX			US26D	IVE
1	EA	GASKETING	488SBK PSA			BK	ZER
1	EA	DOOR BOTTOM	364AA			AA	ZER

HARDWARE GROUP NO. 13

FOR USE ON DOOR #(S):

A1090	A1091	A1092			

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5			652	IVE
1	EA	PRIVACY LOCK W/ OUTSIDE INDICATOR	ND40S SPA OS-OCC			626	SCH

1	EA	GASKETING	488SBK PSA			BK	ZER
1	EA	DOOR BOTTOM	364AA			AA	ZER
1	EA	THRESHOLD	545A			A	ZER

HARDWARE GROUP NO. 14

FOR USE ON DOOR #(S):

A1000A					

PROVIDE EACH PR DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
8	EA	HINGE	5BB1 4.5 X 4.5 NRP			652	IVE
2	EA	POWER TRANSFER	EPT10 CON		~	689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-3549A-EO-CON 24 VDC		~	626	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-3549A-T-360T-CON 24 VDC		~	626	VON
1	EA	CYLINDER	BEST CORMAX SFIC AS REQ'D				BES
2	EA	LONG DOOR PULL	9264 84" 20" O MB			630-316	IVE
2	EA	OH STOP	100S			630	GLY
1	EA	SURFACE CLOSER	4040XP SCUSH			689	LCN
1	EA	SURF. AUTO OPERATOR	4642 WMS 120 VAC		~	689	LCN
1	EA	CUSH SHOE SUPPORT	4040XP-30 SRT			689	LCN
1	EA	BLADE STOP SPACER	4040XP-61 SRT			689	LCN
2	EA	ACTUATOR, TOUCHLESS	8310-813J			BLK	LCN
1	EA	SEAL SET	WEATHER SEALS BY STOREFRONT SUPPLIER				

2	**EA**	**DOOR SWEEP**	**8197AA**			**AA**	**ZER**
1	**EA**	**THRESHOLD**	**626D-223**			**D**	**ZER**
2	**EA**	**WIRE HARNESS**	**CON-26P (POWER TRANSFER TO ELECTRIFIED HARDWARE)**		**~**		**SCH**
2	**EA**	**WIRE HARNESS**	**CON-6W**		**~**		**SCH**
1	**EA**	**POWER SUPPLY**	**PS902 BBK 900-2RS 120/240 VAC**		**~**	**LGR**	**SCE**
1			**CARD READER - WORK OF DIVISION 28**				

POWER SUPPLY AND AUTO OPERATOR REQUIRE 120VDC

DOORS HELD UNLOCKED BY LATCH RETRACTION. EMERGENCY PUSH BUTTON IN VESTIBULE RELEASES LATCH AND LOCKS BOTH DOORS. WHEN LOCKED, VALID CREDENTIAL RETRACTS LATCH MOMENTARILY. KEY OVER RIDE FROM EXTERIOR. RX MONITORS EGRESS. DOORS LOCKED ON FIRE OR LOSS OF POWER. FREE EGRESS AT ALL TIMES.

HARDWARE GROUP NO. 15

FOR USE ON DOOR #(S):

A1000B					

PROVIDE EACH PR DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
8	**EA**	**HINGE**	**5BB1 4.5 X 4.5 NRP**			**652**	**IVE**
2	**EA**	**POWER TRANSFER**	**EPT10 CON**		**~**	**689**	**VON**
1	**EA**	**ELEC PANIC HARDWARE**	**RX-QEL-3549A-EO-CON 24 VDC**		**~**	**626**	**VON**
1	**EA**	**ELEC PANIC HARDWARE**	**RX-QEL-3549A-T-360T-CON 24 VDC**		**~**	**626**	**VON**

1	**EA**	**CYLINDER**	**BEST CORMAX SFIC AS REQ'D**				**BES**
2	**EA**	**LONG DOOR PULL**	**9264 84" 20" O MB**	□		**630-316**	**IVE**
2	**EA**	**OH STOP**	**100S**	□		**630**	**GLY**
1	**EA**	**SURFACE CLOSER**	**4040XP SCUSH**	□		**689**	**LCN**
1	**EA**	**SURF. AUTO OPERATOR**	**4642 WMS 120 VAC**	□	**~**	**689**	**LCN**
1	**EA**	**CUSH SHOE SUPPORT**	**4040XP-30 SRT**	□		**689**	**LCN**
1	**EA**	**BLADE STOP SPACER**	**4040XP-61 SRT**	□		**689**	**LCN**
2	**EA**	**ACTUATOR, TOUCHLESS**	**8310-813J**	□		**BLK**	**LCN**
1	**EA**	**SEAL SET**	**WEATHER SEALS BY STOREFRONT SUPPLIER**				
2	**EA**	**DOOR SWEEP**	**8197AA**	□		**AA**	**ZER**
2	**EA**	**WIRE HARNESS**	**CON-26P (POWER TRANSFER TO ELECTRIFIED HARDWARE)**		**~**		**SCH**
2	**EA**	**WIRE HARNESS**	**CON-6W**		**~**		**SCH**
1	**EA**	**KEY SWITCH**	**653-04**	□	**~**	**630**	**SCE**
1	**EA**	**POWER SUPPLY**	**PS902 BBK 900-2RS 120/240 VAC**	□	**~**	**LGR**	**SCE**
1			**CARD READER - WORK OF DIVISION 28**				

POWER SUPPLY AND AUTO OPERATOR REQUIRE 120VDC

DOORS UNLOCKED DURING BUSINESS HOURS BY LATCH RETRACTION, LOCKED AFTER HOURS, ACCESS BY VALID CRENTIAL OR KEY OVER RIDE. KEY SWITCH DROPS POWER LOCKING DOORS. RX MONITORS EGRESS. DOORS LOCKED ON FIRE OR LOSS OF POWER. FREE EGRESS AT ALL TIMES.

HARDWARE GROUP NO. 16

FOR USE ON DOOR #(S):

A1015	**A1016**				

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
4	EA	HINGE	5BB1 4.5 X 4.5			652	IVE
1	EA	ENTRANCE/OFFICE LOCK	ND50BDC SPA 2" EO			626	SCH
1	EA	CYLINDER	BEST CORMAX SFIC AS REQ'D				BES
1	EA	SURFACE CLOSER	4040XP RW/PA			689	LCN
1	EA	WALL STOP	WS406/407CVX			US26D	IVE
1	EA	GASKETING	488SBK PSA			BK	ZER

HARDWARE GROUP NO. 17

FOR USE ON DOOR #(S):

A1037					

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
4	EA	HINGE	5BB1 4.5 X 4.5 NRP			652	IVE
1	EA	POWER TRANSFER	EPT10 CON		~	689	VON
1	EA	ELEC PANIC HARDWARE	RX-98-EO-ALK HARDWIRED		~	US26D	VON
1	EA	CYLINDER	BEST CORMAX SFIC AS REQ'D				BES

1	EA	SURFACE CLOSER	4040XP SCUSH	□		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	□		630	IVE
1	EA	GASKETING	488SBK PSA	□		BK	ZER
1	EA	THRESHOLD	545A	□		A	ZER

DOOR ALWAYS CLOSED AND LATCHED. ALARM TO SOUND ON EXIT UNLESS DISSARMED. NO ENTRY FROM OUTSIDE. FREE EGRESS AT ALL TIMES.

HARDWARE GROUP NO. 17.1

FOR USE ON DOOR #(S):

C114					

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
4	EA	HINGE	5BB1 4.5 X 4.5 NRP	□		652	IVE
1	EA	POWER TRANSFER	EPT10 CON	□	~	689	VON
1	EA	ELEC PANIC HARDWARE	RX-98-EO-ALK HARDWIRED	□	~	US26D	VON
1	EA	CYLINDER	BEST CORMAX SFIC AS REQ'D				BES
1	EA	SURFACE CLOSER	4040XP SCUSH	□		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	□		630	IVE
1	EA	GASKETING	488SBK PSA	□		BK	ZER
1	EA	THRESHOLD	545A	□		A	ZER
1			CARD READER - WORK OF DIVISION 28				
			DOOR CONTACT(S) - WORK OF DIV. 28 COORDINATE		~		

			WITH SECURITY-PREP DOOR(S) AND FRAME				

DOOR ALWAYS CLOSED AND LATCHED. ALARM TO SOUND ON EXIT UNLESS ALARM IS SHUNTED BY VALID CARD READ. NO ENTRY FROM OUTSIDE. FREE ALARMED EGRESS AT ALL TIMES.

HARDWARE GROUP NO. 18

FOR USE ON DOOR #(S):

A1098A					

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		**DESCRIPTION**	**CATALOG NUMBER**			**FINISH**	**MFR**
4	**EA**	**HINGE**	**5BB1 4.5 X 4.5 NRP**	□		**652**	**IVE**
1	**EA**	**POWER TRANSFER**	**EPT10 CON**	□	**~**	**689**	**VON**
1	**EA**	**ELEC PANIC HARDWARE**	**RX-QEL-98-L-NL-17-CON 24 VDC**	□	**~**	**626**	**VON**
1	**EA**	**SURF. AUTO OPERATOR**	**4642 WMS 120 VAC**	□	**~**	**689**	**LCN**
2	**EA**	**ACTUATOR, TOUCHLESS**	**8310-813J**	□		**BLK**	**LCN**
1	**EA**	**SEAL SET**	**WEATHER SEALS BY STOREFRONT SUPPLIER**				
1	**EA**	**DOOR SWEEP**	**8197AA**	□		**AA**	**ZER**
1	**EA**	**THRESHOLD**	**545A**	□		**A**	**ZER**
1	**EA**	**POWER SUPPLY**	**PS902 900-2RS 120/240 VAC**	□	**~**	**LGR**	**SCE**
1			**CARD READER - WORK OF DIVISION 28**				
			DOOR CONTACT(S) -		**~**		

			WORK OF DIV. 28 COORDINATE WITH SECURITY-PREP DOOR(S) AND FRAME				

DOOR NORMALLY CLOSED AND LOCKED. VALID CARD READ WILL ENERGIZE ACTUATOR, RETRACT LATCH AND ALLOW FOR EITHER MANUAL OR AUTOMATED ENTRY. FREE EGRESS AT ALL TIMES.

HARDWARE GROUP NO. 19

FOR USE ON DOOR #(S):

A1108	**A1109**				

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		**DESCRIPTION**	**CATALOG NUMBER**			**FINISH**	**MFR**
1	**EA**	**PASSAGE SET**	**A10S ORB**			**626**	**SCH**
1	**EA**	**CYLINDER**	**BEST CORMAX SFIC AS REQ'D**				**BES**
1	**EA**	**GATE HINGE/CLOSER**	**MAMMOTH 180**			**626**	**LOX**

HARDWARE GROUP NO. 20

FOR USE ON DOOR #(S):

A1110					

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		**DESCRIPTION**	**CATALOG NUMBER**			**FINISH**	**MFR**
4	**EA**	**HINGE**	**5BB1HW 4.5 X 4.5**			**652**	**IVE**
1	**EA**	**POWER TRANSFER**	**EPT10 CON**		**~**	**689**	**VON**
1	**EA**	**EU STOREROOM LOCK**	**ND80BDCEU SPA RX CON 12V/24V DC**		**~**	**626**	**SCH**

1	**EA**	**CYLINDER**	**BEST CORMAX SFIC AS REQ'D**				**BES**
1	**EA**	**SURFACE CLOSER**	**4040XP RW/PA**			**689**	**LCN**
1	**EA**	**WALL STOP**	**WS406/407CVX**			**US26D**	**IVE**
1	**EA**	**GASKETING**	**488SBK PSA**			**BK**	**ZER**
1	**EA**	**WIRE HARNESS**	**CON-192P AS REQ**		**~**		**SCH**
1	**EA**	**WIRE HARNESS**	**CON-6W**		**~**		**SCH**
			POWER SUPPLY - WORK OF DIVISION 28				
1			**CARD READER - WORK OF DIVISION 28**				
			DOOR CONTACT(S) - WORK OF DIV. 28 COORDINATE WITH SECURITY- PREP DOOR(S) AND FRAME		**~**		

DOOR NORMALLY CLOSED AND LOCKED.
PRESENT CREDENTIAL TO CARD READER FOR ENTRY OR BY KEY OVERRIDE.
RX IN INSIDE LEVER TO SHUNT DOOR POSITION SWITCH UPON EGRESS.
FREE EGRESS AT ALL TIMES.
DOOR TO REMAIN LOCKED, FAIL SECURE DURING POWER FAILURE.

HARDWARE GROUP NO. 21

FOR USE ON DOOR #(S):

A1098B					

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		**DESCRIPTION**	**CATALOG NUMBER**			**FINISH**	**MFR**

4	EA	HINGE	5BB1 4.5 X 4.5 NRP	□		652	IVE
1	EA	POWER TRANSFER	EPT10 CON	□	~	689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-98-L-BE-17-CON 24 VDC	□	~	626	VON
1	EA	SURF. AUTO OPERATOR	4642 WMS 120 VAC	□	~	689	LCN
2	EA	ACTUATOR, TOUCHLESS	8310-813J	□		BLK	LCN
1	EA	SEAL SET	WEATHER SEALS BY STOREFRONT SUPPLIER				
1	EA	WIRE HARNESS	CON-192P AS REQ		~		SCH
1	EA	WIRE HARNESS	CON-6W		~		SCH
1	EA	POWER SUPPLY	PS902 900-2RS 120/240 VAC	□	~	LGR	SCE

DOOR NORMALLY CLOSED BUT UNLOCKED. DEPRESSING ACTUATOR WILL RETRACT LATCH AND ALLOW FOR AUTOMATED ENTRY. FREE EGRESS AT ALL TIMES.

HARDWARE GROUP NO. 22

FOR USE ON DOOR #(S):

A1107	A1127A	C115			

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
4	EA	HINGE	5BB1 4.5 X 4.5	□		652	IVE
1	EA	POWER TRANSFER	EPT10 CON	□	~	689	VON
1	EA	EU STOREROOM LOCK	ND80BDCEU SPA RX CON 12V/24V DC	□	~	626	SCH
1	EA	CYLINDER	BEST CORMAX SFIC AS REQ'D				BES
1	EA	SURFACE CLOSER	4040XP SCUSH	□		689	LCN

1	**EA**	**WALL STOP**	**WS406/407CVX**	□		**US26D**	**IVE**
1	**EA**	**GASKETING**	**488SBK PSA**	□		**BK**	**ZER**
1	**EA**	**DOOR SWEEP**	**8197AA**	□		**AA**	**ZER**
1	**EA**	**THRESHOLD**	**545A**	□		**A**	**ZER**
1	**EA**	**WIRE HARNESS**	**CON-192P AS REQ**		**~**		**SCH**
1	**EA**	**WIRE HARNESS**	**CON-6W**		**~**		**SCH**
			POWER SUPPLY - WORK OF DIVISION 28				
1			**CARD READER - WORK OF DIVISION 28**				
			DOOR CONTACT(S) - WORK OF DIV. 28 COORDINATE WITH SECURITY- PREP DOOR(S) AND FRAME		**~**		

DOOR NORMALLY CLOSED AND LOCKED.
PRESENT CREDENTIAL TO CARD READER FOR ENTRY OR BY KEY OVERRIDE.
RX IN INSIDE LEVER TO SHUNT DOOR POSITION SWITCH UPON EGRESS.
FREE EGRESS AT ALL TIMES.
DOOR TO REMAIN LOCKED, FAIL SECURE DURING POWER FAILURE.

HARDWARE GROUP NO. 23

FOR USE ON DOOR #(S):

A1104	**A1105**				

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		**DESCRIPTION**	**CATALOG NUMBER**			**FINISH**	**MFR**
4	**EA**	**HINGE**	**5BB1 4.5 X 4.5 NRP**	□		**652**	**IVE**

1	**EA**	**POWER TRANSFER**	**EPT10 CON**		**~**	**689**	**VON**
1	**EA**	**EU MORTISE LOCK**	**L9095BDCEU HSLR 09-663 RX CON 12/24 VDC**		**~**	**630**	**SCH**
2	**EA**	**CYLINDER**	**BEST CORMAX SFIC AS REQ'D**				**BES**
1	**EA**	**SURFACE CLOSER**	**4040XP REG OR PA AS REQ**			**689**	**LCN**
1	**EA**	**WALL STOP**	**WS406/407CVX**			**US26D**	**IVE**
1	**EA**	**GASKETING**	**488SBK PSA**			**BK**	**ZER**
1	**EA**	**WIRE HARNESS**	**CON-192P AS REQ**		**~**		**SCH**
1	**EA**	**WIRE HARNESS**	**CON-6W**		**~**		**SCH**
			POWER SUPPLY - WORK OF DIVISION 28				
2			**CARD READER - WORK OF DIVISION 28**				

STRICT HOLDING ROOM, LOCKED BOTH SIDES. NO FREE EGRESS

DOOR NORMALLY CLOSED AND LOCKED BOTH SIDES. VALID CREDENTIAL EITHER SIDE UNLOCKS LEVER. DOOR REMAINS LOCKED ON FIRE ALARM OR LOSS OF POWER. KEY OVERRIDE

HARDWARE GROUP NO. 24

FOR USE ON DOOR #(S):

A1106					

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		**DESCRIPTION**	**CATALOG NUMBER**			**FINISH**	**MFR**
4	**EA**	**HINGE**	**5BB1 4.5 X 4.5 NRP**			**652**	**IVE**
1	**EA**	**DEADBOLT**	**D271**			**626**	**FAL**
1	**EA**	**DOOR PULL, 1" ROUND**	**8103EZHD 12" F**			**626**	**IVE**

1	EA	PUSH PLATE	8200 4" X 16"			US26D	IVE
1	EA	SURFACE CLOSER	4040XP EDA			689	LCN
1	EA	WALL STOP	WS406/407CVX			US26D	IVE
1	EA	GASKETING	488SBK PSA			BK	ZER

FALCON D271 INDICATES BUT DOES NOT LATCH.

DOOR NORMALLY CLOSED BUT NOT LATCHED. THROWING THUMB TURN WILL CHANGE FROM VACANT TO OCCUPIED BUT DOOR REMAINS IN PUSH/PULL MODE. FREE EGRESS AT ALL TIMES.

HARDWARE GROUP NO. 25

FOR USE ON DOOR #(S):

A1127C	A1127D	A1127E			

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
4	EA	HINGE	5BB1HW 4.5 X 4.5			652	IVE
1	EA	CLASSROOM LOCK	ND70BDC SPA 2" EO			626	SCH
1	EA	CYLINDER	BEST CORMAX SFIC AS REQ'D				BES
1	EA	SURFACE CLOSER	4040XP RW/PA			689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS			630	IVE
1	EA	GASKETING	488SBK PSA			BK	ZER

DOOR NORMALLY OPEN. CLASSROOM FUNCTION, OFFICER LOCKS DOOR UPON EXIT AND RETURNS KEY TO EVIDENCE STAFF.

HARDWARE GROUP NO. 26

FOR USE ON DOOR #(S):

A1103A					

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
4	EA	HINGE	5BB1 4.5 X 4.5 NRP	□		652	IVE
1	EA	POWER TRANSFER	EPT10 CON	□	~	689	VON
1	EA	EL MORTISE LOCK	L9095BDCEL 17A 2" EO RX CON 12/24 VDC	□	~	622	SCH
2	EA	CYLINDER	BEST CORMAX SFIC AS REQ'D				BES
1	EA	SURFACE CLOSER	4040XP SCUSH	□		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	□		630	IVE
1	EA	GASKETING	488SBK PSA	□		BK	ZER
1	EA	WIRE HARNESS	CON-192P AS REQ		~		SCH
1	EA	WIRE HARNESS	CON-6W		~		SCH
			POWER SUPPLY - WORK OF DIVISION 28				
2			CARD READER - WORK OF DIVISION 28				
			DOOR CONTACT(S) - WORK OF DIV. 28 COORDINATE WITH SECURITY- PREP DOOR(S) AND FRAME		~		

DOOR NORMALLY CLOSED AND LOCKED BOTH SIDES. VALID CARD READ REQUIRED IN BOTH DIRECTIONS. KEY OVER RIDE ON BOTH SIDES. DOOR CONTACT TO MONITOR DOOR POSITION. DOOR INLOCKED ON FIRE ALARM OR LOSS OF POWER.

HARDWARE GROUP NO. 27

FOR USE ON DOOR #(S):

A1103B					

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
4	EA	HINGE	5BB1HW 4.5 X 4.5	□		652	IVE
1	EA	POWER TRANSFER	EPT10 CON	□	~	689	VON
1	EA	EU MORTISE LOCK	L9095BDCEU 17A RX CON 12/24 VDC	□	~	622	SCH
2	EA	CYLINDER	BEST CORMAX SFIC AS REQ'D				BES
1	EA	SURFACE CLOSER	4040XP EDA	□		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	□		630	IVE
1	EA	GASKETING	488SBK PSA	□		BK	ZER
1	EA	WIRE HARNESS	CON-192P AS REQ		~		SCH
1	EA	WIRE HARNESS	CON-6W		~		SCH
			POWER SUPPLY - WORK OF DIVISION 28				
2			CARD READER - WORK OF DIVISION 28				
			DOOR CONTACT(S) - WORK OF DIV. 28		~		

			COORDINATE WITH SECURITY- PREP DOOR(S) AND FRAME				

DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL REQUIRED BOTH SIDES. DOOR CONTACT MONITORS DOOR POSITION. DOOR REMAINS LOCKED ON FIRE ALARM OR LOSS OF POWER. KEY OVER RIDE BOTH SIDES.

HARDWARE GROUP NO. 28

FOR USE ON DOOR #(S):

A1100	A1101				

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
3	EA	HINGE	HD CAMLIFT HINGE			626	KRI
1	EA	POWER TRANSFER	EPT10 CON	□	~	689	VON
1	EA	EL MORTISE LOCK	L9092BDCEL 17A 2" EO RX CON 12/24 VDC	□	~	626	SCH
2	EA	CYLINDER	BEST CORMAX SFIC AS REQ'D				BES
1	EA	SURFACE CLOSER	4040XP REG OR PA AS REQ	□		689	LCN
1	EA	WALL STOP	WS406/407CVX	□		US26D	IVE
1	EA	GASKETING	488SBK PSA	□		BK	ZER
1	EA	DOOR BOTTOM	364AA	□		AA	ZER
1	EA	THRESHOLD	545A	□		A	ZER
1	EA	VIEWER	U700	□		626	IVE
1	EA	WIRE HARNESS	CON-192P AS REQ		~		SCH
1	EA	WIRE HARNESS	CON-6W		~		SCH
			POWER SUPPLY - WORK OF				

			DIVISION 28				
2			**CARD READER - WORK OF DIVISION 28**				
			DOOR CONTACT(S) - WORK OF DIV. 28 COORDINATE WITH SECURITY- PREP DOOR(S) AND FRAME		**~**		

IN-USE SWITCH/INDICATOR LIGHT PROVIDED BY DIV 28

DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL REQUIRED TO ENTER INTERVIEW ROOM. ALARM WILL SOUND ON EGRESS UNLESS VALID CREDENTIAL IS PRESENTED TO INSIDE CARD READER. RX SWITCH SHUNTED BY INTERIOR CARD READER. DOOR CONTACT TO MONITOR DOOR POSITION. DOOR UNLOCKED ON FIRE ALARM OR LOSS OF POWER. KEY OVER RIDE.

HARDWARE GROUP NO. 29

FOR USE ON DOOR #(S):

A1004C	**A1010**	**A1019A**			

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		**DESCRIPTION**	**CATALOG NUMBER**			**FINISH**	**MFR**
4	**EA**	**HINGE**	**5BB1HW 4.5 X 4.5**	□		**652**	**IVE**
1	**EA**	**POWER TRANSFER**	**EPT10 CON**	□	**~**	**689**	**VON**
1	**EA**	**ELEC PANIC HARDWARE**	**LD-RX-98-L-M996-17-FSE-CON**	□	**~**	**US26D**	**VON**
1	**EA**	**CYLINDER**	**BEST CORMAX SFIC AS REQ'D**				**BES**
1	**EA**	**SURFACE CLOSER**	**4040XP RW/PA**	□		**689**	**LCN**
1	**EA**	**KICK PLATE**	**8400 10" X 2" LDW B-CS**	□		**630**	**IVE**

1	**EA**	**WALL STOP**	**WS406/407CVX**			**US26D**	**IVE**
1	**EA**	**GASKETING**	**488SBK PSA**			**BK**	**ZER**
1	**EA**	**WIRE HARNESS**	**CON-192P AS REQ**		**~**		**SCH**
1	**EA**	**WIRE HARNESS**	**CON-6W**		**~**		**SCH**
			POWER SUPPLY - WORK OF DIVISION 28				
1			**CARD READER - WORK OF DIVISION 28**				
			DOOR CONTACT(S) - WORK OF DIV. 28 COORDINATE WITH SECURITY- PREP DOOR(S) AND FRAME		**~**		

DOOR NORMALLY CLOSED AND LOCKED.
PRESENT CREDENTIAL TO CARD READER FOR ENTRY OR BY KEY OVERRIDE.
RX IN INSIDE LEVER TO SHUNT DOOR POSITION SWITCH UPON EGRESS.
FREE EGRESS AT ALL TIMES.
DOOR TO REMAIN LOCKED, FAIL SECURE DURING POWER FAILURE.

HARDWARE GROUP NO. 30

FOR USE ON DOOR #(S):

A1133					

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
4	**EA**	**HINGE**	**5BB1HW 4.5 X 4.5 NRP**			**630**	**IVE**
1	**EA**	**POWER TRANSFER**	**EPT10 CON**		**~**	**689**	**VON**
1	**EA**	**ELEC PANIC HARDWARE**	**RX-QEL-98-NL-4'-CON 24**		**~**	**626**	**VON**

			VDC				
1	EA	SURFACE CLOSER	4041 DEL SCUSH	□		689	LCN
1	EA	ARMOR PLATE	8400 34" X 2" LDW B-CS	□		630	IVE
1	EA	GASKETING	488SBK PSA	□		BK	ZER
1	EA	DOOR SWEEP	8197AA	□		AA	ZER
1	EA	THRESHOLD	545A	□		A	ZER
1	EA	WIRE HARNESS	CON-192P AS REQ		~		SCH
1	EA	WIRE HARNESS	CON-6W		~		SCH
1			CARD READER - WORK OF DIVISION 28				
			DOOR CONTACT(S) - WORK OF DIV. 28 COORDINATE WITH SECURITY- PREP DOOR(S) AND FRAME		~		

DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL WILL RETRACT LATCH AND DOOR CAN BE PULLED OPEN. RX MONITORS VALID EGRESS. DOOR CONTACT MONITORS DOOR POSITION. KEY OVERRIDE. FREE EGRESS AT ALL TIMES

HARDWARE GROUP NO. 31

FOR USE ON DOOR #(S):

B1000					

PROVIDE EACH PR DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
4	EA	HINGE	5BB1 4.5 X 4.5 NRP	□		652	IVE
2	EA	ELECTRIC HINGE	5BB1 4.5 X 4.5 CON TW4	□	~	652	IVE

1	**EA**	**ELEC PANIC HARDWARE**	**RX-QEL-9849-DT-CON 24 VDC**	□	**~**	**626**	**VON**
1	**EA**	**ELEC PANIC HARDWARE**	**RX-QEL-9849-NL-CON 24 VDC**	□	**~**	**626**	**VON**
2	**EA**	**SURFACE CLOSER**	**4040XP SCUSH**	□		**689**	**LCN**
2	**EA**	**KICK PLATE**	**8400 10" X 2" LDW B-CS**	□		**630**	**IVE**
2	**EA**	**DOOR SWEEP**	**8197AA**	□		**AA**	**ZER**
1	**EA**	**THRESHOLD**	**545A**	□		**A**	**ZER**
2	**EA**	**WIRE HARNESS**	**CON-192P AS REQ**		**~**		**SCH**
2	**EA**	**WIRE HARNESS**	**CON-6W**		**~**		**SCH**
			POWER SUPPLY - WORK OF DIVISION 28				
1			**CARD READER - WORK OF DIVISION 28**				
1			**DOOR CONTACT(S) - WORK OF DIV. 28 COORDINATE WITH SECURITY- PREP DOOR(S) AND FRAME**		**~**		

DOOR CLOSED AND LOCKED. VALID CREDENTIAL MOMENTARILY RETRACTS LATCH. RX MONITORS EGRESS. DOOR CONTACT MONITORS DOOR POSITION. DOORS LOCKED ON FIRE ALARM OR LOSS OF POWER. FREE EGRESS AT ALL TIMES.

HARDWARE GROUP NO. 32

FOR USE ON DOOR #(S):

A1114B					

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
4	EA	HINGE	5BB1 4.5 X 4.5 NRP			652	IVE
1	EA	PANIC HARDWARE	LD-98-EO-4'			630AM	VON
1	EA	SURFACE CLOSER	4040XP HEDA MWMS			689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS			630	IVE
1	EA	GASKETING	488SBK PSA			BK	ZER
1	EA	DOOR SWEEP	8192AA			AA	ZER
1	EA	THRESHOLD	545A			A	ZER

DOOR CLOSED AND LOCKED. NO ENTRY FROM OUTSIDE. FREE EGRESS AT ALL TIMES.

END OF SECTION 08 71 00

SECTION 08 80 00
GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Insulating glass units.

B. Glazing units.

C. Plastic films.

D. Glass coatings.

E. Glazing compounds.

1.02 RELATED REQUIREMENTS

A. Section 06 41 00 - Architectural Wood Casework: Cabinets with requirements for glass shelves and _____.

B. Section 07 25 00 - Weather Barriers.

C. Section 07 92 00 - Joint Sealants: Sealants for other than glazing purposes.

D. Section 08 12 13 - Hollow Metal Frames: Glazed borrowed lites.

E. Section 08 41 26 - All-Glass Entrances and Storefronts: Glazing provided as part of entrance assembly.

F. Section 08 43 13 - METAL-FRAMED ENTRANCES AND STOREFRONTS: Glazing provided as part of storefront assembly.

G. Section 08 44 13 - Glazed Aluminum Curtain Walls: Glazing provided as part of wall assembly.

H. Section 08 87 23 - Safety and Security Films.

1.03 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials.

B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test.

C. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.

D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.

E. ASTM C1036 - Standard Specification for Flat Glass.

F. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass.

G. ASTM C1193 - Standard Guide for Use of Joint Sealants.

H. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass.

I. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings.

J. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation.

K. GANA (GM) - GANA Glazing Manual.

L. GANA (SM) - GANA Sealant Manual.

M. NFRC 100 - Procedure for Determining Fenestration Product U-factors.

N. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence.

O. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data on Insulating Glass Unit, Glazing Unit, and Plastic Sheet Glazing Unit Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements. Provide U-value and SHCG for submitted glass units.

C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.

D. Samples: Submit two samples 12 by 12 inch in size of glass units.

E. Certificate: Certify that products of this section meet or exceed specified requirements, including U-value and SHCG value.

F. Manufacturer's qualification statement.

G. Installer's qualification statement.

H. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

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 Insulating Glass Units: One of each glass size and each glass type.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with GANA (GM) and GANA (SM) for glazing installation methods. Maintain one copy on site.

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 work of the type specified and with at least three years documented experience.

1.06 MOCK-UPS

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Provide on-site glazing mock-up with the specified glazing components.

C. Locate where directed.

D. Mock-ups may remain as part of the Work.

1.07 FIELD CONDITIONS

A. Do not install glazing when ambient temperature is less than 40 degrees F.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Insulating Glass Units: Provide a five (5) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including providing products to replace failed units.

C. Laminated Glass: Provide a five (5) year manufacturer warranty to include coverage for delamination, including providing products to replace failed units.

D. Polycarbonate Sheet Glazing: Provide a five (5) year manufacturer warranty to include coverage for breakage, coating failure, abrasion resistance, including providing products to replace failed units.

E. Heat Soaked Tempered Glass: Provide a five (5) year manufacturer warranty to include coverage for spontaneous breakage of fully tempered glass caused by nickel sulfide (NiS) inclusions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Float Glass Manufacturers:

1. Guardian Industries Corp: www.sunguardglass.com.

2. Vitro Glazing: www.vitroglazings.com (Basis of design)

3. Pilkington North America Inc: www.pilkington.com/na.

4. PPG Industries, Inc: www.ppgideascapes.com.

5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Plastic Films Manufacturers:

1. 3M Window Film: solutions.3m.com/wps/portal/3M/en_US/Window_Film/Solutions/#sle.

2. Takeform, Amplify Glass Film, https://www.takeform.net/

3. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES

A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.

1. Design Pressure: Calculated in accordance with applicable codes.

2. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.

3. Seismic Loads: Design and size glazing components to withstand seismic loads and sway displacement in accordance with the requirements of OSSC code.

4. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.

5. Glass thicknesses listed are minimum.

B. Weather-Resistive Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure water-resistive barrier, vapor retarder, and/or air barrier.

1. In conjunction with weather barrier related materials described in other sections, as follows:

a. Water-Resistive Barriers: See Section 07 25 00.

C. Thermal and Optical Performance: Provide exterior glazing products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:

1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.

2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.

3. Solar Optical Properties: Comply with NFRC 300 test method.

2.03 GLASS MATERIALS

A. Float Glass: Provide float glass based glazing unless otherwise indicated.

1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality - Q3.

2. Kind HS - Heat-Strengthened Type: Complies with ASTM C1048.

3. Kind FT - Fully Tempered Type: Complies with ASTM C1048.

4. Fully Tempered Safety Glass: Complies with ANSI Z97.1 or 16 CFR 1201 criteria for safety glazing used in hazardous locations.

5. Heat-Soak Testing (HST): Provide HST of fully tempered glass used on canopy, point-supported, spider wall, high-risk, sloping overhead, horizontal overhead, free-standing glass protective barrier, or other demanding applications of project, to reduce risks of spontaneous breakage due to nickel sulfide (NiS) induced fractures in accordance with industry established testing requirements.

6. Impact Resistant Safety Glass: Complies with ANSI Z97.1 - Class B, or 16 CFR 1201 - Category I criteria.

7. Tinted Type: ASTM C1036, Class 2 - Tinted, Quality - Q3, with color and performance characteristics as indicated.

8. Thicknesses: As indicated; provide greater thickness as required for exterior glazing wind load design.

2.04 INSULATING GLASS UNITS

A. Manufacturers:

1. Cardinal Glass Industries: www.cardinalcorp.com/#sle.

2. Guardian Glass, LLC: www.guardianglass.com/#sle.

3. Pilkington North America Inc: www.pilkington.com/na/#sle.Pilkington North America Inc: www.pilkington.com/na/#sle.

4. Vitro Architectural Glass (formerly PPG Glass): www.vitroglazings.com/#sle.

5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Fabricator: Certified by glass manufacturer for type of glass, coating, and treatment involved and capable of providing specified warranty.

C. Insulating Glass Units: Types as indicated.

1. Durability: Certified by an independent testing agency to comply with ASTM E2190.

2. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.

3. Metal-Edge Spacers: Aluminum, bent and soldered corners.

4. Warm-Edge Spacers: Low-conductivity thermoplastic with desiccant warm-edge technology design.

a. Spacer Width: As required for specified insulating glass unit.

b. Spacer Height: Manufacturer's standard.

5. Spacer Color: Black.

6. Edge Seal:

a. Dual-Sealed System: Provide polyisobutylene sealant as primary seal applied between spacer and glass panes, and silicone, polysulfide, or polyurethane sealant as secondary seal applied around perimeter.

7. Color: Black.

8. Purge interpane space with dry air, hermetically sealed.

D. Insulating Glass Units: Vision glass, double glazed.

1. Applications: Exterior glazing unless otherwise indicated.

2. Space between lites filled with air.

3. Outboard Lite: Heat-strengthened float glass, 1/4 inch thick, minimum.

a. Tint: TBD.

b. Coating: Low-E (passive type), on #2 surface.

4. Inboard Lite: Heat-strengthened float glass, 1/4 inch thick, minimum.

a. Tint: Clear.

5. Total Thickness: 1/2 inch.

6. Thermal Transmittance (U-Value): 0.34, maximum.
7. Visible Light Transmittance (VLT): _____ percent, nominal.
8. Solar Heat Gain Coefficient (SHGC): 0.38, maximum.
9. Glazing Method: Dry glazing method, gasket glazing.

E. Insulating Glass Units: Safety glazing

1. Applications:
   a. Glazed lites in exterior doors.
   b. Glazed sidelights and panels next to doors.
   c. Other locations required by applicable federal, state, and local codes and regulations.
   d. Other locations indicated on drawings.
2. Space between lites filled with air.
3. Glass Type: Same as other vision glazing except use fully tempered float glass for inboard lite.
4. Tint: Clear.
5. Total Thickness: 1 1/4" inch.
6. Thermal Transmittance (U-Value): 0.34, maximum.
7. Solar Heat Gain Coefficient (SHGC): 0.38, maximum.
8. Glazing Method: Wet/dry glazing method, preformed tape and sealant.

2.05 BASIS OF DESIGN - INSULATING GLASS UNITS

A. Basis of Design - Insulating Glass Units: Vision glazing, with low-e coating.

1. Applications: Exterior insulating glass glazing unless otherwise indicated.
2. Space between lites filled with air.
3. Total Thickness: 1 inch.
4. Thermal Transmittance (U-Value): 0.34, maximum.
5. Solar Heat Gain Coefficient (SHGC): 0.38, maximum.

6. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.

7. Spacer Color: Black.

8. Edge Seal:

   a. Dual-Sealed System: Provide polyisobutylene sealant as primary seal applied between spacer and glass panes, and silicone, polysulfide, or polyurethane sealant as secondary seal applied around perimeter.

9. Color: Black.

10. Purge interpane space with dry air, hermetically sealed.

2.06 GLAZING UNITS

A. Monolithic Exterior Vision Glazing:

1. Applications: Exterior glazing unless otherwise indicated.

2. Glass Type: Annealed float glass.

3. Tint: Clear.

4. Thickness: 1 1/4 inch, nominal.

5. Glazing Method: Dry glazing method, gasket glazing.

6. Manufacturers:

B. Monolithic Interior Vision Glazing:

1. Applications: Interior glazing unless otherwise indicated.

2. Glass Type: Annealed float glass.

3. Tint: Clear.

4. Thickness: 1/4 inch, nominal.

C. Monolithic Safety Glazing: Non-fire-rated.

1. Applications:

   a. Glazed lites in doors, except fire doors.

   b. Total Security Solutions, ; Ballistic & Bulletproof Glass https://www.tssbulletproof.com/

c. Glazed sidelights to doors, except in fire-rated walls and partitions.

d. Other locations required by applicable federal, state, and local codes and regulations.

e. Other locations indicated on drawings.

2. Glass Type: Fully tempered safety glass as specified.

3. Tint: Clear.

4. Thickness: 1/4 inch, nominal.

2.07 PLASTIC FILMS

A. Type F-3 - Decorative Plastic Film: Polyvinyl butyral (PVB) type.

1. Application: Locations as indicated on drawings.

2. Series Type: Frost.

3. Color: White Frost, Semi-Transluscent.

4. Thickness Without Liner: 0.002 inch.

5. Diffuse Visible Light Reflectance, Exterior: _____ percent, nominal.

6. Manufacturers:

a. 3M Window Film; solutions.3m.com/wps/portal/3M/en_US/Window_Film/Solutions/#sle.

b. Substitutions: See Section 01 60 00 - Product Requirements.

2.08 LAMINATED GLASS INTERLAYERS

A. Type LGI-1 - Polyvinyl Butyral (PVB) Interlayer for Laminated Glazing:

1. Functionality: Post-breakage safety and security.

2. Applications:

a. Single pane, laminated glass unit.

b. Interior laminated pane of insulating glass unit.

3. Color: Clear.

4. Thickness: As required for indicated performance of laminated glass application.

5. Manufacturers:

a. Eastman Chemical Company; Saflex Clear PVB Interlayer: www.saflex.com/#sle.

b. Sekisui S-LEC America, LLC; S-LEC Clear Film: www.s-lec.us/#sle.

c. Substitutions: See Section 01 60 00 - Product Requirements.

2.09 GLAZING COMPOUNDS

A. Type GC-2 - 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. Polysulfide Sealant: Two component; chemical curing, non-sagging type; ASTM C920, Type M, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; color as selected.

C. Type GC-4 - 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.

D. 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.

E. Manufacturers:

1. Dow Corning Corporation: www.dowcorning.com/construction.

2. Substitutions: See Section 01 60 00 - Product Requirements.

2.10 ACCESSORIES

A. Setting Blocks: Neoprene, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot of glazing or minimum 4 inch x width of glazing rabbet space minus 1/16 inch 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 long by one half the height of the glazing stop by 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; 5 to 30 cured Shore A durometer hardness; coiled on release paper; black color.

D. Glazing Tape: Closed cell polyvinyl chloride (PVC) foam, coiled on release paper over adhesive on two sides, maximum water absorption by volume of 2 percent, designed for compression of 25 percent to effect an air barrier and vapor retarder seal; ____x____ inch size.

1. Manufacturers:

a. Pecora Corporation; _____: www.pecora.com/#sle.

b. Saint-Gobain Performance Plastics; _____: www.plastics.saint-gobain.com/#sle.

c. Substitutions: See Section 01 60 00 - Product Requirements.

E. Glazing Splines: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color black.

F. Glazing Clips: Manufacturer's standard type.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.

B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.

3.02 PREPARATION

A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.03 INSTALLATION, GENERAL

A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.

B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.

C. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.

D. Prevent glass from contact with any contaminating substances that may be the result of construction operations such as, and not limited to the following; weld splatter, fire-safing, plastering, mortar droppings, and paint.

3.04 INSTALLATION - DRY GLAZING METHOD (GASKET GLAZING)

A. Application - Exterior and/or Interior Glazed: Set glazing infills from either the exterior or the interior of the building.

B. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.

C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.

D. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.05 INSTALLATION - WET GLAZING METHOD (SEALANT AND SEALANT)

A. Application - Exterior Glazed: Set glazing infills from the exterior of the building.

B. Place setting blocks at 1/4 points and install glazing pane or unit.

C. Install removable stops with glazing centered in space by inserting spacer shims both sides at 24 inch intervals, 1/4 inch below sight line.

D. Fill gaps between glazing and stops with _____ type sealant to depth of bite on glazing, but not more than 3/8 inch below sight line to ensure full contact with glazing and continue the air and vapor seal.

E. Apply sealant to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

3.06 INSTALLATION - WET/DRY GLAZING METHOD (PREFORMED TAPE AND SEALANT)

A. Application - Exterior Glazed: Set glazing infills from the exterior of the building.

B. Cut glazing tape to length and set against permanent stops, 3/16 inch below sight line. Seal corners by butting tape and dabbing with butyl sealant.

C. Apply heel bead of butyl sealant along intersection of permanent stop with frame ensuring full perimeter seal between glass and frame to complete the continuity of the air and vapor seal.

D. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.

E. Rest glazing on setting blocks and push against tape and heel bead of sealant with sufficient pressure to attain full contact at perimeter of pane or glass unit.

F. Install removable stops, with spacer strips inserted between glazing and applied stops 1/4 inch below sight lines.

1. Place glazing tape on glazing pane of unit with tape flush with sight line.

G. Fill gap between glazing and stop with _____ type sealant to depth equal to bite of frame on glazing, but not more than 3/8 inch below sight line.

H. Apply cap bead of _____ type sealant along void between the stop and the glazing, to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

3.07 INSTALLATION - WET/DRY GLAZING METHOD (TAPE AND SEALANT)

A. Application - Interior Glazed: Set glazing infills from the interior of the building.

B. Cut glazing tape to length and install against permanent stops, projecting 1/16 inch above sight line.

C. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.

D. Rest glazing on setting blocks and push against tape to ensure full contact at perimeter of pane or unit.

E. Install removable stops, spacer shims inserted between glazing and applied stops at 24 inch intervals, 1/4 inch below sight line.

F. Fill gaps between pane and applied stop with _____ type sealant to depth equal to bite on glazing, to uniform and level line.

G. Carefully trim protruding tape with knife.

3.08 INSTALLATION - PRESSURE GLAZED SYSTEMS

A. Application - Exterior Glazed: Set glazing infills from exterior side of building.

B. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.

3.09 INSTALLATION - STRUCTURAL SILICONE GLAZING

A. Application - Factory (Shop) Glazed: Follow basic guidelines of structural silicone glazing for glazing application.

B. Provide design review of the glazing system and project details, adhesion testing, proper surface preparation, training and a quality service program.

C. Provide only structural silicone sealant, tested and manufactured for structural glazing.

3.10 INSTALLATION - ACRYLIC FOAM TAPE STRUCTURAL GLAZING

A. Application - Factory (Shop) Glazed: Follow basic guidelines of structural silicone glazing for acrylic foam tape structural glazing application.

B. Provide design review of the glazing system and project details, adhesion testing, proper surface preparation, training and a quality service program.

C. Provide only acrylic foam tapes designed, tested and manufactured for structural glazing.

3.11 INSTALLATION - PLASTIC FILM

A. Install plastic film with adhesive, applied in accordance with film manufacturer's instructions.

B. Place without air bubbles, creases or visible distortion.

C. Install film tight to perimeter of glass and carefully trim film with razor sharp knife. Provide 1/16 inch to 1/8 inch gap at perimeter of glazed panel unless otherwise required. Do not score the glass.

3.12 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Glass and Glazing product manufacturers to provide field surveillance of the installation of their products.

C. Monitor and report installation procedures and unacceptable conditions.

3.13 CLEANING

A. See Section 01 74 19 - Construction Waste Management and Disposal, for additional requirements.

B. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.

C. Remove nonpermanent labels immediately after glazing installation is complete.

D. Clean glass and adjacent surfaces after sealants are fully cured.

E. Clean glass on both exposed surfaces not more than 4 calendar days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.14 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.

B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

3.15 SCHEDULES

A. Aluminum Window Glazing: Glass Type _____, install glass using wet/dry method with Type GC- ___ glazing compound.

B. Wood Window Glazing: Glass Type _____, install glass using wet/dry method with Type GC- ___ glazing compound.

C. Aluminum-Framed Storefront Glazing: Glass Type _____, install glass using dry method, and with glass thickness as required to comply with performance requirements indicated in Section 08 43 13.

D. Glazed Aluminum Curtain Wall Glazing: Glass Type _____, install glass using dry method, and with glass thickness required to comply with performance requirements indicated in Section 08 44 13.

E. Aluminum Entrance Window Glazing: Glass Type _____, install glass using wet/dry method with Type GC- ___ glazing compound.

F. Hollow Metal Steel Frames, Interior Glazing: Glass Type _____, install glass using wet method with Type GC- ___ glazing compound.

G. Flush Wood Door Glazing:

1. Interior: Glass Type _____, 1/4 inch thick, install glass using wet method with Type GC- ___ glazing compound.

2. Exterior: Glass Type _____, 1/4 inch thick, install glass using dry method with Type GC- ___ glazing compound.

H. Custom Casework Glazing: Glazed cabinet doors, Type _____, install glass using dry method.

END OF SECTION

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SECTION 08 87 23
SAFETY AND SECURITY FILMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Glazing film applied to existing and new glazing assemblies.

B. New Glazing: Factory or shop install film to glazing before installation in frames.

1.02 RELATED REQUIREMENTS

1.03 ABBREVIATIONS AND ACRONYMS

A. CFR - Code of Federal Regulations.

1.04 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials.

B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test.

C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Record of product certification for safety requirements.

2. Preparation instructions and recommendations.

3. Storage and handling requirements and recommendations.

4. Installation methods.

C. Shop Drawings: Detailing installation of film, anchoring accessories, and sealant.

D. Test Reports: Detailed reports of full-scale chamber tests to specified criteria, using assemblies identical to those required for this project.

E. Specimen Warranty.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Glazing film manufacturer specializing in manufacture of safety glazing films with minimum 10 years successful experience.

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.

1.08 WARRANTY

A. Provide 10 year manufacturer's replacement warranty to cover film against peeling, cracking, discoloration, and deterioration.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Safe Haven Defense, https://safehavendefense.com/

B. Total Security Solutions, https://www.tssbulletproof.com/

1. Source Limitations: Provide glazing, framing, and films from single supplier.

C. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 SAFETY AND SECURITY GLAZING FILM

A. Safety Glazing: Retrofit existing glazing assemblies to provide impact resistance complying with ANSI Z97.1 and 16 CFR 1201, Category II.

1. 1/4 inch thick clear annealed glass.

2. Surface applied film.

3. Requiring no supplemental anchoring devices.

2.03 MATERIALS

A. Glazing Film: Transparent polyester film for permanent bonding to glass.

1. Application: Locations as indicated on drawings.

2. Thickness: 4 mils, 0.004 inch, minimum.

3. Color: Clear.

2.04 GLAZING COMPOUNDS

A. Type GC-1 - Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; nonbleeding, nonstaining; ASTM C920 Type S, Grade NS, Class 25, uses M, A, and G; cured Shore A hardness range of 25 to 35; color as selected.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine glass and frames. Verify that existing conditions are adequate for proper application and performance of film.

B. Verify glass is not cracked, chipped, broken, or damaged.

C. Verify that frames are securely anchored and free of defects.

D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean glass of dust, dirt, paint, oil, grease, mildew, mold, and other contaminants that would inhibit adhesion.

B. Immediately prior to applying film, thoroughly wash glass with neutral cleaning solution.

C. Protect adjacent surfaces.

D. Do not begin installation until substrates have been properly prepared.

3.03 INSTALLATION

A. Do not apply glazing film when surface temperature is less that 40 degrees F or if precipitation is imminent.

B. Install in accordance with manufacturer's instructions, without air bubbles, wrinkles, streaks, bands, thin spots, pinholes, or gaps, as required to achieve specified performance.

C. Accurately cut film with straight edges to required sizes allowing 1/16 inch to 1/8 inch gap at perimeter of glazed panel unless otherwise required by anchorage method.

D. Seams: Seam film only as required to accommodate material sizes; form seams vertically without overlaps and gaps; do not install with horizontal seams.

E. Clean glass and anchoring accessories following installation. Remove excess sealants and other glazing materials from adjacent finished surfaces.

F. Remove labels and protective covers.

END OF SECTION 08 87 23

SECTION 08 88 13
FIRE-RATED GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire-rated glazing units.

B. Glazing compounds.

1.02 RELATED REQUIREMENTS

A. Section 07 92 00 - Joint Sealants: Sealants for other than glazing purposes.

B. Section 08 12 13 - Hollow Metal Frames: Glazed borrowed lites.

C. Section 08 44 13 - Glazed Aluminum Curtain Walls: Glazing furnished as part of wall assembly.

D. Section 08 87 23 - Safety and Security Films.

1.03 REFERENCE STANDARDS

A. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings.

B. GANA (GM) - GANA Glazing Manual.

C. GANA (SM) - GANA Sealant Manual.

D. GANA (LGRM) - Laminated Glazing Reference Manual.

E. IGMA TM-3000 - North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use.

F. NFRC 100 - Procedure for Determining Fenestration Product U-factors.

G. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence.

H. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene preinstallation meeting one week before starting work of this section; require attendance by each of affected installers.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data on Glazing Unit Glazing Types: Provide structural, physical, and environmental characteristics, size limitations, special handling and installation requirements.

1.06 QUALITY ASSURANCE

A. Perform work in accordance with GANA (GM), GANA (SM), GANA (LGRM), and IGMA TM-3000 for glazing installation methods. Maintain one copy on site.

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 work of type specified and with at least three years of documented experience.

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

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty for Insulating Glass Units: Provide 5-year manufacturer warranty coverage for seal failure, interpane dusting or misting, including providing products to replace failed units, and commencing on the Date of Substantial Completion. Complete forms in Owner's name and register with manufacturer.

C. Manufacturer Warranty for Laminated Glass: Provide 5-year manufacturer warranty coverage for delamination, including providing products to replace failed units, and commencing on the Date of Substantial Completion. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fire-Resistance-Rated Glass:

1. Fabricators:

    a. McGrory Glass, Inc: www.mcgrory.com/#sle.

    b. Technical Glass Products; Pilkington Pyrostop: www.fireglass.com/#sle.

2. Manufacturers:

    a. SAFTIFIRST, a division of O'Keeffe's Inc; SuperLite II-XL: www.safti.com/#sle.

    b. Pilkington North America Inc; _____: www.pilkington.com/#sle.

    c. Vetrotech North America; Contraflam 180: www.vetrotechusa.com/#sle.

d. Substitutions: See Section 01 60 00 - Product Requirements.

B. Fire-Protection-Rated Glass:

1. Fabricators:

a. GGI - General Glass International; _____: www.generalglass.com/#sle.

b. McGrory Glass, Inc; PYRAN Platinum Series _____: www.mcgrory.com/#sle.

c. Technical Glass Products; _____: www.fireglass.com/#sle.

2. Manufacturers:

a. McGrory Glass, Inc; FireDefend Series _____: www.mcgrory.com/#sle.

b. SAFTIFIRST, a division of O'Keeffe's Inc; SuperClear 45-HS: www.safti.com/#sle.

c. SCHOTT North America Inc; PYRAN Platinum: www.us.schott.com/#sle.

d. Vetrotech North America; Keralite/Select: www.vetrotechusa.com/#sle.

e. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads and withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.

1. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.

2. Provide glass edge support system sufficiently stiff to limit lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.

3. Glass thicknesses listed are minimum.

B. Vapor Retarder and Air Barrier Seals: Provide completed assemblies that maintain building enclosure vapor retarder and air barrier continuity.

C. Thermal and Optical Performance: Provide exterior glazing products with performance properties as indicated, in accordance with manufacturer's published data as determined with the following procedures or test methods:

1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW software.

2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW software.

3. Solar Optical Properties: Comply with NFRC 300 test method.

2.03 GLASS MATERIALS

END OF SECTION 08 88 13

SECTION 09 21 16
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Performance criteria for gypsum board assemblies.

B. Metal stud wall framing.

C. Metal channel ceiling framing.

D. Gypsum wallboard.

E. Joint treatment and accessories.

F. Bullet resistant sheathing and wallboard.

1.02 RELATED REQUIREMENTS

A. Section 05 40 00 - Cold-Formed Metal Framing: Structural steel stud framing.

B. Section 07 21 00 - Thermal Insulation: Acoustic insulation.

1.03 REFERENCE STANDARDS

A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members.

B. AISI S220 - North American Standard for Cold-Formed Steel Nonstructural Framing.

C. AISI S240 - North American Standard for Cold-Formed Steel Structural Framing.

D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

E. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members.

F. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories.

G. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.

H. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.

I. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.

J. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board.

K. 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.

L. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.

M. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel.

N. ASTM C1396/C1396M - Standard Specification for Gypsum Board.

O. ASTM C1658/C1658M - Standard Specification for Glass Mat Gypsum Panels.

P. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

Q. ASTM E413 - Classification for Rating Sound Insulation.

R. ASTM F1267 - Standard Specification for Metal, Expanded, Steel.

S. GA-216 - Application and Finishing of Gypsum Panel Products.

T. GA-600 - Fire Resistance and Sound Control Design Manual.

U. UL 752 - Standard for Bullet-Resisting Equipment.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the installation of gypsum board assemblies with size, location, and installation of service utilities.

B. Sequencing: Install service utilities in an orderly and expeditious manner.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on metal framing and gypsum board. For metal framing, provide documentation relating proposed framing members to corresponding project wall type/location per Drawings.

1. Provide data on metal framing, gypsum board, accessories, joint finishing system, and ballistic paneling.

2. Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

C. Ballistic Test Reports: Indicate compliance of bullet-resistant sheathing and wallboard assemblies with specified requirements.

1.06 QUALITY ASSURANCE

A. 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. Store gypsum products and accessories indoors and keep above freezing. Elevate boards above floor, on nonwicking supports, in accordance with manufacturer's recommendations.

B. Store metal products to prevent corrosion.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.

1. See PART 3 for finishing requirements.

B. Interior Partitions, Indicated as Acoustic: Provide completed assemblies with the following characteristics:

1. Acoustic Attenuation: STC of 50-54 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.

C. Shaft Walls at HVAC Shafts: Provide completed assemblies with the following characteristics:

1. Air Pressure Within Shaft: Sustained loads of 5 lbf/sq ft with maximum mid-span deflection of L/240.

2. Acoustic Attenuation: STC of 35-39 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.

D. Fire-Resistance-Rated Assemblies: Provide completed assemblies complying with applicable code.

2.02 METAL FRAMING MATERIALS

A. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S220 or equivalent.

1. Structural Grade: As required to meet design criteria.

B. Structural Steel Framing for Application of Gypsum Board: See Section 05 40 00.

C. Nonstructural Framing System Components: AISI S220; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/120 at 10 psf.

1. Studs: C-shaped.

2. Runners: U shaped, sized to match studs.

3. Ceiling Grid suspension system.

a. Main Beam - Formed from cold rolled steel "T" sections, indexed with slots to receive ends of cross furring members.

b. Cross furring Members - Formed from cold rolled steel, designed to permit to permit screw attachment of gypsum board panels, and formed with an end configuration that permits mechanical interlock with the indexed slots of the main beam.

c. Rods and flat hangers- with zinc or other protective coating and complying with requirements of ASTM C 754.

4. Furring Members: Hat-shaped sections, minimum depth of 1 1/2 inch.

5. Security Barriers: Type II, expanded and flattened, Class 1 carbon steel mesh complying with ASTM F1267 in gauge indicated; applied between studs and gypsum board where indicated.

D. Shaft Wall Studs and Accessories: AISI S220; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 and specified performance requirements.

E. Partition Head To Structure Connections: Provide track fastened to structure with legs of sufficient length to accommodate deflection, for friction fit of studs cut short and fastened as indicated on drawings.

F. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection and prevent rotation of studs while maintaining structural performance of partition.

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.

3. Provide components UL-listed for use in UL-listed fire-resistance-rated head of partition joint systems indicated on drawings.

G. Non-structural Framing Accessories:

1. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.

H. Grid Suspension Systems: Steel grid system of main tees and support bars connected to structure using hanging wire.

2.03 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:

1. American Gypsum Company: www.americangypsum.com.
2. CertainTeed Corporation: www.certainteed.com.
3. Georgia-Pacific Gypsum: www.gpgypsum.com.
4. National Gypsum Company: www.nationalgypsum.com/#sle.
5. USG Corporation: www.usg.com.
6. 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. Thickness:
   a. Vertical Surfaces: 5/8 inch.
   b. Ceilings: 1/2 inch.

C. Backing Board For Wet Areas:

1. Application: Surfaces behind tile in wet areas including tub and shower surrounds and shower ceilings.
2. Glass Mat Faced Board: Coated glass mat water-resistant gypsum backing panel as defined in ASTM C1178/C1178M.
   a. Regular Type: Thickness 1/2 inch.
   b. Products:
      1) Georgia-Pacific Gypsum; DensShield Tile Backer: www.gpgypsum.com/#sle.
      2) Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond eXP Fire-Shield Tile Backer: www.goldbondbuilding.com/#sle.

D. Backing Board For Non-Wet Areas: Water-resistant gypsum backing board as defined in ASTM C1396/C1396M; sizes to minimum joints in place; ends square cut.

1. Application: Vertical surfaces behind thinset tile, except in wet areas.

2. Edges: Tapered.

E. Bullet Resistant Sheathing and Wallboard: Woven roving, multi-ply, ballistic grade fiberglass cloth with thermoset polyester resin; comply with UL 752 Level 3.

1. In 1-Hour Fire-Resistance-Rated Partitions: UL listed for assembly used.

2. Products:

a. ArmorCore by Waco Composites; Bullet Resistant Fiberglass Panels: www.armorcore.com/#sle.

b. Total Security Solutions; Bullet Proof Fiberglass Wall Panels: www.tssbulletproof.com .

c. Safe Haven Defense; Kevlar Paneling: www.safehavendefense.com .

F. Shaftwall and Coreboard: Type X; 1 inch thick by 24 inches wide, beveled long edges, ends square cut.

1. Glass Mat Faced Type: Glass mat shaftliner gypsum panel or glass mat coreboard gypsum panel as defined in ASTM C1658/C1658M.

2.04 GYPSUM BOARD ACCESSORIES

A. Acoustic Insulation: ASTM C665; preformed mineral-fiber, friction fit type, unfaced; thickness 2 inches.

B. Acoustic Insulation: See Section 07 21 00.

C. Finishing Accessories: ASTM C1047, extruded aluminum alloy (6063 T5) or galvanized steel sheet ASTM A924/A924M G90, unless noted otherwise.

1. Types: As detailed or required for finished appearance.

2. Special Shapes: In addition to conventional corner bead and control joints, provide U-bead at exposed panel edges.

D. Beads, Joint Accessories, and Other Trim: ASTM C1047, rigid plastic, galvanized steel, or rolled zinc, unless noted otherwise.

1. Corner Beads: Low profile, for 90 degree outside corners.

E. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.

F. Finishing Compound: Surface coat and primer, takes the place of skim coating.

1. Products:

a. CertainTeed Corporation; Quick Prep Plus Interior Prep Coat: www.certainteed.com/#sle.

b. Substitutions: See Section 01 60 00 - Product Requirements.

G. Abuse Resistant Finishes:

1. Acrylic, water-based, non-textured, high build, tintable primer and surfacer.

H. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch in Thickness: ASTM C954; steel drill screws, corrosion-resistant.

I. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.02 SHAFT WALL INSTALLATION

A. Shaft Wall Framing: Install in accordance with manufacturer's installation instructions.

1. Install studs at spacing required to meet performance requirements.

B. Shaft Wall Liner: Cut panels to accurate dimensions and install sequentially between special friction studs.

3.03 FRAMING INSTALLATION

A. Metal Framing: Install in accordance with ASTM C1007AISI S220 and manufacturer's instructions.

B. Suspended Ceilings and Soffits: Space framing and furring members as indicated.

C. Studs: Space studs as indicated.

1. Extend partition framing to structure where indicated and to ceiling in other locations.

2. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.

3. Partitions Terminating at Structure: Attach extended leg top runner to structure, maintain clearance between top of studs and structure, and brace both flanges of studs with continuous bridging.

D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.

E. Standard Wall Furring: Install at concrete walls scheduled to receive gypsum board, not more than 4 inches from floor and ceiling lines and abutting walls. Secure in place on alternate channel flanges at maximum 24 inches on center.

F. Furring for Fire-Resistance Ratings: Install as required for fire-resistance ratings indicated and to GA-600 requirements.

3.04 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.

3.05 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. 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.

E. Bullet Resistant Sheathing and Wallboard:

1. Install bullet-resistant sheathing according to manufacturer's written recommendations and with manufacturer-approved fasteners.

2. Cover all joints between boards with a 4-inch strip of the same thickness material as the boards, centered on the joint.

3.06 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.

1. Not more than 30 feet apart on walls and ceilings over 50 feet long.

2. At exterior soffits, not more than 30 feet apart in both directions.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

D. Moisture Guard Trim: Install on bottom edge of gypsum board according to manufacturer's instructions and in locations indicated on drawings.

E. Exterior Soffit Vents: Install according to manufacturer's written instructions and in locations indicated on drawings. Provide vent area specified.

3.07 JOINT TREATMENT

A. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:

1. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.

2. Level 1: Fire-resistance-rated wall areas above finished ceilings, whether or not accessible in the completed construction.

B. 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.

C. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.

3.08 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

END OF SECTION 09 21 16

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SECTION 09 24 00
CEMENT PLASTERING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cement plastering.

1.02 RELATED REQUIREMENTS

A. Section 09 22 36 - Lath: Lath, furring, beads, screeds, and joint accessories for plaster base.

B. Section 09 91 13 - Exterior Painting.

1.03 REFERENCE STANDARDS

A. ASTM C926 - Standard Specification for Application of Portland Cement-Based Plaster.

B. ASTM C1063 - Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittals procedures.

B. Product Data: Provide data on plaster materials and trim accessories.

1.05 QUALITY ASSURANCE

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

PART 2 PRODUCTS

2.01 CEMENT PLASTER APPLICATIONS

A. Lath Plaster Base: Metal lath.

1. Plaster Type: Factory prepared plaster mix.
2. Number of Coats: Three.
3. First Coat: Apply to a nominal thickness of 3/8 inch.
4. Second Coat: Apply to a nominal thickness of 3/8 inch.
5. Leveling Coat: Apply to a nominal thickness of 1/32 to 1/16 inch.
6. Finish Coat: Apply to a nominal thickness of 1/8 inch.

7. Finish: Acrylic.

2.02 FACTORY PREPARED CEMENT PLASTER

A. Exterior Portland cement plaster system made of scratch and brown base coat, leveling coat with reinforcing mesh, and acrylic finish coat; install in accordance with ASTM C926.

1. Provide continuous exterior insulation as part of the system.

2. Provide weather resistive barrier as part of the system.

3. Manufacturer - Basis of Design:

a. LaHabra; FastWall 300: www.lahabrastucco.com/#sle.

b. Master Builders Solutions; Senergy Platinum CI Stucco Ultra: www.master-builders-solutions.com/en-us/#sle.

c. Sika Corporation; Parex Armourwall 300: www.parex.com/#sle.

4. Other Acceptable Manufacturers:

a. Dryvit Systems, Inc; Dryvit Stuccoat One-Coat System: www.dryvit.com/systems/stucco/#sle.

b. Master Wall, Inc; Cemplaster Fiberstucco: www.masterwall.com/#sle.

c. Substitutions: See Section 01 60 00 - Product Requirements.

B. Premixed Leveling Coat: Acrylic polymer-based blend approved for use with plaster manufacturer's base coat and finish materials.

C. Finish Coating: Portland cement-based coating with acrylic admixture, integrally colored, and trowel applied.

1. Color: To match approved sample.

2.03 ACCESSORIES

A. Lath: See Section 09 22 36.

B. Finishing Accessories: See Section 09 22 36.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions are acceptable prior to starting this work.

B. Verify lath is flat, secured to substrate, and joint and surface perimeter accessories are properly in place.

C. Verify mechanical and electrical equipment and services located within areas to receive this work have been properly tested and approved.

3.02 INSTALLATION - WATER-RESISTIVE BARRIER

A. Where cement plaster is installed as part of a barrier wall system, install two layers of water-resistive barrier in accordance with water-resistive barrier manufacturer's instructions.

B. Integrate water-resistive barrier with flashing accessories, and adjacent doors, windows, penetrations, and cladding transitions.

C. Lap water-resistive barrier at least 6 inches at vertical joints.

3.03 INSTALLATION - RAINSCREEN DRAINAGE MATERIAL

A. Install rainscreen drainage material and metal lath with accessories over sheathing material and water-resistive barrier with fastening system in accordance with ASTM C1063 into wood or metal studs. Install drainage material with filter fabric mortar screen to exterior.

3.04 MIXING

A. Mix only as much plaster as can be used prior to initial set.

B. Mix materials dry, to uniform color and consistency, before adding water.

C. Protect mixtures from frost or freezing temperatures, contamination, and excessive evaporation.

3.05 APPLICATION

A. Apply plaster in accordance with manufacturer's written instructions and comply with ASTM C926.

B. Base Coats:

1. Apply base coat(s) to fully embed lath and to specified thickness.

2. Follow guidelines in ASTM C926 and manufacturer's written installation instructions for moist curing base coats and application of subsequent coats.

C. Leveling Coat:

1. Apply leveling coat to specified thickness.

D. Finish Coats:

1. Cement Plaster:

a. Apply with sufficient material and pressure to ensure complete coverage of base to specified thickness.

b. Apply desired surface texture while mix is still workable.

2. Primer and Acrylic Coatings:

a. Remove surface contaminants such as dust and dirt without damaging substrate.

b. Apply primer in accordance with manufacturer's instructions.

c. Apply finish coating in number of coats and to thickness recommended by manufacturer.

END OF SECTION 09 24 00

SECTION 09 30 00
TILING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tile for floor applications.

B. Tile for wall applications.

C. Stone thresholds.

D. Ceramic accessories.

E. Ceramic trim.

F. Non-ceramic trim.

G. Sealant with backing rod or bond breaker tape.

1.02 RELATED REQUIREMENTS

A. Section 07 92 00 - Joint Sealants: Sealing joints between tile work and adjacent construction and fixtures.

B. Section 09 24 00 - Portland Cement Plastering: Lath and portland cement scratch coat and membrane, where required by TCA Method specified. (Coordinate with applicator specific mix requirements, thickness requirements and materials requirements by the TCA Handbook.)

C. Section 09 21 16 - Gypsum Board Assemblies: Installation of tile backer board. Coordinate with applicator flatness, plumb, tape and joint requirements of TCA Handbook system requirements.

D. Section 22 40 00 - Plumbing Fixtures: Shower receptor.

1.03 REFERENCE STANDARDS

A. ANSI A108/A118/A136 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium).

1. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar.

2. ANSI A108.1b - Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set, Modified Dry-Set, or Improved Modified Dry-Set Cement Mortar.

3. ANSI A108.1c - Contractor's Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set, Modified Dry-Set, or Improved Modified Dry-Set Cement Mortar.

4. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesive or Water Cleanable Tile-Setting Epoxy Adhesive.

5. ANSI A108.5 - Setting of Ceramic Tile with Dry-Set Cement Mortar, Modified Dry-Set Cement Mortar, EGP (Exterior Glue Plywood) Modified Dry-Set Cement Mortar, or Improved Modified Dry-Set Cement Mortar.

6. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grout Epoxy.

7. ANSI A108.8 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout.

8. ANSI A108.9 - American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout.

9. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework.

10. ANSI A118.7 - American National Standard Specifications for High Performance Cement Grouts for Tile Installation.

11. ANSI A137.1 - American National Standard Specifications for Ceramic Tile.

12. ASTM C373 - Standard Test Methods for Determination of Water Absorption and Associated Properties by Vacuum Method for Pressed Ceramic Tiles and Glass Tiles and Boil Method for Extruded Ceramic Tiles and Non-tile Fired Ceramic Whiteware Products.

B. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by affected installers.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative 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. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, ceramic accessories, and setting details.

D. Installer's Qualification Statement:

E. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.

F. 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: 10 square feet of each size, color, and surface finish combination.

1.06 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.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.08 FIELD CONDITIONS

A. Do not install solvent-based products in an unventilated environment.

PART 2 PRODUCTS

2.01 TILE

A. Manufacturers:

1. Portobello America; https://www.portobelloamerica.com/

2. Crossville America; https://www.crossvilleinc.com/

3. Arizona Tile; https://www.arizonatile.com/

B. Ceramic Tile: ANSI A137.1, standard grade.

1. Moisture Absorption: 0 to 0.5 percent as tested in accordance with ASTM C373.

2. Size: 4 by 16 inch, nominal.

3. Shape: Rectangle.

4. Edges: Square.

5. Surface Finish: Matte glazed.

6. Color(s): As indicated on drawings.

7. Trim Units: Matching bead, cove, and surface bullnose shapes in sizes coordinated with field tile.
8. Products:
    a. Portobello America; https://www.portobelloamerica.com/
    b. Substitutions: See Section 01 60 00 - Product Requirements.

C. Pressed Floor Tile: ANSI A137.1 standard grade.
1. Moisture Absorption: 0.5 to 3.0 percent as tested in accordance with ASTM C373.
2. Size: 12 by 24 inch, nominal.
3. Thickness: 3/8 inch, nominal.
4. Edges: Cushioned.
5. Surface Finish: Matte glazed.
6. Color(s): As indicated on drawings.
7. Trim Units: Matching bullnose, double bullnose, cove base, and cove shapes in sizes coordinated with field tile.

D. Porcelain Tile: ANSI A137.1 standard grade.
1. Moisture Absorption: 0 to 0.5 percent as tested in accordance with ASTM C373.
2. Thickness: 3/8 inch.
3. Edges: Square.
4. Surface Finish: Glazed.
5. Color(s): As indicated on drawings.
6. Trim Units: Matching bullnose, cove base, and cove shapes in sizes coordinated with field tile.

E. Natural Stone Tile, Type ST:
1. Mesh-Mounted Tiles:
    a. Size and Shape: Multiple size rectangular tiles on 7-3/16 × 19-5/8 nominal mesh backing.
2. Edges: Square.
3. Color(s): As indicated on drawings.
4. Products:

a. Arizona Tile; https://www.arizonatile.com/

2.02 TRIM AND ACCESSORIES

A. Ceramic Accessories: Glazed finish, same color and finish as adjacent field tile; same manufacturer as tile.

B. Ceramic Trim: Matching bullnose, double bullnose, cove base, and cove ceramic shapes in sizes coordinated with field tile.

1. Applications:

a. Open Edges: Bullnose.

b. Inside Corners: Jointed.

c. Floor to Wall Joints: Cove base.

2. Manufacturers: Same as for tile.

C. Sealant Movement Joint Filler (Interior).

1. Dow Corning 795, color as selected by the Architect from manufacturer full range of standard colors.

2. Always supply with bond breaker tape specifically recommended by sealant manufacturer behind the sealant and proportion the sealant so that it is twice as wide as it is thick.

3. Applications: Use in the following locations:

a. Floor to Wall control joints

b. Wall to wall control joints

c. Floor expansion joints

D. Non-Ceramic Trim: Brushed stainless steel, style and dimensions as indicated on drawings, for setting using tile mortar or adhesive. See

1. Applications:

a. Transition between floor finishes of different heights.

b. Thresholds at door openings.

2. Products:

a. Schluter-Systems: www.schluter.com.

1) Product: Schluter, Schiene-E

2) Product: Schluter: Reno-U

b. Substitutions: See Section 01 60 00 - Product Requirements.

E. Thresholds: 2 inches wide by full width of wall or frame opening; beveled edge on both long edges; without holes, cracks, or open seams.

1. Thickness: 1/2 inch.

2. Applications:

a. At doorways where tile terminates.

b. At open edges of floor tile where adjacent finish is a different height.

2.03 SETTING MATERIALS

A. Mortar Bed Materials: Pre-packaged mix of Portland cement, sand, latex additive, and water.

2.04 GROUTS

A. High Performance Polymer Modified Grout: ANSI A118.7 polymer modified cement grout.

1. Applications: Use this type of grout where indicated and where no other type of grout is indicated.

2. Use sanded grout for joints 1/8 inch wide and larger; use unsanded grout for joints less than 1/8 inch wide.

3. Color(s): As selected by Architect from manufacturer's full line.

4. Products:

a. LATICRETE International, Inc; LATICRETE PERMACOLOR Grout: www.laticrete.com/#sle.

b. Merkrete, by Parex USA, Inc; Merkrete Pro Grout: www.merkrete.com/#sle.

c. Substitutions: See Section 01 60 00 - Product Requirements.

B. Grout Sealer: Liquid-applied, moisture and stain protection for existing or new Portland cement grout.

1. Composition: Water-based colorless silicone.

2. Products:

a. Merkrete, by Parex USA, Inc; Merkrete Grout Sealer: www.merkrete.com.

PART 3 EXECUTION

3.01 EXAMINATION

A. All conditions listed herein shall be complied or written notification be provided stating which conditions are not acceptable to the TCA installation system and what provisions the Contractor proposes for the remedy. Such changes will be without additional cost to the Owner and approved by the Architect before installation begins.

B. Movement and expansion joints meet the requirements of the TCA Handbook.

C. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.

D. Verify slab is well cured, dimensionally stable, and free of cracks, waxy or oily films, and that slab has been steel troweled with fine broom finish and no curing compound. If curing compound used than mechanical scarify without additional cost to the Owner.

E. Verify that maximum variation does not exceed 1/4" in 10'-0" from required plane.

1. Further verify that gypsum surfaces are no more that 1/8" out of plane per foot and corners, door jambs, etc. must be plumb within 1/8" in 8"-0". Also verify that gypsum board faces are treated with tape and joint compound, bedding coat only (no finish coat). Nail heads, shall have one coat only.

F. Verify that the cement board has been installed with horizontal and vertical joints and corners with 1/8 inch spacing filled with dry-set of latex-portland cement and 2 inch wide glass fiber mesh tape is embedded in a skim coat of the mortar over joints and outside corners.

1. Verify that the cement board has been attached by hot-dipped fasteners in wet areas and non-corrosive and non-oxidizing fasteners elsewhere.

G. Verify that subfloor surfaces are dust free and free of substances that could impair bonding of setting materials to subfloor surfaces.

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.

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 floor 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 ceramic accessories rigidly in prepared openings.

F. Install non-ceramic trim in accordance with manufacturer's instructions.

G. Install thresholds where indicated.

H. Sound tile after setting. Replace hollow sounding units.

I. Install movement joints at all wall to floor joints and wall to wall joints in accordance with TCA "Movement Joints Design Essentials" details EJ171.

J. Install isolation/expansion joints in accordance with TCA "Movement Joints Design Essentials" details EJ171 and the following guidelines:

1. Interior-20'-25' in each direction

2. Interior tilework exposed to direct sunlight or moisture - 8'-12' each direction.

3. Joint width: for quarry tile and paver tile same width as the grout joint, but not less than 1/4".

4. Joint width: for ceramic mosaic tile and glazed wall tile-preferred not less than 1/4", but never less than 1/8".

K. Prior to grouting, allow installation to completely cure; minimum of 48 hours.

L. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.

3.04 INSTALLATION - FLOORS - THIN-SET METHODS

A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F113, dry-set or latex-Portland cement bond coat, with standard grout, unless otherwise indicated.

B. Use uncoupling membrane under all tile unless other underlayment is indicated, install in accordance with TCA Handbook Method F128.

C. Where waterproofing membrane is indicated, install in accordance with TCNA (HB) Method F122, with latex-Portland cement grout.

D. Where epoxy or furan grout is indicated, but not epoxy or furan bond coat, install in accordance with TCNA (HB) Method F115.

3.05 INSTALLATION - FLOORS - MORTAR BED METHODS

A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F111, with cleavage membrane, unless otherwise indicated.

B. Cleavage Membrane: Lap edges and ends.

C. Mortar Bed Thickness: 5/8 inch to 2 inches, unless otherwise indicated.

3.06 INSTALLATION - WALL TILE

A. On interior walls install in accordance with TCA Handbook Method W244, thin-set over cementitious backer units, with waterproofing membrane.

B. Over interior concrete and masonry install in accordance with TCNA (HB) Method W202, thin-set with dry-set or latex-Portland cement bond coat.

C. Over metal studs without backer install in accordance with TCNA (HB) Method W241, mortar bed, with membrane where indicated.

3.07 CURING

A. Cover completed tilework and keep damp for 3 to 7 calendar days as previously agreed to with the architect as required by current weather conditions.

END OF SECTION 09 30 00

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SECTION 09 51 00
ACOUSTICAL CEILINGS

<<<< UPDATE NOTES

PART 1 GENERAL

2.01 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Acoustical units.

C. Supplementary insulation above ceiling.

2.02 RELATED REQUIREMENTS

A. Section 07 21 00 - Thermal Insulation: Acoustical insulation.

B. Section 09 51 53 - Direct-Applied Acoustical Ceilings.

2.03 REFERENCE STANDARDS

A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures.

B. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.

C. ASTM E1264 - Standard Classification for Acoustical Ceiling Products.

2.04 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.

2.05 SUBMITTALS

A. See Section 01 30 00 - Administrative 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. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

2.06 QUALITY ASSURANCE

A. Designer Qualifications for Seismic Design: Perform under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed at Project Location State.

B. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

2.07 FIELD CONDITIONS

A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 70 percent prior to, during, and after acoustical unit installation.

PART 2 PRODUCTS

3.01 MANUFACTURERS

A. Acoustic Tiles/Panels:

1. Armstrong World Industries, Inc: www.armstrong.com.

B. Suspension Systems:

1. Same as for acoustical units.

3.02 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Ceiling systems designed to withstand the effects of earthquake motions determined according to ASCE 7 for Seismic Design Category D, E, or F and complying with the following:

1. Local authorities having jurisdiction.

3.03 ACOUSTICAL UNITS

A. Acoustical Units - General: ASTM E1264, Class A.

B. Acoustical Panels: Mineral fiber with Biochar, with the following characteristics:

1. Size: 24 by 24 inches, .
2. Thickness: 3/4 inch.
3. Light Reflectance: 85 percent, determined in accordance with ASTM E1264.
4. NRC ASTM C423 .
5. Articulation Class (AC): ASTM E 1111 .
6. Ceiling Attenuation Class (CAC): ASTM C 1414 .

7. Panel Edge: Beveled Tegular, or Lay In.
8. Tile Edge: Square.
    a. Joint: Kerfed and rabbeted.
9. Color: White.
10. Suspension System: Exposed grid.
11. Suspension System: Exposed T grid, 9/16" Reveal.
12. Products:
    a. Armstrong World Industries, Inc; Ultima Ultima: www.armstrongceilings.com/#sle

C. Acoustical Panels: Mineral fiber with membrane-faced overlay, with the following characteristics:

1. Size: 24 by 72 inches.
2. Thickness: 3/4 inch.
3. Light Reflectance: 85 percent, determined in accordance with ASTM E1264.
4. Panel Edge: Reveal.
5. Color: As indicated on drawings.
6. Suspension System: Exposed grid.
7. Suspension System: Slotted T grid, 1/8" Reveal.
8. Products:
    a. Armstrong World Industries, Inc; Calla: www.armstrongceilings.com/#sle.

3.04 SUSPENSION SYSTEM(S)

A. Manufacturers:

1. Same as for acoustical units.
2. Substitutions: See Section 01 60 00 - Product Requirements.

B. 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.

3.05 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 galvanized steel wire.

C. Seismic Clips: Manufacturer's standard clips for seismic conditions and to suit application.

D. Perimeter Moldings: Same metal and finish as grid.

1. Angle Molding: L-shaped, for mounting at same elevation as face of grid.

E. Metal Edge Trim for Suspension Systems: Steel or extruded aluminum; provide attachment clips, splice plates, and preformed corner pieces for complete trim system.

1. Trim Height: 6 inch.

2. Finish: Baked enamel.

3. Color: White.

4. Products:

a. Amstrong, AXIOM Classic Perimeter Trim: https://www.armstrongceilings.com/commercial/en/

b. Substitutions: See Section 01 60 00 - Product Requirements.

F. Acoustical Insulation: Specified in Section 07 21 00.

1. Thickness: 6 inch.

2. Size: To fit acoustical suspension system.

G. Gypsum Board: Fire rated type; 5/8 inch thick, ends and edges square, paper faced.

H. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

4.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

4.02 PREPARATION

A. Install after major above-ceiling work is complete.

B. Coordinate the location of hangers with other work.

4.03 INSTALLATION - SUSPENSION SYSTEM

A. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

B. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.

1. Use longest practical lengths.

C. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.

D. Seismic Suspension System, Seismic Design Categories D, E, F: Hang suspension system with grid ends attached to the perimeter molding on two adjacent walls; on opposite walls, maintain a 3/4 inch clearance between grid ends and wall.

E. 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.

F. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

G. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.

H. Do not eccentrically load system or induce rotation of runners.

4.04 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 units after above-ceiling work is complete.

E. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

F. Cutting Acoustical Units:

1. Make field cut edges of same profile as factory edges.

G. Where round obstructions occur, provide preformed closures to match perimeter molding.

H. Lay acoustical insulation for a distance of 30 inches either side of acoustical partition types indicated in drawings.

4.05 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 09 51 00

SECTION 09 54 26
SUSPENDED WOOD CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wood grilles.

B. Wood panel canopies.

C. Metal suspension system.

1.02 RELATED REQUIREMENTS

A. Section 09 51 00 - Acoustical Ceilings: Metal suspension systems.

1.03 REFERENCE STANDARDS

A. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.

B. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.

C. 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.

D. CISCA (WC) - Wood Ceilings Technical Guidelines.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Sequence work to ensure ceilings are not installed until building is enclosed, dust generating activities have terminated, and overhead work is completed.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate grid layout and related dimensioning, attachment of wood ceiling components to grid, accessory attachments, junctions with other ceiling finishes, and mechanical and electrical items installed in the ceiling.

C. Product Data: Provide data on wood ceiling components and suspension system components.

1.06 QUALITY ASSURANCE

A. Designer Qualifications for Seismic Design: Perform design under direct supervision of Professional Structural Engineer experienced in design of this type of work and licensed in Project Location State.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with at least three years documented experience.

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

1.07 MOCK-UPS

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Locate where directed.

C. Mock-up may remain as part of the work.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver wood ceiling components to project site in original, unopened packages.

B. Store in fully enclosed space, flat, level and off the floor.

1.09 FIELD CONDITIONS

A. Do not install suspended wood ceiling system until wet construction work is complete and permanent heat and air conditioning is installed and operating.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Suspended Wood Ceilings:

1. Armstrong World Industries, Inc; Woodworks: www.armstrongceilings.com/#sle.

2.02 SUSPENDED WOOD CEILING SYSTEM

A. Performance Requirements:

1. Design for maximum deflection of 1/360 of span.

B. Wood-Based Materials:

1. Solid Wood: Clear, dry, sound, plain sawn, selected for compatible species, grain and color, no defects.

C. Wood Grilles: Pre-assembled module of solid wood grilles with battens.

1. Acoustical Backer: Felt, 1/2 inch thick.

a. Color: Black.

2. Solid Wood Species: Poplar.

    a. Factory Finish: As scheduled.

3. Suspension System: Type specified below.

4. Suspension System: See Section 09 51 00.

D. Metal Suspension System:

1. General: Comply with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold down clips, stabilizer bars, clips, and splices as required.

2. Concealed Ceiling Suspension System: Aluminum grid.

    a. Description: Engineered grid, with slotted faces in main tees, cross tees, hangers, trim molding, load resisting struts, hinge assemblies, and other suspension components required to support ceiling and other ceiling supported construction. Panels installed from below by inserting torsion springs into slots in faces of main tees of ceiling grid.

    b. Structural Classification: Intermediate-duty, when tested in accordance with ASTM C635/C635M.

    c. Profile: Flat.

    d. Finish: Powder coat.

    e. Color: Black.

    f. Products:

3. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement.

E. Accessories: Manufacturer's standard accessories for installation method indicated, seismic requirements and above-ceiling accessibility.

PART 3 EXECUTION

3.01 PREPARATION

A. Layout wood ceiling components in pattern according to reflected ceiling plan and as shown on shop drawings.

B. Acclimate wood ceiling materials by removing from packaging in installation area a minimum of 48 hours prior to installation.

3.02 INSTALLATION

A. General: Install suspended wood ceiling system in accordance with CISCA (WC).

B. Suspension System:

1. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions and as supplemented in this section.

2. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

3. 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.

4. 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.

5. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

6. Do not eccentrically load system or induce rotation of runners.

C. Wood Ceiling:

1. Install wood ceilings in accordance with manufacturer's instructions.

2. Fit wood components in place, free from damaged edges or other defects detrimental to appearance and function.

3. Install components in uniform plane, and free from twist, warp, and dents.

4. Cut to fit irregular grid and perimeter edge trim.

5. Make field cut edges of same profile as factory edges, seal and finish according to manufacturer.

6. Install acoustical backer above wood ceiling components; fit tight between grid members.

3.03 CLEANING

A. Clean and touch up minor finish damage. Remove and replace components that cannot be successfully cleaned and repaired.

END OF SECTION 09 54 26

SECTION 09 65 00
RESILIENT FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Resilient sheet flooring.

B. Resilient tile flooring.

C. Resilient base.

D. Installation accessories.

1.02 RELATED REQUIREMENTS

A. Section 09 05 61 - Common Work Results for Flooring Preparation: Removal of existing floor coverings, cleaning, and preparation.

B. Section 26 05 39 - Underfloor Raceways for Electrical Systems: Electrical floor cover plates for installation of resilient flooring specified in this section.

1.03 REFERENCE STANDARDS

A. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.

B. ASTM F1066 - Standard Specification for Vinyl Composition Floor Tile.

C. ASTM F1700 - Standard Specification for Solid Vinyl Floor Tile.

D. ASTM F1859 - Standard Specification for Rubber Sheet Floor Covering Without Backing.

E. ASTM F1861 - Standard Specification for Resilient Wall Base.

F. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative 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. Shop Drawings: Indicate seaming plans and floor patterns.

D. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.

E. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 60 00 - Product Requirements, for additional provisions.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in installing specified flooring with minimum three years documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.

B. Store all materials off of the floor in an acclimatized, weather-tight space.

C. Maintain temperature in storage area between 55 degrees F and 90 degrees F.

D. Protect roll materials from damage by storing on end.

E. Do not double stack pallets.

PART 2 PRODUCTS

2.01 SHEET FLOORING

A. Rubber Sheet Flooring: Recycled SBR (styrene butadiene rubber) and colored EPDM granules with urethane binder.

1. Manufacturers:

a. Johnsonite, a Tarkett Company: www.johnsonite.com.

2. Thickness: 0.375 inch minimum.

3. Sheet Width: 48 inch minimum.

4. Pattern: As indicated on drawings .

5. Color: As indicated on drawings.

2.02 TILE FLOORING

A. Vinyl Composition Tile - LVT1, LVT3: Surface pattern type.

1. Manufacturers:

a. Mohawk Commercial; Reforestation https://www.mohawkflooring.com/.

b. Substitutions: See Section 01 60 00 - Product Requirements.

2. Minimum Requirements: Comply with ASTM F1066, of Class corresponding to type specified.
3. Size: 9.25 by 59 inch.
4. Thickness: 0.17 inch.
5. Pattern: As indicated on drawings. .
6. Color: As indicated on drawings.

B. Vinyl Tile - LVT2: Surface-decorated, with wear layer.

1. Manufacturers:
   a. Mohawk Commercial; Hot and Heavy II: https://www.mohawkflooring.com/.
   b. Substitutions: See Section 01 60 00 - Product Requirements.
2. Minimum Requirements: Comply with ASTM F1700, of Class corresponding to type specified.
3. Plank Tile Size: 18 by 36 inch.
4. Total Thickness: 0.098 inch.
5. Pattern: As indicated on drawings..
6. Color: As indicated on drawings.

2.03 RESILIENT BASE

A. Resilient Base - Type RB: ASTM F1861, Type TS, rubber, vulcanized thermoset; style as scheduled.

1. Manufacturers:
   a. Roppe Corporation; Contours Profiled Wall Base System: www.roppe.com/#sle.
2. Height: 4 inches.
3. Thickness: 0.125 inch.
4. Length: Roll.
5. Color: As indicated on drawings.

2.04 ACCESSORIES

A. Adhesive for Vinyl Flooring:

1. Manufacturers:

a. H.B. Fuller Construction Products, Inc; TEC Flexera 2K PSA Hybrid Adhesive: www.tecspecialty.com/#sle.

b. H.B. Fuller Construction Products, Inc; TEC Flexera HT - High Tack Premium Universal PSA Adhesive: www.tecspecialty.com/#sle.

c. Loba-Wakol, LLC; WAKOL D 3120 PVC Adhesive: www.loba-wakol.com/#sle.

d. Stauf USA, LLC; D737 High-Tack: www.staufusa.com/#sle.

B. Moldings, Transition and Edge Strips: Metal.

1. Manufacturers:

a. Schluter-Systems; Schulter Reno, Schulter Schiene: www.schluter.com/#sle.

b. Substitutions: See Section 01 60 00 - Product Requirements.

C. Sealer and Wax: Types recommended by flooring manufacturer.

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. 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 resilient base.

C. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Remove existing resilient flooring and flooring adhesives; follow the recommendations of RFCI (RWP).

B. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

C. Remove subfloor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with subfloor filler to achieve smooth, flat, hard surface.

D. Prohibit traffic until filler is fully cured.

3.03 INSTALLATION - GENERAL

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install in accordance with manufacturer's written instructions.

C. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.

D. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.

E. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

F. At movable partitions, install flooring under partitions without interrupting floor pattern.

3.04 INSTALLATION - SHEET FLOORING

A. Lay flooring with joints and seams parallel to longer room dimensions, to produce minimum number of seams. Lay out seams to avoid widths less than 1/3 of roll width; match patterns at seams.

B. Seams are prohibited in bathrooms, kitchens, toilet rooms, and custodial closets.

C. Cut sheet at seams in accordance with manufacturer's instructions.

D. Seal seams by heat welding where indicated on drawings.

3.05 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.

C. Install square tile to ashlar pattern. Allow minimum 1/2 full size tile width at room or area perimeter.

D. Install plank tile with a random offset of at least 6 inches from adjacent rows.

3.06 INSTALLATION - RESILIENT BASE

A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.

B. Miter internal corners. At external corners, use premolded units. At exposed ends, use premolded units.

C. Install base on solid backing. Bond tightly to wall and floor surfaces.

D. Scribe and fit to door frames and other interruptions.

3.07 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

B. Clean in accordance with manufacturer's written instructions.

3.08 PROTECTION

A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION 09 65 00

SECTION 09 67 00
FLUID-APPLIED FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fluid-applied flooring and base.

1.02 REFERENCE STANDARDS

A. ASTM D905 - Standard Test Method for Strength Properties of Adhesive Bonds in Shear by Compression Loading.

B. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.

C. ICRI 310.2R - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns and colors available.

C. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.

D. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention, and application rate for each coat.

E. Applicator's Qualification Statement.

F. Maintenance Data: Include maintenance procedures, recommended maintenance materials, procedures for stain removal, repairing surface, and suggested schedule for cleaning.

1.04 QUALITY ASSURANCE

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

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fluid-Applied Flooring:

1. Sherwin-Williams Company (Basis of Design).

2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 FLUID-APPLIED FLOORING SYSTEMS

A. Fluid-Applied Flooring: Epoxy base coat(s), polyurethane top coat, no aggregate.

1. System Thickness: 50 mils, nominal, dry film thickness (DFT).

2. Texture: Slip resistant.

3. Color: As indicated in drawings.

4. Products:

a. Sherwin-Williams Company: www.protective.sherwin-williams.com/#sle.

b. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 ACCESSORIES

A. Cant Strips: Molded material compatible with flooring.

B. Subfloor Filler: Type recommended by fluid-applied flooring manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive flooring.

B. 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 flooring.

C. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of materials to subfloor surfaces.

D. Cementitious Subfloor Surfaces: Verify that substrates are ready for fluid-applied flooring installation by testing for moisture and alkalinity (pH).

1. Obtain instructions if test results are not within limits recommended by fluid-applied flooring manufacturer.

3.02 PREPARATION

A. Apply primer to surfaces required by flooring manufacturer.

3.03 INSTALLATION - ACCESSORIES

A. Install cant strips at base of walls where flooring is to be extended up wall as base.

3.04 INSTALLATION - FLOORING

A. Apply in accordance with manufacturer's instructions.

B. Apply each coat to minimum thickness required by manufacturer.

C. Finish to smooth level surface.

3.05 PROTECTION

A. Prohibit traffic on floor finish for 48 hours after installation.

END OF SECTION 09 67 00

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SECTION 09 68 13
TILE CARPETING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Carpet tile, fully adhered.

B. Removal of existing carpet tile.

1.02 RELATED REQUIREMENTS

A. Section 09 05 61 - Common Work Results for Flooring Preparation: Removal of existing floor coverings, cleaning, and preparation.

1.03 REFERENCE STANDARDS

A. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.

B. CRI 104 - Standard for Installation of Commercial Carpet.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative 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. Shop Drawings: Indicate layout of joints.

D. Samples: Submit two carpet tiles illustrating color and pattern design for each carpet color selected.

E. Manufacturer's Qualification Statement.

F. Installer's Qualification Statement.

G. 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: Quantity equal to 10 percent of total installed 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:

1. Bentley Mills, https://www.bentleymills.com/
2. Patcraft, https://www.patcraft.com/
3. Staticsmart, https://staticsmart.com/
4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MATERIALS

A. Tile Carpeting, Type CPT1: Tufted, manufactured in one color dye lot.

1. Product: OUTLIER manufactured by BENTLEY MILLS.
2. Tile Size: 18 by 36 inch, nominal.
3. Color: As indicated on drawings.
4. Pattern: As indicated on drawings.

B. Tile Carpeting, , Type CPT2,CPT3 : Tufted, manufactured in one color dye lot.

1. Product: Disruptive Path and Shared Path manufactured by Mohawk Group
2. Tile Size: 18 by 36 inch, nominal.
3. Color: As indicated on drawings.
4. Pattern: As indicated on drawings.

C. Tile Carpeting, , Type CPT4: Tufted, manufactured in one color dye lot.

1. Product: Plus Colonial Series manufactured by Staticsmart.
2. Tile Size: 18 by 36 inch, nominal.
3. Color: As indicated on drawings.

4. Pattern: As indicated on drawings.

2.03 ACCESSORIES

A. Subfloor Filler: White premix latex; type recommended by flooring material manufacturer.

B. Edge Strips: Embossed aluminum, _____ color.

C. 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.

3.02 PREPARATION

A. Remove existing carpet tile.

B. Prepare floor substrates for installation of flooring in accordance with Section 09 05 61.

C. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

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. Locate change of color or pattern between rooms under door centerline.

G. Fully adhere carpet tile to substrate.

H. Trim carpet tile neatly at walls and around interruptions.

I. 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 09 68 13

SECTION 09 72 00
WALL COVERINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation and prime painting.

B. Wall covering and borders.

1.02 RELATED REQUIREMENTS

A. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 09 91 23 - Interior Painting: Preparation and priming of substrate surfaces.

1.03 REFERENCE STANDARDS

A. ASTM D1308 - Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Coating Systems.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

C. ASTM F793/F793M - Standard Classification of Wall Coverings by Use Characteristics.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on wall covering and adhesive.

C. Shop Drawings: Indicate wall elevations with seaming layout.

D. Manufacturer's Installation Instructions: Indicate special procedures.

E. Installer's Qualification Statement.

1.05 QUALITY ASSURANCE

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

B. 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. Inspect roll materials at arrival on site, to verify acceptability.

B. Protect packaged adhesive from temperature cycling and cold temperatures.

C. Do not store roll goods on end.

1.07 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the adhesive or wall covering product manufacturer.

B. Maintain these conditions 24 hours before, during, and after installation of adhesive and wall covering.

PART 2 PRODUCTS

2.01 WALL COVERINGS

A. General Requirements:

1. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84.

2. Chemical and Stain Resistance: No visible staining or discoloration and no damage to surface texture when tested in accordance with ASTM D1308.

B. Wall Covering - Type WC1: Paper-backed vinyl roll stock.

1. Total Thickness: 4 mil.

2. Roll Width: 54 inches.

3. Backing: Polyethylene-coated paper.

4. Color: Graphic varies per location, as indicated on drawings..

5. Surface Texture: Light.

6. Manufacturers:

a. Takeform; SA-105 Traffic https://www.takeform.net

b. Substitutions: See Section 01 60 00 - Product Requirements.

C. Wall Covering - Type WF1, WF2: Paper-backed vinyl roll stock.

1. Total Thickness: 3 mil.

2. Roll Width: 60 inches.

3. Color: As indicated on drawings.

4. Surface Texture: Light.

5. Manufacturers:

    a. Takeform; WF-202 Ghost https://www.takeform.net

    b. Substitutions: See Section 01 60 00 - Product Requirements.

D. Adhesive: Type recommended by wall covering manufacturer to suit application to substrate.

E. Substrate Filler: As recommended by adhesive and wall covering manufacturers; compatible with substrate.

F. Substrate Primer and Sealer: Alkyd enamel type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are prime painted and ready to receive work, and comply with requirements of wall covering manufacturer.

3.02 PREPARATION

A. Fill cracks in substrate and smooth irregularities with filler; sand smooth.

B. Wash impervious surfaces with tetra-sodium phosphate, rinse and neutralize; wipe dry.

C. Surface Appurtenances: Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.

D. Apply one coat of primer sealer to substrate surfaces. Allow to dry. Lightly sand smooth.

E. Vacuum clean surfaces free of loose particles.

3.03 INSTALLATION

A. Apply adhesive and wall covering in accordance with manufacturer's instructions.

B. Apply adhesive to wall surface immediately prior to application of wall covering.

C. Razor trim edges on flat work table. Do not razor cut on gypsum board surfaces.

D. Apply wall covering smooth, without wrinkles, gaps or overlaps. Eliminate air pockets and ensure full bond to substrate surface.

E. Butt edges tightly.

F. Overlap adjacent panels as recommended by manufacturer.

G. Do not seam within 2 inches of internal corners or within 6 inches of external corners.

H. Cover spaces above and below windows, above doors, in pattern sequence from roll.

I. Remove excess adhesive while wet from seam before proceeding to next wall covering sheet. Wipe clean with dry cloth.

3.04 CLEANING

A. Clean wall coverings of excess adhesive, dust, dirt, and other contaminants.

B. Reinstall wall plates and accessories removed prior to work of this section.

END OF SECTION 09 72 00

SECTION 09 83 00
ACOUSTIC FINISHES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Acoustic Coatings.

B. Acoustic Insulation Finishes.

1.02 RELATED REQUIREMENTS

A. Section 09 51 00 - Acoustical Ceilings.

B. Section 09 91 23 - Interior Painting.

1.03 REFERENCE STANDARDS

A. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

C. ASTM E736/E736M - Standard Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's data sheets for products specified.

C. Installer's qualification statement.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in installing work of type specified in this section, and with at least three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

1.07 FIELD CONDITIONS

A. Do not apply acoustical finishes when surface and ambient temperatures are outside the temperature ranges required by manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acoustic Coatings:

1. Soprema,; Sonasoray FC Acoustical Finish: https://www.soprema.ca/en/

B. Acoustic Insulation Finishes:

1. International Cellulose Corporation; K13 Sound Absorption Spray: www.spray-on.com/#sle.

2.02 ACOUSTIC COATINGS

A. General:

1. 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.

B. Acoustic Coatings: Spray-applied, vinyl acrylic dry-fall coatings.

1. Provide nonbridging coating to cover acoustical tile and ceiling grid system.

2. Color: As indicated on drawings.

2.03 ACOUSTIC INSULATION FINISHES

A. General:

1. Provide materials compatible with one another and substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. Description: Spray-applied, recycled cellulose fibers with water-based adhesive.

1. Bond Strength: Greater than 150 psf as tested in accordance with ASTM E736/E736M

2. Noise Reduction Coefficient (NRC) of 0.85, minimum, when tested in accordance with ASTM C423.

3. Surface Burning Characteristics: Class 1, Class A fire rating, flame spread index of 5 maximum; smoke developed index of 5 maximum; when tested in accordance with ASTM E84.

4. Installed Thickness: As required to achieve designated NRC.

5. Provide nonbridging coating to cover substrates.

6. Color: Light gray.

2.04 ACCESSORIES

A. Materials: Provide primers, sealers, cleaning agents, and clean up materials as required for completion of acoustic finish.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin application of acoustic finishes until substrates have been properly prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

3.02 PREPARATION

A. Protect adjacent surfaces and materials not receiving coating from splatter and overspray.

B. Mask surface appurtenances including, but not limited to, exit signs, fire sprinkler escutcheons, HVAC grilles, light fixtures, speaker grilles, and building structural elements (joists, beams, columns).

C. Replace damaged ceiling materials.

D. Prepare surfaces using cleaning methods recommended by the manufacturer.

E. Seal surfaces that may cause bleed through or staining of acoustic finish.

F. Seal surfaces that may cause bleed through or staining of wall covering.

3.03 APPLICATION

A. Apply in accordance with manufacturer's written instructions.

B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

C. Apply each coat to uniform appearance in thicknesses specified by manufacturer.

D. Reinstall surface appurtenances removed prior to finishing.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements for additional requirements.

3.05 CLEANING

A. See Section 01 74 19 - Construction Waste Management and Disposal for additional requirements.

B. 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 from subsequent construction operations.

B. Touch-up damaged finishes.

END OF SECTION 09 83 00

SECTION 09 84 00
ACOUSTICAL PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fabric-covered mineral fiber core panels and mounting accessories.

B. Fabric-covered fiberglass core panels and mounting accessories.

C. Fabric-covered mineral fiber core ceiling baffles.

1.02 RELATED REQUIREMENTS

A. Section 09 51 00 - Acoustical Ceilings: Ceiling suspension system.

B. Section 09 72 00 - Wall Coverings.

C. Section 09 91 23 - Interior Painting.

1.03 REFERENCE STANDARDS

A. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's printed data sheets for products specified.

C. Shop Drawings: Fabrication and installation details, panel layout, and fabric orientation.

D. 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 Panels: Quantity equal to 5 percent of total installed, but not less than one of each type.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company with not less than five years of experience in manufacturing acoustical products similar to those specified.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect acoustical panels from moisture during shipment, storage, and handling. Deliver in factory-wrapped bundles; do not open bundles until panels are needed for installation.

B. Store panels flat, in dry, well-ventilated space; do not stand panels on end.

C. Protect panel edges from damage.

1.07 MOCK-UP

A. See Section 01 40 00 - Quality Requirements, for additional mock-up requirements.

B. Construct mock-up of acoustical panels at location indicated by Architect.

1. Minimum mock-up dimensions; 96 by 96 inches.

2. Approved mock-up may remain as part of the Work.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fabric-Covered Acoustical Panels:

1. Turf; https://turf.design/

2. Valhalla; http://www.valhallaproducts.com/home.html

2.02 FABRIC-COVERED ACOUSTICAL PANELS

A. Panels: Prefinished, factory assembled fabric-covered panels.

1. Surface Burning Characteristics: Flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.

B. PET Felt Core Panels:

1. Noise Reduction Coefficient (NRC): 0.50 to 0.60 when tested in accordance with ASTM C423 for Type A mounting, per ASTM E795.

2. Panel Width: 48 inches.

3. Panel Height: 120 inches.

4. Color: As indicated on drawings.

C. Fiberglass Core Panels:

1. Noise Reduction Coefficient (NRC): 0.80 to 0.90 when tested in accordance with ASTM C423 for Type A mounting, per ASTM E795.
2. Panel Width: As detailed.
3. Panel Height: As detailed.
4. Panel Thickness: 1-1/2 inch.
5. Color: As indicated on drawings.
6. Mounting: Back mounting.

2.03 FABRICATION

A. Fabric Wrapped, General: Fabricate panels to sizes and configurations indicated, with fabric facing installed without sagging, wrinkles, blisters, or visible seams.

1. Where radiused or mitered corners are indicated, install fabric to avoid seams or gathering of material.
2. For panels suspended from ceiling, provide fabric covering both sides, with seams only at panel edges.

2.04 ACCESSORIES

A. Back-Mounting Accessories: Manufacturer's standard accessories for concealed support, designed to allow panel removal, and as follows:

1. Metal impaling clips designed to support full weight of panels, mechanically attached to substrate and adhesively bonded to back of panels.
2. Z-clip hanger and magnet system with magnets recessed into panel frame and designed to engage steel mounting plates secured to substrate with screws.
3. Mechanically Mounted Metal-Framed Panels: Metal panel-clip system designed to engage metal framing of panels.

B. Ceiling-Suspended Accessories: Manufacturer's standard through-threaded eyelets bolted through concealed perimeter frame at 1/4 points on each panel, sized appropriately for weight of panels.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates for conditions detrimental to installation of acoustical panels. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install acoustical panels in locations indicated, following installation recommendations of panel manufacturer. Align panels accurately, with edges plumb and top edges level. Scribe to fit accurately at adjoining work and penetrations.

3.03 CLEANING

A. Clean fabric facing upon completion of installation from dust and other foreign materials, following manufacturer's instructions.

B. Remove surplus materials, trimmed portions of panels, and debris resulting from installation.

3.04 PROTECTION

A. Provide protection of installed acoustical panels until completion of the work.

B. Replace panels that cannot be cleaned and repaired to satisfaction of the Architect.

END OF SECTION 09 84 00

SECTION 09 84 30
SOUND-ABSORBING WALL AND CEILING UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sound-absorbing panels.

B. Mounting accessories.

1.02 RELATED REQUIREMENTS

A. Section 09 51 00 - Acoustical Ceilings: Ceiling suspension system.

1.03 REFERENCE STANDARDS

A. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.

B. 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.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's printed data sheets for products specified.

C. Shop Drawings: Fabrication and installation details, panel layout, fabric orientation, and wood grain orientation.

D. Manufacturer's qualification statement.

E. 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 Panels: Quantity equal to 5 percent of total installed, but not less than one of each type.

1.05 QUALITY ASSURANCE

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect acoustical units from moisture during shipment, storage, and handling. Deliver in factory-wrapped bundles; do not open bundles until units are needed for installation.

B. Store units flat, in dry, well-ventilated space; do not stand on end.

C. Protect edges from damage.

1.07 MOCK-UPS

A. See Section 01 40 00 - Quality Requirements for additional mock-up requirements.

B. Construct mock-up of acoustical units at location as indicated by Architect.

1. Minimum mock-up dimensions; 96 by 96 inches.

2. Mock-up may remain as part of work.

PART 2 PRODUCTS

2.01 FABRIC-COVERED SOUND-ABSORBING UNITS

A. Manufacturers:

1. Turf; https://turf.design/.

B. General:

1. Prefinished, factory assembled fabric-covered panels.

2. Surface Burning Characteristics: Flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.

C. Fabric-Covered Acoustical Panels for Ceilings:

1. Panel Core: Manufacturer's standard PET felt core.

2. Panel Size: 24 inches by 24 inches.

3. Color: As indicated on drawings..

4. Pattern: As indicated on finish schedule.

2.02 FABRICATION

2.03 ACCESSORIES

PART 3 EXECUTION

3.01 INSTALLATION

A. Install acoustical units in locations as indicated, following manufacturer's installation instructions.

B. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions and as supplemented in this section.

C. Install mounting accessories and supports in accordance with shop drawings.

3.02 CLEANING

A. Clean sound-absorptive panels upon completion of installation from dust and other foreign materials, following manufacturer's instructions.

3.03 PROTECTION

A. Provide protection of installed acoustical panels until Date of Substantial Completion.

B. Replace panels that cannot be cleaned and repaired to satisfaction of the Architect.

END OF SECTION 09 84 30

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SECTION 09 90 00
PAINTING AND COATING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints and stains.

C. Scope: Finish all interior and exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.

1. Mechanical and Electrical:

a. In finished areas, paint all insulated and exposed pipes, unless otherwise indicated.

b. In finished areas, paint shop-primed items.

c. On the roof and outdoors, paint all equipment that is exposed to weather or to view, including that which is factory-finished.

d. Paint interior surfaces of air ducts and convector and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black paint to visible surfaces.

D. Do Not Paint or Finish the Following Items:

1. Items fully factory-finished unless specifically so 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, and lead items.

6. Marble, granite, slate, and other natural stones.

7. Floors, unless specifically so indicated.

8. Ceramic and other tiles.

9. Brick, architectural concrete, cast stone, integrally colored plaster and stucco.

10. Glass.

11. Acoustical materials, unless specifically so indicated.

12. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

A. Section 05 50 00 - Metal Fabrications: Shop-primed items.

B. Section 05 51 00 - Metal Stairs: Shop-primed items.

1.03 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency.

B. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials.

C. GreenSeal GS-11 - Standard for Paints, Coatings, Stains, and Sealers.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches 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 definitely not required.

C. Product Data: Provide data on all finishing products, including VOC content.

D. Certification: By manufacturer that all paints and coatings do not contain any of the prohibited chemicals specified; GreenSeal GS-11 certification is not required but if provided shall constitute acceptable certification.

E. Manufacturer's Instructions: Indicate special surface preparation procedures.

F. Maintenance Data: Submit data on cleaning, touch-up, and repair of painted and coated surfaces.

G. 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 Paint and Coatings: 1 gallon of each color; store where directed.

3. Label each container with color in addition to the manufacturer's label.

1.05 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the type of work specified with minimum five years experience.

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 and a maximum of 90 degrees F, 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 exterior coatings 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: 45 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.

E. Minimum Application Temperature for Varnish Finishes: 65 degrees F for interior or exterior, unless required otherwise by manufacturer's instructions.

F. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide all paint and coating products used in any individual system from the same manufacturer; no exceptions.

B. Paints:

1. Behr Process Corporation: www.behr.com/#sle.

2. Comex Group (Color Wheel, Frazee, General Paint, Kwal, or Parker): www.thecomexgroup.com.

3. Glidden Professional, a product of PPG Architectural Coatings: www.gliddenprofessional.com.

4. Benjamin Moore & Co: www.benjaminmoore.com/#sle.
5. Parker Paint Mfg Co Inc., a Comex Group company: www.parkerpaint.com.
6. PPG Paints: www.ppgpaints.com/#sle.
7. Pratt & Lambert Paints: www.prattandlambert.com/#sle.
8. Sherwin-Williams Company: www.sherwin-williams.com/#sle. (Basis of Design)
9. Miller Paint; www.millerpaint.com.

C. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PAINTS AND COATINGS - GENERAL

A. Paints and Coatings: Ready mixed, unless intended to be a field-catalyzed coating.

1. Provide paints and coatings 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.
2. Supply each coating material in quantity required to complete entire project's work from a single production run.
3. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.

B. Primers: As follows unless other primer is required or recommended by manufacturer of top coats; where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.

1. Products:

C. Volatile Organic Compound (VOC) Content:

1. Provide coatings that comply with the most stringent requirements specified in the following:
   a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

2.03 PAINT SYSTEMS - EXTERIOR

A. All Exterior Surfaces Indicated to be Painted, Unless Otherwise Indicated: Including stucco, carport columns, carport fascia / gutters / downspouts, exposed steel at canopies.

1. Preparation as specified by manufacturer.

2. Two top coats and one coat primer recommended by manufacturer.

B. Paint WE-TR-CL - Wood, Transparent, UV protection Clear

1. One coat sealer.

2. Satin: One coat of varnish.

C. Paint CE-OP-2L - Masonry/Concrete, Opaque, Latex, 2 Coat:

1. One coat of latex primer sealer.

2. Flat: One coat of latex enamel; TBD.

D. Paint ME-OP-3L - Ferrous Metals, Unprimed, Latex, 3 Coat:

1. One coat of latex primer.

2. Gloss: Two coats of latex enamel.

3. Semi-gloss: Two coats of latex enamel.

E. Paint MgE-OP-3L - Galvanized Metals, Latex, 3 Coat:

1. One coat galvanize primer.

2. Gloss: Two coats of latex enamel.

3. Semi-gloss: Two coats of latex enamel.

F. Paint E-Pav - Pavement Marking Paint:

1. Yellow: Two coats, with reflective particles .

2. White: Two coats, with reflective particles .

2.04 PAINT SYSTEMS - INTERIOR

A. All Interior Surfaces Indicated to be Painted, Unless Otherwise Indicated: Including gypsum board, concrete masonry, and uncoated steel.

1. Two top coats and one coat primer.

2. Primer(s): As recommended by manufacturer of top coats.

B. Paint WI-OP-3L - Wood, Opaque, Latex, 3 Coat:

1. One coat of latex primer sealer.

2. Gloss: Two coats of latex enamel.
3. Semi-gloss: Two coats of latex enamel.
4. Eggshell: Two coats of latex enamel.

C. Paint WI-TR-V - Wood, Transparent, Varnish, No Stain:

1. One coat sealer.
2. Gloss: One coat of varnish.
3. Satin: One coat of varnish.
4. Flat: One coat of varnish.

D. Paint WI-TR-VS - Wood, Transparent, Varnish, Stain:

1. Filler coat (for open grained wood only).
2. One coat of stain.
3. One coat sealer .
4. Gloss: One coat of varnish.
5. Satin: One coat of varnish.
6. Flat: One coat of varnish.

E. Paint CI-OP-3A - Concrete/Masonry, Opaque, Waterborne Alkyd, 3 Coat:

1. One coat of block filler.
2. Semi-gloss: Two coats of alkyd enamel.
3. Flat: Two coats of alkyd enamel.

F. Paint CI-OP-3L - Concrete/Masonry, Opaque, Latex, 3 Coat:

1. One coat of block filler.
2. Semi-gloss: Two coats of latex enamel.
3. Flat: Two coats of latex enamel.

G. Paint MI-OP-3L - Ferrous Metals, Unprimed, Latex, 3 Coat:

1. One coat of latex primer.

2. Gloss: Two coats of latex enamel.
3. Semi-gloss: Two coats of latex enamel.

H. Paint MgI-OP-3L - Galvanized Metals, Latex, 3 Coat:

1. One coat galvanize primer.
2. Gloss: Two coats of latex enamel.
3. Semi-gloss: Two coats of latex enamel.

I. Paint MaI-OP-3L - Aluminum, Unprimed, Latex, 3 Coat:

1. One coat etching primer.
2. Gloss: Two coats of latex enamel.
3. Semi-gloss: Two coats of latex enamel.

J. Paint CI-OP-3E - Concrete/Masonry, Epoxy Enamel, 3 Coat:

1. One coat of catalyzed epoxy primer.
2. Gloss: Two coats of catalyzed epoxy enamel.

K. Paint GI-OP-3L - Gypsum Board/Plaster, Latex, 3 Coat:

1. One coat of alkyd primer sealer.
2. Gloss: Two coats of latex enamel.
3. Semi-gloss: Two coats of latex enamel.
4. Eggshell: Two coats of latex enamel.
5. Flat: Two coats of latex enamel.

L. Paint GI-OP-3LA - Gypsum Board/Plaster, Latex-Acrylic, 3 Coat:Very Low or No VOC

1. One coat of alkyd primer sealer.
2. Gloss: Two coats of latex-acrylic enamel.
3. Semi-gloss: Two coats of latex-acrylic enamel.
4. Eggshell: Two coats of latex-acrylic enamel.
5. Flat: Two coats of latex enamel-acrylic.

2.05 ACCESSORY MATERIALS

A. Accessory Materials: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required to achieve the finishes specified whether specifically indicated or not; commercial quality.

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. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

D. Test shop-applied primer for compatibility with subsequent cover materials.

E. 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. Gypsum Wallboard: 12 percent.
2. Plaster and Stucco: 12 percent.
3. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
4. Interior Wood: 15 percent, measured in accordance with ASTM D4442.
5. Exterior Wood: 15 percent, measured in accordance with ASTM D4442.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to coating 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. 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. Concrete and Unit Masonry Surfaces to be Painted: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.

G. Gypsum Board Surfaces to be Painted: Fill minor defects with filler compound. Spot prime defects after repair.

H. Plaster Surfaces to be Painted: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.

I. Galvanized Surfaces to be Painted: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.

J. Uncorroded Uncoated Steel and Iron Surfaces to be Painted: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Prime paint entire surface; spot prime after repairs.

K. Shop-Primed Steel Surfaces to be Finish Painted: 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.

L. Interior 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.

M. Interior Wood Surfaces to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats. Prime concealed surfaces with gloss varnish reduced 25 percent with thinner.

N. 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.

O. Exterior Wood to Receive Transparent Finish: Remove dust, grit, and foreign matter; seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes with tinted exterior calking compound after sealer has been applied. Prime concealed surfaces.

P. Glue-Laminated Beams: Prior to finishing, wash surfaces with solvent, remove grease and dirt.

3.03 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. 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.

C. Apply products in accordance with manufacturer's instructions.

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.

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. Wood to Receive Transparent Finishes: Tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.

I. 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 finished coatings until completion of project.

B. Touch-up damaged coatings after Substantial Completion.

END OF SECTION 09 90 00

SECTION 10 11 00
VISUAL DISPLAY UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Glass markerboards.

1.02 RELATED REQUIREMENTS

A. Section 10 22 39 - Folding Panel Partitions: Installation of visual display boards on operable partitions.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's data on glass markerboard, tackboard surface covering, trim, and accessories.

C. Shop Drawings: Indicate wall elevations, dimensions, joint locations , special anchor details.

D. Maintenance Data: Include data on regular cleaning, stain removal .

1.04 QUALITY ASSURANCE

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

1.05 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide five year warranty for markerboard to include warranty against discoloration due to cleaning, crazing or cracking, and staining.

PART 2 PRODUCTS

2.01 VISUAL DISPLAY UNITS

A. Magnetic Glass Markerboards:

1. Manufacturers:

    a. Egan Visual Products, www.egan.com

2. Glass: Laminated, low iron, 1/4 inch thick, with bevel edges and radiused corners, laminated to steel backing sheet for use with magnets. Coated or treated for use as dry erase board or projection surface.

3. Glass Finish: As selected from manufacturer's full range.
4. Steel Backing Sheet Thickness: 24 gauge, 0.0239 inch .
5. Size: As indicated on drawings.
6. Mounting: Concealed Z clips.
7. Accessories: Provide magnetic marker tray and magnetic marker holder.
8. Products:
    a. Egan Visual Corporation; Egan Visual GlassBoards: www.egan.com/#sle.

2.02 MATERIALS

A. Float Glass: Provide float-glass-based glazing unless otherwise indicated.
    1. Thickness: As indicated.

B. Steel Sheet Backing: 28 gauge, 0.0149 inch, galvanized.

C. Adhesives: Type used by manufacturer.

2.03 ACCESSORIES

A. Marker Tray: Aluminum, manufacturer's standard profile, 12", magnetic mount, same finish as frame.

B. Mounting Brackets: Concealed.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that internal wall blocking is ready to receive work and positioning dimensions are as indicated on shop drawings.

3.02 INSTALLATION

A. Install boards in accordance with manufacturer's instructions.

B. Secure units level and plumb.

C. Carefully cut holes in boards for thermostats, wall switches, and devices.

3.03 CLEANING

A. Clean board surfaces in accordance with manufacturer's instructions.

3.04 SCHEDULE

A. Located one single Egan Neo-magnet ONETRAY accessory per room if there are two or more markerboards.

END OF SECTION 10 11 00

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SECTION 10 12 00
DISPLAY CASES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Recessed display cases.

B. Surface-mounted display cases.

1.02 REFERENCE STANDARDS

A. ASTM A555/A555M - Standard Specification for General Requirements for Stainless Steel Wire and Wire Rods.

B. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

C. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass.

PART 2 PRODUCTS

2.01 DISPLAY CASES

2.02 COMPONENTS

A. Wood Case Construction: 7 inch wide, 3/4 inch tongue and groove wood planks. Finish: as indicated in drawings.

B. Glazed Hinged Doors:

1. 1/2 inch clear tempered frameless glass.

2. Hinges: As indicated on drawings..

3. Lock: As indicated on drawings.

C. Glass Shelves:

1. 3/8 inch clear tempered glass with flat-polished edges.

2. Shelf Depth: As indicated on drawings.

D. Cable Display Systems: Sizes and configurations indicated on drawings.

1. Manufacturers:

a. Nova Display Systems, Inc: www.novadisplay.com/#sle.

2. Description:

    a. Tensioned cable display system used to support shelving from ceilings and _____ with the following components:

        1) Tensioned Fittings: Top and bottom fixed piers.

        2) Wire Cable: 7x7 construction.

            (a) Stainless Steel: ASTM A555/A555M; ASTM A666, Type 304 or Type 316.

2.03 MATERIALS

A. Wood: Solid wood planks, 3/4 inch thick.

B. Heat-Strengthened and Fully Tempered Glass: ASTM C1048, Kind FT.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Refer to drawings for display case mounting heights.

C. Provide mitered and wrapped hairline joints for all trims.

END OF SECTION 10 12 00

SECTION 10 14 16
PLAQUES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Plaques.

1.02 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's product literature for each type of plaque sign, indicating style, font, foreground and background colors, locations, and overall dimensions of each sign.

C. Shop Drawings: Indicate dimensions, locations, elevations, materials, text and graphic layout, and attachment details.

1.03 QUALITY ASSURANCE

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

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Plaques:

1. A.R.K. Ramos: www.arkramos.com/#sle.
2. FASTSIGNS International, Inc: www.fastsigns.com/#sle.
3. Takeform: www.takeform.net/#sle.
4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PLAQUES

A. Metal Plaques:

1. Material: Aluminum casting.
2. Material Thickness: Manufacturer's standard.
3. Size: As indicated on drawings.
4. Text and Typeface:

a. Character Font: Helvetica, Arial, or other sans serif font.

b. Character Case: Upper case only.

c. Character Color: Contrast with background color.

5. Border Style: As selected by Architect from manufacturer's standard borders.

6. Background Texture: As selected by Architect from manufacturer's standard textures..

7. Surface Finish: As selected by Architect from manufacturer's full range.

8. Painted Background Color: As selected by Architect from manufacturer's standard background colors.

9. Protective Coating: Manufacturer's standard clear coating.

10. Mounting: Rosettes and toggle bolts.

11. Products:

a. A.R.K. Ramos; Cast Plaques: www.arkramos.com/#sle.

b. Substitutions: See Section 01 60 00 - Product Requirements.

B. Metal Plaques:

1. Material: Aluminum sheet, flat, etched.

2. Material Thickness: Manufacturer's standard.

3. Size: As indicated on drawings.

4. Text and Typeface:

a. Character Font: Helvetica, Arial, or other sans serif font.

b. Character Case: Upper case only.

5. Border Style: As selected by Architect from manufacturer's standard borders.

6. Background Texture: As selected by Architect from manufacturer's standard textures..

7. Surface Finish: As selected by Architect from manufacturer's full range.

8. Painted Background Color: As selected by Architect from manufacturer's standard background colors.

9. Protective Coating: Manufacturer's standard clear coating.

10. Products:

    a. A.R.K. Ramos; Etched Plaques: www.arkramos.com/#sle.

    b. Substitutions: See Section 01 60 00 - Product Requirements.

C. Glass Plaques:

1. Material Thickness: 1/8 inch, minimum.

2. Size: As indicated on drawings.

3. Text and Typeface:

    a. Character Font: Helvetica, Arial, or other sans serif font.

    b. Character Case: Upper case only.

    c. Character Color: Contrast with background color.

4. Background Finish: Clear.

5. Protective Coating: Manufacturer's standard clear coating.

6. Mounting: Aluminum pegs, anodized.

7. Products:

    a. Takeform; www.takeform.net/#sle.

    b. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 ACCESSORIES

A. Concealed Screws: Noncorroding metal; stainless steel, galvanized steel, chrome plated, or other.

B. Exposed Screws: Solid brass.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install with horizontal edges level.

C. Protect from damage until Date of Substantial Completion; repair or replace damaged items.

END OF SECTION 10 14 16

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SECTION 10 14 19
DIMENSIONAL LETTER SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Dimensional letter signage.

B. Illumination system.

1.02 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code.

B. UL 879 - Electric Sign Components.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's product literature for each type of dimensional letter sign, indicating style, font, colors, locations, and overall dimensions of each sign.

C. Shop Drawings:

1. Include dimensions, locations, elevations, materials, text and graphic layout, and attachment details.

2. Show locations of electrical service connections.

3. Include diagrams for power, signal, and control wiring.

D. Selection Samples: Where materials, colors, and finishes are not specified, submit two sets of selection charts or chips.

E. Manufacturer's Installation Instructions: Include installation templates and attachment devices.

F. Manufacturer's qualification statement.

1.04 QUALITY ASSURANCE

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

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Dimensional Letter Signs:

1. A.R.K. Ramos: www.arkramos.com/#sle.
2. CityScapes Inc: www.cityscapesinc.com/#sle.
3. FASTSIGNS International, Inc: www.fastsigns.com/#sle.
4. Inpro Corporation: www.inprocorp.com/#sle.
5. Takeform: www.takeform.net/#sle.
6. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 DIMENSIONAL LETTERS

A. Applications: Building identification.

1. Use individual metal letters.
2. Mounting Location: Exterior as indicated on drawings.
3. Allow for total of 40 letters, height varies by location between 18 inches and 4 inches high.

B. Metal Letters - 18":

1. Material: Stainless steel sheet, fabricated reverse channel.
2. Thickness: Manufacturer's standard for letter size.
3. Letter Height: As indicated on drawings.
4. Text and Typeface:
    a. Character Font: Helvetica, Arial, or other sans serif font.
    b. Character Case: Upper case only.
5. Finish: Brushed, satin.
6. Color: As selected.
7. Mounting: As indicated on drawings.
8. Illumination System:Halo-lit reverse channel letters.
    a. Provide products that are listed and labeled as complying with UL 879, where applicable.
    b. Power: 120 V, 60 Hz, 1 phase, 15 A.
9. Products:

a. A.R.K. Ramos; Metal Letters: www.arkramos.com/#sle.

b. Substitutions: See Section 01 60 00 - Product Requirements.

C. Metal Letters - 4" :

1. Material: Stainless steel sheet, flat.

2. Thickness: Manufacturer's standard for letter size.

3. Letter Height: As indicated on drawings.

4. Text and Typeface:

a. Character Font: Helvetica, Arial, or other sans serif font.

b. Character Case: Upper case only.

5. Finish: Brushed, satin.

6. Color: As selected.

7. Mounting: As indicated on drawings.

8. Illumination System:As indicated on drawings.

a. Provide products that are listed and labeled as complying with UL 879, where applicable.

b. Power: 120 V, 60 Hz, 1 phase, 15 A.

9. Products:

a. A.R.K. Ramos; Metal Letters: www.arkramos.com/#sle.

b. Substitutions: See Section 01 60 00 - Product Requirements.

D.

2.03 ACCESSORIES

A. Concealed Screws: Noncorroding metal; stainless steel, galvanized steel, chrome plated, or other.

B. Exposed Screws: Stainless steel.

C. Electrical Components and Devices: Listed and labeled as defined in NFPA 70 by a qualified testing agency.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install with horizontal edges level.

C. Protect from damage until Date of Substantial Completion; repair or replace damaged items.

END OF SECTION 10 14 19

SECTION 10 21 13.13
METAL TOILET COMPARTMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal toilet compartments.

B. Urinal screens.

1.02 SUBMITTALS

A. See Section 01 30 00 - Administrative 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.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Toilet Compartments:

1. All American Metal Corp - AAMCO: www.allamericanmetal.com/#sle.

B. Substitutions: Section 01 60 00 - Product Requirements.

2.02 COMPONENTS

A. Toilet Compartments: Stainless steel, floor-mounted unbraced.

B. Doors, Panels, and Pilasters: Sheet steel faces, pressure bonded to sound-deadening core, corners made with corner clips or mitered, welded, and ground smooth.

1. Internal Reinforcement: Provide in areas of attached hardware and fittings. Mark locations of reinforcement for partition mounted washroom accessories.

C. Door and Panel Dimensions:

1. Thickness: 1 inch.

2. Door Width: 24 inches.

3. Door Width for Handicapped Use: 36 inch, out-swinging, unless noted otherwise.

4. Height: 63-1/2 inches.

D. Urinal Screens: Stainless Steel, wall mounted with two panel brackets.

2.03 FINISHING

A. Color: Single color as selected.

B. Stainless Steel Compartments: No. 4 finish.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that field measurements are as indicated.

C. Verify correct spacing of and between plumbing fixtures.

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 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. Locate head rail joints at pilaster center lines.

3.03 ADJUSTING

A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch.

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 10 21 13.13

SECTION 10 22 39
FOLDING PANEL PARTITIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Top-supported folding panel partitions, horizontal opening.

1.02 REFERENCE STANDARDS

A. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

B. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).

C. ASTM C1396/C1396M - Standard Specification for Gypsum Board.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

E. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

F. ASTM E413 - Classification for Rating Sound Insulation.

G. ASTM E557 - Standard Guide for Architectural Design and Installation Practices for Sound Isolation Between Spaces Separated by Operable Partitions.

H. ASTM E596 - Standard Test Method for Laboratory Measurement of Noise Reduction of Sound-Isolating Enclosures.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene at project site seven calendar days prior to scheduled beginning of construction activities of this section to review section requirements.

1. Require attendance by representatives of installer.

2. Notify Architect four calendar days in advance of scheduled meeting date.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on partition materials, operation, hardware and accessories, electric operating components, 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. 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 the type specified and with at least three years of documented experience.

1.06 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, 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: www.modernfold.com/#sle.

2.02 FOLDING PANEL PARTITIONS - HORIZONTAL OPENING

A. Folding Panel Partitions: Side opening; paired panels; side stacking; manually operated.

B. Panel Construction:

1. Panel Properties:

a. Thickness With Finish: +/- 4 inches.

b. Width: Standard width.

c. Weight: 10 lb/sq ft.

C. Panel Finishes:

1. Facing: Vinyl coated fabric.

2. Facing: Markerboard

3. Exposed Metal Trim: Custom powder coated paint finish.

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.

E. Suspension System:

1. Track: Formed steel; 1-1/4 by 1-1/4 inch size; thickness and profile designed to support loads, steel sub-channel and track connectors, and track switches.

2. Carriers: Nylon 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. Noise Reduction Coefficient (NRC): ASTM E596, NRC of 0.65 minimum.

b. Sound Transmission Class (STC): 53 to 57 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90, on panel size of 100 sq ft.

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. Pocket Enclosures: Door, frame, and trim to match adjacent walls.

3. Pass Door: Single door, 36 inch wide by 84 inch high opening; same design and construction as panel; fit door with perimeter acoustic gaskets and concealed closer.

4. Acoustic Sealant: As recommended by partition manufacturer.

2.03 MATERIALS

A. Aluminum Extrusions: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.

B. Fire Rated Gypsum Board: ASTM C1396/C1396M, Type X, UL rated; 1/2 inch thick, maximum practical length; ends square cut, square edges.

C. Vinyl Coated Fabric: ASTM F793 Category VI, polyvinyl fluoride (PVC) finish for washability and improved flame retardance; color as selected by Architect from manufacturer's standard range.

D. Markerboard: Porcelain enamel on steel, laminated to core; color(s) as indicated.

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 of required position and parallel to the floor surface.

3.02 INSTALLATION

A. Install partition in accordance with manufacturer's instructions and ASTM E557.

B. Fit and align partition assembly and swing door(s) level and plumb.

C. Lubricate moving components.

D. Install acoustic sealant to achieve required acoustic performance.

E. 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 CLOSEOUT ACTIVITIES

A. Demonstrate operation of partition and identify potential operational problems.

END OF SECTION 10 22 39

SECTION 10 26 00
WALL AND DOOR PROTECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Corner guards.

B. Protective wall covering.

C. Door hardware protection.

1.02 RELATED REQUIREMENTS

A. Section 08 71 00 - Door Hardware: Standard protection plates and trim.

B. Section 09 72 00 - Wall Coverings: Terminating wall covering at wall and door protection.

1.03 REFERENCE STANDARDS

A. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

C. ASTM F476 - Standard Test Methods for Security of Swinging Door Assemblies.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Indicate physical dimensions, features, wall mounting brackets with mounted measurements, anchorage details, and rough-in measurements.

C. Samples: Submit samples illustrating component design, configurations, joinery, color and finish.

1. Submit two sections of corner guards, bumper rails, and protective corridor handrails, 12 inches long.

2. Submit two samples of protective wall covering and door surface protection, 6 by 6 inches square.

D. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

E. 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 Stock Materials: One package(s) of minimum 96 inches long unit of each kind of covers for corner guards, bumper rails, and protective corridor handrails.

1.05 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide 5-year manufacturer warranty for metal crash rails. Complete forms in Owner's name and register with manufacturer.

1. Failures include, but are not limited to, the following:

a. Structural failures or internal connection failures.

b. Deterioration of materials beyond that expected of normal use, as intended by manufacturer.

C. Installer Warranty: Provide 5-year warranty for metal crash rails commencing on Date of Substantial Completion. Complete forms in Owner's name and register with installer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Corner Guards:

1. Construction Specialties, Inc: www.c-sgroup.com/#sle.

2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Protective Wall Covering:

1. Construction Specialties, Inc; Acrovyn High-Impact Wall Covering: www.c-sgroup.com/#sle.

C. Metal Door, Frame, and Knob/Lever Protection:

1. Hiawatha, Inc, an Activar Construction Products Group company; _____: www.activarcpg.com/hiawatha/#sle.

2.02 PERFORMANCE CRITERIA

A. Impact Strength: Unless otherwise noted, provide protection products and assemblies that have been successfully tested for compliance with applicable provisions of ASTM D256 and/or ASTM F476.

2.03 PRODUCT TYPES

A. Corner Guards - Flush Mounted:

1. Material: Type 304 stainless steel, No. 4 Satin finish, 14,18,20 gauge, 0.063 inch thick.

2. Surface Burning Characteristics: Provide assemblies with flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.

3. Width of Wings: 3 1/2 inches.
4. Corner: Radiused.
5. Corner Angle: 90 degree; 105 degree.
6. Color: As selected from manufacturer's standard colors.
7. Length: One piece.
8. Profile: "L" & "U".

B. Corner Guards - Surface Mounted:

1. Material: Type 304 stainless steel, No. 4 finish, 16 gauge, 0.631 inch thick.
2. Surface Burning Characteristics: Provide assemblies with flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
3. Width of Wings: 3 1/2 inches.
4. Corner: Radiused.
5. Corner Angle: 90 degree; 105 degree.
6. Color: As selected from manufacturer's standard colors.
7. Length: As Indicated on Drawings.
8. Preformed end caps.
9. Profile: "L" & "U".

C. Protective Wall Covering:

1. Material: Polyethylene terephthalate (PET or PETG); PVC and PBTs-free.
2. Thickness: 0.040 inch.
3. Surface Burning Characteristics: Provide assemblies with flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
4. Color: As indicated on drawings.
5. Pattern: N/A.
6. Texture: Suede.
    a. Texture Direction: Verify in Submittals.

7. Accessories: Provide manufacturer's standard color-matched trim and moldings.
    a. Inside Corner Trim: Standard angle
    b. Outside Corner Trim: Standard angle.
8. Mounting: Adhesive.

D. Doorway Protection:

1. See Section 08 71 00 - Door Hardware for standard protective plates and trim.
2. Hardware Knob/Lever Protection: Plastic vacuum-formed shapes; manufacturer's standard size and projection.
    a. Material: High-impact acrylic-modified vinyl.
    b. Material: Polyethylene terephthalate (PET or PETG); PVC and PBTs-free.
    c. Type(s) Required: Knob and Lever.
    d. Profile: Wraparound.
    e. Profile: Universal (knob or lever) handed.
    f. Thickness: 0.125 inch.
    g. Mounting: Fasteners furnished by manufacturer. Coordinate with door materials and construction.

E. Adhesives and Primers: As recommended by manufacturer.

2.04 FABRICATION

A. Fabricate components with tight joints, corners and seams.

B. Pre-drill holes for attachment.

C. Form end trim closure by capping and finishing smooth.

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 that substrate surfaces for adhered items are clean and smooth.

3.02 INSTALLATION

A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to supporting construction.

B. Position corner guard 4 inches above finished floor to height indicated on drawings.

3.03 TOLERANCES

A. Maximum Variation From Required Height: 1/4 inch.

3.04 CLEANING

A. Clean wall and door protection items of excess adhesive, dust, dirt, and other contaminants.

END OF SECTION 10 26 00

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SECTION 10 28 00
TOILET ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Commercial toilet accessories.

B. Institutional ligature-resistant toilet accessories.

C. Utility room accessories.

1.02 RELATED REQUIREMENTS

A. Section 10 21 13.13 - Metal Toilet Compartments.

1.03 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design.

B. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

C. ASTM C1036 - Standard Specification for Flat Glass.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.

1. Include a schedule listing the room numbers and number identical to the ones on the drawing and listing the amount (or number) of each component to be furnished in each room.

C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

1.05 COORDINATION

A. Coordinate the work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Commercial Toilet, Shower, and Bath Accessories:

1. AJW Architectural Products: www.ajw.com.
2. ASI - American Specialties, Inc: www.americanspecialties.com.
3. Bobrick: www.bobrick.com
4. Bradley Corporation: www.bradleycorp.com.
5. Substitutions: Section 01 60 00 - Product Requirements.

B. Provide products of each category type by single manufacturer.

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.

B. Keys: Provide 2 keys for each accessory to Owner; master key lockable accessories.

C. Stainless Steel Sheet: ASTM A666, Type 304.

D. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.

E. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.

2.03 FINISHES

A. Stainless Steel: Satin finish, unless otherwise noted.

B. Back paint components where contact is made with building finishes to prevent electrolysis.

2.04 TOILET ROOM ACCESSORIES

A. Combination Toilet Paper Dispenser/Seat Cover Dispenser /Sanitary Napkin Disposal: Double roll, Partition mounted, stainless steel

1. Product: B30919 or B-30929, depending on left/right side configuration, manufactured by Bobrick.

B. Combination Toilet Paper Dispenser/Seat Cover Dispener/Sanitary Napkin Disposal: Double roll, recessed, stainless steel

1. Product: B-3091 or B-3092, depending on left/right side configuration, manufactured by Bobrick.

C. Paper Towel Dispenser: Folded paper type, stainless steel, surface-mounted, with viewing slots on sides as refill indicator and tumbler lock.

1. Capacity: 400 C-fold minimum.

2. Products:

    a. B9262, manufactured by Bobrick.

D. Combination Towel Dispenser/Waste Receptacle: Recessed with projecting waste receptacle, stainless steel; seamless wall flanges, continuous piano hinges, tumbler locks on upper and lower doors.

1. Towel dispenser capacity: 8" diameter towel roll.

2. Waste receptacle capacity: 12 gallons.

E. Automated Soap Dispenser: Liquid soap dispenser, deck-mounted on vanity, with container concealed below deck; stainless steel with bright polished finish.

1. Minimum Capacity: 32 ounces.

2. Power: AC power adapter.

3. Products:

    a. B-86 Series, manufactured by Bobrick.

F. Soap Dispenser: Liquid soap dispenser, wall-mounted, surface, with stainless steel cover and horizontal stainless steel tank and working parts; push type soap valve, check valve, and window gauge refill indicator, tumbler lock.

1. Products:

    a. B-4112 manufactured by Bobrick.

G. Mirrors: Stainless steel framed, 1/4 inch thick annealed float glass; ASTM C1036.

1. Annealed Float Glass: Silvering, protective and physical characteristics in compliance with ASTM C1503.

2. Size: As shown on the drawings..

H. Grab Bars: Stainless steel, smooth surface.

1. Standard Duty Grab Bars:

    a. Push/Pull Point Load: 250 pound-force, minimum.

    b. Dimensions: 1-1/4 inch outside diameter, minimum 0.05 inch wall thickness, exposed flange mounting, 1-1/2 inch clearance between wall and inside of grab bar.

    c. Length and Configuration: As indicated on drawings.

    d. Products:

1) B-6806, manufactured by Bobrick.

I. Combination Sanitary Napkin/Tampon Dispenser with Disposal: Stainless steel, semi-recessed.

1. Door: Seamless 0.05 inch door with returned edges and tumbler lock.

2. Cabinet: Fully welded, 0.03 inch thick sheet.

3. Operation: No charge.

4. Products:

a. B-47064, manufactured by Bobrick.

2.05 INSTITUTIONAL SECURITY AND LIGATURE-RESISTANT TOILET AND BATH ACCESSORIES

A. Toilet Paper Holder: Single roll, recessed unit with beveled wall flange, satin finish stainless steel, spring-loaded spindle button type for standard toilet paper rolls. Install with tamper-resistant screws.

B. Paper Towel Holder: Folded paper type, single bay, satin finish stainless steel, surface-mounted, with open bays as refill indicators. Install with tamper-resistant screws.

1. Capacity: 250 C-fold minimum per bay.

C. Grab Bars: Type 304 stainless steel, smooth surface with closure plate.

1. Standard Duty Grab Bars:

a. Push/Pull Point Load: 250 pound-force, minimum.

b. Dimensions: 1-1/2 inch outside diameter, minimum 0.05 inch wall thickness, 1-1/2 inch clearance between wall and inside of grab bar; 14 gauge stainless steel "L" shaped closure plate with wall mounting flange welded to bottom of tube to prevent ligature. Install grab bar and closure plate with tamper-resistant screws through grab bar circular mounting flange and wall flange of flat closure.

c. Finish: Satin.

d. Length and Configuration: As indicated on drawings.

2.06 SHOWER ACCESSORIES

A. Shower Curtain Rod: Stainless steel tube, 1 inch outside diameter, 0.04 inch wall thickness, satin-finished, with 3 inch outside diameter, minimum 0.04 inch thick satin-finished stainless steel flanges, for installation with exposed fasteners.

B. Shower Curtain:

1. Material: Opaque vinyl, 0.008 inch thick, matte finish, with antibacterial treatment, flameproof and stain-resistant.

2. Size: 48 by 72 inches, hemmed edges.

3. Grommets: Stainless steel; pierced through top hem on 6 inch centers.

4. Color: White.

5. Shower Curtain Hooks: Chrome-plated or stainless steel spring wire designed for snap closure.

C. Folding Shower Seat: Wall-mounted surface; welded tubular seat frame, structural support members, swing-down legs, hinges, and mechanical fasteners of Type 304 stainless steel, L-shaped, right hand seat.

1. Seat: Teakwood slats secured to supporting frame members with stainless steel screws. Ease edges of each slat.

2. Size: ADA Standards compliant.

D. Wall-Mounted Soap Dish: Heavy duty, seamless stainless steel, surface-mounted with drain holes, without grab bar, satin finish; with concealed mechanical fastening suitable for substrate and backplate.

E. Towel Bar: Stainless steel, 3/4 inch square tubular bar; rectangular brackets, concealed attachment, satin finish.

F. Robe Hook: Heavy-duty stainless steel, single-prong, rectangular-shaped bracket and backplate for concealed attachment, satin finish.

2.07 UTILITY ROOM ACCESSORIES

A. Combination Utility Shelf/Mop and Broom Holder: 0.05 inch thick stainless steel, Type 304, with 1/2 inch returned edges, 0.06 inch steel wall brackets.

1. Hooks: Two, 0.06 inch stainless steel rag hooks at shelf front.

2. Mop/broom holders: Three spring-loaded rubber cam holders at shelf front.

3. 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. For electrically-operated accessories, verify that electrical power connections are ready and in the correct locations.

D. 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.

END OF SECTION 10 28 00

SECTION 10 31 00
MANUFACTURED FIREPLACES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Manufactured steel box fireplace.

1.02 RELATED REQUIREMENTS

A. Section 26 05 83 - Wiring Connections.

1.03 REFERENCE STANDARDS

A. UL (DIR) - Online Certifications Directory.

B. UL 127 - Standard for Factory-Built Fireplaces.

1.04 SYSTEM DESCRIPTION

A. Built-in firebox, retangular shape; electric fireplace model.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide fire box cabinet dimensions, clearances required from adjacent dissimilar construction, applicable regulatory agency approvals, electrical characteristics of fan.

C. Manufacturer's Instructions: Indicate installation procedures and component installation sequence, clearances and tolerances from adjacent construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufactured Fireplaces:

1. ModernFlame, Orion Multi; www.Modernflames.com

2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 REGULATORY REQUIREMENTS

A. Comply with applicable code for clearances from adjacent materials, chimney height above roof line requirements, and unit UL approval.

B. Listed by Underwriters Laboratories Inc. (UL) as complying with UL 127.

C. Products Requiring Electrical Connection: Listed and labeled by UL (DIR) or testing firm acceptable to authorities having jurisdiction, as suitable for the purpose specified and indicated.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install unit assembly in accordance with manufacturer's instructions.

3.02 SCHEDULES

A. Room A1099 - Breakroom: 76 inches wide by 18 inches high viewing area.

END OF SECTION 10 31 00

SECTION 10 44 00
FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire extinguishers.

B. Fire extinguisher cabinets.

C. Accessories.

1.02 REFERENCE STANDARDS

A. FM (AG) - FM Approval Guide.

B. NFPA 10 - Standard for Portable Fire Extinguishers.

C. UL (DIR) - Online Certifications Directory.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide extinguisher ratings and classifications.

C. Shop Drawings: Indicate locations of cabinets and cabinet physical dimensions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fire Extinguishers:

1. Ansul, a Tyco Business; Cleanguard: www.ansul.com/#sle.
2. Pyro-Chem, a Tyco Business: www.pyrochem.com.
3. Substitutions: See Section 01 60 00 - Product Requirements.

B. Fire Extinguisher Cabinets and Accessories:

1. Ansul, a Tyco Business: www.ansul.com.
2. JL Industries, Inc: www.activarcpg.com/jl-industries.
3. Larsen's Manufacturing Co: www.larsensmfg.com.
4. Pyro-Chem, a Tyco Business: www.pyrochem.com.

5. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 FIRE EXTINGUISHERS

A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.

1. Provide extinguishers labeled by UL (DIR) or FM (AG) for purpose specified and as indicated.

B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge.

1. Class: A:B:C type.

2. Size: 10 pound.

3. Finish: Baked polyester powder coat red color.

4. Temperature range: Minus 40 degrees F to 120 degrees F.

2.03 FIRE EXTINGUISHER CABINETS

A. Cabinet Construction: Non-fire rated.

1. Formed primed steel sheet; 0.036 inch thick base metal.

B. Cabinet Configuration: Recessed type.

1. Size to accommodate accessories.

C. Door: 0.036 inch metal thickness, reinforced for flatness and rigidity with nylon catch. Hinge doors for 180 degree opening with two butt hinges.

D. Door Glazing: Acrylic plastic, clear, 1/8 inch thick, flat shape and set in resilient channel glazing gasket.

E. Finish of Cabinet Exterior Trim and Door: Baked enamel, white color stainless steel.

F. Finish of Cabinet Interior: White colored enamel.

2.04 ACCESSORIES

A. Extinguisher Brackets: Formed steel, chrome-plated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Place extinguishers in cabinets.

END OF SECTION 10 44 00

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SECTION 10 73 16.13
METAL CANOPIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Freestanding metal canopies:

1. Bidder designed, engineered and installed freestanding, pre-engineered metal canopies including concrete foundation, steel framing, metal roof, roof drains and leaders, fascia components, and metal ceiling and accessories for the Carport in the Secure Parking.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Concrete footings.

B. Section 07 61 00 - Sheet Metal Roofing: Canopy roof.

C. Section 07 71 23 - Manufactured Gutters and Downspouts.

D. Section 09 91 13 - Exterior Painting: Finish coating.

E. Section 09 96 00 - High-Performance Coatings: Finish coating.

F. Division 16 - Electrical: Electrical wiring and connections.

1.03 REFERENCE STANDARDS

A. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges.

B. AISC 360 - Specification for Structural Steel Buildings.

C. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures.

D. ASTM A992/A992M - Standard Specification for Structural Steel Shapes.

E. ASTM E2950 - Standard Specification for Metal Canopy Systems.

F. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification.

G. AWS D1.1/D1.1M - Structural Welding Code - Steel.

H. ITS (DIR) - Directory of Listed Products.

I. NFPA 70 - National Electrical Code.

J. UL (DIR) - Online Certifications Directory.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Submit product data sheets, including material descriptions and finishes, and preparation instructions and recommendations.

C. Shop Drawings: Prior to commencement of fabrication, submit detailed shop drawings, showing profiles, sections of components, finishes, and fastening details.

D. Design Data: Submit comprehensive structural analysis of design for the specified loads. Stamp and sign calculations by professional engineer.

E. Designer's Qualification Statement.

F. Manufacturer's Qualification Statement.

G. Erector's Qualification Statement.

H. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.

I. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

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 Project Location State.

1. Comply with applicable code for submission of design calculations as required for acquiring permits.

2. Cooperate with regulatory agency or authorities having jurisdiction (AHJ), and provide data as requested.

B. Perform steel work in accordance with AISC 303.

C. Manufacturer Qualifications: Company specializing in the manufacture of products similar to those required for this project.

1. Not less than three years of documented experience.

D. Erector Qualifications: Company specializing in performing the work of this section.

1. Not less than three years of documented experience and approved by canopy manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 74 19 - Construction Waste Management and Disposal for packaging waste requirements.

B. Deliver materials to project site ready for erection.

C. Package using methods that prevent damage during shipping and storage on site.

D. Store materials under cover and elevated above grade.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Metal Canopies: Correct defective work within a two year period after Date of Substantial Completion.

C. Finish Warranty: Provide manufacturer's one year warranty on factory finish against cracking, peeling, and blistering.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design: Steelport LLC, which is located at 8565 SW Salish Lane, Suite 140, Wilsonville, OR 97070. Tel: 503-643-7685. Email: jennifer@steelport.net; web: www.steelport.net

2.02 PRE-ENGINEERED METAL CANOPIES

A. Pre-Engineered Shop Fabricated Steel Canopy.

1. Pre-engineered steel system complying with ASTM E2950.

B. Configuration: Layout and dimensions, column layout, canopy clearance, fascia profile, and roof covering design as indicated on drawings.

1. Installation: Freestanding.

2. Structural Framing System: Steel.

3. Covering Material: Steel.

4. Drainage Concept: Water collected in decking conducted into perimeter gutters and discharged through downspouts.

C. Performance Requirements:

1. Design and fabricate metal canopy system to resist wind, snow, live, and seismic loads without failure, damage, or permanent deflection in accordance with ASCE 7:

a. Loads: In compliance with local building codes.

2. Structural Performance: Provide pre-engineered canopies, by a registered Engineer in the state of Washington. The structure must be capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated for the specific location where Canopy will be installed:.

3. Thermal Movement: Design canopy system to accommodate thermal movement caused by ambient temperature range of 120 degrees F and surface temperature range of 180 degrees F without buckling, failure of joint seals, undue stress on fasteners or other detrimental effects on assembly components.

4. Electrical Components, Devices, and Accessories: Listed and labeled by ITS (DIR), UL (DIR), or testing agency acceptable to authorities having jurisdiction and installed in compliance with NFPA 70, and marked for intended application.

2.03 SHOP FABRICATION

A. Provide a complete system ready for erection at project site.

B. Shop fabricate to the greatest extent possible; disassemble if necessary for shipping.

C. Weld steel members in accordance with AWS D1.1/D1.1M.

D. Fabricate connections for bolt, nut, and washer connectors.

2.04 FINISHES

A. Structural Steel Framing:

1. Shop Primer: Rust-inhibitive red oxide.

2. Finish Coating: As specified in Section 09 96 00.

B. Steel Decking and Roofing: Polyester baked enamel finish; color as selected from manufacturer's standard range.

C. Fascia: Polyester baked enamel finish; color as selected from manufacturer's standard range.

2.05 ACCESSORIES

A. Bird netting (By Others) - provide netting under entire structure. Color TBD

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates and site area for conditions that might prevent satisfactory installation.

B. Verify that foundation, electrical utilities, and placed anchors are in correct position.

C. Verify that bearing surfaces are ready to receive this work.

D. Do not proceed with installation until all conditions are satisfactory.

3.02 INSTALLATION - FRAMING

A. Provide for erection and wind loads. Provide temporary bracing to maintain structure plumb and in alignment until completion of erection and installation.

B. Set column base plates with non-shrink grout to achieve full plate bearing.

C. Fasten columns to anchor bolts.

D. Do not field cut or alter structural members without approval.

E. After erection, prime welds, abrasions, and surfaces not shop primed.

3.03 INSTALLATION - CANOPY COVERING

A. Install in accordance with manufacturer's instructions.

B. Fasten metal decking to metal support members, aligned level and plumb.

C. Install fascia panels, trim, and flashing.

D. Separate dissimilar metals using concealed bituminous paint.

E. Touch-up damaged finish coating using material provided by manufacturer to match original coating.

3.04 TOLERANCES

A. Maximum Variation from Level: Plus/Minus 1/8 inch.

3.05 CLEANING

A. See Section 01 70 00 - Execution and Closeout Requirements for additional requirements.

B. Clean surfaces of dust and debris; follow manufacturer's cleaning instructions for the finish used.

3.06 PROTECTION

A. Protect canopy after installation to prevent damage due to other work until Date of Substantial Completion.

END OF SECTION 10 73 16.13

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SECTION 10 75 00
FLAGPOLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aluminum Flagpoles.

1.02 REFERENCE STANDARDS

A. AASHTO M 36 - Standard Specification for Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains.

B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

C. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

D. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).

E. NAAMM FP 1001 - Guide Specifications for Design Loads of Metal Flagpoles.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on pole, accessories, and configurations.

1.04 QUALITY ASSURANCE

A. Designer Qualifications: Design flagpole foundation under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed Project Location State.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Spiral wrap flagpole with protective covering and pack in protective shipping tubes or containers.

B. Protect flagpole and accessories from damage or moisture.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Flagpoles:

1. Concord American Flagpole: www.concordamericanflagpole.com/#sle.

2. Pole-Tech Co, Inc: www.poletech.com/#sle.

3. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 FLAGPOLES

A. Flagpoles: Designed in accordance with NAAMM FP 1001

1. Material: Aluminum.

2. Design: Cone tapered.

3. Mounting: Ground mounted type.

4. Nominal Height: 30 ft; measured from nominal ground elevation.

5. Halyard: Internal type, manual winch operation.

B. Performance Requirements:

1. Wind Pressure Loading on Flagpole with Flag: Resistant without permanent deformation to 120 miles/hr wind speed, in accordance with NAAMM FP 1001; the factor of safety used is 2.5.

2.03 POLE MATERIALS

A. Aluminum: ASTM B221 (ASTM B221M) , 6063 alloy , T6 temper.

2.04 ACCESSORIES

A. Finial Ball: Aluminum, 6 inch diameter.

B. Truck Assembly: Cast aluminum; revolving, stainless steel ball bearings, non-fouling.

C. Cleat Box: Aluminum, with built-in hinge and hasp assembly, attached to pole with tamper proof screws inside box.

D. Halyard: 5/16 inch diameter nylon, braided, white.

2.05 OPERATORS

A. Hand Crank: Removable type.

2.06 MOUNTING COMPONENTS

A. Foundation Tube Sleeve: AASHTO M 36, corrugated 16 gauge, 0.0598 inch steel, galvanized, depth of # inches as indicated per manufacturer.

B. Pole Base Attachment: Flush; steel base with base cover.

2.07 FINISHING

A. Metal Surfaces in Contact With Concrete: Asphaltic paint.

B. Concealed Steel Surfaces: Galvanized to ASTM A123/A123M requirements.

C. Aluminum: Mill finish.

D. Finial: Clear anodized finish.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that concrete foundation is ready to receive work and dimensions are as indicated on shop drawings.

3.02 PREPARATION

A. Coat metal sleeve surfaces below grade and surfaces in contact with dissimilar materials with asphaltic paint.

3.03 INSTALLATION

A. Install flagpole , base assembly, and fittings in accordance with manufacturer's instructions.

B. Install foundation plate and centering wedges for flagpoles base set in concrete base and fasten.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1 inch.

3.05 ADJUSTING

A. Adjust operating devices so that halyard and flag function smoothly.

END OF SECTION 10 75 00

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SECTION 11 30 13
RESIDENTIAL APPLIANCES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Breakroom appliances.

B. Evidence appliances.

C. Grooming appliances.

1.02 RELATED REQUIREMENTS

A. Section 22 10 05 - Plumbing Piping: Plumbing connections for appliances.

B. Section 26 05 83 - Wiring Connections: Electrical connections for appliances.

1.03 REFERENCE STANDARDS

A. UL (DIR) - Online Certifications Directory.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data indicating dimensions, capacity, and operating features of each piece of residential equipment specified.

C. Copies of Warranties: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Electric Appliances: Listed and labeled by UL (DIR) and complying with NEMA Standards (National Electrical Manufacturers Association).

PART 2 PRODUCTS

2.01 BREAKROOM APPLIANCES

A. Refrigerator, REF-1: Free-standing, bottom-mounted freezer, and frost-free.

1. Capacity: Total minimum storage of 14 cubic ft; minimum 6 percent freezer capacity.

2. Features: Include glass shelves, automatic icemaker, and light in freezer compartment.

3. Exterior Finish: Stainless steel, color as indicated.

4. Manufacturers:

    a. Dacor; www.dacor.com.

B. Refrigerator, REF-2: Free-standing, refrigerator column.

1. Capacity: Total minimum storage of 20 cubic ft; minimum.

2. Energy Usage: Minimum 20 percent more energy efficient than energy efficiency standards set by U.S. Department of Energy (DOE).

3. Features: Include glass shelves.

4. Exterior Finish: Stainless steel, color as indicated.

5. Manufacturers:

    a. Dacor; www.dacor.com.

C. Refrigerator, REF-3: ADA Compliant, Under Counter.

1. Capacity: Total minimum storage of 4 cubic ft; minimum.

2. Features: Include glass shelves, automatic icemaker, and light in freezer compartment.

3. Exterior Finish: Stainless steel, color as indicated.

4. Manufacturers:

    a. Summit; www.summitappliance.com.

D. Ice and Water Dispenser, IM-1: Counter-Top Unit.

1. Production: 500 lb daily minimum.

2. Features: Include Touch-free, nugget Ice..

3. Exterior Finish: Stainless steel, color as indicated.

4. Manufacturers:

    a. Scotsman; www.scotsman-ice.com.

E. Microwave, MW-1: Countertop.

1. Capacity: 2 cubic ft.

2. Power: 1100 watts.

3. Features: Include turntable.

4. Exterior Finish: Silver Stainless.
5. Manufacturers:
    a. Dacor; www.dacor.com.

F. Dishwasher, DW-1: Undercounter.

1. Controls: Solid state electronic.
2. Wash Levels: Two (2).
3. Cycles: Nine (9), including Normal, Heavy, Auto, Delicate, Preblast, Express 60, Self Clean, Plastic, Download.
4. Features: Include rinse aid dispenser, adjustable upper rack, adjustable lower rack, and ADA certified.
5. Finish: Stainless steel , color as indicated.
6. Manufacturers:
    a. Dacor; www.dacor.com.

2.02 EVIDENCE APPLIANCES

A. Refrigerator, E-REF-1: Free Standing, Reach-in.

1. Size: ____ 39inch width, 29inch depth, 78inch height minimum..
2. Features: Include Casters, stainless steel interior and exterior, six (6) adjustable heavy duty PVC coated shelves.
3. Finish: Stainless Steel , color as indicated.
4. Manufacturers:
    a. True; www.truemfg.com.

B. Freezer, E-REF-2: Free Standing, Reach-in.

1. Size: 39inch width, 29inch depth, 78inch height minimum..
2. Features: Include Casters, stainless steel interior and exterior, six (6) adjustable heavy duty PVC coated shelves.
3. Finish: Stainless Steel , color as indicated.
4. Manufacturers:

a. True; www.truemfg.com.

2.03 GROOMING APPLIANCES

A. Dog Bathing Station: Free Standing.

1. Size: 62inch.

2. Features: Include Ramp with rubber mats, soap box, shower head with bracket, removeable drain filter .

3. Finish: 304 Stainless Steel.

4. Manufacturers:

a. Vevor; www.Vevor.com.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify utility rough-ins are provided and correctly located.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Anchor built-in equipment in place.

3.03 CLEANING

A. Remove packing materials from equipment and properly discard.

B. Wash and clean equipment.

END OF SECTION 11 30 13

SECTION 12 24 00
WINDOW SHADES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior manual roller shades.

1.02 REFERENCE STANDARDS

A. WCMA A100.1 - Standard for Safety of Window Covering Products.

1.03 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets, including materials, finishes, fabrication details, dimensions, profiles, mounting requirements, and accessories.

B. Shop Drawings: Include shade schedule indicating size, location and keys to details, head, jamb and sill details, mounting dimension requirements for each product and condition, and operation direction.

C. Verification Samples: Minimum size 6 inches square, representing actual materials, color and pattern.

1.04 QUALITY ASSURANCE

1.05 MOCK-UP

A. Mock-Up: Provide full size mock-up of window shade system complete with selected shade fabric including example of seams and batten pockets when applicable.

1. Full-sized mock-up may become part of the final installation.

1.06 WARRANTY

A. Provide manufacturer's warranty from Date of Substantial Completion, covering the following:

1. Shade Hardware: 10 years.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Interior Manually Operated Roller Shades:

1. MechoShade Systems LLC: www.mechoshade.com/#sle.

2.02 ROLLER SHADES

A. General:

1. Provide shade system components that are easy to remove or adjust without removal of mounted shade brackets.

2. Provide shade system that operates smoothly when shades are raised or lowered.

B. Roller Shades:

1. Basis of Design: MechoShade Systems LLC: www.mechoshade.com.

2. Description - Interior Roller Shades: As indicated on drawings roller, manually operated fabric window shade system complete with mounting brackets, roller tubes, hembars, hardware, and accessories.

   a. Mounting: As indicated on drawings.

   b. Size: As indicated on drawings.

   c. Fabric: As indicated in drawings

3. Brackets and Mounting Hardware: As recommended by manufacturer for mounting indicated and to accommodate shade fabric roll-up size and weight.

   a. Double Roller Brackets: Configured for light-filtering and room-darkening shades in one opening.

      1) Light-Filtering Fabric: Room-side of opening.

      2) Room-Darkening Fabric: Glass-side of opening.

4. Roller Tubes: As required for type of shade operation.

   a. Size: As recommended by manufacturer; selected for suitability for installation conditions, span, and weight of shades.

5. Hembars: Designed to maintain bottom of shade straight and flat.

   a. Style: Full wrap fabric covered bottom bar, flat profile with heat sealed closed ends.

6. Manual Operation for Interior Shades:

   a. Drive Chain: Continuous loop, beaded ball chain with restraining device, 95 lb minimum breaking strength; comply with WCMA A100.1. Provide upper and lower limit stops.

7. Accessories:

   a. Fascia: Extruded aluminum, size as required to conceal shade mounting, attachable to brackets without exposed fasteners; clear anodized finish.

      1) Color: Black.

2) Profile: Square.

b. End Caps: Provide manufacturer's standard end caps to cover exposed ends of brackets.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions and approved shop drawings, using mounting devices as indicated.

B. Adjust level, projection, and shade centering from mounting bracket. Verify there is no telescoping of shade fabric. Ensure smooth shade operation.

END OF SECTION 12 24 00

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SECTION 12 36 00
COUNTERTOPS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Countertops for architectural cabinet work.

B. Wall-hung counters and vanity tops.

1.02 RELATED REQUIREMENTS

A. Section 06 41 00 - Architectural Wood Casework.

B. Section 12 31 00 - Manufactured Metal Casework.

C. Section 12 32 00 - Manufactured Wood Casework.

D. Section 22 40 00 - Plumbing Fixtures: Sinks.

1.03 REFERENCE STANDARDS

A. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition.

C. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards.

D. ISFA 3-01 - Classification and Standards for Quartz Surfacing Material.

E. NEMA LD 3 - High-Pressure Decorative Laminates.

F. NSI (DSDM) - Dimensional Stone Design Manual, Version VIII.

G. PS 1 - Structural Plywood.

H. SEFA 3 - Laboratory Work Surfaces.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative 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. Verification Samples: For each finish product specified, minimum size 6 inches square, representing actual product, color, and patterns.

E. Test Reports: Chemical resistance testing, showing compliance with specified requirements.

F. Installer's qualification statement.

G. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

1.05 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.

PART 2 PRODUCTS

2.01 COUNTERTOPS

A. Quality Standard: See Section 12 31 00.

B. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

C. Quality Standard: SEFA 3 for laboratory worksurfaces.

D. Stainless Steel Countertops: , Type 304, stainless steel sheet; 16 gauge, 0.0625 inch nominal sheet thickness.

1. Finish: 4B satin brushed finish.

2. Edge and Backsplash Sink Details: As indicated on drawings.

E. Natural Quartz and Resin Composite Countertops: Sheet or slab of natural quartz and plastic resin over continuous substrate.

1. Flat Sheet Thickness: 1-1/4 inch, minimum.

2. Natural Quartz and Resin Composite Sheets, Slabs and Castings: Complying with ISFA 3-01 and NEMA LD 3; orthophthalic polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard stone fabrication tools; no surface coating; color and pattern consistent throughout thickness.

a. Factory fabricate components to the greatest extent practical in sizes and shapes indicated; comply with NSI (DSDM).

b. Finish on Exposed Surfaces: Polished.

c. Color and Pattern: As indicated on drawings.

3. Other Components Thickness: 3/4 inch, minimum.

4. Back and End Splashes: Same sheet material, square top; minimum 4 inches high.

F. Natural Quartz and Resin Composite Wall Panels: Sheet or slab of natural quartz and plastic resin over continuous substrate.

1. Flat Sheet Thickness: 1/2 inch thick.

2. Natural Quartz and Resin Composite Sheets, Slabs and Castings: Complying with ISFA 3-01 and NEMA LD 3; orthopthalic polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard stone fabrication tools; no surface coating; color and pattern consistent throughout thickness.

a. Factory fabricate components to the greatest extent practical in sizes and shapes indicated; comply with NSI (DSDM).

b. Finish on Exposed Surfaces: Polished.

2.02 MATERIALS

A. Plywood for Supporting Substrate: PS 1 Exterior Grade, A-C veneer grade, minimum 5-ply; minimum 3/4 inch thick; join lengths using metal splines.

B. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.

2.03 ACCESSORIES

A. Fixed Top-Mounted Countertop Support Brackets:

1. Material: Steel.

2. Finish: Manufacturer's standard, factory-applied, textured powder coat.

3. Color: Black.

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 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, unless otherwise indicated.

C. Stainless Steel: Fabricate tops up to 144 inches long in one piece including nosings and back and end splashes; accurately fitted mechanical field joints in lengths over that dimension are permitted.

1. Weld joints; grind smooth and polish to match.

2. Provide stainless steel hat channel stiffeners, welded or soldered to underside, where indicated on drawings.

3. Provide wall clips for support of back/end splash turndowns.

4. Sound Deadening: Apply water resistant, fire resistant sound deadening mastic to entire bottom surface.

D. Wall-Mounted Counters: Provide skirts, aprons, brackets, and braces as indicated on drawings, finished to match.

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 INSTALLATION

A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.

B. Attach stainless steel countertops using stainless steel fasteners and clips.

C. Apply sealer products in accordance with manufacturer's written instructions.

D. Seal joint between back/end splashes and vertical surfaces.

3.03 TOLERANCES

A. Variation From Horizontal: 1/8 inch in 10 feet, maximum.

B. Offset From Wall, Countertops: 1/8 inch maximum; 1/16 inch minimum.

C. Field Joints: 1/8 inch wide, maximum.

3.04 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 12 36 00

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SECTION 12 93 13
BICYCLE RACKS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Indoor bicycle racks.

1.02 RELATED REQUIREMENTS

1.03 PRICE AND PAYMENT PROCEDURES

A. See Section 01 23 00 - Alternates, for product alternatives affecting this section.

1.04 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.

B. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

D. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative 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. Installation methods.

C. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Handle racks and accessories with sufficient care to prevent scratches and other damage to the finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Indoor Bicycle Racks:

1. Ground Control Systems; VR2 Offset: www.groundcontrolsystems.com/#sle.

2. Saris Infrastructure; Vertical Bike Rack: www.sarisinfrastructure.com/#sle.

3. RubberMaid; Fast Track: www.rubbermaid.com.

4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 BICYCLE RACKS AND ACCESSORIES

A. Basis of Design: Fast Track manufactured by RubberMaid

1. Indoor Bicycle Racks: Device designed for indoor storage of bicycles; allows user-provided lock to simultaneously secure one wheel and part of the frame on each bicycle parked or racked.

a. Style: Indoor, wall mounted, two level, vertical, single-sided storage rack with fixed arms and locking loops.

b. Capacity: 20 bicycles total, 10 bicycles per level.

c. Finish: Integral color.

d. Color: As selected by Architect from manufacturer's standard range.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine surfaces to receive bicycle racks and accessories..

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Do not begin installation until unsatisfactory substrates have been properly repaired.

3.02 PREPARATION

A. Ensure surfaces to receive bicycle racks and accessories are clean, flat, and level.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install bicycle racks and accessories level, plumb, square, and correctly located as indicated on drawings.

3.04 CLEANING

A. Clean installed work to like-new condition. Do not use cleaning materials or methods that could damage finish.

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 12 93 13

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SECTION 13 08 00
SEISMIC RESTRAINT FOR NON-STRUCTURAL COMPONENTS

GENERAL

1.01 SECTION INCLUDES

A. Provide seismic restraint in accordance with the requirements of this section in order to maintain the integrity of nonstructural components of the building so that they remain safe and functional in case of seismic event.

B. Definitions: Non-structural building components are components or systems that are not part of the building's structural system whether inside or outside, above or below grade. Non-structural components of buildings include:

1. Architectural Elements: Facades that are not part of the structural system and its shear resistant elements; cornices and other architectural projections and parapets that do not function structurally; glazing; nonbearing partitions; suspended ceilings; stairs isolated from the basic structure; cabinets; bookshelves; medical equipment; elevators; and storage racks.

2. Electrical Elements: Power and lighting systems; substations; switchgear and switchboards; auxiliary engine-generator sets; transfer switches; motor control centers; motor generators; selector and controller panels; fire protection and alarm systems; special life support systems; and telephone and communication systems.

3. Mechanical Elements: Heating, ventilating, and air-conditioning systems; medical gas systems; plumbing systems; sprinkler systems; pneumatic systems; boiler equipment and components.

4. Transportation Elements: Mechanical, electrical and structural elements for transport systems, i.e., elevators and dumbwaiters, including hoisting equipment and counterweights.

1.02 REFERENCE STANDARDS

A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures.

B. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.

C. 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.

1.03 RELATED SECTIONS

A. Section 03 30 00 - Cast-in-Place Concrete

B. Section 04 20 00 - Unit Masonry

C. Section 05 12 00 - Structural Steel Framing

D. Section 05 40 00 - Cold-Formed Metal Framing

E. Section 06 20 00 - Finish Carpentry

F. Section 06 41 00 - Architectural Wood Casework

G. Section 08 11 13 - Hollow Metal Doors and Frames

H. Section 08 62 00 - Unit Skylights

I. Section 08 80 00 - Glazing

J. Section 09 51 00 - Acoustical Ceilings

K. Section 11 40 00 - Foodservice Equipment

L. Section 14 20 10 - Passenger Elevators

M. Section 21 13 00 - Fire-Suppression Sprinkler Systems

N. Section 23 05 48 - Vibration and Seismic Controls for HVAC

O. Section 23 33 00 - Air Duct Accessories

P. Section 26 05 19 - Low Voltage Electrical

Q. Section 26 22 10, Tap-out Control Systems.

R. Section 26 32 14, Gas Engine Generators.

S. Section 26 43 00 - Surge Protective Devices

T. Section 26 51 00 - Interior Lighting

U. Section 27 15 00, Communications Horizontal Cabling.

V. Section 28 46 00 - Fire Detection and Alarm

1.04 QUALITY CONTROL

A. Shop-Drawing Preparation:

1. Have seismic-force-restraint shop drawings and calculations prepared by a professional structural engineer experienced in the area of seismic force restraints. The professional structural engineer shall be registered in the State of Project Location State.

2. Submit design tables and information used for the design-force levels, stamped and signed by a professional structural engineer registered in the State of Project Location State.

B. Coordination:

1. Do not install seismic restraints until seismic restraint submittals are approved by the Structural Engineer of Record.

2. Coordinate and install trapezes or other multi-pipe hanger systems prior to pipe installation.

1.05 SUBMITTALS

A. Submit a coordinated set of architectural components, mechanical and electrical equipment anchorage drawings prior to installation including:

1. Description, layout, and location of items to be anchored or braced with anchorage or brace points noted and dimensioned.

2. Details of anchorage or bracing at large scale with all members, parts brackets shown, together with all connections, bolts, welds etc., clearly identified and specified.

3. Numerical value of design seismic brace loads.

4. For expansion bolts, include design load and capacity if different from those specified.

5. Seal of registered structural engineer responsible for design.

B. Submit the appropriate ICC-ES evaluation reports for concrete anchors.

C. Submit the appropriate seismic certification(s) in accordance with ASCE 7 Section 13.2.2.

PRODUCTS

EXECUTION

3.01 CONSTRUCTION, GENERAL

A. The design of all components as listed following this section are to meet non-structural design criteria of the governing building code and performance objective as listed on the Structural Drawings.

B. Provide equipment supports and anchoring devices to withstand the seismic design forces, so that when seismic design forces are applied, the equipment cannot displace, overturn, or become inoperable.

C. Provide anchorages in conformance with recommendations of the equipment manufacturer and as shown on approved shop drawings and calculations.

D. Construct seismic restraints and anchorage to allow for thermal expansion.

E. Provide supports and anchoring so that, upon application of seismic forces, device remains fully connected as operable systems which will not displace sufficiently to damage adjacent or connecting equipment, or building members.

3.02 RESTRAINT AND BRACING FOR MECHANICAL AND ELETRICAL EQUIPMENT AND ASSOCIATED SYSTEMS

A. See requirements of Sections 21 00 00 through 28 00 00 for equipment, duct work, conduits, and other miscellaneous mechanical, electrical, or plumbing systems to be restrained or braced.

3.03 PARTITIONS

A. In buildings with flexible structural frames, anchor partitions to only one structural element, such as a floor slab, and separate such partition by a physical gap from all other structural elements.

B. Properly anchor masonry walls to the structure for restraint, so as to carry lateral loads imposed due to earthquake along with their own weight and other lateral forces.

3.04 CEILINGS AND LIGHTING FIXTURES

A. Independently support and laterally brace all lighting fixtures.

B. Ceilings shall be designed and installed in accordance with ASTM C636/C636M, ASTM E580/E580M, and ASCE 7 Section 13.5.6.

3.05 FACADES AND GLAZING

A. Do not install concrete masonry unit filler walls in a manner that can restrain the lateral deflection of the building frame. Provide a gap with adequately sized resilient filler to separate the structural frame from the non-structural filler wall.

B. Install attachments to structure for all façade materials as shown on construction drawings to ensure strength against applicable seismic forces at the project location.

3.06 STORAGE RACKS, CABINETS, AND BOOKCASES

A. Install storage racks to withstand earthquake forces and anchored to the floor or laterally braced from the top to the structural elements.

B. Anchor medical supply cabinets to the floor or walls and equip them with properly engaged, lockable latches.

C. Anchor filing cabinets that are more than 2 drawers high to the floor or walls, and equip all drawers with properly engaged, lockable latches.

D. Anchor bookcases that are more than 30 inches high to the floor or walls, and equip any doors with properly engaged, lockable latches.

3.07 DOORS REQUIRED FOR EMERGENCY SERVICES EGRESS

A. Apparatus bay doors and components to be designed and connected to structure to accommodate the drift limits associated with the appropriate nonstructural performance level.

END OF SECTION 13 08 00 13 08 00

SECTION 20 00 00

GENERAL MECHANICAL REQUIREMENTS

PART 1 GENERAL

1.01 GENERAL

A. Includes, but not limited to, furnishing labor, materials, and equipment for completion of work unless indicated or noted otherwise. See Division 1 for sequence of work.

B. Work indicated on the mechanical plans and in the specifications that will not be performed by this Mechanical Contractor (i.e. duct and pipe block-outs, penetrations through walls, floors, and attic, wall patching, work indicated to be performed by other Contractors, etc.) shall be coordinated with the General Contractor prior to bid. The Mechanical Contractor is responsible for identifying quantity, size, and type of work with the General Contractor. Work not coordinated will be the responsibility of the Mechanical Contractor and shall not be charged as additional cost to the Owner.

C. All work included in Division 22 and 23 shall be the responsibility of a single Mechanical Subcontractor. The scope of work identified in these sections can be performed by different subcontractors, but one must take responsibility for coordination. The subcontractor will be identified by the General Contractor at the Pre-Construction Meeting.

D. This Contractor shall obtain and pay for all permits required by State and local authorities governing the installation of the mechanical work. It is the Contractor's responsibility to contact all utility organizations serving the building, prior to bid, and to include all charges for inspections, installation of materials, equipment, and connection of all required utilities.

E. Furnish exact location of electrical connections and complete information on motor controls to Division 26, prior to bid.

F. Put heating, ventilating, cooling, and exhaust systems into full operation and continue their operation during each working day of testing and balancing.

G. Make changes in mechanical drive systems (pulleys, belts, VFD’s, motor speed, etc.) and dampers or add dampers as required for correct balance as recommended by Section 23 05 93 and at no additional cost to Owner. All equipment shall be provided with a single point electrical connection, unless otherwise indicated.

H. The drawings and specifications are complementary and what is called for in either is binding as if called for in both.

I. The ductwork and accessibility to HVAC equipment shall take precedence over all other equipment in the ceiling interstitial spaces or other mechanical areas including, but not limited to, sprinkler piping, heating piping, domestic water piping, and electrical conduit (except fire pump rooms where fire sprinkler equipment takes precedence).

1.02 RELATED SECTIONS

A. General and Supplementary Conditions and Division 1 apply to this Section.

1.03 SUBMITTALS REQUIREMENTS OF THIS SECTION

A. Access doors

1.04 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies:

1. Perform work in accordance with applicable Codes.

2. In case of differences between building codes, state laws, local ordinances, utility company regulations, and Contract Documents, the most stringent shall govern.

B. Product Approvals: See paragraphs elsewhere in this specification.

C. Warranties:

1. In addition to guarantee specified in General Conditions, guarantee heating, cooling, and plumbing systems to be free from noise in operation that may develop from failure to construct system in accordance with Contract Documents.

2. In order to be protected, secure proper guarantees from suppliers and Subcontractors.

3. Provide certificates of warranty for each piece of equipment. Clearly record "start-up" date of each piece of equipment on certificate. Include certificates as part of Operation & Maintenance Manual.

D. Manufacture: Use domestic made pipe, pipe fittings, and motors on Project.

E. Identification: Motor and equipment name plates as well as applicable UL and AGA labels shall be in place when Project is turned over to Owner.

1.05 CODES AND STANDARDS

A. Codes and agencies having jurisdictional authority over mechanical installation.

1. Washington State Energy Code – Latest Approved Edition

2. International Building Code – Latest Approved Edition

3. International Fire Code – Latest Approved Edition

4. International Mechanical Code – Latest Approved Edition

5. Uniform Plumbing Code – Latest Approved Edition

6. Local Sewer and Water District Requirements

7. State and County Department of Health

8. Local Fire Marshal

9. State Boiler Inspector

10. Puget Sound Air Pollution Control

11. State of Washington Boiler and Unfired Pressure Vessel Inspection Law

12. Occupational Safety and Health Administration (OSHA)

13. Washington Industrial Safety and Health Act (WISHA)

14. National Fire Protection Association (NFPA)

B. ASME code stamp required on all pressure vessels and relief valves. Certificate required from the State Boiler Inspector showing approval of the equipment and its installation.

1.06 SYSTEMS DESCRIPTION

A. Site Inspection:

1. Examine premises and understand the conditions which may affect performance of work of this Division before submitting proposals for this work.

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

1.07 DESIGN DRAWINGS

A. Mechanical drawings are not shop drawings and are intended to show general arrangement of piping, ductwork, equipment, etc. Follow as closely as actual building construction and work of other trades will permit.

B. Consider architectural, structural, and electrical drawings part of this work in so far as these drawings furnish information relating to design and construction of building. Architectural drawings take precedence over mechanical drawings.

C. Because of small scale of mechanical drawings, it is not possible to indicate all offsets, fittings, and accessories which may be required. The Mechanical Contractor shall include in the bid a sufficient quantity of offsets, fittings, and accessories for the size of the project, based upon the contractor's experience, necessary to facilitate mechanical utility installation. No additional costs shall be charged for additional offsets, fittings, and accessories required for installation of the mechanical utilities shown on the design drawings. Investigate structural and finish conditions affecting this work and arrange work accordingly, providing such fittings, valves, and accessories required in meeting the design conditions.

1.08 PRE-CONSTRUCTION COORDINATION MEETING

A. This Contractor is responsible to participate in coordination meetings with the General Contractor, Fire Protection Contractor, and other subcontractors needing to coordinate special requirements (such as electrical contractor, HVAC contractor, plumbing contractor, etc.)

B. Coordination meetings shall consider elevations, required clearances, and routings of all trades to assure that all trades can be installed without conflict.

C. The outcome of this coordination shall allow each system (Mechanical, Fire Protection, Plumbing, Electrical, etc.) to be installed without further conflicts for space or locations.

D. Failure to coordinate with other trades and/or existing conditions that result in the removal and re-installation of systems shall not be charged as additional costs.

1.09 COORDINATION DRAWINGS

A. Develop coordination drawings, and other pre-installation coordination methods as necessary to coordinate layouts prior to installation. Coordination drawings shall consist of overlay drawings, or other similar methods to graphically indicate plumbing, fire protection, HVAC, electrical, and other similar elements in a single location in order to identify conflicts. All elements shall be drawn to scale. Coordination drawings are not required to be submitted for approval, except where indicated otherwise in the specification. However, a minimum of one hard copy of coordination drawings shall be present on site at all times and made available to the Architect/Engineer (A/E) Representative upon request. If coordination drawings are not on file, or if systems are not installed per coordination drawings, costs and delays of required re-engineering, replacement, and other work required to correct conflicts shall be solely the Contractor's.

1. Contractor shall have the underground coordination drawings available upon request by A/E Representative within 60 days after Notice to Proceed.

2. Contractor shall have the aboveground coordination drawings available upon request by A/E Representative within 90 days after Notice to Proceed.

B. Coordination drawings shall consist of:

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

C. Where coordination drawings, or other preinstallation coordination methods show that available space is inadequate or that modifications will affect architectural elements, request information from the Architect before proceeding with work. No additional payment will be made for installation conflicts which could have been identified by coordination drawings or other pre-installation coordination methods.

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

E. Each subcontractor shall:

1. Indicate the exact name, location, and dimension of each element to be provided by that subcontractor.

2. Arrange components as necessary to avoid conflict with new and existing conditions and the work of other subcontractors as directed by the General Contractor.

3. Note requirements for sleeves, block-outs, cutting, patching, access doors, blocking, supports, inserts, and other similar items.

4. Notify the General Contractor of conflicts.

5. Approve the coordination drawings when all conflicts are resolved and an acceptable layout is obtained.

F. The General Contractor shall coordinate the layouts indicated on the coordination drawings and resolve any conflicts prior to commencement of subject portions of the work.

1.10 ELECTRICAL

A. All electrical work, conduit, boxes, and devices in connection with control wiring as required to install the control equipment as specified herein or shown on the drawings shall be furnished and installed complete by the Division 26 Contractor.

B. All electrical work performed under this Section of the Specifications shall conform to all applicable portions of the Division 26 specifications and shall conform to all governing codes.

C. All equipment shall be factory wired to a junction box for connection to electrical service.

D. Where a piece of equipment specified includes an electric motor, the motor shall be furnished and mounted by this Contractor. Motor starter, disconnect switches, and wiring from the electrical panel to the motor control devices and to the motor shall be provided by the Division 26 Contractor unless stated otherwise in the mechanical specification and/or on the mechanical drawings.

E. All motor controllers and equipment panels (including but not limited to packaged equipment, custom control panels, custom air handler panels, etc.) shall comply with NEC (including, but not limited to, marking on controllers and labeling requirements).

1.11 TEMPORARY HEATING

A. Temporary heating for facility during construction phase shall not be supplied by the permanent system installed under these specifications, unless all of the following are satisfied:

1. Product warranties shall be extended to account for construction use. Contractor shall furnish certified document stating such extended warranties.

2. Contractor shall obtain letter of approval from the Owner stating that they understand equipment expected life may be shortened due to severe usage.

3. Contractor shall be responsible for pressure cleaning all coils and vacuum cleaning all ductwork prior to occupancy.

1.12 PRODUCT HANDLING AND PROTECTION

A. Contractor is responsible for protection of all material, equipment and apparatus provided under this Section from damage, water, corrosion, freezing and dust, both in storage and when installed, until final project acceptance.

B. Provide temporary heated and sheltered storage facilities for material and equipment.

C. Completely cover motors and other moving machinery to protect from dirt and water during construction.

D. Handle and protect equipment and/or material in manner precluding unnecessary fire hazard.

E. Equipment requiring rotation and/or lubrication during storage shall have records maintained and witnessed on a monthly basis and forwarded to the Architect/Engineer prior to acceptance. Provide recorded maintenance for the O&M Manual.

F. Material or equipment damaged because of improper storage or protection will be rejected.

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

1.13 DEFINITIONS

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

B. Unfinished Spaces: Spaces used for storage or work areas, such as fan rooms, mechanical and boiler rooms, etc., where appearance is not a factor

C. Concealed Spaces: Spaces out of sight. For example, above ceilings; below floors; between double walls; furred-in areas; pipe and duct shafts; and similar spaces

D. Exposed: Open to view. For example, pipe running through a room and not covered by other construction

E. Outside: Open to view up to 5 feet beyond the exterior side of walls, above the roof, and unexcavated or crawl spaces

F. Conditioned Space: An area, room, or space within the building envelope insulation

G. Replace: Existing mechanical equipment and components shall be demolished and discarded from the project site or as directed otherwise. New mechanical equipment and components shall be installed in the area where the existing mechanical equipment and components were demolished or as indicated on the contract documents.

H. Removed: Existing mechanical equipment and components identified on the contract documents shall be taken apart, taken down, and discarded from the project site unless directed otherwise on plan. Removed items shall not be brought back to the project site for use or reinstallation.

I. Reinstall: Existing mechanical equipment and components identified on the contract documents that need to be taken down and installed in the same or new location.

1.14 ABBREVIATIONS

ADA	Americans with Disabilities Act
A/E	Architect/Engineer
AFF	Above Finish Floor
AMCA	Air Moving & Conditioning Association
ANSI	American National Standards Institute
APWA	American Public Works Association
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society of Testing & Materials
AWWA	American Water Works Association
BFF	Below Finish Floor
BHP	Brake Horsepower
BTU	British Thermal Unit
CFM	Cubic Feet per Minute
CISPI	Cast Iron Soil Pipe Institute
fpm	feet per minute
FDC	Fire Department Connection
FCO	Flush Cleanout
FD	Floor Drain
FPWH	Freeze Proof Wall Hydrant

GPM	Gallons per Minute
HP	Horsepower
IAPMO	International Association of Plumbing and Mechanical Officials
IAQ	Indoor Air Quality
IEEE	Institute of Electrical and Electronics Engineers
KW	Kilowatt
MBH	One Thousand British Thermal Units per Hour
MSS	Manufacturers Standardization Society
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NPSH	Net Positive Suction Head
PIV	Post Indicator Valve
PDI	Plumbing and Drainage Institute
per	in accordance with
POC	Point of Connection
PSI	Pounds per Square Inch Gauge Pressure
PVC	Polyvinyl Chloride
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
SP	Static Pressure
SWP	Steam Working Pressure
UL	Underwriter's Laboratories
VFD	Variable Frequency Drive
VTR	Vent Thru Roof
wg	Water Gauge (inches of water)
WP	Working Pressure
WPL	Weatherproof Louver
WQA	Water Quality Association
*	Additional abbreviations are as listed on the drawings or elsewhere in these specifications.

1.15 SCHEDULE OF VALUES

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

1. Division 22 and 23 Breakdown: Provide schedule of values for each building, broken down into labor and materials per specification section at a minimum. Further breakdown into subcategories is at the option of the Contractor, except as noted below:

a. Section 20 00 00 - General Mechanical Requirements: Provide a subcategory for “Mechanical Punchlist, Closeout and Owner Training”. The dollar value for this subcategory shall be no less than 2.25% of the total dollar value of the Division 22 and 23 work (or as indicated in Division 1, whichever is higher). The contractor shall receive payment upon completion of all Mechanical Punchlist and Closeout items and Owner Training.

B. The Contractor is advised that in addition to payments held out for retainage and project final completion (i.e. “Mechanical Punchlist, Closeout, and Owner Training”), as specified above and in Division 1, the Owner reserves the right to withhold 10% of the funds for any of the above categories until the systems (of that category) have been proven to operate as specified and have been completely tested, adjusted, and balanced.

1.16 SUBMITTAL PROCEDURES

A. All material used on the project shall be new and free of defects. The Architect and/or Engineer reserve the right to reject any material, the appearance of which has been damaged on the site or in shipment. The material shall be of pre-approved equal quality to that which is specified. Should the make and type of material differ from that specified, the Contractor may be required to submit catalog and engineering data (samples if requested) necessary to make a comparison and determine its suitability. The Contractor shall also bear the cost of all changes to any aspect of the project (electrical, mechanical, building, etc.) made necessary by any approved substitutions. Approved substitutions include those listed as approved manufacturers or approved substitutions. Tentative approval of substitute material and equipment will be made prior to bid only. Such request for approval shall be made two weeks in advance of the bid opening to allow time to assess its suitability. Failure to obtain approval prior to bid shall require the successful bidder to furnish materials and equipment only as specified herein (see paragraph 2.01, this specification).

B. Equipment submittals shall be submitted per one of the following processes as selected by the Architect/Engineer Representative and/or Owner:

1. Electronic Submittal Process:

a. The Contractor shall upload one complete PDF file of the Electronic Submittal Package to the Architect's SharePoint Site for approval. The Electronic Submittal package shall include the following:

1) All required submittals (i.e. equipment cut sheets, shop drawings, etc.) per each specification section.

2) Table of contents identifying each specification section, submittal requirement of each specification, and the manufacturer name and model number of each item submitted.

3) Index sheet for each specification section.

4) Submission of PDF files of individual specifications or equipment cuts will be automatically rejected.

5) The Contractor shall complete and upload a Submittal Information Form, in Microsoft WORD format, for the A/E team to review. The equipment submittal will not be considered "Received" nor will a review be provided until both the Electronic Submittal Package and Submittal information Form have been uploaded.

6) If the Electronic Submittal Process is not feasible for a particular submittal section (i.e. samples, certain shop drawings, recorded videos, CD's, etc.), the Contractor shall submit a request in writing to the A/E Representative to deviate from the Electronic Submittal Process. If acceptable by the A/E Representative the Contractor shall follow the Hard Copy Submittal Process for the submission.

2. Hard Copy Submittal Process:

    a. The Contractor shall submit to the Architect, for approval, complete information on all equipment and materials to be provided on the project. Provide copies as specified by Division 1 and at a minimum provide six (6) copies of the manufacturer's catalog and engineering data, shop drawings of shop fabricated equipment, and instruction data for each item included under this Section of the Specifications. The Contractor shall submit a typed, signed list including all items to be furnished on the project. The signature on the aforementioned list shall indicate that the Contractor has examined the suitability of all material and equipment with respect to compliance with these specifications. The Contractor's approval shall also indicate that physical dimensions of the equipment have been verified with the installation requirements and were found to cause no interference therewith.

    b. Furnish submittals in a hard-back, three-ring binder. The binder shall have tabs which are indexed with a Table of Contents. The Table of Contents shall correlate an index number for each individual specification number. If the equipment submittal is not bound to the Engineer's satisfaction, it may be rejected.

3. Review of submittal data by the Engineer or Architect does not relieve the Contractor of responsibility for quantities, measurements, and compliance with the intent of all contract documents.

4. Furnish submittals generally according to the list below. Individual sections may contain more specific submittal listing of the particular section labeled "Submittal Requirements." Furnish on each particular section and the following equipment:

    a. Pipe

    b. Pipe Insulation

    c. Duct Insulation and Lining

    d. Hot Water Tanks

    e. Plumbing Fixtures

    f. Valves

    g. Pipe Hangers

    h. Piping Specialties

    i. Pumps

    j. Fire Sprinkler Equipment

    k. HVAC Equipment

    l. Temperature Control Equipment and Shop Drawings

    m. Air Balance Contractor

    n. Fire Marshal Stamped and Approved Shop Drawings for Fire Sprinkler System

o. Any material found to be installed without prior approval will be required to be removed and replaced with only specified material at Contractor's cost.

p. Mechanical Drawings for the project have been developed by the Engineer using AutoCAD™ Revision 2015 software. These drawing files will be made available to the Contractor for development of shop drawings and/or "As-Builts" for a fee of $30.00 per sheet. Full payment to be made prior to release of drawing files.

1.17 OPERATION AND MAINTENANCE MANUAL FOR MECHANICAL SYSTEMS

A. Bind Operation & Maintenance Manual for Mechanical Systems in three-ring, hard-backed binder with clear plastic pocket on spine. Spine of each binder shall have the following typewritten lettering inserted:

OPERATION
AND
MAINTENANCE
MANUAL
FOR MECHANICAL SYSTEMS

B. Provide master index at beginning of Manual showing items included. Use plastic permanent tab indexes for Sections of Manual.

C. First Section shall consist of name, address, and phone number of Architect, General Contractor, and Mechanical, Plumbing, Sheet Metal, Refrigeration, Temperature control, and Electrical Subcontractors. Also include complete list of equipment installed with name, address, and phone number of each vendor.

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

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

F. Include descriptive literature (Manufacturer's catalog data) of each manufactured item. Literature shall show capacities and size of equipment used and be marked indicating each specific item with applicable data underlined.

G. Include all warranties/guarantees including extended warranties.

H. Include all start-up logs.

I. Operating Instructions shall include:

1. General description of each mechanical system.

2. Step-by-step procedure to follow in putting each piece of mechanical equipment into operation.

3. Provide schematic control diagrams for all systems. Each diagram shall show locations of start-stop switches, insertion thermostats, room thermostats, thermometers, firestats, pressure gauges, automatic valves, and refrigeration accessories. Mark correct operating settings for each control instrument on these diagrams.

4. Provide diagram for electrical control system showing wiring of related electrical control items such as firestats, fuses, interlocks, electrical switches, and relays.

5. Provide drawing of each temperature control panel identifying components on panels and their function.

J. Maintenance Instructions shall include:

1. Manufacturer's maintenance instructions for each piece of mechanical equipment installed in Project. Instructions shall include name of vendor, installation instructions, parts numbers and lists, operation instructions of equipment, and maintenance and lubrication instructions.

2. Summary list of mechanical equipment requiring lubrication showing name of equipment, location, and type and frequency of lubrication.

3. List of mechanical equipment used, indicating name, model, serial number, and name plate data of each item together with number and name associated with each system item.

1.18 COMMISSIONING

A. General Requirements: The building's systems shall be tested to ensure that control devices, components, equipment, and systems are calibrated, adjusted, and operate in accordance with the approved plans and specifications. This shall include the following:

1. Commissioning Plan

2. Systems Testing and Balancing

3. Controls Functional Performance Testing

4. Preliminary Commissioning Report

5. Post Construction Documentation

6. Final Commissioning Report

B. Commissioning Plan: A commissioning plan shall be developed by a registered design professional or approved agency and shall include at a minimum the following:

1. A detailed explanation of the design intent

2. Equipment and systems to be tested

3. Functions to be tested (for example, economizer control, discharge air temperature control, etc.)

4. Conditions under which the test shall be performed

5. Measurable criteria for acceptable performance

C. System Testing and Balancing: Provide testing and balancing as specified in Sections 23 05 93.

D. Controls Functional Performance Testing: Functional testing shall demonstrate the correct installation and operation of each component, system, and system to system intertie relationship in accordance with the plans and specifications. This demonstration is to prove operation, function, and maintenance serviceability for each of the commissioned systems. Testing shall include all modes of operation, including:

1. All modes as described in the sequence of operation

2. Performance of alarms

3. Mode of operation upon a loss of power and restored power

4. The HVAC control system shall be tested to ensure that control devices, components, equipment, and systems are calibrated, adjusted, and operate in accordance with the plans and specifications.

E. Preliminary Commissioning Report: The preliminary commissioning report, completed and certified by the registered design professional or approved agency, shall be provided to the Owner. The preliminary commissioning report shall include test procedures and results, and shall identify the following:

1. Deficiencies found during testing which have not been corrected at the time of report preparation and the anticipated date of correction.

2. Deferred tests which cannot be performed at the time of report preparation due to climatic conditions. Include the climatic conditions required for testing and the anticipated date of each deferred test.

3. Record of progress and completion of operator training.

F. Post Construction Documentation: Provide Operation and Maintenance (O&M) data, as-built record drawings, final commissioning report, and test and balance report, as specified in this section, within ninety (90) days of the date of receipt of the Certificate of Occupancy.

G. Final Commissioning Report: Provide a complete report of test procedures and results to the Engineer and the Owner. The report shall identify the following:

1. Procedures and results of all functional performance tests

2. Disposition of all deficiencies found during testing, including details of corrective measures used or proposed

H. The Contractor is responsible to submit to the code official a commissioning compliance checklist, Figure C408.1.2.1 of the WSEC, signed by the building owner.

1.19 WARRANTY

A. All warranty information shall be submitted as part of the “Operation and Maintenance Manual for Mechanical Systems” in this section.

B. All warranties for mechanical and plumbing equipment shall start upon completion of commissioning.

1.20 AS-BUILT DRAWINGS

A. The Contractor shall maintain, in addition to coordination drawings, an as-built set of prints that clearly identify all deviations from the original design. The As-Built drawings shall be drafted per one of the following methods:

1. Draft all revisions on a separate dark layer, on the coordination drawing set. The Contractor shall maintain a copy of the original coordination drawing set.

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

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

C. Drawings shall show locations of all underground pipe and duct installed by this Contractor. Underground pipes and ducts shall be shown with cross section elevations. All pipe, raceway, manholes, or lines of other trades shall be included.

D. The Contractor shall update all references to specific products to indicate products actually installed on project. This shall include, but not be limited to, air handlers, heat pumps etc.

1. Upon completion of the Division 22 and 23 Work, the Contractor shall deliver the red lined drawings and one set of neatly drafted as-built drawings on electronic media in ACAD 2015 format and PDF files to the Engineer for transmittal through the Engineer to the Owner.

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

A. Any reference to the specifications or on the drawings to any article, device, product, material, fixture, form, or type of construction by manufacturer, name, make, or catalog number shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition.

B. The manufacturers listed as Approved Manufacturers are approved to bid the project for the items indicated without obtaining prior approval. Other manufacturers desiring to bid the project require prior approval.

C. The listing of a manufacturer as an Approved Manufacturer does not necessarily mean that the products of that manufacturer are equal to those specified. The listing is only an indication of those manufacturers which may be capable of manufacturing, or have in the past manufactured, items equal to those specified, and is intended to aid the Contractor in identifying manufacturers.

D. Products provided by Approved Manufacturers shall be equal to or superior to the specified manufacturer's item in function, appearance, and quality, and shall fulfill all requirements of the plans and specifications. The Architect/Engineer shall be the final judge as to whether an item meets these requirements or not. If a manufacturer is not certain that his product meets these requirements or not, then the manufacturer shall submit data as required to obtain the Design Consultant's approval prior to bid opening.

E. The approval of a manufacturer applies to the manufacturer only and does not relieve the Contractor from the responsibility of meeting all applicable requirements of the plans and specifications.

F. Contractor shall be responsible for all costs to other trades and all revisions required in accommodating any products which are different from those specified or shown.

G. In reviewing a manufacturer for acceptance, factors considered include the following: engineering data showing item's performance, proper local representation of manufacturer, likelihood of future manufacturer's local support of product, service availability, previous installation, previous use by Owner/Engineer/Architect, and record, product quality, availability/quality of maintenance and operation data, capacity/performance compared to specified items, acoustics, items, geometry/access utility needs, and similar concerns.

H. If approval is received to use other than specified items, responsibility for specified capacities and ensuring that items to be furnished will fit space available lies with this Division.

I. If non-specified equipment is used and it will not fit job site conditions, this Division assumes responsibility for replacement with items named in Specification.

2.02 ACCESS DOORS

A. This Contractor shall be responsible for furnishing and installing flush mounted access doors in walls, ceilings, floors, and chases where the following equipment is concealed and is not accessible through same.

1. Valves (shut off, balancing, control, trap primers, etc.)

2. Dampers (control, balancing, fire, smoke, etc.)

B. Doors shall be UL listed 20 ga. cold rolled steel with concealed hinge, screwdriver operated lock and prime coated. Furnish suitable for area mounted. Provide stainless steel access doors for non-painted surfaces (i.e. tile, MDF).

C. Approved Manufacturers:

1. Milcor

2. Acudor

3. Greenheck

4. Nystrom

5. Duro Dyne

PART 3 EXECUTION

3.01 WORKMANSHIP

A. This Contractor shall provide completed systems with a neat and finished appearance. If, in the judgment of the Engineer, any portion of the work has not been performed in a workmanlike manner or is left in a rough, unfinished state, this Contractor will be required to remove, reinstall, or replace same and patch and paint surrounding surfaces in a manner acceptable to the Engineer, without increase in cost to the Owner.

3.02 FINAL INSPECTION

A. Final Inspection:

1. Prior to acceptance of the mechanical work, the Contractor shall put all mechanical systems into operation for a period of not less than 5 working days so that they may be inspected by the Architect/Engineer and the Owner's representatives.

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

3. The Contractor shall furnish adequate staff to operate the mechanical systems during inspection.

3.03 OPERATION AND MAINTENANCE TRAINING

A. Upon completion of the work, and after all tests and final inspection of the work by the Authority(s) having jurisdiction, the Contractor shall demonstrate and instruct the Owner's designated operation and maintenance personnel in the operation and maintenance of the various mechanical systems. The Contractor shall arrange scheduled instruction periods with the Owner. The Contractor's representatives shall be Superintendents or Foremen knowledgeable in each system and Supplier's Representative when so specified.

B. Scheduled instruction periods shall be:

1.	HVAC System Controls	16 Hours
2.	HVAC Equipment Maintenance	8 Hours
3.	Plumbing Equipment	4 Hours

C. The contractor shall, at a minimum, include an Owner Training sign-in sheet in the O&M Manual that indicates the start and end times of the training and the type of training provided. Owner shall sign off on the Owner training sign-in sheet to be considered complete and satisfactory to Owner.

D. Costs for time involved by Contractor shall be included in the bid.

3.04 CLOSEOUT SUBMITTALS

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

1. Completion of all punchlist items
2. Owner Training Sign-In sheet with Owner's signature
3. Permit Submittal
4. Valve Diagrams
5. Reproducible As-Built drawings delivered to Architect
6. Air Balance Report
7. Asbestos Free Statement
8. Guarantees
9. Equipment Manufacturer of all HVAC compressor units shall provide start-up logs
10. EMCS Trend Logs

3.05 PREPARATION

A. New Buildings: Each Section of this Division shall bear expense of cutting, patching, repairing, and replacing of work of other Sections required because of its fault, error, tardiness, or because of damage done by it.

B. Existing Buildings:

1. Cut carefully to minimize necessity for repairs to existing work. Do not cut beams, columns, or trusses.

2. Patch and repair walls, floors, ceilings, and roofs with materials of same quality and appearance as adjacent surfaces unless otherwise shown. Surface finishes by General Contractor.

3. Cutting, patching, repairing, and replacing pavements, sidewalks, roads, and curbs to permit installation of work of this Division is responsibility of Section installing work.

4. This work shall be scheduled such that utility services and/or existing systems for the facility are not interrupted during normal operating hours, without prior written permission of the Owner's representative. Work that is performed during normal operational hours shall not interfere with the normal function of the facility's daily operation.

5. The Mechanical Contractor shall be responsible for the removal of all existing mechanical equipment and utilities indicated to be removed on the drawings. The Mechanical Contractor shall also be responsible for the removal and reinstallation of all existing mechanical equipment and utilities that will interfere with installation and operation of any new construction indicated or required and shall be responsible for the removal of all existing mechanical equipment and utilities indicated to be abandoned that will interfere with installation and operation of any new construction indicated or required. All mechanical equipment (other than piping) to be removed shall remain the property of the Owner, and shall be transported, stored, or disposed of, as directed by the Owner. This will be at no cost to the Owner.

3.06 INSTALLATION

A. Install mechanical equipment to permit easy access for normal maintenance, and so that parts requiring periodic replacement or maintenance, (e.g., coils, heat exchanger bundles, sheaves, filters, motors, bearings, etc.) can be removed. Relocate items which interfere with access.

B. Provide access doors in equipment, ducts, and walls/ceilings as required to allow for inspection and proper maintenance.

C. Valves, damper operators, and other devices which are manually adjusted or operated shall be located so as to be easily accessible by a person standing on the floor. Any such items which are not in the open shall be made accessible through access openings in the building construction.

D. Gauges, thermometers, instrumentation, and other components which are installed to monitor equipment performance, operating conditions, etc., shall be oriented so as to be easily read by a person standing on the floor. Provide necessary brackets and hangers as needed.

E. If circumstances at a particular location make the accessible installation of an item difficult or inconvenient, the situation shall be discussed with the Architect/Engineer before installing the item in a poor access location.

F. Belts, pulleys, couplings, projecting set screws, keys, and other rotating parts which may pose a danger to personnel, shall be fully enclosed or guarded in accordance with OSHA regulations.

G. Dissimilar Metals: Provide separations between all dissimilar metals. Where not specified in another way, use 10 mil black plastic tape wrapped at point of contact or plastic centering inserts.

H. Provide offsets around all electrical panels (and similar electrical equipment) to maintain space clear above and below panel to structure and clearance of 3.5 feet directly in front of panel, except where indicated otherwise or required by NEC to be more. Such offsets are typically not shown on the drawings, but are required per this paragraph.

I. Piping Through Framing: Piping through framing shall be installed in the approximate center of the member. Where located such that nails or screws are likely to damage the pipe, a steel plate at least 1/16-inch thick shall be installed to provide protection. At metal framing, wrap piping to prevent contact of dissimilar metals. At metal and wood framing, provide plastic pipe insulators at piping penetrations through framing nearest each fixture and on at least 48-inch centers.

J. Safety Protection: All ductwork, piping, and related items installed by this Contractor that present a safety hazard (i.e., items installed at/near head height, items projecting into maintenance access paths, etc.) shall be covered (at hazardous area) with 3/4" thick elastomeric insulation and 2" wide reflective red/white striped self-sticking safety tape.

K. Equipment Access: Access to equipment is of utmost importance. Contractor shall apply extra attention to the laying out of pipe and duct routings, and in coordinating all work. Poor access to equipment will not be accepted. Contractor shall note that in essentially all areas, piping routed in ceiling space needs to run in joist space, necessitating elbows/fittings/transitions at crosses with other trades, at structural beams, and at all connections to mains and branches. Hatched areas at HVAC units indicate equipment access areas. These (and all other) access areas shall be clear of obstructions. The Mechanical Contractor is responsible to coordinate and ensure that all trades stay clear of access areas for any Division 22 and 23 furnished equipment.

L. Ensure that items to be furnished fit space available. Make necessary field measurements to ascertain space requirements including those for connections and furnish and install equipment of size and shape so final installation shall suit true intent and meaning of Contract Documents.

M. Pipe Installation: Install piping in longest reasonable lengths. The use of short lengths of pipe with multiple couplings where a single length of pipe could have been used is not acceptable.

3.07 CONCRETE BASES

A. Provide a 3-inch high "minimum" concrete base under hot water tanks. Provide 6" thick structural concrete pad for equipment located outside the building or as detailed on drawings.

3.08 ADJUSTMENT AND CLEANING

A. Properly lubricate equipment before Owner's acceptance.

B. Clean exposed piping, ductwork, equipment, and fixtures, remove debris from site. Repair all damaged finishes and leave everything in working order.

C. Remove stickers from fixtures and adjust flush valves.

3.09 PAINTING

A. Paint all exposed pieces of equipment if not factory finished or painted under the Architectural Section of these specifications. Paint shall be one coat primer and two (2) coats enamel color as directed by the Architect.

3.10 REBATES

A. Furnish vendor invoices on heat pumps to Owner after installation for power company rebates.

3.11 REQUESTS FOR INFORMATION (RFI)

A. It is our intent to provide a timely response for RFIs regarding Division 22 and 23 Work. To further expedite this process, if a suggestion can be determined or derived at by the initiator of the RFI, it is required this suggestion be supplied with the submitted RFI. If no suggestion is given where one is possible, the RFI will be returned as incomplete. RFI's will be returned to the Contractor within seven (7) business days from the time received by the Architect/Engineer Representative.

END OF SECTION 20 00 00

SECTION 21 13 15

WET PIPE AUTOMATIC SPRINKLER SYSTEMS FOR TENANT IMPROVEMENTS

PART 1 GENERAL

1.01 GENERAL

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

1. Drawings, General Conditions, and Supplementary Conditions of the Contract, including Divisions 0 and 1 Specifications apply to work of this Division.

2. Provide all material, labor, equipment, design, and services necessary to modify the existing wet pipe automatic fire protection sprinkler system for code-compliant fire protection coverage throughout the area of tenant improvement, in accordance with the required and advisory provisions of the latest edition of NFPA #13 accepted by the Authority having Jurisdiction (City of Puyallup), and project specifications, except as modified herein.

3. The Fire Protection Sprinkler System Contractor shall obtain a permit and final approval from City of Puyallup for the fire protection sprinkler system. All permits, fees for plan review, inspections, testing, etc. shall be included in the bid proposal.

4. **The Fire Protection Sprinkler System Contractor shall simultaneously submit shop drawings and manufacturer's data sheets to the local Authority Having Jurisdiction and Architect/Engineer for review and shall be approved by the Architect/Engineer prior to the purchase, fabrication, or installation of any system component as detailed in Paragraph 1.07 of Section 21 13 15.**

5. All existing standard response sprinklers are to be replaced with quick response sprinklers.

1.02 CODES AND STANDARDS

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

1. International Building Code -- Latest Adopted Edition

2. International Fire Code – Latest Adopted Edition

3. Local Fire Marshal

4. Occupational Safety and Health Administration (OSHA)

5. Washington Industrial Safety and Health Act (WISHA)

6. National Fire Protection Association (NFPA)

1.03 GENERAL SYSTEM REQUIREMENTS

A. The Fire Protection Sprinkler System Contractor shall add, relocate, and/or delete sprinklers as required in the tenant improvement areas to reflect T.I. changes including new walls, ceilings, HVAC grilles, and light locations. All sprinklers that are to be relocated shall be replaced with new sprinklers in accordance with NFPA #13 requirements.

B. The fire protection details and/or proposed pipe routing shown on the contract documents are conceptual in nature.

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

D. All HVAC grilles, electrical lights, and fire alarm devices that are to be installed at the ceiling level shall be shown on the submittal drawings to verify sprinkler placements.

E. Failure to coordinate with other trades and/or existing conditions that result in the removal and re-installation of systems shall not be charged as additional costs.

1.04 SITE INSPECTIONS OF EXISTING BUILDINGS PRIOR TO BIDDING

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

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

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

1.05 LOCATION OF SPRINKLERS

A. New sprinklers located in acoustical ceiling tiles shall be installed at center of tile.

B. New sprinklers in exposed areas shall be installed in a consistent pattern while avoiding all lights, ductwork, and structural members.

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

D. Spacing of new sprinklers shall not exceed that permitted by NFPA #13 for occupancy.

1.06 PIPE HANGER DETAILS

A. Provide pipe hanger details and seismic bracing details in strict accordance with NFPA #13 and manufacturer's literature.

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

C. For all trapeze hangars, provide a table indicating the size of the pipe to be supported, size and type of the trapeze member, section modulus of the trapeze member, distance from the structure to pipe being supported (A and B dimensions), and the section modulus required. Per NFPA #13 each component of the trapeze hanger assemble shay be sized per the sprinkler pipe being supported.

1.07 SUBMITTALS

A. Provide copies as specified by Division 1 and at a minimum provide shop drawings and manufacturer's data sheets to the Architect/Engineer for approval prior to the purchase, fabrication, or installation of any system component. Failure to receive the Architect/Engineer approval that results in reordering of material, re-fabrication of piping, removal of installed system components, and the re-installation of the fire protection system shall not be charged as additional cost to the Owner or General Contractor.

B. Shop drawings and equipment submittals for overhead fire protection systems shall be presented to the Architect / Engineer for review and approval within thirty **(30) calendar days** from the date of the Contract signing by the General Contractor.

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

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

E. Review of submittal data by the Engineer or Architect does not relieve the Fire Protection Sprinkler System Contractor of responsibility for quantities, measurements, and compliance with the intent of all contract documents.

F. Any material found to be installed without prior approval will be required to be removed and replaced with only specified material at Fire Protection Sprinkler System Contractor's cost.

G. Product substitution during installation from the approved Equipment Submittals will not be allowed and shall result in the removal and re-installation of system components at no additional cost to the Owner.

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

1. Piping
2. Fittings / Couplings
3. Sprinklers and Accessories
4. Pipe Hangers

I. Equipment submittals shall include all materials, components, and devices being installed. The items contained in the following list are typically included in a Wet Pipe Automatic Sprinkler System for Tenant Improvements installation and would require equipment submittal literature to be provided.

1. Piping
2. Fittings / Couplings
3. Sprinklers
4. Flexible Piping Serving Pendent Sprinklers

5. Pipe Hangers

6. Oversized Escutcheon Trim Rings

J. Submit all test results identified in "Part 3 – Execution" of Specification Section 21 13 15 for review and/or approval.

1.08 QUALIFICATIONS

A. Design and installation of Fire Protection Sprinkler Systems shall be in accordance with Section 212.80.018 of the “Washington State Administrative Code” (WAC).

1.09 PIPING SYSTEM LAYOUT

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

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

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

D. The shop drawings shall clearly state the scope of Contractor’s work, Contractor’s exclusions, which edition of NFPA #13 was used for the sprinkler design, pipe scheduled criteria, and current water flow information used in the pipe scheduled calculations.

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

1.10 WARRANTIES

A. In addition to the guarantee specified in General Conditions, the Fire Protection Sprinkler System Contractor shall guarantee that the fire protection systems are installed to NFPA code and approved shop drawings.

B. Provide a "Certificate of Warranty" letter at the completion of the project. The date of "Substantial Completion" shall be clearly shown on the letter indicating when the warranty period begins and the "Certificate of Warranty" letter shall be signed by the Fire Protection Sprinkler System Contractor.

C. The "Certificate of Warranty" shall be included as part of the Operation and Maintenance Manual. The date of "Substantial Completion" shall be the date indicated on the approved test certificate that was signed by the Authority Having Jurisdiction for system acceptance.

1.11 AS-BUILT DRAWINGS

A. The Fire Protection Sprinkler System Contractor shall maintain, in addition to any reference drawings, an As-Built set of drawings, which have been reproduced from the approved site set on which all deviations from the original design shall be drafted in a neat legible manner with red colored pencil.

B. The Fire Protection Sprinkler System Contractor shall update all references to specific products to indicate products actually installed on project.

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

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

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

PART 2 PRODUCTS

2.01 ABOVEGROUND PIPING SYSTEMS

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

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

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

D. **All fire protection pipe and threaded fittings shall be domestically manufactured. System components and devices shall be listed products directly from a major manufacturer, not re-labeled products**

2.02 SPRINKLER PIPE AND FITTINGS

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

1. Threaded: Black and galvanized steel pipe Schedule 40. Piping with a lesser schedule value (thinner walled pipe e.g., threadable lightwall pipe) will not be allowed for threaded or cut groove connections regardless of the corrosion resistance ratio.

2. Roll Grooved: Black and galvanized steel pipe to be either having a minimum wall thickness in accordance with Schedule 10, Schedule 40, or U.L. listed or Factory Mutual Global approved pipe having a U.L. corrosion resistance ratio equal to or greater than 1.0.

3. All fire protection piping and fittings (above-ground) shall be threaded, grooved, flanged, or welded fittings. The use of plain end, lock-type, friction type, compression type, or any other type of fitting that is plain end ("prepared end", "polished end", beveled end, "FIT" end such as Victaulic "FIT", Gruvlok "Sock-It", Victaulic "Pressfit") is not permitted.

4. Approved manufacturers are as follows:

a. Black and Galvanized Steel Pipe: AMS Tube Corporation, Bull Moose Tube Company, Charlotte Pipe and Foundry Company, North West Pipe and Casing, State Pipe and Supply Company, Wheatland Tube Company, Youngstown Tube, or prior approved equal.

b. Threaded Products: Anvil International, Ward, Youngstown Tube, or prior approved equal.

c. Grooved Products: Gruvlok, Tyco, Victaulic, or prior approved equal.

d. Factory Segmentally Welded Grooved Products: Iowa Fittings, TexLine, Victaulic, or prior approved equal.

e. Welded outlets: Anvil International, Island Fitting, Merit Manufacturing (Mueller), NAP (North Alabama Pipe Corporation), Ward, or prior approved equal.

2.03 SPRINKLERS

A. In ACT and GWB ceilings, provide flat-plate concealed quick-response sprinklers with white cover plates.

B. Provide white, quick-response institutional style pendent sprinklers for Holding Rooms and adjacent Restroom and Vestibule, and where indicated on the criteria drawings.

C. Approved manufacturers are as follows:

1. Sprinklers: Reliable, Tyco, Victaulic, Viking, or prior approved equal.

2.04 DRAINS

A. Provide auxiliary drains for all new trapped sections of system piping per NFPA #13.

2.05 FLEXIBLE PIPING SERVING PENDENT SPRINKLERS

A. If the Fire Protection Sprinkler System Contractor chooses to, provide flexible piping assemblies for drops to pendent sprinklers that are U.L. listed or Factory Mutual Global approved for use in fire protection sprinkler systems to 175 p.s.i.

B. The flexible pipe assembly shall utilize braided type 304 stainless steel flexible hose with factory installed zinc plated steel adapters (1" Male Pipe Thread (MPT) or grooved for connection to the sprinkler system piping and 1/2" or 3/4" Female Pipe Thread (FPT) for connection of the sprinkler) that are fully welded or use of compression fittings to form a single unit.

C. The flexible piping unit shall be held securely to acoustical ceiling assemblies by using one of the following:

1. Mounting brackets that attach to the ceiling runners and utilizes self-tapping screws though each side of the mounting bracket to the ceiling runner.

2. Tube steel cross member that is secured to the ceiling runner with clips having set screws.

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

E. Flexible piping serving pendent sprinklers shall be installed in accordance with the documented manufacturers literature in regard to bend radius and number of bends allowed based upon the length of the flexible piping assembly.

F. Approved manufacturers are as follows:

1. Flexible Piping Serving Pendent Sprinklers: Easyflex, FlexHead, RAscoflex (Reliable),Vic-Flex (Victaulic), or prior approved equal.

2.06 PIPE HANGERS

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

B. Hanger components shall be connected directly to major frame members (Rigid Frames, CMU, Girder Trusses, etc.) wherever possible with connections to secondary framing members (joists, purlins, etc.) being made only when necessary and shall be coordinated with the Structural Engineer.

C. Hangers shall not attach directly to metal decking without exception, unless the metal deck is provided with a concrete topping.

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

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

F. Post-installed concrete hanger attachments shall have passed the ACI 355.2 cracked concrete test.

G. Approved manufacturers are as follows:

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

2. Attachments: Hilti, ITW Ramset, Powers Fastening Innovations, Simpson Manufacturing Company, ITW (Sammy), DeWalt (HangerMate), or prior approved equal.

2.07 OVERSIZED ESCUTCHEON TRIM RINGS

a. Where sprinkler drops are hard-piped, the Fire Protection Sprinkler System Contractor shall provide oversized escutcheon trim rings to conceal the suspended acoustical tile ceiling system penetrations that are oversized to meet the requirements of the International Building Code (I.B.C.) and ASCE 7.

b. The Fire Protection Sprinkler System Contractor shall verify with the local Authority Having Jurisdiction that oversized penetrations and escutcheon trim rings for existing suspended acoustical tile ceiling system penetrations to meet the International Building Code (I.B.C.) and ASCE 7 will not be required.

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

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

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

D. Approved manufacturers are as follows:

1. Oversized Escutcheon Trim Rings: Reliable, Victaulic, Viking, or prior approved equal.

2.08 LIST OF SPRINKLERS

A. The Fire Protection Sprinkler System Contractor shall provide a typed list of all new sprinklers installed in the project per the requirements of NFPA #13.

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

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

PART 3 EXECUTION

3.01 INSTALLATION

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

B. Cutout disks that are created when cutting in mechanical tee type outlets shall be secured with nylon zip ties or metal wiring near the location from which the cutout disk was cut.

C. The Fire Protection Sprinkler System Contractor shall remove and replace any new piping joints deemed improperly installed or show signs of leakage.

D. The Fire Protection Sprinkler System Contractor shall remove and replace any new piping that has been damaged upon installation and shows signs of being bent, warped, or dented.

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

F. The glass bulb protector shall remain in place until the sprinkler is completely installed. The Fire Protection Sprinkler System Contractor shall remove the glass bulb protector by hand after installation and prior to the sprinkler system being placed in service. The use of tools or devices to remove the glass bulb protector is not allowed.

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

H. Ends of new piping and existing piping affected by the Fire Protection Sprinkler System Contractor's operations shall be thoroughly cleaned of water, cutting oil, and foreign matter. Keep piping systems clean during installation. Inspect all piping before placing into position for foreign matter and remove as necessary.

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

J. In rooms with exposed structure, the fire protection sprinkler system piping shall be installed as tight to structure as possible and shall be installed to minimize piping offsets.

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

L. Install piping at such heights and in such a manner so as not to obstruct any portion of windows, doorways, passageways, or lights.

M. Install piping at such heights and in such a manner so as not pose hazards to normal walking head heights, impact the minimum clear height requirements or present tripping hazards.

3.02 FIRE PROTECTION SPRINKLER SYSTEM CONTRACTOR'S RESPONSIBILITY FOR EXISTING BUILDINGS

A. Cut carefully to minimize necessity for repairs to existing work. Do not cut beams, columns, or trusses.

B. This work shall be scheduled such that services and/or existing systems for the facility are not interrupted during normal operating hours, without prior written permission of the Owner's representative. Work that is performed during normal operational hours shall not interfere with the normal function of the facility's daily operation.

C. the existing fire protection system(s) shall be maintained in a fully operational condition outside of the tenant improvement area(s). If the fire protection system(s) outside of the tenant improvement area(s) are not operational, the Fire Protection Sprinkler System Contractor shall conduct fire watches on.

D. Existing system piping and fittings that have been removed for any reason including demolition work and system modifications, shall not be re-installed. New system piping and fittings are required and shall meet the requirements of Paragraph 2.02 of each Fire Protection Specification Section.

E. The Fire Protection Sprinkler System Contractor shall also be responsible for the removal and reinstallation of all existing fire protection equipment that will interfere with installation and operation of any new construction indicated or required at no additional costs to the Owner.

F. All existing fire protection sprinkler system components, devices, and materials that are removed from the original installation location shall not be re-installed or placed back into service as part of the new fire protection sprinkler system work, unless specifically identified on the contract documents.

G. All fire protection equipment (other than piping) to be removed shall remain the property of the Owner, and shall be transported, stored, or disposed of, as directed by the Owner. This will be at no additional cost to the Owner.

3.03 CEILING SYSTEM PENETRATIONS

A. All new pendent sprinklers installed in ceiling systems shall meet the requirements of the International Building Code (I.B.C.) and ASCE 7 by one of the following options:

1. Oversized suspended acoustical tile ceiling system penetrations shall be required on all hard-piped pendent sprinklers installed in suspended acoustical tile ceiling systems. The oversized suspended acoustical tile ceiling system penetration shall have a 1" annular space around the suspended acoustical tile ceiling penetration that will allow free movement of at least 1" in all directions.

2. Tight suspended acoustical tile ceiling system penetrations shall be allowed when a swing joint is installed at the top of the sprinkler drop that can accommodate 1" of ceiling movement in all directions.

3. Tight suspended acoustical tile ceiling system penetrations shall be allowed when flexible piping serving pendent sprinklers is installed that can accommodate 1" of ceiling movement in all directions

4. Tight suspended acoustical tile ceiling system penetrations shall be allowed when the sprinkler system and suspended acoustical tile ceiling system are tied together as an integral unit and evaluated by a registered design professional hired by the Fire Protection Sprinkler System Contractor.

3.04 RESTRAINT OF NEW SPRINKLER SYSTEM BRANCH LINES

A. New sprinkler system branch lines shall be laterally restrained at intervals not exceeding those specified in Table 9.3.6.4(a) of NFPA #13 and are based upon the branch line diameter and the seismic coefficient value of Cp.

B. New branch Line Restraint shall not attach directly to metal decking without exception unless the metal deck is provided with a concrete topping.

C. Means of providing new branch line restraint shall comply with one of the means contained within Section 9.3.6.1 of NFPA #13.

3.05 HYDROSTATIC TEST

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

B. When the work consists of modifying an existing fire protection sprinkler system for tenant improvements, the Fire Protection Sprinkler System Contractor shall be responsible for one of the following:

1. The Fire Protection Sprinkler System Contractor shall take full responsibility of the entire existing sprinkler system for the purpose of hydrostatic testing. All leaks, system failures, and building damage incurred within forty-eight (48) hours after the hydrostatic test due to the condition of the existing fire protection sprinkler system shall be the responsibility of the Fire Protection Sprinkler System Contractor performing the hydrostatic test.

2. The Fire Protection Sprinkler System Contractor shall isolate the new work from the existing fire protection sprinkler system by whatever means necessary.

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

D. When tests have been completed and corrections made, submit a signed and dated certificate similar to that specified in NFPA #13.

3.06 FORMAL TESTS AND INSPECTIONS

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

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

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

D. Correct defects in work provided by the Fire Protection Sprinkler System Contractor and make additional tests until the system(s) comply with contract requirements.

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

F. The Owner will furnish water for the tests.

G. Furnish Architect with copies of certificates required by testing agencies.

END OF SECTION

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SECTION 22 03 00

EXCAVATION AND BACKFILL FOR MECHANICAL UNDERGROUND UTILITIES

PART 1 GENERAL

1.01 GENERAL INCLUDES

A. Excavation and Associated Grading

B. Trenching and Trench Protection

C. Backfilling and Compaction

D. Verification of Existing Utilities

E. Protection of Utilities

1.02 RELATED SECTIONS

A. Section 22 10 05 - Plumbing Piping

1.03 QUALITY ASSURANCE

A. Inspection of Job Conditions: Prior to starting work and during work, the installer shall examine the work by others, site and job conditions under which excavation, trenching, and backfilling for underground utilities work will be performed, and notify the General Contractor in writing of unsatisfactory conditions or work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

B. Codes and Standards: Comply with requirements of the following codes and standards (Latest Edition) except as modified herein:

1. International Conference of Building Officials, "Uniform Building Code"

2. Local requirements for all utility work

3. OSHA and WISHA regulations

4. APWA Standard Specifications

1.04 RESPONSIBILITY

A. The Contractor is solely responsible for compliance with the requirements of the drawings, specifications, local codes and standards, proper construction coordination with work of other trades, and protection and worker's safety. Contractor shall advise Design Consultant of any discrepancy in, or disagreement with the specifications and/or drawings prior to starting work and not proceed until issue is resolved. Commencement of work shall indicate Contractor's acknowledgement of his expertise in this type of work. Any delay resulting from failure to comply with this procedure will not be basis for an extension of the completion date.

1.05 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced.

B. American Society of Testing and materials (ASTM) publications:

1. D 422-63 Particle Size Analysis of Soils
2. D 423-66 Liquid Limit of Soils
3. D 424-59 Plastic Limit and Plasticity Index of Soils
4. D 1557-78 Moisture Density Relations of Soils using a 10 lb. (4.54kg) Rammer and 18-inch (457 mm) Drop
5. D 2167-66 Density of Soil In-Place by the Rubber Balloon Method
6. D 2217-66 Wet preparation of Soil Samples for Particle-Size Analysis and Determination of Soil Contents
7. D 2487-69 Classification of Soils for Engineering Purposes
8. D 2922-81 Test Methods for Density of Soil and Soil-Aggregate In Place by Nuclear Methods (Shallow Depth)
9. E 548-79 Generic Criteria for Use in the Evaluation of Testing and Inspection Agencies

1.06 OPERATION AND MAINTENANCE REQUIREMENTS OF THIS SECTION

Not Applicable

PART 2 MATERIALS

2.01 APPROVED MANUFACTURERS

Not applicable

2.02 SATISFACTORY MATERIALS

A. Materials classified as ASTM D2487, Unified Soil Classification System as SW, SP, GW, and GP are satisfactory for backfill use. Materials classified as SP-SM, GP-GM, GM, GC, and ML are also satisfactory for backfill use provided that they contain moisture contents suitable for the intended use and are reasonably free of organic matter. Native material, not considered unsatisfactory as specified below, may comply, except that no material shall have any object with a dimension exceeding 2 inches.

2.03 UNSATISFACTORY MATERIALS

A. Materials classified in ASTM D2487, Unified Soil Classification System as PT, OH, and OL are unsatisfactory. Unsatisfactory materials also include man-made fills, refuse and all materials containing excessive organic matter or having moisture contents which are not suitable for the intended use, or having objects with dimensions exceeding 2 inches (boulders, etc.).

2.04 UNSTABLE MATERIAL

A. Unstable material shall consist of material too wet to properly support the utility pipe, conduit or appurtenance structure.

2.05 GRAVELLY SAND BORROW MATERIAL

A. Gravelly sand borrow material to provide backfill, or replace unsuitable soil, shall meet the requirements of SW, SP, GW, and GP materials, except that the maximum percentage passing the No. 200 sieve shall not exceed 5% based on the soil fraction passing the U.S. No. 4 sieve, and not contain discrete particles greater than 2 inches in diameter.

2.06 DEGREE OF COMPACTION

A. Degree of compaction shall be expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D1557, Method C. Minimum compaction requirements shall be as specified in PART 3.

2.07 DRAINAGE GRAVEL

A. Shall be 3/4-inch washed gravel with no more than 2% passing 1/2-inch sieve opening

2.08 SPECIAL BEDDING AND INITIAL BACKFILL MATERIAL

A. Minus 3/8-inch washed pea gravel

Unified Soil Classification (USC) System (from ASTM D 2487)				
Major Divisions			**Group Symbol**	**Typical Names**
Course-Grained Soils More than 50% retained on the No. 200 sieve	**Gravels** 50% or more of course fraction retained on the No. 4 sieve	Clean Gravels	GW	Well-graded gravels and gravel-sand mixtures, little or no fines
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines
		Gravels with Fines	GM	Silty gravels, gravel-sand-silt mixtures
			GC	Clayey gravels, gravel-sand-clay mixtures
	Sands 50% or more of course fraction passes the No. 4 sieve	Clean Sands	SW	Well-graded sands and gravelly sands, little or no fines
			SP	Poorly graded sands and gravelly sands, little or no fines
		Sands with Fines	SM	Silty sands, sand-silt mixtures
			SC	Clayey sands, sand-clay mixtures
Fine-Grained Soils More than 50% passes the No. 200 sieve	**Silts and Clays** Liquid Limit 50% or less		ML	Inorganic silts, very fine sands, rock four, silty or clayey fine sands

Unified Soil Classification (USC) System (from ASTM D 2487)			
Major Divisions		**Group Symbol**	**Typical Names**
		CL	Inorganic clays of low to medium plasticity, gravelly/sandy/silty/lean clays
		OL	Organic silts and organic silty clays of low plasticity
	Silts and Clays Liquid Limit greater than 50%	MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts
		CH	Inorganic clays or high plasticity, fat clays
		OH	Organic clays of medium to high plasticity
Highly Organic Soils		PT	Peat, muck, and other highly organic soils

Prefix: G = Gravel, S = Sand, M = Silt, C = Clay, O = Organic Suffix: W = Well Graded, P = Poorly Graded, M = Silty, L = Clay, LL < 50%, H = Clay, LL > 50%

PART 3 EXECUTION

3.01 EXCAVATION

A. If workers enter any trench or other excavation four or more feet in depth that does not meet the open pit requirements of WSDOT Section 2.09.3(3)B, it shall be shored and cribbed. The Contractor alone shall be responsible for worker safety. All trench safety systems shall meet the requirements of the Washington Industrial Safety and Health Act, Chapter 49.17 RCW.

B. Excavation of every description and of whatever substances encountered shall be performed to allow the installation of all utilities at the lines and grades as required. During excavation, material satisfactory for backfilling shall be stockpiled in an orderly manner at a distance from the banks of the trench sufficient to avoid overloading and to prevent slides or cave-ins. Adequate drainage shall be provided for the stockpiles and surrounding areas by means of ditches, dikes, or other approved methods. The stockpiles shall also be protected from contamination with unsatisfactory excavated material or other material that may destroy the quality and fitness of the suitable stockpiled material.

C. If the Contractor fails to protect the stockpiles and any material becomes unsatisfactory as a result, such material shall be removed and replaced with satisfactory on-site or imported material from approved sources at no additional cost to the Owner.

D. Excavated material not required or not satisfactory for backfill shall be removed from the site and shall be disposed of off site, at the Contractor's expense, at the Contractor's waste area. Any excess satisfactory excavated materials shall not be mixed with unsatisfactory materials. Unsatisfactory materials shall not cover available suitable materials, or be disposed of in such a manner as to interfere with subsequent borrow operations.

E. Grading shall be done as may be necessary to prevent surface water from flowing into the excavation, and any water accumulating therein shall be removed so that the stability of the bottom and sides of the excavation is maintained. Unauthorized over-excavation shall be backfilled in accordance with paragraph 3.05 BACKFILLING at no additional cost to the Owner.

F. The Contractor shall provide any dewatering needed and is considered incidental to the Contract.

3.02 TRENCH EXCAVATION

A. The trench shall be excavated as recommended by the manufacturer of the pipe to be installed unless shown otherwise on the drawings. Where recommended trench widths are exceeded, redesign shall be performed by the Contractor using stronger pipe or special installation procedures. The cost of this redesign and the increased pipe or installation procedures shall be borne by the Contractor without additional cost to the Owner.

B. Bottom Preparation: The bottoms of trenches shall be accurately graded to provide uniform bearing and support for the bottom quadrant of each section of the pipe and for bedding. Bell holes shall be excavated to the necessary size at each joint or coupling to eliminate point bearing. Stones of 2 inches or greater in any dimension, or as recommended by the pipe manufacturer, whichever is smaller, shall be removed to avoid point bearing.

C. Removal of Unsuitable Material: Where unsuitable material is encountered in the bottom of the trench, such material shall be removed to the depth directed and replaced to the proper grade with select granular material as provided in paragraph 3.05 BACKFILLING. When removal of unsuitable material is required due to the fault or neglect of the Contractor in his performance of the work, the resulting material shall be excavated and replaced by the Contractor without additional cost to the Owner.

D. Bedding: The bedding surface for the pipe shall provide a firm foundation of uniform density throughout the entire length of the pipe. The pipe shall be bedded carefully in a soil foundation accurately shaped and rounded to conform to the lowest one-fourth of the outside portion of circular pipe or to the lower curved portion of pipe arch for the entire length of pipe or arch. When necessary, the bedding shall be taped. Bell holes and depressions for joints shall be only of such length, depth, and width as required for properly making the particular type joint. Provide bedding using pea gravel where noted on the drawings.

3.03 EXCAVATION FOR APPURTENANCES

A. Excavation for manholes, catch basins, inlets, or similar structures below ground shall be sufficient to leave at least 12 inches clear between the outer structure surfaces and the face of the excavation or support members. When concrete or masonry is to be placed in an excavated area, special care shall be taken not to disturb the bottom of the excavation. Excavation to the final grade level shall not be made until just before the concrete or masonry is to be placed.

3.04 JACKING, BORING, AND TUNNELING

A. Unless otherwise indicated, excavation shall be by open cut, except that sections of a trench may be jacked, bored, or tunneled if the pipe, cable or duct can be safely and properly installed and backfill can be properly tamped in such sections.

3.05 BACKFILLING

A. Backfill material shall be compacted to 6" layers and as specified in Paragraph 3.07.

1. Trench Backfill: Trenches shall be backfilled to finish grade. The trench shall be backfilled to above the top of pipe prior to performing the required pressure tests (except that where piping requires insulation, the pipe shall have an initial test prior to insulating and then a final test as specified herein). The joints and couplings shall be left uncovered during the pressure test.

2. Replacement of Unstable Material: Unstable material removed from the bottom of the trench of excavation shall be replaced with select granular material or gravel borrow placed in layers not exceeding 6 inches loose thickness.

3. Bedding and Initial Backfill: Bedding shall consist of satisfactory materials. Initial backfill shall be in 6-inch lift.

3.06 SPECIAL REQUIREMENTS

A. Special requirements for excavation, backfill, and bedding relating to the specific utilities are as follows:

1. Combination Fire/Water Lines: Trenches shall be of a depth to provide a minimum cover of 3.5 feet from the existing ground surface, or from the indicated finished grade, whichever is lower, to the top of the pipe. Bedding shall use “special bedding” materials as specified in paragraph 2.07.

2. Domestic Water Lines: Trenches shall be of a depth to provide a minimum cover of 3.0 feet from the existing ground surface, or from the indicated finished grade, whichever is lower, to the top of the pipe. Except that branch lines serving individual fixtures within building footprint shall have minimum of 1.0-foot cover. Bedding shall use “special bedding” materials as specified in paragraph 2.07.

3. Backflow Preventer Fire Vault: Provide special bedding as specified in this Specification Section.

4. Where piping passes under footings, provide concrete fill starting 12 inches above pipe for excavated length and width of footing above pipe for footing support. Concrete specification shall match same provided for footing.

3.07 COMPACTION

A. Each layer of fill, or the excavated subgrade, shall be compacted to at least 95%, per ASTM D1557, of laboratory maximum density. Compaction shall be accomplished by approved tamping rollers, pneumatic-tired rollers, three-wheel power rollers, or other approved compaction equipment.

3.08 PROTECTION

A. Newly graded excavated or bedded areas shall be protected from traffic and from erosion, and any settlement or washing away that may occur from any cause, prior to acceptance, shall be repaired and grades reestablished to the required elevations and slopes.

END OF SECTION 22 03 00

SECTION 22 05 13

COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General construction and requirements

B. Single phase electric motors

C. Three phase electric motors

D. Electronically Commutated Motors (ECM)

1.02 RELATED REQUIREMENTS

A. Section 26 05 83 - Wiring Connections: Electrical characteristics and wiring connections

B. Section 26 29 13 - Enclosed Controllers

1.03 REFERENCE STANDARDS

A. IEEE 112 - IEEE Standard Test Procedure for Polyphase Induction Motors and Generators; 2004

B. NEMA MG 1 - Motors and Generators; 2017

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements

1.04 SUBMITTALS

A. Product Data: Provide wiring diagrams with electrical characteristics and connection requirements.

B. Manufacturer's Installation Instructions: Indicate setting, mechanical connections, lubrication, and wiring instructions.

C. Operation Data: Include instructions for safe operating procedures.

D. Maintenance Data: Include assembly drawings, bearing data including replacement sizes, and lubrication instructions.

1.05 QUALITY ASSURANCE

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

B. All motors shall be UL listed.

C. Motors shall not be smaller than indicated on drawings; however, motors shall be of adequate size to drive the respective equipment when handling the quantities specified without exceeding the nameplate full load current at any conditions encountered in actual operation. If it becomes evident that a motor furnished is too small to meet these requirements as a result of the Contractor using substituted equipment or having revised the system arrangement, the Contractor shall replace it with a motor of adequate size at no additional cost to the Owner. This Contractor shall also arrange with the Electrical Contractor to increase the size of the wiring, motor starter, and other accessories as required to serve the larger motor at no additional cost to the Owner.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof covering. For extended outdoor storage, remove motors from equipment and store separately.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Baldor Electric Company/ABB Group

B. Leeson Electric Corporation

C. General Electric

D. Westinghouse

E. Reliance

F. Allis-Chalmers

G. Gould

H. Century

I. Wagner

J. US Motors Marathon

K. Regal-Beloit Corporation (Century)

2.02 GENERAL CONSTRUCTION AND REQUIREMENTS

A. Electrical Service: Refer to Section 26 05 83 for required electrical characteristics.

B. Nominal Efficiency:

1. All motors 1 HP and larger shall be energy efficient type and shall meet the 2015 Washington State Energy Code requirements.

C. Construction:

1. Open drip-proof type except where specifically noted otherwise.

2. Motors located outdoors exposed to weather shall have corrosion resistant finish and shall be totally enclosed fan cooled (TEFC) or totally enclosed non-ventilated (TENV) type.

3. Design for continuous operation in 104 degrees F environment.

4. Design for temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.

D. Visible Nameplate: Indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, and power factor.

E. Wiring Terminations:

1. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70, threaded for conduit.

2. For fractional horsepower motors where connection is made directly, provide threaded conduit connection in end frame.

2.03 SINGLE PHASE POWER - SPLIT PHASE MOTORS

A. Starting Torque: Less than 150 percent of full load torque

B. Starting Current: Up to seven times full load current

C. Breakdown Torque: Approximately 200 percent of full load torque

D. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated sleeve or ball bearings

E. Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings

2.04 SINGLE PHASE POWER - PERMANENT-SPLIT CAPACITOR MOTORS

A. Starting Torque: Exceeding one fourth of full load torque

B. Starting Current: Up to six times full load current

C. Multiple Speed: Through tapped windings

D. Open Drip-proof or Enclosed Air Over Enclosure: Class A (50 degrees C temperature rise) insulation, minimum 1.0 Service Factor, prelubricated sleeve or ball bearings, automatic reset overload protector

2.05 SINGLE PHASE POWER - CAPACITOR START MOTORS

A. Starting Torque: Three times full load torque

B. Starting Current: Less than five times full load current

C. Pull-up Torque: Up to 350 percent of full load torque

D. Breakdown Torque: Approximately 250 percent of full load torque

E. Motors: Capacitor in series with starting winding; provide capacitor-start/capacitor-run motors with two (2) capacitors in parallel with run capacitor remaining in circuit at operating speeds

F. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated sleeve bearings

G. Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings

2.06 THREE PHASE POWER - SQUIRREL CAGE MOTORS

A. Starting Torque: Between 1 and 1-1/2 times full load torque

B. Starting Current: Six times full load current

C. Power Output, Locked Rotor Torque, Breakdown or Pull Out Torque: NEMA Design B characteristics

D. Design, Construction, Testing, and Performance: Conform to NEMA MG 1 for Design B motors

E. Insulation System: NEMA Class B or better

F. Testing Procedure: In accordance with IEEE 112. Load test motors to determine free from electrical or mechanical defects in compliance with performance data.

G. Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts

H. Thermistor System (Motor Frame Sizes 254T and Larger): Three PTC thermistors embedded in motor windings and epoxy encapsulated solid state control relay for wiring into motor starter; refer to Section 26 29 13

I. Weatherproof Epoxy Sealed Motors: Epoxy seal windings using vacuum and pressure with rotor and starter surfaces protected with epoxy enamel; bearings double shielded with waterproof non-washing grease

J. Nominal Efficiency: As indicated at full load and rated voltage when tested in accordance with IEEE 112

K. Nominal Power Factor: As indicated at full load and rated voltage when tested in accordance with IEEE 112

2.07 VARIABLE FREQUENCY DRIVES

A. See Section 23 05 13 Common Motor Requirements.

2.08 ELECTRONICALLY COMMUTATED MOTORS (ECM)

A. Manufacturers:

1. US Motors, a brand of NIDEC Motor Corporation

B. ECM shall conform to the motor requirements listed above. In addition, the Contractor purchasing the equipment that includes the ECM is responsible for ensuring the ECM motor speed control is set to match the required component operation. The ECM motor speed control may be preset by the equipment manufacturer. The Contractor purchasing the equipment shall provide documentation showing the appropriate ECM motor control board jumper pins, dip switches and/or multi-pin plugs settings for correct HVAC equipment component operation.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.

C. Check line voltage and phase and ensure agreement with nameplate.

END OF SECTION 22 05 13

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SECTION 22 05 17

SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe sleeves

B. Pipe sleeve-seals

1.02 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping

1.03 REFERENCE STANDARDS

A. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type); 2016

B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2013a (Reapproved 2017)

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures

B. Seals

1.05 QUALITY ASSURANCE

A. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

PART 2 PRODUCTS

2.01 PIPE SLEEVES

A. Vertical Piping:

1. Sleeve Length: 1 inch above finished floor

2. Provide sealant for watertight joint.

3. Blocked Out Floor Openings: Provide 1-1/2-inch angle set in silicon adhesive around opening.

4. Drilled Penetrations: Provide 1-1/2-inch angle ring or square set in silicone adhesive around penetration.

B. Sheet Metal: Pipe passing through interior walls, partitions, and floors, unless steel or brass sleeves are specified below.

C. Pipe Passing Through Below Grade Exterior Walls:

1. Zinc coated or cast-iron pipe

2. Provide watertight space with link rubber or modular seal between sleeve and pipe on both pipe ends.

D. Pipe Passing Through Concrete Beam Flanges, except where Brass Pipe Sleeves are Specified:

1. Galvanized steel pipe or black iron pipe with asphalt coating.

2. Connect sleeve with floor plate except in mechanical rooms.

E. Pipe Passing Through Mechanical, Laundry, and Kitchen above Basement:

1. Galvanized steel pipe or black iron pipe with asphalt coating.

2. Connect sleeve with floor plate except in mechanical rooms.

F. Penetrations in concrete beam flanges are permitted but are prohibited through ribs or beams without prior approval from the Architect.

G. Clearances:

1. Provide allowance for insulated piping.

2. Wall, Floor, Partitions, and Beam Flanges: 0.5 inch greater than external/pipe diameter.

3. All Rated Openings: Caulked tight with fire stopping material complying with ASTM E814 in accordance with Section 07 84 00 to prevent the spread of fire, smoke, and gases.

2.02 PIPE-SLEEVE SEALS

A. Manufacturers:

1. Flexicraft Industries; PipeSeal

2. GPT Thunderline; Link-Seal

B. Modular/Mechanical Seal:

1. Provide watertight seal between pipe and wall/casing opening.

PART 3 EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and foreign material, from inside and outside, before assembly.

3.02 INSTALLATION

A. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

B. Install piping to conserve building space, to not interfere with use of space and other work.

C. Install piping and pipe sleeves to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

D. Structural Considerations:

1. Provide sleeves when penetrating footings, floors, walls, partitions, and similar elements. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.

2. Underground Piping: Caulk pipe sleeve watertight with mechanically expandable chloroprene inserts with bitumen sealed metal components.

3. Aboveground Piping:

a. Pack solid using mineral fiber complying with ASTM C592.

b. Fill space with an elastomer caulk to a depth of 0.50 inch where penetrations occur between conditioned and unconditioned spaces.

4. All Rated Openings: Caulk tight with fire stopping material conforming to ASTM E814 in accordance with Section 07 84 00 to prevent the spread of fire, smoke, and gases.

5. Caulk exterior wall sleeves watertight with mechanically expandable chloroprene inserts with mastic-sealed components.

E. Manufactured Sleeve-Seal Systems:

1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.

2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.

3. Locate piping in center of sleeve or penetration.

4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.

5. Tighten bolting for a water-tight seal.

6. Install in accordance with manufacturer's recommendations.

F. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, unions, and couplings for servicing are consistently provided.

G. Insulation shall run continuous through sleeves in non-fire rated elements. Insulation shall not run continuous through sleeves in fire rated elements unless the fire sealant system used is UL accepted for use with insulated pipes.

H. Do not place sleeves around soil, waste, vent, or roof drain lines passing through concrete floors on grade.

END OF SECTION 22 05 17

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SECTION 22 05 23

GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Angle valves

B. Ball valves

C. Butterfly valves

D. Check valves

E. Gate valves

F. Globe valves

G. Lubricated plug valves

H. Thermostatic balancing valves

I. Balancing valves

1.02 RELATED REQUIREMENTS

A. Section 20 00 00 - General Mechanical Requirements

B. Section 22 05 48 - Vibration and Seismic Controls for Plumbing Piping and Equipment

C. Section 22 05 53 - Identification for Plumbing Piping and Equipment

D. Section 22 07 19 - Plumbing Piping Insulation

E. Section 22 10 05 - Plumbing Piping

F. Section 22 15 00 - General-Service Compressed-Air Systems

1.03 ABBREVIATIONS AND ACRONYMS

A. CWP: Cold working pressure

B. EPDM: Ethylene propylene copolymer rubber

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber

D. NRS: Non-rising stem

E. OS&Y: Outside screw and yoke

F. PTFE: Polytetrafluoroethylene

G. RS: Rising stem

H. TFE: Tetrafluoroethylene

I. WOG: Water, oil, and gas

1.04 REFERENCE STANDARDS

A. ASME B1.20.1 - Pipe Threads, General Purpose (Inch); 2013

B. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2015

C. ASME B16.5 - Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard; 2017

D. ASME B16.10 - Face-to-Face and End-to-End Dimensions of Valves; 2017

E. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2012

F. ASME B16.34 - Valves - Flanged, Threaded and Welding End; 2017

G. ASME B31.9 - Building Services Piping; 2014

H. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing and Fusing Operators; 2017

I. ASTM A48/A48M - Standard Specification for Gray Iron Castings; 2003 (Reapproved 2016)

J. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings; 2004 (Reapproved 2014)

K. ASTM A536 - Standard Specification for Ductile Iron Castings; 1984 (Reapproved 2014)

L. ASTM B61 - Standard Specification for Steam or Valve Bronze Castings; 2015

M. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings; 2017

N. AWWA C606 - Grooved and Shouldered Joints; 2015

O. MSS SP-45 - Bypass and Drain Connections; 2003 (Reaffirmed 2008)

P. MSS SP-67 - Butterfly Valves; 2017

Q. MSS SP-70 - Cast Iron Gate Valves, Flanged and Threaded Ends; 2011

R. MSS SP-71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends; 2011, with Errata (2013)

S. MSS SP-72 - Ball Valves with Flanged or Butt-Welding Ends for General Service; 2010a

T. MSS SP-78 - Cast Iron Plug Valves, Flanged and Threaded Ends; 2011

U. MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves; 2013

V. MSS SP-85 - Cast Iron Globe & Angle Valves, Flanged and Threaded Ends; 2011

W. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010

X. MSS SP-125 - Gray Iron and Ductile Iron In-Line, Spring-Loaded, Center-Guided Check Valves; 2010

Y. NSF 61 - Drinking Water System Components - Health Effects; 2017

Z. NSF 372 - Drinking Water System Components - Lead Content; 2016

1.05 SUBMITTALS

A. Product Data: Provide data on valves including manufacturer's catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

B. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listings.

C. Maintenance Materials: Furnish Owner with one wrench for every ten plug valves, in each size of square plug valve head.

1.06 QUALITY ASSURANCE

A. Manufacturer:

1. Obtain valves for each valve type from single manufacturer.

2. Company must specialize in manufacturing products specified in this section, with not less than three years of documented experience.

B. Welding Materials and Procedures: Conform to ASME BPVC-IX.

C. Domestic water fittings, joining materials, and all other appurtenances in contact with potable water shall be lead-free except those specifically exempted in Section 3874 of the Safe Water Drinking Act.

1. Lead-free shall mean:

a. Not containing more than 0.2% lead when used with respect to solder and flux; and

b. Not more than a weighted average of 0.25% when used with respect to the wetted surfaces of pipes, pipe fittings, plumbing fittings, and fixtures

1.07 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Minimize exposure of operable surfaces by setting plug and ball valves to open position.

2. Protect valve parts exposed to piped medium against rust and corrosion.

3. Protect valve piping connections such as grooves, weld ends, threads, and flange faces.

4. Adjust globe, gate, and angle valves to the closed position to avoid clattering.

5. Secure check valves in either the closed position or open position.

6. Adjust butterfly valves to closed or partially closed position.

B. Use the following precautions during storage:

1. Maintain valve end protection and protect flanges and specialties from dirt.

a. Provide temporary inlet and outlet caps.

b. Maintain caps in place until installation.

2. Store valves in shipping containers and maintain in place until installation.

a. Store valves indoors in dry environment.

b. Store valves off the ground in watertight enclosures when indoor storage is not an option.

C. Exercise the following precautions for handling:

1. Handle large valves with sling, modified to avoid damage to exposed parts.

2. Avoid the use of operating handles or stems as rigging or lifting points.

PART 2 PRODUCTS

2.01 APPLICATIONS

A. See drawings for specific valve locations.

B. Listed pipe sizes shown using nominal pipe sizes (NPS) and nominal diameter (DN).

C. Provide the following valves for the applications if not indicated on drawings:

1. Shutoff: Ball, butterfly, gate

2. Dead-End: Single-flange butterfly (lug) type

3. Throttling: globe or butterfly

4. Swing Check (Pump Outlet):

a. 2 NPS and Smaller: Bronze swing check valves with bronze or nonmetallic disc

b. 2-1/2 NPS and Larger for Domestic Water: Iron swing check valves with closure control, metal or resilient seat check valves

D. Substitutions of valves with higher CWP classes or WSP ratings for same valve types are permitted when specified CWP ratings or WSP classes are not available.

E. Required Valve End Connections for Non-Wafer Types:

1. Steel Pipe:

a. 2 inch and Smaller: Threaded ends

b. 2-1/2 inch to 4 inch: Grooved or flanged ends except where threaded valve-end option is indicated in valve schedules below

c. 5 inch and Larger: Grooved or flanged ends

d. Grooved-End Copper Tubing and Steel Piping: Grooved

2. Copper Tube:

a. 2 inch and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below

b. 2-1/2 inch to 4 inch: Grooved or flanged ends except where threaded valve-end option is indicated in valve schedules below

c. 5 inch and Larger: Grooved or flanged ends

F. Domestic, Hot and Cold Water Valves:

1. 2-1/2 NPS and Larger:

a. Iron, 2-1/2 NPS to 4 NPS: Provide with threaded or flanged ends

b. Iron Ball: Class 150

c. Iron Single-Flange Butterfly: 200 CWP, EPDM seat, aluminum-bronze disc

d. Iron Grooved-End Butterfly: 175 CWP

e. Iron Swing Check: Class 125, metal seats

f. Iron Swing Check with Closure Control: Class 125, lever and spring

g. Iron Grooved-End Swing Check: 300 CWP

h. Iron Center-Guided Check: Class 125, compact-wafer, metal seat

i. Iron Plate-Type Check: Class 125; single plate; metal seat

j. Iron Gate: Class 125, NRS

k. Iron Globe: Class 125

2.02 GENERAL REQUIREMENTS

A. Valve Pressure and Temperature Ratings: No less than rating indicated; as required for system pressures and temperatures.

B. Valve Sizes: Match upstream piping unless otherwise indicated.

C. Valve Actuator Types:

1. Handwheel: Valves other than quarter-turn types

2. Hand Lever: Quarter-turn valves 6 NPS and smaller

3. Wrench: Plug valves with square heads

D. Valves in Insulated Piping: With 2 NPS stem extensions and the following features:

1. Gate Valves: Rising stem
2. Ball Valves: Extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
3. Butterfly Valves: Extended neck
4. Memory Stops: Fully adjustable after insulation is installed

E. Valve-End Connections:

1. Threaded End Valves: ASME B1.20.1
2. Flanges on Iron Valves: ASME B16.1 for flanges on iron valves
3. Pipe Flanges and Flanged Fittings 1/2 inch through 24 inches: ASME B16.5
4. Solder Joint Connections: ASME B16.18
5. Grooved End Connections: AWWA C606

F. General ASME Compliance:

1. Ferrous Valve Dimensions and Design Criteria: ASME B16.10 and ASME B16.34
2. Solder-joint Connections: ASME B16.18
3. Building Services Piping Valves: ASME B31.9

G. Valve Materials for Potable Water: NSF 61 and NSF 372

H. Bronze Valves:

I. Valve Bypass and Drain Connections: MSS SP-45

J. Source Limitations: Obtain each valve type from a single manufacturer.

2.03 BRONZE, ANGLE VALVES

A. Class 125: CWP Rating: 200 psig:

1. Comply with MSS SP-80, Type 1
2. Body: Bronze; ASTM B62, with integral seat and screw in bonnet
3. End Connections: Pipe thread
4. Stem: Bronze
5. Disc: Bronze
6. Packing: Asbestos free

7. Handwheel: Bronze or aluminum
8. Manufacturers:
    a. Nibco
    b. Stockham
    c. Apollo
    d. McGuire
    e. Chicago Faucets

2.04 BRONZE, BALL VALVES

A. General:
1. Fabricate from dezincification resistant material.
2. Copper alloys containing more than 15 percent zinc are not permitted.

B. One Piece, Reduced Port with Bronze Trim:
1. Comply with MSS SP-110
2. WSP Rating: 400 psi
3. CWP Rating: 600 psi
4. Body: Bronze
5. End Connections: Pipe press
6. Seats: PTFE

C. Two Piece, Full Port with Stainless Steel Trim:
1. Comply with MSS SP-110
2. WSP Rating: 150 psi
3. WOG Rating: 600 psi
4. Body: Forged bronze or dezincified-brass alloy
5. Ends Connections: Pipe thread or solder
6. Seats: PTFE or TFE
7. Stem: Bronze, blowout proof
8. Ball: Stainless steel, vented

9. Manufacturers:
    a. Nibco
    b. Stockham
    c. Apollo
    d. Jomar

D. Three Piece, Full Port with Stainless Steel Trim:
1. Comply with MSS SP-110
2. WSP Rating: 150 psi
3. CWP Rating: 600 psi
4. Body: Bronze
5. End Connections: Pipe thread or press
6. Seats: PTFE or TFE
7. Stem: Stainless steel
8. Ball: Stainless steel, vented
9. Manufacturers:
    a. Nibco
    b. Stockham
    c. Apollo
    d. Jomar

2.05 STAINLESS STEEL, BALL VALVES

A. Two Piece, Full Port with Stainless Steel Trim:
1. Comply with MSS SP-110
2. WSP Rating: 150 psi
3. CWP Rating: 2,000 psi
4. Seats: PFTE
5. Stem: Stainless steel, blowout proof
6. Ball: Stainless steel, vented

7. Manufacturers:
    a. Nibco
    b. Stockham
    c. Apollo

B. Three Piece, Full Port with Stainless Steel Trim:
1. Comply with MSS SP-110
2. WSP Rating: 150 psi
3. WOG Rating: 2,000 psi
4. Seats: PFTE
5. Stem: Stainless steel, blowout proof
6. Ball: Stainless steel, vented
7. Bolts: Stainless steel
8. Manufacturers:
    a. Nibco
    b. Stockham
    c. Apollo

2.06 IRON, BALL VALVES

A. Class 125, Full Port, Stainless Steel Trim:
1. Comply with MSS SP-72
2. CWP Rating: 200 psi
3. Body: ASTM A536, Grade 65-45-12, ductile iron
4. End Connections: Flanged
5. Seats: PTFE or TFE
6. Stem: Stainless steel
7. Ball: Stainless steel
8. Operator: Lever with locking handle
9. Manufacturers:
    a. Nibco

b. Stockham

c. Apollo

2.07 IRON, SINGLE FLANGE BUTTERFLY VALVES

A. Lug type: Bi-directional dead-end service without use of downstream flange

1. Comply with MSS SP-67, Type I
2. Body Material: ASTM A126, cast iron or ASTM A536, ductile iron
3. Stem: One or two-piece stainless steel
4. Seat: EPDM
5. Disc: Stainless steel
6. Manufacturers:
   a. Nibco
   b. Stockham
   c. Apollo

2.08 IRON, GROOVED-END BUTTERFLY VALVES

A. CWP Rating: 175 psig (1200 kPa)

1. Comply with MSS SP-67, Type I
2. Body: Coated ductile iron
3. Stem: Two-piece stainless steel
4. Disc: Coated ductile iron
5. Disc Seal: EPDM
6. Manufacturers:
   a. Nibco
   b. Stockholm
   c. Apollo

2.09 BRONZE, LIFT CHECK VALVES

A. General:

1. Fabricate from dezincification resistant material.
2. Copper alloys containing more than 15 percent zinc are not permitted.

B. Class 125:

1. Comply with MSS SP-80, Type 1, Metal Disc to Metal Seat and Type 2, Nonmetallic Disc to Metal Seat.
2. CWP Rating: 200 psi
3. Design: Vertical flow
4. Body: Comply with ASTM B61 or ASTM B62, bronze
5. End Connections: Threaded
6. Disc (Type 1): Bronze
7. Manufacturers:
    a. Nibco
    b. Stockham
    c. Apollo

2.10 BRONZE, SWING CHECK VALVES

A. General:

1. Fabricate from dezincification resistant material.
2. Copper alloys containing more than 15 percent zinc are not permitted.

B. Class 125: CWP Rating: 200 psig (1380 kPa).

1. Pressure and Temperature Rating: MSS SP-80, Type 3
2. Design: Y-pattern, horizontal or vertical flow
3. Body: Bronze, ASTM B62
4. End Connections: Threaded
5. Disc: Bronze
6. Manufacturers:
    a. Nibco
    b. Stockham
    c. Apollo

2.11 IRON, HORIZONTAL SWING CHECK VALVES

A. Class 125:

1. Pressure and Temperature Rating: MSS SP-71, Type I

2. WOG Rating: 200 psi
3. Body: ASTM A126, gray cast iron with bolted bonnet
4. End Connections: Flanged
5. Trim: Composition
6. Seat Ring and Disc Holder: Bronze
7. Disc: PTFE or TFE
8. Gasket: Asbestos free
9. Manufacturers:
    a. Nibco
    b. Stockham
    c. Apollo

2.12 IRON, SWING CHECK VALVES WITH CLOSURE CONTROL

A. Class 125 with Lever and Spring-Closure Control:

1. Comply with MSS SP-71, Type I
2. Description:
    a. CWP Rating: 200 psi
    b. Design: Clear or full waterway
    c. Body: ASTM A126, gray iron with bolted bonnet
    d. Ends: Flanged as indicated
    e. Trim: Bronze
    f. Gasket: Asbestos free
    g. Closer Control: Factory installed, exterior lever, and weight
3. Manufacturers:
    a. Nibco
    b. Stockham
    c. Apollo

2.13 IRON, GROOVED-END SWING CHECK VALVES

A. 300 CWP:

1. CWP Rating: 300 psi
2. Body: ASTM A536, Grade 65-45-12 ductile iron
3. Seal: EPDM
4. Disc: Ductile iron
5. Coating: Black, non-lead paint
6. Manufacturers:
   a. Nibco
   b. Stockham
   c. Apollo

2.14 IRON, CENTER-GUIDED CHECK VALVES

A. Class 125, Compact-Wafer:

1. Comply with MSS SP-125
2. CWP Rating: 200 psi
3. Body: 316 stainless steel
4. Metal Seat: Stainless steel
5. Manufacturers:
   a. Nibco
   b. Stockham
   c. Apollo
   d. Wheatly
   e. Hammond

2.15 BRONZE, GATE VALVES

A. General:

1. Fabricate from dezincification resistant material.
2. Copper alloys containing more than 15 percent zinc are not permitted.

B. Non-Rising Stem (NRS):

1. Class 125: CWP Rating: 200 psig
2. Ends: Threaded or solder joint
3. Manufacturers:
    a. Nibco
    b. Stockham
    c. Apollo

2.16 IRON, GATE VALVES

A. NRS:

1. Pressure and Temperature Rating: MSS SP-70, Type I
2. Class 125: CWP Rating: 200 psig
3. Body: ASTM A126, gray iron with bolted bonnet
4. End Connections: Flanged
5. Trim: Bronze
6. Disc: Solid wedge
7. Packing and Gasket: Asbestos free.
8. Manufacturers:
    a. Nibco
    b. Stockham
    c. Apollo

2.17 BRONZE, GLOBE VALVES

A. General:

1. Fabricate from dezincification resistant material.
2. Copper alloys containing more than 15 percent zinc are not permitted.

B. Class 125: CWP Rating: 200 psig:

1. Disc: PTFE.
2. Manufacturers:
    a. Nibco

b. Stockham

c. Apollo

2.18 IRON, GLOBE VALVES

A. Class 125: CWP Rating: 200 psig:

1. Comply with MSS SP-85, Type I
2. Body: Gray iron; ASTM A126, with bolted bonnet
3. Connection Ends: Flanged.
4. Trim: Bronz
5. Packing and Gasket: Asbestos free, adjustable
6. Operator: Handwheel or chainwheel
7. Manufacturers:
   a. Nibco
   b. Stockham
   c. Apollo

2.19 LUBRICATED PLUG VALVES

A. Regular Gland and Cylindrical with Flanged Ends:

1. Comply with MSS SP-78, Type II
2. Class 125: CWP Rating: 200 psi
3. Body: ASTM A48/A48M or ASTM A126, cast iron with lubrication sealing system
4. Pattern: Regular or short
5. Plug: Cast iron or bronze with sealant groove.
6. Manufacturers:
   a. Nibco
   b. Stockham
   c. Apollo

2.20 THERMOSTATIC BALANCING VALVES

A. Furnish and install as indicated on the plans, an automatic balancing valve in the domestic hot water piping. Balancing valve shall be self-contained and fully automatic without additional piping or control mechanisms.

1. Balancing Valve shall regulate the flow of recirculated domestic hot water based on water temperature entering valve, regardless of system operating pressure.

a. When fully closed, balancing valve shall bypass a minimum flow to maintain dynamic control of the recirculating loop, and provide a means for system sanitizing.

b. Balancing valve shall be factory set to 110°F.

1) Balancing valve shall modulate between open and closed position within a 10°F range.

c. Balancing valve shall be available in sizes ranging from 1/2" NPT to 2" NPT to match pipe size on plans.

B. Balancing valve body and all internal components shall be constructed of stainless steel with major components constructed of stainless steel or EPDM.

1. Balancing valve sizes 1/2" through 2" shall be rated to 200 PSIG maximum working pressure.

a. All balancing valves shall be standard tapered female pipe thread, NPT.

2. All balancing valves shall be rated to 300°F maximum working temperature.

3. Balancing valves shall be ANSI/AWWA C800 compliant.

4. Thermal actuator shall be spring operated and self-cleaning, delivering closing thrust sufficient to keep orifice opening free of scale deposits.

a. Thermal actuator shall be rated for a minimum of 200,000 cycles.

C. Provide valve with a union and isolation ball valves.

D. Manufacturers:

1. Circuit Solver model CSUA by ThermOmegaTech

2. Acorn

3. Bell and Gossett

2.21 BALANCING VALVES

A. Each valve shall have two 1/4" NPT brass metering ports with Nordel check valves and gasketed caps located on both sides of valve seat. Two additional ¼" NPT connections with brass plugs are to be provided on the opposite side of the metering ports for use as drain connections. Drain connections and metering ports are to be interchangeable to allow for measurement flexibility when valves are installed in tight locations.

B. Valves are to be of the “Y” pattern, modified, equal percentage globe style, and provide three functions:

1. Precise flow measurement
2. Precision flow balancing
3. Positive drip tight shut off

C. Valves shall provide multi-turn, 360° adjustable with a micrometer type indicator located on valve handwheel. Valve handwheel shall have a memory feature, which will provide a means for locking the valve position after the system is balanced. 90° turn adjustable valves are not acceptable.

D. Valve Sizes 1/2" - 2": Valve body shall be bronze with ultra-high strength engineered resin or stainless-steel plug. The plug shall have precision-contoured channels to distribute flow uniformly across valve seat. Low-lead brass stem and high strength resin handwheel and sleeve. Valves shall have a minimum of four full 360° handwheel turns.

E. Single Turn Mini Sweat Size (1/2" to 3/4"):

1. Valve shall be globe style design with bronze body, solder end connection, bronze trim with EPDM plug, high strength resin handwheel with valve position locking inserts, and two ¼" NPT brass metering ports with Nordel check valves and gasketed caps located on both sides of the valve seat.
2. Valve shall provide three (3) functions:
    a. Precision flow measurement
    b. Precision flow balancing
    c. Positive drip tight shut-off
3. Valve shall provide 360° single turn adjustment range with indicating scale on valve handwheel.
4. The valve shall be installed with flow in the direction of the arrow on the valve body and installed at least five pipe diameters downstream from any fitting, and at least ten pipe diameters downstream from any pump, with two (2) pipe diameters downstream from the valve free of any fittings. When installed, easy unobstructed access to the valve handwheel and metering ports for adjustment and measurements shall be provided. Mounting of valve in piping must prevent sediment build-up in metering ports.

F. Insulation (1/2" to 2"):

1. Each valve shall be furnished with a pre-formed removable PVC insulation jacket to meet ASTM D 1784/class 14253-C, MEA#7-87, ASTM-E-84 and ASTM-136 with a flame spread rating of 50 or less. There will be provided sufficient mineral fiberglass insulation to meet ASHRAE 90.1-1989 specifications in operating conditions with maximum Fluid Design Operating Temperature Range of 141-200°F and Mean Rating Temperature of 125°F.

G. Manufacturers:

1. Red-White Valve

PART 3 EXECUTION

3.01 EXAMINATION

A. Discard all packing materials and verify that valve interior, including threads and flanges is completely clean without signs of damage or degradation that could result in leakage.

B. Verify valve parts to be fully operational in all positions from closed to fully open.

C. Confirm gasket material to be suitable for the service, to be of correct size, and without defects that could compromise effectiveness.

D. Should valve be determined to be defective, replace with new valve.

3.02 INSTALLATION

A. Provide unions or flanges with valves to facilitate equipment removal and maintenance while maintaining system operation and full accessibility for servicing.

B. Provide separate valve support as required and locate valve with stem at or above center of piping, maintaining unimpeded stem movement.

C. Install check valves where necessary to maintain direction of flow as follows:

1. Lift Check: Install with stem plumb and vertical.

2. Swing Check: Install horizontal maintaining hinge pin level.

3. Orient plate-type and center-guided into horizontal or vertical position, between flanges.

3.03 INSTALLATION OF THERMOSTATIC BALANCING VALVES

A. Install Thermostatic Balancing Valves in each domestic hot water return piping branch beyond last hot water device on that branch.

END OF SECTION 22 05 23

SECTION 22 05 48

VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 GENERAL REQUIREMENTS

A. Seismic Restraints shall be bidder-designed. Seismic Design Criteria are to be established per the International Building Code and ASCE along with Project Structural drawings.

B. Items not included in this specification shall not relieve the contractor of the responsibility of providing seismic bracing that meets all the criteria required by the referenced codes and in accordance with the seismic design guidelines and the project structural drawings.

1.02 SECTION INCLUDES

A. Vibration-isolated equipment support bases

B. Vibration isolators

C. External seismic snubber assemblies

D. Seismic restraint systems

E. Vibration-isolated and/or seismically engineered roof curbs

1.03 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete

1.04 REFERENCE STANDARDS

A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; 2016

B. ASCE 19 - Structural Applications of Steel Cables for Buildings; 2016

C. MFMA-4 - Metal Framing Standards Publication; 2004

D. ICC (IBC) - International Building Code; 2018

E. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems; 2008

F. Applicable Project Structural Drawings for Seismic Design Criteria

G. Applicable Manufacturer's Seismic Design Guides for Proprietary listed seismic braces and mounting hardware

1.05 SEISMIC DESIGN CRITERIA

A. Occupancy Category of Structure (I-IV) per ICC (IBC) or ASCE 7

B. Component Importance Factor (Ip) per ASCE 7

C. Mapped Acceleration Parameters (S1 and (Ss) per ICC (IBC) and Project Structural Drawings

D. Site Class (A - F) per ICC (IBC) and Project Structural Drawings

E. Site Coefficient (Fa) per ICC (IBC) and Project Structural Drawings

F. Site Coefficient (Fv) per ICC (IBC) and Project Structural Drawings

G. Seismic Design Category (A - D) based on Short Period Response Accelerations per ICC (IBC) and Project Structural Drawings

H. Seismic Design Category (A - D) based on 1-Second Period Response Acceleration per ICC (IBC) and Project Structural Drawings

I. Amplification Factor ap per ASCE 7

J. Response Modification Factor Rp per ASCE 7

1.06 SUBMITTALS

A. Shop Drawings:

1. Include the seal of the Professional Engineer registered in the State of Washington in which the Project is located, on drawings and calculations which at a minimum include the following:

B. Periodic Special Inspections: The mechanical contractor shall provide a list of components/systems requiring periodic special inspections per ICC (IBC).

C. Special Certification Requirements: Each contractor responsible for the construction of a "Designated Seismic System" for active plumbing equipment that must remain operable following the design earthquake, or components with hazardous contents certified by the manufacturer to maintain containment following the design earthquake, shall submit a Manufacturer's Certificate of Compliance for review and approval by the Registered Design Professional responsible for the design of the system. This information shall then be submitted to the AHJ.

1.07 QUALITY ASSURANCE

A. Comply with applicable building code.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Kinetics Noise Control, Inc

B. Mason Industries

C. Vibration Eliminator Company, Inc

2.02 PERFORMANCE REQUIREMENTS

A. General:

1. All vibration isolators, base frames, and inertia bases to conform to all uniform deflection and stability requirements under all operating loads.

2.03 VIBRATION-ISOLATED EQUIPMENT SUPPORT BASES

2.04 VIBRATION ISOLATORS

A. General Requirements:

1. Resilient Materials for Vibration Isolators: Oil, ozone, and oxidant resistant.

2.05 EXTERNAL SEISMIC SNUBBER ASSEMBLIES

A. Description: Steel snubbing assemblies designed for external attachment to both equipment and supporting structure that, as part of a complete system, restrain equipment motion in all directions during a seismic event while maintaining vibration isolation during normal operation.

B. Seismic Snubbing Elements:

1. Air Gap: Between 0.125 inches and 0.25 inches unless otherwise indicated.

2. Points of Contact: Cushioned with resilient material, minimum 0.25 inch thick; capable of being visually inspected for damage and replaced.

C. Lateral External:

1. Performance: Equipment movement at each snubber location limited to a maximum of 0.25 inches in any direction without significantly degrading the vibration isolation capability of the isolator during normal operating conditions.

D. Omni Directional External:

1. Performance: Equipment movement at each snubber location limited to a maximum of 0.25 inches in any direction without significantly degrading the vibration isolation capability of the isolator during normal operating conditions.

E. Horizontal Single Axis External:

1. Performance: Equipment movement at each snubber location limited to a maximum of 0.25 inches in any direction without significantly degrading the vibration isolation capability of the isolator during normal operating conditions.

2.06 SEISMIC RESTRAINT SYSTEMS

A. Description: System components and accessories specifically designed for field assembly and attachment of seismic restraints.

B. Cable Restraints:

1. Comply with ASCE 19

2. Cables: Pre-stretched, galvanized steel wire rope with certified break strength

3. Cable Connections: Use only swaged end fittings. Cable clips and wedge type end fittings are not permitted in accordance with ASCE 19

4. Use protective thimbles for cable loops where potential for cable damage exists.

C. Rigid Restraints: Use MFMA-4 steel channel (strut), steel angle, or steel pipe for structural element; suitable for both compressive and tensile design loads.

D. Cable Restraints:

1. Connections:

a. Use overlapping wire rope U clips, cable clamping bolts, swaged sleeves, or seismically rated tool-less wedge insert lock connectors.

2.07 VIBRATION-ISOLATED AND/OR SEISMICALLY ENGINEERED ROOF CURBS

A. Vibration Isolation Curbs:

1. Non-Seismic Curb Rail:

a. Location: Between existing roof curb and rooftop equipment

b. Construction: Aluminum

c. Integral vibration isolation to comply with requirements of this section

d. Weather exposed components consist of corrosion resistant materials

2. Non-Seismic Curb:

a. Location: Between structure and rooftop equipment

b. Construction: Aluminum

c. Integral vibration isolation to comply with requirements of this section

d. Weather exposed components consist of corrosion resistant materials

3. Seismic Curb:

a. Location: Between structure and rooftop equipment

b. Construction: Steel

c. Integral vibration isolation to comply with requirements of this section

d. Snubbers consist of minimum 0.25-inch-thick resilient pads to avoid metal-to-metal contact without compromising vibration isolating capabilities

e. Weather exposed components consist of corrosion resistant materials

B. Seismic Type Non-Isolated Curb and Fabricated Equipment Piers:

1. Location: Between structure and rooftop equipment

2. Construction: Steel

3. Weather exposed components consist of corrosion resistant materials

PART 3 EXECUTION

3.01 INSTALLATION - SEISMIC

A. Seismic Snubbers:

1. Provide on all isolated equipment and piping.

B. Floor and Base-Mounted Equipment, Vibration Isolated Equipment and associated Vibration and Seismic Controls for Connections:

1. Provide isolators and restraints designed for amplified code forces per ASCE 7 and with demonstrated ability to resist required forces including gravity, operational, and seismic forces.

2. Where timber/wood floor or other substrate is inadequate for installation of lag bolts, screws, or other mechanical fasteners, install supplemental framing or blocking to transfer loads to structural elements.

C. Wall Mounted Mechanical Equipment:

1. Anchoring to gypsum wallboard, plaster, or other wall finish that has not been engineered to resist imposed loads is not permitted.

D. Piping:

1. Pipes and Connections Constructed of Ductile Materials (copper; ductile iron, steel or aluminum; and brazed, welded or screwed connections) and is 2.5 inches and larger and all fuel piping 1 inch and larger:

a. Provide transverse bracing at spacing not more than 40.0 feet on center.

b. Transverse bracing for one pipe section may also act as a longitudinal bracing for a pipe section connected perpendicular to it, if the bracing is installed within 2 feet of the elbow or tee of similar size.

c. Piping conveying fluids at 100°F. and higher shall have expansion devices provided in between longitudinal braces to allow for thermal expansion.

d. Bracing may be omitted when the top of the pipe is suspended 12 inches or less from the supporting structural member and the pipe is suspended by an individual hanger.

2. Pipes and Connections Constructed of Non-Ductile Materials (cast iron, no-hub, plastic or non-UL listed grooved coupling pipe) and is 2.5 inches and larger:

    a. Transverse bracing for one pipe section may also act as a longitudinal bracing for a pipe section connected perpendicular to it, if the bracing is installed within 2 feet of the elbow or tee of similar size.

    b. Piping conveying fluids at 100°F. and higher shall have expansion devices provided in between longitudinal braces to allow for thermal expansion.

    c. Bracing may be omitted when the top of the pipe is suspended 12 inches or less from the supporting structural member and the pipe is suspended by an individual hanger.

3. For equipment 400 lbs. or greater, provide lateral force calculations per ICC (IBC) if required by the building official.

4. Provide earthquake bumpers for all equipment that is supported on isolators and weighing over 300 lbs. including base. Provide minimum of four bumpers for equipment weighing less than 2,000 lbs., and eight bumpers for heavier equipment.

E. Tanks:

1. Provide seismic bracing for hot water tanks.

END OF SECTION 22 05 48

SECTION 22 05 53

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates

B. Tags

C. Stencils

D. Pipe markers

1.02 RELATED REQUIREMENTS

A. Section 09 91 23 - Interior Painting: Identification painting

1.03 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2015

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures

B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

C. Operation and Maintenance Data:

1. Valve Diagram: Provide an unlaminated copy of the valve diagram.

2. Valve Tag Schedule: Provide an unlaminated copy of the valve tag schedule.

3. Concealed Items Legend: Provide a color legend listing the colors used to label equipment above the ceiling.

D. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.01 NAMEPLATES

A. Manufacturers:

1. Brimar Industries, Inc

2. Kolbi Pipe Marker Co

3. Seton Identification Products

B. Description: Laminated three-layer plastic with engraved letters

1. Letter Color: White
2. Letter Height: 1/4 inch
3. Background Color: Black
4. Plastic: Conform to ASTM D709

2.02 TAGS

A. Manufacturers:

1. Advanced Graphic Engraving
2. Brady Corporation
3. Brimar Industries, Inc
4. Kolbi Pipe Marker Co
5. Seton Identification Products

B. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2-inch diameter.

C. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2-inch diameter with smooth edges.

D. Valve Tag Chart: Typewritten letter size list hard laminated.

2.03 STENCILS

A. Manufacturers:

1. Brady Corporation
2. Kolbi Pipe Marker Co
3. Seton Identification Products

B. Stencils: With clean cut symbols and letters of following size:

C. Stencil Paint: As specified in Section 09 91 23, semi-gloss enamel, colors conforming to ASME A13.1.

2.04 PIPE MARKERS

A. Manufacturers:

1. Brady Corporation
2. Brimar Industries, Inc
3. Kolbi Pipe Marker Co

4. Seton Identification Products

B. Comply with ASME A13.1.

C. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

D. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

E. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

F. Identification Scheme, ASME A13.1:

1. Primary: External Pipe Diameter, Uninsulated or Insulated

2. Secondary: Color scheme per fluid service

a. Water; Potable, Cooling, and Other: White text on green background

G. Color code assignments shall be verified with the Owner prior to ordering. Color code as follows:

1. Potable Domestic Cold, Hot, and Hot Recirculation Water: Green with white letters

2. Fire Quenching Fluids: Red with white letters

3. Flammable Fluids: Yellow with black letters

4. Compressed Air: Blue with white letters

2.05 VALVE TAG SCHEDULES

A. Provide a Valve Tag Schedule for each piping system, typewritten, and reproduced on 8-1/2" x 11" bond paper, hard laminated. Tabulate valve number, piping system, system abbreviation (as shown on tag), location of valve (room or space), and variations for identification (if any). Mark valves which are intended for emergency shut-off and similar special uses, by special "flags", in margin of schedule.

2.06 VALVE DIAGRAM

A. Provide a Valve Diagram showing the location of all valves relative to the floor plan of the building. Each Valve Diagram shall be 11x17, hard laminated sheets. Each piping system shall be in a unique color and a legend noting the system colors shall be placed on the first page.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive identification products.

3.02 INSTALLATION

A. Install flexible nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags in clear view and align with axis of piping.

C. Install plastic pipe markers in accordance with manufacturer's instructions.

D. Install plastic tape pipe marker around pipe in accordance with manufacturer's instructions.

E. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

F. Locate ceiling tacks to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

3.03 PIPE MARKERS AND COLOR BANDS

A. Locate pipe markers and color bands as follows wherever piping is exposed to view in occupied space, machine rooms, accessible maintenance spaces and exterior non-concealed locations or in accessible ceiling spaces.

1. Near each valve and control device

2. Near each branch, excluding short take-offs for fixtures and terminal units; mark each pipe at branch where there could be question of flow pattern

3. Near locations where pipes pass through walls or floor/ceilings, or enter non-accessible enclosures

4. At access doors, manholes, and similar access points which permit view of concealed piping

5. Near major equipment items and other points of origination and termination

3.04 PLUMBING EQUIPMENT IDENTIFICATION

A. Install engraved plastic laminate sign on or near each major item of plumbing equipment and each operation device. Provide signs for the following general categories of equipment and operational devices. Provide signs or suspended ceiling tile below mechanical equipment located above ceiling.

1. Pumps and similar motor-driven units

2. Tanks and pressure vessels

3.05 CONCEALED ITEMS

A. Items concealed above accessible ceilings requiring access, shall have the ceiling marked to indicate such item's location. The marking system shall consist of colored phenolic plates with 1/2” tall, engraved lettering specifying the item concealed; plate shall be applied to ceiling T-bar framing with rivets or other owner approved method below the concealed item. Colors used shall be verified with Owner, and unless directed otherwise, shall be:

1. Fire Protection System Components: Red

2. Domestic Plumbing System Components: Green

3.06 VALVE TAG SCHEDULE

A. Provide the hard laminated Valve Tag Schedule in the mechanical/janitors room.

3.07 VALVE DIAGRAM

A. Provide the hard laminated Valve Diagram in the mechanical/janitors room.

END OF SECTION 22 05 53

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SECTION 22 07 19

PLUMBING PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cellular glass insulation

B. Flexible elastomeric cellular insulation

C. Flexible removable and reusable blanket insulation

D. Glass fiber insulation

E. Hydrous calcium silicate insulation

F. Jacketing and accessories

1.02 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping

1.03 REFERENCE STANDARDS

A. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless-Steel Sheet, Strip, Plate, and Flat Bar; 2015

B. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2013

C. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2007 (Reapproved 2013)

D. ASTM C449 - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement; 2007 (Reapproved 2013)

E. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2017

F. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation; 2013

G. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2016

H. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2017

I. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation; 2016a

J. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013

K. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2013)

L. ASTM C1695 - Standard Specification for Fabrication of Flexible Removable and Reusable Blanket Insulation for Hot Service; 2010 (Reapproved 2015)

M. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2017

N. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016

O. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.05 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum 5 years of documented experience

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.07 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723

2.02 GLASS FIBER INSULATION

A. Manufacturers:

1. CertainTeed Corporation
2. Johns Manville Corporation
3. Knauf Insulation
4. Owens Corning Corporation; Fiberglas Pipe Insulation ASJ
5. Manson Insulation

B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible

1. K Value: ASTM C177, 0.24 at 75 degrees F
2. Maximum Service Temperature: 850 degrees F
3. Maximum Moisture Absorption: 0.2 percent by volume
4. Maximum flame/smoke spread developed: 25/50

C. Vapor Barrier Jacket: White Kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches

D. Vapor Barrier Lap Adhesive: Compatible with insulation

E. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool

F. Outdoor Vapor Barrier Mastic: Vinyl emulsion type acrylic or mastic, compatible with insulation, black color

G. Outdoor Breather Mastic: Vinyl emulsion type acrylic or mastic, compatible with insulation, black color

H. Insulating Cement: ASTM C449

2.03 FLEXIBLE REMOVABLE AND REUSABLE BLANKET INSULATION

A. Insulation: ASTM C553 Type V; flexible, noncombustible

1. Comply with ASTM C1695
2. K Value: 0.37 at 100 degrees F, when tested in accordance with ASTM C177 or ASTM C518
3. Minimum Service Temperature: 32 degrees F
4. Maximum Service Temperature: 500 degrees F
5. Maximum Water Vapor Absorption: Less than 5.0 percent by weight

2.04 CELLULAR GLASS INSULATION

A. Manufacturers:

1. Pittsburgh Corning Corporation

B. Insulation: ASTM C552, Type II

1. K Value: 0.35 at 100 degrees F
2. Service Temperature Range: From 250 degrees F to 800 degrees F
3. Water Vapor Permeability: 0.005 perm-inch maximum per inch
4. Water Absorption: 0.5 percent by volume, maximum

2.05 HYDROUS CALCIUM SILICATE INSULATION

A. Manufacturers:

1. Johns Manville Corporation

B. Insulation: ASTM C533 and ASTM C795; rigid molded, asbestos free, gold color

1. K Value: 0.40 at 300 degrees F when tested in accordance with ASTM C177 or ASTM C518
2. Maximum Service Temperature: 1,200 degrees F
3. Density: 15 pcf

C. Tie Wire: 0.048-inch stainless steel with twisted ends on maximum 12-inch centers

D. Insulating Cement: ASTM C449

2.06 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturer:

1. Aeroflex USA, Inc
2. Armacell LLC; AP Armaflex
3. K-Flex USA LLC; Insul-Tube
4. Durkflex

B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.

1. Minimum Service Temperature: Minus 40 degrees F
2. Maximum Service Temperature: 220 degrees F
3. Connection: Waterproof vapor barrier adhesive
4. K" Value: 0.25 Btu-in per hour per square foot °F at 75 degrees F
5. Maximum flame/smoke spread developed: 25/50
6. Maximum water vapor permeability, wet cup, perm-in 0.10
7. Fiber free, formaldehyde-free, and low VOC's
8. Install with fitting covers or installers shall have training through Armacell Qualified Installer Program (AQIP) or equivalent.
9. Provide black color in all cases except provide white color if exposed to view or specifically called out on the plans.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation

2.07 JACKETING AND ACCESSORIES

A. PVC Plastic:

1. Manufacturers:

a. Johns Manville Corporation; Zeston 2000

2. Jacket: One-piece molded type fitting covers and sheet material, gloss white color.

a. Minimum Service Temperature: 0 degrees F

b. Maximum Service Temperature: 150 degrees F

c. Moisture Vapor Permeability: 0.002 perm-inch, maximum, when tested in accordance with ASTM E96/E96M

d. Thickness: 10 mil, 0.010 inch

e. Connections: Pressure sensitive color matching vinyl tape

B. Canvas Jacket: UL listed 6 oz/sq yd plain weave cotton fabric treated with dilute fire-retardant lagging adhesive

1. Lagging Adhesive: Compatible with insulation

C. Aluminum Jacket: ASTM B209 (ASTM B209M) formed aluminum sheet

1. Thickness: 0.016-inch sheet

2. Finish: Embossed

3. Joining: Longitudinal slip joints and 2-inch laps

4. Fittings: 0.016-inch-thick die shaped fitting covers with factory attached protective liner

5. Metal Jacket Bands: 3/8 inch wide; 0.015-inch-thick aluminum

D. Stainless Steel Jacket: ASTM A666, Type 304 stainless steel

1. Thickness: 0.010 inch

2. Finish: Smooth

3. Metal Jacket Bands: 3/8 inch wide; 0.010-inch-thick stainless steel

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Exposed Piping: Locate insulation and cover seams in least visible locations.

C. Neatly finish insulation at supports, protrusions, and interruptions.

D. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

E. Glass fiber insulated pipes conveying fluids below ambient temperature:

1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure-sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.

2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

F. For hot piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.

G. Glass fiber insulated pipes conveying fluids above ambient temperature:

1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive.

2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

H. Insulated Pipe Supports and Shields:

1. Install in place at each hanger and support as required by Section 221005 Plumbing Piping prior to insulating.

2. Application: Piping 1-1/2 inches diameter or larger

3. Shields: Galvanized steel or PVC as follows:

a. 20 gauge (18 gauge for pipe larger than 3 inches) galvanized steel between pipe hangers or pipe hanger rolls and insulated pipe supports. Shield shall cover a minimum of 40% of the insulation where the pipe is supported from the bottom and 100% of the insulation where the pipe is clamped.

b. PVC shield the full diameter of the pipe insulation with 20-gauge galvanized steel shield riveted to the PVC.

c. Utilize the Armacell Insulguard pipe shield system.

4. Insulated Pipe Supports Location: Between support shield and piping and under the finish jacket

5. Insulated Pipe Support Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation. Provide 9 inches (230 mm) long insulated pipe support and 18-gauge galvanized steel shield for pipes larger than 3 inches.

6. Insert Material: See Section 22 10 05 Plumbing Piping.

I. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations except where prohibited by code. Finish at supports, protrusions, and interruptions. At fire separations, refer to Fire Stop Specification Section 07 84 00.

J. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with PVC jacket and fitting covers.

K. Exposed Work: Finish with PVC jacket and fitting covers applied after pipe insulation is installed. A pre-cut "Hi-Lo Temp" insulation insert, conforming to the UL 25/50 rating, shall be snugly tucked around the fitting making sure the fitting is covered with the full thickness of insulation.

1. All others provide covering in pad form, constructed as follows: Use 1-inch-thick Owens-Corning Fiberglas TIW Glass Wool, Type I, non-oiled, fully enclosed on all sides and edges within tight-weave canvas jacket. Attach Bergen hooks around edges of pad. Fit pad to device with edges tightly butted and secure with copper wire laced between hooks. Provide vapor seal where vapor seal is required for adjacent insulation.

L. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

M. Installation of below ground domestic hot water piping insulation: All piping shall be insulated with cellular glass with heat sealed "pittwrap" or pre-insulated pipe system with Type K copper carrier (See Section 23 07 19 - HVAC Piping Insulation) with schedule 80 PVC or HDPE jacket.

N. Gauge Lines: Insulate to the gauge shutoff valve.

O. Elastomeric Insulation Installation:

1. For PEX piping installation, elastomeric insulation shall be installed continuous through stud framing and all penetration locations through walls, floors, and ceilings.

2. Elastomeric insulation with wall thicknesses greater than 1” shall not be installed in air plenums unless specifically UL723 listed for use in a plenum.

3. All elastomeric foam and sheet seams shall be sealed with adhesive per the insulation manufacturer’s recommendations.

4. Install elastomeric insulation on all PEX domestic hot water and recirculation water piping.

3.03 PIPE HANGERS

A. Do not allow pipes to come in contact with hangers.

3.04 SCHEDULES

A. Plumbing Systems:

1. Domestic Hot Water Supply (including Recirculation):

a. Glass Fiber Insulation:

1) For Pipe Size Range of 1/2 to 1-1/4 inch, provide insulation thickness of: 1-inch.

2) For Pipe Size Range of 1-1/2 inch and greater, provide insulation thickness of: 1-1/2 inch.

b. Cellular Glass Insulation and Pre-insulated Piping Systems for underground applications: For all pipe sizes, provide insulation thickness of 1-1/2 inch.

c. Flexible Elastomeric Cellular Insulation (PEX only): For all pipe sizes, provide insulation thickness of 1-inch.

2. Domestic Cold Water:

a. Glass Fiber: For all pipe sizes on metal pipe, provide insulation thickness of 1-inch.

b. Flexible Elastomeric Cellular Insulation (PEX pipe): Not Required.

3. Roof Drainage Above Grade for the greater of 10 feet or through all horizontal pipe:

a. Flexible Elastomeric Cellular Insulation: For all pipe sizes, provide insulation thickness of 1 inch.

B. Other Systems:

1. Piping Exposed to Freezing or Semi-Heated Spaces (less than 50 degrees F.) with or without Heat Tracing:

a. Glass Fiber: For all pipe sizes, provide insulation thickness of 1-1/2 inch.

b. Flexible Elastomeric Cellular Insulation: For all pipe sizes, provide insulation thickness of 1-1/2 inch.

2. Copper Condensate Piping:

a. Glass Fiber: For all pipe sizes, provide insulation thickness of 1-inch.

b. Flexible Elastomeric Cellular Insulation: For all pipe sizes, provide insulation thickness of 1-inch.

END OF SECTION 22 07 19

SECTION 22 10 05

PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sanitary waste piping, buried within 5 feet of building

B. Sanitary waste piping, above grade

C. Domestic water piping, buried beyond 5 feet of building

D. Domestic water piping, buried within 5 feet of building

E. Domestic water piping, above grade

F. Storm drainage piping, buried within 5 feet of building

1. Storm drainage piping, above grade

2. Pipe flanges, unions, and couplings

3. Pipe hangers and supports

4. Pipe sleeve-seal systems

5. Pressure reducing valves

6. Pressure relief valves

7. Strainers

1.02 RELATED REQUIREMENTS

A. Section 22 05 48 - Vibration and Seismic Controls for Plumbing Piping and Equipment

B. Section 22 05 53 - Identification for Plumbing Piping and Equipment

1.03 REFERENCE STANDARDS

A. ANSI Z21.22 - American National Standard for Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems; 2015

B. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2012

C. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2013

D. ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings - DWV; 2016

E. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV; 2012

F. ASME B31.9 - Building Services Piping; 2014

G. ASME BPVC-IV - Boiler and Pressure Vessel Code, Section IV - Rules for Construction of Heating Boilers; 2017

H. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing and Fusing Operators; 2017

I. ASSE 1003 - Performance Requirements for Water Pressure Reducing Valves for Domestic Water Distribution Systems; 2009

J. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014

K. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999 (Reapproved 2014)

L. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017

M. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless-Steel Tubing for General Service; 2015a

N. ASTM B32 - Standard Specification for Solder Metal; 2008 (Reapproved 2014)

O. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes; 2015a

P. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2016

Q. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2016

R. ASTM B306 - Standard Specification for Copper Drainage Tube (DWV); 2013

S. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube; 2016

T. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings; 2016

U. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings; 2014

V. ASTM D2239 - Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter; 2012a

W. ASTM D2564 - Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems; 2012

X. ASTM D2609 - Standard Specification for Plastic Insert Fittings for Polyethylene (PE) Plastic Pipe; 2015

Y. ASTM D2657 - Standard Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings; 2007 (Reapproved 2015)

Z. ASTM D2665 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings; 2014

AA. ASTM D2855 - Standard Practice for the Two-Step (Primer & Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets; 2015

BB. ASTM D3034 - Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2016

CC. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2017

DD. ASTM D4101 - Standard Specification for Polypropylene Injection and Extrusion Materials; 2014, with Editorial Revision (2016)

EE. ASTM F876 - Standard Specification for Crosslinked Polyethylene (PEX) Tubing; 2017

FF. ASTM F877 - Standard Specification for Crosslinked Polyethylene (PEX) Plastic Hot- and Cold-Water Distribution Systems; 2011a

GG. ASTM F1960 - Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-linked Polyethylene (PEX) Tubing; 2015

HH. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2011 (Amended 2012)

II. AWWA C550 - Protective Interior Coatings for Valves and Hydrants; 2017

JJ. AWWA C606 - Grooved and Shouldered Joints; 2015

KK. AWWA C651 - Disinfecting Water Mains; 2014

LL. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Transmission and Distribution; 2016

MM. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications; 2009 (Revised 2012)

NN. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; 2011 (Revised 2012)

OO. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements; 2015

PP. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry Elements; 2015

QQ. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements; 2015

RR. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements; 2016

SS. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2009

TT. NSF 61 - Drinking Water System Components - Health Effects; 2017

UU. NSF 372 - Drinking Water System Components - Lead Content; 2016

VV. PPI TR-4 - PPI Listing of Hydrostatic Design Basis (HDB), Hydrostatic Design Stress (HDS), Strength Design Basis (SDB), Pressure Design Basis (PDB), and Minimum Required Strength (MRS) Ratings For Thermoplastic Piping Materials or Pipe; 2017

WW. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions

1.04 SUBMITTALS

A. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

B. Welder Certificate: Include welders certification of compliance with ASME BPVC-IX.

C. Shop Drawings: For non-penetrating rooftop supports, submit detailed layout developed for this project, with design calculations for loadings and spacings.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 60 00 - Product Requirements for additional provisions.

E. Operation and Maintenance Data:

1. Domestic water sterilization test

2. Domestic water pressure tests

1.05 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

B. Valves: Manufacturer's name and pressure rating marked on valve body.

C. Welding Materials and Procedures: Conform to ASME BPVC-IX and applicable state labor regulations.

D. Welder Qualifications: Certified in accordance with ASME BPVC-IX.

E. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

F. Domestic water fittings, joining materials, and all other appurtenances in contact with potable water shall be lead-free except those specifically exempted in Section 3874 of the Safe Water Drinking Act.

1. Lead-free shall mean:

a. Not containing more than 0.2% lead when used with respect to solder and flux; and

b. Not more than a weighted average of 0.25% when used with respect to the vetted surfaces of pipes, pipe fittings, plumbing fittings, and fixtures

1.06 DELIVERY, STORAGE, AND HANDLING

A. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

B. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.02 SANITARY WASTE PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Cast Iron Pipe: Conform to CISPI 301, hubless pipe and fittings

1. Manufacturers:

a. AB&I

b. Charlotte

c. Tyler

B. Joints: CISPI 310, neoprene gasket and stainless-steel clamp and shield assemblies. Couplings shall be constructed of 300 Series type stainless steel with a minimum shield thickness equal to 0.007. There shall be a minimum of 2 bands for pipe sizes up to 4" and a minimum of 4 bands for pipe sizes 5" and larger. Coupling shall be capable of holding 15 psi of pressure. Sealing bands shall have a minimum thickness of 0.026 and require a minimum of 80-inch lbs. torque per band. Neoprene gasket shall meet ASTM C564.

1. Manufacturers:

a. Thermafit Heavy Duty

b. Clamp-All HI-TORQ 80

c. Husky 4000

d. Ideal Pow'r-Gear

e. MiFab MI-QXHUB

C. PVC Pipe: ASTM D2665 and ASTM D3034, schedule 40, DWV, solid core pipe.

1. Fittings: PVC

2. Joints: ASTM D2564

a. Mechanical Joints: Mechanical joints on drainage pipe shall be made with an elastomeric seal conforming to ASTM C 1173, ASTM D 3212 or CSA CAN/CSA-B602. Mechanical joints shall not be installed in above-ground systems, unless otherwise approved. Joints shall be installed in accordance with the manufacturer's instructions.

b. Plastic to Cast Iron Mechanical Joints: CISPI 310, neoprene gasket and stainless-steel clamp and shield assemblies. Couplings shall be constructed of 300 Series type stainless steel with a minimum shield thickness equal to 0.015. There shall be a minimum of 2 bands for pipe sizes up to 4" and a minimum of 4 bands for pipe sizes 5" and larger. Coupling shall be capable of holding 15 psi of pressure. Sealing bands shall have a minimum thickness of 0.026 and require a minimum of 80-inch lbs. torque per band. Neoprene gasket shall meet ASTM C564.

1) Manufacturers:

a) Husky 4200

c. Solvent Cementing: Joint surfaces shall be clean and free from moisture. A purple primer that conforms to ASTM F 656 shall be applied. Solvent cement not purple in color and conforming to ASTM D 2564, CSA CAN/CSA-B137.3, CSA CAN/CSA-B181.2 or CSA CAN/CSA-B182.1 shall be applied to all joint surfaces. The joint shall be made while the cement is wet and shall be in accordance with ASTM D 2855. Solvent-cement joints shall be permitted above or below ground.

d. Threaded Joints: Threads shall conform to ASME B1.20.1. Schedule 80 or heavier pipe shall be permitted to be threaded with dies specifically designed for plastic pipe. Approved thread lubricant or tape shall be applied on the male threads only.

3. Manufacturers:

a. Charlotte

b. Mueller Industries

c. Cresline

2.03 SANITARY WASTE PIPING, ABOVE GRADE

A. Cast Iron Pipe: Conform to CISPI 301, hubless pipe and fittings.

1. Manufacturers:

a. AB&I

b. Charlotte

c. Tyler

B. Joints: CISPI 310, neoprene gaskets and stainless-steel clamp-and-shield assemblies. Couplings shall be constructed of 300 Series type stainless steel. There shall be 2 bands for pipe sizes up to 4" and a minimum of 4 bands for pipe sizes 5" and larger. Sealing bands shall require a minimum of 60-inch lbs. torque per band. Neoprene gasket shall meet ASTM C 564.

1. Manufacturers:

a. Thermafit Regular Duty

b. Tyler Standard No-Hub

c. Clamp-All HI-TORQ 80

d. Husky 2000

e. Anaco

f. Ideal Pow'r Gear

g. MiFab MI-QHUB

C. Flashing: Lead flashing, 4 lbs. per sq. ft. of sheet lead flashing. Flashing skirt radius from the inserted pipe of at least 8 inches or 2-foot square.

1. Manufacturers:

a. Elmdor Stoneman

D. Vent Cap: Vandal Resistant. Cast Iron. Minimum of 2 to 1 open area compared to the cross-sectional area of the vent pipe

1. Manufacturers:

a. Elmdor Stoneman

E. PVC Pipe: ASTM D2665, schedule 40, DWV, solid core pipe

1. Fittings: PVC

2. Joints: ASTM D2564

a. Mechanical Joints: Mechanical joints on drainage pipe shall be made with an elastomeric seal conforming to ASTM C 1173, ASTM D 3212 or CSA CAN/CSA-B602. Mechanical joints shall not be installed in above-ground systems, unless otherwise approved. Joints shall be installed in accordance with the manufacturer's instructions.

b. Solvent Cementing: Joint surfaces shall be clean and free from moisture. A purple primer that conforms to ASTM F 656 shall be applied. Solvent cement not purple in color and conforming to ASTM D 2564, CSA CAN/CSA-B137.3, CSA CAN/CSA-B181.2 or CSA CAN/CSA-B182.1 shall be applied to all joint surfaces. The joint shall be made while the cement is wet and shall be in accordance with ASTM D 2855. Solvent-cement joints shall be permitted above or below ground.

c. Threaded Joints: Threads shall conform to ASME B1.20.1. Schedule 80 or heavier pipe shall be permitted to be threaded with dies specifically designed for plastic pipe. Approved thread lubricant or tape shall be applied on the male threads only.

3. Manufacturers:

a. Charlotte

b. Mueller Industries

c. Cresline

2.04 DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Copper Pipe: ASTM B42, hard drawn, type K (A)

1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and bronze

2. Joints: AWS A5.8M/A5.8, BCuP copper/silver braze, lead free conforming to UPC standards for solder and all local code requirements

a. Manufacturers:

1) Canfield

2) J.W. Harris

3) Aqua-Clean

B. Cross-Linked Polyethylene (PEX) Pipe: ASTM F876 or ASTM F877.

1. Manufacturers:

a. Uponor, Inc

b. Wirsbo

c. Zurn Industries, LLC

d. Viega

e. Rehau

f. Watts

g. Mr. PEX

h. Heat Link

2. PPI TR-4 Pressure Design Basis:

a. 100 psig at maximum 180 degrees F

3. Fittings: Brass and copper

4. Fittings: Brass and engineered polymer (EP) ASTM F1960

5. Joints: Mechanical compression fittings

6. Joints: ASTM F1960 cold-expansion fittings

2.05 DOMESTIC WATER PIPING, ABOVE GRADE

A. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), hard drawn

1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze

2. Joints: ASTM B32, alloy Sn95 solder, lead free conforming to UPC standards for solder and all local code requirements.
    a. Manufacturers:
        1) Canfield
        2) J.W. Harris
        3) Aqua-Clean
3. Mechanical Press Sealed Fittings: Double pressed type, NSF 61 and NSF 372 approved or certified, utilizing EPDM, nontoxic synthetic rubber sealing elements.
    a. Manufacturers:
        1) Grinnell Products, a Tyco Business
        2) Viega LLC
        3) Nibco
4. Mechanical Couplings on pipe 2.5" and larger: NSF 61
    a. Manufacturers:
        1) Victaulic
        2) Gruvlok

B. Cross-Linked Polyethylene (PEX) Pipe: ASTM F876 or ASTM F877. Pipe shall be NSF 61 and NSF 14 certified.
1. Manufacturers:
    a. Uponor, Inc
    b. Viega LLC
    c. Zurn Industries, LLC
    d. Watts
    e. Rehau
    f. Mr. PEX
    g. Heat Link
2. PPI TR-4 Pressure Design Basis:
    a. 100 psig at maximum 180 degrees F
3. Fittings: Brass and engineered polymer (EP) ASTM F1960
4. Joints: Mechanical compression fittings

5. Joints: ASTM F1960 cold-expansion fittings

C. Stainless Steel Pipe: ASTM A269/A269M, Grade TP304 alloy welded and seamless

1. Mechanical Press Sealed Fittings Double pressed type, NSF 61 and NSF 372 approved or certified, utilizing EPDM, non-toxic synthetic rubber sealing elements.

a. Manufacturers:

1) Grinnell Products, a Tyco Business

2) Viega LLC

3) Victaulic

4) Nibco

2. Mechanical Couplings on Pipe 2.5" and Larger: NSF 61

a. Manufacturers:

1) Victaulic

2) Gruvlok

2.06 STORM DRAINAGE PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Cast Iron Pipe: Conform to CISPI 301, hubless pipe and fittings.

1. Manufacturers:

a. AB&I

b. Charlotte

c. Tyler

2. Joints: CISPI 310, neoprene gasket and stainless-steel clamp and shield assemblies. Couplings shall be constructed of 300 Series type stainless steel with a minimum shield thickness equal to 0.015. There shall be 2 bands for pipe sizes up to 4” and a minimum of 4 bands for pipe sizes 5” and larger. Coupling shall be capable of holding 15 psi of pressure. Sealing bands shall have a minimum thickness of 0.026 and require a minimum of 80-inch lbs. torque per band. Neoprene gasket shall meet ASTM C564.

a. Thermafit Heavy Duty

b. Clamp-All HI-TORQ 80

B. Copper Tube: ASTM B306, DWV.

1. Fittings: ASME B16.23, cast copper, or ASME B16.29, wrought copper

2. Joints: ASTM B32, alloy Sn50 solder

C. PVC Pipe: ASTM D2665 or ASTM D3034, schedule 40, DWV, solid core pipe

1. Fittings: PVC

2. Joints: ASTM D2564

a. Mechanical Joints: Mechanical joints on drainage pipe shall be made with an elastomeric seal conforming to ASTM C 1173, ASTM D 3212 or CSA CAN/CSA-B602. Mechanical joints shall not be installed in above-ground systems, unless otherwise approved. Joints shall be installed in accordance with the manufacturer's instructions.

b. Solvent Cementing: Joint surfaces shall be clean and free from moisture. A purple primer that conforms to ASTM F 656 shall be applied. Solvent cement not purple in color and conforming to ASTM D 2564, CSA CAN/CSA-B137.3, CSA CAN/CSA-B181.2 or CSA CAN/CSA-B182.1 shall be applied to all joint surfaces. The joint shall be made while the cement is wet and shall be in accordance with ASTM D 2855. Solvent-cement joints shall be permitted above or below ground.

c. Threaded Joints: Threads shall conform to ASME B1.20.1. Schedule 80 or heavier pipe shall be permitted to be threaded with dies specifically designed for plastic pipe. Approved thread lubricant or tape shall be applied on the male threads only.

3. Manufacturers:

a. Charlotte

b. Mueller Industries

c. Cresline

2.07 STORM DRAINAGE PIPING, ABOVE GRADE

A. Cast Iron Pipe: Conform to CISPI 301, hubless pipe and fittings.

1. Manufacturers:

a. AB&I

b. Charlotte

c. Tyler

B. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies. Couplings shall be constructed of 300 Series type stainless steel. There shall be 2 bands for pipe sizes up to 4" and a minimum of 4 bands for pipe sizes 5" and larger. Sealing bands shall require a minimum of 60-inch lbs. torque per band. Neoprene gasket shall meet ASTM C564.

1. Thermafit Regular Duty

2. Tyler Standard No-Hub

3. Clamp-All HI-TORQ 80

C. Copper Tube: ASTM B306, DWV

1. Fittings: ASME B16.23, cast copper, or ASME B16.29, wrought copper

2. Joints: ASTM B32, alloy Sn50 solde.

D. PVC Pipe: ASTM D2665 or ASTM D3034, schedule 40, DWV, solid core pipe

1. Fittings: PVC

2. Joints: ASTM D2564

a. Mechanical Joints: Mechanical joints on drainage pipe shall be made with an elastomeric seal conforming to ASTM C 1173, ASTM D 3212 or CSA CAN/CSA-B602. Joints shall be installed in accordance with the manufacturer's instructions.

b. Solvent Cementing: Joint surfaces shall be clean and free from moisture. A purple primer that conforms to ASTM F 656 shall be applied. Solvent cement not purple in color and conforming to ASTM D 2564, CSA CAN/CSA-B137.3, CSA CAN/CSA-B181.2 or CSA CAN/CSA-B182.1 shall be applied to all joint surfaces. The joint shall be made while the cement is wet and shall be in accordance with ASTM D 2855. Solvent-cement joints shall be permitted above or below ground.

c. Threaded Joints: Threads shall conform to ASME B1.20.1. Schedule 80 or heavier pipe shall be permitted to be threaded with dies specifically designed for plastic pipe. Approved thread lubricant or tape shall be applied on the male threads only.

3. Manufacturers:

a. Charlotte

b. Mueller Industries

c. Cresline

2.08 CONDENSATE PIPING

A. Schedule 40 PVC, solid core

B. Type L copper for use in air plenum, penetrating a fire wall, or used with gas-fired equipment

C. Insulate per Section 22 07 19 Plumbing Piping Insulation.

2.09 FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 3 Inches and Under:

1. Ferrous pipe: Class 150 malleable iron threaded unions

2. Copper tube and pipe: Class 150 bronze unions with soldered joints

B. Flanges for Pipe Size Over 1 Inch:

1. Ferrous Pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets

2. Copper Tube and Pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets

C. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier

2.10 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.

1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.

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

a. 610 pounds for 3/8" diameter rods

b. 1130 pounds for 1/2" diameter rods

3. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.

a. Cold and Hot Pipe Sizes 6 inch and Larger: Double hangers.

4. Trapeze Hangers: Welded steel channel frames attached to structure

5. Vertical Pipe Support: Steel riser clamp, epoxy coated

6. Steel: Provide structural steel per ASTM A36/A36M.

7. Wood: Shall be fire treated

8. Rooftop Supports for Low-Slope Roofs: Steel pedestals with bases that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified; and as follows:

a. Bases: High-density polypropylene

b. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly

c. Steel Components: Stainless steel or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M

d. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports; corrosion-resistant material

e. Height: Provide minimum clearance of 6 inches under pipe to top of roofing.

f. Manufacturers:

1) PDH

2) Elcen

3) Grinnel

4) B-line

5) Miro Industries, Inc

6) Unistrut

7) Caddy

8) Tolco

B. Plumbing Piping - Drain, Waste, and Vent:

1. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Malleable iron, adjustable swivel, split ring

2. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis

3. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook

4. Copper Pipe Support: Carbon steel ring, adjustable, copper plated

C. Plumbing Piping - Water:

1. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Malleable iron, adjustable swivel, split ring

2. Hangers for Cold Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis

3. Hangers for Hot Pipe Sizes 2 Inches to 4 Inches: Carbon steel, adjustable, clevis

4. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook

5. Copper Pipe Support: Carbon steel ring, adjustable, copper plated

D. Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:

1. Concrete Wedge Expansion Anchors: Complying with ICC-ES AC193

2. Masonry Wedge Expansion Anchors: Complying with ICC-ES AC01

3. Concrete Screw Type Anchors: Complying with ICC-ES AC193

4. Masonry Screw Type Anchors: Complying with ICC-ES AC106

5. Concrete Adhesive Type Anchors: Complying with ICC-ES AC308

6. Other Types: As required

7. Manufacturers:
    a. Powers Fasteners, Inc
    b. Rawplug
    c. Phillips
    d. Hilti
    e. Caddy

E. Insulated Pipe Inserts and Insulation Shields:
1. Insulated pipe insert shall have no more than 5% deformation at 100 psi and a thermal conductivity no more than 0.38 Btu/hr./sq. ft./degree F/1-inch thick at 75°F.
2. Insulated pipe insert shall be same thickness as adjoining pipe insulation and sized to match pipe in which it is used on. See Section 22 07 19 for insulation sizes.
3. Where elastomeric insulation is being used, pipe inserts may be omitted.
4. Provide shield per Section 22 07 19 Plumbing Piping Insulation.
5. Manufacturers:
    a. TPS Thermal Pipe Shields
    b. B-Line
    c. Clement Support Services
    d. Snappitz

F. PEX Pipe Hangers and Supports:
1. Provide continuous steel channel pipe supports at all horizontal PEX pipe runs greater than 6’-0” in length.
    a. Steel Channel Pipe Supports:
        1) 23-gauge, galvanized steel channel with a copper tube size controlled outside diameter
        2) Steel channel pipe supports shall be available in lengths up to 9’-0” for pipe sizes 1/2” - 3 ½”.
        3) Secure pipe to channel support with stainless steel straps rated for 300-pound tensile strength.
2. Manufacturers:
    a. Uponor PEX-a Pipe, or approved equivalent
3. All horizontal PEX pipe shall utilize steel brackets, clevis, J-hangers, or trapeze style hangers.

2.11 PIPE SLEEVE-SEAL SYSTEMS

A. Manufacturers:

1. The Metraflex Company; MetraSeal
2. Link Seal

B. Modular/Mechanical Seal:

1. Elastomer-based interlocking links continuously fill annular space between pipe and wall-sleeve, wall or casing opening.
2. Watertight seal between pipe and wall-sleeve, wall or casing opening.
3. Size and select seal component materials in accordance to service requirements.
4. Glass reinforced plastic pressure end plates.

2.12 PRESSURE REDUCING VALVES

A. Manufacturers:

1. Amtrol Inc
2. Cla-Val Company
3. Flomatic Valves
4. Watts Regulator Company
5. Wilkins
6. Apollo Conbraco

B. Up to 2 Inches:

1. ASSE 1003, bronze body, stainless steel, and thermoplastic internal parts, fabric reinforced diaphragm, strainer, threaded single union ends.

C. Over 2 Inches:

1. ASSE 1003, cast iron body with interior lining complying with AWWA C550, bronze fitted, elastomeric diaphragm and seat disc, flanged.

2.13 PRESSURE RELIEF VALVES

A. ANSI Z21.22, AGA certified, bronze body, teflon seat, steel stem and springs, automatic, direct pressure actuated.

B. Pressure:

1. Manufacturers:
   a. Cla-Val Co

b. Watts Regulator Company

C. Temperature and Pressure:

1. Manufacturers:

a. Cla-Val Co

b. Watts Regulator Company

2.14 STRAINERS

A. Manufacturers:

1. Armstrong International, Inc
2. Bell and Gossett
3. Apollo Conbraco
4. Hoffman
5. Wheatley
6. Nibco

B. Size 2 inch and Under:

1. Threaded brass body for 175 psi CWP, Y pattern with 1/32-inch stainless steel perforated screen
2. Class 150, threaded bronze body 300 psi CWP, Y pattern with 1/32-inch stainless steel perforated screen

C. Size 1-1/2 inch to 4 inch:

1. Class 125, flanged iron body, Y pattern with 1/16-inch stainless steel perforated screen

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.03 GENERAL INSTALLATION

A. Furnish and install complete system of piping, valved as indicated or as necessary to completely control entire apparatus. Pipe drawings are diagrammatic and indicate general location and connections. Piping may have to be offset, lowered, or raised as required or directed at site. This does not relieve this Division from responsibility for proper erection of systems of piping in every respect. Install in accordance with manufacturer's instructions.

B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

D. Consult all drawings for location of pipe spaces, ducts, electrical equipment, ceiling heights, door openings, window openings, and other details and report discrepancies or possible conflicts to Architect/Engineer before installing pipe.

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

F. Install piping to maintain headroom, conserve space, and not interfere with use of space, removal of other equipment, ducts, or devices, or block access to doors, windows, or access openings.

G. Group piping whenever practical at common elevations.

H. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

I. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

J. Provide access where valves and fittings are not exposed.

K. Establish elevations of buried piping outside the building to ensure not less than 3.3 ft (1 m) of cover.

L. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

M. Provide support for utility meters in accordance with requirements of utility companies.

N. Install valves with stems upright or horizontal, not inverted. Refer to Section 22 05 23.

O. Install water piping to ASME B31.9.

P. Sleeve pipes passing through partitions, walls and floors.

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

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

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

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

U. Install all exposed piping parallel to the closest wall and in a neat, workmanlike manner.

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

W. Strainers: Install strainers as indicated. Provide plugged gate or ball valve in blow-off connection on strainers, valve shall be same size as blow-off tapping. Final blow-off shall have a hose connection fitting.

X. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813; in potable water systems use flux also complying with NSF 61 and NSF 372.

Y. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.

Z. Inserts:

1. Provide inserts for placement in concrete formwork.
2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

AA. Pipe Hangers and Supports:

1. Install in accordance with ASME B31.9.
2. Support horizontal piping as indicated.
3. Install hangers to provide minimum 1/2-inch space between finished covering and adjacent work.
4. Place hangers within 12 inches of each horizontal elbow.
5. Use hangers with 1-1/2-inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
6. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
8. Provide copper plated hangers and supports for copper piping.
9. Provide hangers adjacent to motor-driven equipment with vibration isolation; see Section 22 05 48.
10. Support cast iron drainage piping at every joint.

BB. Manufactured Sleeve-Seal Systems:

1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.

3. Locate piping in center of sleeve or penetration.

4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.

5. Tighten bolting for a watertight seal.

6. Install in accordance with manufacturer's recommendations.

CC. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

3.04 SOIL, WASTE, VENT, AND STORM DRAIN SYSTEMS

A. Place cleanouts as follows:

1. Where shown on plans and near bottom of each stack and riser.

2. At every 90 degrees change of direction for horizontal lines.

3. Every 100 feet of horizontal run.

4. Extend cleanout to accessible surface. Do not place cleanouts in carpeted floors. In such locations, use wall type cleanouts.

B. Vent entire waste system to atmosphere. Discharge vent pipe minimum 14 inches above roof. Join lines together in least practicable number before projecting above roof. Set back vent lines so they will not pierce roof near edge or valley. Install vent piping penetrating roofed areas to maintain integrity of roof assembly.

C. Use torque wrench to obtain proper tension in cinch bands on above ground hubless cast iron pipe. Butt ends of pipe against centering flange of coupling.

D. Flash pipes passing through roof (or as shown on the plan) fitted snugly around pipes and caulk between flashing and pipe with flexible waterproof compound. Provide counterflashing fitting with vandal resistant screws. Extend lead up and turn in a minimum of 1" into the pipe. Flashing base shall be at least 24 inches square (or 8-inch radius).

E. Install an expansion joint in each vertical straight run of PVC or polypropylene soil, waste, vent, and drain pipe at intervals in excess of 30 feet. Install and anchor pipe per expansion joint manufacturer’s instructions. Provide access panel as required for servicing the expansion joint.

F. Install vertical waste pipe to comply with standard installation practices for suds control.

G. Provide hubless cast iron for the first 20 feet downstream of drains located in the kitchen and boiler room.

H. Reducing size of pipe in the direction of flow is prohibited.

I. Install drainage piping at the following minimum slopes unless otherwise indicated:

1. Building soil and waste drain: 2 percent downward in the direction of flow unless indicated otherwise on the plans

2. Building storm drain: 1 percent downward in direction of flow

J. Field Quality Control:

1. Test storm drainage piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

   a. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

   b. Leave uncovered and unconcealed new, altered, extended, or replaced storm drainage piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.

   c. Test Procedure: Test storm drainage piping on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10- foot head of water. From 15 minutes before inspection starts until completion of inspection, water level must not drop. Inspect joints for leaks.

   d. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.

   e. Prepare reports for tests and required corrective action.

2. Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

   a. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.

   b. Cap and subject piping to static-water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.

   c. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.

   d. Prepare reports for tests and required corrective action.

K. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

3.05 CROSS-LINKED POLYETHYLENE (PEX) PIPE

A. Provide stainless steel inserts at compression stop valves.

B. All couplings, elbows, tees, reducing tees, adapters, and any other connecting devices shall be of the same manufacturer as the PEX piping.

C. Kinked tubing shall be reformed in accordance with manufacturer’s recommendation or cut out and replaced.

D. 90-degree direction turns and wall penetrations shall be provided with a bend support or elbow fitting.

E. Copper sweated and threaded connections are to be made prior to PEX connections.

F. Transition PEX to copper at fire walls. Provide fire stop sealants at fire rated walls.

G. PEX tubing shall be fully seated against shoulder of fitting.

H. Horizontal piping shall be supported every 32".

I. Vertical piping shall be supported every 4'.

J. Allow 1/8" to 3/16" of slack per foot of run for expansion and contraction.

K. PEX tubing shall be installed to allow for expansion and contraction. Do not rigidly attach to structure.

L. Provide sleeves where PEX piping passes through masonry walls.

M. Protect tubing from nail/screw damage with suitable steel plate protectors.

N. The minimum bend radius of PEX tubing is six times its diameter. Smaller radius turns shall be provided with an elbow.

O. Provide insulators where PEX piping passes through metal studs.

P. Supply stops shall be provided with a pipe bracket support from adjacent structure, a pipe clamp, tube talon, and a plastic or metal bend support. (Sioux Chief Universal Slider Bracket or approved equal).

Q. Insulation does not have to be continuous at hanging brackets and clamps.

R. Plastic speed clips may be used for connection to structure. Speed clips shall be listed for use on PEX piping.

3.06 APPLICATION

A. Install unions downstream of valves and at equipment or apparatus connections.

B. Provide flow controls in water recirculating systems where indicated.

3.07 TOLERANCES

A. Drainage Piping: Establish invert elevations within 1/2 inch vertically of location indicated and slope to drain at minimum of 1/4 inch per foot slope.

B. Water Piping: Slope at minimum of 1/32 inch per foot and arrange to drain at low points.

3.08 DOMESTIC WATER PIPING TESTS

A. Tests: As the work progresses each section of the water system shall be tested under a 100psi hydrostatic test held for 2 hours without reduction of pressure (a pressure fluctuation of +/- 1 psi is acceptable). If any leaks occur or piping or valves are found to be defective, same shall be removed and new material installed, and the test made on that section again until all material is found to be satisfactory. Such test shall be made in the presence of the Owner's Representative.

B. Provide written test documentation in the operation and maintenance manual.

3.09 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Prior to starting work, verify system is complete, flushed, and clean.

B. Ensure acidity (pH) of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).

C. Inject disinfectant, free chlorine in liquid, powder, tablet, or gas form throughout system to obtain 50 to 80 mg/L residual.

D. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.

E. Maintain disinfectant in system for 24 hours.

F. If final disinfectant residual tests less than 25 mg/L, repeat treatment.

G. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.

H. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

I. Provide test results in the operation and maintenance manual.

3.10 SERVICE CONNECTIONS

A. Provide new sanitary sewer services. Before commencing work, check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.

B. Provide new water service complete with approved reduced pressure backflow preventer and water meter with by-pass valves, pressure reducing valve, and sand strainer.

1. Provide sleeve in wall for service main and support at wall with reinforced concrete bridge. Caulk enlarged sleeve and make watertight with pliable material. Anchor service main inside to concrete wall.

3.11 SCHEDULES

A. Pipe Hanger Spacing:

1. Metal Piping:

a. Pipe Size: 1/2 inch to 1-1/4 inch:

1) Maximum Hanger Spacing: 6.5 ft

2) Hanger Rod Diameter: 3/8 inches

b. Pipe Size: 1-1/2 inch to 2 inch:

1) Maximum Hanger Spacing: 10 ft

2) Hanger Rod Diameter: 3/8 inch

c. Pipe Size: 2-1/2 inch to 3 inch:

1) Maximum Hanger Spacing: 10 ft

2) Hanger Rod Diameter: 1/2 inch

d. Pipe Size: 4 inch to 6 inch:

1) Maximum Hanger Spacing: 10 ft

2) Hanger Rod Diameter: 5/8 inch

e. Pipe Size: 8 inch to 12 inch:

1) Maximum hanger spacing: 14 ft

2) Hanger Rod Diameter: 7/8 inch

f. Pipe Size: 14 inch and Over:

1) Maximum Hanger Spacing: 20 ft

2) Hanger Rod Diameter: 1 inch

2. Plastic Piping:

a. All Sizes:

1) Maximum Hanger Spacing: 6 ft

2) Hanger Rod Diameter: 3/8 inch

B. Storm Piping Schedule:

1. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

2. Aboveground storm drainage piping 6” and smaller shall be any of the following:

a. Service class, hub and spigot cast-iron soil pipe and fittings; gaskets; and gasketed joints

b. Hubless, cast-iron soil pipe and fittings; CISPI, heavy-duty, hubless-piping couplings; and coupled joints

c. PVC pipe, PVC socket fittings, and solvent-cemented joints

d. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings

3. Aboveground, storm drainage piping 8” and larger shall be any of the following:

a. Service class, hub and spigot cast-iron soil pipe and fittings; gaskets; and gasketed joints

b. Hubless, cast-iron soil pipe and fittings; CISPI, heavy-duty, hubless-piping couplings; and coupled joints

c. PVC pipe, PVC socket fittings, and solvent-cemented joints

d. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings

4. Underground storm drainage piping 6” and smaller shall be any of the following:

   a. Service class, hub and spigot cast-iron soil pipe and fittings; gaskets; and gasketed joints

   b. Hubless, cast-iron soil pipe and fittings; CISPI, heavy-duty, cast-iron, hubless-piping couplings; and coupled joints

   c. PVC pipe, PVC socket fittings, and solvent-cemented joints

   d. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings

5. Underground, storm drainage piping 8” and larger shall be any of the following:

   a. Service class, hub and spigot cast-iron soil pipe and fittings; gaskets; and gasketed joints

   b. Hubless, cast-iron soil pipe and fittings; CISPI, heavy-duty, cast-iron, hubless-piping couplings; and coupled joints

   c. PVC pipe, PVC socket fittings, and solvent-cemented joints

   d. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings

END OF SECTION 22 10 05

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SECTION 22 10 06

PLUMBING PIPING SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Thermometers

B. Pressure Gauges

C. Unions

D. Flexible Connectors

E. Trap Primers

F. Aquastats

G. Drains

H. Cleanouts

I. Washing machine boxes and valves

J. Refrigerator valve and recessed box

K. Backflow preventers

L. Double check valve assemblies

M. Water hammer arrestors

N. Mixing valves

1.02 REFERENCE STANDARDS

A. ASME A112.6.4 - Roof, Deck, and Balcony Drains; 2008 (Reaffirmed 2012)

B. ASSE 1011 - Performance Requirements for Hose Connection Vacuum Breakers; 2004, with Errata

C. ASSE 1012 - Performance Requirements for Backflow Preventers with an Intermediate Atmospheric Vent; 2009

D. ASSE 1013 - Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Principle Fire Protection Backflow Preventers; 2011

E. ASSE 1019 - Performance Requirements for Wall Hydrant with Backflow Protection and Freeze Resistance; 2011 (Reaffirmed 2016)

F. NSF 61 - Drinking Water System Components - Health Effects; 2017

G. NSF 372 - Drinking Water System Components - Lead Content; 2016

H. PDI-WH 201 - Water Hammer Arresters; 2010

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures

B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.

C. Manufacturer's Instructions: Indicate Manufacturer's Installation Instructions. Indicate assembly and support requirements.

D. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views, etc. for the following:

1. Trap primers
2. Thermostatic mixing valves
3. Backflow prevention devices
4. Aquastats

1.04 QUALITY ASSURANCE

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

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept specialties on site in original factory packaging. Inspect for damage.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Specialties in Potable Water Supply Systems: Provide products that comply with NSF 61 and NSF 372 for maximum lead content.

2.02 THERMOMETERS

A. Adjustable angle type, 304 stainless steel stem, 5" reading dial type, true anti-parallax-dial black numerals, markings in degrees F., stainless steel, double-strength glass viewing window. Provide sockets with extension necks where installed on insulated piping.

B. Thermometer Temperature Ranges:

1. Domestic Cold Water, range of 0 - 100 degrees F with 1 degree F increments
2. Domestic Hot Water, range of 30 - 180 degrees F with 2 degrees F increments

C. Manufacturers:

1. Ashcroft

2. March
3. Weiss
4. Tel-Tru
5. Winters
6. Taylor

2.03 PRESSURE GAUGES

A. Glycerin filled type, 2.5" reading dial with aluminum face and black numerals, markings in English units, 304 stainless steel case and acrylic lens. Provide each gauge with snubber and needle valve. Provide sockets with extension necks where installed on insulated piping.

B. Pressure Gauge Ranges:

1. Domestic Hot Water, range 0 - 160 PSI with numeral intervals of 20 PSI and 2 PSI inter-graduations
2. Domestic Cold Water, range 0 - 160 PSI with numeral intervals of 20 PSI and 2 PSI inter-graduations
3. Compressed Air, range 0 - 160 PSI with numeral intervals of 20 PSI and 2 PSI inter-graduations

C. Manufacturers:

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

2.04 UNIONS

A. Dielectric Waterways: Inert, non-corrosive thermoplastic lining with zinc electroplated casing, rated at 300 psi at 225 deg. F., conforming to NSF 61. Type and size to match piping.

1. Manufacturers:
   a. Walter Vallett Company V-line
   b. Clear Flow

B. Unions on Copper Pipe:

1. In 2" Pipe and Smaller: Wrought copper solder joint copper to copper union.
2. In 2.5" Pipe and Larger: Brass flange unions.

3. Manufacturers:
    a. Watts
    b. Nibco
    c. Mueller

2.05 FLEXIBLE CONNECTORS

A. Water Pump Flexible Connectors: Flexible bronze braid, bronze hose, and copper ends rated to a working pressure of 470 psi at 70°F for a 1" flexible connector.

1. Manufacturers:
    a. Metraflex
    b. Flex Hose
    c. Minnesota Flex
    d. Resistoflex

2.06 TRAP PRIMERS

A. Provide an approved trap primer at each floor drain, funnel drain, shower drain, janitor mop sink, and floor sink.

1. Automatic Trap Primers (Water Pressure Drop Activated): Up to 4 traps may be served by a single trap primer and trap primer distribution system. Automatic primers shall be concealed in every case, located in pipe spaces or wall cavities; and where not accessible in a pipe space, provide an access panel. Elevate trap primer at increments of 12" per 20 linear foot of pipe run to trap.
    a. Manufacturers:
        1) JR Smith
        2) Sioux Chief Manufacturing
        3) Mifab
        4) Precision Plumbing Products
2. Automatic Trap Primers (Electronically Activated): Up to 30 trap primers may be served by a single electronic trap primer assembly. Electronic trap primer assemblies shall be provided preassembled with an atmospheric vacuum breaker, preset 24-hour clock, manual override switch/test button, calibrated manifold providing equal water distribution, and a recessed wall box with a locking stainless steel access panel. MC to coordinate electrical connections with EC.
    a. Manufacturers:
        1) JR Smith
        2) Precision Plumbing Products

3. Trap primer Tailpieces: 17 GA chrome plated. To be installed on lavatories and hand sinks only. One (1) trap may be served by a single tailpiece trap primer. Provide with stainless steel braided primer hose and escutcheon.

    a. Manufacturers:

        1) JR Smith

        2) Watts

        3) Zurn

2.07 AQUASTATS

A. Automatic Timer Kit:

1. The timer kit shall be UL approved.

2. The timer kit shall be installed on the connection box of the pump.

3. The timer kit will be suitable for 115/120V, 60 HZ operation.

4. The timer shall provide automatic ON-OFF. It shall also have the option of providing manual ON-OFF control.

B. Aquastats:

1. The aquastat shall be UL approved.

2. The aquastat shall be connected to the lead wires in the connection box of the pump.

3. The aquastat will be suitable for 115/120V, 60 HZ operation.

4. The aquastat shall provide thermostat control to the circulator. It will turn OFF (open) at 120°F (48.9°C) water temperature and ON (closed) at 100°F (37.8°C) water temperature.

C. Automatic Timer Kit and Aquastat Combination:

1. The automatic timer kit and aquastat shall be combined to provide automatic time and temperature control to the pump.

2. When the automatic timer and the aquastat are used together, the pump will only circulate water when the ON time conditions are met and when the water temperature is low enough to cause the aquastat to switch ON.

D. Manufacturers:

1. Bell & Gossett

2. Honeywell

2.08 CLEANOUTS

A. Manufacturers:

1. Jay R. Smith Manufacturing Company
2. Josam Company
3. MIFAB, Inc: www.mifab.com/#sle
4. Watts
5. Zurn Industries, LLC

B. Cleanouts at Exterior Surfaced Areas:

1. Round cast nickel bronze access frame and non-skid cover.

C. Cleanouts at Interior Finished Floor Areas:

1. Lacquered cast iron body with anchor flange, reversible clamping collar, threaded top assembly, and round gasketed scored cover in service areas and round gasketed depressed cover to accept floor finish in finished floor areas.

D. Cleanouts at Interior Finished Wall Areas:

1. Line type with lacquered cast iron body and round epoxy coated gasketed cover, and round stainless-steel access cover secured with machine screw.

2.09 WASHING MACHINE BOXES AND VALVES

A. Box Manufacturers:

1. Guy Gray
2. Oatey Supply Chain Services, Inc
3. Acorn

B. Description: Plastic preformed rough-in box with brass long shank valves with wheel handles, socket for 2-inch waste, slip in finishing cover.

2.10 REFRIGERATOR VALVE AND RECESSED BOX

A. Box Manufacturers:

1. Guy Gray
2. Oatey Supply Chain Services, Inc

2.11 BACKFLOW PREVENTERS

A. Provide letter of certification to Owner.

B. Type and configuration shall conform to local authority requirements.

C. REDUCED PRESSURE BACKFLOW PREVENTORS

1. Manufacturers:

   a. Conbraco Industries, Inc

   b. Watts Regulator Company, a part of Watts Water Technologies

   c. Zurn Industries, LLC

2. Reduced Pressure Backflow Preventers:

   a. ASSE 1013; cast bronze body and stainless-steel springs; two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve that opens under back pressure in case of diaphragm failure, and non-threaded vent outlet.

D. DOUBLE CHECK-VALVE ASSEMBLIES

1. Manufacturers:

   a. Conbraco Industries, Inc

   b. Watts Regulator Company, a part of Watts Water Technologies

   c. Zurn Industries, LLC

2. Double Check Valve Assemblies:

   a. ASSE 1012; Bronze body with corrosion resistant internal parts and stainless-steel springs; two independently operating check valves with intermediate atmospheric vent.

2.12 WATER HAMMER ARRESTORS

A. Manufacturers:

1. Jay R. Smith Manufacturing Company

2. Sioux Chief; 650 Series

3. Watts Regulator Company, a part of Watts Water Technologies: www.wattsregulator.com/#sle

4. Wade; WP5-100

5. Zurn Industries, LLC; 1250 XL

B. Water Hammer Arrestors:

1. Piston-type with sized in accordance with PDI-WH 201, sufficient volume of air to dissipate the calculated kinetic energy generated in the piping system

2. Arrestors shall be effective when installed at any angle.

3. Provide isolation valve for service.

4. Maximum working temperature of 250 degrees F
5. Maximum working pressure 350 PSIG
6. Performance per ANSI/ASSE 1010-2004 Standard

2.13 MIXING VALVES

A. Thermostatic Mixing Valves:

1. Manufacturers:
   a. Leonard Valve Company
   b. Bradley
   c. Apollo Conbraco
   d. Lawler
   e. Powers
   f. Acorn
   g. Armstrong
2. Recirculation Station: Recirculation station shall consist of thermostatic mixing valve in combination with piping assembly, inlet/outlet shutoff valves, pressure/temperature gauges, circulation pump (see pump schedule), circuit setter balancing valve, etc. All components pre-assembled to enamel coated strut and tested by manufacturer.
3. Thermostatic Mixing Valves: The thermostatic water mixing valve (TMV) shall consist of a liquid-filled thermal motor control mechanism with a positive shut-off of hot water when cold water supply is lost. The TMV shall allow a restricted cold flow in the event of loss or interruption of the hot water supply. All flow is shut off in the event of thermostat failure. The TMV shall be constructed of bronze bodies with corrosion resistant components and shall be equipped with integral checkstops, thermometer, outlet temperature gauge, and removable strainers. The TMV shall control the temperature to within +/- 3 degrees from low flow to the maximum flow rate scheduled.
4. Electronic Mixing Valves: The mixing valve shall consist of an electronic actuated mixing valve. Self-balancing, daily self-cleaning maintenance sweep feature, holds +/- 2°F temperature accuracy, standard serviceable integral check valves on all models. Self-Diagnostic Digital electronic control box with LCD display, programmable temperature setpoints, simple setup/simple error coding and upon power failure, holds last set temperature to avoid thermal shock. Provide a 2-hour battery backup if called for on the equipment schedule.
5. Cabinet: 16-gauge, 0.0598 inch prime-coated steel, for recessed mounting with keyed lock.

B. Thermostatic Mixing Valves for Emergency Eyewashes, Showers, and Combination Eyewash/Showers:

1. Manufacturers:
   a. Bradley

b. Apollo Conbraco

c. Acorn

2. The mixing valve shall be manufactured specifically for emergency fixture applications and be compliant with ANSI 358-1.

3. The mixing valve shall have solid bimetal thermostat directly linked to valve porting to control the intake of hot and cold water and compensate for supply temperature and pressure fluctuations.

4. Provide a locking type temperature regulator to prevent accidental movement, set temperature at 80 degrees F.

5. The mixing valve shall close down on failure of cold-water supply.

6. Shall have internal cold-water bypass capable full flow upon failure of hot water supply.

7. Provide outlet dial thermometer, integral wall support, union angle check stops on inlets, and recessed or surface mounted cabinet with locking access panel.

8. Mixing valves for eyewashes shall be capable of 4 gpm, including cold water bypass. Mixing valves for showers and combination eyewash showers shall be capable of 20 gpm, including cold water bypass.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Thermometers: Install thermometers and thermal wells in piping at locations indicated, and so as to be easily read.

C. Pressure Gauges: Install pressure gauges at each side of pressure reducing valves; and as indicated.

D. Unions: Install unions in pipe connections to control valves, coils, regulators, reducers, all equipment, and where it may be necessary to disconnect the equipment or piping for repairs or maintenance; and as indicated.

E. Install one (1) piston type water hammer arrestor at each quick acting valve for branch supply lines up to 20’ in length serving plumbing fixture groups. Install water hammer arrestor between last two fixtures, for branch supply lines exceeding 20’ in length, serving plumbing fixture groups. Size per manufacturer’s instructions.

F. Thermostatic Mixing Valves: Install in accordance with installation detail and the manufacturer’s recommendations.

G. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.

H. Encase exterior cleanouts in concrete flush with grade.

I. Install floor cleanouts at elevation to accommodate finished floor.

J. Install approved potable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, and interior and exterior hose bibbs.

K. Pipe relief from backflow preventer to nearest drain.

L. Install water hammer arrestors complete with accessible isolation valve on hot and cold-water supply piping to fast acting valves such as water closet flush valves, washer machines, etc.

M. Install an approved trap primer at each floor drain, funnel drain, shower drain, janitor mop sink, and floor sink.

N. For plumbing systems without flush valves, provide electronically activated trap primer or tailpiece trap primer.

END OF SECTION 22 10 06

SECTION 22 30 00

PLUMBING EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water Heaters:

B. Packaged water heating systems

C. Domestic hot water storage tanks

D. Diaphragm-type compression tanks

E. In-line circulator pumps

F. Condensate removal pumps

1.02 RELATED REQUIREMENTS

A. Section 22 05 48 - Vibration and Seismic Controls for Plumbing Piping and Equipment

B. Section 23 05 13 - Common Motor Requirements for HVAC Equipment

C. Section 26 05 83 - Wiring Connections: Electrical characteristics and wiring connections

1.03 REFERENCE STANDARDS

A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings; 2015

B. ABMA STD 11 - Load Ratings and Fatigue Life for Roller Bearings; 2014

C. ANSI Z21.10.1 - Gas Water Heaters - Volume I - Storage Water Heaters with Input Ratings of 75,000 Btu per Hour or Less; 2014

D. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1 - Rules for Construction of Pressure Vessels; 2017

E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014

F. NSF 372 - Drinking Water System Components - Lead Content; 2016

G. NSF 61 - Drinking Water System Components - Health Effects; 2017

H. UL 174 - Standard for Household Electric Storage Tank Water Heaters; Current Edition, Including All Revisions

I. UL 778 - Standard for Motor-Operated Water Pumps; Current Edition, Including All Revisions

1.04 SUBMITTALS

A. Product Data:

1. Provide dimensional drawings of water heaters indicating components and connections to other equipment and piping.

2. Indicate pump type, capacity, and power requirements.

3. Provide certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.

4. Provide electrical characteristics and connection requirements.

B. Project Record Documents: Record actual locations of components.

C. Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number. Include pump performance curves with pump.

D. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Certifications:

1. Water Heaters: NSF approved

2. Gas Water Heaters: Certified by CSA International to ANSI Z21.10.1, as applicable, in addition to requirements specified elsewhere

3. Electric Water Heaters: UL listed and labeled to UL 174

4. Water Tanks: UL listed units, for units with a storage tank of less than 120 gallons and gas input of less than 200,000 Btu per hour. All others to be ASME labeled to ASME BPVC-VIII-1

5. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated

B. Identification: Provide pumps with manufacturer's name, model number, and rating/capacity identified by permanently attached label.

C. Performance: Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.07 WARRANTY

A. Provide five-year manufacturer warranty for domestic water storage tanks. Provide one year manufacturer warranty for domestic water heater parts.

PART 2 PRODUCTS

2.01 WATER HEATERS

A. Manufacturers:

1. A.O. Smith Water Products Co
2. Bock Water Heaters, Inc
3. Rheem
4. State
5. Lochinvar
6. Bradford White
7. PVI
8. Heat Transfer Products

B. Residential Electric:

1. Type: Automatic, electric, vertical storage
2. Performance:
    a. Maximum Working Pressure: 150 psig
3. Tank: Glass lined welded steel, thermally insulated with one-inch-thick glass fiber; encased in corrosion-resistant steel jacket; baked-on enamel finish.
4. Controls: Automatic water thermostat with externally adjustable temperature range from 120 to 170 degrees F, flanged or screw-in nichrome elements, enclosed controls and electrical junction box.
5. Accessories:
    a. Water Connections: Brass
    b. Dip Tube: Brass
    c. Drain valve
    d. Anode: Magnesium
    e. Temperature and Pressure Relief Valve: ASME labeled

C. Commercial Electric:

1. Type: Factory-assembled and wired, electric, vertical storage

2. Performance:

   a. Maximum Working Pressure: 150 psig

3. Controls: Automatic immersion water thermostat; externally adjustable temperature range from 60 to 180 degrees F, flanged or screw-in nichrome elements, high temperature limit thermostat.

4. Accessories:

   a. Water Connections: Brass

   b. Dip Tube: Brass

   c. Drain valve

   d. Anode: Magnesium

   e. Temperature and Pressure Relief Valve: ASME labeled.

5. Tank: Welded steel ASME labeled pressure vessel; glass lining, mounted on steel channel base with lifting lugs, insulated with 2-inch glass fiber; enclosed with 16-gage, 0.0598-inch steel jacket; baked enamel finish.

6. Controls: Ventilated control cabinet, factory-wired with solid state progressive sequencing step controller, fuses, magnetic contactors, control transformer, pilot lights indicating main power and heating steps, control circuit toggle switch, electronic low-water (probe-type) cut-off, high temperature limit thermostat, flush-mounted temperature and pressure gauges.

7. Heating Elements: Flange-mounted immersion elements; individual elements sheathed with Incoloy corrosion-resistant metal alloy, rated less than 75 W/sq in.

2.02 DOMESTIC HOT WATER STORAGE TANKS

A. Manufacturers:

1. A.O. Smith Water Products Co

2. Bock Water Heaters, Inc

B. Tank: Welded steel, ASME labeled for working pressure of 125 psig, steel support saddles, tappings for accessories, threaded connections of stainless steel, access manhole

C. Lining: 0.015 inches epoxy continued into flanged connections

D. Openings: Up to 3 inches, copper-silicone threaded; over 4 inches, flanged; flanged collar for heat exchanger; manway fitting

E. Accessories: Tank drain, water inlet and outlet, thermometer range of 40 to 200 degrees F, ASME pressure relief valve suitable for maximum working pressure

2.03 DIAPHRAGM-TYPE COMPRESSION TANKS

A. Manufacturers:

1. Amtrol Inc
2. Bell & Gossett, a xylem brand
3. Taco, Inc
4. Wilkins
5. Armstrong

B. Construction: Welded steel, tested and stamped in accordance with ASME BPVC-VIII-1; supplied with National Board Form U-1, rated for working pressure of 125 psig, with flexible EPDM diaphragm sealed into tank, and steel legs or saddles

C. Accessories: Pressure gage and air-charging fitting, tank drain; precharge to 55 psig

2.04 IN-LINE CIRCULATOR PUMPS, BRONZE

A. Manufacturers:

1. Armstrong Fluid Technology
2. Bell & Gossett, a xylem brand
3. Taco
4. Grundfos

B. Casing: Bronze, rated for 125 psig working pressure, with stainless steel rotor assembly

C. Impeller: Bronze

D. Shaft: Alloy steel with integral thrust collar and two oil lubricated bronze sleeve bearings

E. Seal: Carbon rotating against a stationary ceramic seat suitable for continuous operation at 225 degrees F

F. Drive: Flexible coupling

G. Pump must be capable of being serviced without disturbing piping connections.

H. Pump shall be water lubricated type for horizontal or vertical installation.

I. Each pump shall be factory tested. It shall then be thoroughly cleaned and painted with at least one coat of high-grade machinery enamel prior to shipment.

J. Entire pump to be NSF 372 certified

K. See Section 23 05 13 - Common Motor Requirements for HVAC Equipment if equipment schedule calls out for any variable drive or ECM requirements.

2.05 IN-LINE CIRCULATOR PUMPS, STAINLESS STEEL

A. Manufacturers:

1. Armstrong Fluid Technology
2. Bell & Gossett, a xylem brand
3. Taco
4. Grundfos

B. Casing: Stainless steel, rated for 125 psig working pressure

C. Impeller: Polyphenylene ether/high impact polystyrene blend or stainless steel

D. Shaft and Bearings: Ceramic or stainless steel

E. Seal: Carbon rotating against a stationary ceramic seat suitable for continuous operation at 225 degrees F

F. Pump must be capable of being serviced without disturbing piping connections.

G. Pump shall be water lubricated type for horizontal or vertical installation.

H. Each pump shall be factory tested. It shall then be thoroughly cleaned and painted with at least one coat of high-grade machinery enamel prior to shipment.

I. Entire pump to be NSF 372 certified

J. See Section 23 05 13 - Common Motor Requirements for HVAC Equipment if equipment schedule calls out for any variable drive or ECM requirements

2.06 CONDENSATE REMOVAL PUMPS

A. Manufacturers:

1. Franklin Electric Company
2. Liberty Pumps Inc
3. Little Giant
4. Hartell
5. Saniflo

B. Construction: Commercial grade, nonferrous pump with stainless steel shaft, integral discharge check valve, integral float switch, safety switch, thermoplastic reservoir, motor assembly, and power cord with ground.

C. Safety: UL 778

PART 3 EXECUTION

3.01 INSTALLATION

A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions of certification, if any.

B. Coordinate with plumbing piping and related fuel piping work to achieve operating system.

C. Domestic Water Heaters:

1. Water heaters shall each have a relief valve sized to match heat input and set to relieve at 120 psi.

2. Install temperature-pressure relief valve on hot water heater and pipe discharge directly above funnel of floor drain or as shown on plans.

3. If system has a hot water recirculating line and/or check valve in the cold-water supply to tank, provide a pre-charged, type expansion tank. Size per schedule or Hot Water Tank Piping Diagram. Provide ASME rated expansion tank on water heaters that are ASME rated.

4. Electric water heaters installed in unconditioned space or on a concrete floor shall be placed on incompressible insulation having a minimum insulation value of R-10.

5. On all water heaters, provide and install seismic bracing per SMACNA zone 3.

6. For water heaters larger than 199 MBH and water heater boilers of any size, contact boiler inspector for preliminary layout approval prior to final piping. Ensure installation meets all manufacturers required clearances as well as local code (WAC and L&I).

7. Provide and install brass fittings between water heater and piping connections. Dielectric fitting connections are not acceptable.

8. Install condensate drain to nearest floor sink, floor drain, or mop sink or as indicated on the plans.

9. Install flue and combustion air intake per manufacturer's recommendations and not to exceed water heater listed equivalent lengths.

10. High efficiency, gas-fired water heaters shall have the start-up provided by a factory authorized representative.

D. Domestic Water Storage Tanks:

1. Provide steel pipe support, independent of building structural framing members.

2. Clean and flush prior to delivery to site. Seal until pipe connections are made.

E. Pumps:

1. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

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SECTION 22 40 00

PLUMBING FIXTURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flush valve water closets

B. Lavatories

C. Wall-hung, solid surface, multistation lavatory units

D. Wall-hung, multistation wash fountains

E. Sinks

F. Under-lavatory pipe supply covers

G. Bathtubs and showers

H. Shower receptors

I. Showers

J. Indoor drinking fountains

K. Electric water coolers

L. Service sinks

M. Floor Drains

N. Floor Sinks

O. Hot Water Dispenser

P. Hydrants

Q. Hose Bibbs

1.02 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010

B. ASTM D3222 - Standard Specification for Unmodified Poly (Vinylidene Fluoride) (PVDF) Molding Extrusion and Coating Materials; 2005 (Reapproved 2015)

C. ASHRAE Std 18 - Methods of Testing for Rating Drinking-Water Coolers with Self-Contained Mechanical Refrigeration; 2013

D. ASME A112.6.1M - Supports for Off-the-Floor Plumbing Fixtures for Public Use; 1997 (Reaffirmed 2017)

E. ASME A112.18.1 - Plumbing Supply Fittings; 2012

F. ASME A112.19.2 - Ceramic Plumbing Fixtures; 2013

G. ASME A112.19.4M - Porcelain Enameled Formed Steel Plumbing Fixtures; 1994 (R2009)

H. ASME A112.19.14 - Six Liter Water Closets Equipped with Dual Flushing Device; 2013

I. ASSE 1014 - Performance Requirements for Backflow Prevention Devices for Hand-Held Showers; 2005

J. ASSE 1070 - Performance Requirements for Water Temperature Limiting Devices; 2015

K. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2013

L. ASTM C1822 - Standard Specification for Insulating Covers on Accessible Lavatory Piping; 2015

M. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2017

N. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015

O. ISFA 2-01 - Classification and Standards for Solid Surfacing Material; 2013

P. NEMA LD 3 - High-Pressure Decorative Laminates; 2005

Q. NSF 61 - Drinking Water System Components - Health Effects; 2017

R. NSF 372 - Drinking Water System Components - Lead Content; 2016

1.03 SUBMITTALS

A. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

B. Manufacturer's Instructions: Indicate installation methods and procedures.

C. Maintenance Data: Include fixture trim exploded view and replacement parts lists.

D. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

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

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept fixtures on site in factory packaging. Inspect for damage.

B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.06 WARRANTY

A. Provide five-year manufacturer warranty for electric water coolers.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Potable Water Systems: Provide plumbing fittings and faucets that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.02 FLUSH VALVE WATER CLOSETS

A. Water Closets: Vitreous china, ASME A112.19.2, Wall hung or floor mounted as noted on Equipment Schedule, siphon jet flush action, china bolt caps.

1. Bowl: ASME A112.19.2; As noted on Architectural elevations high with elongated rim
2. Flush Valve: Exposed (top spud)
3. Handle Height: 44 inches or less
4. Outlet Size: 2 inches
5. Color: White
6. Assemblies need to have a current Maximum performance (MaP) rating of 800 or more and be listed as a WaterSense approved fixture.
7. Manufacturers:
    a. American Standard, Inc
    b. Kohler Company
    c. Zurn Industries, Inc
    d. Mansfield
    e. Sloan
    f. Toto

B. Flush Valves: ASME A112.18.1, diaphragm type, complete with vacuum breaker stops and accessories

1. Provide manual or sensor flush valve as indicated on the equipment schedule.
2. Sensor-Operated Type: Solenoid operator, hard wired or battery powered as noted on Equipment Schedule, infrared sensor and over-ride push button.
3. Exposed Type: Chrome plated, escutcheon, integral screwdriver stop
4. Handle placed on turn-around side for ADA applications.
5. Manufacturers:
    a. American Standard, Inc
    b. Sloan Valve Company

c. Zurn Industries, Inc

d. Geberit

e. Toto

f. Moen

C. Seats:

1. Manufacturers:

a. American Standard, Inc: www.americanstandard-us.com/#sle

b. Bemis Manufacturing Company

c. Church Seat Company

d. Zurn Industries, Inc

2. Solid white plastic, open front, extended back, self-sustaining hinge, brass bolts, without cover

D. Water Closet Carriers:

1. Manufacturers:

a. JOSAM Company

b. Zurn Industries, Inc

c. J.R. Smith

d. Wade

e. Watts

2. ASME A112.6.1M; adjustable cast iron frame, integral drain hub and vent, adjustable spud, lugs for floor and wall attachment, threaded fixture studs with nuts and washers. Provide heavy duty carriers (500 pound rated) as a minimum unless specifically called out as light duty carriers on the plans. Provide extra heavy-duty carriers (750 pound rated or greater) as noted on the plans.

2.03 LAVATORIES

A. Lavatory Manufacturers:

1. American Standard, Inc

2. Kohler Company

3. Zurn Industries, Inc

4. Mansfield

5. Sloan

6. Toto

B. Vitreous China Wall Hung Basin: ASME A112.19.2; vitreous china wall hung lavatory, Size as indicated on Equipment Schedule minimum, with 4-inch-high back, rectangular basin with splash lip, front overflow, and soap depression.

1. Drilling Centers: 4 inches

C. Steel Counter Top Basin: ASME A112.19.4M; porcelain on steel self-rimming counter top lavatory, Size as indicated on Equipment Schedule with drillings on 4 inch centers, front overflow, soap depression, seal of putty, caulking, or concealed vinyl gasket

D. Vitreous China Counter Top Basin: ASME A112.19.2; vitreous china self-rimming counter top lavatory, Size as indicated on Equipment Schedule with drillings on 4 inch centers, front overflow, soap depression, seal of putty, caulking, or concealed vinyl gasket

E. Vitreous China Under-Mount Basin: ASME A112.19.2; vitreous china under-mount lavatory, front overflow, mounting kit and template by manufacturer

1. Bowl size: Size as indicated on Equipment Schedule

F. Supply Faucet Manufacturers:

1. American Standard, Inc
2. Kohler Company
3. Zurn Industries, Inc
4. Chicago Faucets
5. Symmons
6. Toto
7. T&S Brass
8. Speakman
9. Moen
10. Mac Faucets

G. Supply Faucet: ASME A112.18.1; chrome plated supply fitting with open grid strainer, water economy aerator with maximum flow of 0.5 gallon per minute (low-flow), handles or sensor as indicated on Equipment Schedule

H. Sensor Operated Faucet: Cast brass, chrome plated, wall mounted with sensor located on neck of spout

1. Power Supply: Battery, easily replaceable, alkaline or lithium, minimum 200,000 cycles
2. The sensor faucet shall have access to controls and battery through spout. Provide with vandal resistant aerator, cover plate to match hole pattern of lavatory, and supply hose(s).

3. Water Supply: 1/2-inch compression connections
4. Aerator: Vandal resistant, 0.5 GPM, laminar flow device
5. Automatic Shut-off: 30 seconds
6. Sensor range: Factory set at a minimum of 3-inch adjustable up to 24 inches
7. Finish: Polished chrome
8. Accessory: 4-inch deck plate
9. Lead Content: Extra low; maximum 0.25 percent by weighed average
10. Sensor Operated Faucet Manufacturers:
    a. American Standard, Inc
    b. The Chicago Faucet Company
    c. Moen Incorporated
    d. Sloan Valve Company
    e. Toto USA
    f. Zurn Industries, Inc; AquaSense Z6913
    g. Symmons
    h. Speakman
    i. Mac Faucets
    j. Delany
11. P-Trap:
    a. 17-gauge seamless chrome plated brass
    b. Adjustable, ground joint swivel
    c. 2" water seal
    d. Provide cleanout
    e. Manufacturers
        1) Just Manufacturing
        2) Engineered Brass Company
        3) McGuire Manufacturing

2.04 SINKS

A. Sink Manufacturers:

1. Just
2. Elkay

B. Single Compartment Bowl: ASME A112.19.3; 18 gage, 0.0359 inch (0.91 mm) thick, Type 304 stainless steel, self rimming and undercoated, with ledge back drilled for trim

1. Drain: 3-1/2-inch crumb cup and tailpiece
2. Verify amount of hole punches required for each sink prior to ordering.

C. Double Compartment Bowl: ASME A112.19.3; 18 gage, 0.0359 inch (0.91 mm) thick, Type 304 stainless steel, self rimming and undercoated, with ledge back drilled for trim

1. Drain: 3-1/2-inch crumb cup and tailpiece
2. Verify amount of hole punches required for each sink prior to ordering.

2.05 UNDER-LAVATORY PIPE SUPPLY COVERS

A. Manufacturers:

1. Plumberex Specialty Products, Inc
2. ProWrap

B. General:

1. Insulate exposed drainage piping including hot, cold and tempered water supplies under lavatories or sinks per ADA Standards.
2. Adhesives, sewing threads and two-ply laminated materials are prohibited.
3. Exterior Surfaces: Smooth nonabsorbent with no finger recessed indentations for easy cleaning.
4. Construction: 1/8-inch PVC with antimicrobial, antifungal and UV resistant properties.
    a. Provide one piece injected molded design with internal bridge at top of J-bend to prevent separating.
    b. Comply with ASTM C1822 Type III for covers on accessible lavatory piping.
    c. Thermal Resistance: R value of 0.504 or lower when tested by ASTM C177
    d. Microbial and Fungal Resistance for Interior and Exterior: Comply with ASTM G21

C. Under-Lavatory Covers with Snap-Lock Fasteners:

1. Manufacturers:
    a. Plumberex Specialty Products, Inc: Plumberex Pro-Extreme

2. Construction: PVC with antimicrobial, antifungal, and UV-resistant properties, one piece injected molded design with internal bridge at top of J-bend to prevent separating.

3. Fasteners: Reusable, snap-locking fasteners with no sharp or abrasive external surfaces. No cable ties allowed.

4. Maintenance: Valve and supply cover shall be accessible for maintenance without removal and with removable, reusable access cap.

5. Provide with weep hole for condensation drainage and ventilation.

6. Vandal Resistance: Internal line grooves for trimming not easily torn by hand. All trim line grooves shall require tool cutting only.

7. Color: High gloss white

2.06 SHOWER RECEPTORS

A. Solid Surfacing Shower Receptors: Solid plastic resin casting, self-supporting, for installation over conventional subfloor; complying with IAPMO Z124

1. Material: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, renewable material 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.

2. Surface Burning Characteristics: Flame spread index of 25 or less, and smoke developed index of 450 or less, Class A, when tested in accordance with ASTM E84

3. Finish on Exposed Surfaces: Provide satin or matte, gloss rating of 3 to 20.

4. Color/Pattern Family: White

5. Manufacturers:

a. Fiberfab

b. Lasco

B. Drain Trim: Removable chrome plated strainer and tail piece

2.07 SHOWERS

A. Shower Manufacturers:

1. Fiberfab

2. Lasco

B. Cabinet: IAPMO Z124 reinforced glass fiber, size as indicated on Equipment Schedule with smooth texture, integral receptor, soap dish, removable chrome plated strainer, tail piece, white color.

C. Shower Valve:

1. Comply with ASME A112.18.1

2. Provide two way in-wall diverter valve body with integral thermostatic mixing valve to supply 1.5 gpm.

3. Shower Valve Manufacturers:

   a. Bradley

   b. Symmons

   c. Powers

   d. Speakman

   e. Moen

   f. Acorn

D. Shower Head:

1. Shower Head Manufacturers:

   a. Speakman

   b. Bradley

   c. Symmons

   d. Powers

   e. Moen

   f. Acorn

E. Low-Flow Shower Head:

1. ASME A112.18.1; chrome-plated vandal-proof institutional head with integral wall bracket, built-in 1.5 gpm flow control

2. Low-Flow Shower Head Manufacturers:

   a. Speakman

   b. Bradley

   c. Symmons

   d. Powers

   e. Moen

   f. Acorn

F. Hand-Held Shower Head:

1. ASME A112.18.1, adjustable spray hand-held shower head with swivel fitting with ASSE 1014 backflow preventer
2. Provide pushbutton flow control.
3. Include 60-inch minimum flexible polished stainless-steel hose and in-line vacuum breaker
4. Provide 25-inch grab bar with sliding spray holder that locks at any height, allowing use of unit as either a hand-held spray or a fixed shower head.
5. Hand-Held Shower Head Manufacturers:
   a. Speakman
   b. Symmons
   c. Bradley
   d. Powers
   e. Moen
   f. Acorn

2.08 INDOOR DRINKING FOUNTAINS

A. Drinking Fountain Manufacturers:

1. Elkay Manufacturing Company
2. Halsey Taylor
3. Haws Corporation
4. Murdock Manufacturing

B. Fountain: brushed Stainless Steel, surface mounted, with elevated anti-squirt bubbler with stream guard, automatic stream regulator, bar handle, access cover plate, mounting bracket, screwdriver stop.

C. If labeled 'Vandal Resistant' on Equipment Schedule, provide heavy duty, 14-gauge stainless steel cabinet with vandal resistant screw hardware.

2.09 ELECTRIC WATER COOLERS

A. Electric Water Cooler Manufacturers:

1. Elkay Manufacturing Company
2. Haws Corporation
3. Oasis, a Lynn Tilton Company
4. Murdock Manufacturing

B. Water Cooler: Electric, mechanically refrigerated; surface ADA mounted; stainless steel top, stainless steel body, elevated anti-squirt bubbler with stream guard, automatic stream regulator, push button, mounting bracket; integral air-cooled condenser and stainless-steel grille.

1. Capacity: Provide a minimum of 8 gallons per hour of 50 degrees F water with inlet at 80 degrees F and room temperature of 90 degrees F, when tested in accordance with ASHRAE Std 18.

2. Electrical: 115 V, 60 Hertz compressor, 6-foot cord and plug for connection to electric wiring system including grounding connector. Coordinate receptacle location with EC

C. Bottle Filler: Materials to match fountain. See below for specifications.

D. If labeled 'Vandal Resistant' on Equipment Schedule, provide heavy duty, 14-gauge stainless steel cabinet with vandal resistant screw hardware. Provide stainless steel louver screening to prevent objects from being inserted into cabinet.

2.10 SERVICE SINKS

A. Service Sink Manufacturers:

1. Florestone

2. Fiat

3. Acorn

B. Bowl: 36 by 24 by 10 inch high unless otherwise stated in the plumbing fixture schedule, white molded stone, floor mounted, with one-inch-wide shoulders, vinyl bumper guard, stainless steel strainer

C. Accessories:

1. 4 feet of 1/2-inch diameter plain end reinforced plastic hose

2. Hose clamp hanger

3. Mop hanger

2.11 FLOOR DRAINS (F.D.)

A. Cast iron body, heavy duty floor drain, with 5" nickel bronze adjustable strainer head, vandal proof screws, and trap primer connections. Size outlet to match pipe size shown on drawings. Where used for shower drain, provide with chrome plated strainer. Furnish with 6" diameter strainer and funnel where indicated.

B. Cast iron body, heavy duty floor drain, with Type 'N' 7" diameter, nickel bronze grate, vandal proof screws, and trap primer connections. Size outlet to match pipe size shown on drawings. Use in mechanical rooms and utility spaces.

C. Floor drains labeled medium duty, light duty, or commercial duty are not allowed.

D. Manufacturers:

1. J.R. Smith

2. Josam

3. Zurn
4. Wade
5. MIFAB
6. Watts

2.12 FLOOR SINKS (FS)

A. 12x12x6 deep cast iron body and square slotted medium duty grate, with white acid resisting porcelain enamel interior and top, complete with white ABS anti-splash interior bottom dome strainer.

B. Manufacturers:

1. J.R. Smith
2. Josam
3. Zurn
4. Wade
5. MIFAB
6. Watts

2.13 HOT WATER DISPENSER

A. Hot water dispenser shall be U.L. listed, 750 watts, 6.5 amps, 115 volts, factory mounted 3 wire cord and 3 prong plug, adjustable thermostat with range of 140°F to 200°F. 1/2 gallon storage capacity with faucet having chrome plated finish. Refer to manufacturer's installation manual for proper installation. Provide shut-off valve in supply line to unit, install in back left or back right corner of sink.

B. Manufacturers:

1. In-sink-erator (ISE)
2. Other manufacturers will be allowed by prior approval only. To request approval, the manufacturer must provide an equipment layout showing how the proposed equipment will fit in the space and meet all access requirements. This manufacturer must include in the cost of the proposed equipment, at bid time, the difference in piping, electrical, etc.

2.14 HYDRANTS

A. Wall Hydrants: Approved freeze-proof type with integral anti-siphon vacuum breaker, self-draining, ¾ hose connection, loose key operated:

1. Manufacturers:
   a. Zurn: Z-1310
   b. Wade: W-8620 with union elbow

c. Smith: 5609

d. Josam: 71050

e. Woodford: 65

f. Acorn: 8161

B. Wall Box Hydrants: Freezeproof type with integral anti-siphon vacuum breaker, 3/4" hose connection, loose key operated, enclosed in a bronze or stainless-steel box for flush wall installation with hinged door and key lock:

1. Manufacturers:

a. Jay R. Smith: 5509QT

b. Zurn: Z-1300

c. Woodford: B 65

d. Acorn: 8160

2.15 HOSE BIBBS

A. Surface Mounted: Approved types with integral vacuum breaker, 3/4" hose connection, chrome plated face and loose key:

1. Manufacturers:

a. J.R. Smith: 5618

b. Woodford: Model 75

c. Chicago Faucet: Model 387-E27CP

d. Acorn: 8141

B. Surface Mounted in a Box: Approved type with integral vacuum breaker, 3/4" hose connection, enclosed in box for flush wall installation with hinged door and operating key lock.

1. Manufacturers:

a. Woodford: Model B75

b. Zurn: Z1350-VB

c. J.R. Smith: 5518

d. Acorn: 8151

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.

B. Verify that electric power is available and of the correct characteristics.

C. Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

3.02 PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.03 INSTALLATION

A. Install each fixture with a removable trap to be easily removable for servicing and cleaning.

B. Provide chrome plated rigid supplies to fixtures with loose key stops, reducers, and escutcheons.

C. Install components level and plumb.

D. Make fixture floor connections with approved brand of cast iron floor flange, soldered or caulked securely to waste pipe.

E. Make joints between fixtures and floor flanges tight with approved fixture setting compound or gaskets.

F. Caulk between fixtures and wall and floor with white butyl rubber non-absorbent caulking compound. Point edges.

G. Install and connect all Kitchen Fixtures. Provide chrome plated brass waste, "Just" or equal.

H. Provide concealed arm supports for wall mounted china lavatories.

I. All exposed metal shall be chrome-plated brass.

J. Provide floor-mount fixture support with concealed heavy steel stanchion and supporting plate for lavatories and urinals.

K. Provide floor-mount fixture support for wall-hung water closets, and with 2” no-hub auxiliary inlet at each location of back-to-back water closet and urinal.

L. Provide flush valve supply support on all WC and urinal carriers.

M. Provide rear anchor support for all heavy-duty WC carriers.

N. Provide trap primer and connection to p-trap of showers, floor sinks, floor drains, and service sinks.

O. ADA showers shall be installed with entrance lip flush with finish floor.

P. On ADA water closets provide flush valve handle or tank handle on side facing wheelchair turn around.

Q. All ADA lavatory P-trap and angle stop assemblies shall be insulated with institutional A.D.A. insulator kit as manufactured by E.B.C. or equal. Abrasion resistant exterior cover shall be smooth and have 1/8" wall minimum over cushioned foam insert. Fasteners shall remain substantially out of sight. Use part 500RHS on offset P-trap if required.

R. Sensor Type Fixtures: Mechanical contractor to coordinate with electrical contractor for installation of all infra-red sensor type fixtures. Transformer kit provided and installed by mechanical contractor, all electrical connectors, wire connections, and testing by electrical contractor.

S. Hose Bibb: Install one (1) hose bibb in each toilet room with 2 or more water closets, urinals or a combination thereof, mount at 18" under one lavatory.

T. Wall Hydrant: Install at 18" above finished grade, unless otherwise indicated.

3.04 INTERFACE WITH WORK OF OTHER SECTIONS

A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

3.05 ADJUSTING

A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.06 CLEANING

A. Clean plumbing fixtures and equipment.

B. Polish chrome finish at completion of Project.

C. Remove all manufacturers' labels tags, and protective plastic.

D. Polish floor drain covers.

3.07 PROTECTION

A. Protect installed products from damage due to subsequent construction operations.

B. Repair or replace damaged products before Date of Substantial Completion.

3.08 MOUNTING HEIGHTS

A. Fixture Heights: Install fixtures to heights above finished floor as indicated on the architectural elevation drawings. Architectural elevation dimensions take precedent over the following heights:

1. Water Closet:

   a. Standard: 16-17 inches to top of seat

   b. ADA: 17-19 inches to top of seat

   c. Pre-school and Kindergarten: 13 inches to top of seat (Upon approval by District)

2. Urinal:

   a. Standard: 24 inches from floor to bottom lip

   b. ADA: 16 inches from floor to bottom lip

   c. Pre-school and Kindergarten: 16 inches from floor to bottom lip

3. Lavatory:
    a. Standard: 29 inches from floor to top of apron
    b. ADA: 33 inches from floor to top of apron with 29 inches clearance under fixture
4. Drinking Fountain:
    a. Standard: 40 inches from floor to bubbler height
    b. ADA: 36 inches from floor to bubbler height with 27 inches clearance under fixture
5. Shower Heads and Control Valve:
    a. Adult Male: 69.5 inches to bottom of head
    b. Adult Female: 64.5 inches to bottom of head
    c. Child: 58.5 inches to bottom of head
    d. Standard control valve: 48 inches above finished floor
    e. ADA control valve: 40 inches above finished floor

END OF SECTION 22 40 00

SECTION 23 05 13

MOTORS AND VARIABLE DRIVES

PART 1 GENERAL

1.01 GENERAL

A. Includes, but not limited to, motors 1/12 HP or larger used in Division 23.

1.02 RELATED SECTIONS

A. General Conditions, Division 1

B. Section 20 00 00 – General Mechanical Requirements

1.03 SUBMITTALS REQUIREMENTS OF THIS SECTION

A. All variable drives.

B. Total harmonic voltage distortion calculation.

1.04 OPERATION AND MAINTENANCE REQUIREMENTS OF THIS SECTION

A. Check out sheet for each variable drive showing all programmed parameters. Date of check out, and name and company address of employee responsible for checkout.

B. Programming manual explaining how to access and change all programmable points.

C. International wiring diagram for each different unit.

D. Parts diagram with replacement parts listed.

E. Trouble shooting guide.

PART 2 PRODUCTS

2.01 MOTORS

A. Motors located indoors shall be open frame, drip-proof type, unless indicated otherwise. Motors located outdoors exposed to weather shall have corrosion resistant finish and shall be totally enclosed fan cooled (TEFC) or totally enclosed non-ventilated (TENV) type, unless indicated otherwise. Motors used in fans serving dishwashing hoods shall be TEFC type.

B. All motors shall be UL listed.

C. All motors used with variable frequency drives shall be premium efficiency inv*ert*er ready and shall be capable of running at least 85 Hz.

D. All motors 1 HP and larger shall be energy efficient type and shall meet the 2015 Washington State Energy Code requirements.

E. All fan motors 1/12 HP or greater and less than 1 HP shall be Electronically Commutated Motors (ECM) or shall have a minimum motor efficiency of 70 percent when rated in accordance with DOE 10 C.F.R. 431. These motor speeds shall be adjustable.

F. Motors shall not be smaller than indicated on drawings; however, motors shall be of adequate size to drive the respective equipment when handling the quantities specified without exceeding the nameplate full load current at any conditions encountered in actual operation. If it becomes evident that a motor furnished is too small to meet these requirements as a result of the Contractor using substituted equipment or having revised the system arrangement, the Contractor shall replace it with a motor of adequate size at no additional cost to the Owner. This Contractor shall also arrange with the Electrical Contractor to increase the size of the wiring, motor starter and other accessories as required to serve the larger motor at no additional cost to the Owner.

G. ECM (Electrically Commutated Motors) shall conform to the motor requirements listed above. In addition, the Contractor purchasing the HVAC equipment that includes the ECM is responsible for ensuring the ECM motor control speed control is set to match the required component operation. The ECM motor control speed control may be preset by the HVAC equipment manufacturer. The Contractor purchasing the HVAC equipment shall provide documentation showing the appropriate ECM motor control board jumper pins, dip switches and/or multi-pin plugs settings for correct HVAC equipment component operation.

H. Approved Manufacturers:

1. General Electric
2. Westinghouse
3. Reliance
4. Allis-Chalmers
5. Gould
6. Century
7. Wagner
8. Baldor
9. U.S. Motors Marathon

2.02 VARIABLE FREQUENCY DRIVES (VFD UNDER 5 HP)

A. Variable Frequency Drives (VFD):

1. Description:

a. Provide enclosed adjustable speed drives suitable for operating at the current, voltage, and horsepower indicated on the equipment schedule. Conform to requirements of NEMA ICS 3.1.

b. VFD shall not increase the voltage distortion above 5% at the input terminals of the VFD or line filters. The manufacturer shall make all modifications to the drive necessary to meet this requirement.

B. Ratings:

1. VFD must operate, without fault or failure, when voltage varies plus or minus 10 percent from rating and frequency varies plus or minus 5 percent from rating.

2. VFD shall be voltage as shown on schedule.

3. Operating Ambient Temperature: 14 degrees F to 104 degrees F.

4. Humidity: non-condensing to 95%.

5. Altitude: to 3300 feet, higher altitudes achieved by derating.

6. Starting Torque: 100% starting torque shall be available from 0.5 Hz to 60 Hz.

7. Overload capability: 110% of rated F.L.A. (full load amps) for 60 seconds; 150% of rated F.L.A., instantaneously.

8. The VFD must meet the requirements for Radio Frequency Interface (RFI) above 7 MHz as specified by FCC regulations, part 15, subpart J, Class A devices.

9. In compliance with IEEE 519, the Total Harmonic Voltage Distortion for the VFD shall be no greater than 5%, the supplier of the VFD shall provide a dc bus choke or line reactors to ensure compliance. In order to estimate THVD the following is needed: Point of Common Coupling (PCC) and the KVA, and secondary voltage of the supply transformer. Assume 5.00% transformer impedance. If no transformer is present assume 50% of service demand.

10. VFDs must have a minimum short circuit rating of 65 Kamps RMS without additional input fusing.

C. Design:

1. VFD shall employ microprocessor-based inverter logic, isolated from all power circuits.

2. VFD shall include surface mount technology, with conformal coating.

3. VFD shall employ a PWM (pulse width modulated) inverter system, consisting of:

a. Input Section:

1) VFD input power stage shall convert three-phase AC line power into a fixed DC voltage via a solid-state full wave diode rectifier, with MOV (metal oxide varistor) protection.

b. Intermediate Section:

1) DC bus as a supply to the VFD Output Section shall maintain a fixed voltage with filtering and short circuit protection.

2) DC Bus shall be interfaced with the VFD diagnostic logic circuit, for continuous monitoring and protection of the power components.

c. Output Section:

1) Insulated gate bipolar transistors (IGBT's) shall convert DC bus voltage to variable frequency and voltage.

2) PWM sine coded output to the motor.

4. The VFD must be selected for operation at carrier frequencies at or above 5 kHz without derating to satisfy the conditions for current, voltage and horsepower as indicated on the equipment schedule.

5. VFD shall include one independent remote reference input. The input shall be 0 - 10 VDC or 4 – 20mA. Input shall respond to a programmable bias and gain.

6. VFD shall include a minimum of two digital input terminals:

   a. Reverse rotation direction

   b. Remote Reset

7. VFD shall provide terminals for remote contacts, to allow starting in the automatic mode.

8. VFD shall include one fully rated form “A” contact and one fully rated form “C” contact. The contact purpose is selectable and shall provide one of two functions:

   a. Drive Running

   b. Drive Faulted

9. VFD shall include a power loss ride of 2 seconds.

10. VFD shall include front mounted control operators that set the motor overheat drive shutdown, set the acceleration and deceleration, and set the output frequency limits. Operating mode (auto or manual) and speed setting functions shall also be provided.

11. VFD shall include electronic thermal overload protection for both the drive and motor. The electronic thermal motor overload shall be approved by UL. If the electronic thermal motor overload is not approved by UL, a separate UL approved thermal overload relay shall be provided in the VFD enclosure.

12. VFD shall include the following program functions:

    a. Auto restart capability.

    b. Stall prevention capability.

    c. Ability to close fault contact after the completion of all fault restart attempts.

13. VFD shall include factory settings for all parameters, and the capability for those settings to be reset.

14. VFD shall include the capability to adjust the following functions, while the VFD is running:

    a. Forward/Reverse direction.

    b. Acceleration adjustment from 0 to 3600 seconds.

    c. Deceleration adjustment from 0 to 3600 seconds.

    d. One preset speed.

15. All units to be provided with fused disconnect integral to the VFD. Fuse sized for the equipment per NEC.

D. Product Options:

1. Provide the following:

a. RFI (radio frequency interference) filters to attenuate possible VFD generated noise. The addition of these filters should reduce the line conducted noise levels within the limits of FCC regulations, part 15, subpart J, for Class A devices.

b. Current limiting input fusing for the protection of VFD semiconductor devices.

c. Line reactors reduce the effect of the load and line side transients on the drive. May be used on either the input side or output side of the drive.

d. "DC bus reactor", to attenuate harmonic distortion.

e. DV/DT Filtering: When inverter duty type motors are not provided, maximum allowed VFD output rise is 1000 volts in 2 microseconds.

E. Fabrication:

1. Enclosure: NEMA Type 1 unless otherwise specified on drawings.

F. Source Quality Control:

1. In-circuit testing of all printed circuit boards shall be conducted, to insure the proper mounting and correct value of all components.

2. All printed circuit boards shall be burned in for 96 hours, at 85 degrees C.

3. Final printed circuit board assemblies shall be functionally tested, via computerized test equipment. All tests and acceptance criteria shall be preprogrammed. All tests results shall be stored as detailed quality assurance data.

4. All fully assembled controls shall be functionally tested, with fully loaded induction motors. The combined test data shall then be analyzed, to insure adherence to quality assurance specifications.

5. Inspect and production test, under load each completed VFD assembly.

G. Acceptable Manufacturers:

1. Square D

2. ABB

3. Yaskawa

4. Danfoss

5. Miscellaneous Options:

   a. RFI (radio frequency interference) filters to attenuate possible VFD generated noise. The addition of these filters should reduce the line conducted noise levels within the limits of FCC regulations, part 15, subpart J, for Class A devices.

   b. Current limiting input fusing for the protection of VFD semiconductor devices.

   c. Line reactors reduce the effect of the load and line side transients on the drive. May be used on either the input side or output side of the drive.

   d. DV/DT Filtering: When inverter duty type motors are not provided, maximum allowed VFD output rise is 1000 volts in 2 microseconds.

   e. Pressure transducer (3 to 15 PSI input = 0 to 10 V DC output), to convert a pneumatic signal into a VFD auto reference signal.

H. Fabrication:

1. Enclosure: NEMA Type 1 unless otherwise specified on drawings.

I. Source Quality Control:

1. In-circuit testing of all printed circuit boards shall be conducted, to insure the proper mounting and correct value of all components.

2. All printed circuit boards shall be burned in for 96 hours, at 85 degrees C.

3. Final printed circuit board assemblies shall be functionally tested, via computerized test equipment. All tests and acceptance criteria shall be preprogrammed. All tests results shall be stored as detailed quality assurance data.

4. All fully assembled controls shall be functionally tested, with fully loaded induction motors. The combined test data shall then be analyzed, to insure adherence to quality assurance specifications.

5. Inspect and production test, under load each completed VFD assembly.

J. Approved Manufacturers:

1. Square D

2. ABB

3. Yaskawa

4. Danfoss

PART 3 EXECUTION

Not Applicable

END OF SECTION 23 05 13

SECTION 23 05 29

HANGERS & SUPPORTS FOR HVAC PIPING & EQUIPMENT

PART 1 GENERAL

1.01 GENERAL

A. Includes:

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

1.02 RELATED SECTIONS

A. General Conditions, Division 1

B. Section 20 00 00 – General Mechanical Requirements

C. Section 22 20 00 – Excavation & Backfill for Mechanical Underground Utilities

D. Section 23 05 48 – Vibration and Seismic Control

E. Section 23 07 19 – HVAC Piping Insulations

F. Section 23 11 19 – HVAC Piping Specialties

G. Section 23 20 00 – Hydronic System

H. Section 23 23 00 – Refrigerant Piping

1.03 QUALITY ASSURANCE

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

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

1.04 SUBMITTAL REQUIREMENTS OF THIS SECTION

A. Hangers

B. Struts

C. Anchors

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

1.05 OPERATION AND MAINTENANCE OF THIS SECTION

Not Applicable

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

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

B. Anchors: Rawplug, Phillips, Hilti, Caddy, Powers

C. Rooftop Support Systems: Miro Industries, Inc

2.02 GENERAL HANGERS AND SUPPORTS

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

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

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

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

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

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

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

E. Steel: Structural steel, per ASTM A36.

F. Wood: Shall be fire treated.

2.03 PIPE HANGERS AND SUPPORTS

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

B. Riser clamps shall be epoxy coated.

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

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

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

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

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

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

H. Insulated Pipe Inserts and Insulation Shields:

1. Insulation material at pipe insert shall be calcium silicate with jacket of nylon reinforced kraft paper bonded to aluminum foil cover on insulation. Insulated pipe insert shall have no more than 5% deformation at 100 psi and a thermal conductivity no more than 0.38 Btu/hr./sq. ft./degree F/1-inch thick at 75°F.

2. Insulated pipe insert shall be same thickness as adjoining pipe insulation and sized to match pipe in which it is used on. See Section 23 07 19 for insulation sizes.

3. Provide shield per Section 23 11 19 HVAC Piping Specialties.

4. Manufacturers:

a. TPS Thermal Pipe Shields

b. B-Line

c. Clement Support Services

2.04 REFRIGERANT PIPE HANGERS AND SUPPORTS

A. All horizontal refrigerant pipe shall utilize clevis, strut-mounted, or trapeze style supports.

B. All hangers, supports, and hardware shall be cadmium-plated or galvanized where used indoors, and galvanized where used outdoors.

C. Secure refrigerant pipe to strut channel using either of the following:

1. Snap in Shield Supports:

a. Polypropylene Copolymer construction.

b. Rated for an operating temperature of -40°F to 178°F.

c. Material shall be paintable.

d. UL 723 (ASTM E 84) listed.

e. Meets UL 94 HB flammability standards.

f. Approved Manufacturers:

1) Eaton Snap 'N Shield

2) TB Concept, Inc. Insuguard

2. Insulated Pipe Inserts and Insulation Shields:

a. Insulation material at pipe insert shall be calcium silicate with jacket of nylon reinforced Kraft paper bonded to aluminum foil cover on insulation. Insulated pipe insert shall have no more than 5% deformation at 100 psi and a thermal conductivity no more than 0.38 Btu/hr./sq. ft./degree F/1-inch thick at 75°F.

b. Insulated pipe insert shall be same thickness as adjoining pipe insulation and sized to match pipe in which it is used on. See Section 23 07 19 for insulation sizes.

c. Provide shield per Section 23 11 19 HVAC Piping Specialties.

d. Manufacturers:

1) TPS Thermal Pipe Shields

2) B-Line

3) Clement Support Services

D. Trapeze Hangers: Shall be constructed of carbon steel strut supports. Trapeze hangers shall be supported with hanger rods suspended from approved structural clips. Provide a steel washer plat (Elcen Fig. 84 or equal) where hanger rod nuts bear on trapeze hanger.

E. Clevis Hangers:

1. ANSI/SP-69 and SP-58 (Type 1).

2. Provide with electro-galvanized finish.

3. Install snap-in shield, or insulated pipe inserts, and insulation shields at each clevis hanger support.

4. Snap in shields shall comply with the following requirements:

a. Material: Polypropylene

b. UL-723 (ASTM E 84) and UL-2043

c. Service Temperature: -40°F to 178°F

d. Approved Manufacturers:

1) Eaton Snap 'N Shield

2) TB Concept Inc. Insuguard

5. Insulated Pipe Inserts and Insulation Shields:

    a. Insulation material at pipe insert shall be calcium silicate with jacket of nylon reinforced Kraft paper bonded to aluminum foil cover on insulation. Insulated pipe insert shall have no more than 5% deformation at 100 psi and a thermal conductivity no more than 0.38 Btu/hr./sq. ft./degree F/1-inch thick at 75°F.

    b. Insulated pipe insert shall be same thickness as adjoining pipe insulation and sized to match pipe in which it is used on. See Section 23 07 19 for insulation sizes.

    c. Provide shield per Section 23 11 19 HVAC Piping Specialties.

    d. Manufacturers:

        1) TPS Thermal Pipe Shields

        2) B-Line

        3) Clement Support Services

6. Approved Manufacturers:

    a. Caddy

    b. PHD, Inc.

    c. B-Line

F. Vertical refrigerant pipe supports shall utilize struts with cushion clamps.

1. Cushion Clamps:

    a. Temperature: -65°F to 275°F

    b. Yellow trivalent plated mild steel

    c. Provide with nylon locknut washer

    d. Approved Manufacturers:

        1) Holdrite

        2) BlueRidge

        3) Caddy

        4) PHD, Inc.

2.05 DUCT HANGERS AND SUPPORTS

A. Hangers: As shown in SMACNA HVAC Duct Construction Standards.

B. Vertical Duct Supports at Floor: 1-1/2" x 1-1/2" x 1/8" (minimum) galvanized steel angle and to support ducts, as shown in SMACNA HVAC Duct Construction Standards Figure 4-6. For ducts over 30 inches wide, provide riser reinforcing with hanger rods between the riser support and riser reinforcing.

C. Vertical Duct Supports at Wall: 1-1/2" x 1/8" (minimum) strap or 1-1/2" x 1-1/2" x 1/8" (minimum) angle bracket and as shown in SMACNA HVAC Duct Construction Standards Figure 4-7.

D. Hanger Attachments to Structure: As shown in SMACNA HVAC Duct Construction Standard Figures 4-1, 4-2, 4-3 to suit building construction and as allowed on structural drawings. Where C-clamps are provided, retainer clips shall be used. Friction beam clamps shall not be used.

E. Hanger Attachments to Ducts: As shown in SMACNA HVAC Duct Construction Standards Figure 4-4.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

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

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

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

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

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

3.02 INSTALLATION OF PIPE HANGERS AND SUPPORTS

A. Use of zip ties or plastic straps is strictly prohibited.

B. Insulation shall be continuous at pipe hangers and supports. Insulation may only be broken at vertical pipe supports where insulated cushion clamps are utilized.

C. Above ground pipe shall be adequately anchored to the structure to prevent sagging and to keep pipe in alignment.

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

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

F. Provide supports at each change in direction of piping.

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

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

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

H. Steel Pipe: Maximum spacing between supports:

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

*Gas piping.

I. Copper Tubing: Maximum spacing between supports:

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

J. Soft Copper Pipe: Maximum spacing between supports:

Nominal Tubing Diameter	Maximum Span of Soft Copper
All Sizes	5 Feet

K. Vertical Piping Supports: Support piping at each floor line with pipe clamps and at intermediate points as required to prevent excessive pipe movement and so as to comply with the maximum spacings cited above. Support all pipe stacks at their bases with a concrete pier or suitable hanger. For vertical pipe drops which occur away from a wall or similar anchoring surface, provide angled bracing from nearest structure to provide rigid anchoring of pipe drop. Any pipe requiring insulation shall use an insulated pipe insert at pipe clamp with 360° shield.

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

Nominal Pipe Diameter in Inches	Insert Length in Inches**	Shield Length in Inches	Minimum Shield Gauge
½ to 1½*	6	6	20
2 to 3 ½	6	6	20
4 to 5	9	9	18
6 to 10	9	9	18

*Insulated pipe inserts and shields may be omitted for pipe supported from the bottom.
**Inserts shall be in place at the time of installing pipe.

M. Underground Pipe: Shall be evenly supported on approved bedding materials, as specified for the type of piping being used. Such bedding and backfilling shall be as specified in Section 22 20 00.

3.03 INSTALLATION OF DUCT HANGERS AND SUPPORTS

A. Provide anchors and supports for all ductwork.

B. Rectangular Duct: Supports and hangers shall be of size and spacing as shown in SMACNA HVAC Duct Construction Standards for the appropriate class of duct. (Hangers maximum allowable loads shall not be as shown in SMACNA Tables but shall be as specified in these specifications.)

C. Round Duct: Supports and hangers shall be of size and spacing as shown in SMACNA HVAC Duct Construction Standards for the appropriate class of duct.

D. Maximum Hanger Spacing (provided duct gauge and reinforcement comply with SMACNA Standards for such spacing):

Duct Area	Maximum Spacing
Up to 4 sq. ft. (27” Diameter)	8 Feet
4.1 to 10 sq. ft. (28” to 42” Diameter)	6 Feet
10.1 sq. ft. and up (43” Diameter and up)	4 Feet

E. Provide supports at each change in direction of duct. Locate hangers at inside and outside corners of elbows, or at each end of fitting, on each side.

F. Provide additional supports at each side concentrated loads (such as modulating dampers, duct heaters, sound attenuators, etc.)

G. Provide supports for exterior ductwork per SMACNA HVAC Duct Construction Standards or as detailed on the drawings.

3.04 CEILING AIR TERMINALS/SERVICES

A. Ceiling mounted air terminals or services weighing less than 20 pounds shall be positively attached to the ceiling suspension main runners or to cross runners with the same carrying capacity as the main runners.

B. Terminals or services weighing 20 pounds but not more than 56 pounds in addition to the above shall have two No. 12 gauge hangers connected from the terminal or service to the ceiling system hangers or to the structure above. These wires may be slack.

C. Terminals or services weighing more than 56 pounds shall be supported directly from the structure above by approved hangers.

D. All air terminals that use side inlet "plenums" or have fire dampers shall be supported directly from the structure with approved hangers (regardless of total weight).

3.05 INSTALLATION OF MECHANICAL EQUIPMENT ANCHORS AND SUPPORTS

A. Provide anchoring and supports for all mechanical equipment.

B. Heating, Ventilating and Air Conditioning equipment where suspended from structure shall be supported per SMACNA HVAC Duct Construction Standards or as shown on the drawings.

C. Roof mounted equipment shall be installed on roof curbs provided with the equipment (unless indicated otherwise). Such equipment shall be anchored to the curb, with the curb anchored to the building structure.

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

E. Added supports and bracing shall be provided per Section 23 05 48.

F. Provide curbing as shown on drawings and as required to support all mechanical equipment.

END OF SECTION 23 05 29

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SECTION 23 05 48

VIBRATION AND SEISMIC CONTROL

PART 1 GENERAL

1.01 GENERAL REQUIREMENTS

A. This section includes, but not limited to vibration isolation and seismic restraint installation for all equipment, ductwork, and piping as described here-in.

B. Seismic Restraints shall be bidder-designed. Seismic Design Criteria are to be established per the International Building Code and ASCE along with Project Structural drawings.

C. Items not included in this specification shall not relieve the contractor of the responsibility of providing seismic bracing that meets all the criteria required by the referenced codes and in accordance with the seismic design guidelines and the project structural drawings.

1.02 REFERENCED CODE AND STANDARDS

A. The latest adopted versions of the following codes and standards apply to this section.

1. International Building Code (IBC)
2. National Fire Protection Association (NFPA-13)
3. Seismic Restraint Manual – Guidelines for Mechanical Systems (SMACNA)
4. ASCE 7-10, American Society of Civil Engineers “Minimum Design Loads for Buildings and Other Structures”
5. Applicable Project Structural Drawings for Seismic Design Criteria
6. Applicable Manufacturer’s Seismic Design Guides for proprietary listed seismic bracing and mounting hardware
7. Where there is a conflict in requirements between these guidelines and above-mentioned codes the more stringent parameters shall prevail.

1.03 RELATED SECTIONS

A. General Conditions, Division 1 and Division 23

B. Section 20 00 00 – General Mechanical Requirements

1.04 DESIGN CRITERIA

A. Occupancy Category of Structure (I-IV) per IBC or ASCE

B. Component Importance Factor (Ip) per ASCE

C. Mapped Acceleration Parameters (S1 and (Ss) per IBC and Project Structural Drawings

D. Site Class (A – F) per IBC and Project Structural Drawings

E. Site Coefficient (Fa) per IBC and Project Structural Drawings

F. Site Coefficient (Fv) per IBC and Project Structural Drawings

G. Seismic Design Category (A – D) based on Short Period Response Accelerations per IBC and Project Structural Drawings

H. Seismic Design Category (A – D) based on 1-Second Period Response Acceleration per IBC and Project Structural Drawings

I. Amplification Factor ap per ASCE

J. Response Modification Factor Rp per ASCE

1.05 SUBMITTAL REQUIREMENTS

A. Isolation Pads

B. Spring Isolators

C. Seismic Control:

1. Include design calculations and details for selecting seismic restraints complying with performance requirements, design criteria, and analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

2. Design Calculations: Calculate static and dynamic loading due to equipment weight, operation, seismic, and wind forces required to select vibration isolators, seismic and wind restraints.

    a. Coordinate design calculations with wind load calculations required for equipment mounted outdoors. Comply with requirements in other sections for equipment mounted outdoors.

3. Seismic and Wind Restraint Details:

    a. Design Analysis: To support selection and arrangement of seismic and wind restraints. Include calculations of combined tensile and shear loads.

    b. Details: Indicate fabrication and arrangement. Detail attachments of restraint to the restrained items and to the structure. Show attachment locations, methods, and spacing's. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.

    c. Coordinate seismic-restraint and vibration isolation details with wind-restraint details required for equipment mounted outdoors.

4. Periodic Special Inspections: The mechanical contractor shall provide a list of components/systems requiring periodic special inspections per IBC.

5. Special Certification Requirements: Each contractor responsible for the construction of a "Designated Seismic System" for active mechanical equipment that must remain operable following the design earthquake, or components with hazardous contents certified by the manufacturer to maintain containment following the design earthquake shall submit a Manufacturer's Certificate of Compliance for review and approval by the Registered Design Professional responsible for the design of the system. This information shall then be submitted to the AHJ.

6. All brace or restraint components, mounting devices, snubbers and anchors.

1.06 OPERATION AND MAINTENANCE REQUIREMENTS OF THIS SECTION

Not Applicable

PART 2 PRODUCTS

2.01 NEOPRENE ISOLATORS

A. Isolation Pads: Oil resistant neoprene pads, minimum ¼-inch thick, with cross-ribbed or waffle design. Size pads for not more than 50 psi or as recommended by vibration isolator manufacturer.

B. Floor Mounted Isolators: Double deflection type neoprene mounts, having minimum deflection of 0.35-inch. All metal surfaces shall be neoprene covered, base plate shall have mounting holes, and top shall have threaded steel plate or threaded steel insert. Element shall be color coded or labeled with molded symbols to identify capacity. Mason Series ND, Amber Booth "RV" or approved.

C. Suspension Isolators: Shall be double deflection neoprene type, with isolator encased in open steel bracket and minimum 3/8-inch deflection. Hanger rod shall be isolated from steel bracket with neoprene grommets. Mason Series HD, Amber Booth "BRD" or approved.

2.02 SPRING ISOLATORS

A. General: The load carried by each isolator shall be carefully calculated and isolators selected so that the static deflection will be the same and the supported equipment will remain level. Isolators shall be so designed that the ends of the springs will remain parallel during and after deflection to operating height. At operating height, springs shall have additional travel to complete (solid) compression equal to at least 50 percent of the operating deflection. Suspension isolator springs shall have a static deflection (as shown on drawings) not less than 1-1/2", except that for units with components rotating at 1000 rpm and less, the static deflection shall be not less than 2 inches. Floor isolator springs shall have deflection of not less than 1 inch. All isolators shall provide at least 96% isolation efficiency. Note: Deflections other than these may be used where circumstances warrant and more optimum isolation results can be achieved.

B. Floor Type Spring Isolators: Shall be open spring type with approximate ratio between horizontal and vertical spring constant of 1.0. A ribbed neoprene acoustical friction pad shall be bonded to the underside of the isolator. Provide with height saving bracket.

1. Approved Manufacturers:

a. Mason Series SLF

b. Amber Booth "SW" or approved

C. Floor Housed Type: Housed spring isolator with ductile iron housing, steel base plate with mounting holes, spring inspection ports, neoprene cushion, leveling screws.

1. Approved Manufacturers:

    a. Mason Series SSLFH

    b. Amber Booth "XLS" or approved

D. Suspension Type Spring Isolators: Shall consist of a rigid steel frame, a stable steel spring in the bottom part of the frame, and double deflection neoprene isolating pad at the top of the frame. Where supporting rods pass through the frame, a clearance of not less than on half rod diameter shall be provided all around the rod.

1. Approved Manufacturers:

    a. Mason Series DNHS

    b. Amber Booth "BSSR" or approved

2.03 SEISMIC RESTRAINTS

A. General:

1. All seismic hangers and components shall be domestically made. Products designed domestically and fabricated in a foreign country are prohibited.

2. Products not permitted include powder actuated anchors, gas actuated anchors, or anchors requiring epoxy.

3. Only Steel or Ductile Iron components shall be provided. No Cast Iron or Cast Aluminum components are allowed.

4. Steel shall be per ASTM A36; hangers and other devices shall be as shown in “SMACNA Seismic Restraint Manual” or approved manufacturers seismic design guidelines.

B. Seismic Bracing (rigid and cable):

1. Approved Manufacturers:

    a. Tolco

    b. International Seismic Application Technology (ISAT)

    c. Mason Industries

    d. Cooper B-Line

    e. Kinetics Noise Control

    f. AFCON

    g. Gripple

    h. PHD

    i. Unistrut

j. Anvil or prior approved equal

C. Seismic Anchorages (for wood, steel and concrete):

1. Approved Manufacturers:

a. Hilti

b. ITW Ramset/Red Head

c. ITW Buildex

d. Mason Industries

e. Tolco, AFCON

f. Simpson Strong-Tie

g. Powers Fasteners, Inc. or prior approved equal

D. Flexible Connectors:

1. Approved Manufacturers:

a. Mason Industries

b. Metraflex

c. Victaulic

d. Kinetics Noise

e. International Seismic Application Technology (ISAT) or prior approved equal

E. Pipe Hanger Components:

1. Approved Manufacturers:

a. Tolco

b. International Seismic Application Technology (ISAT)

c. Mason Industries

d. Cooper B-Line

e. Kinetics Noise Control

f. AFCON

g. Gripple

h. PHD

i. Unistrut

j. Anvil or prior approved equal

PART 3 EXECUTION

3.01 VIBRATION ISOLATION

A. Motorized equipment shall be mounted on or suspended from spring vibration isolators either integral or external to the equipment. Floor mounted or suspended isolators.

B. Unless otherwise indicated, resilient mounts for motorized equipment shall be of the type and size to provide maximum ten percent transmissibility. Use unhoused, free-standing stable steel springs which are preferred over housed spring assemblies. The horizontal stiffness of the spring shall be approximately equal to its vertical stiffness. The spring deflection shall be selected based on the equipment power range (HP), speed range (RPM), and static deflection of the supporting structural floor. It is a specific recommendation that whenever a steel spring is used, two pads of ribbed waffle-pattern neoprene be used in series with the spring.

C. The design of vibration dampening shall consider lateral load as well as vertical load and be suitably snubbed against earthquake forces.

D. A list of isolators accompanied by certified transmissibility ratings for the required duty shall be submitted for each item of equipment.

E. Unless noted otherwise, all vibration isolating equipment shall be of the same make and shall be submitted as one group.

F. All piping in the mechanical equipment rooms connected to vibrating equipment shall be supported from resilient ceiling hangers or from floor mounted resilient supports.

G. Special equipment, such as boilers, etc., shall be selected on an individual basis.

H. Inertia bases shall be provided for all equipment with rotating or reciprocating parts when such equipment is located above occupied spaces and for equipment where the motor is separate from equipment. Bases shall be constructed of welded steel angles and channel frame filled solid with structural concrete with #4 rebar at 6 inches on center spanning short dimensions.

3.02 SEISMIC BRACING GENERAL REQUIREMENTS

A. Support and bracing from the structure to pipes, ducts and mechanical equipment shall conform to ASCE and the plumbing & HVAC industry standard SMACNA “Seismic Restraint Manual, Guidelines for Mechanical Systems” or approved manufacturer’s listed seismic assemblies.

B. Provide snubbers for all equipment that is supported on isolators and weighing over 400 lbs. including base. Provide minimum of four snubbers for equipment weighing less than 2,000 lbs., and eight snubbers for heavier equipment.

C. Curb-mounted rooftop units shall be provided with suitable bracing on four sides connecting unit with curb to prevent excessive movement in a seismic event. The contractor is responsible for proper seismic attachment of the rooftop curb to building structure.

D. Housekeeping pads shall be properly anchored to the roof deck or floor per ASCE.

3.03 SEISMIC BRACING GENERAL REQUIREMENTS - PIPING

A. When determining horizontal load requirements, consider all pipes full of water and maximum equipment heights unless calculated for other substances and equipment.

B. Seismic bracing shall not limit the expansion and contraction of the piping system. When thermal expansion or contraction is involved, longitudinal bracing shall be designed at the anchor point of the piping system. The longitudinal bracing and the connections must be capable of resisting the additional force induced by expansion and contraction.

C. Seismic bracing for fire sprinkler system piping and riser components shall be as specified per Division 21.

3.04 INSTALLATION

A. Installation of seismic restraints shall be as follows:

1. Upon completion of installation of all seismic restraint materials and before start-up of restrained equipment, all debris shall be cleaned from beneath all protected equipment, leaving equipment free to contact snubbers.

2. All external utility connections to restrained equipment shall be designed to allow differential seismic motion without damage to the equipment or utility connections.

3. Adjust isolators and restraints after piping systems have been filled and equipment is at its operating weight, following manufacturer’s written instructions.

4. After equipment installation is completed, adjust limit stops following manufacturer’s written instructions so they are out of contact during normal operation.

5. Adjust snubbers according to manufacturer's written instructions.

6. Torque anchor bolts according to anchor manufacturer's written instructions to resist seismic forces.

7. Attach piping to the trapeze per seismic restraint manufacturer’s design. Install cables so they do not bend across sharp edges of adjacent equipment or building structure.

8. Install vertical braces to stiffen hanger rods and prevent buckling per seismic restraint manufacturer’s design. Clamp vertical brace to hanger rods. Requirements apply equally to hanging equipment. Do not weld vertical braces to rods.

9. Housekeeping Pads must be adequately reinforced and adequately sized for proper installation of equipment anchors. Refer to seismic restraint manufacturer's written instructions

3.05 SPECIAL INSPECTIONS

A. When required continuous or periodic special inspections of the equipment and systems designated on the list provided by the mechanical contractor shall be performed in accordance with the IBC and ASCE. The owner shall reserve the right to employ an approved special inspector.

B. Per the IBC, the registered design professional in responsible charge may designate members of the A&E team to act as special inspectors provided those personnel meet the qualification requirements of the IBC to the satisfaction of the building official.

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SECTION 23 05 53

MECHANICAL IDENTIFICATION FOR HVAC PIPING & EQUIPMENT

PART 1 GENERAL

1.01 DESCRIPTION

A. General Requirements: Drawings and general provisions of the Contract, including General and other Conditions and Division 1 - General Requirements sections, apply to the work specified in this Section.

1.02 STANDARDS

A. ANSI Compliance: Comply with ANSI A13.1 for lettering size, colors, and installed viewing angles of identification devices.

1.03 SCHEDULES

A. Submit Valve Schedule for each piping system, typewritten, and reproduced on 8-1/2" x 11" bond paper. Tabulate valve number, piping system, system abbreviation (as shown on tag), location of valve (room or space), and variations for identification (if any). Mark valves which are intended for emergency shut-off and similar special uses, by special "flags", in margin of schedule. Provide a framed copy of Valve Tag Schedule in the mechanical/janitors room.

1.04 OPERATION AND MAINTENANCE REQUIREMENTS OF THIS SECTION

Not Applicable

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

Not Applicable

2.02 PLASTIC PIPE MARKERS

A. Provide manufacturer's standard preprinted, flexible or semi-rigid, permanent, color-coded, plastic sheet pipe markers.

1. Insulation: Furnish 1" thick molded fiberglass insulation with jacket for each plastic pipe marker to be installed on uninsulated pipes subjected to fluid temperatures of 125° F (52° C) or greater. Cut length to extend 2" beyond each end of plastic pipe marker.

2. Small Pipes: For external diameters less than 6" (including insulation if any), provide full band pipe markers, extending 360° around pipe and minimum 12" long at each location, fastened by one of the following methods:

    a. Snap-on application of pre-tensioned semi-rigid plastic pipe marker.

    b. Adhesive lap joint in pipe marker overlap. Laminate or bonded application of pipe marker to pipe (or insulation).

c. Strapped to pipe with nylon strap.

3. Lettering: Manufacturer's standard pre-printed nomenclature which best describes piping system in each instance, as selected by Architect/Engineer in cases of variance with names as shown or specified.

a. Arrows: Print each pipe marker with arrows indicating direction of flow, either integrally with piping system service lettering (to accommodate both directions), or as separate unit of plastic.

2.03 PLASTIC TAPE

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

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

2.04 PLASTIC VALVE TAGS

A. Provide manufacturer's standard plastic valve tags with printed enamel lettering, with piping system abbreviation in approximately 3/16" high letters and sequenced valve numbers approximately 3/8" high, and with 5/32" hole for fastener.

2.05 VALVE TAG FASTENERS

A. Manufacturer's standard solid brass (wire link or beaded type), or solid brass S-hooks of sizes required for proper attachment of tags to valves, and manufactured specifically for that purpose.

2.06 VALVE SCHEDULE FRAMES

A. For each page of Valve Schedule, provide glazed display frame, with screws for removable mounting on masonry walls. Provide frames of finished hardwood or extruded aluminum, with SSB-grade sheet glass.

2.07 ENGRAVED PLASTIC-LAMINATE SIGNS

A. Provide engraved stock phenolic plastic laminate, complying with FS L-P-387, engraved with engraver's standard letter style of sizes and wording, black with white core (letter color) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.

1. Thickness: 1/16" for units up to 20 sq in or 8" length; 1/8" for larger units.

2. Fasteners: Self-tapping stainless-steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate substrate.

3. Letter Size: No less than 1/2" tall. (Use unit# as noted on the equipment schedules)

B. Provide for all items on equipment schedules.

C. Provide for all emergency shut-offs.

D. Provide for all pressure vessels, storage tanks, air separators, etc.

2.08 PAINT

A. Behr Urethane Alkyd Satin Enamel.

B. Use appropriate primer.

PART 3 EXECUTION

3.01 COORDINATION

A. Where identification is to be applied to surfaces which require insulation, painting or other covering or finish including valve tags in finished mechanical spaces, install identification prior to installation of acoustical ceilings and similar removable concealment.

3.02 PIPING IDENTIFICATION

A. Install pipe markers on each system, and include arrows to show normal direction of flow.

3.03 PIPE MARKERS AND COLOR BANDS

A. Locate pipe markers and color bands as follows wherever piping is exposed to view in occupied space, machine rooms, accessible maintenance spaces and exterior non-concealed locations or in accessible ceiling spaces.

1. Near each valve and control device.

2. Near each branch, excluding short take-offs for fixtures and terminal units; mark each pipe at branch where there could be question of flow pattern.

3. Near locations where pipes pass through walls or floor/ceilings, or enter non-accessible enclosures.

4. At access doors, manholes, and similar access points which permit view of concealed piping.

5. Near major equipment items and other points of origination and termination.

6. Spaced intermediately at maximum spacing of 50' along each piping run, except reduce spacing to 25' in congested areas of piping and equipment.

7. On piping above removable acoustical ceilings omit intermediately spaced markers.

8. Color assignments and stencil for piping identification shall be as listed below (colors used shall be verified with Owner prior to ordering).

Service	Color	Stencil
Refrigerant Liquid	Yellow	White
Sprinkler Work	Red	White
Condensate Piping	Green	White

9. Identification stenciling and flow arrows shall be following colors for proper contrast:

Arrows & ID Stenciling	Color Shade Of Pipe
White	Red, Gray, Black and Green
Black	Yellows, Oranges and White

3.04 VALVE IDENTIFICATION

A. Provide valve tag on every valve, cock, and control devices in each piping system; exclude check valves, valves within factory-fabricated equipment units, convenience and lawn watering hose bibbs, and shut-off valves at plumbing fixtures, HVAC terminal devices and similar rough-in connections of end-use fixtures and units. List each tagged valve in Valve Schedule for each piping system.

3.05 SCHEDULES

A. Mount Valve Schedule frames and schedules in riser rooms or as directed by Engineer.

3.06 MECHANICAL EQUIPMENT IDENTIFICATION

A. Install engraved plastic laminate sign on or near each major item of mechanical equipment and each operation device. Provide signs for the following general categories of equipment and operational devices. Provide signs on suspended ceiling tile below mechanical equipment located above ceiling.

1. Pumps and similar motor-driven units.

2. Fans, exhaust, and air handling units.

3. Tanks and pressure vessels.

3.07 FIRE AND FIRE/SMOKE DAMPER IDENTIFICATION

A. Furnish and install label reading "FIRE DAMPER" or "FIRE/SMOKE DAMPER" on each fire damper duct access door. Provide additional labels at locations where external duct insulation covers the access door. Install on outside of insulation.

3.08 CONCEALED ITEMS

A. Items concealed above accessible ceilings requiring access, shall have the ceiling marked to indicate such item's location. The marking system shall consist of colored phenolic plates with 1/2" tall, engraved lettering specifying the item concealed; plate shall be applied to ceiling T-bar framing with rivets or other owner approved method below the concealed item. Colors used shall be verified with Owner, and unless directed otherwise, shall be:

Item	Color
Heating System Equipment Component	Green
Fire Protection System Component	Red

B. Provide three (3) color legends (hard laminate) listing the above colors. Locate as directed by Owner.

END OF SECTION 23 05 53

SECTION 23 05 93

AIR SYSTEM TESTING & BALANCING

PART 1 GENERAL

1.01 GENERAL

A. Includes, but not limited to, testing, balancing and adjusting of air heating, cooling and exhaust systems.

1.02 RELATED SECTION(S)

A. General Conditions and Division 1 apply to this section.

B. Division 23 shall make changes in pulley, belts, and dampers as required for correct balance as recommended by Air Testing & Balancing Agency at no additional cost to Owner.

C. Division 23 shall repair leaks in ductwork at no additional cost to Owner.

1.03 SYSTEM DESCRIPTION (PERFORMANCE REQUIREMENTS)

A. Perform testing and balancing in complete accordance with the Associated Air Balancing Council (AABC), National Environmental Balancing Bureau (NEBB), or National Balancing Council (NBC) standards and procedures.

B. Air Testing & Balance Agency shall perform tests specified, compile test data, and submit copies of complete test data to Contractor for forwarding to Architect/Engineer for evaluation and approval.

1.04 SUBMITTALS REQUIRED BY THIS SECTION

A. Company information including Washington State Contractors' license

B. Key personnel and resumes

C. AABC, NEBB, or NBC certifications

D. Provide reference of five (5) completed jobs of similar size and complexity.

1.05 OPERATION AND MAINTENANCE REQUIREMENTS OF THIS SECTION

A. Final air balance report shall be bound in the O & M Manual or provided under a separate volume.

B. Preliminary air balance report shall be submitted to the Architect/Engineer for approval. Preliminary report shall note all finished measured data.

C. Final Test Data:

1. Provide project name, name and telephone number of balancing firm, GC, MC, Architect, and Engineer in the cover (or first page) of report.

2. Provide a summary of air balance findings regarding airtightness of each ducted systems, deficiencies of equipment to meet design requirements, deficiencies of space pressure relationships, etc.

3. Cover sheet shall have a statement from the site project manager that reads, "The air system testing and balancing report contained herein is true and factual based on actual field measurements and adjustments. I have personally performed or witnessed a minimum of 5% of the airflow tests."

4. Each page of test report to have a unique page number.

5. Provide fan curve or chart of each fan in system.

6. Provide final approved test report in PDF format on CD. Provide one more CD than hard copies of test report.

7. Obtain and provide a copy of the air barrier test (building tightness) whether or not the Air Balance Contractor produced the test.

1.06 QUALITY ASSURANCE (QUALIFICATIONS)

A. Mechanical Contractor shall procure services of an independent Air Testing & Balance Agency, which specializes in testing, and balancing of heating, ventilating, and cooling systems to balance, adjust, test air-moving equipment, air distribution, and exhaust systems.

B. Agency shall be approved in writing by Consultant.

C. Instruments used by Agency shall be accurately calibrated and maintained good working order.

D. If requested, conduct tests in presence of Architect/Owner/Engineer.

1.07 SEQUENCING & SCHEDULING

A. Mechanical Contractor shall award test and balance contract to approved agency upon receipt of his contract to proceed to allow Agency to schedule this work in cooperation with other Sections involved and comply with completion date.

B. Begin air testing and balancing upon completion of air cooling, heating, and exhaust systems including installation of all specialties and devices.

C. Mechanical Contractor shall put heating, ventilating, and cooling systems and equipment into full operation and continue their operation during each working day of testing and balancing.

PART 2 PRODUCT

Not applicable

PART 3 EXECUTION

3.01 FIELD QUALITY CONTROL

A. Testing Procedure: Air Testing & Balancing Agency shall perform following tests and balance system in accordance with following requirements at design conditions of supply and a minimum outside air CFM (not 100% return or 100% economizer).

1. Test, adjust, and record fan rpm to design requirements.

2. Test and record motor amperes at design conditions.

3. Make pitot tube traverse of main supply duct and obtain design cfm at fans. (systems of 1000 CFM or greater)

4. Test and record system static pressures: suction, discharge, and clean filters (if applicable; for systems of 2000 CFM or greater)

5. Test, adjust, and record system for design cfm air.

6. Test, adjust, and record system for design cfm outside air.

7. Test, adjust, and record each diffuser, grille, and register to within 10% of design requirements.

8. On a floor plan, identify each diffuser, grille, and register to location and area using a designation symbol unique to that page.

9. Identify and list size, type, and manufacturer of diffusers, grilles, registers, and testing equipment. Use manufacturer's rating on equipment to make required calculations.

10. In readings and tests of diffusers, grilles, and registers, include required cfm and test cfm after adjustments.

11. In cooperation with Division 23, set adjustments of automatically operated dampers to operate as specified, indicated, or noted.

12. Adjust diffusers, grilles, and registers to minimize drafts.

13. Identify at each volume damper with permanent mark, the position of actuator handle once final balance has been achieved.

14. Measure and record all pressure differential relationships as identified by the control's diagrams (i.e. labs, kitchen, pharmacy, art rooms, building pressure, etc.). These measurements are to be taken when all HVAC is running after full balance has been completed. Note the measured reference points to determine the pressure differential.

15. For any spaces with exhaust and supply to them where design airflows cannot be obtained, the systems shall be adjusted to produce a negative pressure to the adjacent space (i.e. workrooms, restrooms, labs, nurse rooms, etc.)

16. When reconciling supply, return, outside, and exhaust air quantities, priority shall be placed on outside air quantities (typically, return air quantities noted on plans are for duct sizing only).

17. Where duct pressure sensors are noted in controls diagrams (i.e. variable volume systems) adjust system to its minimum pressure point that still achieves full airflow to all terminals. Record this setpoint in test report and provide data to controls contractor.

18. For variable volume systems, adjust sheave package to produce maximum airflow (or diversity as applicable) at 60 Hz with simulated filter loading. If maximum airflow cannot be obtained at 60 Hz, increase frequency until maximum airflow is obtained as allowed by the equipment manufacturer and maximum motor amperes. Record final values.

19. Verify that all gravity backdraft dampers are moving freely, open in proper direction, and are unbound.

20. After balancing system, measure terminal CFM when system is in 100% economizer. If supply is greater than design, coordinate with controls contractor or MC to provide damper stops to provide design CFM during 100% economizer.

21. On All Motors with Variable Drives: Set maximum amperage safety to protect motor from over loading.

B. Final Inspection & Adjustments:

1. Balancing agency shall be represented at final inspection meeting by qualified testing personnel with balancing equipment and two (2) copies of air balancing test report.

   a. Architect may choose and direct spot balancing of one (1) zone. Differences between the spot balance and test report will be justification for requiring repeat of testing and balancing for entire building.

   b. Rebalancing shall be done in presence of Architect and subject to his approval.

   c. Spot balance and rebalance shall be performed at no additional cost to Owner.

2. System shall be completely balanced and all reports submitted to Architect prior to prefinal inspection.

3. Where equipment supplied to job site provides over 5% more air than schedule requirements, rooms supplied by that equipment shall have their supply air quantities increased by the ratio of actual total air quantity supplied to minimum air quantity required by schedule.

3.02 BALANCING FIRMS (APPROVED)

A. Hardin and Sons

B. MTW Design

C. Airtest Company, Inc.

D. American Air Balance Company

E. Advanced Mechanical Services, Inc.

F. Testing & Commissioning Services

G. Precision Test and Balance, Inc.

END OF SECTION 23 05 93

SECTION 23 07 13

EQUIPMENT DUCTWORK INSULATION

PART 1 GENERAL

1.01 GENERAL

A. This section describes the insulation requirement to meet or exceed the 2018 Washington State Energy Code. Lining installation is per Section 23 31 13.

1.02 RELATED SECTION(S)

A. General Conditions, Division 1

B. Section 20 00 00 - General Mechanical Conditions

C. Section 23 31 13 - Steel Ductwork

1.03 SUBMITTAL REQUIREMENTS OF THIS SECTION

A. Wrap Insulation

1.04 OPERATION AND MAINTENANCE REQUIREMENTS OF THIS SECTION

Not Applicable

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

Not Applicable

2.02 DUCTWORK INSULATION

A. Manufacturers: Manville Corporation Owens Corning, Knauf Insulation, Manson Insulation, or approved equal.

B. Flexible Fiber Glass Blanket (Wrap Insulation): Manville, Microlite Type 75 meeting ASTM C553, Type 1, Class B-2; flexible blanket.

1. 'K' ('ksi') Value: 0.27 at 75°F (0.040 at 24°C) installed.

2. Density and R-value:

a. R-3.3: 1.0” inch of 1.5 to 3.0 lb/cu. Ft. glass fiber blanket.

b. R-5.3: 2.0” inches of 0.75 lb/cu. Ft. or 1.5 inches of 1.5 to 3.0 lb/cu. Ft. glass fiber blanket.

c. R-7: 3.0 inches of 0.75 lb/cu. Ft. or 2.0 inches of 1.5 to 3.0 lb/cu. Ft. glass fiber blanket.

3. Vapor Barrier Jacket: FSK, aluminum foil reinforced with fiber glass yarn and laminated to fire-resistant kraft, secured with UL listed pressure sensitive tape and/or outward cinched expanded staples and vapor barrier mastic as needed.

C. Rigid Fiber Glass Board: Insulation Board meeting ASTM C 612 Type IA and IB; rigid.

1. 'K' ('ksi') Value: ASTM C 177, 0.22 at 75°F mean temperature.

2. Maximum Service Temperature: 450°F.

3. Vapor Retarder Jacket: ASJ conforming to ASTM C 1136 Type I, or FSK or PSK conforming to ASTM C 1136 Type II.

4. Securement: Secured in place using adhesive and mechanical fasteners spaced a minimum of 12" on center with a minimum of 2 rows per side of duct. Insulation shall be secured with speed washers and all joints, breaks and punctures sealed with appropriate pressure-sensitive foil tape, or glass fabric and vapor retarder mastic.

5. Density and R-value:

a. R-4.5: 1.0" of 6.0 lb./cu.ft.

b. R-6.8: 1.5" of 6.0 lb./cu.ft.

c. R-9.1: 2.0" of 6.0 lb./cu.ft.

D. Duct Insulation Protection:

1. Aluminum Jacket: 0.016-inch (.045 mm) thick sheet, smooth/embossed finish, with longitudinal slip joints and 2-inch (50 mm) lamps.

2. Manville Insulkote ET, a non-water-vapor retarder, non-burning, weatherproof coating for use over insulation where "breathing" is required.

3. Manville Zeston 2000 jacketing, UV resistant polyvinyl chloride covering with joints secured and sealed with Manville Perma-Weld Adhesive.

4. Canvas Jacket: UL listed fabric, 6 oz/sq. yd. (220 g/sq. m.), plain weave cotton treated with dilute fire-retardant lagging adhesive.

5. Self-Adhering Jacketing: Material to be VentureClad [1579CW] with a white finish. Jacketing material is to have a maximum flame spread/smoke developed index of 25/20 per UL 723, 1 0.0000 water vapor permeance rating per ASTM E-96, mold inhibitors incorporated, and be UV stable.

2.03 DUCTWORK LINING

A. See Section 23 31 13 - Steel Ductwork.

PART 3 EXECUTION

3.01 EXAMINATION AND PREPARATION

A. Verify that ductwork has been tested for leakage in accordance with SMACNA standards before applying insulation materials.

B. Verify that all surfaces are clean, dry, and free of foreign material.

C. External Ductwork Insulation:

1. Provide insulated ductwork conveying air below ambient temperature with vapor retardant jacket. Seal all vapor retardant jacket seams and penetrations with UL listed tapes or vapor retardant adhesive.

2. Provide insulated ductwork conveying air above ambient temperature with or without vapor retardant jacket. Where service access is required, bevel and seal ends of insulation.

3. Continue insulation through walls, sleeves, hangers, and other duct penetrations except where prohibited by code.

4. The underside of ductwork 24 inches or greater shall be secured with mechanical fasteners and speed clips spaced approximately 18 inches on center. The protruding ends of the fasteners should be cut off flush after the speed clips are installed, and then, when required, sealed with the same tape as specified above.

5. For ductwork exposed to physical abuse in unfinished and exposed spaces, finish with duct insulation protection.

6. For outdoor applications, provide insulation with a weather protection jacket. Manville Zeston 2000, VentureClad self-adhering or approved equal. Install per manufacturer's instructions.

D. For installation of lining insulation, see Section 23 31 13.

3.02 INSULATION SCHEDULE

A. Provide wrap insulation and duct liner for the duct systems indicated per the following table (R-value indicates the thickness to be provided as defined in Section 23 07 13 for wrap insulation and Section 23 31 13 for liner):

DUCT TYPE AND LOCATION	LINER	WRAP
Within the Building Envelope:		
- Supply Air	R - 3.3	Not Allowed
- Return Air	R - 3.3	Not Allowed
- Primary Supply Air	Not Allowed	R – 3.3[1]
- Primary Return Air	Not Allowed	R – 3.3[1]
- Relief Air	Not Allowed	R – 3.3[1,2]
- Transfer Air	R-3.3	Not Allowed
- Exhaust Air	R-3.3	Not Allowed [2]
- HRU/ERU Exhaust Air	Not Allowed	R – 7[1,2]
- HRU/ERU Return Air	R-3.3	Not Allowed
- Outside Air	Not Allowed	R - 7[1,2]

Table Footnotes:

1. Where duct is exposed to view, provide wrap with paintable duct insulation protection.
2. Building level insulation is required from backdraft/motorized damper to louver or roof hood. See plans for additional details. Coordinate with GC for insulation.
3. Use liner or rigid fiberglass board.

B. For purposes of the Insulation Schedule above, the following defines the duct systems:

1. Supply Air: Air that has passed through mechanical conditioning device, such as a furnace, coil, evaporative section, heat recovery device, etc. that is distributed to the conditioned space.

2. Return Air: Air from the conditioned space to an air handler.

3. Primary Supply and/or Return Air: Any duct between an air handler and a terminal unit (capable of throttling the air with a motorized damper, capable of heating the air, and/or capable of cooling the air). Example of terminal unit is a variable air volume terminal (fan or throttle damper) or an induction/chilled beam terminal.

4. Relief Air: Air from the conditioned space to the outdoors or to a large semi-conditioned or non-conditioned space.

5. Transfer Air: Air from one conditioned space to another conditioned space.

6. Exhaust air: Air from a space moved by a fan to directly outside. Also, air downstream of an energy recovery device to directly outside.

7. HRU/ERU Return Air: Return air from a grille to a heat recovery device. or motorized damper.

8. HRU/ERU Exhaust Air: Exhaust air from heat recovery device to directly outside.

9. Outside Air: Air from the outside to a mechanical conditioning device such as a furnace, coil, evaporative section, heat recovery device, etc.

END OF SECTION 23 07 13

SECTION 23 09 00

ADDITION TO EXISTING CONTROLS

PART 1 GENERAL

1.01 GENERAL REQUIREMENTS

A. Conform to General Conditions and Supplemental Conditions for Washington State Facilities Construction.

B. The general Provisions of the Contract, including General, Supplementary, and Special Conditions, and Division 1- General Requirements, apply to work specified in this section. Subcontractor must familiarize himself with the terms of the above documents.

1.02 SCOPE OF WORK

A. Scope of Work: Under the base bids, the controls as specified under Section 23 09 00 shall be provided. The following Controls manufacturers are approved for use on this project. No substitutions of manufacturers other than those listed will be considered. Input and output devices are not restricted to these manufacturers. Systems approved for bidding are:

1. Approved Manufacturers:

a. Honeywell Niagara by TRS Mechanical

b. Honeywell Niagara by MacDonald Miller

c. Honeywell Niagara by Sunset Air

d. Honeywell Niagara by Sound Energy

1.03 RELATED DOCUMENTS

A. All work of this Division shall be coordinated and provided by the single Controls Contractor.

B. The work of this Division shall be scheduled, coordinated, and interfaced with the associated work of other trades. Reference the Division 23 Sections for details.

1.04 DEFINITIONS

A. Analog: A continuously variable system or value not having discrete levels. Typically exists within a defined range of limiting values.

B. Binary: A two-state system where an “ON” condition is represented by one discrete signal level and an “OFF” condition is represented by a second discrete signal level each separated by a defined deadband. Digital Inputs and Digital Outputs are examples.

C. Controls Contractor: The single Contractor to provide the work of this Division. This Contractor shall be the primary installer, commissioner and ongoing service provider for the Controls work.

D. Control Sequence: A pre-programmed arrangement of software algorithms, logical computation, target values and limits as required to attain the defined operational control objectives.

E. Direct Digital Control: The digital algorithms and pre-defined arrangements included in the controls software to provide direct closed-loop control for the designated equipment and controlled variables. Inclusive of Proportional, Derivative and Integral control algorithms together with target values, limits, logical functions, arithmetic functions, constant values, timing considerations and the like.

F. Node: A digitally programmable entity existing on the controls network.

G. PC: Personal Computer from a recognized major manufacturer. PC "clones" assembled by a third-party Subcontractor are not acceptable. PC must also have documentation verifying that it has been tested and is completely compatible with all installed software and communicates with any peripherals such as modems, NEC cards, printers, hubs, zip drives, etc. that may be attached.

H. Operator Workstation: Software and PC combination that serves as the graphic and/or text interface to EMCS

I. Wiring: The term "Wiring" and its derivatives when used in this Division shall mean provide the controls wiring and terminations.

J. Install: The term "Install" and its derivatives when used in this Division shall mean receive at the jobsite and mount.

K. Software: The term "software" and its derivatives when used in this Division shall mean all of programmed digital processor software, preprogrammed firmware and project specific digital process programming and database entries and definitions as generally understood in the controls industry for real-time, integrated controls configurations.

L. The following abbreviations and acronyms may be used in describing the work of this Division:

ADC	-	Analog to Digital Converter
AI	-	Analog Input
ANSI	-	American National Standards Institute
AO	-	Analog Output
ASCII	-	American Standard Code for Information Interchange
AWG	-	American Wire Gauge
CFM	-	Cubic Feet Per Minute
DAC	-	Digital to Analog Converter
DDC	-	Direct Digital Control
DI	-	(Binary) Digital Input
DO	-	(Binary) Digital Output
EEPROM	-	Electronically Erasable Programmable Read Only Memory
EMI	-	Electromagnetic Interference
EMCS	-	Energy Management Control System
FAS	-	Fire Alarm Detection and Annunciation System
HOA	-	Hand-Off-Auto
ID	-	Identification
IEEE	-	Institute of Electrical and Electronics Engineers
I/O	-	Input/Output
LCD	-	Liquid Crystal Display
LED	-	Light Emitting Diode
MCC	-	Motor Control Center
NC	-	Normally Closed
NIC	-	Not in Contract

NO	-	Normally Open
OWS	-	Operator Workstation
OAH	-	Outdoor Air Humidity
OAT	-	Outdoor Air Temperature
PC	-	Personal Computer
RAM	-	Random Access Memory
RF	-	Radio Frequency
RFI	-	Radio Frequency Interference
RH	-	Relative Humidity
ROM	-	Read Only Memory
SPDT	-	Single Pole Double Throw
SPST	-	Single Pole Single Throw
TBA	-	To Be Advised
VAC	-	Volts, Alternating Current
VAV	-	Variable Air Volume
VDC	-	Volts, Direct Current

1.05 QUALITY ASSURANCE

A. General:

1. The Controls Contractor shall have a branch facility within a 100-mile radius of the job site supplying complete maintenance and support services on a 24 hour, 7-day-a-week basis. This branch facility shall provide the work for this project. This support facility shall have spare parts and all necessary test and diagnostic equipment required to install, commission and service the additional controls.

2. As evidence and assurance of the Contractor’s ability to support the Owner's system with service and parts, the Contractor must have been in business for at least the last ten (10) years and have successfully completed three projects comparable to the value of this contract in the preceding five years

B. Quality Management Program:

1. Provide a competent and experienced Controls Project Manager employed by the Controls Contractor. The Project Manager shall be supported as necessary by other Controls Contractor employees in order to provide professional management service for the work. The Project Manager shall attend scheduled Project Meetings as required and shall be empowered to make technical, scheduling and related decisions on behalf of the Controls Contractor

1.06 REFERENCES

A. All work shall conform to the following Codes and Standards, as applicable:

1. National Fire Protection Association (NFPA) Standards.

2. National Electric Code (NEC) and applicable local Electric Code.

3. Underwriters Laboratories (UL) listing and labels.

4. UL 916 Energy Management

5. NFPA 70 - National Electrical Code.
6. NFPA 90A - Standard for The Installation of Air Conditioning and Ventilating Systems.
7. NFPA 92A and 92B Smoke Purge/Control Equipment.
8. Factory Mutual (FM).
9. American National Standards Institute (ANSI).
10. National Electric Manufacturer's Association (NEMA).
11. American Society of Mechanical Engineers (ASME).
12. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE).
13. Air Movement and Control Association (AMCA).
14. Institute of Electrical and Electronic Engineers (IEEE).
15. American Standard Code for Information Interchange (ASCII).
16. Electronics Industries Association (EIA).
17. Occupational Safety and Health Administration (OSHA).
18. American Society for Testing and Materials (ASTM).
19. Federal Communications Commission (FCC) including Part 15, Radio Frequency Devices.
20. Americans Disability Act (ADA)

B. In the case of conflicts or discrepancies, the more stringent regulation shall apply.

C. All work shall meet the approval of the Authorities Having Jurisdiction at the project site.

1.07 SUBMITTALS

A. Control Drawings, Product Data, and Samples:

1. The Controls Contractor shall submit a complete controls package divided in two sections. The first section shall be delivered within thirty (30) days after the contract has been awarded and the second section shall be delivered within sixty (60) days after the contract has been awarded.
2. Allow at least fifteen (15) working days for the review of each package by the Engineer.

3. Equipment and systems requiring approval of local authorities must comply with such regulations and be approved. Filing shall be at the expense of the Controls Contractor where filing is necessary. Provide a copy of all related correspondence and permits to the Owner.

B. Submittal Section 1:

1. Product data sheets for all products including software.

C. Submittal Section 2:

1. Controller wiring diagrams and sequences. Control drawings shall be created on AUTOCAD software, version 14 or newer.

2. Detailed Bill of Material, identifying part number, quantity, description, and optional features.

3. Details of all interfaces and connections to the work of other trades.

1.08 RECORD DOCUMENTATION

A. Operation and Maintenance Manuals:

1. Three (3) copies of the Operation and Maintenance Manuals shall be provided to the Owner's Representative upon completion of the project. The entire Operation and Maintenance Manual shall be furnished on Compact Disc media, and include the following for the controls provided:

a. Table of contents

b. As-built Control Drawings using AutoCAD Version 14 or newer Drawings shall represent the as-built condition of the system and incorporate all information supplied with the approved submittal.

c. Manufacturer’s product data sheets for all products including software

d. System Operator’s manuals

e. Wiring termination diagrams (use AutoCAD version 14 or newer)

f. Interfaces to all third-party products and work by other trades

g. Point to point checkout sheets with dates and checkout signatures

h. Repair contact name and phone number

1.09 WARRANTY

A. Standard Material and Labor Warranty:

1. Provide a one-year labor warranty on the Controls.

2. The controls components shall be free from defects in material and workmanship under normal use and service. If within one (1) year from the date of awarding of the Certificate of Occupancy any controls equipment is found to be defective, it will be replaced, repaired or adjusted by the Controls Contractor free of charge. The Controls Contractor is not responsible for the removal or reinstallation of any components that were originally installed by others, such as valves, dampers, wells, air flow stations, etc.

3. Maintain an adequate supply of materials within 100 miles of the Project site such that replacement of key parts and labor support, including programming. Warranty work shall be done during Controls Contractor's normal business hours unless there is an emergency.

4. Maintain an on-site record of all work done, all items removed from site, all items returned to site, all new replacement items installed and all remedial programming and database entry work undertaken including software revisions installed. Maintain a record of all re-calibrations required as a result of Warranty service.

1.10 OPERATION AND MAINTENANCE REQUIREMENTS OF THIS SECTION

Not Applicable

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

Not Applicable

2.02 CONTROLS DESCRIPTION

A. The controls work shall be an addition to the existing EMCS. It shall have controls and sensors that shall perform all the functions listed in the drawings. The new additional controls shall be added via graphics and/or text test screens to all operator workstations currently communicating with the existing EMCS. All controllers and workstations connected to or communicating with the new additional controls shall be updated as necessary to continue connection and/or communication. Controls contractor is responsible for all programming and scheduling changes that need to occur though-out the existing EMCS to accommodate the new additional controls.

B. The work of the single Controls Contractor shall be as defined individually and collectively in all Sections of this Division specifications together with the associated Point Sheets and Drawings and the associated interfacing work as referenced in the related documents as are listed in Part 1 of this Section.

C. The controls work shall consist of the provision of all labor, materials, etc. as Specified in these Division documents which are required for the complete, fully functional and commissioned controls.

D. Provide a complete, neat and workmanlike installation. Use only employees who are skilled, experienced, trained, and familiar with the specific equipment, software and configurations to be provided for this Project.

E. Manage and coordinate the controls work in a timely manner in consideration of the Project schedules. Coordinate cooperatively with the associated work of other trades so as to assist the progress and not impede or delay the work of associated trades.

2.03 NODES

A. HVAC and Application Nodes:

1. HVAC Node shall provide direct digital control of HVAC systems.

2. A dedicated HVAC Node shall be configured and provided for the new additional controls.

3. The HVAC Node shall retain its function and setpoint information in the event of a power failure, and shall return to normal operation upon restoration of power.

4. Application Nodes shall be physically separate from server hardware and software, reside in the building, and be the only means of EMCS data transfer to the server. Application node shall be a complete off the shelf software/hardware package manufactured by a licensed Application node manufacturer.

PART 3 PERFORMANCE/EXECUTION

3.01 INSTALLATION PRACTICES

A. Controls Wiring:

1. All conduit, wiring, accessories and wiring connections required for the installation of the Controls, as herein specified, shall be provided by the Controls Contractor unless specifically shown on the Electrical Drawings under Division 26 Electrical.

2. The EMCS contractor is responsible for coordinating with the Electrical contractor (At EMCS Contractors' expense) to furnish and install any additional line voltage circuits, line voltage wiring, line voltage panels, and associated line voltage appurtenances not shown on the Electrical Drawings as required to provide a compete and functioning EMCS system, regardless of the quantity or presence of EMCS circuits shown on the Electrical Drawings.

3. All wiring shall comply with the requirements of applicable portions of Division 26 and all local and national electric codes, unless specified otherwise in this section.

4. All Controls wiring materials and installation methods shall comply with Controls manufacturer recommendations.

5. The sizing type and provision of cable, conduit, cable trays, and raceways shall be the design responsibility of the Controls Contractor. If complications arise, however, due to the incorrect selection of cable, cable trays, raceways and/or conduit by the Controls Contractor, the Contractor shall be responsible for all costs incurred in replacing the selected components.

6. Wire/conduit ratios shall follow the same wire/conduit ratios included in Division 26.

7. Class 2 Wiring:

   a. All Class 2 (24VAC or less) wiring shall be installed in conduit or be plenum rated and shall be installed in accordance with local code requirements.

   b. Conduit is not required for Class 2 wiring in concealed accessible locations. Inaccessible locations such as “hard lid” ceilings require conduit.

   c. Wire supports and be installed per local wiring code requirements. As a default, wire shall be supported every 5’ from the building structure utilizing metal hangers designed for this application.

   d. Where it is not possible to conceal raceways in finished locations, surface raceway (Wiremold) may be used as approved by the Engineer.

   e. All conduits and raceways shall be installed level, plumb, at right angles to the building lines and shall follow the contours of the surface to which they are attached.

   f. Provide firestopping for all penetrations used by dedicated Controls conduits and raceways using approved fire resistive sealant. All other project firestopping to be by other trade.

   g. All wiring passing through penetrations, including walls or other structure, shall be in conduit or enclosed raceway.

   h. Penetrations of floor slabs shall be by core drilling. All penetrations shall be plumb, true, and square.

   i. No penetrations in structural elements shall be made before receipt of written approval from the Structural Engineer.

8. Class 2 signal wiring and 24VAC power can be run in the same conduit. Power wiring 120VAC and greater cannot share the same conduit with Class 2 signal wiring.

9. Perform circuit tests using qualified personnel only. Provide necessary instruments and equipment to demonstrate that:

   a. All circuits are continuous and free from short circuits and grounds.

   b. All circuits are free from unspecified grounds; that resistance to ground of all circuits is no less than 50 megaohms.

   c. All circuits are free from induced voltages.

10. Provide complete testing for all cables used under this Contract. Provide all equipment, tools, and personnel as necessary to conduct these tests.

11. Provide for complete grounding of all signal and communications cables, panels and equipment so as to ensure system integrity of operation. Ground cabling and conduit at the panel terminations. Avoid grounding loops.

B. Controls Line Voltage Power Source:

1. 120-volt AC circuits used for the controls shall be taken from panelboards and circuit breakers provided by Division 26. Coordinate circuit installation with Division 26. Division 26 shall be responsible for the installation of 120 VAC controls circuits.

2. Circuits used for the controls shall be dedicated and shall not be used for any other purposes.

3. Terminal unit controllers may use 120-volt AC power from motor power circuits.

C. Controls Identification Standards:

1. Node Identification: All nodes shall be identified by a permanent label fastened to the outside of the enclosure. Labels shall be suitable for the node location.

2. Cable and/or conduit shall be labeled at suitable intervals with the controlled unit's name. Labeling shall be sufficient to trace cable from device to unit.

3. Specify a different wire color for analog, digital, power and communication wiring. Include wiring color on control drawings legends.

4. Raceway Identification: All the covers to junction and pull boxes of the control's raceways shall be labeled.

5. Wire Identification: All low and line voltage control wiring shall be identified by a number, as referenced to the associated shop drawing and as-built drawing, at each end of the conductor or cable. Identification number shall be permanently secured to the conductor or cable and shall be typed.

D. Node Installation:

1. The controls panels and cabinets shall be mounted at shoulder height wherever possible. All panels shall be accessible. Each cabinet shall be anchored per the manufacturer's recommendations.

2. The Controls Contractor shall be responsible for coordinating panel locations with other trades and Electrical and Mechanical Contractors.

E. Input Devices:

1. All Input devices shall be installed per the manufacturer recommendation and shall be of the type and accuracy suitable for this specific application.

2. Locate components in accessible local control panels wherever possible.

3. The Mechanical Contractor shall install all in-line devices such as temperature wells, pressure taps, airflow stations, etc.

4. Input Flow Measuring Devices shall be installed in strict compliance with ASME guidelines affecting non-standard approach conditions.

5. Outside Air Sensors:

    a. Sensors shall be mounted on the North wall to minimize solar radiant heat impact or located in a continuous intake flow adequate to monitor outside air conditions accurately.

    b. Sensors shall be installed with a rain proof, perforated cover.

6. Building Differential Air Pressure Applications (-0.25" to +0.25" w.c.):

    a. Transmitter's exterior sensing tip shall be installed with a shielded static air probe to reduce pressure fluctuations caused by wind.

    b. The interior tip shall be inconspicuous and located as shown on the drawings.

7. Duct Temperature Sensors:

    a. Duct mount sensors shall mount in an electrical box through a hole in the duct and be positioned so as to be easily accessible for repair or replacement.

    b. The sensors shall be insertion type and constructed as a complete assembly including lock nut and mounting plate.

    c. For ductwork greater in any dimension than 48 inches or where air temperature stratification exists such as a mixed air plenum, utilize an averaging sensor. Sensors shall be installed in a "Z" configuration as default.

    d. The sensor shall be mounted to suitable supports using factory approved element holders.

8. Low Temperature Limit Switches:

    a. Install on the discharge side of the first water or steam coil in the air stream.

    b. Mount element horizontally across coil in a serpentine pattern ensuring each square foot of coil is protected by 1 foot of sensor.

    c. For large duct areas where the sensing element does not provide full coverage of the air stream, provide additional switches as required to provide full protection of the air stream.

9. Air Differential Pressure Status Switches:

    a. Install with static pressure tips, tubing, fittings, and air filter.

10. Water Differential Pressure Status Switches:

    a. Install with shut off valves for isolation.

    b. Installation of pipe taps and valves by Division 23.

11. Room Temperature Sensor:

    a. Install sensor with insulation if mounted on an exterior wall.

12. CO2 sensor:

    a. Shall be factory calibrated and be self-calibrating when installed.

    b. Range: 0-2000 ppm

    c. Accuracy: Plus or minus 30 ppm plus 2% of reading

    d. UL listed

F. HVAC Output Devices:

1. All output devices shall be installed per the manufacturers recommendation and shall be suitable in type and accuracy for this specific application. The Mechanical Contractor shall install all in-line devices such as control valves, dampers, etc.

2. Actuators: All control actuators shall be sized and capable of closing against the maximum system shut-off pressure. The actuator shall modulate in a smooth fashion through the entire stroke. When any pneumatic actuator is sequenced with another device, pilot positioners shall be installed to allow for proper sequencing.

3. Electronic Signal Isolation Transducers: Whenever an analog output signal from the EMCS is to be connected to an external control system as an input (such as a chiller control panel), or is to receive as an input a signal from a remote system, provide a signal isolation transducer. Signal isolation transducer shall provide ground plane isolation between systems. It is the Controls Contractor's responsibility to determine if isolation is necessary.

4. Relays: All relays used to start/stop any piece of mechanical equipment that does not have an HOA switch shall have a Closed-Open-Auto override switch located on the load side of the relay.

3.02 TRAINING

A. The Controls Contractor shall provide the following training services:

1. Provide one half day of on-site orientation by a system technician who is fully knowledgeable of the specific installation details of the project. This orientation shall, at a minimum, consist of a review of the project as-built drawings and a walk through of the facility to identify panel and device locations. Training may be split into smaller sessions on different days if the Owner prefers.

2. Supply a list of available factory training classes and contact information.

3.03 COMMISSIONING

A. Acceptance Verification Document is defined as a series of check sheets that include all controls and functions. Each point entry shall be signed and dated verifying that each point and function has been fully calibrated and tested.

B. Conduct functional performance tests to demonstrate that controls systems maintain setpoints and operates through the full range of operations. The commissioning agent will provide functional tests that the Controls Contractor shall review and provide comments on the tests for incorporation into the final test documents.

C. Provide all necessary specialist labor, materials and tools to demonstrate to the Engineer that the controls have been commissioned and are operating in compliance with the contract. Prepare a list of noted deficiencies signed by both the Engineer and the Controls Contractor.

D. Promptly rectify all listed deficiencies and submit to the Engineer that this has been done.

END OF SECTION 23 09 00

SECTION 23 09 00

ENERGY MANAGEMENT & CONTROLS (DDC)

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Conform to General Conditions and Supplemental Conditions for Washington State Facilities Construction.

B. The general Provisions of the Contract, including General, Supplementary, and Special Conditions, and Division 1- General Requirements, apply to work specified in this section. Subcontractor must familiarize himself with the terms of the above documents.

C. EMCS shall monitor electric power, water and natural gas usage as shown in the mechanical and electrical drawings. Control's contractor shall provide meters not provided by the associated utility. Control's contractor shall coordinate with power, water and natural gas utilities.

1.02 BASE AND ALTERNATE BIDS

A. Scope of Work:

1. Furnish and install a direct digital control and energy management system per Section 23 09 00 and related sections as required for control of all equipment indicated on the mechanical drawings and in the specifications, being furnished under this scope of work. The server platform (Niagara or approved equal) shall have Connection Points and at least two extra Connection points.

B. Base Bids: No Controls

C. Alternate Bids: Under the base bids, the Controls as by the scope of work will be added as a separate bid line item on the bid form. The following manufacturers and systems are approved for use on this project. No substitutions of systems other than those listed will be considered. Systems approved for bidding are:

1. Approved Controls Contractors:

a. Alerton by ATS

b. Johnson Controls by JCI

c. Siemens by Siemens

d. Honeywell by TRS Mechanical

e. Reliable by Johnson Barrow Controls

1.03 RELATED DOCUMENTS

A. All work of this Division shall be coordinated and provided by the single Energy Management and Controls System (EMCS) Contractor.

B. The work of this Division shall be scheduled, coordinated, and interfaced with the associated work of other trades. Reference the Division 23 Sections for details.

C. The work of this Division shall be as required by the Specifications, Point Schedules and Drawings.

D. If the EMCS Contractor believes there are conflicts or missing information in the project documents, the Contractor shall promptly request clarification and instruction from the design team.

1.04 DEFINITIONS

A. Analog: A continuously variable system or value not having discrete levels. Typically exists within a defined range of limiting values.

B. Binary: A two-state system where an "ON" condition is represented by one discrete signal level and an "OFF" condition is represented by a second discrete signal level each separated by a defined deadband. Digital Inputs and Digital Outputs are examples.

C. Energy Management and Controls System (EMCS): The total integrated system of fully operational and functional elements, including equipment, software, programming, and associated materials, to be provided by this Division EMCS Contractor and to be interfaced to the associated work of other related trades.

D. EMCS Contractor: The single Contractor to provide the work of this Division. This Contractor shall be the primary installer, commissioner and ongoing service provider for the EMCS work.

E. Control Sequence: An EMCS pre-programmed arrangement of software algorithms, logical computation, target values and limits as required to attain the defined operational control objectives.

F. Direct Digital Control: The digital algorithms and pre-defined arrangements included in the EMCS software to provide direct closed-loop control for the designated equipment and controlled variables. Inclusive of Proportional, Derivative and Integral control algorithms together with target values, limits, logical functions, arithmetic functions, constant values, timing considerations and the like.

G. EMCS Network: The total digital on-line real-time interconnected configuration of EMCS digital processing units, workstations, panels, sub-panels, controllers, devices and associated elements individually known as network nodes. May exist as one or more fully interfaced and integrated sub-networks, LAN, WAN or the like.

H. Node: A digitally programmable entity existing on the EMCS network.

I. EMCS Integration: The complete functional and operational interconnection and interfacing of all EMCS work elements and nodes in compliance with all applicable codes, standards and ordinances so as to provide a single coherent EMCS as required by this Division.

J. PC: Personal Computer from a recognized major manufacturer. PC "clones" assembled by a third-party Subcontractor is not acceptable. PC must also have documentation verifying that it has been tested and is completely compatible with all installed software and communicates with any peripherals such as modems, NEC cards, printers, hubs, zip drives, etc. that may be attached.

K. Wiring: The term "Wiring" and its derivatives when used in this Division shall mean provide the EMCS wiring and terminations.

L. Install: The term "Install" and its derivatives when used in this Division shall mean receive at the jobsite and mount.

M. Protocol: The term "protocol" and its derivatives when used in this Division shall mean a defined set of rules and standards governing the on-line exchange of data between EMCS network nodes.

N. Software: The term "software" and its derivatives when used in this Division shall mean all of programmed digital processor software, preprogrammed firmware and project specific digital process programming and database entries and definitions as generally understood in the EMCS industry for real-time, on-line, integrated EMCS configurations.

O. Operator Workstation: Personal Computer from a recognized major manufacturer installed with the software and hardware required to permit multiple, simultaneous (at least three) user access to the EMCS, either remotely or on site.

P. Floor Plans: CAD drawings showing the location of equipment, EMCS controllers, EMCS, remote devices and wiring including room temperature sensors and duct and building pressure sensors, and communications wiring. Controllers, equipment, remote devices and wiring, and communications wiring shall appear on the same drawing.

Q. The following abbreviations and acronyms may be used in describing the work of this Division:

ADC	-	Analog to Digital Converter
AI	-	Analog Input
ANSI	-	American National Standards Institute
AO	-	Analog Output
ASCII	-	American Standard Code for Information Interchange
ASP	-	Microsoft Active Server Page
AWG	-	American Wire Gauge
CFM	-	Cubic Feet Per Minute
CPU	-	Central Processing Unit
CRT	-	Cathode Ray Tube
DAC	-	Digital to Analog Converter
DDC	-	Direct Digital Control
DI	-	(Binary) Digital Input
DO	-	(Binary) Digital Output
EEPROM	-	Electronically Erasable Programmable Read Only Memory
EMCS	-	Energy Management Control System
EMI	-	Electromagnetic Interference
FAS	-	Fire Alarm Detection and Annunciation System
GUI	-	Graphical User Interface
HOA	-	Hand-Off-Auto
HTML	-	Hypertext Markup Language
HTTP	-	HyperText Transfer Protocol
ID	-	Identification
IEEE	-	Institute of Electrical and Electronics Engineers
I/O	-	Input/Output
IP	-	Internet Protocol
IT	-	Information Technology
LAN	-	Local Area Network
LCD	-	Liquid Crystal Display

LED	-	Light Emitting Diode
MCC	-	Motor Control Center
NC	-	Normally Closed
NIC	-	Not in Contract
NO	-	Normally Open
OWS	-	Operator Workstation
OAH	-	Outdoor Air Humidity
OAT	-	Outdoor Air Temperature
PC	-	Personal Computer
RAM	-	Random Access Memory
RF	-	Radio Frequency
RFI	-	Radio Frequency Interference
RH	-	Relative Humidity
ROM	-	Read Only Memory
SMTP	-	Simple Mail Transfer Protocol
SNMP	-	Simple Network Management Protocol
SNTP	-	Simple Network Time Protocol
SPDT	-	Single Pole Double Throw
SPST	-	Single Pole Single Throw
XVGA	-	Extended Video Graphics Adapter
TBA	-	To Be Advised
TCP/IP	-	Transmission Control Protocol/Internet Protocol
UPS	-	Uninterruptible Power Supply
VAC	-	Volts, Alternating Current
VAV	-	Variable Air Volume
VDC	-	Volts, Direct Current
WAN	-	Wide Area Network
XML	-	Extensible Markup Language

1.05 QUALITY ASSURANCE

A. General:

1. The EMCS Contractor shall have a branch facility within a 100-mile radius of the job site supplying complete maintenance and support services on a 24 hour, 7-day-a-week basis. This branch facility shall provide the work for this project. This support facility shall have spare parts and all necessary test and diagnostic equipment required to install commission and service the specified EMCS.

2. As evidence and assurance of the Contractor’s ability to support the Owner's system with service and parts, the Contractor must have been in the EMCS business for at least the last ten (10) years and have successfully completed three projects comparable to the value of this contract in the preceding five years

3. The EMCS architecture shall consist of products manufactured by companies regularly engaged in the production of EMCS, and shall be the manufacturer’s latest standard of design at the time of bid.

4. The EMCS software residing in Nodes and servers shall be updated to the latest currently available revision at the start of Warranty. If updating any node affects an existing EMCS's ability to communicate to any other existing node on any part of the EMCS, then the contractor shall update any or all existing nodes and workstations to provide seamless communications throughout the entire existing and new system.

B. Quality Management Program:

1. Provide a competent and experienced EMCS Project Manager employed by the EMCS Contractor. The Project Manager shall be supported as necessary by other EMCS Contractor employees in order to provide professional management service for the work. The Project Manager shall attend scheduled Project Meetings as required and shall be empowered to make technical, scheduling and related decisions on behalf of the EMCS Contractor

1.06 REFERENCES

A. All work shall conform to the following Codes and Standards, as applicable:

1. National Fire Protection Association (NFPA) Standards.

2. National Electric Code (NEC) and applicable local Electric Code.

3. Underwriters Laboratories (UL) listing and labels.

4. UL 916 Energy Management

5. NFPA 70 - National Electrical Code.

6. NFPA 90A - Standard for The Installation of Air Conditioning and Ventilating Systems.

7. NFPA 92A and 92B Smoke Purge/Control Equipment.

8. Factory Mutual (FM).

9. American National Standards Institute (ANSI).

10. National Electric Manufacturer's Association (NEMA).

11. American Society of Mechanical Engineers (ASME).

12. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE).

13. Air Movement and Control Association (AMCA).

14. Institute of Electrical and Electronic Engineers (IEEE).

15. American Standard Code for Information Interchange (ASCII).

16. Electronics Industries Association (EIA).

17. Occupational Safety and Health Administration (OSHA).

18. American Society for Testing and Materials (ASTM).

19. Federal Communications Commission (FCC) including Part 15, Radio Frequency Devices.

20. Americans Disability Act (ADA)

B. In the case of conflicts or discrepancies, the more stringent regulation shall apply.

C. All work shall meet the approval of the Authorities Having Jurisdiction at the project site.

1.07 SUBMITTALS

A. Control Drawings, Product Data, and Samples:

1. The EMCS Contractor shall submit a complete controls package divided in two sections. The first section shall be delivered within 30 days after the contract has been awarded and the second section shall be delivered within 60 days after the contract has been awarded.

2. Allow at least 15 working days for the review of each package by the Engineer.

3. Equipment and systems requiring approval of local authorities must comply with such regulations and be approved. Filing shall be at the expense of the EMCS Contractor where filing is necessary. Provide a copy of all related correspondence and permits to the Owner.

B. Submittal Section 1:

1. Site Specific EMCS network architecture diagrams including all nodes and interconnections including controllers, Operator Workstations, modems and gateways.

2. Product data sheets for all products including software.

C. Submittal Section 2:

1. Drawing Index, floor plans, schematics, controller wiring diagrams and sequences. Control drawings shall be created on AUTOCAD software, version 14 or newer.

2. Points schedule for each real point in the EMCS, including Tag, Point Type, System Name, Display Units, Scale Range, Unique Address, and Reference Drawing.

3. Samples of Graphic Display screen types and associated menu penetrations to show hierarchy and functional interrelationships.

4. Detailed Bill of Material, identifying part number, quantity, description, and optional features.

5. Room Schedule including a separate line for each terminal unit showing system name, minimum/maximum cfm, box area, and number of reheat stages.

6. Details of all EMCS interfaces and connections to the work of other trades.

7. Tier 1 Ethernet TCP/IP BACnet network criteria including controller IP addressing capabilities, PICS, BIBBS and BTL listings.

1.08 RECORD DOCUMENTATION

A. Operation and Maintenance Manuals:

1. Three (3) copies of the Operation and Maintenance Manuals shall be provided to the Owner's Representative upon completion of the project. The entire Operation and Maintenance Manual shall be furnished on Compact Disc media, and include the following for the EMCS provided:

   a. Table of contents

   b. As-built Control Drawings using AutoCAD Version 14 or newer. Drawings shall represent the as-built condition of the system and incorporate all information supplied with the approved submittal. Include as-built floor plans.

   c. Manufacturer’s product data sheets for all products including software.

   d. System Operator’s manuals.

   e. Archive copy via a read/write CD-ROM all site-specific databases and sequences.

   f. EMCS network diagrams (use AutoCAD version 14 or newer).

   g. Wiring termination diagrams (use AutoCAD version 14 or newer).

   h. Interfaces to all third-party products and work by other trades.

   i. Points list

   j. Room Schedules

   k. Point to point checkout sheets with dates and checkout signatures

   l. Repair contact name and phone number.

2. An Operation and Maintenance Manual CD that shall be a self-contained read/write CD-ROM that includes all of the information listed above and all the necessary viewer software required for access. Include a logically organized table of contents. Viewer software shall provide the ability to display, zoom, and search all documents.

1.09 WARRANTY

A. Standard Material and Labor Warranty:

1. Provide a one-year labor warranty on the EMCS.

2. The EMCS components shall be free from defects in material and workmanship under normal use and service. If within one (1) year from the date of awarding of the Certificate of Occupancy any EMCS equipment is found to be defective, it will be replaced, repaired or adjusted by EMCS Contractor free of charge. The EMCS Contractor is not responsible for the removal or reinstallation of any components that were originally installed by others, such as valves, dampers, wells, air flow stations, etc.

3. Maintain an adequate supply of materials within 100 miles of the Project site such that replacement of key parts and labor support, including programming. Warranty work shall be done during EMCS Contractor's normal business hours unless there is an emergency.

4. Maintain an on-site record of all work done, all items removed from site, all items returned to site, all new replacement items installed and all remedial programming and database entry work undertaken including software revisions installed. Maintain a record of all re-calibrations required as a result of Warranty service.

1.10 OPERATION AND MAINTENANCE REQUIREMENTS OF THIS SECTION

Not Applicable

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

Not Applicable

2.02 EMCS DESCRIPTION

A. EMCS shall include a graphical interface that shall allow users to access the EMCS data via a remote Operator Workstation. Remote Operator Workstation access shall take place through a WAN IP address access program, a WEB based internet access, or modem dial-up. The WEB graphical user interface shall be setup as described in WEB BASED USER INTERFACE of this specification.

B. The EMCS shall be a complete system designed for use on a Tier 1 Ethernet TCP/IP BACnet network. This functionality shall extend into the equipment rooms. Application nodes located in equipment rooms and similar shall be fully IT compatible devices that mount and are capable of communicating directly on the IT infrastructure existing in the facility. If Owner's LAN is used contractor shall be responsible for coordination with the Owner's IT staff to ensure that the EMCS will perform in the Owner's environment without disruption to any of the other activities taking place on that LAN. Where necessary and as dictated elsewhere in these Specifications, Servers shall be used for the purpose of providing a location for archiving system configuration data, and historical data such as trend data and operator transactions.

C. The work of the single EMCS Contractor shall be as defined individually and collectively in all Sections of this Division specifications together with the associated Point Sheets and Drawings and the associated interfacing work as referenced in the related documents as are listed in Part 1 of this Section.

D. The EMCS work shall consist of the provision of all labor, materials, etc. as Specified in these Division documents which are required for the complete, fully functional and commissioned EMCS.

E. Provide a complete, neat and workmanlike installation. Use only employees who are skilled, experienced, trained, and familiar with the specific equipment, software and configurations to be provided for this Project.

F. Manage and coordinate the EMCS work in a timely manner in consideration of the Project schedules. Coordinate cooperatively with the associated work of other trades so as to assist the progress and not impede or delay the work of associated trades.

G. The EMCS as provided shall incorporate, at minimum, the following integrated features, functions and services:

1. Operator information, alarm management and control functions at any Operator's Workstation without the need to purchase special software from the EMCS manufacturer for those consoles.

2. Software and hardware that allows third party access for the purpose of creating a combined graphical interface. The combined graphical interface shall have the ability to read, write and acknowledge actual hardware inputs and outputs, setpoints, off/on switches, schedules, alarms and trend logs.

3. Information management including monitoring, transmission, archiving, retrieval, and reporting functions.

4. Diagnostic monitoring and reporting of EMCS functions.

5. Offsite monitoring and management.

6. Energy management.

7. Fire Alarm System secondary monitoring.

8. Lighting Control System monitoring and control.

9. Irrigation System monitoring and control.

H. Graphic Displays:

1. Provide color graphics for each system with all points as indicated on the point list. All graphics shall be available for viewing on any Operator Workstation directly or remotely connected to the Tier 1 TCP/IP BACnet network.

2. Provide a color graphic display for each floor in the facility. Indicate each HVAC zone and temperature, Lighting Control System zone status, and zone occupancy status.

3. User shall access the various system schematics and floor plans via a graphical penetration scheme and menu selection.

2.03 EMCS ARCHITECTURE

A. Overall Conceptual Description:

1. The EMCS shall be designed entirely for use on intranets and internets. All networking technology used at the Tier 1 Ethernet TCP/IP level shall be off the shelf, industry standard technology fully compatible with other Owner provided networks in the facility.

2. The primary components of the system will be the Operator Workstations, Application Nodes and Servers located at the highest level of the network architecture. All will use the same graphical user interface and provide the same level of accessibility via the network. The only distinction between the user interface used on servers as compared to Application Nodes or Operator Workstations shall be select menu items used for accessing long term storage features on the servers or on their respective archive devices (CD/RW, etc.)

B. General:

1. The EMCS shall consist of a number of Nodes and associated equipment connected by industry standard network practices. All communication between Nodes shall be by digital means only.

2. The EMCS network shall at minimum comprise of the following:

a. Operator Workstations– fixed or portable.

b. Network processing, data storage and communication equipment.

c. Routers, bridges, switches, hubs, modems and like communications equipment.

d. Active processing Nodes including field panels.

e. Intelligent and addressable elements and end devices.

f. Third-party equipment interfaces.

g. Modem attached to EMCS so that dial-up communication from a remote Operator Workstation is available.

h. Other components required for a complete and working EMCS.

i. All EMCS features shall be accessible via a graphical interface. All programming shall be accessible by intranet Operator Workstations. Intranet access and Internet browser shall have equivalent EMCS access control for user access.

j. The EMCS shall support auto-dial/auto-answer communications to allow EMCS Nodes to communicate with other remote EMCS Nodes via standard analog telephone lines.

k. The Operator Workstations, File servers and principal network equipment shall be standard products of recognized major manufacturers and shall have documentation stating that have been tested and are fully functional using the EMCS software.

l. Provide licenses for all software residing in the EMCS system and transfer these licenses to the Owner prior to completion.

C. Network:

1. The EMCS shall incorporate a primary Tier 1 Ethernet TCP/IP network. At the Contractor's option, the EMCS may also incorporate integrated secondary Tier 2 and tertiary Tier 3 networks.

2. The EMCS Network shall utilize an open architecture capable of all of the following:

a. Utilizing standard Ethernet communications and operate at a minimum speed of 10/100 Mb/sec

b. Connecting via BACnet at the Tier 1 level in accordance with ANSI/ASHRAE Standard 135-2001.

c. All Tier 2 (subnet) level communications shall be via BACnet in accordance with ANSI/ASHRAE Standard 135-2001. Gateways may be employed to communicate with existing or third-party system controllers.

3. The EMCS network shall support both copper and optical fiber communication media.

D. Third-Party Equipment Interfaces:

1. EMCS Contractor shall integrate real-time data from systems supplied by other trades as required in Part 3.03 THIRD PART EQUIPMENT INTERFACE.

2. The EMCS system shall include necessary EMCS hardware equipment and software to allow data communications between the EMCS system and systems supplied by other trades.

3. The trade Contractor supplying other systems will provide their necessary hardware and software and will cooperate fully with the EMCS Contractor in a timely manner to ensure complete data integration.

E. Uninterruptible Power Supply (UPS):

1. Provide UPS for non-remote intranet Operator Workstations and servers, and any other equipment as indicated on the drawings.

2. UPS shall be sized to last 30 minutes.

F. Power Fail/Auto Restart:

1. Provide for the automatic orderly and predefined startup of parts or all of the EMCS following total loss of power to those parts or all of the EMCS. Archive and annunciate time and details of restoration.

2. Provide for the orderly and predefined scheduling of controlled return to normal, automatically time scheduled, operation of controlled equipment as a result of the auto restart processes.

3. Maintain the EMCS real-time clock operation during periods of power outage for a minimum of 72 hours.

G. Downloading and Uploading:

1. Provide the capability to generate EMCS software-based sequences, database items and associated operational definition information and user-required revisions at any intranet Operator Workstation, and provide the means to download any of the items listed above to its associated Application Node or Terminal Unit Node.

2. Provide the capability to upload EMCS operating software information, database items, sequences and alarms to the designated server.

H. All networking technology used at the Tier 1 level shall be off the shelf, industry standard technology fully compatible with other Owner provided networks in the facility. The Operator Workstations, File servers and principal network equipment shall be standard products of recognized major manufacturers available through normal vendor channels. "Clones" are not acceptable. All aspects of the user interface shall be via graphical interfaces. All other hardware, software, servers, firewalls, etc. shall be provided by the EMCS Contractor. The EMCS Contractor shall coordinate with the Owner and have approval from the Owner for all additions or modifications to the existing IT infrastructure.

2.04 OPERATOR WORKSTATIONS

A. The Operator Workstations shall provide the primary means of communication with the EMCS and shall be used for operations, engineering, management, audit, reporting and other related functions.

B. The Operator Workstations shall consist of fixed and portable units. The fixed units shall consist of installed PC-based configurations. The portable units shall consist of PC Laptops. Both units shall display the same graphics and data.

C. Each Operator Workstation shall, at minimum, consist of:

1. PC processor with minimum 64-bit word structure.

2. Hard drive sized to store several months of trend data for the entire EMCS.

3. Removable high-speed data storage and export device(s) such as Read/Write CD ROM or equal.

4. Full ASCII keyboard and digital Mouse or equal pointing device.

5. Full color, flat screen VDU display unit, minimum 17 inches diagonal screen, minimum 1280 x 1024 resolution, 0.26 or better dot pitch and minimum 72 Hz refresh rate.

6. RAM large enough to provide graphics data updated in 2 seconds or less.

7. Network card capable of providing graphics updates in 2 seconds or less.

D. Printers shall be full color and designed for the functional requirements and duty of the application.

E. All software and hardware required to access the EMCS from the Tier 1 Ethernet TCP/IP BACnet network. Read and write functions for hardware inputs and outputs, alarms, schedules and trend logs along with application programming abilities shall be included. Also include hardware/software access for at least three simultaneous users.

F. Operator Workstations shall operate independently and concurrently without interference and under individual user password protection.

G. Operator Workstations shall have software that shall provide functional access level defined individual operator access.

2.05 OPERATOR WORKSTATION SOFTWARE

A. General:

1. The EMCS Operator Workstation software shall be user friendly, readily understood and shall make maximum use of colors, graphics, icons, embedded images, animation, text-based information and data visualization techniques to enhance and simplify the use and understanding of the EMCS by authorized users at the OWS.

2. User access to the Operator Workstation shall be protected by a flexible and Owner redefinable software-based password access protection. Password protection shall be multi-level and partitionable to accommodate the varied access requirements of the different user groups. Provide the means to define unique access privileges for each individual authorized user. Also provide the means to establish general password groups to which an individual will then be assigned. Once assigned to the group each individual will assume all the capabilities and restrictions of that group. Provide the means to on-line manage password access control under the control of a Master Password.

3. The Operator Workstation software shall be able to combine data from any and all of the system components in a single graphic window. This shall include historical data stored on a server.

4. The Operator Interface shall incorporate comprehensive support for functions including, but not necessarily limited to, the following:

   a. User access for selective information retrieval and control command execution

   b. Monitoring and reporting

   c. Alarm, non-normal, and return to normal condition annunciation

   d. Selective operator override and other control actions

   e. Information archiving, manipulation, formatting, display and reporting

   f. EMCS internal performance supervision and diagnostics

g. On-line access to user HELP menus

h. On-line access to current EMCS as-built records and documentation

i. Ability to re-program and re-configure all Application and Terminal Unit Nodes

5. Provide EMCS reports and displays making maximized use of simple English language descriptions and readily understood acronyms, abbreviations and the like to assist user understanding and interpretation. All text naming conventions shall be consistent in their use and application throughout the EMCS.

6. Shall operate on latest operating system.

7. Each fixed and portable Operator Workstation shall be on-line configurable for specific applications, functions and groups of EMCS points.

8. Any existing workstation software must be upgraded to most current manufacturers control software platform.

B. Navigation Trees:

1. The system will have the capability to display multiple navigation trees that will aid the operator in navigating throughout all systems and points connected. At minimum provide a tree that identifies all systems on the networks.

2. The navigation trees shall appear as part of the display, but can be detached and then minimized to the Windows task bar or closed altogether. A simple keystroke will reattach the navigation to the primary display of the user interface.

C. Dividable Display Panels:

1. It shall be possible for the operator to divide the display area within a single window into multiple display panels. The content of each display panel can be any of the standard summaries and graphics provided by the system.

2. Provide each display panel with minimize, maximize, and close icons.

D. Alarms:

1. Alarms shall be routed directly from Application Nodes to Operator Workstations and servers. It shall be possible for specific alarms from specific points to be routed to specific Operator Workstations and servers. The alarm management portion of the EMCS software shall, at the minimum, provide the following functions

a. Log date and time of alarm occurrence.

b. Generate a “Pop-Up” window, with audible alarm, informing a user that an alarm has been received.

c. Allow a user, with the appropriate security level, to acknowledge, temporarily silence, or discard an alarm.

d. Provide an audit trail on hard drive for alarms by recording user acknowledgment, deletion, or disabling of an alarm. The audit trail shall include the name of the user, the alarm, the action taken on the alarm, and a time/date stamp.

e. Provide the ability to direct alarms to an e-mail address or alpha-numeric pager. This must be provided in addition to the pop-up window described above. Systems which use e-mail and pagers as the exclusive means of annunciating alarms are not acceptable.

f. Any object in the system may be designated to report an alarm.

2. The EMCS shall annunciate diagnostic alarms indicating system failures and non-normal operating conditions

E. Reports:

1. Reports shall be generated and directed to one or more of the following: User interface displays, printers, or archive at the user's option. As a minimum, the system shall provide the following reports:

a. All points in the EMCS, especially those points connected to any metering equipment

b. All points in each EMCS application

c. All points in a specific Application or HVAC Node

d. All points in a user-defined group of points

e. All points currently in alarm in an EMCS application

f. All points locked out in an EMCS application

g. All EMCS schedules

h. All user defined and adjustable variables, schedules, interlocks and the like

i. EMCS diagnostic and system status reports

2. Provide for the generation by the user of custom reports.

F. Dynamic Color Graphics:

1. An unlimited number of graphic displays shall be able to be generated and executed.

2. Values of real time attributes displayed on the graphics shall be dynamic and updated on the displays.

3. The graphic displays shall be able to display and provide animation based on real-time EMCS data that is acquired, derived, or entered.

4. The user shall be able to change values (setpoints) and states that affect the system-controlled equipment directly from the graphic display.

5. Provide a graphic editing tool that allows for the creation and editing of graphic files. It shall be possible to edit the graphics directly while they are on line, or at an off-line location for later downloading.

6. EMCS system shall be provided with a complete user expandable symbol library containing all of the basic symbols used to represent components of a typical EMCS system. Implementing these symbols in a graphic shall involve dragging and dropping them from the library to the graphic.

7. All points on graphics shall be identified by their unique point addresses. Addresses may appear in "pop-up" screens associated with the point on the graphic.

G. Schedules:

1. The system shall provide multiple schedule input forms for automatic EMCS time-of-day scheduling and override scheduling of EMCS operations. At a minimum, the following spreadsheet types shall be accommodated:

   a. Weekly schedules.

   b. Temporary override schedules.

   c. Special "Only Active If Today Is a Holiday" schedules.

   d. Monthly schedules.

2. Schedules shall be provided for each system or sub-system in the EMCS. Each piece of equipment in each system may have a unique schedule of operation relative to the system use schedule, allowing for sequential starting and control of equipment within the system. Scheduling and rescheduling of points shall be accomplished easily via the system schedule graphics.

3. Monthly calendars for a 12-month period shall be provided that allow for simplified scheduling of holidays and special days in advance. Holidays and special days shall be user-selected via schedule graphics, and shall automatically reschedule equipment operation as previously defined on the weekly schedules.

H. Historical Trending and Data Collection:

1. Trend and store point history data for all EMCS points and values as selected by the user for five (5) years.

2. The trend data shall be stored in a manner that allows custom queries and reports using industry-standard software tools.

3. At a minimum, provide the capability to perform statistical functions on the historical database:

    a. Average.

    b. Arithmetic mean.

    c. Maximum/minimum values.

    d. Range – difference between minimum and maximum values.

    e. Standard deviation.

    f. Sum of all values.

    g. Variance.

I. Paging:

1. Provide the means of automatic e-mail and/or telephone type paging of personnel for user-defined EMCS events.

    a. Users shall have the ability to modify the address identifier or message to be displayed on the e-mail or telephone type pager through the system software.

    b. Contractor shall be responsible for providing connection to the e-mail or telephone type paging service.

2.06 WEB BASED USER INTERFACE

A. The EMCS shall have the ability to provide a web based graphical interface that allows users to access the EMCS data, configure data, commission, archive data, monitor, command, edit and perform system diagnostics via the Internet. The interface shall us HTML based ASP pages or HTTP, IP, SNTP, SMTP, SNMP, and XML to send and receive data from the EMCS system to a web browser.

B. All information exchanged over Internet shall be encrypted and secure (all hardware and software provided by EMCS Contractor).

C. The Owner shall be able to access data in the EMCS, intranet or internet with any type of computer (desktop or laptop) that runs standard Web browser software. The Web browser shall be set up to access the EMCS system directly over the IP network or via the Internet or Public telephone service for remote operation and system fault diagnosis.

D. The EMCS system shall recognize legitimate users through the entry of a user ID and a password at the Web browser user interface. User access data shall be encrypted in the transmission and in the EMCS system database and user profiles and accounts are managed at a site or system level by the user's security administrator. The authorization levels range from configuring the complete system to only viewing one section of the system or site. The system administrator shall assign a user ID, password, and specific data access privileges in each user account.

E. Access to the Web interface shall be password protected. A user's rights and privileges to points and graphics will be the same as those assigned at the EMCS workstation. An option will exist to only allow users "read" access via the Web browser, while maintaining "command" privileges via the EMCS workstation.

F. The Web-based interface shall provide the following functionality to users, based on their access and privilege rights:

1. Logon Screen: allows user to enter their user name, password and Domain name for logging into the web server.

2. Alarm Display: a display of current EMCS alarms to which the user has access will be displayed. Users will be able to acknowledge and erase active alarms, and link to additional alarm information including alarm messages, and informational and memo text. Any alarm acknowledgements initiated through the Web interface will be written to the EMCS central workstation activity log.

3. Graphic Display: display of system graphics available in the EMCS workstation will be available for viewing over the web browser. A graphic selector list will allow users to select any graphics to which they have access. Graphic displays will automatically refresh with the latest change of values. Users will have the ability to command and override points from the graphic display as determined by their user accounts rights.

4. Point Details: users will have access to point detail information including operational status, operational priority, physical address, and alarm limits, for point objects to which they have access rights.

5. Point Commanding: users will be able to override and command points they have access to via the web browser interface. Any commands or overrides initiated via the web browser interface will be written to the EMCS central workstation activity log.

6. Programming Capabilities: shall be excluded for web browser application.

G. EMCS Contractor shall provide licenses for all software residing in the EMCS system. Provide EMCS software and web server site licenses allowing concurrent access by three (3) browser connections. Transfer these licenses to the Owner prior to completion.

H. Internet connections and ISP services shall be provided by the Owner as required to support the web access feature.

2.07 WEB BASED SERVER

A. Web access software shall be installed as described below shall support browser access via the most current version of Microsoft Internet Explorer, or Navigator Netscape. Include Server software using standard Client Access Licenses (CALs) with enabled Terminal Services software. Server software can be installed on an Operator's Workstation.

B. Provide standard Client Access Licenses (CALs) for every concurrent user that may access the server (minimum of 3 concurrent users). In addition to the standard CALs for the operating system, every remote computer that accesses the server shall be provided with a reciprocating operating system (minimum of 3 concurrent users). All licenses shall be purchased by the Contractor.

C. Equip servers with the same EMCS tool set for graphic and system configuration and custom logic definition. Access to all information on the server will be through the same graphical user interface software used to access the EMCS system. When logged onto a server the operator will be able to also interact with any of the controllers in the facility.

D. The hardware platform for the server will, at minimum, consist of

1. Processor capable of supporting graphic data updates for 3 concurrent users under 2 seconds.
2. RAM capable of supporting 3 concurrent users with graphics updates 2 seconds or less.
3. Operating Systems software consistent with the EMCS
4. Terminal system software consistent with the EMCS
5. Server software consistent with the EMCS
6. Network card capable of supporting graphic data updates for 3 concurrent users under 2 seconds.
7. CD-ROM drive
8. Hard drive sized to store 5 years of trended data for all points connected to the server.
9. Current version of Internet software consistent with the EMCS.

2.08 NODES

A. Application Nodes:

1. Application nodes shall perform the function of monitoring system variables, both from real hardware points, software variables, and controller parameters such as setpoints that are relevant to its operation.
2. Application Nodes shall be entirely solid-state devices. No rigid disk drives will be permitted in the equipment rooms.
3. The application nodes shall be capable of managing and directing all information traffic on the Tier 1 network, between the Tier 1 and Tier2 networks, and to servers.
4. Any node on the Tier 1 network shall be equipped with all software necessary to interface with a Tier 1 Operator Workstation via network or local port.
5. The operating system of the Application Node shall support multi-user access. At minimum three users shall be able to access the same application node simultaneously.
6. Communication between nodes shall be peer-to-peer via 10/100 Ethernet using the BACnet protocol.

7. The Application Node shall be capable of direct connection to a subnet. The subnet shall use BACnet communications per ANSI/ASHRAE Standard 135-2001.

8. Application Nodes shall be programmable and governed by the requirements of their applicable codes, approvals and regulations. Configurable nodes are not acceptable.

9. The Application Nodes shall be designed, packaged, installed, programmed and commissioned in consideration of their specific service and prevailing operating conditions. They shall be proven standard product of their original manufacturer and not a custom product for this Project.

10. A failure at an Application Node shall not cause failures or non-normal operation at any other Application Node or subnet node other than the possible loss of active real-time information from the failed Application Node.

11. Application Nodes shall comply with FCC Part 15 subpart J Class A emission requirements.

12. Each Application Node shall be equipped with battery back-up source.

13. Application Nodes shall be physically separate from server hardware and software, reside in the building, and be the only means of EMCS data transfer to the server. Application node shall be a complete off the shelf software/hardware package manufactured by a licensed Application node manufacturer.

B. HVAC Node:

1. HVAC Node shall provide both standalone and networked direct digital control of HVAC systems.

2. A dedicated HVAC Node shall be configured and provided for each primary HVAC system (air handler, chiller, boiler) and each terminal HVAC system (VAV Box, Unit Heater, Fan Coil Unit, Cabinet Heater, Heat Pump, Fan Powered Box, CV Box)

3. Each HVAC Node shall retain program, control algorithms, and setpoint information in non-volatile memory in the event of a power failure, and shall return to normal operation upon restoration of power.

4. Each HVAC Node shall report its communication status to the EMCS. The EMCS shall provide a system advisory upon communication failure and restoration.

5. The HVAC Node shall provide the ability to download and upload configuration data, both locally at the Node and via the EMCS communications network.

6. HVAC nodes connected directly to the Tier 1 network shall be subject to all of the conditions listed in Section 2.07.A Application Node.

7. Configurable rather than programmable nodes may be used, but must perform specified sequences. The configurable nodes shall be replaced at the Contractor's expense if during the design, checkout or warranty periods it is discovered that the configurable node cannot adequately perform the specified sequence.

2.09 NODE SOFTWARE

A. Application and HVAC Node Software:

1. Event Messaging: Provide for the automatic execution of user-defined messages on the occurrence of each predefined EMCS real-time event including equipment/point status change, approaching limit or alarm, time of day and the like. Direct messages to any number of operator PCs, e-mail destinations, and pagers.

2. Optimum Start/Stop: Provide software to start equipment on a sliding schedule based upon indoor and outdoor conditions, to determine the minimum time of HVAC system operation needed to satisfy the space environmental requirements. The program shall also determine the earliest possible time to stop the mechanical systems. The optimum start/stop program shall operate in conjunction with, and be coordinated with, the scheduled start/stop and night setback programs.

3. Auto Alarm Lockout: Provide for scheduled and automatic lockout of alarm annunciation from equipment during non-normal operating conditions including shutdown, emergency power operation, fire alarm and the like.

4. Energy Monitoring: Provide software to monitor and totalize consumption as measured by pulse meters.

5. Event Initiated Programs and Custom Logic: Provide software to define custom logic sequences that will reside in the nodes. The definition software will also reside in the node and be accessible via the network or direct connected workstation.

6. System Restart: Upon restoration of the AC power to an HVAC Node, automatically restart all equipment and restore all loads to the state as required by the EMCS. Provide appropriate time delays to prevent demand surges or overload trips.

7. Equipment Delays: The system shall provide protection against excessive demand situations during start-up periods by automatically introducing time delays between successive start commands.

8. Runtime Totalization: Automatically sample, calculate and store runtime hours for binary input and output points as listed in the point schedule of this specification.

9. Analog/Pulse Totalization: Sample, calculate and store consumption totals on a daily, weekly, or monthly basis for user-selected analog and binary pulse input-type points.

10. Setpoints and Setpoint Ranges: All setpoints and their ranges shall be accessible via an Operator's Workstation.

PART 3 PERFORMANCE/EXECUTION

3.01 EMCS SPECIFIC REQUIREMENTS

A. Temperature Sensors:

1. Office and classroom temperature sensors shall have pushbutton interface capabilities that allow for occupied/unoccupied override and adjustable setpoint unless otherwise specified on drawings. Sensors shall be capable of displaying room temperature and setpoint and shall be capable of a 5-degree F deadband between cooling and heating.

2. Gyms, hallways and other high traffic areas subject to abuse shall have stainless steel, flush mounted, plain front temperature sensors.

3. Room temperature sensors shall be mounted 48" ADA unless otherwise specified on drawings. Verify locations with customer representative.

B. Operator Workstation Schedule:

1. One (1) desktop workstation and (1) laptop capable of displaying all system graphics and accessing the data and control code in all controllers. Confirm PC type with customer representative. Workstation count does not include separate servers, if separate servers are necessary for system operation.

2. Supplied workstations shall have all software and hardware required for optional dial-up, website remote access, and multiple user access.

3. Workstations shall be fully tested and certified compatible with all EMCS software

C. Actuation / Control Type:

1. Primary Equipment:

a. As a default, spring return is required in all equipment exposed to outside air and/or fail-safe situations.

b. All air handling equipment damper and valve actuation shall be electric, spring return and proportionally controlled.

c. Air handling equipment is defined as any unit with outside air intake.

d. All valves associated with units directly processing outside air and the main hydronic system shall have mechanical override capabilities.

e. All 120 VAC driven actuators shall have disconnects in accordance with electrical standards.

2. Terminal Equipment:

    a. Terminal Air Boxes (VAV, etc.) shall have electric damper and valve actuation. 3-point floating actuation is acceptable.

    b. Hydronic Based Heaters shall have electric actuated valves with electric thermostat control.

D. Current Sensors and Current Switches:

1. Install on all fans including fan terminal boxes, heat pumps fans, and exhaust fans. Install on all hydronic pumps. Install on all compressors.

2. Use sensor types that provide detection of belt breakage when belt driven equipment is used.

3. As default, all variable speed motors shall have current sensors on their power input if manufacturer variable speed motor status is not available.

E. Extra HVAC Node Physical Hardware Points:

1. All HVAC nodes controlling major hydronic system elements such as chillers, boilers, main system valves and pumps, and major outside air system units such as AHUs, HPs, Split-Systems, and Gas Furnaces, shall have one unused universal input, analog output, and digital output.

F. Adjust room numbers and floor plans on graphics as necessary to reflect actual conditions.

G. Meters:

1. Water Meters:

    a. Install with built in strainers, locking nuts, gaskets and coupling pieces.

    b. Installation by Division 23.

    c. Totalizing pulse output type, accuracy shall be 2% of rate fluid.

    d. Turbine style meter.

    e. Maximum pressure drop shall be less than 3 psi at design flow rates or meter size to match pipe size.

2. Gas Meter:

    a. Installation by Division 23.

    b. Diaphragm meter with self-lubricating bearings.

    c. Capacity and line pressure to match building requirements.

d. Include totalizing pulse option.

3. Power Meter:

a. Meter measures Accumulated Real Energy (kWh), Instantaneous Peak (kW); Current (amps), Maximum Peak (kW) for all phases and in total.

b. Meter shall communicate using BACnet MS/TP protocol and shall be compatible with EMCS.

c. Meter shall include all current transformers, fuses, resistors, power transformers and enclosures.

d. CT installation by Division 26. Coordinate CT type with EC. Solid core CT's preferred.

e. Default power reading every 15 minutes.

H. Wireless Temperature Sensor System:

1. Overall System: The Contractor and/or Installation Firm shall provide fully supervised wireless temperature sensing equipment by operating above 900MHZ frequency band. To provide extended range for larger installations, wireless repeaters are available. In order to provide maximum reliability and interference immunity, all wireless sensors (transmitters and repeaters) shall use a spread spectrum, frequency-hopping technique, which sends redundant messages across a bandwidth that is at least 10MHz wide.

a. The wireless sensors and repeaters shall be capable of periodically transmitting check-in signals to monitor the integrity of their wireless links. These transmitters and repeaters shall be able to be programmed for check-in transmissions that occur as frequently as every 60 seconds. The information provided in these check-in messages shall at least include battery condition status and tamper status or temperature data.

b. Wireless receivers shall resolve signals from the transmitters and repeaters specifically registered into the system, even in the presence of RF interference. The receivers shall interface to a direct serial data interface on an Andover Controls Corporation CS type Net Controller.

2. Repeater: To accommodate wireless temperature applications in large commercial and industrial facilities, or to support future site expansion or remodeling, a repeater product shall be available to increase data transmission range. This repeater must provide at least 200 milliwatts of effective radiated RF power. The repeaters shall have the ability to communication with other repeaters, thus allowing for multiple repeaters to be installed as a micro-cellular network. Data and supervisory check-in signals from transmitters must be maintained reliably with multiple repeaters in the system. The repeater shall NOT require a home run wire back to the receiver.

a. Open Field Transmit Range: 4 miles

b. Ambient Operating Temp: 32°F to 140°F

3. Wireless Sensors (Transmitters): The wireless equipment shall include either a transmitter with an external temperature probe attached to a terminal block or a sensor with an on-board thermistor. In addition to measuring and temperature data, the sensor shall be capable of monitoring and transmitting Delta R (change in resistance).

    a. Open Field Transmit Range: 2500 feet

    b. Ambient Operating Temp: 32°F to 140°F

4. Receivers: The wireless equipment shall include receivers that decode valid temperature system transmission. Receivers can support hundreds of temperature transmitters.

    a. Ambient Operating Temp: 32°F to 140°F

5. Wireless Survey Tool: A portable, hand-held, easy-to-use survey kit shall be available that will measure transmitter signal strength as well as signal margin (dBm above background noise of received signals). The survey kit shall have the ability to determine the performance of the transmitters to be installed, and if necessary, the amount and locations of wireless repeaters.

6. Quality Assurance: To ensure consistent product quality, the wireless equipment manufacturer shall be ISO9001 registered with an active certification.

3.02 INSTALLATION PRACTICES

A. EMCS Wiring:

1. All conduit, wiring, accessories and wiring connections required for the installation of the Energy Management System, as herein specified, shall be provided by the EMCS Contractor unless specifically shown on the Electrical Drawings under Division 26 Electrical.

2. The EMCS contractor is responsible for coordinating with the Electrical contractor (At EMCS Contractors' expense) to furnish and install any additional line voltage circuits, line voltage wiring, line voltage panels, and associated line voltage appurtenances not shown on the Electrical Drawings as required to provide a compete and functioning EMCS system, regardless of the quantity or presence of EMCS circuits shown on the Electrical Drawings.

3. All wiring shall comply with the requirements of applicable portions of Division 26 and all local and national electric codes, unless specified otherwise in this section.

4. All EMCS wiring materials and installation methods shall comply with EMCS manufacturer recommendations.

5. The sizing type and provision of cable, conduit, cable trays, and raceways shall be the design responsibility of the EMCS Contractor. If complications arise, however, due to the incorrect selection of cable, cable trays, raceways and/or conduit by the EMCS Contractor, the Contractor shall be responsible for all costs incurred in replacing the selected components.

6. Wire/conduit ratios shall follow the same wire/conduit ratios included in Division 26.

7. Class 2 Wiring:

    a. All Class 2 (24VAC or less) wiring shall be installed in conduit or be plenum rated and shall be installed in accordance with local code requirements.

    b. Conduit is not required for Class 2 wiring in concealed accessible locations. Inaccessible locations such as “hard lid” ceilings require conduit.

    c. Wire supports and be installed per local wiring code requirements. As a default, wire shall be supported every 5’ from the building structure utilizing metal hangers designed for this application.

    d. Where it is not possible to conceal raceways in finished locations, surface raceway (Wiremold) may be used as approved by the Engineer.

    e. All conduits and raceways shall be installed level, plumb, at right angles to the building lines and shall follow the contours of the surface to which they are attached.

    f. Provide firestopping for all penetrations used by dedicated EMCS conduits and raceways using approved fire resistive sealant. All other project firestopping to be by other trade.

    g. All wiring passing through penetrations, including walls or other structure, shall be in conduit or enclosed raceway.

    h. Penetrations of floor slabs shall be by core drilling. All penetrations shall be plumb, true, and square.

    i. No penetrations in structural elements shall be made before receipt of written approval from the Structural Engineer.

8. Class 2 signal wiring and 24VAC power can be run in the same conduit. Power wiring 120VAC and greater cannot share the same conduit with Class 2 signal wiring.

9. Perform circuit tests using qualified personnel only. Provide necessary instruments and equipment to demonstrate that:

    a. All circuits are continuous and free from short circuits and grounds.

    b. All circuits are free from unspecified grounds; that resistance to ground of all circuits is no less than 50 megaohms.

    c. All circuits are free from induced voltages.

10. Provide complete testing for all cables used under this Contract. Provide all equipment, tools, and personnel as necessary to conduct these tests.

11. Provide for complete grounding of all signal and communications cables, panels and equipment so as to ensure system integrity of operation. Ground cabling and conduit at the panel terminations. Avoid grounding loops.

B. EMCS Line Voltage Power Source:

1. 120-volt AC circuits used for the EMCS shall be taken from panelboards and circuit breakers provided by Division 26. Control contractor shall be responsible for installing, adding or adjusting all 120-volt AC circuits. Control's contractor shall coordinate all 120-volt AC work with Division 26.

2. Circuits used for the EMCS shall be dedicated to the EMCS and shall not be used for any other purposes.

3. DDC terminal unit controllers may use 120-volt AC power from motor power circuits.

C. EMCS Identification Standards:

1. Node Identification: All nodes shall be identified by a permanent label fastened to the outside of the enclosure. Labels shall be suitable for the node location.

2. Cable and/or conduit shall be labeled at suitable intervals with the EMCS system manufacturer's name. Labeling shall be sufficient to trace cable from device to device.

3. Specify a different wire color for analog, digital, power and communication wiring. Include wiring color on control drawings legends.

4. Raceway Identification: All the covers to junction and pull boxes of the EMCS raceways shall be labeled.

5. Wire Identification: All low and line voltage EMCS wiring shall be identified by a number, as referenced to the associated shop drawing and as-built drawing, at each end of the conductor or cable. Identification number shall be permanently secured to the conductor or cable and shall be typed.

D. EMCS Node Installation:

1. The EMCS panels and cabinets shall be mounted at shoulder height wherever possible. All panels shall be accessible. Each cabinet shall be anchored per the manufacturer's recommendations.

2. The EMCS Contractor shall be responsible for coordinating panel locations with other trades and Electrical and Mechanical Contractors.

E. Input Devices:

1. All Input devices shall be installed per the manufacturer recommendation and shall be of the type and accuracy suitable for this specific application.

2. Locate components of the EMCS in accessible local control panels wherever possible.

3. The Mechanical Contractor shall install all in-line devices such as temperature wells, pressure taps, airflow stations, etc.

4. Input Flow Measuring Devices shall be installed in strict compliance with ASME guidelines affecting non-standard approach conditions.

5. Outside Air Sensors:

    a. Sensors shall be mounted on the North wall to minimize solar radiant heat impact or located in a continuous intake flow adequate to monitor outside air conditions accurately.

    b. Sensors shall be installed with a rain proof, perforated cover.

6. Water Differential Pressure Sensors:

    a. Differential pressure transmitters used for flow measurement shall be sized to the flow-sensing device.

    b. Differential pressure transmitters shall be supplied with tee fittings and shut-off valves in the high and low sensing pick-up lines.

    c. The transmitters shall be installed in an accessible location.

    d. Installation of pipe taps and shutoff valves by Division 23.

7. Medium to High Differential Water Pressure Applications (Over 21” w.c.):

    a. Air bleed units, bypass valves and compression fittings shall be provided.

    b. Installation of pipe taps valves and air bleed units by Division 23.

8. Building Differential Air Pressure Applications (-0.25” to +0.25” w.c.):

    a. Transmitter’s exterior sensing tip shall be installed with a shielded static air probe to reduce pressure fluctuations caused by wind.

    b. The interior tip shall be inconspicuous and located as shown on the drawings.

9. Duct Temperature Sensors:

    a. Duct mount sensors shall mount in an electrical box through a hole in the duct and be positioned so as to be easily accessible for repair or replacement.

    b. The sensors shall be insertion type and constructed as a complete assembly including lock nut and mounting plate.

c. For ductwork greater in any dimension than 48 inches or where air temperature stratification exists such as a mixed air plenum, utilize an averaging sensor. Sensors shall be installed in a "Z" configuration as default.

d. The sensor shall be mounted to suitable supports using factory approved element holders.

10. Low Temperature Limit Switches:

a. Install on the discharge side of the first water or steam coil in the air stream.

b. Mount element horizontally across coil in a serpentine pattern ensuring each square foot of coil is protected by 1 foot of sensor.

c. For large duct areas where the sensing element does not provide full coverage of the air stream, provide additional switches as required to provide full protection of the air stream.

11. Air Differential Pressure Status Switches:

a. Install with static pressure tips, tubing, fittings, and air filter.

12. Water Differential Pressure Status Switches:

a. Install with shut off valves for isolation.

b. Installation of pipe taps and valves by Division 23.

13. Room Temperature Sensor:

a. Install sensor with insulation if mounted on an exterior wall.

14. CO2 sensor:

a. Shall be factory calibrated and be self-calibrating when installed.

b. Range: 0-2000 ppm.

c. Accuracy: plus or minus 30 ppm plus 2% of reading.

d. UL listed.

15. Refrigerant Sensors:

a. Shall be factory calibrated and be self-calibrating when installed.

b. Shall be maintenance free.

c. Range: 0-1000 ppm

d. Accuracy: plus or minus 25 ppm plus 20% of reading

e. Ul listed

f. Shall have audible alarm if levels above 50 ppm are detected.

g. Shall be 24 VAC or 24 VDC.

F. HVAC Output Devices:

1. All output devices shall be installed per the manufacturer's recommendation and shall be suitable in type and accuracy for this specific application. The Mechanical Contractor shall install all in-line devices such as control valves, dampers, etc.

2. Actuators: All control actuators shall be sized capable of closing against the maximum system shut-off pressure. The actuator shall modulate in a smooth fashion through the entire stroke. When any pneumatic actuator is sequenced with another device, pilot positioners shall be installed to allow for proper sequencing.

3. Electronic Signal Isolation Transducers: Whenever an analog output signal from the EMCS is to be connected to an external control system as an input (such as a chiller control panel), or is to receive as an input a signal from a remote system, provide a signal isolation transducer. Signal isolation transducer shall provide ground plane isolation between systems. It is the Controls Contractor's responsibility to determine if isolation is necessary.

4. Relays: All relays used to start/stop any piece of mechanical equipment that does not have an HOA switch shall have a Closed-Open-Auto override switch located on the load side of the relay.

G. Provide a file that tracks all software changes along with associated login name and password. Start file at beginning of construction process.

3.03 THIRD PARTY EQUIPMENT INTERFACE

A. The EMCS shall utilize the following protocols to communicate with the third-party equipment described in this section:

1. Connecting via Ethernet TCP/IP BACnet at the Tier 1 level in accordance with ANSI/ASHRAE Standard 135-2001.

2. Tier 2 connection specifications shall be via BACnet in accordance with ASNI/AHSRAE Standard 135-2001. Gateways may be employed to communicate to existing or third-party controllers. Objects commonly used for HVAC control shall be accessible. Accessible is defined as the ability to read, write create and acknowledge objects. Objects are defined as input and output points, setpoints, on/off switches, alarms, schedules and trend logs.

B. Each of the following independent systems Contractor shall provide all material and field labor necessary to accomplish interfaces to the EMCS:

1. Fire Alarm System: Fire Alarm System Interface: Fire alarm system and air handling equipment smoke detectors shall be provided under Division 26. Coordinate EMCS requirements with Fire Alarm System Contractor to monitor the Fire Alarm System only. One fire alarm panel contact shall be monitored by the EMCS operator workstation.

2. Lighting Control System: The entire lighting control system shall be provided under Division 26. Coordinate all EMCS Point numbers and requirements with Electrical Contractor. All lighting control system points as shown on the drawings shall be monitored by the EMCS Workstation and shown on graphics as detailed in the EMCS Description Graphic Displays Section (Section 2.01.I). As default, assume all exterior lighting shall be controlled by EMCS.

   a. The Lighting Control Application shall be part of the EMCS System and fully accessible from any Workstation. Point inputs and outputs from the lighting control system shall have real-time interoperability with EMCS software features including circuit status, scheduling and independent overrides.

   b. Include graphical software programming utilizing floor plans and color to communicate information related to lighting zone status and scheduling. The graphical program shall enable operators to manage their lighting system on a day-to-day basis. The user shall navigate within the system to check on the conditions, schedules, etc. by using a 'point and click' interface based upon floor plans and area graphics.

3. Boiler, Chiller and Variable Frequency Drive Control Systems: Whenever possible, use Modbus, BACnet or another communications interface. Verify with manufacturer. If communications interface is unavailable, the Controls Contractor is expected to provide control relays and current sensors to enable/disable and record status and alarm conditions on the unit. Any analog (i.e., setpoint) terminal point interface shall be provided by manufacturer.

3.04 TRAINING

A. The EMCS Contractor shall provide the following training services:

1. Provide two days of on-site orientation by a system technician who is fully knowledgeable of the specific installation details of the project. This orientation shall, at a minimum, consist of a review of the project as-built drawings, the EMCS software layout and naming conventions, and a walk through of the facility to identify panel and device locations. Training may be split into smaller sessions on different days if the Owner prefers.

2. Supply a list of available factory training classes and contact information.

3.05 COMMISSIONING

A. Controls Contractor shall provide the Commissioning Agent with a completed Acceptance Verification document prior to beginning point-to-point activities. Final Acceptance Verification document shall be included in the Commissioning Field Notebook. The commissioning agent may be an independent agent, the customer, or the Design Engineer.

B. Acceptance Verification Document is defined as a series of check sheets that include all EMCS points and functions. Each point entry shall be signed and dated verifying that each point and function has been fully calibrated and tested.

C. The Controls Contractor shall provide qualified technician to support the commissioning requirements outlined in specification Sections 01 65 00 and 23 08 00. The Controls Contractor shall provide support to the commissioning agent during the performance testing and shall provide trends as needed for their review.

D. Conduct functional performance tests to demonstrate that controls systems maintain setpoints and operates through the full range of operations. The commissioning agent will provide functional tests that the Controls Contractor shall review and provide comments on the tests for incorporation into the final test documents.

E. Provide System Performance Trend Logs as specified by the Design Engineer or commissioning agent to verify that all systems are functioning satisfactorily.

F. Provide all necessary specialist labor, materials and tools to demonstrate to the Engineer that the EMCS has been commissioned and is operating in compliance with the contract. Prepare a list of noted deficiencies signed by both the Engineer and the EMCS Contractor.

G. Promptly rectify all listed deficiencies and submit to the Engineer that this has been done.

H. Final Commissioning:

1. Upon successful completion of Owner-Witnessed Functional Tests, a Performance Period (15 consecutive calendar days) shall commence on the first day following the last performance test. This period shall be completed prior to final acceptance of the project. In event of failure to meet standard of performance during any initiated performance period, it is not required that one (1) 15-calendar day period expire in order for another performance period to begin.

2. If equipment or system operates so as to demonstrate continuing compliance with specified requirements for period of 15 consecutive calendar days from commencement date of performance period, it shall be deemed to have met standard of performance. In addition, equipment or systems shall operate in conformance with all Contract Specifications and with Contractor's bid and published Specifications in effect on date Contract is executed, provided such specifications are equal to or better than specifications submitted with Contractor's bid.

3. Performance period shall be monitored through trend review of controls systems. The Controls Contractor shall be responsible for configuring the controls system to collect trends and shall provide trends to the commissioning agent for review. Typical trend data will be collected on approximately 8 points for each unit and as determined for other systems. Trend data for each unit shall be collected in a single file and all columns in each file shall have descriptive headers. Trend collection or points shall be provided in 15-minute increments.

4. Provide a complete set of trend logs for all HVAC equipment for a 24-hour period on a normally occupied day. Trend points shall be in 15-minute increments and shall include setpoints.

I. Commissioning of the Web interface shall not require modification or creation of HTML or ASP pages. All dynamic graphics and real-time data available at the EMCS graphical workstation shall be available to users via a web browser.

END OF SECTION 23 09 00

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SECTION 23 11 00

NATURAL GAS

PART 1 GENERAL

1.01 SUMMARY

A. Includes But Not Limited To: Furnish and install gas piping and fittings.

B. Related Sections:

1. General Conditions, Division 01
2. Section 20 00 00 – General Mechanical Requirements
3. Section 22 05 29 – Hangers and Supports for Plumbing Equipment
4. Section 22 05 48 – Vibration and Seismic Control
5. Section 22 11 16 – Domestic Water Pipe and Fittings
6. Section 22 20 00 – Excavation and Backfill for Mechanical Underground Utilities

C. The above-mentioned Section applies to this section. Contractor is responsible for all service charges. Charges may be indicated by Architect on bid form.

1.02 QUALITY ASSURANCE

A. Qualifications: Welders shall be certified and bear evidence of certification 30 days prior to commencing work on project. If there is doubt as to proficiency of welder, Owner's Representative may require welder to take another test. This shall be done at no cost to Owner. Certification shall be by Pittsburgh Testing Laboratories or other approved authority.

1.03 SUBMITTAL REQUIREMENTS OF THIS SECTION

A. Pipe

B. Fittings

C. Valves

D. Stops

E. Gas Regulators

F. Gas Solenoid Valve

G. Gas Seismic Valve

1.04 OPERATION AND MAINTENANCE REQUIREMENTS OF THIS SECTION

A. Pressure reducing valve manufacturer’s data and pressure setting

B. Solenoid valve manufacturer’s data

PART 2 PRODUCTS

2.01 PIPE

A. Meet requirements of ASTM A 53-87b, "Specification for Piping, Steel, Black & Hot-Dipped Zinc-Coated Welded & Seamless".

B. Schedule 40 black steel pipe

C. Flex Connection: Corrugated 300 Series stainless steel tubing conforming to ASTM A240, ANSI LC-1, and UL Listed Through Penetration Firestop for one (1) hour to four (4) hours. Tubing to be rated for up to 25 psi. Tubing shall be protectively coated against accidental contact with substances shown to be caustic to 300 Series stainless steel. Coating shall be UV resistant.

D. Approved Manufacturers: Wardflex

2.02 FITTINGS

A. Black Pipe: Welded forged steel fittings of ASTM A 234-87, "Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures," or standard weight malleable iron screwed.

2.03 VALVES (GAS SHUT OFF VALVE)

A. 125 psi bronze body, square head cock, with bronze plug or CSA approved ball valve.

B. Approved Manufacturers: Apollo, Combraco, Nibco, red-white.

2.04 GAS REGULATORS

A. Provide gas pressure regulators, pressures and capacity as scheduled on Plans to reduce medium pressure gas to recommended equipment operating range. Furnish regulators with full size vents and VTR's. Gas regulators shall be by Sensus or approved.

2.05 GAS CABINETS

A. Furnish access panels with non-locking cover. Access panels shall be polished chrome-plated. Cover must be marked "Gas Valve."

2.06 SCIENCE ROOM OUTLETS

A. Furnish and install Chicago Faucet outlet models as scheduled.

1. #982 Turret with 90 deg. outlets

2. #937 valve needlepoint cock with wheel handle (two per turret)

2.07 GAS SOLENOID VALVE

A. Solenoid operated gas shut-off valve shall be rated at 120V. Size valve as required to match supply pipe size. Valve shall operate at required flow rates without pressure drop. The valve shall trip closed when solenoid is de-energized, and shall be manually reset. Manual reset shall have a high visibility position indicator and shall not open until solenoid is energized.

B. Approved Manufacturers: ASCO Series 8044

2.08 GAS SEISMIC VALVE

A. Provide flanged seismic valve. Size valve as required to match supply pipe size and configuration. Valve shall meet California Standards for Earthquake Actuated Automatic Gas Shutoff Systems, Standard No. 12-23-1, ANSI Z 21.70, 1981 and ASCE 25-97 standards.

B. Approved Manufacturers: Pacific Seismic Products

PART 3 EXECUTION

3.01 INSTALLATION

A. Pipe installed underground, through air plenums, in walls, and pipes 2-1/2 inches and larger shall have welded fittings and joints. Other pipe may have screwed or welded fittings.

B. Machine apply coating and lay underground pipe in accordance with local gas utility company regulations and specifications.

C. Install gas shut off valves on lines serving all gas fired equipment adjacent to or on outside of equipment cabinet and easily accessible.

D. Install dirt leg with pipe cap, 6 inches long minimum, on each vertical gas drop to all gas equipment.

E. Gas piping installed under slab shall be provided in an airtight conduit sealed at floor level. The conduit shall be vented to the exterior. The piping and conduit shall be buried with a minimum of 12" of cover.

F. Paint all piping exposed to elements with one (1) coat primer and two (2) coats paint to match adjacent surfaces.

G. Provide at main and at each connection to equipment a gas shut-off valve. All risers taken off from main shall be furnished with gas lever shut-off valve. Provide regulators herein before specified complete with vent, enclosures, and shut-off valves for gas-fired equipment, including HVAC equipment and hot water tanks.

H. Furnish union joint as required for removal of each piece of gas equipment.

I. Coordinate gas solenoid valve locations and power requirements with electrical and fire system contractors.

J. Hang aboveground pipe with rods within 12” of structure. If pipe cannot be hung within 12” of structure, provide seismic bracing (including calculations, shop drawings, etc.) per code. Notify Engineer for special inspection of braces.

K. Pressure regulator vents shall be installed to prevent the entry of water, insects and foreign objects.

END OF SECTION 23 11 00

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SECTION 23 21 00

SLEEVES AND SEALS FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 GENERAL

A. Includes sleeving and sealing of piping and ductwork.

1.02 RELATED SECTIONS

A. General Conditions, Division 1

B. Section 22 11 16 – Domestic Water Pipe and Fittings

C. Section 23 31 13 – Steel Ductwork

1.03 REFERENCES

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

B. UL 1479: Through-Penetration Fire Stop Systems

1.04 SUBMITTAL REQUIREMENTS

A. Submittal requirements for this Section:

1. Seals

1.05 OPERATION AND MAINTENANCE REQUIREMENTS FOR THIS SECTION

Not Applicable

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

A. Products shall comply with Section 20 00 00, paragraph 2.01, Approved Manufacturers.

B. Fire Seals: 3M, Dow Corning, General Electric, Rectorseal Metacaulk

2.02 PIPE SLEEVES

A. Size: Inside diameter of pipe sleeves shall be at least 1/2-inch larger than the outside diameter of the pipe or pipe covering, so as to allow free movement of piping.

B. Ends: Sleeve ends shall be cut flush with finished surfaces, except in rooms having floor drains where sleeves shall be extended 3/4-inch above finished floor.

C. Material - Structural: Sleeves through structural elements shall be fabricated from Schedule 40 steel pipe.

D. Material - Non-structural: Sleeves through non-structural elements shall be fabricated from 18-gauge galvanized sheet metal or 24-gauge spiral duct.

E. De-burr pipe ends and smooth slab penetration (to accept final slab finish) from sleeves extending above finished floor.

2.03 DUCT SLEEVES

A. Size: Inside dimension of sleeves shall be at least 1/2" larger than the outside dimensions of the duct or duct covering on all sides.

B. Ends: Sleeve ends shall be cut flush with finished surface.

C. Material - Non-structural: Sleeves shall be fabricated from 20-gauge galvanized steel, shall be continuous around the interior without holes or openings, and shall match the configuration of the item being sleeved.

D. Material - Structural: Sleeves through structural elements shall be fabricated from Schedule 40 steel pipe (round openings) and welded steel supporting elements (sizes/arrangement as shown on drawings) for other openings.

2.04 SEALS

A. Seals in Interior Fire Rated Assemblies: Shall be tested in accordance with ASTM E814 and shall be UL classified per UL 1479 as a through-penetration fire stop device.

B. Seals in Exterior Masonry Walls and Floors:

1. Piping: Seals shall consist of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and wall opening. The seal assembly shall expand when mechanically tightened to provide an absolute watertight seal between the pipe and wall opening. Sizing shall be per manufacturer's recommendations. Seal shall be Thunderline "Link-Seal" or approved equal.

2. Ducts: Silicone type sealant, designed for use with duct material involved as weatherproof sealant.

C. Seals in Other Areas: Packed fiberglass or wool insulation, where no weatherproofing or adhesive properties are required; otherwise, sealants shall be silicone type, as specified in applicable Division 7 Sections.

PART 3 EXECUTION

3.01 INSTALLATION OF PIPE SLEEVES

A. Provide pipe sleeves for all piping passing through walls, floors, partitions, roofs, foundations, footings, grade beams, and similar elements, except that sleeves are not required for penetrations through existing single solid elements, having no voids, at the location where the piping passes through the solid elements (e.g., solid wood stud, core drilled solid concrete, etc.). Where a sleeve is required, such sleeve shall continue all the way through any solid items within that element.

B. Set sleeves plumb or level (or sloped as required for drainage pipe) in proper position, tightly fitted into the work.

C. Fill openings around outside of pipe sleeve with same material as surrounding construction, or with material of equivalent fire and smoke rating.

D. Seal around all pipes inside of pipe sleeve.

E. Insulation shall run continuous through sleeves in non-fire rated elements. Insulation shall not run continuous through sleeves in fire rated elements unless the fire sealant system used is UL accepted for use with insulated pipes.

F. Do not place sleeves around soil, waste, vent, or roof drain lines passing through concrete floors on grade.

3.02 INSTALLATION OF DUCT SLEEVES

A. Provide duct sleeves for all round ducts less than 15 inches in diameter where the duct passes through any floors, walls, ceilings, partitions, or roofs and similar elements.

B. Provide duct sleeves for all square and rectangular ducts having their largest dimension 14 inches and less where the duct passes through any floors, walls, ceilings, partitions, roofs, and similar elements.

C. Round ducts larger than 15 inches in diameter, and square or rectangular ducts larger than 14 inches in any dimension, shall have framed openings where the duct passes through any element. Such framed openings shall be of the same type as the structural materials used in the wall and shall comply with materials specified for this project. Sleeves shall be provided in addition to the framed opening where any void space(s) occurs through the penetration (as through CMU walls, double walls, etc.).

D. Set sleeves plumb or level, in proper position and location, tightly fitted into the work.

E. Fill openings around outside of duct sleeve with same material as surrounding construction, or with material of equivalent fire and smoke rating.

F. Sleeves are not required for penetrations through existing single solid elements, having no voids, at the location where the duct passes through the element (e.g., precast concrete panels with pre-framed openings, core drilled/saw cut solid concrete, etc.). Where a sleeve is required, such sleeve shall continue all the way through any solid items within that element however.

G. Insulation shall run continuous through sleeves in non-fire rated elements. Insulation shall not run continuous through sleeves in fire rated elements unless the fire sealant system used is UL accepted for use with insulated pipes.

H. Sleeves for fire dampers shall be as specified for fire dampers and be in compliance with the damper UL listing.

3.03 INSTALLATION OF SEALS

A. Provide seals around all piping and ducts passing through walls, floors, roofs, foundations, footings, grade beams, partitions, and similar elements.

B. Seals shall be of material and workmanship to maintain the fire and smoke rating of element being penetrated. Seals ability to maintain the rating of the element being penetrated shall be listed in UL Laboratories Building Materials Directory or otherwise confirmed by an approved listing agency. It shall be the Contractor's responsibility to submit shop drawings and technical data showing seals and systems proposed, and corresponding agency approval. The Contractor shall also be responsible to submit any data as required by local agencies to satisfy them that the Contractor's proposed fire seals are satisfactory.

C. Seals shall be watertight where the penetration may be exposed to water or moisture.

D. Duct penetrations through roof or exterior wall assemblies shall be provided with flashings for a weathertight assembly in accordance with SMACNA HVAC Duct Construction Standards. Such openings shall be sealed to be weatherproof.

END OF SECTION 23 21 00

SECTION 23 23 00

REFRIGERANT PIPING SYSTEM

PART 1 GENERAL

1.01 GENERAL

A. Includes, but not limited to, the furnishing and installation of piping for refrigeration systems. The general arrangement and location of piping is shown on the plans. The pipe sizing and exact arrangements shall be designed by this contractor. This contractor shall provide all labor, materials, equipment, refrigeration specialties, testing, evacuation, oil and refrigerant charging as required for a complete and operational system. The design and installation shall conform to the equipment manufacturer's recommendations and installation instructions and all local mechanical and environmental codes.

B. Single line indicated on plans designates the proposed routing for the refrigeration piping between the indoor and outdoor units. That single line represents all the required piping runs required for the system designed. Contractor to verify quantity of circuits, piping runs and sizing prior to bid and installation.

1.02 RELATED SECTIONS

A. General Conditions, Division 01

B. Section 20 00 00 – General Mechanical Requirements

C. Section 22 11 16 – Domestic Water Pipe and Fittings

D. Section 22 20 00 – Excavation and Backfill For Mechanical Underground Utilities

E. Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment

F. Section 23 07 19 – HVAC Piping Insulation

1.03 QUALITY ASSURANCE

A. Refrigerant piping shall be installed by a refrigeration contractor licensed in the State of Washington, having a minimum of five (5) years' experience in refrigeration piping installation, and certification of technical training specifically in refrigeration from an industry recognized training program. Proof of license, experience and training shall be submitted as part of the Mechanical Submittals, see Section 20 00 00. All technicians working on-site shall be certificated in the use and handling of refrigerants in accordance with federal EPA regulation 40 CFR Part 82, sub-paragraph F.

1.04 SUBMITTAL REQUIREMENTS OF THIS SECTION

A. Pipe

B. Fittings

C. Brazing Material

D. Isolation Valves

E. Shop Drawings and Calculations

F. Certified Installer Information

1.05 OPERATION AND MAINTENANCE REQUIREMENTS FOR THIS SECTION

A. Valve Diagram

B. Shop Drawings and Calculations

PART 2 PRODUCTS

2.01 REFRIGERANT PIPING

A. Meet the requirements of ASTM B 280-86, "Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service", ACR hard drawn straight lengths.

B. Use of pre-charged soft copper line sets is prohibited.

2.02 REFRIGERANT FITTINGS

A. General: 100% Wrot copper with long radius elbows

B. Approved Manufacturers: Mueller Streamline, Nibco

2.03 BRAZING MATERIAL

A. Brazing rods with a minimum of 5% silver content shall be utilized. Rods containing Cadmium will not be permitted.

2.04 ISOLATION VALVES

A. Line size, ball type isolation valves shall be provided on both vapor and liquid lines of all systems. Provide one vapor and 2 liquid line valves (for filter/drier isolation) at the outdoor unit.

B. Valves shall be suitable for use with HCFC and HFC refrigerants, forged brass body, seal cap and wrot copper fitting extensions. Temperature rating shall be -40°F to +325°F minimum.

C. Coordinate optimum location of valves with filter/dryer unit (a valve on each side of the filter) to facilitate replacement with minimal loss of refrigerant. At minimum, provide one set of schrader valves located on the indoor coil side of the valves to facilitate evacuation and charging of the piping.

PART 3 EXECUTION

3.01 SHOP DRAWINGS AND CALCULATIONS

A. Provide shop drawings of each system in the project. Drawings are to be at 1/8-inch per foot minimum, and in sufficient detail to count fittings and devices with all vertical and horizontal runs fully dimensioned. Show sizes of all piping and type of fittings. Provide large scale details of indoor and outdoor equipment connections with all devices located chases through the building components, refrigerant traps, and underground piping runs.

B. Provide calculations that support the shop drawings with an individual pipe sizing calculation for each piping system. These calculations are to be performed by the equipment manufacturer's technical support personnel and submitted to the Engineer. These calculations shall provide total system capacity loss due to piping, system vapor velocities and critical system operating temperatures.

C. **All piping systems shall be sized as required to prevent no more than 5% system capacity loss due to piping.**

D. Each piping system is to be individually sized accounting for that particular unit's capacity, piping lengths, fittings and devices. Oil return is a major consideration and refrigerant vapor velocity must be sufficient to entrain oil. Minimum velocity must be 800 fpm in horizontal runs and 1500 fpm in vertical suction risers.

3.02 PIPING INSTALLATION

A. All vapor lines shall be sloped downward towards the compressor at a rate of 1- inch per 10 lineal feet to facilitate oil return.

B. Provide oil traps at vertical risers where required to return oil to compressor and to prevent liquid migration back to the compressor in the off cycle.

C. Refrigeration system connections shall be copper-to-copper type properly cleaned and brazed. Use flux only where required for brazing brass components. Soft solder connections are prohibited. Only silver solder containing a minimum of 5% silver shall be utilized

D. Circulate dry nitrogen as a shield gas through piping while being brazed to eliminate formation of copper oxide during brazing operation.

E. All piping shall be secured using unistrut type channel with "Hydrosorb" type clamps. All clamps shall be specifically designed for use with refrigeration piping and shall contain internal plastic grommet for vibration and thermal isolation. The use of general-purpose clamps, conduit straps or plumbers' tape is strictly prohibited. Carefully plan routing and grouping of all piping to ensure a neat and professional installation.

F. Where necessary to offset piping around obstructions, utilize 45° elbows in lieu of 90° elbows to minimize pressure losses.

G. Where piping is installed underground, provide an utilidor or conduit type system in which all piping shall be routed and protected against physical damage and moisture. Refer to drawings for additional installation details.

H. A complete review of all installation recommendations produced by the equipment manufacturer is recommended prior to the installation of ACR piping. Conformance to all manufacturers' recommendations will be enforced.

I. All leak testing shall be performed and verified prior to covering any concealed or buried piping. See Field Leak Tests.

3.03 FIELD LEAK TESTS

A. All leak tests shall be witnessed and confirmed by the Engineer or Owner's representative. The purpose of all leak testing is to confirm the integrity of field installed piping. If equipment is provided with a factory provided refrigerant charge, the equipment may be isolated and excluded from the test. If shipped with only a "holding charge" or no charge, the isolation valves shall be opened, and the equipment shall be included in the pressure testing.

B. Following completion of the refrigeration piping systems, the following tests shall be performed.

1. Connect test gauge with minimum of "2% accuracy to the piping system to be tested and pressurize piping system with dry nitrogen gas to 1.25 x design service pressure (minimum of 250 psi) or as recommended by the equipment manufacturer. Do not introduce any refrigerant into the system prior to pressure testing. The test gauge shall remain connected throughout the test period. Record actual test gauge pressure, date, time and ambient temperature. System shall remain under test for a period of one week. At the conclusion of the test period, record pressure, date, time and ambient temperature. If the test gauge is within 1% (2.5 PSIG) of the original test pressure as witnessed by the Engineer, (plus adjustment fluctuations in ambient temperatures) the system will be "Passed" and approved for evacuation and charging procedures.

3.04 OIL/REFRIGERANT CHARGING

A. Prior to commencing oil and refrigerant charging procedures, this Contractor shall refer to and closely follow the manufacturers' specific procedures for charging the system. As a minimum, the following procedures shall be followed:

1. Calculate oil charge using manufacturer's recommended method and add oil to compressor crankcase as necessary for size of piping system. Affix permanent, weatherproof label to unit indicating date, type of oil, and amount added, signed by the technician performing the task.

2. Draw a vacuum on each entire system with vacuum pump to 200 microns using vacuum gauge calibrated in microns. Break vacuum with refrigerant shipped with unit and re-establish a 200-micron vacuum (double evacuation). Calculate recommended charge and add the appropriate refrigerant charge by weight using a digital scale. Check and adjust charge as necessary to obtain manufacturer's specified operating pressures and superheat during start-up procedure.

3.05 SYSTEM START-UP

A. Perform a system start-up and check-out procedure as recommended by the equipment manufacturer, and as indicated on the enclosed system Start-up and Check-out Log. This start-up and check-out shall be performed in the presence of the Engineer or Owner's representative.

B. Provide one week’s written notice to the Engineer prior to start of equipment start-up and check-out.

C. Submit the following completed documentation including copies of the completed compressor warranty registration forms to the Engineer upon completion of system start-up.

3.06 START-UP LOG

(See attached.)

START-UP LOG

Date: _____ Project Title: _____

Contractor: _____ Tech. Name: _____

Refrigerant License #: _____

EQUIPMENT:

	Indoor	Outdoor	Accessories
Unit #:			
Make:			
Model:			
Serial#:			
Location:			

REFRIGERANT CHARGE: Type: _____ Amount: _____

OIL CHARGE: Type: _____ Amount: _____

TEMPERATURES:

Indoor: _____ Outdoor: _____

Return Air: _____ Supply Air: _____

COMPRESSOR(S):

	#1		#2	
		Cooling		Cooling
Discharge Pressure:				
Suction Pressure:				
	Actual	Rated	Actual	Rated
Amps:				

Volts(at disconnect): L1 - L2 _____ L2 - L3 _____ L1 - L3 _____

INDOOR MOTOR:

Direct Drive: _____ Belt Drive: _____ Belt Size: _____

Amps-Actual: _____ Amps-Rated: _____ Volts: _____

Rotation Verified? Yes ( ) No ( )

OUTDOOR MOTOR:

Amps-Actual: _____ Amps-Rated: _____ Volts: _____

HEAT:

Electric: _____ KW _____ Volts

None: _____(check if no heat)

THERMOSTAT OPERATION:

Type: _____ Fan On During Occupied? Yes ( ) No ( )

Setpoints: Occupied Cool _____ Unoccupied Cool_____

FILTERS: Type: _____ Size: _____ Quantity: _____

COMMENTS: _____

_____

_____

_____

TECHNICIAN SIGNATURE: _____

END OF SECTION 23 23 00

SECTION 23 31 13

STEEL DUCTWORK

PART 1 GENERAL

1.01 GENERAL

A. Includes, but not limited to, furnishing and installing above-ground ductwork and related items specified below and shown on Drawings.

1.02 RELATED SECTIONS

A. General Conditions and Division 01 apply to this Section.

B. Section 20 00 00 - General Mechanical Conditions

C. Section 23 05 29 - Hangers and Supports for HVAC Piping & Equipment

D. Section 23 07 13 - Equipment/Ductwork Insulation

E. Section 23 33 00 - HVAC Specialties

1.03 SUBMITTAL REQUIREMENTS OF THIS SECTION

A. Duct liner

B. Acoustic duct

C. Access doors

D. Volume dampers

E. Motorized dampers

F. Duct Silencers

G. Duct Sealers

H. Duct Closure Collars

I. Turning vanes

1.04 OPERATION AND MAINTENANCE REQUIREMENTS OF THIS SECTION

A. Motorized dampers

1.05 DEFINITIONS

A. Duct Sizes: All duct dimensions shown are inside clear dimensions. Where inside duct lining is specified or indicated, duct dimensions are to the inside face of lining.

B. Low Pressure System: Velocities less than 1,500 fpm and static pressure in duct 2 inches w.g. or less.

C. Medium Pressure System: Velocities less than 2,500 fpm or static pressure in duct up through 6 inches w.g.

D. Primary Duct System: See Section 23 07 13 - Equipment/Ductwork Insulation.

E. Gauges: Steel sheet and wire are U.S. Standard Gauge; aluminum sheet is Brown and Sharpe Gauge.

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

Not Applicable

2.02 DUCTS

A. Fabricate and support in accordance with SMACNA HVAC Duct Construction Standards - Metal, except as indicated. Fabricate of zinc-coated lock-forming quality steel sheets meeting requirements of ASTM A 527-85, "Specification for Sheet Steel Zinc Coated (Galvanized) by the Hot-Dip Process, Lock Forming Quality", with G 60 coating.

B. Construct T's, bends, and elbows with radius of 1-1/2 times width of duct on centerline. Where not possible, provide turning vanes.

C. Increase duct sizes gradually, not exceeding 30° divergence and 45° convergence.

D. Use crimp joints with or without bead for joining round duct sizes 8 inches (200 mm) and smaller with crimp in direction of airflow.

2.03 DUCT JOINTS

A. General: Duct with sides or diameter up to and including 36 inches shall be as scheduled below.

Max. Side Inches	Required Minimum Metal Gauges Steel, U.S. Standard Gauge	Type of Transverse Joint Connections	Bracing Required
Under 13"	26	S-drive, pocket or bar slips on 7 - 10" centers	None
13" to 24"	24	S-drive, pocket or bar slips on 7-10" centers	None
25" to 30"	24	S-drive, 1" pocket or 1" bar slips on 7'-10" centers	1"x1"x1/8" angles 4' from joints
31" to 36"	22	Drive 1"pocket or 1"bar slips on 7'-10" centers	1"x1"x1/8" angles 4' from joints

B. Ducts with sides over 36 inches to 48 inches, transverse duct joint system by Ductmate/25, Nexus, or WDCI (Lite) (SMACNA "E" or "G" Type connection).

C. Ducts 48 inches and larger, Ductmates/35, Nexus, or WDCI (Heavy) (SMACNA "J" Type connection).

D. Proprietary duct connections may be used on other sizes, Ductmate, WDCI, or equal.

2.04 ROUND DUCT

A. Fabricate of zinc-coated lock-forming quality steel sheets meeting requirements of ASTM A 527-85, "Specification for Sheet Steel Zinc Coated (Galvanized) by the Hot-Dip Process, Lock Forming Quality", with G 60 coating.

B. Gauge Selection Table:

Duct Diameter in Inches	Maximum 2" w.g. Static Positive		Maximum 2" w.g. Static Negative	
	Spiral Seam Gauge	Longitudinal Seam Gauge	Spiral Seam Gauge	Longitudinal Seam Gauge
3 thru 8	28	28	28	24
9 thru 14	28	26	26	24
15 thru 26	26	24	24	22
27 thru 36	24	22	22	20
37 thru 50	22	20	20	18
51 thru 60	20	18	18	16
61 thru 84	18	16	16	14

C. Provide insulation where required by the Insulation Schedule in Section 23 07 13 - Equipment/Ductwork Insulation.

2.05 SPIRAL DUCT

A. The outer pressure sheet shall be manufactured from galvanized steel meeting ASTM A-527-67 in the following minimum gauges:

Nominal Size Range	Solid Spiral Wound Duct Outer Pressure Shell	Solid Welded Fitting Outer Pressure Shell
3"-12"	26 Ga.	20 Ga.
13"-24"	24 Ga.	20 Ga.
25"-34"	22 Ga.	20 Ga.
35"-48"	20 Ga.	18 Ga.
50"-58"	18 Ga.	16 Ga.

2.06 DUCT LINER

A. Densities and R-value:

1. R-3.3: 1.0 inch of 1.5 to 3.0 lb/cu. Ft. duct liner
2. R-5.3: 1.5 inches of 1.5 to 3.0 lb/cu. Ft. duct liner
3. R-7: 2.0 inches of 1.5 to 3.0 lb/cu. Ft. duct liner

B. Duct Liner:

1. 'K' ('ksi') Value: ASTM C518, 0.25 at 75°F (0.036 at 24°C)
2. Noise Reduction Coefficient: 0.65 or higher based on "Type A mounting"
3. Maximum Velocity on Mat or Coated Air Side: 5,000 ft/min (25.4 m/sec)

4. Adhesive: UL listed waterproof type
5. Fasteners: Duct liner galvanized steel pins, welded or mechanically fastened
6. Approved Manufacturers:
    a. Manville Permacote Linacoustic (HP)

C. Spiral Duct Liner:

1. For ductwork requiring 1-inch (25 mm) Spiracoustic Plus System Lining:
    a. The installed 1-inch lining shall have a Thermal Resistance (R-Value) of 4.3 (.76) at 75°F (24°C) mean temperature, and Noise Reduction Coefficients (NRC) per ASTM C 423, Type "A" mounting.
    b. Metal duct with inside diameters from 8 inches to 18 inches (203 to 457 mm) shall be lined with 1-inch Preformed Round Liner.
        1) Approved Manufacturers:
            a) Permacote Spiracoustic Liner
    c. Metal duct with inside diameters from 18 inches to 32 inches (457 to 813 mm) shall be lined with 1-inch Round Liner Board.
        1) Approved Manufacturers
            a) Spiracoustic Plus “SD” Liner
    d. Metal duct with inside diameters greater than or equal to 34 inches (364 mm) shall be lined with 1-inch Round Liner Board.
        1) Approved Manufacturers
            a) Spiracoustic Plus “LD” Liner
2. For ductwork requiring 1 1/2-inch (38 mm) Lining:
    a. The installed 1 1/2-inch lining shall have a Thermal Resistance (R-Value) of 6.3 (1.11) at 75°F (24°C) mean temperature, and a Noise Reduction Coefficient (NRC) of 0.95 per ASTM C 423, Type "A" mounting.
    b. Metal duct with inside diameters from 9 inches to 18 inches (229 to 457 mm) shall be lined with 1 1/2-inch Preformed Round Liner.
        1) Approved Manufacturers:
            a) Permacote Spiracoustic Liner

c. Metal duct with inside diameters from 22 inches to 38 inches (559 to 965 mm), shall be lined with 1 1/2-inch Round Liner Board.

1) Approved Manufacturers:

a) Spiracoustic Plus “SD” Liner

d. Metal duct with inside diameters greater than or equal to 40 inches (1.02 m), shall be lined with 1 1/2-inch Spiracoustic Plus LD Round Liner Board.

2.07 ACCESS DOORS IN DUCTS

A. At each backdraft damper and at each motorized damper, install factory built 1" insulated access door with hinges and sash locks. Locate doors within 6 inches of installed dampers. Construction shall be galvanized sheet metal, 22 ga. minimum frame and 24 ga. minimum door. Minimum door shall be 12x12. If duct is too small for 12" door, then maximum door size shall be installed in duct.

B. Access doors for fire damper shall have a minimum clear opening of 12"x12" or as specified on Drawings to easily service fire damper. Doors shall be within 6 inches of fire dampers.

C. Approved Manufacturers:

1. Nailor - Hart Industries Inc.
2. Cesco - Advanced Air
3. AirBalance Fire/Seal
4. Louvers & Dampers
5. Kees Inc.
6. Ductmate Industries Inc "Sandwich" Access Door
7. National Controlled Air Inc.
8. Greenheck
9. Elmdor

2.08 FLEXIBLE EQUIPMENT CONNECTIONS

A. Provide flexible equipment connections between ductwork and equipment. See Section 23 33 00 - HVAC Specialties.

2.09 VOLUME DAMPERS

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.

B. Fabricate splitter dampers of same material and gage as duct to 24 inches (600 mm) size in either direction, and two gages heavier for larger sizes, secured with continuous hinge or rod, operated with minimum 1/4-inch (6 mm) diameter rod.

C. Fabricate single blade dampers for duct sizes to 9-1/2 x 30 inch (240 x 760 mm).

D. Fabricate multi-blade damper of opposed blade pattern with maximum blade sizes 12 x 72 inch (300 x 825 mm). Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.

E. Except in round ductwork 12 inches (300 mm) in diameter and smaller, provide end bearings.

F. Provide locking, indicating quadrant regulators on single and multi-blade dampers. Where width exceeds 30 inches (750 mm), provide regulator at both ends.

2.10 MOTORIZED DAMPERS

A. General:

1. Coordinate actuator type with Controls Contractor.

2. Damper actuators and actuator linkages shall be mounted in the airstream for all rooftop fans/roof hoods and mounted external of the airflow at all other locations, unless specifically indicated otherwise on plans.

3. Multi section damper assemblies shall be provided with a factory installed common jackshaft.

4. Provide with double flange duct connection.

5. Shall be Class IA leakage rated.

6. Provide parallel blade airfoil type for open/closed control and opposed blade airfoil type for modulating/throttling control.

B. Damper Blades:

1. Extruded aluminum or galvanized steel air foils with replaceable rubber blade seals, 6-inches wide maximum.

2. 304 stainless steel when installed in dishwasher hood ductwork.

3. Jamb seals shall be flexible metal compression type.

C. Performance:

1. Maximum leakage rate shall be 3 cfm/sq. ft. of damper area per 1.0-inch w.g. in accordance with AMCA Standard 500D.

2. Maximum pressure drop for a 12”x12” damper shall be 0.08” w.g. at 1,000 fpm face velocity.

D. Approved Manufacturers:

1. Ruskin (CD50/CD60)

2. Greenheck (VCD-33/VCD-43)

3. Pottorff

2.11 DUCT HANGERS

A. See Section 23 05 29 - Hangers and Supports for HVAC Piping & Equipment.

2.12 DUCT SEALANT AND ADHESIVES

A. Duct Sealant technical makeup shall be water based, solvent-free and of the synthetic latex family. Sealants shall be UL 181 Listed, meet all SMACNA pressure and seal classes and be rated to ± 15 inches water gauge. Sealants shall have flame spread of 0 and smoke development of 0 when tested in accordance to ASTM E-84. They shall be formulated to withstand working temperatures of -25°F to +200°F. All sealants shall exceed 500 hours under ASTM C-732 (Artificial Weathering) and pass ASTM C-734 (Low Temperature Flexibility after Artificial Weathering). All sealants shall be of an elastomeric nature, have a minimum weight of 12 pounds and a minimum solids content by weight of 66% ± 2%. Sealants shall be resistant to cracking, peeling, mold and mildew. Sealants shall also have excellent water and UV resistance. Sealants shall meet FDA, USDA and EPA standards as well as meet NFPA 90A and 90B requirements. Sealant shall be Design Polymerics DP 1010 or DP 1020 duct sealant or equal.

B. Solvent based duct sealant VOC shall be less than or equal to 50 g/l and be UL 723 Classified with a flame spread of 0 and a smoke development of 0. Sealant shall have passed 1000 hours of QUV accelerated outdoor aging testing. Sealant shall be Design Polymerics DP 1090 duct sealant or equal.

1. All traverse joints, longitudinal seams and penetrations in duct systems shall be sealed with duct sealant of the type specified. Spiral lockseams are not longitudinal seams and do not require duct sealant. All sealant shall be applied per the manufactures' recommendations. Joints that are not fully welded shall be sealed. For spiral and flat oval duct slip connections; coat both the female and male ends. The slip connections should then be brushed over with an additional coat 2 to 3 inches wide 20 to 40 mils thick.

2. All conditioned air supply ducts, return ducts and fresh air intakes shall have all joints and seams sealed or welded, except spiral seams round and flat oval ducts, which are exempt.

3. Seal sealants and joint sealants shall not be used as a substitute for good workmanship. No ductwork will be covered or installed until inspected and pressure tested if necessary.

C. Gaskets for TDC, TDF and applied flange connections shall meet all SMACNA pressure and seal classes. The gasket shall meet UL 723, ASTME E-84, NFPA 90A and 90B requirements as well as FDA, USDA and EPA standards. The tape shall be 5/8 inches by 3/16 inches and applied according to the manufactures' directions. Expanded or extruded foam gaskets are not acceptable. Gasket shall be Design Polymerics DP 1040 Butyl Gasket Tape or equal.

D. Exterior Ductwork: Sealant shall be Design Polymerics DP 1090, or equal.

2.13 DUCT CLOSURE COLLARS

A. General: Closure collars shall provide closure of opening between duct and opening in element penetrated and shall abut tight up to and overlap duct and shall consist of rolled angle material (for round ducts) and welded framed angles (for rectangular/round ducts).

B. Size: Closure collars shall be sized to match duct/opening applied to and shall have minimum 2-inch overlap on duct side and 2-inch overlap at opening/ penetrated element side but shall completely cover opening in element penetrated with minimum 1-inch overlap to undisturbed element (i.e., wall, floor, etc.).

C. Material: Closure collars shall be fabricated of 20-gauge galvanized steel for ducts 15 inches diameter and less and shall be fabricated of 18-gauge galvanized steel duct for all larger ducts and all square and rectangular ducts.

2.14 TURNING VANES

A. Turning vanes may be either Contractor or factory fabricated. Factory fabricated vanes shall be Barber Colman "Airturns" or approved.

B. Vanes and runners shall be fabricated of minimum 24 gauge galvanized.

C. Turning vanes shall comply with SMACNA HVAC Duct Construction Standards. For duct widths less than 19 inches, vanes may be single wall construction; for widths greater than 19 inches, vanes shall be double wall "airfoil" type.

D. Turning vanes shall be equally spaced, parallel to each other, and securely attached to runners.

E. For elbows where the inlet and outlet dimensions are not the same, modify vane shape or angle to provide optimum turning.

PART 3 EXECUTION

3.01 INSTALLATION

A. Ducts:

1. Straight and smooth on inside with joints neatly finished unless otherwise directed.

2. Duct panels through 48-inch dimension having acoustic duct liner need not be crossbroken or beaded.

3. Crossbreak unlined ducts and duct panels larger than 48 inch or bead 12 inches on center.

4. Securely anchor ducts to building structure with screws.

5. Brace and install ducts so they shall be free of vibration under all conditions of operation.

6. Round, horizontal ducts shall be hung with bands, which extend the entire perimeter of the duct.

7. Ducts shall be braced and guyed to prevent lateral or horizontal swing.

8. Ducts shall not bear on top of structural members.

9. Make duct take-offs to branches, registers, grilles, and diffusers as detailed on Drawings.

10. Ducts shall be large enough to accommodate inside duct liner. Dimension shown on Drawings are net clear inside dimensions after duct liner has been installed.

11. Properly flash where ducts protrude above roof.

12. Install internal ends of slip joints in direction of flow. Make joints airtight using specified duct sealer.

13. Cover horizontal and longitudinal joints on exterior ducts two layers of Hardcast tape installed with Hardcast HC-20 adhesive according to Manufacturer's recommendations.

14. Ducts installed on mechanical space floor or walkway where ducts may be subject to abuse shall have Ductmate/35 or (heavy) SMACNA "J" type connection on all joints.

15. Contractor shall obtain a signed statement from kitchen Contractor verifying ceiling height and hood configuration prior to hood ductwork fabrication.

16. Provide acoustic duct for first 15 feet downstream of all air handling unit supply and return ducts.

17. All exposed ducts shall be spiral.

18. Quick fit duct shall be used where called out on the plans or as called out in specialty exhaust specifications (i.e., 23 35 13 Sawdust Collection System).

19. Provide duct transitions to equipment openings.

B. Duct Liner:

1. Adhere insulation to sheet metal with full coverage of a UL listed adhesive.

2. Secure insulation with mechanical liner fasteners as indicated by SMACNA or manufacturer. Pin length should be as recommended by the liner manufacturer.

3. All exposed edges of the fibrous type liner must be factory or field coated. For systems operating at 4000 fpm or higher, a metal nosing must be installed in all liner leading edges.

4. Repair fibrous type liner surface penetrations with UL listed adhesive.

5. Duct dimensions indicated are net inside dimensions required for air flow. Increase duct size to allow for insulation thickness.

6. Provide duct liner for all return air ducts unless specifically excluded in Section 23 07 13.

7. Provide acoustic duct liner for duct indicated on plan and Section 23 07 13.

8. Provide liner for all supply duct unless specifically excluded from Section 23 07 13.

9. Provide duct liner for first 10’ in and out of all exhaust fans (excluding dishwasher, kitchen fume, and particulate fans).

C. Turning Vanes:

1. Install turning vanes in all square duct turns, and at locations shown on drawings.

2. Securely attach turning vane runners to ductwork.

D. Flexible Connections: See Section 23 33 00 - HVAC Specialties.

E. Balancing Dampers:

1. Provide each take-off with an adjustable volume damper to balance that branch.

2. Anchor dampers securely to duct.

3. Install dampers in main ducts within insulation.

4. Dampers in branch ducts shall fit against sheet metal walls, bottom and top of duct, and be securely fastened. Cut duct liner to allow damper to fit against sheet metal.

F. Motorized Dampers:

1. Motorized dampers shall be installed in all outside air intakes, exhaust outlets, and relief outlets per WSEC and as shown on drawings.

G. Grilles, Registers, and Diffusers: Install and anchor securely.

H. Adjustable Lock Splitter Dampers:

1. Dampers in equipment rooms shall be complete with locking quadrant.

2. Other dampers shall have concealed ceiling damper regulator with plate.

I. Painting of Ductwork: Paint ductwork visible through registers, grilles, and diffusers flat black.

J. Ductwork Leakage Criteria:

1. All transverse joints and longitudinal seams shall conform to SMACNA's Class A sealing requirements as defined on page 1-6 of the 1985 SMACNA Manual, First Edition.

2. Constant Volume Systems/Supply Ductwork:

a. Allowable Leakage – per SMACNA

3. Constant Volume Systems/Return Ductwork:

a. Return Ductwork – per SMACNA

4. Variable Air Volume Systems/Supply Ductwork:

a. Fan to VAV Boxes -- 1% of design cfm

b. VAV Boxes to Registers -- 2% of design cfm

5. Variable Air Volume Systems/Return Ductwork:

a. Return Ductwork -- 2% of design cfm

K. Ductwork Leakage Testing:

1. Duct leakage testing is required for all duct systems constructed to a pressure class of 3” water column or greater per the 2015 Washington State Energy Code, Section C403.2.8.3.3.

2. Installed ductwork shall be tested prior to installation of access doors, take-offs, insulation, etc.

3. All leak testing shall be witnessed by the Engineer or representative of the Engineer. The Contractor shall give the Engineer 72 hours’ notice prior to testing. Any testing not witnessed by the Engineer or his/her representative, shall be considered invalid and will be redone.

4. Ductwork shall be tested in accordance with the requirements outlined in the SMACNA HVAC Air Duct Leakage Test Manual and shown to have a (CL) less than or equal to 4.0.

5. Duct leakage, in excess of SMACNA HVAC Air Duct Leakage Manual, shall be repaired and have the test re-performed until the leakage rate is within acceptable levels.

6. Submit leakage test report identifying on a plan all the ducts tested and tested leakage rate.

L. Duct Cleanliness Criteria: Unless otherwise specified, the delivery, storage, and installation of all un-lined ductwork shall comply with the intermediate duct cleanliness level of SMACNA Duct Cleanliness for New Construction Guidelines. All lined and acoustic duct shall comply with the advanced level.

END OF SECTION 23 31 13

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SECTION 23 33 00

HVAC SPECIALTIES

PART 1 GENERAL

1.01 SUMMARY

A. Includes, but not limited to, furnishing and installing specified material as described in Contract Documents.

B. Filters used in air handling units and heat pumps.

C. Flexible ductwork from supply air branch duct runouts to diffusers where indicated on drawings.

D. Furnishing and installing fire dampers, ceiling radiation, and fire/smoke dampers at penetrations of fire rated walls, floors, and ceiling membranes, at ducts, registers, grilles, or louvers as indicated on drawings. Installation shall be complete with sleeves, angles, and all other accessories as required by UL installation instructions, local codes, and reviewing authorities.

E. Section Includes:

1. Backdraft dampers
2. Filters and filter housing
3. Flexible duct
4. Flexible equipment connections
5. Fire and fire/smoke dampers

1.02 RELATED SECTIONS

A. General Conditions

B. Division 01

C. Section 20 00 00 - General Mechanical Requirements

D. Section 23 31 13 - Steel Ductwork

1.03 SUBMITTAL REQUIREMENTS OF THIS SECTION

A. Backdraft dampers

B. Filters

C. Filter housing

D. Air filter gauge

E. Flexible ductwork

F. Flexible equipment connections

G. Fire and/or smoke dampers

H. Airflow station

I. Duct smoke detectors

1.04 OPERATION AND MAINTENANCE REQUIREMENTS OF THIS SECTION

A. Backdraft dampers

B. Filters (Summarized list including equipment tag and size and quantity of filter per unit.)

1. Provide dates or projected dates of extra filter replacement.

C. Air Filter gauge pressure drop

D. Fire and/or smoke dampers

E. Airflow station maintenance and calibration

F. Duct smoke detectors

1.05 QUALITY ASSURANCES

A. Requirements of Regulatory Agencies:

1. Bear the AMCA seal and UL label, NSF approved.

2. Fire and fire/smoke dampers to conform to UL Standards 555, 5558, and 555C and NFPA requirements as required and bear the correct UL label for the damper's application.

3. Fire and fire/smoke dampers shall be approved by State Fire Authorities where so required.

4. Fabric duct shall be UL listed in accordance with the 25/50 flame spread/smoke developed requirements of NFPA-90-A.

1.06 SPARE PARTS

A. Deliver with O&M Manuals six fusible links of each type used on the project where replaceable link-type dampers are furnished.

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

Not Applicable

2.02 BACKDRAFT DAMPERS (COUNTER BALANCED)

A. General: 0.125 inches extruded aluminum frame, 0.07 inches aluminum blades with extruded vinyl edges, synthetic bearings, counterbalance, adjustable zinc plated bar on blades.

B. Backdraft dampers are to be factory set to open at 0.01" w.c. of building pressure and shall have a maximum static pressure drop of 0.05" w.c. at 700 fpm per AMCA Standard 500. Backdraft dampers shall have a leakage rate at no more than 20 CFM/sq. ft. at 1" w.c. of static pressure with a dimension of 24" or greater and 40 CFM/sq. ft. at 1" w.c. of static pressure with dimension smaller than 24" per AMCA Standard 500D.

C. Approved Manufacturer:

1. Ruskin
2. Greenheck

2.03 FILTERS

A. 2" MERV 8:

1. General: 30% efficient filters as specified herein shall be medium efficiency, pleated panel type, disposable filters; Farr 30/30 or approved and shall have an average efficiency of 25-30% atmospheric and 90-92% arrestance by ASHRAE Standard 52-76 unless instructed otherwise.
2. Filter Housings: Shall be sized to fit furnished unit or duct to be installed in and provide minimum filter sizes to obtain a maximum filter velocity of 300 fpm.
3. Resistance: Initial resistance of a 24"x24"x2" filter handling 2000 CFM shall not exceed 0.31" w.g.
4. Duct Holding Capacity: Shall be no less than 60 grams per square foot of face area at 1.0" w.g.
5. Size: Filters shall be 2" deep (unless indicated otherwise), with number and sizes indicated, or as required to give minimum nominal face area as scheduled on drawings.
6. Provide a filter pull strap for all multiple filter sets longer than 24 inches.
7. Approved Manufacturers:
   a. Farr Co.
   b. Airguard
   c. Purolator
   d. Eco-Air

B. 2" or 4" MERV 13 Low Static:

1. General: 80% efficient filters as specified herein shall be high efficiency, pleated panel type, disposable filters; Filtration Group MERV 13 Green Pleat or approved and shall have a Minimum Efficiency Reporting Value of MERV 13 when evaluated under the guidelines of ASHRAE Standard 52.2 2007.
2. Filter Housings: Shall be sized to fit furnished unit or duct to be installed in and provide minimum filter sizes to obtain a maximum filter velocity of 300 fpm.
3. Resistance: Initial resistance of a 24"x24"x2" filter handling 500 fpm shall not exceed 0.38" w.g. and 24"x24"x4" shall not exceed 0.23" w.g.

4. Duct Holding Capacity: Shall be no less than 60 grams per square foot of face area at 1.0" w.g.

5. Size: Filters shall be 2" deep (unless indicated otherwise), with number and sizes indicated, or as required to give minimum nominal face area as scheduled on drawings.

6. Provide a filter pull strap for all multiple filter sets longer than 24 inches.

7. Approved Manufacturers:

   a. Filtration Group

C. 2" or 4" MERV 13:

1. General: 80% efficient filters as specified herein shall be high efficiency, pleated panel type, disposable filters and shall have a Minimum Efficiency Reporting Value of MERV 13 when evaluated under the guidelines of current ASHRAE Standard 52.2.

2. Filter Housings: Shall be sized to fit furnished unit or duct to be installed in and provide minimum filter sizes to obtain a maximum filter velocity of 300 fpm.

3. Resistance: Initial resistance of a 24"x24"x2" filter handling 500 CFM shall not exceed 0.41" w.g. and 24"x24"x4" shall not exceed 0.35" w.g.

4. Duct Holding Capacity: Shall be no less than 60 grams per square foot of face area at 1.0" w.g.

5. Size: Filters shall be 2" deep (unless indicated otherwise), with number and sizes indicated, or as required to give minimum nominal face area as scheduled on drawings.

6. Provide a filter pull strap for all multiple filter sets longer than 24 inches.

7. Approved Manufacturers:

   a. Farr

   b. Airguard

   c. Purolator

   d. Eco-Air

2.04 FILTER HOUSINGS - FAN COIL UNITS

A. Shall be fabricated and furnished as part of the fan coil units.

2.05 FILTER HOUSINGS - DUCT MOUNTED

A. Filter housings shall be factory or Contractor fabricated of not less than 20-gauge galvanized steel.

B. Housing shall have access doors on two sides, constructed of minimum 20-gauge galvanized steel and shall be hinged type with minimum of two heavy-duty latches (Ventlock or equal) and have neoprene sponge gasketing.

C. Holding frames shall be constructed of minimum 20-gauge galvanized steel, with U-type bearing channels, polyurethane gasketing on surfaces adjacent to filters.

2.06 TEMPORARY AIR INLET FILTERS

A. Type: Glass fiber or synthetic material blanket type filter media. Inlets and outlets shall be MERV 8 and unit shall be same as final.

B. Capacity: Shall have an average arrestance no less than 64%; dust holding capacity of 172 grams.

C. Size: Minimum 1" thick cut to size as required to cover inlets.

2.07 AIR FILTER GAUGE

A. An air filter gauge for measuring the resistance to air flow through the filters. The gauge shall be diaphragm actuated, shall have 3-7/8" diameter white dial with black figures and graduations, shall have pointer zero adjustment and shall be furnished complete with two static pressure tips, fittings for 1/4" metal tubing and means for mounting the gauge.

B. Gauge shall be Dwyer No. 2001-ASF reading to 3 times nominal operating pressure.

2.08 FLEXIBLE DUCTWORK

A. Formable, flexible, circular duct shall have a fiberglass scrim (or equivalent) and retain its cross-section, shape, rigidity, and shall not restrict air flow after bending.

B. Normal 1-1/2 inches thick, 3/4 lb./cu ft density fiberglass insulation with airtight, see-through polyethylene or polyester core, sheathed in seamless vapor barrier jacket factory installed over flexible assembly.

C. Assembly including insulation and vapor barrier, shall meet Class 1 requirements of NFPA 90A and be UL 181 rated, with flame spread of 25 or less and smoke developed rating of 50 or under.

D. Approved Manufacturers:

1. Wiremold
2. Flexible Air Movers Inc.
3. J.P. Lamborn
4. General Flex Corp.
5. Young & Co. Mfg. 165
6. Thermaflex 'GKM'
7. Cleavaflex
8. Hart & Cooley

2.09 FLEXIBLE EQUIPMENT CONNECTIONS (INDOOR)

A. General: 30 oz. closely woven UL approved glass fabric, double coated with neoprene. Fire retardant, waterproof, airtight, resistant to acids and grease, and withstand constant temperatures of 200°F.

B. Approved Manufacturers:

1. Ventglas by Ventfabrics

2. DuroDyne MFN

2.10 FLEXIBLE EQUIPMENT CONNECTIONS (OUTDOOR)

A. General: 26 oz. closely woven UL approved glass fabric, double coated with Hypalon. Fire retardant, waterproof, airtight, resistant to acids and grease, resistant to ozone and weathering, and withstand constant temperatures of 250°F.

B. Approved Manufacturers:

1. Ventglas by Ventfabrics

2. DuroDyne MFN

2.11 VERTICAL & HORIZONTAL FIRE DAMPERS

A. Must conform to and bear the UL 555 label.

B. Out of airstream type "B" with standard 165-degree link. 1 ½ hour dampers for wall or floor construction of less than 3 hours. Three-hour dampers for wall or floor construction of 3 hours or greater.

C. In-air-stream type "A", dampers with standard 165-degree link for installation in existing duct (if any) and where "B" style dampers cannot be installed.

D. Fire dampers in round duct must be "C" style with both blades and frame located out-of-air-stream and standard 165-degree F. links.

2.12 COMBINATION FIRE/SMOKE DAMPERS

A. Furnish and install at location shown on plans combination fire/smoke dampers meeting or exceeding the following specifications:

1. Use 1 ½ hour dampers for wall or floor construction of less than 2 hours. Use 3-hour dampers for wall or floor construction of 2 hours or greater.

2. Frame shall be a minimum of 16-gauge galvanized steel formed into a structural hat channel shape with tabbed corners for reinforcement. The blades shall be single skin 16 gauge minimum galvanized with three longitudinal grooves for reinforcement. Bearing shall be stainless steel sleeve turning in an extruded hole in the frame. Blade edge seals shall be silicone rubber mechanically locked in blade edge (adhesive or clip fastened seals are not acceptable). Jamb seals shall be stainless steel flexible metal compression type.

3. Each combination fire/smoke damper shall be rated for 1.5 hours under UL Standard 555 and shall further be classified by UL as a leakage rated damper for use in smoke control systems under UL 555S and bear the UL labels for both UL 555 and UL 555S. Damper manufacturer shall have tested a range of damper sizes covering all dampers covered by the specification. Testing and qualifying a single damper size are not acceptable. The leakage rating under UL 555S shall be leakage Class II (10 cfm/sq.ft. at 1" W.G.)

4. Fire/smoke dampers may be round or square depending on the duct to which it is attached. Contractor must provide square-to-round adapters as required.

5. As part of the UL Qualification, dampers shall demonstrate a capacity to operate (open and close) under HVAC system operating conditions, with pressure of at least 4" W.G. in the closed position and 2000 fpm air velocity in the open position.

6. In addition to the leakage rating already specified herein, the dampers and their actuators shall be qualified under UL 555S to a minimum elevated temperature of 250°F. Appropriate 120-volt electric actuators shall be installed by the damper manufacturer at the time of damper fabrication. Damper and actuator shall be installed as a single entity which meets all applicable UL 555 and UL 555S qualifications for both dampers and actuators. Dampers must be open and close within 15 seconds of appropriate signal and dampers must close upon lack of power.

7. Manufacturer shall provide factory assembled sleeve of 17" minimum length (Contractor to verify requirement). Factory supplied caulked sleeve shall be minimum 20 gauge for dampers through 84" wide and 18 gauge above 84" wide if breakaway connections are provided, 16-gauge sleeves are required if other connection methods are provided. Damper and actuator assembly shall be factory cycled 10 times before shipment to assure operation.

8. Temperature Control Contractor shall provide all necessary switches and relays etc. to interface damper with smoke control system and building control system as described elsewhere in these specifications.

9. Fire/smoke dampers in tunnel corridor construction must bear UL 555 and UL 555S labels and meet all of the above criteria and have installation instructions showing UL approval for tunnel corridor construction.

10. Fire/smoke dampers shall be rated for no higher than Class II leakage and with an elevated temperature rating of not less than 250°F and shall bear both UL 555 and UL 555S labels.

11. In systems requiring a smoke control system, provide remote sensing of damper position and damper override of damper closure to permit controlled operation in a dynamic smoke management system. Device shall be Ruskin Model TS 150 Fire Stat or approved.

12. Approved Manufacturers:

    a. Ruskin

    b. Greenheck

    c. Air Balance

    d. National Controlled Air

    e. Prefco

2.13 AIRFLOW MEASUREMENT STATION

A. Provide airflow measurement systems for outside air. Airflow measuring stations shall be manufactured by Trane (TRAQ) or Ruskin (IAQ Damper). The airflow measurement stations shall be installed in strict accordance with the manufacturer's published requirements to achieve the accuracy listed below. The airflow measurement systems shall operate with a 24 VAC power supply and be capable of functioning accurately between -20°F and +158°F. The airflow measurement station shall transmit a 4-20 mA linear signal representative of velocity and be factory calibrated to provide accuracy of ±5 percent of actual flow down to 15 percent of the normal flow.

2.14 AIRFLOW MEASUREMENT SENSORS

A. Differential pressure airflow sensor shall traverse the duct using the equal cross-sectional area or log-linear traverse method along two perpendicular diameters. Single axis sensor shall not be acceptable for duct diameters 6” or larger. A minimum of twelve (12) total pressure sensing points shall be utilized. The total pressure inputs shall be averaged using a pressure chamber located at the center of the senor. A sensor that delivers the differential pressure signal from one end of the sensor is not acceptable. The sensor shall output an amplified differential pressure signal that is at least 2.5 times the equivalent velocity pressure signal obtained from a conventional pitot tube. The sensor shall develop a differential pressure of 0.03” W.G. at an air velocity of < 450 FPM.

B. Approved Manufacturers:

1. Enviro-Tec
2. Titus
3. Krueger

2.15 DUCT SMOKE DETECTORS

A. General: Smoke detectors shall be installed in supply duct within 4'-0" of each air handler of 2000 cfm and above.

B. Responsibility: This Contractor shall be responsible for control circuit from smoke detectors to fan starter and to remote test station.

C. Equipment: Detectors shall be "Notifier" DH400 series with sampling tube. Remote test station shall be "Notifier" RTS 451.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine areas for compliance with requirements for installation tolerances and for structural rigidity, strength, anchors, and other conditions affecting performance of heat exchangers.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Backdraft Dampers: Provide access doors to backdraft dampers.

B. Filters and Filter Housing:

1. Contractor to install temporary filters to provide temporary sealing of all duct systems during the construction period to prevent the entry of dirt, dust and debris into the duct systems. These systems that are operated during the construction period shall have temporary filters installed over all inlets and filters installed in the air handling equipment. Filters installed in equipment shall be same type as final filters required for the units. Temporary air inlet type filters shall be taped over all inlets to completely filter all air drawn into the systems.

2. Contractor to provide and install four (4) complete sets of all filters as scheduled below:

   a. At equipment start-up

   b. Prior to balancing system

   c. Three (3) months after building occupancy

   d. During the one-year warranty to be scheduled with Owner

3. Construct and install filter housings to prevent passage of unfiltered air. Provide sheet metal blanks, felt, rubber, and/or neoprene seals as necessary.

4. Provide air filter gauge on units over 2000 cfm. Connect sensing tips to gauge with copper or aluminum tubing. Locate gauge in easily read position, provide brightly colored tape marker to indicate clean filters pressure drop and change-out pressure drop (use clean pressure drop plus 0.15" unless instructed otherwise).

5. Furnish Owner with schedule of filter sizes for each air handler, heat pump, furnace, and fan coil unit.

C. Flexible Equipment Connections:

1. Provide insulated flexible equipment connections between ducts and vibrating equipment. Fans which are internally isolated with spring isolators do not require flexible connections, unless indicated on the plans.

2. Install flexible connections with sufficient slack to permit 2 inches of horizontal or vertical movement of ducts or equipment at connection point without stretching the flexible material.

3. Where installed exposed to weather, provide a galvanized "hat" channel protecting top and vertical stretches of flexible connector from sunlight and weather.

D. Flexible Ductwork:

1. Install duct in fully extended condition free of sags and kinks, using ten-foot maximum lengths.

2. Make duct connections by coating exterior of duct collar for 3 inches with duct sealer and securing duct in place over sheet metal collar with 1/2-inch-wide metal cinch bands and sheet metal screws. Tape exterior of flex to duct ahead of damper.

E. Fire and Fire/Smoke Dampers:

1. Fire damper installation shall conform to details shown in the UL installation instructions for the particular damper.

2. Each fire damper or fire/smoke damper shall have an access panel located not more than 6 inches from the fire damper served. Access panel shall not be less than 10" x 10" or equivalent size in smaller ducts.

3. All dampers must be installed strictly in accordance with the UL installation instructions that must accompany the dampers and be available on site for the appropriate building inspector to view.

F. Install duct smoke detectors in air handling units over 2000 CFM.

END OF SECTION 23 33 00

SECTION 23 34 23

EXHAUST FANS

PART 1 GENERAL

1.01 GENERAL

A. Includes, but not limited to, furnishing and installing specified material as described in Contract Documents.

1.02 RELATED SECTIONS

A. General Conditions and Division 1 apply to this Section.

B. Section 20 00 00 - General Mechanical Conditions

C. Section 23 31 13 – Steel Ductwork

1.03 QUALITY ASSURANCES (REQUIREMENTS OF REGULATORY AGENCIES)

A. Bear AMCA seal, UL 507 (for continuous operation), and UL 705 (volume control by speed control on direct drive units).

1.04 SUBMITTAL REQUIREMENTS OF THIS SECTION

A. Exhaust Fans

B. Exhaust Fan Curbs (Rooftop Fans)

C. Fan curves showing system curve, and a fan curve with the maximum operation point with maximum motor size (limited by maximum shaft speed of and/or surge point).

1.05 OPERATION AND MAINTENANCE OF THIS SECTION

A. Submittal Data including Curves

B. Exhaust Fan Operation and Maintenance Manual

PART 2 PRODUCTS

2.01 ROOF MOUNTED (DOWN BLAST) EXHAUST FANS

A. General:

1. Direct drive or have adjustable pitch V-belt as noted on plans.

2. Wheels shall be backward curved with aluminum housing.

3. Isolate motor with vibration dampeners.

4. Provide quiet type back-draft dampers where indicated on drawings.

B. Roof Curbs:

1. Provide with prefabricated insulated roof curb.

2. Curb shall be constructed of galvanized steel or aluminum with a solid metal interior liner, 1½" thick 3 lb. density insulation, include damper tray for a motorized damper, and rubber curb seal.
3. Curb shall be provided with factory mounted hinged base.
4. Curb shall be 14" tall (minimum).
5. Furnish with cant strip where installed on roofs with insulation below the roof deck.
6. Approved Manufacturers:
    a. Breidert
    b. Carnes
    c. Cook
    d. Greenheck
    e. Jenn
    f. Penn Barry
    g. Twin City Fans

2.02 IN-LINE FANS

A. General:

1. Motors on V-belt units shall be supported on the exterior of the fan casing with bearings encased within the fan tube.
2. All models shall incorporate a panel to permit access to interior.
3. Centrex wheels shall be backwardly inclined, non-overloading and made of aluminum.
4. Inlets shall be deep spun for non-turbulent entrance condition.
5. Approved Manufacturers:
    a. Cook
    b. Greenheck
    c. Pace
    d. Penn Barry
    e. Twin City Fans

2.03 ROOF MOUNTED (UP BLAST) EXHAUST FANS

A. Description:

1. Fan shall be spun aluminum, roof mounted, belt driven, up blast centrifugal exhaust ventilator.

B. Certifications:

1. Fan shall be listed by Underwriters Laboratories (UL 762) and UL listed for Canada (UL 762). Fan shall bear the AMCA certified ratings seal for sound and air performance.

C. Construction:

1. The fan shall be of bolted and welded construction utilizing corrosion resistant fasteners. The spun aluminum structural components shall be constructed of minimum 16-gauge marine alloy aluminum, bolted to a rigid aluminum support structure.

2. The aluminum base shall have a one-piece inlet spinning and continuously welded curb cap corners for maximum leak protection.

3. The motor, bearings and drives shall be mounted on a minimum 14-gauge steel power assembly, isolated from the unit structure with solid vibration isolators. The components shall be enclosed in a weather-tight compartment, separated from the exhaust airstream.

4. Unit shall bear an engraved aluminum nameplate.

D. Wheel:

1. Wheel shall be centrifugal backward inclined, constructed of 100 percent aluminum, including a precision machined cast aluminum hub. Wheel inlet shall overlap an aerodynamic aluminum inlet cone to provide maximum performance and efficiency. Wheel shall be balanced in accordance with AMCA standard 204-96, balance quality and vibration levels for fans.

E. Motor:

1. Motor shall be heavy duty type with permanently lubricated sealed ball bearings and furnished at the specified voltage, phase and enclosure.

2. Motor shall be explosion-proof, when indicated on drawings.

F. Bearings:

1. Bearings shall be designed and individually tested specifically for use in air handling applications. Construction shall be heavy duty regreasable ball type in a cast iron housing selected for a minimum L50 life in excess of 200,00 hours at maximum cataloged operating speed.

G. Belts and Drives:

1. Belts shall be oil and heat resistant, non-static type. Drives shall be precision machined cast iron type, keyed and securely attached to the wheel and motor shafts. Drives shall be sized for 150 percent of the installed motor horsepower. The variable pitch motor drive must be factory set to the specified fan RPM.

H. Roof Curbs:

1. Provide with prefabricated insulated roof curb.

2. Curb shall be constructed of galvanized steel or aluminum with a solid metal interior liner cover, 1½" thick 3 lb. density insulation, include damper tray for a motorized damper, and rubber curb seal.

3. Curb shall be provided with a factory mounted hinged base.

4. Curb shall be 14" tall (minimum) for all non-grease fans.

5. Provide a vented curb extension for all grease fans to provide the required 40" minimum discharge height above the roof line.

6. Furnish with 2" wide flashing all around with cant strip.

7. Approved Manufacturers:

   a. Cook

   b. Carnes

   c. Penn Barry

   d. Greenheck

   e. Jenn

   f. Twin City Fans

2.04 IN-LINE DRYER FANS

A. General: Supply, exhaust or return air inline fans shall be of the centrifugal, direct driven type.

B. Construction:

1. Fan housing shall be constructed of heavy gauge galvanized sheet metal with powder coated finish. Internal air turning vanes shall be provided for maximum air performance. Fan shall be supplied with externally mounted electrical terminal strip connections. Integral disconnect switch shall be provided when specified.

2. Motorized impeller shall be an external rotor type, class B insulation, totally enclosed with permanent split capacitor (except K4 and K5, shaded pole type). Motor shall be permanently sealed self-lubricating ball bearing type. Motor shall be equipped with automatic reset thermal overload protection. Motor shall be provided to ensure long maintenance free operation over maximum load conditions.

3. Fan wheel shall be of the backward inclined airfoil type with a well-designed inlet venturi for maximum performance. Motorized impeller shall be both statically and dynamically balanced as one integral unit to provide for vibration free performance.

C. Performance: Fan air flow and sound performance shall be certified by AMCA and licensed to bear the AMCA Certified Ratings seal.

D. Code Approval: Fan shall be tested and approved by UL and CSA (or equal) for safety.

E. Warranty: Fan shall be fully warranted for a period of no less than three years from the date of installation.

F. Approved Manufacturers:

1. Kanalflakt

2.05 CEILING MOUNTED EXHAUST FAN

A. General:

1. Acoustically insulated housings.
2. Include chatterproof integral back-draft damper with no metal contact.
3. True centrifugal wheels.
4. Entire fan, motor, and wheel assembly shall be easily removable without disturbing housing.
5. Suitably ground motors and mount on rubber-in shear vibration isolators.
6. Provide roof cap or wall cap as required.
7. Provide “Architectural deluxe” metal grille.

B. Approved Manufacturers:

1. Penn Barry
2. Cook
3. Greenheck
4. Twin City Fans

2.06 SPEED CONTROL

A. Use manufacturer’s recommended speed control, which varies speed from 50 to 100% of full speed.

B. All fan motors 1/12 HP or greater and less than 1 HP shall be Electronically Commutated Motors (ECM) or shall have a minimum efficiency of 70 percent when rated in accordance with DOE 10 C.F.R. 431. These motor speeds shall be adjustable.

PART 3 EXECUTION

3.01 INSTALLATION

A. Anchor fan units securely to structure or curb.

B. Extend all internal wiring to box on exterior of unit.

C. Factory mount speed control on outside of case on in-line fans, including wall propeller fans, and underneath weather casing for rooftop fans.

END OF SECTION 23 34 23

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SECTION 23 36 00

VAV TERMINAL BOX UNITS

PART 1 GENERAL

1.01 SUMMARY

A. Includes But Not Limited To: Furnish and install specified material as described in Contract Documents.

B. Related Sections: General Conditions and Division 1 apply to this Section.

1.02 SUBMITTAL REQUIREMENTS OF THIS SECTION

A. Fan terminal boxes

B. VAV Shut-off boxes

C. Sound Data (discharge, intake, and radiated)

1.03 OPERATION AND MAINTENANCE REQUIREMENTS OF THIS SECTION

A. Submittal Data

B. Unit Operation and Maintenance Manual

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

A. Trane

B. Titus

C. Nailor

D. Price

E. ENVIRO-TEC (ETI)

2.02 FAN TERMINAL VAV BOX

A. Fan Terminal Box Unit:

1. Horizontal constant fan series.

2. Standard UL approved unit consists of: Casing, fan, motor and drive, coils, single point electrical connection, control power transformer, fan relay, control box, filter section, and electrical components

B. Casing:

1. Single wall constructed of 22-gauge minimum galvanized steel. Provide with flange at outlet and inlets for duct connections.

2. Insulated with 1", 1.55 lb./cu. ft. density glass fiber, coated to retard erosion, meets NFPA 90A and UL 181.

3. Entire bottom panel to be removable for service of components.

C. Fan, Motor and Drive:

1. Forward curved, centrifugal type, aluminum wheel with factory-built housing and inlet cones, direct drive.

2. Fans are statically and dynamically balanced.

3. Motors to be permanently lubricated, permanent split capacitor type with thermal overload protection.

4. Motors rated for 100,000-hour life.

5. Motors to be factory run tested in unit.

6. ECM motor with factory mounted controller to change fan motor speed. Adjustment knob located external to control panel.

7. Fan Control Relay - 24 VAC coil, rated as required for fan motor, suitable for connection to terminal unit controller.

D. Damper Assemblies of 16-gauge, galvanized steel shall be multiple opposed blade construction arranged to close at 45 degrees from full open to minimize air turbulence. Damper blades shall be fitted with flexible seals for tight closure. In the fully closed position, air leakage past the closed damper shall not exceed 2% of the nominal catalog rating a 3.0" wg inlet static pressure as rated by ASHRAE Standard 130. Each unit shall be complete with factory mounted DDC controls including actuators, which shall be fully coordinated with Controls Contractor prior to equipment ordering. Gauge tap ports shall be supplied in the piping between the flow pick up and the controller.

2.03 SHUT-OFF VAV BOX

A. Casing:

1. Unit casing shall be 22-gauge, galvanized steel with round or flat oval inlets (flanged).

2. Units shall be internally lined with 1" dual density fiberglass insulation. Edges shall be sealed against airflow erosion. Units shall meet NFPA 90A and UL 181 standards.

B. Inlet Damper Assemblies shall be of galvanized steel construction with a fully closed leakage rate no greater than 2% at 3.0" wg. Damper blades shall be fitted with flexible seals for tight closure. In the fully closed position, air leakage past the closed damper shall not exceed 2% of the nominal catalog rating a 3.0" wg. inlet static pressure as rated by ASHRAE Standard 130. Each unit shall be complete with factory mounted DDC controls including actuators, which shall be fully coordinated with Controls Contractor prior to equipment ordering. Gauge tap ports shall be supplied in the piping between the flow pick up and the controller.

2.04 ELECTRIC COILS

A. Provide electric coils sized and staged per equipment schedule.

PART 3 EXECUTION

3.01 GENERAL

A. Physical size and noise criteria will be strictly enforced. Approved manufacturers are listed for quality only, not for noise and size. It is up to the equipment supplier to provide equal VAV boxes to those listed on the schedule.

END OF SECTION 23 36 00

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SECTION 23 37 00

AIR TERMINALS

PART 1 GENERAL

1.01 SUMMARY

A. Includes But Not Limited To:

1. Furnish and install complete, all air terminals described in Contract Documents.
2. Ceiling diffusers with damper
3. Louvers connected to ductwork
4. Roof hoods

1.02 RELATED SECTIONS

A. General Conditions and Division 1 apply to this Section.

B. Section 20 00 00 - General Mechanical Conditions

1.03 SUBMITTAL REQUIREMENTS OF THIS SECTION

A. Grilles, registers, and diffusers

B. Louvers

C. Wall caps

D. Roof hoods

1.04 OPERATION AND MAINTENANCE REQUIREMENTS OF THIS SECTION

Not Applicable

PART 2 PRODUCTS

2.01 GRILLES, REGISTERS AND DIFFUSERS (GRD)

A. Shall be as scheduled on drawings.

B. Provide the various grilles, registers and diffusers shown on the plans and of the various types herein before specified. All terminals with prime-coat finish shall be installed before the walls and ceiling is painted, in order that they may be finish painted by the General Contractor. Those with factory finish or aluminum construction shall be installed after the walls and ceilings are painted. All air terminals located in shower, toilet rooms, locker and dressing rooms shall be of aluminum construction w/baked off-white finish. All other Air Terminals shall be of a standard steel construction; wall-mounted terminals shall be prime coat finish; ceiling diffusers, exhaust and return air terminals shall have factory-applied baked enamel finish, color as selected by Architect.

C. Approved Manufacturers: (subject to submittal approval):

1. Anemostat
2. Nailor
3. Kees
4. Krueger
5. Price
6. Titus
7. Tuttle & Bailey
8. Shoemaker (except 700MA)

2.02 LOUVERS

A. Provide stationary type with 4" frame, drainable blades, and aluminum bird screen. Frame and blade shall be 6063-T-5 aluminum alloy. Blades shall be at 37.5° angle and supported by hidden mullions. Intermediate support mullions shall not interrupt blade exterior appearance. Louvers shall receive finish color coating of modified fluoropolymer baked enamel following cleaning and pretreatment of metal. A 50% Kynar resin shall provide approximately 0.3" total dry film thickness when baked at 450°F. Color shall be as selected by the Architect. Provide appropriate frame type for installation type.

B. Louvers shown are minimum sizes for airflow requirements. Refer to Architectural elevations for exact size and location of louvers. This contractor is to provide full size louver as shown on the plans or Architectural elevations (whichever is larger), including but not limited to: hidden mullions, louver extensions, and louver shapes. Any louver area not used for ductwork shall be blanked off with sheet metal. The General Contractor to provide insulation for blanked off sections.

C. Louver performance shall be as follows:

1. Maximum S.P. drop of 0.15" at 800 ft./min.
2. Minimum beginning point of water penetration at 0.01 oz/sq. ft. is 800 feet per minute (48"x48" size at 15-minute test period).
3. Minimum AMCA rated free area of 54% (48"x48" size).
4. Approved Manufacturers:
    a. Ruskin (ELF 375DX)
    b. American Warming
    c. Wonder Metals
    d. Greenheck
    e. Metal Form

f. United Enertech

g. Pottorff

2.03 WALL CAPS

A. Wall caps shall be constructed of extruded aluminum, with bird screen, sizes and model numbers as indicated on plans.

B. Dryer vent caps shall be of aluminum construction with integral backdraft damper.

2.04 ROOF HOOD

A. Manufactured of extruded aluminum complete with roof curb to fit slope of roof and have minimum 12" height.

1. 1/2-inch mesh 16-gauge aluminum bird screen

2. Units shall be factory prime coated to be field painted. Coordinate with General Contractor to field paint; color selected by Architect.

3. Size: Roof vents shall have throat size as shown on the drawings.

4. Dampers: Dampers shall be gravity, counter-balanced, or motorized.

5. Provide 4" wide flashing all around, with cant strip.

6. Approved Manufacturers:

a. Cook

b. Penn Ventilator

c. Greenheck

d. Equals as approved by Architect

B. For Dryers and Residential Type Hoods:

1. PennBarry WC

2. Greenheck GRSR/GRSF

2.05 MISCELLANEOUS

A. Bird Screen: 1/2-inch mesh, constructed of either 0.051-inch aluminum wire or 19-gauge galvanized steel wire.

B. Insect Screen: 14 x 18, 0.009" galvanized steel mesh.

PART 3 EXECUTION

3.01 INSTALLATION

A. The interior of duct connection including opposed blade damper and all visible duct interiors at connection shall be painted matte black.

B. Each air terminal shall be installed with a spun rubber gasket between the flange and the frame or wall.

C. Each air terminal with flexible duct connection shall have a square-to-round transition adapter box.

D. Anchor securely into openings.

E. All air terminals that supply, return, and/or exhaust air, which are not required to have an OBD, shall be provided with a volume damper.

F. Provide round neck to flex duct reducers as required.

G. Provide bird screened openings (1/2" mesh) on all duct openings where indicated and where openings do not have grilles or registers.

H. All outlet and inlets exposed to the weather shall be adequately flashed and installed in a manner to assure complete weatherproofness.

I. Provide blank-off panels on louver portion not connected to a duct. Blank-off panels to be painted flat black.

J. Install louvers level and plumb.

K. Secure louver frames in openings with concealed fasteners.

L. Provide bird screen for all louvers, wall caps, and roof hoods.

M. Provide insect screen where indicated on drawings.

N. Install roof caps in accordance with manufacturer’s recommendations.

O. Provide louvers with motorized dampers on all ductless, through wall relief penetrations unless otherwise noted on the drawings.

END OF SECTION 23 37 00

SECTION 23 51 19

FLUES

PART 1 GENERAL

1.01 SUMMARY

A. Includes But Not Limited To: Furnish and install water heater, furnace and other flues as described in the Contract Documents.

B. Related Sections:

1. General Conditions, Division 01

2. Section 20 00 00 – General Mechanical Requirements

1.02 SUBMITTAL REQUIREMENTS OF THIS SECTION

A. Flues

B. Vent Caps

1.03 OPERATION AND MAINTENANCE REQUIREMENTS OF THIS SECTION

Not Applicable

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

Not Applicable

2.02 FLUES (B-VENT TYPE)

A. Double-wall prefabricated sectional type of construction designed to handle combustion products of fuel being used. Provide with inspection cap as required by local code, roof flashing and cleanout.

1. Height of flue above roof shall be as shown on drawings unless local code requires it to be higher.

2. Size and install flues from equipment according to local codes, except as follows:

a. No vertical flue shall have an area of less than 12-1/2 sq. inches (4 inches round).

b. In no case shall vent connector from furnace be smaller than outlet collar provided by manufacturer.

3. Every portion of flue connector shall have a rise of 1-inch per foot minimum from appliance to vertical flue.

4. Length of horizontal flues or flue connectors shall not be longer than 75% of height of vertical flue between point at which horizontal flue enters vertical flue to top of vertical flue. In no case shall horizontal run exceed 15 feet.

5. When two or more flue connections enter common vertical flue, smaller flue connector shall enter at a higher level. Do not enter flue connectors in same horizontal plane.

6. For hot water tanks and furnaces flue shall be constructed of aluminum.

7. For boiler stacks, inner liner shall be stainless steel; outer jacket shall be aluminized steel; provide with exit cone.

8. For boiler stacks, install a thermometer "Terice" B85600, 0 to 1000□F, 6-inch diameter, bi-metal type. Mount with tapped flange to fit radius of flue.

B. Approved Manufacturers:

1. Ameri-vent

2. Dura-vent

3. Selkirk/Metalbestos

4. Metal-FAB

2.03 FLUES (CATEGORY III)

A. Double-wall prefabricated sectional type of construction designed to handle combustion products of fuel being used. Provide with inspection cap as required by local code, roof flashing and cleanout.

1. Height of flue above roof shall be as shown on drawings unless local code requires it to be higher.

2. Size and install flues from gas-fired equipment according to local codes, except as follows:

a. No vertical flue shall have an area of less than 12-1/2 sq. inches (4 inches round).

b. In no case shall vent connector from furnace be smaller than outlet collar provided by manufacturer.

3. Every portion of flue connector shall have a rise of 1-inch per foot minimum from appliance of vertical flue.

4. Two or more flue connections are prohibited to enter common vertical flue.

5. For boiler stacks, provide double wall flue pipe with inner wall constructed of 304 stainless steel and an outer wall constructed of aluminized steel. Material shall be as recommended by boiler manufacturer. UL listed as category III flue.

6. For boiler stacks, install a thermometer “Terice” B85600, 0 to 1000°F, 6-inch diameter, bi-metal type. Mount with tapped flange to fit radius of flue.

B. Approved Manufacturers:

1. Selkirk Metalbestos

2. American Metal Products

3. Selkirk/Metalbestos

4. Metal-Fab, Inc.

2.04 FLUES (CATEGORY IV)

A. Double-wall prefabricated sectional type of construction designed to handle combustion products of fuel being used. Provide with inspection cap as required by local code, roof flashing and cleanout.

1. Height of flue above roof shall be as shown on drawings unless local code requires it to be higher.

2. Size and install flues from furnaces according to local codes, except as follows:

a. No vertical flue shall have an area of less than 12-1/2 sq. inches (4 inches round).

b. In no case shall vent connector from furnace be smaller than outlet collar provided by manufacturer.

3. Every portion of flue connector shall have a rise of 1-inch per foot minimum from appliance of vertical flue.

4. Two or more flue connections are prohibited to enter common vertical flue.

5. For boiler stacks, provide double wall flue pipe construction of AL 29-4C stainless steel. Material shall be as recommended by boiler manufacturer. UL listed as category IV flue.

6. For boiler stacks, install a thermometer “Terice” B85600, 0 to 1000°F, 6-inch diameter, bi-metal type. Mount with tapped flange to fit radius of flue.

B. Approved Manufacturers:

1. Selkirk Metalbestos

2. Metal-Fab, Inc.

2.05 VENT CAPS

A. Non-backdraft type for installation on top of flue, aluminum construction.

B. Approved Manufacturers:

1. Ameri-cap

2. Breidert Type L

3. Triangle AFL

4. Acme Mastervent Type MVR

5. Selkirk/Metalbestos

6. Metal-Fab, Inc.

PART 3 EXECUTION

3.01 INSTALLATION

A. Provide flues complete with offsets, elbows, rain caps, expansion devices, cleanout section with door, breeching connectors, flashing and counter flashing, guyed and anchored per manufacturers recommendations.

B. Provide B-vent type flue for all negative or neutral flue gas systems unless specifically called out differently on plans.

C. Provide category III type flue for all positive flue gas systems as required by the gas-fired equipment manufacturer unless specifically called out differently on plans.

D. Provide category IV type flue for all positive flue gas systems as required by the fired equipment manufacturer unless specifically called out differently on plans.

E. For boiler stacks, install barometric dampers provided with boiler.

END OF SECTION 23 51 19

SECTION 23 74 00

PACKAGED ROOFTOP UNITS

PART 1 GENERAL

1.01 SUMMARY

A. Includes, but not limited to, furnishing and installing packaged units as shown on Contract Documents.

B. Related Section(s):

1. General Conditions and Division 01 apply to this Section.

2. Section 20 00 00 - Mechanical General Requirements.

3. Section 23 33 00 - HVAC Specialties.

1.02 QUALITY ASSURANCE

A. Qualifications:

1. Air-Cooled Condensing Unit Section shall be rated according to ARI Standards.

2. Air delivery of units certified in accordance with standard test code for centrifugal fans adopted by AMCA.

3. All units shall be designed for outdoor use.

4. Furnace sections shall be AGA approved.

B. Requirements of Regulatory Agencies: Each unit shall be UL labeled.

1.03 WARRANTY

A. This Contractor shall warrant the systems to be free from defects in material, equipment and workmanship under normal use and service and any time within one (1) year from date of final acceptance, with repair or replacement without cost to the Owner, any material, equipment or workmanship found to be defective. The date of final acceptance shall be recorded on a warranty certificate for each unit. The certificate is to be included in Operation & Maintenance Manual. See Section 20 00 00.

B. All systems and control equipment shall be inspected and serviced or adjusted as required for optimum and satisfactory performance a minimum of four (4) times during the next twelve (12) months after the date of final acceptance. The first inspection shall be made approximately thirty (30) days after final acceptance and the final inspection shall be made during the eleventh month thereafter.

C. At the end of the first year, the Contractor shall present a service contract to the Owner which would cover the following warranty and filter replacement:

D. In addition to the above one-year warranty, all motor compressors furnished under this Contract shall be warranted to be free from defects in material and workmanship under normal use and service for an additional four (4) years.

E. This Contractor shall warrant the heat exchanger to be free from defects in material, equipment, and workmanship for ten (10) years from the date of final acceptance.

1.04 REFERENCES

A. ARI 210/240 - Unitary Air Conditioning and Air-Source Heat Pump Equipment.

B. ARI 270 - Sound Rating of Outdoor Unitary Equipment.

1.05 OPERATION AND MAINTENANCE REQUIREMENTS OF THIS SECTION

Not Applicable

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

A. York

B. AAON

C. Trane

D. Daikin

2.02 MANUFACTURED UNITS

A. General: Units shall be completely factory assembled and tested and fully charged with non-ozone depleting refrigerant. Units shall include the following:

1. Refrigerant Coils
2. Condenser Fans and Motors
3. Interconnected Wiring
4. Prewired Control Panel
5. Filter Section. Also, see Section 23 33 00 HVAC Specialties.
6. Factory installed 100% modulating economizer cycle including motorized dampers and controls. Include barometric relief or powered relief as noted on schedule.
7. Factory installed motorized dampers capable of 100% economizer cooling via EMCS control. Include analog control signal damper actuators. Include barometric relief or powered relief as noted on schedule.
8. Corrosion resistant, all-weather cabinet with down flow through curb configuration.
9. Unit shall have an efficiency rating equal to or better than that scheduled.
10. Cooling units shall be operable down to 35°F outdoor temperature.
11. Heat pump unit shall be operable down to 0°F outdoor temperature.

12. Supplemental Electric Heaters

B. Refrigerant Coils: Constructed of copper tubes with mechanically bonded aluminum plate fins.

C. Cabinets: Galvanized, weatherproof and coated inside and outside with corrosion-resistant paint.

D. Roof Curb: Shall be factory furnished to mate with unit. Curb height not to exceed 14 inches.

E. Refrigerant shall meet the latest EPA requirements.

F. Powered exhaust shall be available on units above 5 tons. The accessory shall assist the barometric relief damper in the economizer in relieving building pressurization.

G. Air-Cooled Condensing Unit Section:

1. Unit shall contain a strainer-dryer.

2. Furnish unit with time delay or cycle protection to prevent short cycling.

H. Compressor:

1. Hermetic or semi-hermetic type mounted on vibration isolators.

2. Equip with crankcase heater.

I. Condenser Fan: Axial flow type propeller fan.

J. Refrigerant Lines: Shall have:

1. Flexible connections.

2. Suction and liquid line service valves.

K. Fan Section:

1. Centrifugal Fan - One or more.

a. Double inlet.

b. Double width forward curved Class I.

c. Constructed and tested in accordance with AMCA requirements.

L. Dampers:

1. Motorized dampers shall be Class IA and have a leakage rate of no more than 4 cfm/sq.ft. at 1.0-inch w.g.

2. Non-motorized dampers shall have a leakage rate of no more than 20 cfm/sq.ft. at 1.0-inch w.g.

PART 3 EXECUTION

3.01 INSTALLATION

A. Provide PVC P-trap on condensate discharge.

END OF SECTION 23 74 00

SECTION 23 81 26

DUCTLESS SPLIT SYSTEMS

PART 1 GENERAL

1.01 GENERAL

A. Includes, but not limited to, furnishing and installing material as described in Contract Documents.

B. Ductless split systems shall be separate from VRF systems.

1.02 RELATED SECTIONS

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

B. Section 20 00 00 - General Mechanical Requirements

C. Section 23 23 00 – Refrigerant Piping System

D. Section 23 33 00 - HVAC Specialties

1.03 QUALITY ASSURANCE

A. Qualifications: Air-cooled condensing section shall be rated according to ARI standards.

B. Requirements of Regulatory Agencies: Each unit shall be UL labeled.

1.04 WARRANTY

A. This Contractor shall warrant the systems to be free from defects in material, equipment and workmanship under normal use and service and any time within one (1) year as defined in Section 20 00 00, with repair or replacement without cost to the Owner, any material, equipment or workmanship found to be defective. The date of final acceptance shall be recorded on a warranty certificate for each unit. The certificate is to be included in Operation & Maintenance Manual.

B. At the end of the first year the contractor shall present a service contract to the owner which would cover the following warranty and filter replacement:

C. In addition to the above one (1) year warranty, all motor compressors furnished under this Contract shall be warranted to be free from defects in material and workmanship under normal use and service for an additional four (4) years.

1.05 REFERENCES

A. ARI 210/240 - Unitary Air-Conditioning and Air-Source Heat Pump Equipment

B. ARI 270 - Sound Rating of Outdoor Unitary Equipment

1.06 SUBMITTAL REQUIREMENTS OF THIS SECTION

A. Outdoor Units

B. Indoor Units

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

A. Mitsubishi

B. Daikin

C. C.L.G

D. Samsung

2.02 MANUFACTURED UNITS

A. Cabinet to be 20-gauge galvanized steel.

B. Fans to be centrifugal type and dynamically balanced.

C. Coil is seamless, copper tubing with aluminum fins mechanically attached.

D. Compressor shall be of the hermetic design.

E. Wall sleeve shall be fully weatherproof for outdoor installation.

F. Refrigerant shall meet the latest EPA requirements.

G. Isolate moving parts from cabinets to reduce noise.

H. Single point electrical connection.

I. Accumulator as required per manufacturer.

J. Unit subbase which includes prewired receptacle, conceals power cord, attaches to wall sleeve, and has leveling legs.

K. Compressor heat shall operate down to 25°F.

2.03 CONTROLS

A. For heat pumps, thermostats to be installed integral to the unit by the equipment manufacturer. Heat pump microprocessor controls shall minimize supplemental electric resistance heat. Compressor heat shall always be first stage. Controls shall indicate the use of supplemental heat with LED indicators. Include all wiring.

PART 3 EXECUTION

3.01 INSTALLATION

A. General: Install units in locations shown on plans and in accordance with manufacturer's instructions.

B. Piping: Provide condensate piping from unit to outdoors.

C. Unit Protection: Units shall be protected during construction to prevent debris from depositing on the unit.

D. Installation of factory provided refrigerant pipe line sets is acceptable where the entire length of refrigerant pipe run is located above a ceiling unexposed to view. Locations where the refrigerant piping crosses through an exposed space (e.g., open to structure or below a ceiling) other than a mechanical, electrical, elevator machine, server, or telecommunications room, shall use piping, per Section 23 23 00.

END OF SECTION 23 81 26

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SECTION 23 82 39

ELECTRIC HEATERS

GENERAL

1.01 SUMMARY

A. Includes but not limited to: Furnishing and installing specified material as described in the Contract Documents.

B. Related Sections:

1. General Conditions and Division 1 apply to this section.

2. Section 20 00 00 – General Mechanical Requirements.

1.02 QUALITY ASSURANCE

A. Units to be UL listed.

B. Shall conform to NEC and NFPA requirements.

1.03 SUBMITTAL REQUIREMENTS OF THIS SECTION

A. Electric Heaters

1.04 OPERATION AND MAINTENANCE REQUIREMENTS OF THIS SECTION

A. Operation and Maintenance Manual

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

Not Applicable

2.02 FAN FORCED WALL HEATERS

A. Provide recess mounting in stud wall and surface mounting in block wall unless otherwise stated on plans.

B. 20-gauge minimum sheet metal casing.

C. Heating element shall be encased in steel finned casting and protected by thermal switch.

D. Fan motor shall be heavy duty enclosed and permanently lubricated.

E. Fan shall be precision balanced and fan motor assembly mounted to be vibration free.

F. Units shall be controlled automatically by integral thermostat when heater is in “ON” position unless otherwise stated on plans.

G. Heater shall have built-in fan delay.

H. Finish shall be baked-on enamel.

I. Bi-metallic limit turns the element off when an over temperature condition occurs. Automatically resets when the normal temperature returns.

J. Approved Manufacturers:

1. Berko
2. King
3. Markel

2.03 DUCT HEATERS

A. Heaters:

1. Eighty (80%) percent nickel, 20% chromium resistance coils insulated by floating ceramic bushings and supported in an aluminized steel frame.
2. Bushing shall be recessed into embossed openings and staked into supporting brackets spaced 3-1/2 inches maximum center to center.
3. Coils shall be machine crimped into stainless steel terminals and insulated with phenolic bushings.
4. Heaters shall be listed by UL for zero clearance to combustible surfaces.
5. Heater casings shall be of flanged type for attachment to external duct flanges and shall be made to accommodate internally insulated ducts with insulation thickness as specified.

B. Furnish disc-type thermal cutouts for primary and secondary protection.

1. Automatic reset primary cutout shall be suitable for scheduled voltage operation.
2. Manual reset secondary cutouts shall be factory wired directly in series with each circuit.
3. Non-reusable thermal links are not acceptable.

C. Voltage, phase and number of heating stages to be furnished are shown on Drawings. Limit step controller to eight (8) steps.

1. Three phase heaters shall have equal, balanced circuits.
2. Circuits shall be rated at 48-amps maximum.
3. Heating elements shall be de-rated to 35-watts per sq. ft. of element surface.
4. Test heaters di-electrically at 2,000 volts before shipments.

D. Each heater shall have following built-in components which shall be wired to terminal blocks for field connections. Internal wiring shall be suitable for 105°C.

1. Mercury contactors shall disconnect circuits.
2. Control transformer shall be dry industrial type, sized to carry full contactor holding coil load. Primary winding to be factory fused.

3. Door mounted unfused disconnect switch, snap acting, industrial type to be built into access door. Hinged, latched disconnect switch and door cover shall lock in closed position when switch is on.

4. Built-in fuses properly sized complete with fuse block.

5. Air-flow switch wired in series with automatic reset thermal cutout.

6. Provide heaters of 100 KW capacity or greater with recycling relay to prevent all steps from simultaneously energizing after power interception.

E. Approved Manufacturers:

1. Indeeco

2. Trane

3. Markel

PART 3 EXECUTION

Not Applicable

END OF SECTION 23 82 39

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SECTION 23 90 00

MECHANICAL DEMOLITION

PART 1 GENERAL

1.01 SUMMARY

A. Includes But Limited To: Demolition and maintaining existing systems.

B. Related Sections: General Conditions, Division 1 and Section 20 00 00 apply to this Section.

1.02 OPERATION AND MAINTENANCE REQUIREMENTS OF THIS SECTION

Not applicable

PART 2 PRODUCTS

Not applicable

PART 3 EXECUTION

3.01 DEMOLITION

A. The Mechanical Contractor shall be responsible for the removal of all existing Mechanical equipment including, but not limited to piping, fixtures, HVAC equipment, ductwork in areas shown on the drawings and indicated thereon.

B. The Mechanical Contractor shall also be responsible for the removal and/or relocation of all Mechanical equipment that will interfere with installation and operation of any new construction indicated or required.

C. Any existing equipment to which modifications are made under this contract shall be painted and labeled in accordance with specifications for new materials.

D. All Mechanical equipment (other than piping) to be removed shall remain the property of and shall be transported, stored, or disposed as directed by the Owner. This will be at no cost to the Owner.

END OF SECTION 23 90 00

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SECTION 26 00 00

ELECTRICAL GENERAL CONDITIONS

PART 1 GENERAL

1.01 GENERAL

A. Conform to the General Conditions, Supplementary Conditions, and related work in other Divisions for all work in Divisions 26, 27, and 28. See Division 01 for sequence of work.

1.02 WORK INCLUDED

A. It is the intention of this division of the specifications and the accompanying drawings to describe and provide for the furnishing, installing, testing and placing in satisfactory and successful operation all equipment, materials, devices, and necessary appurtenances to provide a complete electrical system, together with such other miscellaneous installations and equipment hereinafter specified and/or shown in the plans. The work shall include all materials, appliances and apparatus not specifically mentioned herein or noted on the plans, but which are necessary to make a complete working installation of all electrical systems shown on the plans or described herein. Equipment and devices furnished and installed under other divisions of this specification (or by the Owner) shall be connected under this division. The drawings and specifications are complementary and what is called for in either is binding as if called for in both.

B. By submitting a bid, the Contractor is acknowledging that he has made a thorough examination of the Contract Documents, existing site and building conditions, and has determined that these documents do sufficiently describe the scope of construction work required under this Contract.

1.03 SCOPE OF BASIC BID

A. Included in Divisions 26, 27, and 28 is all work and related items necessary to provide all electrical installations except as specifically excluded. In general, this includes all labor, equipment, tools, etc., to complete the electrical work.

1.04 RELATED WORK

A. Temporary Power and Lighting - See Section 01 51 00

B. Mechanical Control Wiring – See Division 23

C. Cutting and Patching - See Division 01

D. Trenching, backfill and asphalt work – See Division 02.

1.05 STANDARDS AND REGULATIONS

A. The work shall comply with the latest edition of the applicable Standards and Codes of the following:

ASTM	American Society for Testing and Materials
CBM	Certified Ballasts Manufacturers
ETL	Electrical Testing Laboratories
IPCEA	Insulated Power Cable Engineers Associated
NBFU	National Board of Fire Underwriters

NEC	National Electrical Code
---	State Electrical Code
NESC	National Electrical Safety Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
U.L.	Underwriters Laboratories Inc.
WAC	Washington Administrative Code
WSEC	Washington State Energy Code
---	Federal, State and Local Building Codes
---	State Electrical Code

B. If any conflict occurs between Government adopted Code Rules and this specification, the codes are to govern. Nothing in these drawings and specifications shall be construed to permit work not conforming with governing codes. Also, this shall not be construed as relieving the Contractor from complying with any requirements of the plans and specifications which may be in excess of, but not in conflict with, requirements of the Governing Codes.

1.06 PERMITS & FEES

A. The Contractor shall obtain and pay for all licenses, permits, and inspections required by laws, ordinances, and rules governing work specified herein. The Contractor shall arrange for inspection of work by the inspectors and shall give the inspectors all necessary assistance in their work of inspection.

B. The Contractor shall consult with and follow the requirements of the local fire, power, telephone, and television utilities serving the area and shall coordinate the work with them.

C. Utility connection and hook-up charges for power, telephone, and television shall be paid by the Owner directly to the utility. The Electrical Contractor is required to provide any and all coordination necessary to support the utility connection, file for application of service (or assist the Owner in filing for application of service) and coordinate dates for service with the utilities.

D. This project has utilized the electronic plan review submittal process for the applicable jurisdiction. The engineer will make available to the contractor an electronic version of the Approved Plans in PDF format on a USB thumb drive. The contractor shall include in their bid all costs associated with printing the plans, full size and in color, as required by the local Electrical Inspector.

1.07 DEFINITIONS

A. When "provide" is used, it shall be interpreted as "furnishing and installing complete in operating condition".

B. When "drawings" is used, it shall be interpreted as "all Contract Drawings for all disciplines".

C. When "Contractor" is used, it shall be interpreted as the Electrical Contractor.

1.08 INTENT OF DRAWINGS

A. The electrical drawings are intended to serve as working drawings for general layout. The equipment layout is diagrammatic and, unless specifically dimensioned or detailed, does not indicate all fittings, hardware, or appurtenances required for a complete operating installation.

B. Anything shown on the drawings but not covered in the specifications, or anything covered in the specifications but not shown on the drawings, shall be as if covered in both. In case of conflict between the drawings and specifications, the Engineer will select the method to be used. The Contractor shall be responsible for verifying all measurements before proceeding with the work.

C. Wiring diagrams are not intended to indicate the exact course of raceways or exact location of outlets. Raceway and outlet locations are approximately correct and are subject to revision as may be necessary or desirable at the time of installation. Precise location in every case shall be subject to the Engineer's approval.

1.09 PROTECTION

A. The Contractor shall store and guard all equipment before installation and shall protect same, and replace any equipment that has been damaged prior to final acceptance. See Division 01 for detailed requirements.

1.10 HOUSEKEEPING

A. All electrical materials shall be kept stored in an orderly fashion protected from heat, cold, and the weather.

B. All marred surfaces shall be refinished and painted after installation.

C. All debris shall be removed from premises during work, as directed, and at completion of job.

1.11 TEMPORARY USE

A. Temporary or interim use of any and all portions of the electrical system shall be under the supervision of the Electrical Contractor.

B. Temporary power and lighting for use during construction shall be provided per the requirements of the Division 01 specifications.

1.12 AS-BUILT DRAWINGS

A. The Contractor shall maintain, in addition to any reference drawings, an as-built set of prints, on which all deviations from the original design shall be drafted in a neat, legible manner with red colored pencil. This red-lined set shall identify all drawing revisions including addenda items, change orders, and Contractor revisions. The Contractor is responsible to revise panel schedules and load calculations as required.

B. Drawings shall show locations of all concealed raceway runs larger than 1", giving the number of conductors and size of raceway. Underground ducts shall be shown with cross section elevations. All pipe, raceway, manholes or lines of other trades shall be included.

C. The Contractor shall update all references to specific products to indicate products actually installed on project. This shall include, but not be limited to, lighting fixtures, baseboard heaters, etc.

D. Upon completion of the Division 26 work, the Contractor shall deliver the red-lined drawings and one set of neatly drafted as-built drawings on electronic media in AutoCAD R-2013 format and full-size PDF to the Engineer for transmittal through the Engineer to the Owner.

E. See Section 27 00 00 for additional requirements of low voltage systems.

1.13 WARRANTY

A. Provide a written warranty that the Division 26, 27, and 28 work is free from mechanical and electrical defects. Contractor shall replace and repair, to the satisfaction of the Engineer, any parts of the installation which may fail within a period of 12 months after the date of substantial completion, provided that such failure is due to defects in material or workmanship, or failure to follow the specifications and drawings.

B. See Section 27 00 00 for additional requirements of low voltage systems.

1.14 INSTRUCTIONS AND MANUALS

A. Operation and maintenance data shall be submitted in accordance with Section 01 78 23.

B. Manuals shall contain shop drawings, wiring diagrams, operating and maintenance instructions, replacement parts lists, and equipment nameplate data for all equipment and systems installed under the project. Signal equipment submittals shall contain step-by-step circuit description information designed to acquaint maintenance personnel with equipment operation in each mode of operation. Manuals shall contain original brochures supplied by manufacturers. Copies of originals will not be accepted.

C. Each type of device provided shall be identified in the O & M Manual using the same identification as shown on the drawings and specifications. The information included must be the exact equipment installed, not the complete "line" of the manufacturer. I Installed equipment shall be neatly and clearly identified on sheets where both installed equipment and other equipment are shown. Parts lists shall give full ordering information assigned by the original parts manufacturer. Relabeled and/or renumbered parts information as reassigned by equipment supplier are not acceptable. The following information shall be provided for each device:

1. Manufacturer’s name, address, and phone number.
2. Local supplier's name, address, and phone number.
3. Complete parts lists including quantities and manufacturer's part numbers.
4. Installation instructions.
5. Recommended maintenance items including maintenance procedure and recommended interval of maintenance listed in hours of operation, calendar unit or other similar time unit.

D. The O & M Manual shall be assembled as detailed in Section 01 70 00. As a minimum, the following sections shall be broken out:

1. Light Fixtures
2. Panelboards, Switchgear, and Transformers
3. Motor Controls
4. Fire Alarm System
5. Intrusion Alarm
6. Access Control System

7. CCTV
8. Intercom/Clock/Program
9. Telecommunication System
10. Television System
11. Audio/Visual Presentation Systems
12. Sound Systems
13. Low Voltage Lighting Control Systems
14. Surge Protection Device (SPD)
15. Data Network
16. Generator & ATS
17. Uninterruptible Power Supply System
18. Electrical System Protective Device Study
19. Ground Fault Testing Results

E. Wiring Diagrams for each system shall be complete for the specific system installed under the Contract. "Typical" line diagrams will not be acceptable unless properly marked to indicate the exact field installation.

1.15 WORK NOT INCLUDED

A. Indicated motors, controls, and equipment as described in other divisions shall be furnished by other trades, but shall be moved, set, and wired to electrical controls and power supply by the Electrical Contractor.

B. Work to be included under this Contract shall be defined on drawings and in these specifications. Any details beyond these limits are meant only to give installation clarity to that portion which is a part of this Contract.

1.16 INSTRUCTION PERIODS

A. Upon completion of the work and after all tests and final inspection of the work by the authority(ies) having jurisdiction, the Contractor shall demonstrate and instruct the Owner's designated operation and maintenance personnel in the operation and maintenance of the various electrical systems. The Contractor shall arrange scheduled instruction periods with the Owner. The Contractor's representatives shall be superintendents or foremen knowledgeable in each system and suppliers' representatives when so specified.

B. Scheduled Instruction periods shall be:

1.	Access Control System	1/2 day
2.	CCTV System	1/2 day

3.	Data Network	1/2 day
4.	Daylighting Control Systems	1/2 day
5.	Fire Alarm System	1/2 day
6.	Generator Systems	1/2 day
7.	Intercom/Clock/Program System	1/2 day
8.	Low Voltage Lighting Control Systems	1/2 day
9.	Security System	1/2 day
10.	Sound Systems	1/2 day
11.	Television System	1/2 day
12.	Uninterruptible Power Supply System	1/2 day

C. Costs for time involved by Contractor shall be included in the bid.

1.17 COMPLETION OF WORK

A. Upon completion of the Division 26, 27, and 28 work, the Contractor shall comply with requirements of Section 01 70 00 for project closeout.

B. Arrange for and obtain all required inspections and certificates pertaining to the Division 26, 27, and 28 work and deliver the certificates to the Engineer in triplicate.

C. Prior to or at the time of final inspection, the Contractor shall, as outlined in detail in the specifications, complete the delivery of all the following items:

1.	Completion Letter	
2.	Certificate of Final Inspection. Electrical Inspector Fire Department	COMPLETION OF WORK - 26 00 00 – 1.17
3.	Warranty to Owner (with copy for Engineer)	SUPPLEMENTARY GENERAL CONDITIONS – 26 00 00 – 1.13
4.	Marked Set of As-Built Electrical Drawings	GENERAL AS-BUILT DRAWINGS 26 00 00 – 1.12
5.	Marked Set, Electronic Media Set on Solid-State Drive-in AutoCAD R-2013 Format, and full-size PDF of As-Built Electrical Drawings	GENERAL AS-BUILT DRAWINGS 26 00 00 – 1.12
6.	Certificate of Completion and Document Requirements for Protective Device Study	ELECTRICAL SYSTEM PROTECTIVE DEVICE STUDY – 26 05 73
7.	Motor Current Readings	GENERAL, TESTS – 26 05 19 – 3.03(D)

8.	Phase Current Readings	GENERAL, TESTS – 26 05 19 – 3.03(E)
9.	OHMIC Test Readings	GENERAL, TESTS – 26 05 19 – 3.03(B)
10.	Ground Fault Settings	
11.	Panelboard and Special Equipment Shop Drawings and Final Approved List of Materials Installed	MATERIALS, GENERAL – 26 00 00 – 2.03
12.	Certificate of Feeders Torque Results	WIRES AND CABLES – 26 05 19
13.	* Receipt from person to whom delivered the following spare glasses, plastic diffusers, lamps, and ballast fuses.	LIGHTING FIXTURES – 26 50 00
14.	* Receipt from person to whom delivered the following: Spare Elements for Fire Detectors, Fuses for Switches, Spare Keys for Panelboards, receptacles switches, plugs, etc.	LOW VOLTAGE – 27 00 00 FIRE ALARM – 28 31 00 FUSES – 26 28 13 PANELBOARDS – 26 24 16 SWITCHES & RECEPTACLES – 26 27 26
15.	Wiring diagrams, Maintenance Manuals, Operation Instructions, and Brochures (5 sets minimum)	GENERAL, INSTRUCTIONS & MANUALS – 26 00 00 – 1.14

* Secure delivery instructions from Architect for delivery to Owner.

1.18 SHOP DRAWING SUBMITTALS

A. This Contractor shall submit to the Architect as described in Section 01 60 00. When shop drawings are submitted electronically, they shall be submitted as described in Paragraph B below.

B. The Contractor shall submit to the Architect electronic shop drawings in PDF format. Electronic Shop Drawings that are submitted without following the format as outlined below will be returned for corrections without any further review.

1. A separate PDF file shall be submitted for each Division including All submittal items for that Division as outlined below:

   a. Division 25 – Integrated Automation

   b. Division 26 – Electrical

   c. Division 27 – Telecommunications

   d. Division 28 – Electronic Safety and Security

2. The contractor shall provide either a digital or hardware method of transporting the electronic submittal to the Architect. Files larger than 10Megabytes shall not be sent via email and shall be transferred via a file transfer protocol, PC compatible CD or PC compatible thumb drive. Divisions shall not be broken up into separate files for transfer via email.

3. Each Specification PDF shall be submitted with the following format and salient attributes:

    a. Cover page including:

        1) Project Title as indicated on the plans

        2) Project Location including address, city, state, country

        3) Prime Contractor name, phone number, and email address

        4) Sub-Contractor name, phone number, and email address

        5) Specification Division number and title

    b. Index Page outlining each specification section included in the submittal. This list shall be linked to a corresponding Specification Section Divider for each section. This link shall enable the reviewer to jump to a specification section by clicking the item in the list.

    c. Specification Section Divider: Shop Drawings shall be divided by specification section and each section shall begin with a divider page outlining the Specification number, title, and a list of submittal items for the section. In the upper right-hand corner of the divider page, a link shall be provided returning the reviewer to the Index Page.

    d. Each Submittal Item listed on the Specification Section Divider shall be linked to the specific item being submitted. Each Submittal Item shall be highlighted yellow with a note reference to the specific paragraph giving the submittal requirements.

    e. Each page of the submittal shall be numbered in the bottom right corner of the page. Page numbering shall be Roman numerals for all pages before the First Specification Section. Each Specification Section page shall be numbered with the Specification Section number, a dash, and the page number in the Section.

    f. Specification items shall be specifically highlighted as they apply to the project rather than highlighting an entire product family. Items that do not apply to this project shall be crossed out with a red “X”.

    g. The PDF file shall not be protected to prevent printing, selecting of text within the document, or extracting of pages from the document.

C. Shop drawings shall be submitted complete, at one time, and with each item indexed with dividers and separated per specification section and shall include, at a minimum, the items of equipment listed below:

1. All panelboards, showing breaker arrangement with circuit numbers, relays, and panel skirts.

2. Motor starters and controls designating where items are intended to be used and equipment being controlled.

3. Transformers (Dry Type)

4. Surge Protection Device

5. Disconnect Switches

6. Fuses and spare fuse cabinet
7. Electrical System Protective Device Study
8. Lighting Fixtures (Complete)
9. Low Voltage Lighting Control Systems
10. Wiring Devices
11. Back Boxes
12. Coverplates
13. Raceways and Connectors
14. Fire Wall Penetration Seals
15. Cable Tray
16. Copper Wire
17. Aluminum Wire
18. *Fire Alarm System
19. *Security System
20. *CCTV
21. *Access Control System
22. *Telecommunication System
23. *Intercommunication/Clock/Program System
24. *Sound Systems
25. *Audio/Visual Presentation Systems
26. *Data Network Systems
27. Automatic Transfer Switches
28. Generator System
29. **All Specialty Systems not listed above**
30. Any other items requested by Engineer.

* See Section 27 00 00 for further requirements.

D. Within ten (10) working days after the date of the letter rejecting any items of equipment, lighting fixtures, or materials as not in accordance with the specifications, the Contractor shall submit a new list of items to furnish and install in place of those items rejected. If the Contractor fails to submit this new list within the above specified time, or if any items on this second list are rejected as not being in accordance with these specifications, the Engineer may select the items which the Contractor shall furnish and install without change in Contract price or time of completion.

E. The acceptance of a manufacturer's name or product by the Engineer does not relieve the Contractor of the responsibility for providing materials and equipment which comply in all details with the requirements of the Contract Documents. The Contractor shall be solely responsible for submitting materials at such a time to allow a minimum of two weeks for Engineer's review.

F. Electrical Drawings for the project have been developed by the Engineer using AutoCAD Revision 2013 software or newer. These drawing files will be made available to the Contractor for development of shop drawings and/or As-Builts with a signed waiver of responsibility.

1.19 SCHEDULE OF VALUES

A. Provide Schedule of Values per Division 01 and related project requirements.

B. Divisions 26, 27, and 28 Breakdown: Provide schedule of values for the following categories (as a minimum):

1. Electrical Mobilization
2. Electrical Submittals
3. Electrical General Project Management, General Design, General Coordination
4. Branch Circuit Materials Rough-in
5. Branch Circuit Materials Rough in – Labor
6. Branch Circuit Trim – Materials
7. Branch Circuit Trim – Labor
8. Service Materials
9. Service Materials – Labor
10. Feeder Materials
11. Feeder Materials - Labor
12. Panelgear, Disconnects, Starters
13. Panelgear, Disconnects, Starters – Labor
14. Light Fixtures
15. Light Fixtures – Labor

16. *Intercom/Clock System
17. *Distributed Audio-Video Communication System
18. *Sound Systems – Break out per space
19. *Fire Alarm/Emergency Communication System
20. *Security System
21. *Data System
22. Generator and Transfer Switches
23. Electrical System Protective Device Study
24. Commissioning
25. Electrical Punchlist, Closeout, and Owner Training

* Provide engineering/shop drawings, material, and labor for each system. Engineering/shop drawings shall be 10% of the labor and material value.

C. The dollar value for "Electrical Punchlist, Closeout, and Owner Training" shall in no case be less than 2% of the total dollar value of the Division 26, 27, and 28 work (or as indicated in Division 01, whichever is higher).

D. The Contractor is advised that in addition to payments held out for retainage and project final completion (i.e. "Electrical Punchlist, Closeout, and Owner Training"), as specified above and in Division 01, the Owner reserves the right to withhold 10% of the funds for any of the above categories until the systems (of that category) have been proven to operate as specified and have been completely tested and adjusted.

PART 2 PRODUCTS

2.01 COMPETITIVE PRODUCTS

A. Any reference in the specifications to any article, device, product, material, fixture, form, or type of construction by name, make, or catalog number shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition. The Contractor, in such cases, may use any article, device, product, material, fixture, form, or type of construction which in the judgment of the Engineer, expressed in writing, is equal to that specified. However, any manufacturer not listed as an accepted bidder for a specific item must be submitted for acceptance in writing in accordance with Section 01 60 00.

2.02 MANUFACTURER/EQUIPMENT PRIOR APPROVALS

A. Any manufacturer/equipment not listed as an approved substitute for a specified item must be submitted for acceptance in accordance with Section 01 60 00, in writing, with detailed information to include:

1. Manufacturer's Catalog Data
2. Complete Physical and Technical Data
3. Wiring Diagrams

4. Detailed reference (written or highlighted) noting compliance with the appropriate Specification Section and all applicable Specification item numbers within that Section

5. Complete type written index cross referencing all proposed substitutes and specified items

6. Detailed reference to specified items (written or highlighted) noting equal quality and performance of proposed substitute equipment

7. Other descriptive data, as required by the Engineer

B. If substitute material is determined to be acceptable by the Engineer, it will be included in a subsequent Addenda prior to bidding. The acceptance of a manufacturer's name or product by the Engineer does not relieve the Contractor of the responsibility for providing materials and equipment which comply in all details with the requirements of the Contract Documents.

C. Only materials which are specified or published in addenda as acceptable shall be used.

2.03 MATERIALS

A. All materials must be of the quality herein specified. All materials shall be new, of the best quality, and free from defects. They shall be designed to ensure satisfactory operation and operational life in the environmental conditions which will prevail where they are being installed.

B. Each type of material shall be of the same make and quality. The materials furnished shall be standard products of the manufacturers regularly engaged in the production of such equipment and shall be the manufacturer's latest standard design.

C. All materials shall be U.L. or E.T.L. listed for the purpose for which they are used.

D. Equipment in compliance with U.L. standards but not bearing their label is not acceptable. If the manufacturer cannot arrange for labeling of an assembled unit at the factory the unit shall be field evaluated per the Washington State Administrative Code (WAC) and the electrical inspector's requirements.

2.04 COMPLETE SYSTEM

A. All the systems mentioned shall be complete and operational in every detail except where specifically noted otherwise. Mention of certain materials in these specifications shall not be construed as releasing the Contractor from furnishing such additional materials and performing all labor required to provide a complete and operable system.

2.05 NAMEPLATES

A. Provide nameplates constructed of plastic (black on white) laminated material engraved through black surface material to white sublayer (attach with screws on NEMA 1 enclosures). EXCEPTION (1): Emergency distribution system component labeling - white letters on red background. Exception (2): Series rated systems shall be yellow background with white letters.

1. Service Entrance Label: Refer to Section 26 24 13.

2. Panelboard Labels: Refer to Section 26 24 16.

3. Switch and Receptacle Labels: Refer to Section 26 27 26.

4. Motor Starter and Disconnect Labels: Refer to Section 26 28 16.

5. Special Equipment/Outlet Labels: Refer to Appropriate Sections.

6. Under 600 Volt Feeder Tags: Refer to Section 26 05 19.

PART 3 EXECUTION

3.01 GENERAL

A. Careful consideration shall be given to clearances under and over beams, pipes and ducts, to provide proper headroom in all cases. Check drawings to determine heights of all suspended ceilings and size of pipe shafts where raceway and wire-ways shall run. Coordinate installation of Divisions 26, 27, and 28 wiring and equipment with Division 23 and other trades. Where insufficient room for proper installation appears, obtain clarification from Engineer before any installation begins.

B. Cutting and Patching:

1. Obtain permission from the Architect and/or Owner's Representative prior to cutting. Locate cuttings so they will not weaken structural components. Cut carefully and only the minimum amount necessary. Cut concrete with diamond core drills except where space limitations prevent the use of such drills.

2. All construction materials damaged or cut into during the installation of this work must be repaired or replaced with materials of like kind and quality as original materials by skilled labor experienced in that particular building trade.

3.02 COORDINATION

A. The Contractor is responsible for accomplishing work contained within Divisions 26, 27, and 28. The work shall coordinate with that of the other Contractors and/or other trades doing work in the building. The contractor shall examine all drawings, including the several divisions of mechanical, structural, civil and architectural, for construction details and necessary coordination. Specific locations of construction features and equipment shall be obtained from the Contract Documents, field measurements, and/or from the trade providing the material or equipment. No extra costs will be allowed for failure to obtain this information.

B. All conflicts shall be reported to the Engineer in writing before installation for decision and correction. Special attention is called to the following items:

1. Door swings to the end that switches will be located on "Strike" side of the door.

2. Location of grilles, pipes, sprinkler heads, ducts, and other mechanical equipment so that all electrical outlets, lighting fixtures, and other electrical outlets and equipment are clear from and in proper relation to these items.

3. Location of cabinets, counters, and doors so that electrical outlets, lighting fixtures, and equipment are clear from and in proper relation to these items.

4. Type and height of ceiling.

5. All device measurements referenced on drawings or specifications are to be centered of device unless noted otherwise.

C. The Contractor will not be paid for work requiring reinstallation due to lack of coordination or interference with other Contractors or trades. This includes, but is not limited to, removing, replacing, relocating, cutting, patching, and finishing.

D. The Contractor shall review the installation manual for each device to be installed. If a conflict appears to occur between the manufacturer's recommended installation practices and the plans or specifications, notify the Engineer immediately. Final determination shall be by the Engineer. The Contractor will not be paid for reinstallation due to failure to comply with manufacturer instructions or design documents.

E. Device and fixture locations may be changed within 15 feet without extra charge if so desired by the Engineer, before installation.

3.03 REQUESTS FOR INFORMATION (RFI)

A. It is our intent to provide a timely response for RFIs regarding Division 26, 27, and 28 Work. To further expedite this process, where a suggestion can be determined or derived at by the initiator of the RFI, it is required this suggestion be supplied with the submitted RFI. If no suggestion is given where one is possible, the RFI will be returned as incomplete.

3.04 CLEANING AND PAINTING

A. All equipment, whether exposed to the weather or stored indoors shall be covered to protect it from water, dust and dirt.

B. After installing, all metal finishes shall be cleaned and polished, cleaned of all dirt, rust, cement, plaster, grease, and paint.

C. All equipment with a primer coat of paint shall be given two (2) or more coats of a finish enamel and scratched surfaces be refinished to look like new. Markings, identification, and nameplates shall be replaced.

3.05 EQUIPMENT IDENTIFICATION

A. Provide identifying engraved Bakelite nameplate on all equipment, including pull boxes, to clearly indicate its use, area served, circuit identification, voltage, and any other useful data.

B. Each auxiliary system, including communications, shall be clearly labeled to indicate its function.

3.06 DEVIATION

A. Deviation from the shop drawings in construction or installation of equipment shall not be made unless Shop Drawings showing proposed deviations are submitted to and approved by the Engineer. If any equipment is furnished under this or other divisions with current, voltage, or phase ratings that differ from those shown on the drawings, the Contractor shall notify the Engineer in writing immediately and shall not connect said equipment until instructed as to required changes by the Architect. No extension of time will be granted as a result of such changes.

3.07 EXCAVATIONS

A. All excavations are to be conducted so that no walls or footings shall be disturbed in any way.

B. Remove all surplus earth not needed for backfilling and dispose of same as directed.

3.08 WIRING METHODS

A. All low voltage wiring shall be in raceway with junction boxes and fittings where concealed in walls, in inaccessible ceiling space, or where exposed in finished or unfinished areas.

B. Provide conduit sleeves through all walls to accommodate all low voltage cabling. Conduit sleeves shall be sized to allow for 40% future spare capacity.

C. All branch circuit wiring shall be installed in raceway with junction boxes and fittings.

D. Provide access panels as needed for pull boxes and equipment located above ceiling or behind walls.

E. All emergency systems outlet and junction boxes shall have a red plastic tag inside marked critical or life safety as applicable.

F. Multiple feeder runs shall be rod hung, using a strut type channel with individual one-hole clamps, back plates, and machine screws.

G. Any low voltage cables that are not terminated at both ends shall be tagged and labeled per code.

H. See Section 27 00 00 for additional requirements of low voltage systems.

3.09 PENETRATIONS OF FIRE RATED ELEMENTS

A. Penetrations of fire rated elements must be made such as to retain that rating. See architectural sheets for specific fire rated locations.

3.10 HANGERS AND SUPPORTS

A. Provide hangers, brackets, and suspension rods and supplementary steel to support equipment.

B. Hangers provided under other divisions shall not be used for support of Division 26, 27, or 28 equipment unless permitted by Architect/Engineer.

3.11 CHASES AND OPENINGS

A. Provide to the masonry and concrete trades all templates and details of chases, openings in floors, and walls as required for Division 26, 27, and equipment installation.

3.12 PAINTING

A. Painting in general will be covered under another division of this specification, except items furnished under Divisions 26, 27, and 28 that are scratched or marred in shipment or installation and shall be refinished by the Division 26 Contractor.

3.13 WORKMANSHIP AND OBSERVATION

A. Workmanship shall be of the best quality and none but competent workers shall be employed under the supervision of a competent foreman. All completed work shall represent a neat, professional appearance.

B. All work and materials shall be subject to observation at any and all times by representatives of the Engineer.

3.14 MISCELLANEOUS

A. Provide complete seismic anchorage and bracing for the lateral and vertical support of conduit and electrical equipment, as required by the International Building Code.

B. Conduits that cross seismic separations shall be installed with flexible connection suitable to accommodate conditions. Secure raceways on each side of a separation and provide a minimum of 36” length of flexible conduit to span separation.

3.15 CABLE AND WIRING ROUTED UNDERGROUND OR UNDERSLAB

A. All cables and conductors, both line voltage and low voltage, routed underground or underslab shall be U.L. listed for installation in wet locations per NEC and WAC codes.

END OF SECTION 26 00 00

SECTION 26 00 10

EXCAVATION AND BACKFILL FOR ELECTRICAL UNDERGROUND UTILITIES

PART 1 GENERAL

1.01 GENERAL INCLUDES

A. Excavation and Associated Grading

B. Trenching and Trench Protection

C. Backfilling and Compaction

D. Verification of Existing Utilities

E. Protection of Utilities

1.02 RELATED SECTIONS

A. Section 26 00 00 – Electrical General Conditions

B. Section 26 05 33 – Raceways

C. Section 26 50 00 – Lighting

D. Section 27 00 00 – Low Voltage System General Requirements

E. Section 27 20 00 – Data and Voice Infrastructure

F. Section 28 16 00 – Intrusion Alarm System

G. Section 28 31 00 – Fire Alarm System

1.03 QUALITY ASSURANCE

A. Inspection of Job Conditions: Prior to starting work and during work, the installer shall examine the work by others, and shall evaluate site and job conditions under which excavation, trenching, and backfilling for underground utilities work will be performed, and notify the General Contractor in writing of unsatisfactory conditions or work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

B. Codes and Standards: Comply with requirements of the following codes and standards (Latest Edition) except as modified herein:

1. International Conference of Building Officials, "International Building Code".

2. Local requirements for all utility work.

3. OSHA and WISHA regulations.

4. APWA Standard Specifications.

5. National Electrical Code – NFPA 70.

1.04 RESPONSIBILITY

A. The Contractor is solely responsible for compliance with the requirements of the drawings, specifications, local codes and standards, proper construction coordination with work of other trades, and protection and worker's safety. Contractor shall advise Engineer of any discrepancy in, or disagreement with the specifications and/or drawings prior to starting work and not proceed until issue is resolved. Commencement of work shall indicate Contractor's acknowledgement of his expertise in this type of work. Any delay resulting from failure to comply with this procedure will not be basis for an extension of the completion date.

1.05 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced.

B. American Society of Testing and Materials (ASTM) Publications:

1. D 422-63 Particle Size Analysis of Soils.
2. D 423-66 Liquid Limit of Soils.
3. D 424-59 Plastic Limit and Plasticity Index of Soils.
4. D 1557-78 Moisture Density Relations of Soils using a 10 lb. (4.54kg) Rammer and 18 inches (457 mm) Drop.
5. D 2167-66 Density of Soil In-Place by the Rubber Balloon Method.
6. D 2217-66 Wet preparation of Soil Samples for Particle-Size Analysis and Determination of Soil Contents.
7. D 2487-69 Classification of Soils for Engineering Purposes.
8. D 2922-81 Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
9. E 548-79 Generic Criteria for Use in the Evaluation of Testing and Inspection Agencies.

PART 2 MATERIALS

2.01 SATISFACTORY MATERIALS

A. Materials classified as ASTM D2487, Unified Soil Classification System as SW, SP, GW, and GP are satisfactory for backfill use. Materials classified as SP-SM, GP-GM, GM, GC and ML are also satisfactory for backfill use provided that they contain moisture contents suitable for the intended use and are reasonably free of organic matter. Native material, not considered unsatisfactory as specified below, may comply. Except that no material shall have any object with a dimension exceeding 2 inches and no object shall be sharply angular.

2.02 UNSATISFACTORY MATERIALS

A. Materials classified in ASTM D2487, Unified Soil Classification System as PT, OH, and OL are unsatisfactory. Unsatisfactory materials also include man-made fills, refuse and all materials containing excessive organic matter or having moisture contents which are not suitable for the intended use, or having objects with dimensions exceeding 2 inches (boulders, etc.).

2.03 UNSTABLE MATERIAL

A. Unstable material shall consist of material too wet to properly support the utility conduit or appurtenance structure, and material identified as unsuitable in the National Electrical Code 300.5(F).

2.04 GRAVELLY SAND BORROW MATERIAL

A. Gravelly sand borrow material to provide backfill, or replace unsuitable soil, shall meet the requirements of SW, SP, GW, and GP materials, except that the maximum percentage passing the No. 200 sieve shall not exceed 5% based on the soil fraction passing the U.S. No. 4 sieve, and not contain discrete particles greater than 2 inches in diameter.

2.05 DEGREE OF COMPACTION

A. Degree of compaction shall be expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D1557; Method D. Minimum compaction requirements shall be as specified in PART 3.

2.06 DRAINAGE GRAVEL

A. Shall be 3/4-inch washed gravel with no more than 2% passing 1/2-inch sieve opening.

2.07 SPECIAL BEDDING AND INITIAL BACKFILL MATERIAL

A. Minus 3/8-inch washed pea gravel.

PART 3 EXECUTION

3.01 EXCAVATION

A. If workers enter any trench or other excavation four or more feet in depth that does not meet the open pit requirements of WSDOT Section 2.09.3(3)B, it shall be shored and cribbed. The Contractor alone shall be responsible for worker safety. All trench safety systems shall meet the requirements of the Washington Industrial Safety and Health Act, Chapter 49.17 RCW.

B. Excavation of every description and of whatever substances encountered shall be performed to allow the installation of all utilities at the lines and grades as required. During excavation, material satisfactory for backfilling shall be stockpiled in an orderly manner at a distance from the banks of the trench sufficient to avoid overloading and to prevent slides or cave-ins. Adequate drainage shall be provided for the stockpiles and surrounding areas by means of ditches, dikes, or other approved methods. The stockpiles shall also be protected from contamination with unsatisfactory excavated material or other material that may destroy the quality and fitness of the suitable stockpiled material.

C. If the Contractor fails to protect the stockpiles and any material becomes unsatisfactory as a result, such material shall be removed and replaced with satisfactory on-site or imported material from approved sources at no additional cost to the Owner.

D. Excavated material not required or not satisfactory for backfill shall be removed from the site and shall be disposed of off site, at the Contractor's expense, at the Contractor's waste area. Any excess satisfactory excavated materials shall not be mixed with unsatisfactory materials. Unsatisfactory materials shall not cover available suitable materials or be disposed of in such a manner as to interfere with subsequent borrow operations.

E. Grading shall be done as may be necessary to prevent surface water from flowing into the excavation, and any water accumulating therein shall be removed so that the stability of the bottom and sides of the excavation is maintained. Unauthorized over-excavation shall be backfilled in accordance with paragraph 3.05 BACKFILLING at no additional cost to the Owner.

F. The Contractor shall provide dewatering as required for installation of underground work.

3.02 TRENCH EXCAVATION

A. The trench excavation shall meet the requirements of the National Electrical Code and local utility standards.

B. Bottom Preparation: The bottoms of trenches shall be accurately graded to provide uniform bearing and support for the bottom quadrant of each section of the conduit and for bedding. Stones of 2 inches or greater in any dimension, or as recommended by the conduit manufacturer, whichever is smaller, shall be removed to avoid point bearing.

C. Removal of Unsuitable Material: Where unsuitable material is encountered in the bottom of the trench, such material shall be removed to the depth directed and replaced to the proper grade with select granular material as provided in paragraph 3.05 BACKFILLING. When removal of unsuitable material is required due to the fault or neglect of the Contractor in his performance of the work, the resulting material shall be excavated and replaced by the Contractor without additional cost to the Owner.

D. Bedding: The bedding surface for the conduit shall provide a firm foundation of uniform density throughout the entire length of the conduit. The conduit shall be bedded carefully in a soil foundation accurately shaped and rounded to conform to the lowest one-fourth of the outside portion of circular conduit or to the lower curved portion of conduit arch for the entire length of pipe or arch. When necessary, the bedding shall be taped. Provide bedding using pea gravel, where noted on the drawings.

3.03 EXCAVATION FOR APPURTENANCES

A. Excavation for manholes, handholes or similar structures below grade shall be sufficient to leave at least 12 inches clear between the outer structure surfaces and the face of the excavation or support members. When concrete or masonry is to be placed in an excavated area, special care shall be taken not to disturb the bottom of the excavation. Excavation to the final grade level shall not be made until just before the concrete or masonry is to be placed.

3.04 JACKING, BORING, AND TUNNELING

A. Unless otherwise indicated, excavation shall be by open cut, except that sections of a trench may be jacked, bored, or tunneled if the raceway, cable or duct can be safely and properly installed and backfill can be properly tamped in such sections.

3.05 BACKFILLING

A. Backfill material shall be compacted to 6" layers and as specified in Paragraph 3.06-Compaction.

1. Trench Backfill: Trenches shall be backfilled to finish grade.

2. Replacement of Unstable Material: Unstable material removed from the bottom of the trench of excavation shall be replaced with select granular material or gravel borrow placed in layers not exceeding 6 inches loose thickness.

3. Bedding and Initial Backfill: Bedding shall consist of satisfactory materials. Initial backfill shall be in 6-inch lift.

3.06 COMPACTION

A. Each layer of fill, or the excavated subgrade, shall be compacted to at least 95%, per ASTM D1557, of laboratory maximum density. Compaction shall be accomplished by approved tamping rollers, pneumatic-tired rollers, three-wheel power rollers, or other approved compaction equipment.

3.07 PROTECTION

A. Newly graded excavated or bedded areas shall be protected from traffic and from erosion, and any settlement or washing away that may occur from any cause, prior to acceptance, shall be repaired and grades reestablished to the required elevations and slopes.

END OF SECTION 26 00 10

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SECTION 26 05 19

WIRES AND CABLES

PART 1 GENERAL

1.01 WORK INCLUDED

A. Provide all wire, cable, and terminations complete.

1.02 RELATED DOCUMENTS

A. Section 26 00 00 – Electrical General Conditions

PART 2 PRODUCTS

2.01 WIRE AND CABLE (COPPER, 600-VOLT)

A. Interior and Above Grade: All wires to be Type THW or RHW. Type THWN/THHN or XHHW wire may be utilized at Contractor's option, subject to Code requirements. All wire and cables shall be brought to the project in original containers bearing the Underwriters' label. Type UF cable may be utilized concealed in storefront, curtain wall, or similar applications, where routing of MC cable in the mullion is not possible without subjecting it to damage. Provide Type AVA wire where conductors are subject to temperatures above 167 °F.

B. Underground: All conductors to be type USE. Increase Raceway size when necessary to accommodate conductors per code. Exception: Underground conductors completely contained in code recognized Raceway and boxes may be Type THW, THWN or XHHW.

2.02 WIRE AND CABLE (ALUMINUM, 600-VOLT)

A. May be used at Contractor's option (except for ground cable) subject to the following requirements:

1. Increased size for same current capacity (increased raceway size may be necessary).
2. No aluminum conductors smaller than #4 AWG shall be used.
3. Insulation requirements are the same as for copper conductor wires and cables.
4. Aluminum conductors shall be made of an AA-8000 series electrical grade aluminum alloy conductor material.

2.03 SPLICES

A. Above Grade: Solderless type only. Preinsulated "twist-on" type (limited to size #10 and smaller). Bolt on compression type with application of preformed insulated cover, heat shrinkable tubing or plastic insulated tape acceptable for all sizes.

B. Below Grade: Splices below grade shall be in handholes and shall be made watertight with epoxy resin type splicing kits similar to Scotchcast.

2.04 TERMINATIONS

A. Compression set, bolted or screw terminal.

B. Conductors #12 and smaller shall utilize eye or forked tongue type compression set terminator when termination is to a bolted or screw set type terminal block or terminal cabinet.

2.05 PLASTIC CABLE TIES

A. Nylon or Equivalent, locking type.

PART 3 EXECUTION

3.01 GENERAL

A. Install all wiring in Raceway unless shown or specifically authorized otherwise.

3.02 WIRE SIZE

A. No. 12 AWG minimum for power and lighting circuits.

B. Provide solid wire for No. 10 AWG and smaller, and stranded conductors for No. 8 AWG and larger (600) volts.

3.03 TESTS

A. In addition to the factory testing of all equipment and cable, the Contractor shall test all wiring connections for continuity and ground before any fixtures or other loads are connected. Tests shall be made with a 500V minimum DC "Megger" type tester. If tests indicate faulty insulation (less than 2 megohms), such defects shall be corrected and tested again. Contractor shall provide all apparatus to make tests and shall bear all expenses of required testing. Routine operation tests shall be made on all pieces of equipment to demonstrate that working parts are in operating condition. Results of all tests shall be recorded and submitted to the Architect. The Contractor shall immediately replace all parts, which fail to pass the test.

B. Measure the OHMIC value of the Electric Service Entrance metallic "System Ground" with reference to "Earth Ground" using the "Multiple Ground Rod Fall-In-Potential" method and suitable instruments. Maximum resistance to ground shall be less than 10 ohms. If this resistance cannot be obtained with the ground system shown, notify the Architect immediately for further instructions. Provide OHMIC test results to Engineer.

C. All circuits both in and out of the building shall test out free of grounds, short circuits and other defects.

D. Check and record catalog number and ampere size of controller overload heaters installed, nameplate full-load amperes, and actual operating amperes of each motor. **IMPORTANT**: Submit recorded data in triplicate to the Engineer. Check proper load balance on the electrical system, direction of rotation, lubrication, and overload protection of all motors before placing in operation.

E. Provide a log of ampere reading for all panels from phase to neutral for 4 wire panels and from phase to phase for 3 wire panels. These readings shall be taken with all loads activated.

F. The final test of all equipment shall be made on dates designated by the Architect/Engineer and all readings shall be made in his presence.

G. Feeders shall be checked to ensure all phases are energized before connecting to their respective motors. Each motor shall rotate in the proper direction for its respective load. Prior to rotation test, all bearings shall be inspected for proper lubrication.

H. Minimum megger test for equipment shall be as follows:

Equipment Maximum Voltage Rating	Minimum Test Resistance
1,000-Volts or less	2 Megohms

I. Provide certification of torque values for feeder and service entrance conductors per equipment manufacturer's recommendation.

3.04 CONDUCTOR SIZES, REFERENCED ON PLANS

A. Copper, type THW or RHW unless noted.

3.05 ALUMINUM CONDUCTORS

A. Aluminum conductors serving switchboards and service entrance rated panelboard shall be terminated using compression type oxide inhibiting compound filled aluminum lugs only.

B. Compression fittings shall be sized for the conductor used and shall be set with a tool, which assures a preset deformation before release.

C. Aluminum lugs, where in contact with copper studs, bolts or bus, shall be plated.

D. Bolted aluminum lugs shall be installed with a Belleville washer under nut unless specifically permitted otherwise.

E. Branch panelboards with bolted pressure lugs shall use aluminum conductors designed to minimize creep; i.e., Stabiloy by ALCAN. Oxide inhibiting joint compound shall be applied to both the conductor and terminal lug. Manufacturer's torque specifications shall be used to prevent creep.

3.06 PULLING

A. Use no mechanical means for pulling No. 8 AWG conductors and smaller. Powdered soap stone or approved spray cream shall be the only lubricant used.

3.07 STRIPPING INSULATION

A. Do not ring the cable, always pare or pencil.

3.08 TAPING

A. If used shall be half lapped synthetic tape.

3.09 CONDUCTORS IN PANELS AND SWITCHBOARDS

A. Conductors in panels, switchboards, and terminal cabinets shall be neatly grouped and formed in a manner to "Fan" into terminals with regular spacing.

3.10 CABLE SUPPORTS

A. Provide conductor support devices as required by code in vertical cable runs.

3.11 RACEWAY SIZES REFERENCED ON DRAWINGS

A. Raceways are sized for copper, type THW, unless otherwise noted. Size all Raceways per code unless specifically noted to be larger on the drawings.

END OF SECTION 26 05 19

SECTION 26 05 26

GROUNDING

PART 1 GENERAL

1.01 WORK INCLUDED

A. A grounding system shall be provided for neutral ground and equipment ground as required by code.

B. An isolated grounding system shall be provided for all isolated ground receptacles as allowed by Code (2020 NEC 250-146).

C. Provide all grounding of other systems as indicated in Divisions 26, 27, and 28.

PART 2 PRODUCTS

2.01 GROUNDING CONDUCTORS

A. Copper, code size, with physical protection where subject to damage. Bare or green insulated.

2.02 GROUND RODS

A. 3/4" x 8'-0" copper clad steel.

2.03 ISOLATED GROUND BARS

A. Provide in all panels containing isolated ground circuits.

PART 3 EXECUTION

3.01 GENERAL

A. Provide all grounding for electrical systems and equipment as required by codes and as specified herein.

3.02 SIZE OF GROUND WIRE

A. Provide ground wire sizing as required by Code. Where ground wire is exposed to physical damage or is used outside of the building, protect with conduit.

3.03 GROUND RODS

A. Provide as shown and/or required. Connect the ground conductor to each rod.

3.04 CONCRETE-ENCASED ELECTRODE

A. Provide in accordance with NEC 2020, Article 250.52 (A)(3) and Article 250.68 (C)(3).

3.05 GROUND CONNECTION OF WATER PIPING

A. Metal internal piping shall be grounded, as part of this Contract. This includes jumpers for dielectric fittings.

3.06 CONNECTION TO THE GROUND BUS

A. Provide connections in accordance with the codes; including but not limited to conduit system, switchboard frame, service neutral and electrically operated equipment and devices. No device or equipment shall be connected for electrical service which has a neutral conductor connected to a grounding conductor or to the frame within the device or equipment.

3.07 METHOD OF CONNECTION

A. Make all underground ground connections and ground cable splices by thermal welding. Aboveground ground connections and ground cable splices may be by permanent compression connector. Grounding lugs, where provided as standard Manufacturer's items on equipment furnished, may be used.

3.08 FLEXIBLE RACEWAY

A. Shall not be used for grounding. Install separate ground conductor in all flexible raceway.

3.09 PVC RACEWAY

A. Install separate ground conductor in all PVC raceway as required per code.

3.10 DROP CORDS

A. Shall have a grounding wire and be connected with a grounding type plug and receptacle.

B. TESTING REQUIREMENTS

C. Measure the OHMIC value of the Electric Service Entrance metallic "System Ground" with reference to "Earth Ground" using the "Multiple Ground Rod Fall-In-Potential" method and suitable instruments. Maximum resistance to ground shall be less than 25 ohms. If this resistance cannot be obtained with the ground system shown, notify the Architect immediately for further instructions. Provide OHMIC test results to Engineer.

END OF SECTION 26 05 26

SECTION 26 05 32

OUTLET AND PULL BOXES

PART 1 GENERAL

1.01 WORK INCLUDED

A. Provide outlet and pull boxes to enclose devices, permit the pulling of conductors and for wire splices and branches.

1.02 RELATED DOCUMENTS

A. Section 26 00 00 – Electrical General Conditions

PART 2 PRODUCTS

2.01 INTERIOR WIRING

A. General: Outlet and pull boxes shall be steel, zinc coated with plaster ring where applicable. 4-inch size minimum. Large pull boxes shall be fabricated sheet steel, zinc coated or baked enamel finish, with return flange and screw retained cover.

B. Surface Metal Raceway: Boxes of same Manufacture and to match Raceway. Boxes to accommodate standard devices and device plate.

C. Concrete and Masonry: Boxes for casting in concrete or mounting in masonry walls shall be the type specifically designed for that purpose.

D. Install pull boxes so as to be accessible after completion of building construction.

E. Ceiling outlet boxes shall be galvanized octagonal 4-inch, 1-1/2-inch-deep (without fixture stud), 2-1/8 inches deep (with fixture stud).

2.02 EXTERIOR WIRING

A. Above Grade: Outlet and junction boxes shall be cast or malleable iron or shall be cast of corrosion resistant alloy compatible with Raceway to which it is connected. Pull boxes shall be fabricated of heavy gauge steel and hot dipped galvanized. All boxes shall have gasketed covers.

1. Exterior outlet boxes shall be weather resistant and rain tight, with appropriate covers, gaskets, and screws.

B. Below Grade: Unless otherwise noted or as required by Code, and where exposed to earth, handholes and vaults shall be constructed of precast concrete with base, and shall include lid with galvanized, diamond plate, slip-resistant door with locking hatch. Door shall be spring-assisted with full 180-degree swing, where available, and shall be H-20 rated where installed in traffic areas. Where not exposed to earth, box shall comply with Paragraph 2.02A above. Provide with configuration, cover, grates and reinforcing as required by the particular installation.

1. For systems rated 600V and under, minimum box size shall be equivalent to H^2 Pre-cast Type 2 junction box.

2. For systems rated over 600V, minimum box size shall be equivalent to Oldcastle Precast 444LA.

C. Exterior outlet boxes shall be weather resistant and rain tight, with appropriate covers, gaskets and screws.

PART 3 EXECUTION

3.01 ANCHORING

A. All boxes shall be firmly anchored directly or with concealed bracing to building studs or joints. Boxes must be attached so that they will not "Rock" or "Shift" when devices are operated.

3.02 FLUSH MOUNTING

A. Except for surface mounted boxes or boxes above accessible ceilings, all boxes shall have front edge (box or plaster ring) even with the finished surface of the wall or ceiling.

3.03 ELECTRICAL OUTLETS

A. General: Coordinate the work of this section with the work of other sections and trades. Study all Drawings that form a part of this Contract and confer with various trades involved to eliminate conflicts between the work of this section and the work of other trades. Check and verify outlet locations indicated on Architectural Drawings, door swings, installation details, layouts of suspended ceilings and locations of all plumbing, heating and ventilating equipment.

B. Centered on Built-In Work: In the case of doors, cabinets, recessed or similar features, or where outlets are centered between such features, such as between a door jamb and a cabinet, make these outlet locations exact. Relocate any outlets which are located off center.

C. Above Counter: Locate device outlet just above backsplash or 6” above counter if there is no backsplash. Review casework shop drawings prior to final rough-in.

D. Vertical and Horizontal Relationships: Where more than one outlet is shown or specified to be at the same elevation or one above the other, align them exactly on centerlines horizontally or vertically. Relocate as directed all such outlets (including lighting, receptacle, power signal and thermostat outlets) which are not so installed, at no additional cost to Owner.

E. Device Outlet Height: Measure from the finished floor.

*Switches	4 Feet, Set Vertically, to Top of Box
*Receptacles, Telecommunications	18 Inches, Set Vertically to Centerline
Other	As Noted or as Directed by Architect
**Heights may vary.*	*See Drawings for additional information*

F. Ceiling Location: For acoustical material locate outlet either at the corner joint or in the center of a panel, whichever is closer to the normal spacing. Locate all outlets in the same room in the same panel location.

G. Installed In Sound Walls: Boxes installed in sound walls shall not be installed back-to-back. All boxes shall be separated by one stud space and shall be interconnected with flex conduit with a 90° loop. Where stud space separation is not possible, utilize sound attenuating mastic around each box. 3M Fire Barrier Moldable Putty Pads MPP+ (2.54 mm minimum) or similar.

3.04 ELECTRICAL WORK IN COUNTERBACKS, MILLWORK AND CASEWORK

A. Provide as shown and/or specified. Provide templates, where required, to other trades for drilling and cutting to ensure accurate location of electrical fixtures (outlets and devices) as verified with the Architect. Provide all wiring, devices, plates and connections required by said fixture.

3.05 CONNECTION TO EQUIPMENT

A. For equipment furnished under this or other Divisions of the Specifications, or by others. Provide outlet boxes of sizes and at locations necessary to serve such equipment. An outlet box is required if the equipment has pigtail wires for external connection, does not have space to accommodate circuit wiring used. Study equipment details to assure proper coordination.

3.06 BLANK COVERS

A. Provide blank covers or plates over all boxes not covered by equipment.

3.07 JUNCTION OR PULL BOXES

A. Pull and junction boxes shall be installed as shown, and to facilitate pulling of wire and to limit the number of bends within code requirements. Boxes shall be permanently accessible and shall be placed only at locations approved by the Architect.

B. In suspended ceiling spaces, boxes shall be supported from the structure independently from ceiling suspension system.

C. The Drawings do not necessarily show every pull or Junction Box required. The Contractor is permitted to provide boxes deemed necessary by him for his work when installed in accordance with these Specifications.

3.08 ELECTRIC WATER COOLER

A. Conceal the Electrical Outlet behind the unit housing as provided for by the Manufacturer.

3.09 BOXES CONTAINING MULTIPLE DEVICES

A. Boxes containing emergency and normal devices are permitted only with steel barriers Manufactured especially for the purpose of dividing the box into two completely separate compartments.

B. Device Boxes Containing Multiple Devices and Wiring Rated Over 150 Volts to Ground and Over 300 Volts Between Conductors are permitted only with steel barrier manufactured especially for the purpose of dividing the box into separate compartments for each device having exposed live parts.

3.10 BOXES IN EARTH

A. Provide for all wire splices and as required to pull conductors. Boxes (handholes) shall be set in place on a 3" sand bed. Coverplates shall be flush to, and match the slope of, the final surface grade.

3.11 COLOR CODING

A. All Junction Boxes installed in accessible spaces and exposed in unfinished areas shall be color coded using spray paint or tape on the box and cover as applicable in the following manner:

277/480-Volt ..... Sand
120/208-Volt ..... Gray
Emergency Power ..... Orange
Fire Alarm ..... Red
Clock & Program ..... Green
Intrusion Alarm ..... Yellow
Telephone ..... Dark Blue
Nurse Call ..... Light Blue
Public Address ..... Silver
Television ..... Rust

B. The colors shall match the colors used on the Raceway - See Section 26 05 33.

END OF SECTION 26 05 32

SECTION 26 05 33

RACEWAY

PART 1 GENERAL

1.01 WORK INCLUDED

A. Provide Raceway System complete.

1.02 RELATED DOCUMENTS

A. Section 26 00 00 – Electrical General Conditions

PART 2 PRODUCTS

2.01 GALVANIZED RIGID STEEL CONDUIT (GRS)

A. General: Hot dipped galvanized.

B. Fittings: Galvanized malleable iron or noncorrosive alloy compatible with galvanized conduit. Erickson couplings, watertight split couplings (O.Z. type or equivalent) permitted. Running thread or set screw type fittings not approved.

2.02 INTERMEDIATE METAL CONDUIT (IMC)

A. General: Hot Dipped galvanized.

B. Fittings: Galvanized malleable iron or noncorrosive alloy compatible with galvanized conduit. Erickson couplings, watertight split couplings (O.Z. type or equivalent) permitted. Running thread or set screw type fittings not approved.

2.03 ELECTRICAL METALLIC TUBING (EMT)

A. General: Hot dipped galvanized.

B. Fittings: Raintight; steel or malleable iron type using a split corrugated compression ring and tightening nut or stainless-steel locking disc. Steel set screw fittings are acceptable for dry locations. Indenter, drive-on and pressure cast or die cast type set screw are not acceptable.

2.04 FLEXIBLE METAL CONDUIT (FMC, LFMC)

A. Dry Locations:

1. General: Galvanized flexible steel for dry locations only.

2. Fittings: Malleable iron or steel, Thomas and Betts "squeeze" type or equal.

B. Damp and Wet Locations:

1. Liquid Tight: Polyvinyl chloride (PVC) weatherproof cover over flexible steel conduit.

2. Fittings: Thomas and Betts "liquid tight" or equal.

2.05 SURFACE METAL RACEWAY

A. Formed steel or aluminum type. Standard factory finish. Where color choice is available, consult Architect/Engineer for selection prior to ordering.

2.06 RIGID NON-METALLIC CONDUIT (PVC)

A. Schedule 40 rigid polyvinyl chloride type unless otherwise noted.

PART 3 EXECUTION

3.01 GENERAL

A. Install Raceway concealed in construction unless noted otherwise on the Drawings or specifically approved in writing by the Architect/Engineer.

B. Cut Raceway ends square, ream and extend maximum distance into all couplings and connectors.

C. Provide and install manufactured end caps on all Raceway ends during construction to prevent the entrance of water or dirt. Tape, as a cover, not permitted.

D. Swab out all Raceways before pulling wires.

E. All elbows for GRS and PVC Raceway shall be factory radius bends. For all other Raceway, use factory radius bends of 1-1/4" and larger diameter.

F. Raceway shall not penetrate sheet metal ducts unless permission is granted by Architect/Engineer. All sleeves shall be provided for Raceway installation.

G. Provide two (2) - 3/4" conduit stub into accessible ceiling space from all recessed panelboards or systems terminal boxes.

3.02 GALVANIZED RIGID STEEL CONDUIT

A. All Connections shall be watertight. Install for all Raceways in concrete or where subject to damage.

3.03 INTERMEDIATE METAL CONDUIT

A. Intermediate metal conduit is permitted as a substitute for galvanized rigid steel conduit except where GRS is required by code.

3.04 ELECTRICAL METALLIC TUBING

A. Install for wiring in masonry, frame construction, furred ceilings and above suspended ceilings. May be used for exposed work in unfinished areas where not subject to damage. Where construction involves masonry work, surface cut masonry units wherever such masonry units are to remain unplastered or uncovered in complete construction.

3.05 RACEWAYS UNDERGROUND

A. Galvanized rigid steel conduit - painted with two coats of bitumastic paint - or galvanized rigid steel conduit with 15 mil. polyvinyl chloride (PVC) jacket (repair abrasions with PVC base paint or PVC).

B. PVC Raceways may be used for underground runs when permitted by code. Field bends, when necessary, shall be formed only with factory recommended heater. Penetrations through floor and walls shall be galvanized rigid steel (GRS) conduit. PVC, if used, shall be increased in size from that shown to include code required ground wire.

C. All underground bends in excess of 10 degrees and all elbows shall be GRS.

D. Arrange and slope Raceways entering building to drain away from building.

E. Ground wires shall be provided in all PVC Raceway.

3.06 INSERTS, SHIELDS AND SLEEVES

A. Furnish and set in place, in advance of pouring slabs and walls, all inserts and sleeves needed to execute Division 26 equipment installation.

B. Where supports in slabs are required after wall has been poured, use a drilled-in threaded insert, installed as recommended by Manufacturer.

C. Sleeves shall be provided for all wall penetrations.

3.07 RACEWAYS THAT STUB UP THROUGH FLOOR

A. Install at such depth that the exposed Raceway is vertical and no curved section of the elbow is visible.

B. PVC Raceway shall not be stubbed through floors.

3.08 SEALING OF RACEWAY PENETRATIONS

A. Exterior Wall Surfaces Above Grade: Seal around all penetrations with caulking approved by Engineer. For concrete construction above ground level, cast Raceway in wall or core drill wall and hard pack with a mixture of equal parts of sand and cement.

B. Exterior Surfaces Below Grade: Cast Raceway into wall (or floor) or use manufactured seal assembly (such as O.Z. type "FSK") cast in place.

C. Roofs: Provide mopped, lead, roof jack where Raceway penetrates roof membrane.

D. Fire Rated Floors, Walls, Ceiling/Roofs: Concrete or masonry, seal around Raceway penetration with Dow Corning 3-6548 silicone RTV foam or approved equal. Plaster or gypsum wallboard, seal around Raceway penetration with plaster, fire tape per local Fire Marshal's requirements.

3.09 SEALING OF RACEWAYS

A. Seal interior of all Raceways which pass through buildings roofs, floors or through outside walls of the building, above or below grade. Seal on the end inside the building using duct sealing mastic, non-hardening compound type, specially designed for such service to maintain the integrity of the seal of the wall, floor or roof. Pack around the wires in the Raceways.

3.10 HANGERS FOR RACEWAYS

A. In suspended ceiling spaces Contractor may, at his option, attach 1/2" or 3/4" EMT Raceways to the ceiling suspension system where such system is structurally suitable on independent wire secured at both ends; in which case, provide clips manufactured for the purpose.

B. When more than two (2) Raceways use the same routing, group together on a patented channel support system (such as Unistrut).

3.11 SURFACE METAL RACEWAY

A. Install parallel to building surface (i.e., wall, ceiling, floor). Fasten to surface as recommended by Manufacturer. Mount so Raceway is in the least obvious location. Shall be used in lieu of conduit in finished areas.

3.12 FLEXIBLE CONDUIT

A. Flexible conduit shall be used **only** for connection to motors and equipment subject to vibration with 90 degrees loop minimum to allow for isolation and for lay-in fluorescent fixtures above T-Bar ceilings. For fixture installations, one end of flex must terminate in rough-in junction box. Flex conduit shall not be installed over 6' long or used to connect from fixture to fixture. Use liquid tight for pumps, equipment which is regularly washed down, and equipment in damp locations. Provide ground wire.

3.13 COLOR CODING

A. General: Provide color bands of tape or paint 1-inch (25 mm) wide for Raceways up to 2 inches (51 mm) in diameter and one-half the Raceway diameter for larger Raceways, applied at panel and pullbox locations within each room, and 50 ft. (15.25 m) on centers within an area.

B. Color Banding:

120/208 Volt ..... Gray
277/480 Volt ..... Sand
Clock and Program ..... Green
Emergency Power ..... Orange
Fire Alarm ..... Red
Intrusion Alarm ..... Yellow
Low Voltage Switching ..... Black
Telephone ..... Dark Blue
Television ..... Rust

C. The colors shall match the colors used on the boxes - See Section 26 05 32.

3.14 PULL CORDS

A. Nylon type shall be included in all installed empty Raceway.

END OF SECTION 26 05 33

SECTION 26 05 34

METAL CLAD CABLE (TYPE MC) AND FITTINGS

PART 1 GENERAL

1.01 WORK INCLUDED

A. Provide Metal Clad (Type MC) Cable for power, control and lighting systems.

B. Provide wiring connections and terminations.

1.02 REGULATORY REQUIREMENTS

A. Products shall be tested, approved and labeled/listed by Underwriters Laboratories, Inc. in accordance with UL 1569.

1.03 USES PERMITTED

A. MC Cable is permitted to be used for 20amp lighting and power circuits where routing is above grade, concealed and the installation meets the requirements of NEC 330.

B. MC Cable shall NOT be used for homerun circuits from the fixture, receptacle, or equipment to the panelboard. Hard conduit must be used from the panelboard to the nearest accessible ceiling space to the panelboard.

C. MC Cable shall not be used for HVAC equipment.

PART 2 PRODUCTS

2.01 CABLE ASSEMBLY

A. Metal clad cable assemblies shall consist of 2, 3 or 4 current carrying conductors and an equipment ground conductor.

B. Conductors: Solid Copper conductor, No. 12 AWG minimum or No. 10 AWG maximum. Installation methods shall be as specified under Part 3 – Execution below.

C. Insulation: Conductor insulation shall be rated 600-volt, Type THHN, 90°C dry.

D. Fillers: Fillers shall be non-hygroscopic and non-wicking.

E. Binder: Core binder shall be corrugated polyester.

F. Sheath: The metal sheath shall be galvanized steel or aluminum. The metal sheath shall be extruded onto the cable or applied longitudinally, then wrapped and welded. The sheath shall then be corrugated for greater flexibility.

G. Jacketing: When PVC jacketing is required, the jacket shall be flame-retardant PVC with a temperature range of -40°C to 90°C.

H. Equipment Grounding Conductor: The equipment ground wire shall be of the same construction as specified in 2.02.A and 2.02.B and be at a minimum the same size as the current carrying conductors. The insulation color shall be green.

2.02 FITTINGS

A. Fittings shall be UL listed and identified for such use with metal clad continuous corrugated sheath cable, with or without PVC jacketing, as is appropriate for the installation.

B. Connectors shall be of steel or malleable iron and shall be a squeeze type clamp connector with a locknut for non-jacketed metal clad cable. Compression gland type connectors shall be used for jacketed metal clad cable.

PART 3 EXECUTION

3.01 INSTALLATION – POWER AND LIGHTING SYSTEMS WIRING

A. All wiring shall be installed in compliance with the latest version of the National Electrical Code and all other applicable codes and standards as indicated elsewhere in these specifications.

B. Use of metal clad cable shall be permitted only for lighting, equipment and receptacle branch circuits. Metal clad cable shall not be permitted in locations designated to be hazardous Class I, II or III.

C. Metal clad cable shall be permitted only for motor circuits where the motor being served is less than ½ HP and rated for 120V, single phase. Metal clad cable is not permitted for HVAC equipment and controls.

D. Metal clad cable shall only be installed concealed within walls and above ceiling interstitial spaces. Where there is no ceiling interstitial space, metal clad cable may not be used.

E. Metal clad cable shall not be installed between floor levels. Provide hard pipe (i.e., EMT, RGS, IMC) when routing between floors levels.

F. Bends in corrugated sheath metal clad cable shall be made so that the cable will not be damaged. The radius of the curve of the inner edge of any bend shall not be less than seven (7) times the diameter of the metallic sheath.

G. Metal clad cable is not permitted to connect branch circuits to fumehoods, gas storage cabinets, or chemical storage cabinets.

H. No metal clad cable shall be installed in ventilation ducts or plenums.

I. Conductors in Enclosures: Provide neat and workmanlike installation with conductors tied with T&B Ty-Rap, Virginia Plastics, or equal, nylon wire ties in terminal cabinets, gutters and similar locations.

J. MC cable shall only be installed in dry locations.

3.02 FITTINGS

A. Fittings used for connecting metal clad cable to boxes, light fixtures or other equipment shall be UL listed and identified for such use.

B. Cable preparation for installation of fittings shall follow manufacturer's instructions. The manufacturer's specialized tools shall be used for preparing cable ends for installation of fittings.

C. The cable end shall be cut square to ensure flush seating of the cable into the fitting. Fitting securement screws shall be properly torqued. Cable ends shall be fitted with insulating bushings intended for the type of metal clad cable being installed.

D. For jacketed metal clad cable, the outer jacket shall be removed to the length specified by the fitting manufacturer's instructions. Remove oils or solvent by-products from the outer jacket of the cable. The cable end shall be cut square to ensure flush seating of the cable into the fitting. The fitting gland nut shall be properly torqued to the manufacturer's specifications.

3.03 ARRANGEMENT AND SUPPORT

A. Metal clad cables shall be run parallel with walls or structural elements. Vertical runs shall be plumb; horizontal runs level and parallel with structure, as appropriate. Groups shall be racked together neatly with both straight runs and bends parallel and uniformly spaced.

B. Metal clad cables shall be securely fastened in place at intervals of not more than six feet, with suitable clamps or fasteners of approved type, and all vertical conduits shall be properly supported to present a mechanically rigid and secure installation.

C. Metal clad cable installed parallel to framing members, such as studs, joist, or rafters, shall be supported so that the nearest outside surface of the cable is not less than 1-1/4 inches from the nearest edge of the framing member. Where this distance cannot be maintained, the cable shall be protected by a steel plate, sleeve, or equivalent that is at least 1/16-inch thick.

D. Maintain at least 6-inch clearance between metal clad cables and other piping systems. Maintain 12-inch clearance between metal clad cables and heat sources such as flues, steam pipes, and heating appliances.

E. No metal clad cable shall be fastened to other conduits or pipes or installed so as to prevent the ready removal of other pipes or ducts for repairs.

F. Individual metal clad cables hung from roof structure or structural ceiling shall be supported by split-ring hangers and wrought-iron hanger rods. Where three (3) or more metal clad cables are suspended from the ceiling in parallel runs, use steel channels, Kindorf, Unistrut or equal, hung from 1/2-inch rods to support the conduits. The conduit on these channels shall be held in place with metal clad cable clamps designed for the particular channel that is used.

G. Secure metal clad cable support racks to concrete walls and ceilings by means of cast-in-place anchors; die-cast, rustproof alloy expansion shields; or cast flush anchors. Wooden plugs, plastic inserts, or gunpowder driven inserts shall not be used as a base to secure conduit supports.

H. Metal clad cable shall be supported immediately on each side of a bend and not more than 1 foot from an enclosure where a run of metal clad cable ends.

3.04 INSPECTION AND TESTS

A. General: The electrical installation shall be inspected and tested to ensure safety to building occupants and operating personnel and conformity to Code

B. Measure and record insulation resistance of all power and control wiring including insulation resistance of all equipment:

1. The insulation resistance of each circuit phase-to-phase and phase-to-ground shall be measured. For circuits rated less than 600 volts, the resistance shall not be less than 2 megohms.

2. Systems rated above 240 volts shall be tested with a 1000-volt Megohmmeter. Circuits rated 240 volts and below shall be tested with a 500-volt Megohmmeter. The D.C. potential shall be applied for thirty (30) seconds.

C. The contractor shall record test readings and submit certified test to the Engineer for review and acceptance approval before energizing respective circuits.

END OF SECTION 26 05 34

SECTION 26 05 39

FLOOR OUTLET DEVICES – FLUSH

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Section 26 00 00 – Electrical General Conditions

1.02 SCOPE

A. The floor box provides the interface between power and communication cabling in an on grade or above grade concrete floor where power and/or communication services are required.

1.03 CLASSIFICATION AND USE

A. Floor boxes, covers, above floor fittings and accessories shall be of same manufacturer and be designed, manufactured, tested and installed to comply with UL514A, UL514C and NCE/NFPA 370-17(b), covers are suitable for tile, terrazzo, wood, and carpet covered floors.

1.04 SUBMITTALS

A. Product Data: provide catalog cuts of specified floor boxes and accessories upon request.

B. The manufacturer's catalog numbers specified represent the minimum standard required. If product alternate manufactures are selected from the approved manufacture list, they must be equal to or exceed the standards and quality criteria set forth by listed Hubbell Inc. catalog numbers. Alternative manufacturers must submit catalog cuts and samples for approval ten (10) days prior to bid date.

C. In general, all floor boxes shall be of size and type indicated on drawings herein specified. All floor boxes shall be located as directed by architect or as dimensioned on the architectural drawings. If drawings are not dimensioned, coordinate exact location prior to rough-in.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Following are acceptable:

1. Hubbell
2. Legrand
3. Or approved equal.

2.02 MATERIALS

A. Stamped Steel – For Installation Above Grade:

1. Concealed Large Capacity Floor Box – Carpet or Tile Floor Applications:

a. The large capacity floor boxes shall allow for the activation of power, data and communication in a single box. All connections shall be made below the surface of the floor, recessed inside the box. When the box is in use, only the cords exiting the unit will be visible. For concrete pours 3¼" and greater, the floor box shall be stamped steel with a galvanized finish. The depth of the box shall not exceed 3¼", with total dimensions of 12½" square. The box shall have vertical and angular adjustments of 1¼" before and 5/8" after the pour. Conduit connections shall be made through six (6) 3/4" and six 1"-1¼" combination style concentric knockouts. Total cubic inch capacity is to be 328.2. Six (6) individual wiring chambers shall include barriers to provide separation between power and low voltage conductors. Internal chamber plugs allow for various wire routing methods. Six (6) #12 A.W.G. green grounding lead wire assemblies are included to assure a proper grounding path. The large capacity floor box shall be Hubbell type LCFBSSA. Covers with no flange for tile floor applications must be available. Non-metallic service plates must be furnished separately to enclose each of six individual wiring chambers. When installed, these plates will enclose four wiring chambers with 38.2 cu. in. and two (2) wiring chambers with 25.4 cu. in. capacity. Service plate options include blank, duplex, Style Line and 20A single Twist-Lock receptacle openings. Plates to be furnished shall be Hubbell type LCFBP14, LCFBP8, LCFBP26 and LCFBP720.

B. Cast Iron – For Installation Above, On, Or Below Grade:

1. Concealed Large Capacity Floor Box – Carpet or Tile Floor Applications: The large capacity floor boxes shall allow for the activation of power of power, data and communication in a single box. All connections shall be made below the surface of the floor, recessed inside the box. When the box is in use, only the cords exiting the unit will be visible. For concrete pour 3½" and greater, the floor box shall be cast iron with a powder paint finish. The depth of the box shall not exceed 3½", with total dimensions of 13" square. The box shall have vertical and angular adjustments of 1¼" before and 5/8" after the pour. Conduit connections shall be made through six (6) ¾" and six (6) 1¼" threaded conduit hubs. Total cubic inch capacity is to be 322.6. Six (6) individual wiring chambers shall include barriers to provide separation between power and low voltage conductors. Internal chamber plugs allow for various wire routing methods. Six (6) #12 A.W.G. green grounding lead wire assemblies are included to assure a proper grounding path. The detailed above large capacity floor box shall be Hubbell type LCFBCA. Covers with no flange for tile floor applications must be available. Non-metallic service plates must be furnished separately to enclose each of six (6) individual wiring chambers. When installed, these plates will enclose four wiring chambers with 36.8 cu. in. and two (2) wiring chambers with 25.4 cu. in. capacity. Service plate options include blank, duplex, Style Line and 20A single Twist-Lock receptacle openings. Plates to be furnished shall be Hubbell type LCFBP14, LCFBP8, LCFBP26 and LCFBP720.

C. Stamped Steel Shallow Box – For Installation Above Grade In 3” Toping Slab:

1. Concealed 4-gang Capacity Floor Box – Carpet or Tile Floor Applications:

a. The recessed floor box shall allow for the activation of power, data and communication in a single box. All connections shall be made below the surface of the floor, recessed inside the box. When the box is in use, only the cords exiting the unit will be visible. For concrete pours 3" and greater, the floor box shall be stamped steel with a galvanized finish. The depth of the box shall not exceed 2.7”, with total dimensions of 10" square. Conduit connections shall be made through three (3) 1/2” and three (3) 1/4" concentric knockouts. Four individual wiring chambers shall include barriers to provide separation between power and low voltage conductors. Internal chamber plugs allow for various wire routing methods. Four #12 A.W.G. green grounding lead wire assemblies are included to assure a proper grounding path. The shallow floor box shall be Hubbell type HBLCFB401BASE. Covers with no flange for tile floor applications must be available. Non-metallic service plates must be furnished separately to enclose each of four (4) individual wiring chambers. When installed, these plates will enclose four wiring chambers with 25.5 cu. in. capacity. Service plate options include blank, duplex, Style Line and 20A single Twist-Lock receptacle openings. Provide appropriate plates and blank plates for application.

D. Stamped Steel Deep Box – For Installation Above Grade in Areas Where Structure Is 12” On Center:

1. Concealed 4-gang Capacity Deep Floor Box – Carpet or Tile Floor Applications:

a. The recessed floor box shall allow for the activation of power, data and communication in a single box. All connections shall be made below the surface of the floor, recessed inside the box. When the box is in use, only the cords exiting the unit will be visible. The depth of the box shall be 4”, with total dimensions of 10" square. Conduit connections shall be made through knockouts sized 1/2”, 3/4”, 1”, 1¼”. Four (4) individual wiring chambers shall include barriers to provide separation between power and low voltage conductors. Internal chamber plugs allow for various wire routing methods. Four (4) #12 A.W.G. green grounding lead wire assemblies are included to assure a proper grounding path. The deep floor box shall be Hubbell type HBLCFB301BASE. Covers with no flange for tile floor applications must be available. Non-metallic service plates must be furnished separately to enclose each of four individual wiring chambers. When installed, these plates will enclose four wiring chambers with 29.5 cu. in. capacity. Service plate options include blank, duplex, Style Line and 20A single Twist-Lock receptacle openings. Provide appropriate plates and blank plates for application.

2.03 MATERIALS – COVERS

A. Covers for Concealed Large Capacity Stamped Steel*:* Cover/flange assemblies re-enforced with metal cover plate shall be mounted to the box previously mentioned. Cover shall be made of die-cast aluminum. Flanges and cable doors shall be made of thermoplastic (ABS) or die-cast aluminum. The die-cast aluminum covers shall be brushed aluminum. All covers shall be UL listed for either tile floors or carpet floors. A die-cast aluminum cover shall also be available with no flange and a solid surface (no-insert required) for tile floor applications. This cover shall be hinged to allow for access to connections inside the box. When the box is in use, cable(s) will exit through two (2) cable doors located on opposite ends of the cover. When the box is not in use, the cover will lay flush with the floor. This cover is 180 degrees reversible and will accept a carpet insert. (Except "T" series)

1. For LCFB Series Floor Boxes:

   a. **Die-cast aluminum** large capacity floor box cover flange assemblies shall be Hubbell type LCFBCALC (brushed aluminum).

   b. **Die-cast aluminum flangeless covers for tile** floor applications shall be Hubbell type LCFBCALT (aluminum). Covers shall feature ScrubShield gasketing technology and pass 2003 UL 514A scrub-water exclusion test requirements for carpet and tile floor applications.

2. For HBLCFB Series Floor Boxes:

   a. Die-cast floor box cover flange assemblies shall be Hubbell type HBLTCGNTSW (Granite). (non-tile applications only) ScrubShield gasketing technology and pass 2003 UL 514A scrub-water exclusion test requirements for carpet applications.

PART 3 EXECUTION

3.01 GENERAL

A. Cast metal watertight floor boxes shall be used in slabs, on grade level or below.

B. Steel concrete tight floor boxes shall be used in slabs above grade level.

C. After positioning the box, conduit is installed in accordance with local codes.

D. Box shall be secured and pre-pour adjustments made.

E. Grease shall be applied to outside of cement cover and exposed portion of adjustable collar.

F. Cover shall be duct taped prior to pour.

G. Locate boxes after pour and cement cover shall be removed.

H. Wires shall be pulled and receptacles installed per local and national codes.

I. Provide all service plates required to complete installation to include required plates for receptacles, low voltage devices and blank plates.

J. Coordinate and pay carpet installer to install matching carpet in floor box cover where installed in carpeted areas.

K. Coordinate cover orientation with architect prior to installation.

L. Where topping slab thickness is less than manufacturers recommendation, EC shall coordinate and pay for the GC to install structural support of floor box from below.

END OF SECTION 26 05 39

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SECTION 26 05 73

ELECTRICAL SYSTEM STUDIES

PART 1 GENERAL

1.01 GENERAL

A. Conform to the General Conditions, Supplementary Conditions, and related work in other Divisions for all work in Division 26. See Division 01 for sequence of work.

1.02 RELATED SECTIONS

A. Section 26 00 00 – Electrical General Conditions

B. Section 26 24 13 – Switchboards

C. Section 26 24 16 – Panelboards

D. Section 26 24 19 – Motor Controllers

E. Section 26 28 13 – Fuses

F. Section 26 28 16 – Disconnects and Fused Switches

1.03 SECTION INCLUDES

A. This section includes the requirements for the contractor to perform electrical system studies based on the selected electrical equipment.

B. The required studies include but are not limited to a Coordination Study and an Arc Flash Assessment Study.

C. Each of the studies performed shall be based on the actual equipment to be installed. Any revisions of the selected equipment shall result in an updated study with the revised equipment submitted for review and approval prior to ordering equipment.

D. If the contractor installs different equipment than was included in the approved electrical system studies, the owner reserves the right to require the contractor to replace the non-approved electrical equipment at no additional cost to the owner.

E. The contractor shall provide all studies in agreement with all applicable codes and standards. If a specific code is applicable to the electrical system being modeled, the code shall be referenced and the portion of the electrical system impacted shall be noted.

1.04 SUBMITTAL REQUIREMENTS OF THIS SECTION

A. During the Shop Drawing process and prior to ordering electrical equipment, the contractor shall submit an **Electrical System Overcurrent Protective Device Coordination Study**. The Coordination study shall be submitted with the product data for all devices included in the coordination study and shall be formatted as indicated in Paragraph 2.01.

B. After the electrical system has been installed and is ready for energization, the Contractor shall provide an **Arc Flash Assessment Study**. The Arc Flash Assessment shall be submitted for approval prior to substantial completion. Once the Arc Flash Assessment Study is approved, the Contractor shall print and install the approved Arc Flash notification labels on all equipment containing overcurrent protective devices. Labels installed outdoors shall be suitable for outdoor installation. The Arc Flash Assessment Study shall be assembled as outlined in Paragraph 2.02.

1.05 QUALIFICATIONS

A. All Studies shall be prepared by a qualified professional electrical engineer.

1.06 DEFINITIONS

A. For the purposes of this section, overcurrent device coordination shall be defined in two levels as follows:

1. Coordinated = Full coordination outside of the instantaneous region of the overcurrent devices.

2. Selectively Coordinated = Full coordination including the instantaneous region of the overcurrent devices.

1.07 OPERATION AND MAINTENANCE REQUIREMENTS OF THIS SECTION

A. The contractor shall provide to the owner the following information to be included in the Operation and Maintenance Manual:

1. Final Arc Flash Assessment Study submitted in accordance with the requirements outlined in Section 26 00 00 Electrical General Conditions.

2. The electronic copy shall also include a sub-folder with the software model used to perform the calculations. The model shall include all files necessary to access and review the model electronically. The Contractor shall include a Text File in the directory labeled “MODEL_INFORMATION.TXT” which includes the following:

a. Project Name

b. Electrical Contractor Name

c. Software used to model the system including version

d. Date the model was last updated

e. Contact information for the individual/organization who prepared the model.

PART 2 PRODUCTS

2.01 PROTECTIVE DEVICE COORDINATION STUDY

A. The contractor shall submit an **Electrical System Overcurrent Protective Device Coordination Study** during the Shop Drawing submittal phase of the project prior to ordering equipment with overcurrent protective devices. The Coordination study shall be submitted with the product data for all devices included in the coordination study.

B. All overcurrent protection devices shall be provided as a coordinated system by the manufacturer. Any cases where the selected manufacturer is unable to coordinate two overcurrent devices in series due to the sizes indicated in the design, the engineer shall be notified and a recommended coordination solution provided by the manufacturer prior to or during the submittal phase. For overcurrent protection devices 400A and larger where the manufacturer is unable to provide a coordinated system, the overcurrent protection devices shall include Long-Time/Short-Time/Instantaneous (LSI) time delay and ampacity settings minimum.

C. Unless noted otherwise, when a main service overcurrent device with adjustable Ground Fault trip has been specified, the next level feeder overcurrent devices shall also include adjustable Ground Fault trip. The Coordination Study shall also provide recommended settings for all adjustable Ground Fault trip devices.

D. All emergency system overcurrent protection devices shall be selectively coordinated as defined by applicable codes and standards (2017 NEC 700.32 and WAC 296-46B-700). The scope of the selectively coordinated system shall be as defined by applicable local, state, and federal codes.

E. For modifications/additions to existing electrical systems, at a minimum the Coordination Study shall include:

1. All new electrical equipment containing overcurrent devices

2. The existing overcurrent protective devices immediately downstream of the new electrical equipment

3. All existing overcurrent protective devices upstream of the new electrical equipment to the main electrical utility service entrance.

F. The Protective Device Coordination Study shall present the following information in an organized report:

1. Coordination Study Title Page shall include:

a. Project Name

b. Electrical Contractor name

c. Date Study was performed

d. Study Type (i.e. Overcurrent Device Coordination Study)

e. Name/Company/Contact information for organization performing the study

f. Analysis software used to perform the study including version

2. Coordination Study Executive Summary shall include a brief project description, an overall description of the electrical system, and a listing of any items that may need resolution. If specific Code requirements exist for any portion of the electrical system, they shall be noted in addition to how the requirement was implemented.

3. Coordination Study Analysis shall include a detailed outline of the overcurrent device coordination analysis. Time Current Curves shall be provided for each unique coordination path in the electrical system from the Main service protective device to the largest branch circuit breaker. Each Time Current Curve shall be uniquely labeled. The report shall include a list of the overcurrent devices included in each Time Current Curve and a description of any potential un-coordinated devices with the potential impact on the electrical system due to the lack of coordination.

4. Conclusion shall include a summary of overall protective device coordination for the electrical system being modeled. The Conclusion shall also include a table listing all devices with adjustable settings and the recommended settings based on the coordination study. Any uncoordinated electrical devices that include recommended revisions shall be listed with the proposed system revision.

5. As an Appendix, the Coordination Study shall include a one-line diagram of the modeled system with each bus and overcurrent device identified. The naming of the devices in the one-line diagram shall exactly match the device names in the report and time-current curves.

2.02 ARC FLASH ASSESSMENT STUDY

A. After the electrical system has been installed and is ready for energization, the Contractor shall provide an Arc Flash Assessment Study. The Arc Flash Assessment Study shall be submitted for approval prior to substantial completion. Once the Arc Flash Assessment Study is approved, the Contractor shall print and install the approved Arc Flash notification labels on all equipment containing overcurrent protective devices.

B. The Arc Flash Assessment Study shall include the following at a minimum:

1. Study Title Page shall include the following information:

   a. Project Name

   b. Date Study was performed

   c. Name/Company/Contact information for organization performing the study

   d. Analysis software used to perform the study including version

2. An Index shall be provided listing each Section included in the Arc Flash Assessment Report.

3. Study Executive Summary shall a brief overview of each section of the Study including any recommended revisions to the electrical system based on the results of the Study. The overview shall include at a minimum, any pieces of equipment with a calculated fault current that exceeds the equipment rating, a listing of any overcurrent devices with revised settings, a brief listing of un-coordinated equipment that necessitate revisions, and a listing of each piece of equipment with a Dangerous level of Arc Flash energy.

C. Each of the following sections and appendices shall include a dedicated Cover Page outlining the contents of the Section.

D. Section #1 Fault Analysis shall include an updated Fault Current Analysis of the entire electrical system. The Fault Analysis shall include as a minimum the following information:

1. The available fault current at the Utility for the fault analysis shall be based on the actual Utility fault current and not an assumption. For electrical distribution systems that are primary metered, the study shall include the primary electrical system back to the point of service including but not limited to actual cable lengths/sizes/types and any overcurrent protective devices. The study shall include correspondence from the utility showing the available fault current at the utility service point in the appendices.

2. Updated cable size/type/length shall be included in the report based on the installed conditions.

3. Updated transformer information based on the installed transformer nameplates

4. Current limiting fuses shall be indicated where applicable based on the actual equipment installed.

5. Large motors (>50hp) shall be included in the analysis. Smaller motors shall be grouped together at each panel/switchboard.

6. A Table shall be provided with a comparison of calculated fault current to equipment fault rating for each piece of equipment containing overcurrent protective devices. The calculated fault current shall be adjusted as necessary based on the calculated X/R ratio.

7. Any equipment that is found to have a rating less than the calculated/adjusted fault current shall be specifically indicated along with recommended corrective action.

8. The Fault Analysis shall include the system model one-line diagram with the following information indicated:

    a. Utility connection point with available fault current and X/R ratio.

    b. Cables with conductor size, length, parallel count, raceway type.

    c. Transformers with impedance, kva, X/R ratio.

    d. Large motors (>50hp). Smaller motors shall be grouped together at each panel/switchboard.

    e. Electrical equipment with overcurrent protective devices showing calculated fault current.

E. Section #2 Protective Device Coordination Study shall include an updated Coordination Study for the entire distribution system as outlined in Paragraph 2.01. The updated coordination study shall optimize settings to provide coordination while reducing the Arc Flash energy present.

F. Section #3 Arc Flash Assessment shall include a description of the method used to calculate the Arc Flash energy present and the assumptions of the study. The following additional items shall be included in the study as a minimum:

1. Table summarizing the Arc flash energy present at each piece of equipment and the conditions under which the incident energy occurred. The table shall also include the arcing time, fault current, upstream overcurrent device, and any notes for different conditions present.

2. A template Arc Flash label with each piece of information included on the label explained.

3. Sample Arc Flash Labels for each piece of equipment in the model showing the code required information.

G. Appendix A shall include that correspondence from the electric utility providing the available fault current used in the analysis.

H. Appendix B shall include cut sheets for all electrical equipment included in the Arc Flash Assessment study.

PART 3 EXECUTION

3.01 TESTING/VERIFICATION

A. The contractor shall provide testing of each piece of electrical equipment with adjustable overcurrent protective devices to verify proper operation in accordance with the manufacturer's recommendations. The test reports shall indicate the following at a minimum:

1. Equipment name.

2. Date of the test.

3. Name and organization of the individual performing the testing

4. Test results. Any equipment failing the testing shall be replaced at no additional cost to the owner.

5. As-Left settings. These settings shall be as indicated in the Arc Flash Assessment Study. Any settings that vary from the Study shall be either updated in the Study including a revised submittal package or shall be corrected in the field and an updated test report provided.

3.02 FIELD APPLIED ARC FLASH LABELS

A. After the Arc Flash Assessment Study is approved and the electrical equipment has been successfully tested, the Contractor shall provide Arc Flash and Shock Hazard warning labels on all electrical devices containing overcurrent protection stating the following information at a minimum:

1. PPE level of protection

2. Incident energy (cal/cm^2) at 24" from the equipment unless specified otherwise by the Owner/Engineer

3. Flash hazard boundary

4. Glove class

5. Limited approach distance
6. Restricted approach distance
7. Prohibited approach distance
8. Date study was performed

B. Labels shall be permanently affixed to the equipment or wiring method and shall not be hand written.

C. The label shall be of sufficient durability to withstand the installed environment. Labels installed outdoors shall be suitable for outdoor installation with no degradation due to sun light or precipitation.

D. The label shall meet ANSI Z535 guidelines and requirements.

END OF SECTION 26 05 73

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SECTION 26 09 23

NETWORK DIGITAL LIGHTING CONTROL SYSTEM

PART 1 GENERAL

1.01 INTRODUCTION

A. The work covered in this section is subject to all of the requirements in the general conditions of the specifications. Contractor shall coordinate all of the work in this section with all the trades covered in the other sections of the specification to provide a complete and operative system.

B. Electrical Contractor shall provide all support, labor and material to accommodate commissioning, per Section 01 91 13.

1.02 DESCRIPTION OF WORK

A. Extent of lighting control system work is indicated by drawings and by the requirements of this section. It is defined to include low voltage lighting control panels, switch inputs, and wiring.

B. The work covered by this section of the specifications shall be coordinated with the related work as specified elsewhere under the project specifications.

1.03 QUALITY ASSURANCE

A. UL & ULC Approvals: The control panels shall be tested and listed under the UL 916 Energy Management Equipment standards by a nationally recognized testing laboratory. Emergency Lighting Equipment shall be listed under UL 924.

B. NEC Compliance: The control system shall comply with all applicable National Electrical Codes regarding electrical wiring standards.

C. NEMA Compliance: The control system shall comply with all applicable portions of the NEMA standards regarding the types of electrical equipment enclosures.

D. Component Pre-Testing: All control equipment shall undergo strict inspection standards. The equipment shall be previously tested and burned-in at the factory prior to installation.

E. System Checkout: A factory-trained technician or factory-authorized personnel or Contractor shall functionally test the control system and verify performance after installation.

F. Manufacturer: Manufacturer shall have a minimum of 10 years' experience in control systems. These specifications are based on Wattstopper. Substitutions of the specified equipment will be considered given sufficient documentation is provided to the Engineer which certifies that the equipment qualification meets the requirements of this specification.

G. Similar systems manufactured by Acuity Brands (nLight) or Encelium Networked Light Management System by Osram Sylvania are also acceptable. The listing of any manufacturer as "acceptable" does not imply automatic approval. It is the sole responsibility of the electrical contractor to ensure that any price quotations received and submittals made are for devices and systems which meet or exceed the specifications included herein.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's data on lighting control system and components.

B. Shop Drawings: Submit drawings of lighting control system and accessories including, but not necessarily limited to, the low voltage relay panels, power wiring, and switch inputs.

1. Complete layout of every space with the parts identified and wire routing

2. Riser Diagram/System Diagram

3. Switch Input Wiring

C. Example Contractor Startup/Commissioning Worksheet

D. Hardware and Software Operation Manuals

1.05 COORDINATION

A. Coordinate lighting control components to form an integrated interconnection of compatible components.

B. Coordinate lighting controls with BAS (building automation system) either through IP based intercommunication of system or hardwired auxiliary relay outputs.

C. The installing contractor shall be responsible for a complete and functional system in accordance with all applicable local and national codes.

1.06 WARRANTY

A. All devices in lighting control system shall have a five (5) year warranty.

PART 2 PRODUCTS

2.01 SYSTEM PERFORMANCE REQUIREMENTS

A. This specification is intended to fully describe all of the design, engineering, programming, hardware, software, ancillary devices and associated technical services required to provide a building-wide networked lighting control system. This system is specified to perform scheduled and automated lighting control sequences.

B. The lighting control “system” shall include a fully distributed WAN/LAN network of global controller/routers, individually addressable System Field Devices that are not integral to luminaires, sensors, switches, relays and other ancillary devices required for a complete and operable system. The system WAN/LAN start-up shall be by the control system manufacturer or contractors certified by the manufacturer.

C. The basis of system design shall utilize non-proprietary industry standard 0-10V dimming or fixed output ballasts and/or 0-10V LED drivers, occupancy sensors, daylight sensors, etc.

D. UL 924 listed devices shall have the ability to control 120V/277V/347V load.

E. System software interface shall have the ability to notify communication failures to system users via system & email messages. Email messages shall be available in html and text formats.

F. On-going system expansion, service and support shall be available from multiple factory certified vendors. Recommended service agreements may be submitted at the time of bid complete with manufacturers suggested inventory and pricing for system parts and technical support labor.

G. Lighting Control Software: The system shall offer central lighting control for the facility lighting administrator to perform energy management, configuration maintenance, monitoring operations, and providing support to building occupants.

1. Native central control software shall be utilized for energy performance monitoring and complete programming without the need for any third-party hardware or software. Systems that require any third party linked software or graphics shall be unacceptable.

2. Software shall provide information on general system settings via mouse click on a floor plan. Left clicking over a device on the graphical software interface shall show a description of the selected device/function attribute.

H. Central Lighting Control:

1. Shall provide an Interactive, Web-based graphical user interface (GUI) showing floor plans and lighting layouts that are native to the lighting control software. The only means required to program and operate the lighting control system shall be programmed and operated from a user interface that is based on a plan view graphical screen on the user's computer or the lighting control system's main computer. Shall include the navigational features listed below to allow for user's orientation within the controlled space, geographic heading and/or landmarks:

a. Interactive;

b. Vector based;

c. Zoom;

d. Rotate;

e. Pan;

f. Tilt.

2. Shall allow building operator to navigate through an entire facility both in two- dimensional and three-dimensional multi-floor view, allowing for fast and easy navigation.

3. Three-dimensional view shall exclude walls and other structural features to avoid shadowing and cluttering of the plan view.

4. Shall display multiple floors in single view resulting in easier system performance visualization for the entire site as well as individual zones or spaces.

5. Shall allow system performance visualization across a portfolio of buildings via a single interface.

6. All programming assignments of lighting loads to control strategies, lighting status and lighting energy reporting shall be native to the software and executed from this GUI. Editing shall be available from this GUI in a drag and drop format or from drop down menus without the need for any third-party software. Systems that utilize or require third party linked graphics are unacceptable. The GUI shall continuously indicate the status of each connected device on the system and a warning indicator on the software if a device goes offline. Systems requiring spreadsheet editing for programming and that don't offer real time feedback are not acceptable.

7. Software settings and properties shall be selectable per individual device, room based, floor based or global building based.

    a. Lighting Control Software interface shall provide current status and enable configuration of all system zones including selected individual luminaire availability, current light level, maximum light level, on/off status, occupancy status, and emergency mode (response to an emergency signal) status.

8. Shall have the ability to display various lighting system parameters such as Lighting status (ON/OFF); Lighting levels, Load shedding status, or Lighting energy consumption, Occupancy status in a colorized gradient ("weather" map) type of graphical representation.

9. Energy Analysis data shall be exportable in CSV or image file formats.

10. Shall allow import of native AutoCAD files.

I. Reports: Reporting feature shall be native to the lighting control software and capable of reporting the following parameters for each device and zone individually without requiring any third-party hardware and software:

1. Energy consumption broken down by energy management strategy.

2. Energy demand broken down by energy management strategy.

3. Occupancy data by zone.

4. Building wide occupancy status

5. Time Schedule status

6. Lighting energy consumption in a color gradient ("weather map" type) view

7. Energy performance reports shall be printable in a printer friendly format and downloadable for use in spreadsheet applications, etc.

8. Battery status report indicating device name, location on the floor plan and battery voltage shall be printable in a printer friendly format and downloadable for use in spreadsheet applications, etc.

9. Color gradient ("weather map" type) view for the following:

    a. Robustness of the mesh network (hop count)

    b. Route of the signal

c. Wireless signal strength

d. Battery status for wireless components

J. Daylight Harvesting (Light Regulation Averaging): In a photo sensor-equipped system, the Central Controller Unit shall rationalize changes to light levels when ambient (natural) light is available and shall maintain a steady light level when subjected to fluctuating ambient conditions where 0-10V dimming ballasts and/or drivers exist. Areas equipped with fixed output ballasts and/or drivers shall energize when natural light falls below foot-candle levels specified. System shall utilize light level inputs from common and/or remote sensor locations to minimize the number of photo sensors required. The System shall operate with multiple users in harmony and not react adversely to manual override inputs.

K. Time Clock Scheduling: The system shall be programmable for scheduling lights on or off via the Lighting Control Software interface.

1. Programming: User friendly, Outlook style interface shall be available for programming schedules.

2. Override: Manual adjustments via wallstations or personal control software shall temporarily override off status imposed by time clock schedule.

3. Response to Power Failure: In the event of a power failure, the time clock shall execute schedules that would still be in progress had they begun during the power outage.

4. Flick Warning: Prior to a scheduled lights-off event or expiry of a temporary override, the system shall provide two short light level drops as a warning to the affected occupants. Flick warning time shall have the ability to be programmed via software between 1 and 5 minutes.

5. Option to automatically turn on or wait for an input: Using this option, a group of luminaires can be made to turn on automatically in response to a scheduled event or wait for a signal from a wallstation to turn the same group of luminaires on (and stay on) for the reminder of the scheduled event.

6. Shall support BMS Schedules/Calendars

L. Load Shed Mode: An automatic load shedding mode shall be available where, when activated through the system, the control unit will reduce its output to a programmable maximum electrical demand load. The system shall not shed more load than required and load shedding priority shall be centrally configurable by control zone or by common uses (i.e., all hallways can be treated as one load shed group), with subsequent load shed priority groupings being utilized until the required defined load has been shed, for either a defined period, or until the demand response input has been removed. Systems that simply select a “load shed scene” whereby there is no guarantee that the defined required load will actually be shed are not acceptable.

M. Emergency Mode: There shall be a mode, when activated through the system, that will immediately adjust lights to full light output and retain that level until the mode is deactivated in the event of an emergency. This setting shall override all other inputs. The system shall interface with the building emergency monitoring system at a convenient point and not require multiple connections.

N. Addressing: All ballasts and/or drivers shall be centrally addressable, on a per luminaire or multiple luminaire/zone basis, through the Central Control Software. The basis of design shall utilize 0-10V Dimming, Fixed Output Ballasts and/or 0-10V LED Drivers connected to an Output Module. To simplify ongoing maintenance, the system shall not require manual recording of addresses for the purpose of start-up or reconfiguration.

O. Programmable Task Tuning: The light output level of an individual or group of luminaires shall be programmed via system software.

P. Continuous Dimming: Individual or group of luminaires dimming in response to user-initiated action and/or system generated signal shall be over continuous range.

Q. Unoccupied State: The system shall provide two (2) states when occupancy status is vacant as per an occupancy sensor - lights turn off or lights adjust to configurable (dimmed) light level.

R. Occupied State: The system shall be capable of creating “comfort” or “support” zones to ensure that occupants are not isolated by turning off lights in adjacent areas, such as a hallway path to exit the premises for occupant comfort and safety.

S. Overlapping Zones: System shall be capable of creating “overlapping” zones to ensure continuous lighting and safety of the occupants as they move from one lighting zone to another (for example, hallways) while minimizing the energy use.

T. Participation in Intelligent Building Framework: The system shall have the ability to be a component of Intelligent Building framework. Wireless Managers and System server communication shall be based on TCP/IP over Ethernet backbone.

U. LAN Operations: System shall be capable of operating independent of building’s existing network infrastructure if desired and shall not rely on tenant supplied PCs for operation. Network infrastructure shall only be utilized for Personal Control Software.

V. Network Security: Firewall Technologies & VLAN Configuration methods shall be utilized to separate tenants from the lighting control network and ensure the integrity of lighting control network.

W. Lamp Burn In: The system software shall have the capability of not permitting dimming of new lamps prior to completion of lamp manufacturer recommended accumulated operation at full brightness.

X. Lighting Maintenance:

1. System software shall notify wireless low battery, lamp or ballast failure events via system & email messages.

2. Wireless devices hop count, route of the signal, signal strength & battery voltage levels shall be available via GUI.

3. Percentage left in Lamp & Ballast Life Time shall be programmed to display in different colors for easier visual representation and quicker maintenance turnaround time.

4. 0-10V Dimming and/or Fixed Output Ballast/LED Driver replacements shall not require re-programming of the system or re-addressing of the said components.

Y. Group (zone) Configuration: The assignment of individual or group of system components to zones shall be performed via Central Control Software such that physical rewiring will not be necessary when workspace reconfiguration or re-zoning is performed. Removal of covers, faceplates, ceiling tiles, etc. shall not be required.

Z. Sensor Control Parameters: Occupancy sensor time delays shall be configurable through software. Light level sensor parameters shall be configurable through software.

AA. Automatic Time Adjustment: System shall automatically adjust for leap year and daylight savings time and shall provide weekly routine and annual holiday scheduling.

BB. The system software shall have the capability of providing an optional web-based energy dashboard to show real time energy savings data and carbon footprint reductions.

CC. Contact closure input: System shall be capable of receiving a momentary and sustained contact closure input from third party sources to control lighting zones.

DD. The system shall have the ability to control (dim/switch) a group of luminaires with loads up to 20A.

EE. Plug Load Control: The system shall offer occupancy sensing or time schedule-based plug load control capability.

FF. Astronomical Clock feature: Luminaires switch ON/OFF with the sunset and sunrise (with an option to select offset, depending on the geographic location (latitude & longitude) of the building. An offset option shall be available to turn the schedule ON/OFF up to 12 hours before or after dusk or dawn.

GG. System shall auto-configure lighting controls for spaces that have been combined or divided temporarily by moving wall or similar systems.

HH. System shall automatically lock wallstations and/or disable sensors based on one of the following system inputs: contact closure, a time schedule or the status of a monitored space.

II. BAS Interface: The light management system shall be capable of interfacing digitally with a building automation system via BACnet/IP. The lighting control system shall be capable of communicating the status of output devices (lighting loads) as well as input devices (dry contacts, switches, occupancy sensors, vacancy sensors, and photocells) to the BAS. Building Automation System, utilize data from lighting control system input devices such as occupancy sensors to determine the status (occupied/unoccupied) of the mechanical control zones and perform climate adjustments accordingly.

JJ. AV Interface: The light management system shall be capable of interfacing with audio-visual system (e.g., LCD Touch Screen Panel) via TCP/IP interface.

KK. Migration plan to control LED luminaire: System shall be capable of migrating from the control of 0-10V Ballasts to 0-10V LED Drivers utilizing the same control hardware.

LL. AC Phase Cut Dimming circuit Integration: System shall have the ability to control Incandescent, Fluorescent or LED lighting load that are otherwise controlled by manual AC Phase Cut Dimmers.

MM. Wireless networks shall be reliable (mesh topology), self-configuring (discovery) and self-healing. Unexpected interruptions in the network shall be automatically compensated for by re-directing communication.

NN. Wireless network shall provide high level of security by employing logically unbreakable secure encryption methods (e.g., 128-bit encryption).

OO. System design shall ensure seamless communication among devices when hybrid wired/wireless control systems are implemented. Hybrid control system refers to devices that communicate over a DALI/0-10V field bus and/or wireless medium that uses non-proprietary open protocol (e.g., ZigBee®) for communication. Devices in the hybrid control system shall communicate with all the devices in the system regardless of their native protocol they are designed to work with.

1. Luminaires enable wireless communication either via add-on or integrated modules

PP. System shall be capable of operating a lighting control zone according to several sequences of operation. System shall be able to change a spaces sequence of operation according to a time schedule so as to enable customized time-of-day, day-of-week utilization of a space. Note operating modes should be utilized only in manners consistent with local energy codes.

1. Auto-On / Auto-Off (via occupancy sensors):

    a. Zones with occupancy sensors automatically turn lights on when occupant is detected.

    b. Zones with occupancy and/or photocell sensors turn lights off when vacancy or sufficient daylight is detected.

    c. Pressing a switch will turn lights off. The lights will remain off regardless of occupancy until switch is pressed again, restoring the sensor to Automatic On functionality.

2. Manual-On / Auto-Off (also called Semi-Automatic, Vacancy Sensing or Occupant Sending Device set to Vacancy Mode):

    a. Pushing a switch will turn lights on.

    b. Zones with occupancy and/or photocell sensors turn lights off when vacancy or sufficient daylight is detected.

3. Manual-On to Auto-On/Auto-Off:

    a. Pushing a switch will turn lights on.

    b. After initial lights on, zones with occupancy and/or photocell sensors turn lights on/off according to occupancy/vacancy and/or daylight conditions.

    c. Sequence can be reset via scheduled (ex. daily each morning) events

4. Auto-to-Override On:

    a. Zones with occupancy sensors automatically turn lights on when occupant is detected.

    b. Zone lighting then goes into an override on state for a set amount of time or until the next time event returns the lighting to an auto-off style of control.

    c. Sequence can be reset via scheduled (ex. daily each morning) events

5. Manual-to-Override On

    a. Pushing a switch will turn lights on.

    b. Zone lighting then goes into an override on state for a set amount of time or until the next time event returns the lighting to an auto-off style of control.

    c. Sequence can be reset via scheduled (ex. daily each morning) events

6. Auto On / Predictive Off

    a. Zones with occupancy sensors automatically turn lights on when occupant is detected.

    b. Zones with occupancy and/or photocell sensors turn lights off when vacancy or sufficient daylight is detected.

        1) If switch is pressed, lights turn off and a short “exit timer” begins. After timer expires, sensor scans the room to detect whether occupant is still present. If no occupancy is detected, zone returns to auto-on. If occupancy is detected, lights must be turned on via the switch.

QQ. Lighting Control Applications:

1. Unless relevant provisions of the applicable local Energy Codes are more stringent, provide a minimum application of lighting controls as follows:

    a. Space Control Requirements – Provide occupancy/vacancy sensors with Manual- or Partial-ON functionality in all spaces except toilet rooms, storerooms, library stacks, or other applications where hands-free operation is desirable and Automatic-ON occupancy sensors are more appropriate. Provide Manual-ON occupancy/vacancy sensors for any enclosed office, conference room and meeting rooms. For spaces with multiple occupants, or where line-of-sight may be obscured, provide ceiling- or corner-mounted sensors and Manual-ON switches.

    b. Bi-Level Lighting – Provide multi-level controls for the Gymnasium and Auxiliary Gymnasium.

    c. Daylit Areas – Provide daylight-responsive automatic control in all spaces (conditioned or unconditioned) where daylight contribution is available as defined by relevant local building energy code:

        1) All luminaires within code-defined daylight zones shall be controlled separately from luminaires outside of daylit zones.

        2) Daytime setpoints for total ambient illumination (combined daylight and electric light) levels that initiate dimming shall be programmed in compliance with relevant local building energy codes.

        3) Multiple-leveled switched daylight harvesting controls may be utilized for areas marked on drawings.

4) Provide smooth and continuous daylight dimming for areas marked on drawings. Daylighting control system may be designed to turn off electric lighting when daylight is at or above required lighting levels, only if system functions to turn lamps back on at dimmed level, rather than turning full-on prior to dimming.

PART 3 EXECUTION

3.01 PRE-INSTALLATION MEETING

A. A factory authorized manufacturer's representative shall provide the electrical contractor a functional overview of the lighting control system prior to installation. The contractor shall schedule the pre-installation site visit after receipt of approved submittals to review the following:

1. Confirm the location and mounting of all digital devices, with special attention to placement of occupancy and daylighting sensors.

2. Review the specifications for low voltage control wiring and termination.

3. Discuss the functionality and configuration of all products, including sequences of operation, per design requirements.

4. Discuss requirements for integration with other trades.

B. Calibrate all sensor time delays and sensitivity to guarantee proper detection of occupants and energy savings.

C. Adjust time delay so that controlled area remains lighted while occupied.

D. Provide written or computer-generated documentation on the configuration of the system including room by room description including:

1. Sensor parameters, time delays, sensitivities, and daylighting setpoints.

2. Sequence of operation, (e.g., manual ON, Auto OFF. etc.)

3. Load Parameters (e.g., blink warning, etc.)

E. Post start-up tuning – After thirty (30) days from occupancy contractor shall adjust sensor time delays and sensitivities to meet the Owner's requirements. Provide a detailed report to the Architect / Owner of post start-up activity.

3.02 COMMISSIONING SUPPORT SERVICES

A. On this project, a commissioning agent will be hired to verify the installation and programming of all building systems, which includes the lighting control system. Manufacturer should include an extra day of technician's time to review the functionality and settings of the lighting control hardware with the commissioning agent, including reviewing submittal drawings and ensuring that instructions on how to configure each device are readily available. Manufacturer is NOT responsible for helping the commissioning agent inspect the individual devices. It will be the commissioning agent's responsibility to create and complete any forms required for the commissioning process, although the manufacturer or contractor may offer spreadsheets and/or printouts to assist the agent with this task.

B. The commissioning agent shall work with the electrical contractor during installation of the lighting control hardware to become familiar with the specific products. The agent may also accompany the manufacturer's technicians during their start-up work to better understand the process of testing, calibration and configuration of the products. However, the contractor and manufacturer shall ensure that interfacing with the agent does not prevent them from completing the requirements outlined in the contract documents.

3.03 EQUIPMENT INSTALLATION AND DOCUMENTATION

A. Installation: The control system shall be installed and fully wired as shown on the plans by the installing Contractor. The Contractor shall complete all electrical connections to all control circuits and override wiring.

B. Documentation: The Contractor shall provide accurate "as-built" drawings to the Owner for correct programming and proper maintenance of the control system. The "as-builts" shall indicate the load controlled by each relay and the relay panel number.

C. Operation and Service Manuals: The factory shall supply all operation and service manuals as related to the design of the control system.

3.04 PRODUCT SUPPORT AND SERVICE

A. Factory Support: Factory telephone support shall be available at no cost to the Owner. Factory assistance shall consist of solving programming or application questions concerning the control equipment. The factory shall maintain toll-free numbers for technical support for their customers.

3.05 START-UP & SUPPORT FEATURES

A. Upon completion of the installation, the manufacturer's factory authorized representative shall start up and verify a complete fully functional system.

B. The electrical contractor shall provide both the manufacturer and the electrical engineer with three weeks written notice of the system start up and adjustment date.

C. Upon completion of the system start up, the factory-authorized technician shall provide the proper training to the owner's personnel on the adjustment and maintenance of the system.

D. To facilitate start-up, all devices daisy-chained together (using CAT-5) shall automatically be grouped together into a functional lighting control zone.

E. All lighting control zones shall be able to function according to default settings once adequate power is applied and before any system software is installed.

F. Once software is installed, system shall be able to auto-discover all system devices without requiring any commissioning.

G. All system devices shall be capable of being given user defined names.

H. All devices within the network shall be able to have their firmware reprogrammed remotely and without being physically uninstalled for purposes of upgrading functionality at a later date.

I. All sensor devices shall have the ability to detect improper communication wiring and blink it's LED in a specific cadence as to alert installation/startup personnel.

3.06 SYSTEM ACCEPTANCE

A. The Contractor is responsible for complete installation of the system according to strict factory standards and requirements. The following items shall be included requirements:

B. All system equipment shall operate in accordance with specification and industrial standard procedures.

C. An operational user program shall exist in the control system. The program shall execute and perform all functions required to effectively operate the site according to the requirements.

D. Demonstration of program integrity during normal operation and pursuant to a power outage.

E. Contractor shall provide a minimum of three hours training on the operation and use of the control system. Additional support services shall be negotiated between the Contractor and the building Owner or manager.

END OF SECTION 26 09 23

SECTION 26 22 13

DRY TYPE TRANSFORMERS

PART 1 GENERAL

1.01 WORK INCLUDED

A. When shown on drawings, provide dry type transformers complete. Transformers shall be UL listed and comply with NEMA Standard ST-20.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Tierney.

B. Sorgel Quiet Quality.

C. General Electric QL.

D. Federal Pacific.

E. Similar units by Cutler-Hammer, Acme or Hevi-Duty may be utilized if the core and coil assembly is mounted on rubber isolation pads.

2.02 STANDARDS

A. ANSI C57.12.01/NEMA ST-20: General Requirements for Distribution, Power, and Regulating Transformers.

B. Underwriters Laboratories Standard 1561.

C. NEMA ST-20: Dry-Type Transformers for General Applications.

D. Transformers shall be NEMA TP-22016 Energy Efficient compliant and meet the requirements of the Department of Energy, 10 CFR Energy Conservation Standards for Distribution Transformers.

2.03 SHOP DRAWINGS

A. Prepare and submit for review prior to manufacture; include dimensioned front plan and section views, wiring and connection diagrams and bolting template. Contractor shall indicate on the drawings, mounting methods and connection lugs required.

2.04 CABINET

A. Steel panel enclosure over core, coil, and terminal chamber with louvered openings for convection cooling. Cooling and terminal access shall be possible with both sides and rear of enclosure obstructed.

B. Provide weatherproof or special enclosure when required for environment in which it is located.

2.05 WINDINGS

A. Separate primary and secondary. Windings shall have Class H insulation and shall be rated for continuous operation at rated KVA with temperature rise of not over 150 degrees C above a 40 degree C ambient, with a maximum hot spot temperature of 220 degrees C. Windings and core and coil assembly shall be treated and built to resist the effects of dirt and moisture.

B. Core coil shall be mounted on rubber isolation mounting pads. Cores shall have a common core construction having low hysterisis and eddy current losses grounded to the transformer core. The neutral bus shall be sized and configured for at least 200% of the secondary full load current. Transformer impedance shall be a minimum of 3 and a maximum of 5%. The transformer shall be UL listed and suitable for non-sinusoidal loads with a K factor of 4.

C. Shall contain grounded electrostatic shield.

2.06 PRIMARY TAPS

A. Four full capacity taps, minimum of two 2-1/2 percent above and two 2-1/2 percent below normal (rated) primary voltage.

2.07 CONNECTIONS

A. Unless noted otherwise, three phase transformers shall have a 480-volt delta connected primary and 208Y/120-volt, three phase, four wire connected secondary, single phase transformers shall be 480-volt primary, 120/240 volt secondary. Provisions for external connections shall be made by means of a terminal board employing lugs conforming which are compatible with the external conductors installed. (Note: aluminum conductors require special lugs.) All connections shall be accessible for front and top of cabinet.

2.08 NOISE LEVEL

A. Noise level shall not exceed ANSI Standard C89.2 sound levels of 45 dB for sizes less than 51 kVA, 50 dB for 51-150 kVA, 55 dB for 151-300 kVA and 60 dB for greater than 300 kVA as measured by NEMA ST20.

B. When shown, transformers shall be ultra-quiet type. Noise level shall not exceed 35 dB for all sizes through 300 kVA. Shall be similar to Tierney Quietran. All ultra-quiet transformers shall be factory certified to have noise levels not exceeding those specified. Forward certification to Engineer and include copy in the O&M Manual.

2.09 EFFECIENCY

A. Dry transformers shall have a minimum efficiency that complies with NEMA TP-2-2016.

2.10 VIBRATION ISOLATORS

A. The following are options that the Contractor may utilize for the vibration isolators:

1. **Spring vibration isolators** shall be B-Line model HMT or equal with neoprene top and base.

2. **Vibration pads** shall be cork, neoprene, and steel construction, B-Line model CNNK or equal.

3. **Neoprene pad spacers** shall be B-Line model NNP or equal.

PART 3 EXECUTION

3.01 MOUNTING

A. Transformers shall be attached to the building structure to prevent overturning in the event of earthquake. All attachment nuts to have washer and rubber pad spacer under them. Provide neoprene pad spacers under mounting rails. Transformers shall be mounted on floor, wall or suspended from ceiling as noted in the contract documents or as required. Remove all shipping blocks prior to installation.

B. Transformers with enclosures designed for floor mounting where suspended from ceiling shall be suspended on a trapeze constructed of a minimum of two horizontal structural channels hung from threaded rods attached to structural members or inserts in structural slab. Channel, rod, and inserts shall be sized for not less than 400% load safety factor.

C. Transformers shall be installed with four spring vibration isolators, one at each corner, when any of the following conditions are present. Size each isolator for the full transformer weight.

1. Transformer is 45 kVA or larger.

2. Transformer is located higher than one floor above grade.

3. Transformer is noted "SIM" in the contract documents.

D. All transformers mounted directly on a wall shall be mounted with vibration pads sized to give 400% safety factor.

3.02 CONNECTIONS

A. 208Y/120V three-phase secondary transformers shall be considered "grounded neutral separately derived systems" and be grounded per code accordingly.

B. Transformer raceway connections shall be flexible metal raceway. See Section 26 05 33.

C. Voltage Tap Connection: Connect all transformers at "normal" tap. After facility is completely energized, measure secondary voltages at all transformers and service switchboard. Forward a list to the Architect/Engineer for evaluation. Include copy in O&M Manuals. Reconnect taps as subsequently directed. All costs associated with this work shall be included in base bid.

END OF SECTION 26 22 13

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SECTION 26 24 13

SWITCHBOARDS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Section 26 00 00 – Electrical General Conditions

1.02 WORK INCLUDED

A. Provide all service entrance and main distribution switchgear with equipment as shown and described, with continuous full load ampacities as indicated.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Square-D

B. General Electric

C. Cutler-Hammer

D. Siemens

2.02 ENCLOSURES

A. Shall be freestanding, steel with steel angle or channel framework of adequate strength and rigidity necessary to resist all conditions of use to which it may be subjected and to support all equipment, devices and appurtenances contained therein. Front plates shall be installed in sections so that all parts of the board are front accessible without disturbing other parts. A removable lifting angle shall be provided at the top and bottom of each shipping section(s).

B. Minimum 12-gauge steel, except front panels and doors may be minimum 14 gauge.

C. Shall be front access only unless noted otherwise.

D. Provide on 3-inch housekeeping concrete pad with minimum 3-inch lip on front and sides.

E. Finish shall be factory applied; standard gray color for all exterior and interior painted surfaces. Other colors may be considered.

F. Outdoor installation shall be NEMA 3R.

2.03 SWITCHBOARD DIMENSIONS

A. Overall height of switchboards shall not exceed 90 inches (not including base channels). Length and depth shall not exceed dimensions as scaled or noted in contract documents. Manufacturers whose equipment dimensions exceed those indicated shall notify the Engineer in writing ten (10) days prior to bid date. These Manufacturers may not bid as "Not Conforming to Contract Documents". Contractor shall base bid only on equipment which fully complies with contract documents. Cost of building modifications or switchboard relocations, if permitted, or other additional work required to fit larger size switchboard(s) than shown on drawings shall be borne totally by the Contractor.

2.04 SWITCHBOARD BUSBARS

A. Aluminum or copper at manufacturer's option, factory fabricated; carried to terminals for connection to service cables or busway. Brace switchboard components for symmetrical fault current shown plus a symmetrical offset (50,000-amp bracing minimum). Aluminum bus shall be tin plated over its full length.

B. Busbar Joints:

1. Busbar to busbar shall be bolted, lapped and silver or tin plated, having low contact resistance and low temperature rise. For aluminum bus bolt using Grade 5 bolts with Belleville washers.

2. Overcurrent devices shall be bolted to busbars using Grade 5 bolts and Belleville washers. Exception: Square-D I-line and 30-200A fused switches

C. Conductor connectors shall be bolted to busbars using Grade 5 bolts and Belleville washers. Where aluminum conductors are utilized for feeders the connectors shall conform with Section 26 05 19.

D. System of Bussing: Three phase, 4 wire, full size neutral unless otherwise noted.

E. Ground Bus: Full length ground bus bonded to frame conforming to U.L. 891 for minimum size except larger as required by the code for grounding neutral conductor.

2.05 SWITCHBOARD COMPONENTS

A. Switchboards shall include (but not limited to) the following components:

1. Shall be full-fault current rated, series rating of devices is not allowed.

2. Switches and fuses or breakers as shown. If fuses are used, provide all necessary fuses and spares per Section 26 28 13.

3. Space for future switches or breakers as shown including complete bussing and required hardware for mounting devices. Space for metering and instrumentation components, and current limiters (when required).

4. Miscellaneous appurtenances as required for a complete installation.

5. Cleats for securing all conductors.

B. When Serving as Service Entrance Equipment:

1. Shall conform to UL 869 and have a Service Entrance Type UL label

2. Shall be full-fault current rated, series rating of devices is not allowed. See drawings.

3. Where utility company metering equipment is shown, provide current transformer space, meter base(s), metering conductors and miscellaneous appurtenances as required by serving utility.

4. Shall contain surge arrestors on all phases for voltage surge protection on secondary (under 600V) electrical wiring systems. Similar to Square-D, J9200.

C. Digital Line Meter/Monitor

1. Provide a digital line Meter / Monitor device equal to Cutler-Hammer type IQ DP-4000 Series having the features and functions specified below. The Meter / Monitor device shall consist of a single microprocessor-based unit capable of monitoring and displaying the functions listed below with the accuracy indicated; the MM4 shall auto range between units, kilounits and megaunits. The Meter / Monitor device shall provide the adjustable protection functions indicated and the capability to communicate data via twisted pair network. The MM4 shall be UL listed, CUL and CE certified and also meet ANSI standard C37.90.1 for surge withstand.

Metered Values	**Alarm Functions (Accuracy % Full Scale)**
AC Phase Amperes +/- (0.3%)	Voltage Phase Loss
AC Phase Voltage +/- (0.3%)	(less than 50% rms)
Watts +/- (0.6%)	Current Phase Loss
VA +/- (0.6%)	(1/16 largest phase)
vars +/- (0.6%)	Phase Voltage Unbalance
Power Factor 1.0% (+/- 1 digit)	(5 to 40% – 5% steps)
Frequency +/- (0.1 Hz)	Phase Voltage Reversal
Watthours +/- (0.6%)	Overvoltage
varhours +/- (0.6%)	(105 to 140% – 5% steps)
VA hours +/- (0.6%)	Undervoltage (95 to 60% – 5% steps)
Watt Demand with	Time Delay for Overvoltage,
10-, 15-, 20-, 25-, 30-,	Undervoltage, and Phase
45-, 60-minute interval)	Unbalance (0 to 20 seconds –
%THD (through 31st harmonic)	1-sec. steps)
Voltage – minimum/maximum	
Current – minimum/maximum	
Power – minimum/maximum	
Power Factor – minimum/maximum	
Frequency – minimum/maximum	
Peak % THD	
Peak Demand	

2. Input ranges of the Meter / Monitor device shall accommodate external current transformers with ranges from 5/5 through 12,800/5 amperes. Provide external current transformers sized for incoming service. Potential transformers shall be self-included and fused up to 600 volts. Above 600 volts, provide fused external potential transformers.

3. Control power shall be capable of being supplied from the monitored incoming AC line without the need for a separate AC supply control circuit or separate remote power source (96 to 264V AC or 100 to 350V DC) where shown on the drawings.

4. Provide the following features:

   a. Synchronizing pulse input shall be provided, and when activated, shall override the preset watt demand interval and let the utility control the demand window.

   b. Load shed feature, which activates the pulse initiation relay when a user selected parameter exceeds a pre-programmed range.

   c. Outputs shall have separate Form C (NO/NC) trip and alarm contacts with ratings of 10 amperes at 115/240V AC or 30V DC resistive. In addition, provide a separate Form C (NO/NC) contact to provide a programmable kilowatt-hour pulse output. The pulse shall be KYZ type.

5. Provide an addressable communication card capable of transmitting all data, including trip data over a compatible two-wire local area network to a central personal computer for storage and/or printout. The network shall also be capable of transmitting data in RS-232c format via a translator module.

D. Ground Fault Protection: Provide the following ground fault protection equipment on breakers (switches) rated 1000 amps or more, and as indicated.

1. A current transformer (also called a sensor or current monitor) installed and connected to indicate the sum of all phase and neutral currents. (Zero sequence method). A current transformer on the grounding conductor is not acceptable.

2. A current transformer (also called a ground break relay) operated by the current transformer. Trip point shall be adjustable (calibrated scale indication) from 20% to 60% of the breaker or switch rating (or 1200 amps whichever is lower). The sensor shall also include an adjustable time delay (calibrated scale indication) from .1 second to .4 second (approximately).

3. A monitor or test panel whose functions shall furnish a means to test the ground fault system; monitor to control voltage; indicate when the sensor has tripped the breaker (switch); and reset the system.

4. A trip device on the breaker or switch operated by the ground fault sensor.

E. Ground current meter and current transformer similar to Square-D #EA1GG/GF1 with current transformer on the neutral bonding jumper.

2.06 NAMEPLATES

A. Nameplates shall be installed on all switchboards. Each individual switch shall be identified with a nameplate adjacent to the switch, describing the load connected.

B. Provide a service entrance label nameplate on the main switchboard which includes the following:

1. Architect

2. Electrical Consultant

3. Electrical Contractor
4. Date of Installation
5. Service Voltage & Bus Amperage Rating
6. Symmetrical Short Circuit Current Rating
7. Year of Manufacture

C. Lettering size shall be suitable for the size of plate and information contained. Nameplates shall be engraved plastic (3/8-inch high minimum letters). Attach with stainless steel screws.

D. Nameplate color shall be Emergency System - white on red, normal System - white on black.

E. Provide a riser diagram drawing using non-fading ink and mylar installed under glass and attached to the exterior of the main switchboard showing feeder runs, panels, transformers and raceway sizes.

2.07 SINGLE PHASING SENSORS

A. Provide single-phasing sensors to trip the main switches in the event of a single-phase failure.

2.08 CLEATS

A. Provide for securing all feeder cables within the switchboard.

PART 3 EXECUTION

3.01 MOUNTING

A. Shall be bolted to floor using 1/2" x 8" (minimum) black mild steel foundation anchor J-bolts and anchored similarly to building structure to prevent overturning in the event of earthquake. Provide 3" thick structural concrete "housekeeping pad". J-Bolts in the floor shall be set in the structural floor and extend through the housekeeping pad with sufficient threads to attach the switchboard.

3.02 WIRING

A. Shall conform to applicable Sections of these specifications.

B. Shall be secured to switchboard enclosure with cleats. Maximum spacing shall not exceed 24 inches.

3.03 SPACE

A. Verify space available with equipment sizes and code required working clearances prior to submittals of shop drawings

3.04 GROUNDING

A. Provide pursuant to Section 26 05 26.

3.05 UTILITY REQUIREMENTS

A. When service switchboard includes utility company metering equipment, provide all devices and wiring to meet serving utility requirements.

3.06 TESTS

A. Torquing requirements and installation of all terminations 1,000 amps and above shall be certified by an independent testing agency.

3.07 PULSE OUTPUT FOR REMOTE METERING, SINGLE PHASE, UNDER/OVER VOLTAGE OUTPUT

A. Provide programming of the digital meter assembly and provide all necessary components to supply a calibrated pulse output signal and a single phase, under/over voltage signal to interface with the EMCS system. Programming shall be provided by a factory authorized representative. Coordinate with the EMCS Contractor as required for complete operation.

END OF SECTION 26 24 13

SECTION 26 24 16

PANELBOARDS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Section 26 00 00 – Electrical General Conditions

1.02 WORK INCLUDED

A. Provide all panelboard equipment, complete; dead front type.

PART 2 PRODUCTS

2.01 PANELBOARD TYPE

A. Panelboards shall be rated at proper voltage and current for intended use with busbars of copper or aluminum. Panels shall be 3-phase, 4-wire, 100% neutral, unless noted otherwise. Where aluminum is utilized, all lugs shall be of an approved compression type. Provide multiple lugs where conductors in parallel or "feed through" are shown on the Drawings.

B. Conductor Connectors shall be bolted to busbars using Grade 5 bolts and Belleville washers. Feeder conductor connectors shall be rated for 75 Degree C. wire when 75 Degree C. wire is indicated. Where aluminum conductors are utilized for feeders or branch circuits the connectors shall conform with Section 26 05 19.

C. Panelboards shall have a separate ground bus bonded to the panelboard frame.

D. Where 120-Volt, 15- or 20-Amp breakers are intended for switching loads they shall be of type rated for switching duty labeled "SWD."

2.02 ACCEPTABLE MANUFACTURERS

A. General Electric

B. Square-D

C. Siemens

D. Cutler-Hammer

2.03 CIRCUIT BREAKERS

A. For all systems 480Y/120V, the interrupting capacity shall be a minimum 14,000 AIC symmetrical amps. For all systems 208Y/120V, the interrupting capacity shall be a minimum 10,000 AIC symmetrical amps. Other ratings shall be as specified on panel schedules shown on the Drawings. Series rating of breakers is not allowed.

B. Mount breakers in all panelboards so that breaker handles operate in a horizontal plane. Bolt in type only. Provide common trip on all multiple pole breakers.

C. Where noted, provide spare breakers, complete for future connection of wiring circuits. Where "Space" is indicated for breakers, provide all bussing and breaker mounting hardware in the panelboard, provide steel knockouts in dead front metal closure of unused part of panel. If any steel knockouts are removed, provide breakers in such spaces or approved cover plates. Open spaces are not permitted.

2.04 CABINET FOR EACH PANELBOARD

A. Flush or surface, as indicated; tight closing doors without play, when latched. Where two cabinets are located adjacent to each other in finished areas, provide matching trim of the same height. Where a remote-controlled switch or contactor is mounted in any panelboard, mount on same frame as panelboard interior with screw retained access door in dead front shield; common door over circuit breakers and remote-controlled device. Where flush mounted, provide two (2) 3/4" conduits to accessible ceiling space for future expansion.

B. All conduits for future expansion shall stub into a junction box, where located above grade, and shall be sealed in the panel.

C. Provide cabinets of sufficient dimensions to allow for future expansion and addition of circuit breakers within the panelboards as indicated on panel schedules.

D. Provide cabinet front with full-height hinged door. One door over the interior and an additional hinged dead front cover over interior and wireway (door-in-door). Full-height front cover hinged to box with concealed trim clamps. Provide flush door locks.

E. Provide lock for each cabinet door. All Electrical Distribution Equipment Locks shall be keyed identically. Key system shall match existing. Supply Owner with minimum six keys.

F. Fasten panelboard front with machine screws with oval counter-sunk heads, finish hardware quality, with escutcheons or approved trim clamps. Clamps accessible only when dead front door is open are acceptable. Surface mounted panelboards with fronts greater than 48 inches vertical dimension shall be hinged at right side in addition to hinged door over dead front.

G. Finish: Provide factory prime coat for cabinets to be located in finished areas. Where cabinets are located in unfinished areas, standard lacquer or enamel finish, gray or blue-gray color, shall be substituted for factory prime coat.

2.05 SYSTEM OF NUMBERING AND BUS ARRANGEMENT

A. Shall be as shown on the Panel Schedules on the Drawings.

2.06 PANELBOARD NAMEPLATE

A. Provide engraved and filled (or color layer - engraved through outer layer) plastic nameplate with 1/2-inch high characters (for panel name); attached with screws to each NEMA 1 panelboard front. White on black, include voltage, phases, wires and minimum A.I.C. Rating in 3/8-inch characters.

B. Nameplate color shall be:

1. Emergency System: White letters on red
2. Normal System: White letters on black

C. Provide a service entrance label nameplate on the main panelboard which includes the following:

1. Architect
2. Electrical Consultant
3. Electrical Contractor
4. Date of Installation
5. Service Voltage & Bus Amperage Rating
6. Symmetrical Short Circuit Current Rating
7. Year of Manufacture

D. Provide a riser diagram drawing using non-fading ink and mylar installed under glass and attached to the exterior of the main panelboard showing feeder runs, panels, transformers and raceway sizes.

PART 3 EXECUTION

3.01 MOUNTING

A. Secure in place with top of cabinet at 6'-0", unless otherwise noted. Top of cabinet and trim shall be level. Firmly anchor cabinets directly or with concealed bracing to Building Structure. When panels are not located in or directly on a wall, provide a support frame of formed steel channel which is anchored to the floor and Ceiling Structure. Interiors shall not be installed until Structure is totally enclosed. Where panels are mounted adjacent to each other, the top edges shall be at the same height.

3.02 CIRCUIT INDEX

A. For each branch circuit panelboard provide a typewritten index listing each circuit in the panelboard by number with its proper load designation. Mount with a transparent protective cover inside cabinet door. Listing shall match circuit breaker arrangements, typically with odd numbers on the left and even numbers on the right. Room numbers used shall be final room numbers used in the building as verified with the Owner, and not room number assigned on Plans.

3.03 CABINET PAINTING

A. Cabinets furnished as prime painting shall be field painted to match color of adjacent wall. (See Division 09 - Painting).

3.04 SPACE

A. Verify space available with equipment sizes and Code Required Working Clearances prior to Submittal of Shop Drawings.

3.05 GROUNDING

A. Provide separate ground busbar for all panels supplying isolated ground circuits.

3.06 FEED THROUGH AND DOUBLE LUGS

A. Provide feed through or double lugs with amperage equal to the incoming feeder amperage unless shown as larger.

END OF SECTION 26 24 16

SECTION 26 24 19

MOTOR CONTROLLERS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Section 26 00 00 – Electrical General Conditions

1.02 WORK INCLUDED

A. Work under this section includes all requirements for motor controls to be furnished under the electrical portion of the work on all electrical motor driven equipment. Individually mounted starters shall be provided by Division 26 Contractor. Motor controls shall conform to NEMA Standards for each specific purpose.

B. The Division 26 Contractor shall furnish all motor controllers not included with equipment furnished under other divisions of these specifications or by Owner. The Division 26 Contractor shall install all motor controllers including all controllers not factory assembled into equipment furnished under other divisions of these specifications or by Owner.

1.03 MOTOR VOLTAGE INFORMATION

A. Voltages available are 480 Volt, 3 phase or 208 Volt, 3 Phase, and 115 Volt Single Phase.

B. Circuits are designed (in general) for motors as follows:

1. Smaller than 1/2 H.P. - 115 Volts, Single Phase

2. 1/2 H.P. and larger - 460 or 208 Volts, 3 Phase

C. Verify motor sizes and voltages provided under other divisions and notify General Contractor immediately if any discrepancies are noted.

1.04 REGULATORY REQUIREMENTS

A. Provide motor protection switches of the appropriate NEMA size. For units not using NEMA rating, use equivalent NEMA size.

PART 2 PRODUCTS

2.01 MOTOR STARTERS

A. Magnetic Motor Starters: Unless noted otherwise, shall be full voltage non-reversing with three overloads sized to suit nameplate amperes of motor served, motor "On" and "Off" pilot lights, "Hands-Off-Auto" switch, and auxiliary contacts for interlocking.

B. Combination Motor Starter/Disconnect: Shall be fused switch type with all features of Paragraph A above. In addition, provide disconnect switch auxiliary contacts for disconnection of externally powered control circuits where applicable. Fuses shall be sized in accordance with motor manufacturer's requirements.

C. Manual Starters: Shall be toggle switch or push-button type, lockable in the "Off" position, with overload relays, pilot light and enclosure pursuant to Paragraph D below. Manual starters shall only be used where specifically shown or called out on the drawings and only for single phase, fractional horsepower motors.

D. Enclosures: All motor controllers shall be contained in an enclosure suitable for the environment in which the controller is mounted, and shall be weatherproof when exposed to weather.

E. Overload Devices: Shall be melting alloy or bimetallic type. One overload shall be provided for each phase. Provisions shall be made for resetting the overload devices from outside the starter enclosure. Provide ambient compensated overload devices only when the motor is at a constant temperature and the controller is subject to a separate, varying temperature. Automatic reset overload devices are not permitted.

2.02 ACCEPTABLE MANUFACTURERS

A. Square D

B. Allen Bradley

C. General Electric

D. Cutler-Hammer

E. Siemens

2.03 MOTOR CONTROL CENTERS

A. Motor Control Centers shall consist of one or more enclosed vertical sections jointed together to form a rigid, free-standing assembly. The construction of the Motor Control Center shall meet the requirements set forth by U.L. 845, NEMA number ECS-2-322 and the N.E.C. The enclosure shall in accordance with NEMA standards type 12. Wiring shall be Class II Type B. Terminal blocks shall be conventional track mounted.

2.04 NAMEPLATES

A. Pursuant to Section 26 00 00, Paragraph 2.05, provide nameplates permanently attach (with screws on NEMA 1 enclosures) on each controller, nameplates with the following information: Load served, voltage, phase, short circuit rating, panel/circuit number and where applicable fuse size and type.

2.05 FAN SHUTDOWN RELAYS

A. Contractor shall provide relay(s) with sufficient contacts to shut down all fans over 2000 cfm upon receipt of Fire Alarm. See Section 28 31 00. Coordinate coil voltage with Fire Alarm System Supplier.

2.06 POWER FACTOR CORRECTION

A. Provide power factor correction capacitors for all motors 25 horsepower and above. Capacitor size when indicated on the drawings is an approximation only. Final size shall be determined by the Contractor based on the recommendations of the motor manufacturer to bring the power factor to between 0.9 and 0.95. All capacitors are to be fused, with blown fuse indicators mounted on the front of the unit. Provide discharge resistors when required by code.

PART 3 EXECUTION

3.01 FINISHED AREAS

A. In finished areas, mount motor protection switches flush and install suitable coverplates.

3.02 HEATERS

A. Install heaters co-related with full-load current of motors provided.

3.03 OVERLOADS

A. Set overload devices to suit motors provided.

3.04 SUPPORTS

A. Securely mount to equipment, wall or acceptable mounting frame.

3.05 FAN SHUTDOWN WIRING

A. Provide wiring interlock connections for all (over 2000 cfm) fan starter control circuits via Division 23 furnished fan shutdown relay to shutdown fans upon receipt of Fire Alarm.

3.06 FAN SHUTDOWN WIRING

A. Provide wiring interlock connections for all (over 2000 cfm) fan starter control circuits via a relay to shutdown fans upon receipt of Fire Alarm.

3.07 CONNECTION TO MECHANICAL EQUIPMENT ON ROOFS

A. The Contractor shall coordinate all roofing penetrations with the general contractor and roofing contractor to assure that the roofing warranty is maintained.

B. Attachment of conduits to the roof to serve mechanical equipment and devices shall comply with Section 26 05 33.

3.08 MECHANICAL EQUIPMENT NAMEPLATE RATINGS

A. The Division 26 Contractor shall verify that the nameplate ratings of the mechanical equipment, when they arrive on site, are consistent with the ampacity called out on the drawings. The Contractor shall bring any discrepancies to the Engineers attention prior to installation of conduit and wiring.

END OF SECTION 26 24 19

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SECTION 26 27 26

SWITCHES AND RECEPTACLES

PART 1 GENERAL

1.01 WORK INCLUDED

A. Provide all wiring devices and plates.

B. No push-in terminals allowed.

C. All devices color shall be white, unless otherwise noted.

D. Device plates shall be stainless steel, unless otherwise noted.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Hubbell

B. Pass & Seymour

C. Leviton

D. Cooper

2.02 SWITCHES

A. Emergency Push-Button Switches: Provide a red emergency push-button, momentary contact, yellow enclosure with clear plastic cover. Reset shall be by twisting the push-button.

1. Approved Manufacturer: STI – Safety Technology International.

B. "Industrial Specification Grade", quiet type, rated 277-volt, 20 amp, unless noted, with plastic handle. Single pole, double pole, 3-way, or locking type as required. Meets Fed. Spec. WS-896 Provide matching styles and colors in other devices as required for the conditions of installation. Hubbell CSB120, Eaton CSB120, Leviton 1221, and P&S 20AC1

C. Momentary Contact Line Voltage Switches: Single pole, double throw, 3-wire, normally open. Rating same as above.

D. Key Operated: Hubbell HBL1221L (or equal) with 1209 Key. Provide 24 spare Keys.

E. Timer Switch: Provide electronic light timer switch where indicated on drawings. The timer switch shall be connected to the room lighting and fan. The timer switch shall be programmable for time-out from five (5) minutes to two (2) hours. Set timer for standard twenty (20) minutes time-out period, time scrolls up, flash off, beeper on. Manufacturer: Watt Stopper – Inteli-switch Digital Time Switch.

F. Motor rated switches: Switches serving as motor disconnecting means shall be horsepower rated with overload relays and meet requirements as stated above. See manual starters in Section 26 24 19, ‘Manual Starters’.

G. Device plates shall be Hubbell and Cooper Type 302 stainless steel.

2.03 RECEPTACLES

A. In All Unfinished Areas & Non-Occupiable Spaces: Provide "Industrial Specification Grade", Duplex NEMA 5-20R configuration (20-Amp, 120-Volt) unless shown otherwise. Must have “rivetless ground” contact manufactured as an integral component of the external ground screw terminal. Meets Federal Specification WC-596 Hubbell HBL5362, Cooper 5362, P&S 5362A, and Leviton 5362.

B. In All Finished Areas: Provide heavy-duty specification grade; general purpose 20-Amp. 125-Volt, NEMA 5-20R, 2-pole, 3-wire decora plus duplex receptacle, straight blade, commercial grade, self-grounding, back and side wired - Leviton 16352W.

C. Self-Testing Ground-Fault Circuit-Interrupter (GFCI) Duplex Receptacles: 20-Amp. 125-Volt; 2-pole, 3-wire grounding; 10,000-Amps current interrupting; green light indicator when power is ‘on’; red light indicator when device is in the tripped position; Red “EOL” (end of life) indicator with rapid flash when the unit has reached end of life and/or cannot provide GFCI protection. Provide GFCI receptacles where required by Code and as indicated on the plans.

D. Tamper-resistant duplex receptacle with one (1) Type-A and one (1) Type-C USB charger: Duplex 20-Amp; 125-Volt; 5.1-Amp, 5-Volt USB charging capability - Leviton T5833.W.

E. Switched Receptacles: Switched receptacles shall be green in color, smooth nylon face, and permanently marked for use with automatic control systems, back- and side-wired, decora style - Leviton 16352-2PW or Leviton G5362-2TW (GFCI).

F. I3 Occupancy Group: Extra Heavy-Duty Hospital Grade, Duplex NEMA 5-20R configuration,20-Amp, 120-Volt, unless shown otherwise - Leviton 16362-HGW.

G. UPS: all receptacles on centralized UPS power shall be ‘red’ in color and shall match the manufacturer and style utilized throughout the project.

H. Tamper resistant, Duplex NEMA 5-20R Configuration: Hubbell BR20WHITR, Leviton 5362-SGW, Cooper TR8300W, or Leviton TDR20-W to match decora style installed in finished spaces per Paragraph B above.

I. Weather Resistant (WR) / Ground Fault Circuit-Interrupter (GFCI) Outdoor Duplex Receptacles: NEMA 5-20R. Hubbell GFWRST20W or equal, for 20-Amp, 125-Volt AC.

J. Special Purpose Receptacles: For special purpose receptacles, see drawings for Voltage, amperage, and phase. Provide with matching plug delivered to the Owner.

2.04 OCCUPANCY SENSORS

A. Provide occupancy sensor switches for control of lighting as shown on the drawings. Sensors shall be ceiling mounted to provide adequate coverage. Occupancy sensor shall be “Sensor Switch” Model CM-PDT-R, complete with power pack PP-20-20P, Auxiliary Relay SP-20-20P and associated mounting hardware. Sensors shall be wired and installed per Manufacturer’s direction to maintain switching and circuits shown on drawings. Where multiple sensors are located in an individual room, sensors shall be wired parallel with the relays such that either sensor will provide input to turn all lights on and reset time delay. Where occupancy sensors are shown on the drawings to be wall mounted, provide WSD or approved equal.

2.05 DEVICE PLATES

A. I3 Occupancy Group: detention-grade security wall plates shall be Kenall WSP/WPP Series, 14-Ga brushed stainless steel, or approved equal, with Torx head center pin security fasteners.

B. Interior: Plates for recessed boxes shall be Hubbell and Cooper Type 302 stainless steel. Attachment screws shall match finish of plate. Plates for surface mounted boxes shall be of pressed stainless steel with size to fit exactly the box used.

1. Where a duplex receptacle is indicated next to a USB receptacle, provide a dual-gang faceplate and mount both devices in the same backbox under the same faceplate.

2. For thirteen (I3) occupancy groups, provide device plates with security screws.

C. Exterior: Intermatic # WP1010MC, for vertical mount and # WP1010HMC for horizontal mount, or equivalent for receptacles. Metal cover shall be raintight while-in-use.

2.06 LABELING

A. For NEMA 5-20R receptacles, each device shall be identified with a clear label with black typing stating the panel & circuit number.

B. For receptacles other than NEMA 5-20R, the coverplate shall have ampere rating, voltage and phase engraved on a phenolic label and attached to the cover plate.

2.07 MULTIOUTLET ASSEMBLY (WHEN SHOWN)

A. Provide assemblies complete, including necessary fittings and hardware with circuits as indicated on Plans and outlet spacing as indicated. All assemblies shall contain ground wire. Wiremold or equal.

2.08 SPARE DEVICES

A. Provide the following spare devices:

Device	Quantity
Single-pole switch	3
Duplex receptacle	5
Dedicated duplex receptacle	5
GFI receptacle	5
20A, single-phase equipment connection	5
20A, three-phase equipment connection	3

B. Each spare device shall include 100 feet of conduit, wire, faceplate and labor; all as required for a complete installation. Location of these units to be determined by the Owner's representative at the site. Unused devices shall be turned over to the Owner.

PART 3 EXECUTION

3.01 MOUNTING

A. Rigidly fasten each device to the outlet box at proper position with the wall to bring receptacle flush with plate or switch handle the proper distance through the plate.

B. Occupancy sensors that are ceiling mounted shall be located a minimum of 4’-0” away from a mechanical equipment diffuser.

3.02 ORIENTATION

A. Set Switches vertical with handle operating vertically, up position "ON" at +48" above finished floor.

B. Set Receptacles vertical with ground slot down at +18" above finished floor.

C. Set Exterior Receptacles horizontal at +18" above finished grade.

3.03 DEVICE PLATES

A. Shall be stainless steel for each new wiring device and for each telephone and signal equipment outlet, except where equipment mounted thereon covers the outlet box completely.

3.04 DIMMER SWITCHES

A. Provide a separate neutral for each phase.

3.05 RECEPTACLE GROUNDING

A. Provide bare bonding wire between receptacle grounding terminal and box. Plaster ear screws connecting frame to the box will not be acceptable for grounding.

B. Provide green insulated grounding conductor in all branch circuits supplying isolated ground and ground-fault circuit-interrupter type receptacles.

3.06 HANDICAPPED ACCESS

A. Comply with requirements of Washington State Handicapped Access Code.

END OF SECTION 26 27 26

SECTION 26 28 13

FUSES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Section 26 00 00 – Electrical General Conditions

1.02 WORK INCLUDED

A. Provide all fuses as required. Provide three (3) spare of each size and type required. Fuses shall not be installed until equipment is ready to be energized. This measure prevents fuse damage during shipment of the equipment from the manufacturer to the jobsite or from water that may contact the fuse before the equipment is installed. Final tests and inspections shall be made prior to energization of the equipment. This shall include a thorough cleaning, tightening, and review of all electrical connections and inspection of all grounding conductors. All fuses shall be furnished by the Electrical Contractor. All fuses shall be of the same manufacturer.

PART 2 PRODUCTS

2.01 MAINS, FEEDERS, AND BRANCH CIRCUITS

A. Circuits 601 to 6000 amperes shall be protected by current limiting BUSSMANN Low-Peak Time-Delay Fuses KRP-C. Fuse links shall be pure silver links (99.9% pure), delay and must hold 500% of rated current for a minimum of 4 seconds, clear 20 times rated current in .01 seconds or less and be listed by Underwriters Laboratories Inc., with an interrupting rating of 200,000 amperes RMS.

B. Circuits 0 to 600 amperes shall be protected by current limiting BUSSMANN LOW-PEAK Dual-Element Fuses LPN-RK (250 volts) or LPS-RK (600 volts). All dual-element fuses shall have separate overload and short-circuit elements. Fuse shall incorporate a spring activated thermal overload element having a 284°F. melting point alloy and shall be independent of the short-circuit clearing chamber. The fuse must hold 500% of rated current for a minimum of 10 seconds and be listed by Underwriters Laboratories, Inc., with an interrupting rating of 200,000 amperes RMS symmetrical. The fuses shall be UL Class RK1 to maintain the Engineered protection of the system components.

C. Motor Circuits: All individual motor circuits with full load amperes ratings (FLA) of 480 amperes or less shall be protected by BUSSMANN LOW-PEAK Dual-Element Fuses LPN-RK (250 volts) or LPS-RK (600 volts). Larger H.P. motors shall be protected by BUSSMANN Type KRP-C Low-Peak Time-Delay Fuses of the ratings shown on the drawings. All other motors, (such as 1.0 service factor motors) shall be protected by BUSSMANN LOW-PEAK Dual-Element Fuses LPN-RK (250 volts) or LPS-RK (600 volts) installed in ratings of approximately 115% of the motor full load current except as noted above. The fuses shall be UL Class RK1 Dual Element Time Delay or Class L.

2.02 SPARE FUSES

A. Spare fuses shall be provided with a minimum of three of each ampere rating. See Section 26 50 00 for quantities of spare fusing required for ballasted light fixtures.

2.03 ACCEPTABLE MANUFACTURERS

A. Bussman

B. Little Fuse

2.04 SPARE FUSE CABINET

A. Provide a spare fuse cabinet for the above-required spare fuses. Cabinet front and lock shall match panelboard equipment specified in Section 26 24 16.

2.05 NAMEPLATE

A. Provide Nameplate "Spare Fuse Cabinet.” Construct and attach in accordance with Section 26 24 16, Paragraph 2.06.

PART 3 EXECUTION

3.01 FUSES

A. Install in all fusible devices provided under this Contract.

3.02 SPARE FUSE CABINET

A. Locate in Main Distribution Switchboard Room or as shown on drawings.

END OF SECTION 26 29 13

SECTION 26 32 13.13

EMERGENCY GENERATOR - DIESEL

PART 1 GENERAL

1.01 GENERAL

A. Provide all labor, materials, and equipment to furnish, install, and place in operation the emergency power generation system in accordance with the contract documents and manufacturer's drawings and installation instructions. All equipment shall be new, factory tested, and delivered ready for field installation.

B. The responsibility for performance to this specification shall not be divided among individual component manufacturers, but must be assumed solely by the primary manufacturer. This includes generating system design, manufacture, test, and having a local supplier responsible for service, parts, and warranty for the total system.

C. Generator set mounted subassemblies such as cooling system, base, fuel tank, air intake system, exhaust outlet fittings, load bank, and generator set mounted controls and switchgear shall also be designed, built, and assembled as a complete unit by the engine/generator manufacturer.

D. See drawings for generator size.

1.02 APPROVED MANUFACTURERS

A. The engine and generator shall be the product of an ISO 9001 certified manufacturer. The design is based on a Cummins engine/generator set. Any changes to the design based on other manufacturers will be the responsibility of the installing contractor at no additional cost to the owner.

B. Approved Alternate Manufacturers:

1. Caterpillar
2. Cummins
3. Kohler
4. MTU

C. Must meet NFPA 110, level 1 requirements.

1.03 SUBMITTALS

A. Submittals for approval shall include but not be limited to:

B. Certification and results of Prototype Testing and Production Testing.

C. Component List - A breakdown of all components and options.

D. Technical Data - Manufacturer produced generator set specification or data sheet identifying make and model of engine and generator, and including relevant component design and performance data.

E. Auxiliary Equipment - Specification or data sheets, including switchgear, transfer switch, vibration isolators, and fuel tank.

F. Drawings - General dimensions drawings showing overall generator set measurements, mounting location, and interconnect points for load leads, fuel, exhaust, cooling and drain lines.

G. Wiring Diagrams - Wiring diagrams, schematics and control panel outline drawings published by the manufacturer for controls and switchgear showing interconnected points and logic diagrams for use by contractor and owner.

H. Warranty Statements - Warranty verification published by the manufacturer.

I. Apply and obtain all permitting required by the local jurisdiction for the generator.

1.04 PRODUCTION TESTS

A. The system manufacturer shall perform production tests on the complete generator set supplied at the generator set manufacturers facility. A certified report of these tests shall be available when requested at the time of the generator set order. These tests and controls shall include but not be limited to:

1. Operation at rated kW

2. Operation at rated kVA

3. Transient and steady state governing

4. Transient and steady state voltage regulation

5. Operation of all alarm and shutdown devices

6. Single step load pickup of rated kW

B. Not applicable and not recommended for production test. Prototype testing is recommended.

1.05 PROTOTYPE TESTS

A. The system manufacturer must certify that engine, generator, controls, and switchgear have been tested as complete system of representative engineering models (not on equipment sold). Prototype testing shall include:

1. Fuel consumption at 1/4, 1/2, 3/4, and full load

2. Exhaust emissions

3. Mechanical and exhaust noise

4. Governor speed regulation at 1/4, 1/2, 3/4, and full load; and during transients

5. Motor starting kVA

6. Generator temperature rise in accordance with NEMA MG1-22.40

7. Voltage regulation at 1/4, 1/2, 3/4, and full load; and during transients

8. Harmonic analysis, voltage waveform deviation and telephone influence factor

9. Generator short circuit capability

10. Cooling system performance

11. Force factor calculations

12. Torsional analysis

13. Linear vibration analysis

14. Generator revolving field assembly at 2250 rpm (125% overspeed) at room temperature.

1.06 WARRANTY/SERVICE

A. A two-year warranty for the generator set shall be included to guarantee against defective material and workmanship in accordance with the manufacturer's published warranty from date of start-up.

B. The generator set manufacturer and its distributor shall maintain a 24-hour parts and service organization. This organization shall be regularly engaged in a maintenance contract program to perform preventive maintenance and service on equipment similar to that specified. A service agreement shall be available and shall include system operation under simulated operating conditions, adjustment to the generator, transfer switch as required and certification in the owner's maintenance log of repairs made and proper functioning of all systems.

PART 2 PRODUCTS

2.01 SYSTEM PERFORMANCE

A. The power generating system shall conform to the following performance criteria at the site conditions:

B. Rating - Engine brake horsepower shall be sufficient to deliver full rated generator set kW/kVA when operated at rated rpm and equipped with all engine-mounted parasitic and external loads such as radiator fans and power generators.

C. Start Time and Load Acceptance - Engines shall start, achieve rated voltage and frequency, and be capable of accepting load within 10 seconds when properly equipped and maintained.

D. With the power generating system at normal operating temperature, it shall accept a 100% block load, less applicable derating factors, in accordance with NFPA 110.

E. Steady state frequency regulation shall be +/- 0.33 % with no load to full load speed droop less than 3 %.

F. Voltage regulation shall be +/- 2% for any steady state load between no load and full load.

2.02 DIESEL ENGINE

A. The diesel engine shall be a stationary, liquid cooled, 1800-rpm, four-cycle design, vertical in-line, with dry exhaust manifolds. It shall have 6 cylinders and be manufactured in the United States.
Two cycle engines are not acceptable.

2.03 ENGINE ACCESSORY EQUIPMENT

A. The engine shall be cooled by an engine mounted, vertical radiator with blower type fan, using a 50% antifreeze/coolant mixture. Antifreeze shall have a service life of 3000 hours without maintenance. The radiator shall properly cool the engine while the engine is operating at full load and 0.25-inch H_2O external air restriction. The minimum ambient capability shall be 104 deg F (40 deg C).

B. Electric starting motor and control circuit capable of three complete starting cycles without overheating.

C. Mechanical, positive displacement lube oil pump with replaceable full flow filter, oil cooler, and dip stick.

D. Mechanical, positive displacement fuel transfer pump with replaceable full flow filter.

E. Fuel Filter and serviceable fuel system components shall be located to prevent fuel from spilling onto genset batteries.

F. Manually operated fuel-priming pump.

G. Replaceable dry element air filter.

H. Engine mounted electrically powered, thermostatically controlled jacket water heater sized to ensure proper starting at 0° F. Shall include isolation valves and adjustable thermostat.

I. Flexible, stainless steel exhaust connector.

J. Flexible fuel lines.

K. The use of charging alternators as the only means of charging the unit batteries is not acceptable.

L. Remote engine shut off switch mounted within clear weatherproof cover, with name plate "Emergency Generator Shut Off Switch". Attached with stainless steel screws. Locate within sight of generator.

M. Provide with radiator-mounted load bank – sized per drawings.

2.04 GENERATOR

A. The generator shall be close coupled, drip proof and guarded, constructed to NEMA 1 and IP 22 standards, single bearing, salient pole, revolving field, synchronous type with amortisseur windings in the pole faces of the rotating field and skewed stator windings to produce optimum voltage waveform.

B. The generator pitch shall be selected to optimize the generator efficiency and minimize the total harmonic distortion, especially the third harmonics which are detrimental to AC motors.

C. The generator shall be capable of delivering rated kVA at 60 Hz and 0.8 PF within +/-5% of rated voltage.

D. All insulation systems shall meet NEMA MG-1 standards for Class H systems. The actual generator temperature shall be limited to Class F levels (130° C rise by resistance over 40° C ambient). Materials which support fungus growth, shall not be used.

E. The revolving field coils shall be precision wet layer wound with epoxy-based material applied to each layer of magnet wire. The revolving field assembly shall be prototype tested at 2250 rpm (125% overspeed) at room temperature. The revolving field assembly shall be balanced to 0.5 mil peak-peak. The stator shall have two dips and bakes using Class H impregnating varnish.

F. The self-excited, brushless exciter shall consist of a three-phase armature and a three-phase full wave bridge rectifier mounted on the rotor shaft. Surge suppressers shall be included to protect the rotating diodes from voltage spikes.

G. The automatic voltage regulator (AVR) shall maintain generator output voltage within +/- 2% for any constant load between no load and full load. The regulator shall be a totally solid-state design which includes electronic voltage buildup, volts per Hertz regulation, three phase sensing, over excitation protection, loss of sensing protection, temperature compensation, shall limit voltage overshoot on startup, and shall be environmentally sealed.

H. The automatic voltage regulator and all low voltage control wiring shall be located in a separate enclosure.

2.05 CIRCUIT BREAKER - GENERATOR SET MOUNTED

A. The three-pole main line circuit breakers shall be provided to protect the generator against external faults and provide a positive disconnect device at the generator output terminals. The breaker shall be UL listed with shunt trip device connected to engine/generator safety shutdowns. The breaker shall be mounted on the generator in a NEMA 1P22 guarded drip-proof enclosure, which provides direct access for cable from the top or bottom.

2.06 CONTROLS - GENERATOR SET MOUNTED

A. The control panel shall be designed and built by the engine-generator manufacturer. It shall be mounted on the generator set and incorporate 100% solid state microprocessor-based control circuitry and digital instrumentation. All electronic control components are to be mounted in sealed, dust tight, watertight, metal housings. Housings which must be opened for service or setup are not acceptable. All output circuits greater than 100mA shall be fuse or circuit breaker protected. The panel shall be labeled with ISO symbols and comply with IEC 144, IP 22, and NEMA 12 for external environmental resistance, and IP 44 and NEMA 12 for resistance of the internal sealed modules. The control panel shall be capable of facing the right, left, or rear and shall be vibration isolated.

B. The panel shall include the following equipment/functions:

1. Automatic remote start capability with mode of operation selectable from a panel-mounted 4-position switch (Stop, Manual, Automatic, Reset).

2. Generator will accept remote signal from ATS for automatic starting and exercising.

3. Cycle crank with adjustable "crank" and "rest" times.

4. Adjustable cooldown timer.

5. Emergency Stop push button requiring manual reset.

6. Voltage adjustment potentiometer to adjust voltage +/- 5% of rated.

7. Individual flashing LED's or a Graphical User Interface shall be provided. The use of a common alarm or shutdown lamp, which depends on a separate display to determine the alarm or fault condition, is not acceptable. Annunciation shall be provided for:

a. Overspeed (red)

b. Overcrank (red)

c. High Coolant temperature (red)

d. Low Oil pressure (red)

e. Emergency Stop (red)

f. Low Coolant Level (red - programmable as alarm or shutdown)

C. Digital displays shall be provided for the engine and generator parameters. These displays shall allow the simultaneous display of AC parameters and at least one (selectable) engine parameter to be displayed at the same time. Requirements for these displays are as follows:

1. Digital display and phase selector switch for generator operational parameters. True RMS sensing of these parameters shall be utilized to minimize distortion due to non-linear loads and ensure accuracy.

2. AC volts (+/- 0.5% accuracy)

3. AC amps (+/- 0.5% accuracy)

4. Hertz (+/- 0.3 Hz accuracy)

5. Digital display for:

    a. Engine RPM (+/- 0.5% accuracy)

    b. DC voltage (+/- 0.5% accuracy)

    c. Oil pressure (+/- 0.5% accuracy)

    d. Coolant temperature (+/- 0.5% accuracy)

    e. Operating hours

6. Diagnostic Capability: Must provide dual level diagnostics identifying both system level and component level. The diagnostic codes shall be maintained in a history log specifying the number of occurrences, and second/minute/hr at which they occur.

7. Sensors: Sensors providing a pulse width modulated output shall be utilized for oil pressure, coolant temperature sensing and shall be protected against a fault to (+/-) battery. The usable output range of the sensor shall be limited to 5% to 95% duty cycle. Output outside the usable range shall be diagnosed as a fault condition and appropriate diagnostic shall be provided. Separate speed sensing signals shall be provided for overspeed protection and electronic governing.

8. Ambient Parameters:

    a. Operating: -40C to +70C (-40 F to +158 F)

    b. Storage: -55 C to +85 C (-67 F to +185 F)

    c. Humidity: 0 to 100% relative humidity

    d. Must be impervious to salt spray, fuel, oil and oil additives, coolant, spray cleaners, chlorinated solvents, hydrogen sulfide and methane gas, and dust.

2.07 BASE

A. The engine and generator shall be assembled to the base using vibration isolators spring/pad type. Isolators shall include seismic restraints, which comply with seismic zone 4. The generator set base shall be designed and built by the engine-generator manufacturer to resist deflection, maintain alignment, and minimize resonant linear vibration.

2.08 BASE TANK

A. The generator skid base shall contain an integral, UL listed, steel fuel storage tank with diked rupture basin for containment of fuel resulting from a tank rupture or leak. The base tank shall be UL 142 listed for “Steel Above Ground Tanks for Flammable and Combustible Liquids.”

B. The tank shall be manufactured entirely of 8-gauge steel with continuously welded seems and steel channel side beams. The tank shall have leak detection.

C. The tank shall be sized for 48 hours of generator operation at full load.

D. Provide venting of base tank as required by local jurisdiction.

E. All above ground and exposed piping shall be labeled with contents and flow direction per ANSI A13.1. Label piping every 20' and at bends and penetrations with black letters on yellow background.

F. Accessories per International Fire Code:

1. 5 gal. fuel fill container mounted on a side of the enclosure. Fill to be piped to the fuel fill on the tank.

2. Fuel fill tube to be extended inside the tank and terminated within 6" from the bottom.

3. 90% high fuel alarm and float switch.

4. Normal vent to be extended and terminated 12' above grade.

5. Primary and secondary emergency vents to be extended outside of the enclosure.

6. Provide a permanent sign posted at the tank documenting filling procedures and tank calibration chart.

2.09 BATTERY CHARGER

A. A dual rate 10-ampere battery charger shall be provided which shall accept 120-volt AC single-phase input to provide 12-volt DC output. It shall be fused on the AC input and DC output, incorporate current limiting circuitry, and include a DC ammeter and voltmeter. The use of a crank disconnect relay to protect the charger during starting is not acceptable. The charger shall be housed in a NEMA 1 enclosure and vibration mounted on the genset. The preferred connection type is a 5-20R receptacle fed from internal distribution panelboard for ease of maintenance by City staff.

2.10 BATTERIES

A. 12 volt starting batteries; sized as recommended by the generator set manufacturer to comply with the starting and temperature specifications; battery cables, and base mounted battery rack shall be provided. Shall be warranted by the gen set manufacturer.

2.11 EXHAUST SILENCER

A. A critical exhaust silencer providing 26 dba attenuation shall be sized and supplied by the engine supplier. The silencer and associated piping shall not impose more than 27 in H_2O restriction.

B. The silencer shall utilize a high temperature coating system to prevent rusting and shall be mounted near the engine to minimize noise and condensation. A provision for draining moisture shall be included.

2.12 GENERATOR HOUSING

A. Provide housing enclosure around the complete generator set. Housing shall allow ample cooling air flow. The housing shall be made of heavy gauge, reinforced steel and attach directly to the generator set skid base. Service access to the engine-generator shall be through hinged doors on each side of the housing and a rear hinged door for access to the generator set control panel. Housing shall be corrosion resistant, NEMA 3R and protect from the elements, animal intrusion and unwanted entry. Enclosure sound attenuation shall need to exceed 75dBA at 23ft.

2.13 WIRING AND CONDUIT

A. Engine and generator control wiring shall be multi-strand annealed copper conductors encased by cross-linked polyethylene insulation resistant to heat, abrasion, oil, water, antifreeze, and diesel fuel. Wiring shall be suitable for continuous use at 120C (250F) with insulation not brittle at -50C (-60F). Each cable will be heat stamped throughout the entire length to identify the cable's origin and termination. Cables shall be enclosed in nylon flexible conduit which is slotted to allow easy access and moisture to escape. Reusable bulkhead fittings will attach the conduit to generator set mounted junction boxes.

2.14 ADDITIONAL LOCAL AUTHORITY REQUIREMENTS

A. Provide diesel, hazardous-material and no smoking signs with proper wording as required by the local Authority Having Jurisdiction.

B. Provide a fuel tank exhaust pipe to approximately 15’ AFF or as required by the local jurisdiction.

2.15 BLOCK HEATER

A. Provide with block heater. The preferred connection type is a receptacle fed from internal distribution panelboard for ease of maintenance by City staff.

2.16 MAINTENANCE PLATFORM

A. Provide full length platform with stairs on both sides of the genset enclosure for maintenance access.

PART 3 CONTRACT COMPLETION

3.01 INSTALLATION/ON SITE TESTING

A. The installation shall be performed in accordance with shop drawings, specifications, and the manufacturer's instructions; and shall comply with applicable state and local codes.

B. Equipment shall be installed on concrete housekeeping pads. Equipment shall be permanently fastened to the pad in accordance with manufacturer’s instructions and seismic requirements of the site. The bottom of integral base tank shall not be more than 12” above the ground.

C. The generator set shall be tested as defined below by the manufacturers authorized dealer to show it is free of any defects and will start automatically and carry full load. This testing is to be performed at the jobsite. Testing shall be completed in the presence of the owner's engineer or appointed representative. With the exception of fuel, all consumables necessary for testing shall be furnished by the bidder. Any defects which become evident during the test shall be corrected by the bidder at his own expense. Scheduling of tests shall be coordinated with Owner and Engineer with seven (7) days maximum notice.

1. Proper operation of the following shall be demonstrated:

2. All auxiliary equipment supplied to this specification.

3. Starting and charging system components.

4. All controls, engine shutdowns, and safety devices

D. Cold Start Test: The unit shall demonstrate the ability to start from a "cold" standby condition (i.e., normal standby mode with engine coolant temperature at normal temperature established by properly functioning jacket water heater.

E. Load Bank Test: The unit shall be operated at 80% of full load rating for one hour followed by two (2) hours operation at 100% full load. After the first half-hour stabilization period at full load, the following shall be recorded at fifteen (15) minute intervals:

1. Voltage and amperage (3 phase), frequency

2. Fuel pressure, oil pressure and water temperature

3. Exhaust gas temperature at engine exhaust outlet

4. Ambient temperature

F. Simulated Power Failure Test: Starting of test shall be by simulated power failure. Contractor shall test all components of generator system including transfer switch.

3.02 BASE TANK TEST

A. The following tests shall be observed by the local Fire Prevention Bureau Inspector. It is the contractor’s responsibility to coordinate all witness testing with the local authority.

1. The 90% high fuel alarm and 5 gal. fuel fill container shall be tested for proper operation.

2. Prior to any filling of combustible or flammable liquids the base tank shall be pressure tested per NFPA 30, Section 2.4.2.

3.03 SERVICE MANUALS AND PARTS BOOKS

A. The system manufacturer's authorized local dealer shall furnish one copy each of the manuals and books listed below for each unit under this contract:

B. OPERATING INSTRUCTIONS - with description and illustration of all switchgear controls and indicators; and engine and generator controls and indicators.

C. PARTS BOOKS - that illustrates and list all assemblies, subassemblies and components, except standard fastening hardware (nuts, bolts, washers, etc.).

D. PREVENTATIVE MAINTENANCE INSTRUCTIONS - on the complete system that cover daily, weekly, monthly, biannual, and annual maintenance requirements and include a complete lubrication chart.

E. ROUTINE TEST PROCEDURES - for all electronic and electrical circuits and for the main AC generator.

F. TROUBLESHOOTING CHART - covering the complete generator set showing description of trouble, probable cause, and suggested remedy.

G. RECOMMENDED SPARE PARTS LIST - showing all consumables anticipated to be required during routine maintenance and test.

H. WIRING DIAGRAMS AND SCHEMATICS - showing function of all electrical components.

END OF SECTION 26 32 13.13

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SECTION 26 33 53

UNINTERRUPTIBLE POWER SUPPLY (UPS)

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Section 26 00 00 – Electrical General Conditions

1.02 GENERAL

A. This specification defines the electrical and mechanical characteristics and requirements for an uninterruptible stored emergency power supply system. The system as specified herein includes all the components required to deliver reliable, high quality uninterruptible power for the data center equipment. The system consists of a high-speed transfer device, constant voltage regulating transformer, battery charging system, energy storage battery platform, a diagnostic monitoring display panel, maintenance bypass and all the related hardware components and software to facilitate a functional centralized system. The emergency power supply system shall provide immunity from all line disturbances and power interruptions. The system shall include a self-diagnostic monitoring alarm system that continuously advises of system status and battery condition.

B. For the purpose of maintaining a functional system during power outages, provide Uninterruptible Power Supply for all equipment in the MDF room.

C. The UPS shall be capable of providing backup power for a minimum of five (5) minutes of continuous operation to allow switchover to emergency generator circuits. All equipment shall bear the UL label.

D. The UPS units shall have the ability to provide additional run-time via optional external battery enclosures.

1.03 STANDARDS

A. The systems shall be designed in accordance with applicable portions of the following standards:

1. American National Standards Institute (ANSI C57.110).
2. Institute of Electrical and Electronic Engineers (IEEE 519-1992) (C62.41-1991).
3. National Electrical Manufacturers Association (NEMA PE-1).
4. National Electric Code (NEC 2005) (NEC 2005, Article 700).
5. National Fire Protection Association (NFPA 70) (NFPA 101) (NFPA 111).
6. Underwriters Laboratories (U.L. 924).
7. Federal Communications Commission (FCC Part 15, Sec. J, Class A).
8. Federal Aviation Administration (FAA-G-201e).
9. Listed U.L. Standards UL924 Emergency Lighting Equipment, UL924 Auxiliary Power Supplies, UL1778 and CUL1778 Standard for UPS Equipment.

1.04 SUBMITTALS

A. The manufacturer shall supply documentation for the installation of the system, including wiring diagrams and cabinet outlines showing dimensions, weights, BTUs, input/output current, input/output connection locations and required clearances.

B. The manufacturer shall be ISO9001 "Quality Assurance Certified" and shall upon request furnish certification documents.

C. The manufacturer shall have five (5) years' experience or greater in design and fabrication of uninterruptible power supply and power distribution rack mounted power modules designed for a data center.

D. Factory test results shall be provided to show compliance with the requirements. The manufacturer shall include battery test documentation to validate the specified minimum battery reserve with full rated KW load.

E. The supplier shall furnish equipment submittals for the specific equipment furnished.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. The equipment specified is based on an APC Galaxy VS 20kW; 208V – 3-phase input/ 208V – 3-phase output uninterruptible power supply and a rack mount power module.

2.02 MANUFACTURED UNITS

A. The system shall be designed and manufactured to assure maximum reliability, serviceability and performance. The system's microprocessor, transistorized PWM inverter, highly filtered current and voltage regulated 2 stage battery charger and high-speed transfer devices shall be provided as one single main PC board for rapid service or replacement. The main PC board, constant voltage regulating transformer and filtering components shall be installed into one single main control module for rapid module service or replacement. The diagnostic monitor panel display and display select push button shall be mounted on the front of the system for easy operation and viewing. The system is to be furnished with internally located AC input circuit breaker and AC output circuit breakers. The battery and DC conductors shall be DC fuse protected. All conductors and transformer windings shall be copper constructed. Cabinets are wall and/or floor mountable, constructed of steel, front accessible through a hinged, key lockable door and shall be NEMA 2 drip proof rated for indoor use.

1. Automatic Restart: In the case of a commercial power outage that exceeds the battery run time requirement, the output of the inverter shall shut off, but automatically restart once commercial AC power returns. Recharging of the batteries shall commence immediately.

2. System Power Output Capability: The stored emergency power supply system output power rating shall be as listed on the inverter panel schedule.

3. Battery Time Reserve Capacity: Battery shall be capable of producing emergency power for five (5) minutes at full rated Watts.

2.03 PERFORMANCE SPECIFICATIONS

A. Input Specifications:

1. Input Voltage: 208 volt – 3 phase.
2. Frequency Range: 40 Hz to 70 Hz.
3. Power Factor: Self-correcting to >0.95 (approaching unity).
4. Input Harmonics: < 5% THD (total harmonic distortion).
5. Spike Attenuation: 3000:1.

B. Output Specifications:

1. Output Voltage: 208 volt – 3 phase.
2. Sine Wave Voltage: Maximum 5% harmonic distortion under linear load.
3. Line Voltage Regulation: +/-1% static.
4. Load Regulation: Typically, better than +/-3%.
5. Output Power Rating: KVA at 1.0 power factor (unity). KVA = KW.

C. Battery Specifications:

1. Battery time: 5 Minutes at full rated Kwatt output capability.
2. Battery Type: LG Lithion Ion, maintenance free.
3. Recharge Time: 3.5 hours.
4. Projected Life: Batteries shall have a projected service life of ten (10) years.
5. Overload Capability: 125% for ten minutes.

D. Environmental Specifications:

1. Operating Temperature: 0 (32) to 40 (104) degrees Celsius (F).
2. Storage Temperature: -15 to 40 degrees Celsius.
3. Relative Humidity: 95% non-condensing.
4. Elevation: 5,000 feet, 1,500 meters.
5. Audible Noise Level: Not greater than 54 dba.
6. Enclosure: NEMA 2. Drip proof for indoor use. Sealed, prohibiting rodent entry.

2.04 DISPLAY AND DIAGNOSTICS

A. Display Monitor and Diagnostics:

1. Display Panel – Systems shall include a local, front mounted, sealed, alphanumeric LED display. Display shall indicate inverter input voltage, inverter output voltage, % load, % battery as selected using a display select push button. System display panel shall include automatic visual status indicators for system on, system on battery, low battery, general alarm. Include audible alarm for system on battery, low battery and general alarm condition(s).

2. Communications Port (RS232) – Include communications port for remote monitoring access to general alarm conditions and electrical measurements.

3. General Alarm Conditions – General alarm conditions shall include Loss of AC input power, Low battery warning, frequency fault, check battery, shorted SCR, low battery shutdown, low output voltage, high output voltage, system overload, system over temperature warning.

4. Electrical Measurements – Electrical measurements shall include AC Input voltage, AC output voltage, output amps, % load, % battery voltage, output watts, output va, power factor, input line frequency, number of power outages recorded from last clear function, number of overloads recorded from last clear function.

5. Battery Replacement Testing – Include provision for determining battery life and scheduled battery replacement.

6. Status / Alarm relay interface normally open contacts shall be provided for optional remote annunciator panel or automatic message dialer. Include contacts for inverter on, utility AC power failure (system using battery power), low battery warning, general alarm.

2.05 ACCESSORIES

A. Include auxiliary relay for interface to the energy management system for alarm conditions for system on emergency battery power, low battery warning, general alarm.

B. Include output circuit breakers for each load indicated on the inverter schedules. Quantity and ampacity size of output breakers shall match the schedules.

PART 3 EXECUTION

3.01 MANUFACTURERS WARRANTY

A. The manufacturer shall guarantee all systems to be free from material defects and workmanship for a period of two (2) years following shipment from the factory.

B. One-year on-site repair or replace with factory authorized start-up.

C. Battery warranty shall be fifteen (15) years prorated with full replacement in the first year.

3.02 MANUFACTURER START-UP

A. The manufacturer shall perform full review of the installation and provide factory representative review and start-up of the system to make sure it is operating to the specifications and Owner satisfaction. The cost for time and material shall be included in the cost of the equipment at the time of bid.

END OF SECTION 26 33 53

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SECTION 26 36 13

3-WAY MANUAL TRANSFER SWITCH

PART 1 GENERAL

1.01 WORK INCLUDED

A. Contractor shall furnish, deliver, install and test the 3-way manual transfer switches as specified herein and in accordance with the drawings.

1.02 QUALITY ASSURANCE

A. 3-way manual transfer assembly switch shall be UL listed and labeled under the UL 1008 standard.

B. 3-way manual transfer switch manufacturer shall provide a complete factory assembled, wired and tested 3-way manual transfer switch.

C. 3-way manual transfer switch shall be factory Hi-pot tested for a period of not less than sixty 60 seconds.

D. 3-way manual transfer switch installation shall meet all applicable NEC standards.

E. 2020 NEC 700.3 (F) compliant when used in conjunction with an ATS.

1.03 SUBMITTALS

A. Prepare and submit detailed shop drawings for review prior to manufacture. Include the following information (written or highlighted): wiring diagrams, dimensions, front view, catalog information indicating complete electrical and mechanical characteristics and compliance with all specification items of Section 26 36 13.

B. Upon installation of 3-way manual transfer switches Contractor shall submit manufacturer's Operating & Maintenance Manual which shall include as a minimum:

1. Certified as-built General Arrangement drawings and Wiring Diagram.

2. Materials / Component List including part numbers.

3. Maintenance and service requirements.

4. Certificate of Compliance and hi-pot test data.

1.04 WARRANTY

A. 3-way manual transfer switches shall be covered by manufacturer's warranty for a minimum period of one (1) year after shipment from manufacturer.

1.05 DEFITIONS

A. Disconnect(s): 100% Rated Molded Case Circuit Breaker or Molded Case Switch as indicated on the drawings.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. ESL Power Systems Inc. 'Triple Switch' or equal as approved by the Engineer.

2.02 3-WAY MANUAL TRANSFER SWITCHES

A. 3-way manual transfer switch shall consist of three (3) mechanically-interlocked disconnects, male cam-style inlet connectors, female cam-style outlet connectors, power distribution blocks and grounding terminals, all housed within a pad-lockable enclosure.

B. 3-way manual transfer switch enclosure shall be Type 3R, constructed of continuous seam-welded, powder coated galvanized steel. The main access shall be through an interlocked, hinged door that extends the full height of the enclosure. Access for both portable generator cables with female cam-style plugs and for load bank cables with male cam-style plugs shall be via drawn flange cable entry openings in the bottom of enclosure for wall mount units, or hinged lower door for pad mount units. A hinged flap door shall be provided to cover the cable openings when cables are not connected; the hinged flap door shall allow cable entry only after the main access door has been opened. Enclosure shall be powder coated after fabrication; color shall be wrinkle gray RAL 7035.

C. Cam-style male connectors (inlets) and cam-style female connectors (outlets) shall be UL Listed single-pole separable type and rated 400 amps at 600VAC. All cam-style connectors shall be color coded. Cam-style connectors shall be provided for each phase and for ground, and shall also be provided for neutral. Each of the phase cam-style connectors and the neutral cam-style connectors within the enclosure shall be factory-wired to a disconnect. The ground cam-style male connectors shall be bonded to the enclosure, and a ground lug shall be provided for connection of the facility ground conductor. None of the cam-style connectors shall be accessible unless all three (3) disconnects are in the "OFF" position and the main access door is open.

D. A power distribution block shall be provided for load-side field wiring. The power distribution block shall be factory wired to the disconnects.

E. Disconnects shall be UL Listed 3-pole and the short circuit interrupt rating shall be a minimum of 35kAIC. Trip rating of the disconnects shall be as shown on the drawings. One disconnect shall control the connection between the permanent generator and the automatic transfer switch. The second circuit breaker shall control the connection between the permanent generator and the load bank female cam-style connectors. The third circuit breaker shall control the connection between the automatic transfer switch and the portable generator male cam-style connectors. All three (3) disconnects shall include UL Listed door-mounted operating mechanisms, preventing the opening of the main access door unless all three (3) breakers are in the "OFF" position. All three (3) disconnects shall be mounted behind a dead-front panel. The load-side of the disconnects shall not be energizable unless the main access door is closed and one of the disconnects is in the "ON" position. The three (3) disconnects shall be safety interlocked by mechanical means to ensure that only certain breakers can be closed at any given time.

2.03 RATING

A. Shall have voltage, amperage and ampere withstand ratings as indicated on the drawings.

PART 3 EXECUTION

3.01 MOUNTING

A. Wall mounted or free-standing assembly as per plans.

3.02 INSTALLATION

A. Prior to installation of 3-way manual transfer switches, Contractor shall examine the areas and conditions under which the 3-way manual transfer switch is to be installed and notify the Engineer in writing if unsatisfactory conditions exist.

B. 3-way manual transfer switch shall be installed as shown on the drawings and per the manufacturer's written instructions. In addition, the installation shall meet the requirements of local codes, the National Electrical Code and National Electrical Contractors Association's "Standard of Installation".

C. Conduit entry into the 3-way manual transfer switch shall be by Contractor; Contractor shall furnish and install listed watertight conduit hubs, as manufactured by MYERS or T&B, for each conduit entry on the 3-way manual transfer switch. The incoming hub size shall match the conduit size for feeders and ground as shown on the drawings. The outgoing hub size shall match the conduit size for loads and ground as shown on the drawings. Hubs shall be properly installed and tightened to maintain Type 3R integrity of the 3-way manual transfer switch enclosure.

D. Contractor shall terminate feeder conductors, load conductors and ground per the manufacturer's instructions. All field wiring terminations shall be torqued as required per the instructions on the 3-way manual transfer switch's power distribution blocks, disconnects & ground lugs.

3.03 FIELD TESTING

A. Prior to energizing 3-way manual transfer switch, the Contractor shall perform the following checks and tests as a minimum:

1. Verify mounting and connections are complete and secure.

2. Verify internal components and wiring is secure.

3. Perform continuity check of all circuits.

4. Perform 1,000 VDC megger test on feeder, load and ground cables.

5. Verify dead-front is secure.

6. With the 3-way manual transfer switch dead-front in place and the main access door closed and properly latched, actuate all three (3) Operator Mechanisms; verify:

    a. With the disconnect controlling the connection between the permanent generator and the automatic transfer switch (ATS) in the "ON" position, neither of the other two (2) disconnects can be turned to the "ON" position.

b. With the disconnect controlling the connection between the permanent generator and the automatic transfer switch (ATS) in the “OFF” position, the other two (2) disconnects can be turned “ON” or “OFF”, independent of each other.

c. With the disconnect controlling the connection between the permanent generator and the automatic transfer switch (ATS) in the “OFF” position and with either or both of the other two (2) disconnects in the “ON” position, the breaker controlling the connection between the permanent generator and the automatic transfer switch (ATS) cannot be turned “ON”.

7. Confirm operation of the 3-way manual transfer switch ground receptacle by attaching a plug to the 3-way manual transfer switch ground receptacle and then verify that the plug is grounded to the facility ground.

8. Once normal power has been applied, confirm operation of 3-way manual transfer switch by following directions on main access door.

3.04 OPERATIONS AND MAINTENANCE MANUALS

A. Provide pursuant to Specification Section 26 00 00. Manuals shall in addition contain the following information:

1. Operating Instructions

2. Recommended maintenance.

3. The first page of the manual shall contain the name, address and phone number of the local representative to be called for service and parts.

3.05 INSTRUCTION

A. The Contractor shall (after one week (minimum) written notification to Architect) conduct an instruction session during which all maintenance and operational aspects of the system will be described and demonstrated to personnel selected by the Owner in conjunction with instruction period for Generator System Equipment. The session shall be conducted by a Contractor's representative thoroughly familiar with the characteristics of the system. O & M Manual information regarding the system shall be turned over to the Architect prior to scheduling the instruction session.

END OF SECTION 26 36 13

SECTION 26 36 23

AUTOMATIC TRANSFER SWITCHES TIME DELAY NEUTRAL

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Section 26 00 00 – Electrical General Conditions

1.02 WORK INCLUDED

A. Provide all automatic transfer switches. Meet UL Standard 1008.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Asco

B. Zenith

2.02 TYPE

A. Transfer and retransfer to normal load shall be automatic. Automatic transfer switches shall be electrically operated, mechanically held and supplied with positive mechanical interlocking. The main contracts shall be equipped with a safe manual override capability, UL 1008 listed meeting tables 21.1, 23.1, 23.2.

2.03 RATING

A. Shall have voltage, amperage and ampere withstand ratings as indicated on the drawings.

B. Transfer switches used to transfer from normal to emergency power shall be approved for emergency service, full ampere rated (no derating) with make rating at 20 times and break rating at 6 times full load current rating. Provide 4 pole device for switching of neutral in addition to phase conductors when generator neutral is grounded at the generator, or as indicated on the plans.

2.04 ACCESSORIES

A. The following accessories shall be provided as a minimum in addition to those normally required for proper operation.

1. Full three phase voltage failure and phase reversal sensing. Adjusting drop out and pick up. Set at 85% drop out, 92% pick up.

2. Signals: Two pilot lights for indicating transfer position. White - normal, yellow - emergency at transfer switch. Auxiliary contacts for remote pilot lights.

3. Test Switch: For simulating power failure.

4. Transfer: Adjustable ride through feature of approximately 0-10 seconds for start of engine generator and transfer on momentary loss of normal source. Set at 1 second. Includes two auxiliary contacts, one N.O. and one N.C. for use for engine start signal.

5. Retransfer: Adjustable time delay (with emergency failure by-pass) of 0 to 30 minutes for retransfer to normal. Set at 15 minutes.

6. "Time Delay Neutral": Provide time delay with transfer switch in neutral position and load disconnected from either source, adjustable from 2 to 50 seconds, to prevent transfer between sources when sources are significantly out of phase. Set per Engineers instructions.

2.05 ENCLOSURE

A. Each transfer switch shall be enclosed in an enclosure suitable for the environment in which it is located, with front opening lockable door.

2.06 SHOP DRAWINGS

A. Prepare and submit detailed shop drawings for review prior to manufacture. Include the following information (written or highlighted): wiring diagrams, dimensions, front view, catalog information indicating complete electrical and mechanical characteristics and compliance with all items of Section 26 36 23.

PART 3 EXECUTION

3.01 MOUNTING

A. Wall mounted or free-standing assembly as per plans.

3.02 OPERATION TEST

A. Provide testing of transfer system coordinated with generator set(s) and start control panel to insure proper operation of transfer devices under actual operating conditions.

3.03 SEQUENCE

A. Any automatic transfer switch sensing loss of power shall start the emergency generator set and the set shall continue to run until after all transfer switches have returned to normal power (engine cool-down timer part of emergency generator set).

3.04 OPERATIONS AND MAINTENANCE MANUALS

A. Provide pursuant to Section 16050. Manuals shall in addition contain the following information:

1. Recommended test intervals.

2. Recommended service intervals.

3. Test and service record forms showing proper intervals for tests.

4. Recommended maintenance.

5. The first page of the manual shall contain the name, address and phone number of the local representative to be called for service and parts.

3.05 INSTRUCTION

A. The Contractor shall (after one week (minimum) written notification to Architect) conduct an instruction session during which all maintenance and operational aspects of the system will be described and demonstrated to personnel selected by the Owner in conjunction with instruction period for generator system equipment. The session shall be conducted by a Contractor's representative thoroughly familiar with the characteristics of the system. O & M Manual information regarding the system shall be turned over to the Architect prior to scheduling the instruction session.

END OF SECTION 26 36 23

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SECTION 26 43 00

SURGE PROTECTIVE DEVICE (SPD)

PART 1 GENERAL

1.01 DESCRIPTION

A. This Section describes the materials and installation requirements for Surge Protective Devices (SPD). SPD devices are used for the protection of all AC electrical circuits from the effects of lightning induced currents, substation switching transients and internally generated transients resulting from inductive and/or capacitive load switching.

B. This specification also describes the mechanical and the electrical requirements for the SPD devices. The SPD shall be suitable for application in both category A, B and C environments as described in ANSI/IEEE C62.41- 2002.

C. The SPD shall be of parallel design and provide individual protection components connected Line to Ground and Line to Line for Delta and High Resistance Grounded systems and Line to Ground, Line to Neutral and Neutral to Ground for Wye and Single-Phase distribution systems.

D. Systems not providing discreet protection components in the above configuration will be rejected. A schematic diagram showing the configuration and technology of all internally connected components must be provided with submittals.

E. The SPD devices will be used both near electrical service entrance locations and at locations distant from service entrance locations (Panels, MCC's, Equipment Disconnects, etc.). For the purposes of this specification, it should not be assumed that on Wye-connected systems a neutral to-ground bond will not be located electrically close to the suppressor location, thus discreet Neutral to Ground Suppression and Filter components are required.

F. The Manufacturer/Vendor shall furnish all of the necessary SPD products and related hardware (i.e., flush mounting kits, mounting brackets, etc.) as required for the installation of the Surge Protective Devices (SPD) System suitable for the application.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 26 00 00 – Electrical General Conditions

B. Section 26 05 19 - Wire and Cable

C. Section 26 05 26 - Grounding

D. Section 26 05 32 – Outlet and Pull Boxes

E. Section 26 05 33 – Raceways

F. Section 26 24 13 - Switchboards

G. Section 26 24 16 – Panelboards

1.03 SUBMITTALS

A. The vendor/manufacturer shall submit 3 copies of all related SPD Specifications, product data, electrical and mechanical shop drawings, installation requirements/instructions, maintenance manuals (if applicable) and performance/warranty information requested in this document for the actual proposed SPD device(s) to the Project Engineer. All information shall be submitted in a PDF indexed by response and test. Project Engineer reserves the right to select or reject any vendor response or product.

B. In order for SPD device to be considered for this project, all responses to information requested in this specification must be provided in writing and must reference each specification section and sub-section. Written submittal responses shall be signed by the manufacturer's VP of Engineering. Attach information as necessary to provide compliance with specification response requirements. If a manufacturer cannot fully comply with a section of the specification, this must be stated in the response and the reason for non-compliance shall be provided.

1.04 QUALITY ASSURANCE AND PERFORMANCE

A. Each complete suppression unit shall be UL1449 4th Edition Listed as a Surge Protective Device. UL 1449 test data for proposed SPD devices, including UL let through voltage classification shall be provided with submittal. Units shall bear suppressed voltage rating issued by UL.

B. The Engineer reserves the right to have an employee or a representative designated by firm witness any testing required by this document. Vendor/manufacturer shall provide written notice of intent to test and shall coordinate testing with the Engineer, should the Engineer desire to witness tests.

C. Performance & Durability Testing: Units shall be tested by an independent test agency in accordance with test procedures outlined in ANSI/IEEE C62.45, NEMA LS1 & UL1449. The following test data shall be provided:

1. Provide Maximum Surge Current (Single Pulse Rated, 8/20µS, by mode, Amperes) as per NEMA LS1-1992 – 2.2.9 with submittals document. Maximum surge current rating shall not be less than 120kA (60kA per mode including N-G) for branch panel models in low exposure areas, high exposure areas and for IEEE C62.41.1-2002 - Category B Switchboard and Motor Control Center Locations. Maximum surge current rating (per phase in applicable modes other than Neutral to Ground) shall not be less than 240kA (120kA per mode including N-G) for IEEE C62.41.1-2002 - Category C Locations, including all Electrical Equipment located at Service Entrance location. Provide proof of completion of such tests and test data with submittal data. Provide surge current ratings for each applicable protection mode (L-L, L-N, L-G & N-G) with submittals.

2. Provide durability test data utilizing the ANSI/IEEE C62.41-1991, Category C3, 20kV/10kA, 1.2 x 50 S - 8x20S combination waveform. Provide test data with submittals. Let through voltages shall be provided for all applicable protection modes (L-N, L-G & N-G) from zero reference. All SPD devices (including branch panel) shall withstand a minimum of 5,000 hits delivered at a rate of one (1) pulse per minute. Unit shall not fail or suffer let through voltage degradation of more than 7%. Lead length for testing and let through measurements shall be 6". Provide lead length used for testing with submittals.

3. Provide performance test data utilizing the ANSI/IEEEC62.41.2-2002, Exposure - High, 10kV/10kA, 1.2 x 50µS - 8x20µS combination waveform. Provide test data with submittals. Let through voltages shall be provided for all applicable protection modes (L-N, L-L & L-G) from zero reference. Lead length for testing and let through measurements shall be 6". Provide lead length used for testing with submittals.

4. Provide let through voltage test data and test waveforms used for (N-G) with the submittals for units intended for grounded Wye systems.

5. Provide let through voltage test data for the ANSI/IEEE C62.41.2-2002, Category B, 0.5µS-100 kHz 6kV/.5kA ring wave (L-L, L-N & L-G) with the submittals. Let through voltages shall be provided for all applicable protection modes and shall be measured from the zero reference.

6. Provide let through voltage test data for the ANSI/IEEE C62.41.2-2002, Neutral grounded at service entrance – Far Category, 0.5µS-100 kHz 3kV ring wave (N-G) with the submittals for units intended for grounded systems.

7. If available, test data shall be provided for the ANSI/IEEEC62.41.2-2002 level three category of the 5/50 nS EFT Burst waveform as a part of this submittal package. Let through voltages shall be provided for all applicable protection modes (L-L, L-N, L-G & N-G).

8. All SPD tests must provide let through voltages using a positive polarity pulse at the 90-degree phase angle location on the sine wave for Category B and C waveforms and 180-degree for Category A waveforms. Let through voltages must be measured from the zero-voltage reference line for the tests.

9. All let through voltage test results must be provided with a minimum of six inches of lead length as measured from the point where the wire would normally exit the SPD enclosure (standard installation) to the point of termination. Wire used for test must be of the type of building wiring material recognized by the latest adopted version of the NEC and must be readily available for wiring commercial buildings, unless permanently attached to and supplied with suppressor. Conductors sizing used for test shall be based on manufacturer's installation instructions for the proposed product.

10. The above test results, including oscillographs, test conditions, identity of the testing lab and the test technicians and engineers shall be provided as part of the submittal package. The manufacturer shall provide the contact phone number for a readily available factory engineer responsible for answering questions about this product and the tests performed. Information shall be provided in a format that is easy to analyze and review.

11. Maximum Let Through Voltages based on above requirements:

Peak Voltage Let Through Table Peak Let Through Voltages (measured from zero reference per NEMA LS-1) shall not exceed:						
Voltage & Configuration	**Test / Wave**	**L-L**	**L-N**	**L-G**	**N-G**	**Phase Angle**
480/277 Wye - Grounded	C3 – 20 kV/10ka	2500	1600	1900	1700	90
480/277 Wye - Grounded	B3 – 6 kV/3kA	1700	1000	1100	1000	90
480/277 Wye - Grounded	A1 – 2kV – 67A	150	150	150	150	180
480/277 Wye - Grounded	UL1449 Rev2 Update	1500	800	800	800	----
480 Delta	C3 – 20 kV/10ka	2400	N/A	2400	N/A	90
480 Delta	B3 – 6 kV/3kA	2000	N/A	1900	N/A	90
480 Delta	A1 – 2kV – 67A	75	N/A	1200	N/A	180
120/208 Wye	C3 – 20 kV/10ka	1400	1100	1300	1150	90
120/208 Wye	B3 – 6 kV/3kA	950	550	600	550	90
120/208 Wye	A1 – 2kV – 67A	100	75	120	100	180
120/208 Wye	UL1449 Rev2 Update	800	400	400	400	-----
120/240 Split Phase	C3 – 20 kV/10ka	1400	1100	1250	1200	90
120/240 Split Phase	B3 – 6 kV/3kA	1000	600	600	600	90
120/240 Split Phase	A1 – 2kV – 67A	100	75	120	95	180

D. Manufacturers Qualifications: Only firms regularly engaged in the manufacture of SPD products for category C locations (ANSI/IEEE C62.41.1-2002), and whose products have been providing satisfactory service for not less than five years, shall be considered. A customer reference list, with a minimum of five contact names and current phone numbers shall be provided with the submittals. All manufacturer qualifications shall be provided as part of the submittal.

E. The successful manufacturer/vendor shall assign a technical contact person for SPD application, installation and warranty questions. This contact shall be available to provide a response to a technical question within a maximum of two (2) business days.

F. The Engineer reserves the right to accept or reject any or all submittals, to request additional information as deemed necessary or to request submittals for a different unit that may be deemed more appropriate for this installation.

G. Engineer reserves the right to have an employee or a representative designated by firm witness any testing required by this document. Vendor/manufacturer shall provide written notice of intent to test and shall coordinate testing with Engineer, should Engineer desire to witness tests.

1.05 CODES AND STANDARDS

A. UL compliance and labeling: Listed per UL 1449, 4th Edition.

B. SPD and Enclosures proposed and submitted shall be safety agency listed for all intended installations, meeting or exceeding all of the following: NEMA 1, 3R, 4, 12 & 13.

C. SPD device shall be designed to allow installation in accordance with latest adopted version of the National Electrical Code (NEC), National Electrical Safety Codes (NESC) and applicable OSHA 1910 requirements.

D. NEMA LS1 (latest revision)

E. IEEE Standard C62.41.1, IEEE Standard C62.41.2 & IEEE Standard C62.45 (latest revisions)

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. The SPD shall be compatible with the electrical system voltage, current, system configuration and intended applications.

B. The SPD maximum continuous operation voltage (MCOV) shall be capable of sustaining 115% of the nominal RMS voltage (with the associated peak voltage of 1.414*RMS) continuously without degradation and heating.

C. The TVSS shall only use clamping components connected in parallel with the supply to limit the surge voltages.

D. Arc Discharge components, such as Gas Tube Arresters shall not be used as the sole protection component in any protection mode. Gas Tube Arresters may be used in conjunction with other components, such as MOV's and SAD's to provide protection. Where Gas Tube Arresters are installed, the circuit shall be specifically designed to prevent power follow current.

E. Internal Fusing – If provided, shall be component level style:

1. Component Level Fusing:

a. Each Metal Oxide Varistor, or other primary suppression component, shall be individually fused for safety and performance to allow the SPD to withstand the full rated single pulse peak surge capacity per mode without the operation or failure of the fuses. Overcurrent fusing that limits the listed peak surge current of the SPD is not acceptable. Replaceable cartridge type per phase or per mode overcurrent fusing is not acceptable.

b. For arc quenching capability, minimization of smoke and contaminates in the event of a failure, and to ensure the safest possible design, all surge components, current carrying paths and fusing shall be packed in fuse grade silica sand.

c. Fusing shall be present in every mode, including Neutral-to-Ground.

d. The fusing shall be capable of interrupting up to a 200kA symmetrical fault current with 600VAC applied, providing a listed 200kAIC Short Circuit Current Rating (SCCR) without additional over-current protection.

F. Status Indication & Monitoring: The suppressor shall include individual Phase Status LEDs, a red Service Required LED, an integrated Audible Alarm with silence button and Form C dry contacts (N.O. or N.C.) for remote monitoring capability. The form C contacts must be rated a minimum of 65VDC/150VAC with a load of 30WDC/60VA AC, and must be isolated and insulated from the ground plane and the power system to prevent Surges from reaching the monitoring system. The system shall provide insulation and isolation against any impressed voltages. Contacts shall be designed to change state upon device failure or loss of power.

G. The protection should be housed in the appropriate NEMA rated; heavy duty powder coated steel enclosure. This enclosure must provide complete protection against personnel hazards and damage to equipment should a failure of the SPD protection device occur. This enclosure shall also be designed to allow connection of the SPD device without sharp bends in the conductors and lead lengths of less than 18" from the SPD Lugs (or enclosure opening for devices with leads attached) to the final point of attachment to the power system for the application (assuming connection point is 12" from the exterior of the enclosure).

H. Manufacturer shall provide a comprehensive warranty that provides for unlimited full replacement of a suppressor that is damaged or that fails to meet manufacturers published specifications and specifications provided within, without pro-rating value. Warranty shall provide coverage for a minimum period of twenty (20) years for individual units (standard warranty) and. Series SPDs shall be covered for ten (10) years. These Unlimited Replacement Warranties cannot exclude system over-voltages or direct lightning strike events. Warranty shall not require any factory or third-party testing. Warranty shall apply to installed unit(s) for the duration of the warranty period no matter who owns the facility or equipment. All warranty information and copies of warranty documents must be provided with this response.

1. All replacements shall be of same make, model and configuration as original unit unless otherwise requested or approved by customer.

2. The manufacturer/vendor shall provide a warranty replacement unit at the facility within five (5) days of receipt of written notification that the SPD unit has failed, at no cost to the customer.

3. If the manufacturer/vendor requires inspection of the installed unit to validate warranty claim, the manufacturer/vendor must visit the site where the failed SPD device(s) are located within three (3) days of notification. This visit will be performed at no cost to customer. This section does not modify the requirement for the SPD replacement to be within five (5) days of written notification as described in section G, above.

4. The replacement unit shall be sent to the facility without shipping, handling, examination or other fees.

I. Complete, comprehensive installation instructions shall be provided for the SPD systems proposed. Installation instructions must provide for compliance with latest adopted NEC requirements and UL listing requirements, while not degrading performance of SPD device as tested. Provide copies of installation instructions for the models proposed with the specification response. Successful vendors/manufacturer shall provide a complete, comprehensive installation checklist.

J. If manufacturer claims SPD device to have filtering capabilities, provide complete information on filtering performance of TVSS device with specification response. This information must include attenuation across a stated frequency range. If the SPD is a UL 1283 listed device, the manufacturer shall provide all performance specifications for filter attenuation.

K. Provide complete enclosure dimensions (H*W*D) and cutsheets indicating dimensions including locations of terminations and wire entry locations with specification response.

L. Provide UL Short Circuit Current Ratings (SCCR). Minimum ratings shall be 200kAIC without additional/external over-current protection.

M. Manufacturer shall make available metal flush plates for distribution and branch panel SPDs. The flush plate shall provide for a clean architectural finish and be utilized where the attached panel is mounted flush.

N. Manufacturer must have knowledgeable local representation and distribution within 100 miles of the project location and must be willing to provide technical support, warranty claim support, and installation support for the project.

O. Successful manufacturer/vendor must be capable of supplying SPD for project within twenty (20) days of receipt of order for orders of 25 units and less for models submitted in response to this specification.

2.02 SERVICE ENTRANCE

A. Surge Protective Devices shall be installed at all service entrances of each building and as shown on the riser / one-line diagram. Suppressors shall be listed in accordance with UL 1449
4th Edition, Standard for Surge Protective Devices.

B. For 3-phase, 4-wire plus ground configurations, suppressors shall provide suppression and filter elements between each phase conductor and the system neutral, each phase conductor and the system ground and between the neutral conductor and ground.

C. Suppressors shall include a passive circuit that allows the suppressor to actively follow the voltage waveform and provide a clamping envelope that follows the sine wave to limit low level IEEE C62.41 A1 ring waves (of either polarity) at all locations on the sine wave. This circuit shall also perform in the Neutral to Ground Mode where a sine wave does not exist. Details of circuit used to provide this function and information detailing and quantifying the performance of this circuit (in all modes with Category A1 ring wave) shall be provided with specification response. All Let Through Voltage (LTV) values shall not exceed those stated in section 1.04.C.11.

D. Indication of proper suppressor connection and operation shall be provided, consisting of status LEDs for each phase, a Red Service Required LED and an internal Audible Alarm with silence/mute button. Dry contacts (NO/NC) are required for external monitoring.

E. SPD shall exhibit fully redundant protection for each phase.

F. The surge suppressor shall be of parallel design and shall be capable of being removed and replaced without disrupting electrical service to the facility.

G. Suppressors shall consist of solid-state components and shall operate bi-directionally.

H. All surge protective devices shall be of the same manufacturer.

I. The minimum single impulse current rating (as per NEMA LS-1) shall not be less than 240,000 amperes per phase (120KA per mode). Provide proof of compliance by supplying certified test results from independent test lab with submittals.

J. Maximum size of SPD units for Primary Service Entrance applications is 15.5”x12.3”x8.25”.

2.03 SECONDARY SUPPRESSORS FOR MCC, DISTRIBUTION & BRANCH PANELS

A. Surge Protective Devices shall be installed at all service entrances of each building and as shown on the riser / one-line diagram. Suppressors shall be listed in accordance with UL 1449 4th Edition, Standard for Surge Protective Devices.

B. For 3-phase, 4-wire plus ground configurations, suppressors shall provide suppression and filter elements between each phase conductor and the system neutral, each phase conductor and the system ground and between the neutral conductor and ground.

C. Suppressors shall include a passive circuit that allows the suppressor to actively follow the voltage waveform and provide a clamping envelope that follows the sine wave to limit low level IEEE C62.41 A1 ring waves (of either polarity) at all locations on the sine wave. This circuit shall also perform in the Neutral to Ground Mode where a sine wave does not exist. Details of circuit used to provide this function and information detailing and quantifying the performance of this circuit (in all modes with Category A1 ring wave) shall be provided with specification response. All Let Through Voltage (LTV) values shall not exceed those stated in section 1.04.C.11.

D. Indication of proper suppressor connection and operation shall be provided, consisting of status LEDs for each phase, a Red Service Required LED and an internal Audible Alarm with silence/mute button. Dry contacts (NO/NC) are required for external monitoring.

E. SPD shall exhibit fully redundant protection for each phase.

F. The surge suppressor shall be of parallel design and shall be capable of being removed and replaced without disrupting electrical service to the facility.

G. Suppressors shall consist of solid-state components and shall operate bi-directionally.

H. All surge protective devices shall be of the same manufacturer.

I. The minimum single impulse current rating (as per NEMA LS-1) shall not be less than 120,000 amperes per phase (60KA per mode). Provide proof of compliance by supplying certified test results from independent test lab with submittals.

J. Maximum size of SPD units for Secondary Suppressors for MCC, Distribution & Branch Panel applications is 15.5”x12.3”x8.25”.

2.04 PRIOR APPROVALS

A. The following manufacturer(s) have submitted the required information and have been reviewed and approved for this project:

Total Protection Solutions SPD by Thomas & Betts Power Solutions						
Voltage / Location	**480Y277v 3 Phase Bonded Wye**	**480v 3 Phase Delta**	**208Y120v 3 Phase Bonded Wye**	**208v 3 Phase Delta**	**120/240v Single / Split Phase**	**120v Fire Alarm, Security, PLC, etc.**
Main Services	**ST240-3Y480-FL**	ST240-480NN-FL	**ST240-3Y208-FL**	ST240-240NN-FL	ST240-1S240-FL	N/A
Distribution MCC & Branch Panels	**LP120-3Y480-FL**	ST120-480NN-FL	**LP120-3Y208-FL**	ST120-240NN-FL	LP120-1S240-FL	N/A
Dedicated Equipment	N/A	N/A	N/A	N/A	N/A	**LTE120-30A**

SPD Applications Notes:

1. Use 60 Amp Circuit Breakers for Service Entrances and 30 Amp Circuit Breakers for Distribution, MCC & Branch Panel applications.
2. Use Delta units for unbonded/ungrounded and high resistance ground Wye applications.

Innovative Technology Protector by Eaton/Cutler Hammer						
Voltage / Location	**480Y277v 3 Phase Bonded Wye**	**480v 3 Phase Delta**	**208Y120v 3 Phase Bonded Wye**	**208v 3 Phase Delta**	**120/240v Single / Split Phase**	**120v Fire alarm Security, PLC, etc.**
Main Services	**PTE240-3Y201-L-SD**	PTE240-NN400-L-SD	**PTE240-3Y101-L-SD**	PTE240-NN201-L-SD	PTE240-1S101-L-SD	N/A
Distribution MCC & Branch Panels	**PTE120-3Y201-L-SD**	PTE120-NN400-L-SD	**PTE120-3Y101-L-SD**	PTE120-NN201-L-SD	PTE120-1S101-L-SD	N/A
Dedicated Equipment	N/A	N/A	N/A	N/A	N/A	**LTE120-30A**

PART 3 EXECUTION

3.01 GENERAL

A. Suppressors shall be installed per the manufacturer's installation instructions and the requirements of the NEC, the local authority having jurisdiction and the project engineer.

B. Size overcurrent protective device and conductors per manufacturer's recommendations and NEC requirements.

C. Project Engineer or their appointed representative may perform inspection of the installed suppressors and reserves the right to require corrections to the installation to comply with manufacturer's installation requirements and project specifications.

D. The SPD supplier must provide on-site installation training for the electrical contractor.

3.02 SERVICE ENTRANCE

A. Install one primary suppressor at each utility service entrance to the facility as indicated on the drawings.

B. Suppressor shall be installed on the load side of the service entrance disconnecting means in accordance with NEC requirements.

C. Provide a 60 Amp circuit breaker (with a safety clip to ensure the circuit breaker cannot be inadvertently turned off) in the switchboard as over-current protection for the wire and as a disconnecting means for the SPD (or as specified by the manufacture).

D. Use minimum #6 AWG wire for connecting the SPD.

E. Conductors between suppressor and point of attachment shall be kept as short and straight as possible. Lead length of connecting conductor shall not exceed two (2) feet without written permission of the specifying Engineer. If length is exceeded, Contractor may be required to relocate SPD at no cost to the Owner.

F. Over-length SPD leads (greater than 24") must be twisted together (1 twist/foot) and securely tie-wrapped once per foot to reduce impedance of the leads.

G. SPD leads may not be spliced.

H. Suppressor's ground shall be bonded to enclosure frame and the service entrance ground bus, and conduit between the SPD and the switchboard must provide secure electrical/mechanical connections.

3.03 SECONDARY SUPPRESSORS FOR MCC, DISTRIBUTION & BRANCH PANELS

A. Install one secondary suppressor at each MCC, Distribution Panel, Branch Panel & Sub-Panel location as indicated on the drawings.

B. Provide a 30 Amp circuit breaker (with a safety clip to ensure the circuit breaker cannot be inadvertently turned off) in the panel being protected as over-current protection for the wire and as a disconnecting means for the SPD (or as specified by the manufacture).

C. Conductors between suppressor and point of attachment to the panelboard shall be kept as short and straight as possible. Mount the SPD directly adjacent to the circuit breaker closest to the neutral bus, such that the maximum length of connecting wiring is kept as short as possible, not exceed 18 inches for all phase and neutral leads (24" for ground lead on IG panels). If length is exceeded, Contractor may be required to relocate SPD at no cost to the Owner.

D. Over-length SPD leads (greater than 18") must be twisted together (2 twists/foot) and securely tie-wrapped once per foot to reduce impedance of the leads. Quality compression butt-splice connections are required when extending SPD leads (wire nuts are not acceptable).

E. Grounding for all non-IG installations: Suppressor's ground lead shall be bonded to the panel enclosure with a small ground lug as close as possible to the SPD mounting point. Conduit between the SPD and the switchboard must provide secure electrical/mechanical connections.

F. Multiple “Feed-Through” Panels with shared SPD units must be immediately adjacent to each other (side by side) with short tie cables not to exceed 36”. Sub-panels must be feed from a primary panel with a “lug-out’, lug-in” tie connection, and the tie connection lugs must be at the same end of the primary and sub-fed panel. i.e., bottom to bottom or top to top to ensure short tie “sub-feed” cables.

1. Dual Panel Configurations: One SPD per two panels

2. Three and Four Panel Configurations: One SPD installed on both outside panels of the multi-panel configuration, i.e., Install SPD on first (primary) and another one on the third or fourth sub-fed panel for a total of two (2) SPDs.

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SECTION 26 50 00

LIGHTING

PART 1 GENERAL

1.01 WORK INCLUDED

A. Provide the lighting system complete and operational.

B. Recessed fixtures installed in fire-resistive ceiling construction shall have the same fire rating as the ceiling or shall be provided with fireproofing boxes having materials of the same fire rating as the ceiling.

1.02 RELATED DOCUMENTS

A. Section 26 00 00 – Electrical General Conditions

1.03 FIXTURE SCHEDULE MANUFACTURER'S SERIES NUMBERS

A. The design series reference does not necessarily represent the number, size, wattage, lumen output or special requirements as specified hereinafter.

1.04 SUBMITTALS

A. Shall be neatly and clearly marked to indicate the fixtures, performance, efficiency, and mounting methods complying with contract documents.

B. When substitute fixtures are submitted (if permitted) the data shall clearly cross reference (written or highlighted) that the substitute fixture complies with every detail of the specified fixture. The substitute fixture must be supplied with an IES file for verification of the fixture performance and lumen output.

C. The manufacturer’s representative will be required to provide the photometric reports for various areas with the substituted fixture to prove the foot-candle level is adequate and meets the design intent.

D. The Engineer has the right to request a working sample of the substituted light fixture to verify quality and style meet the design intent.

E. Fixtures not fully complying with the intent of the contract documents and design criteria will be rejected.

PART 2 PRODUCTS

2.01 DLC COMPLIANCE

A. Light fixtures are required to be DLC 4.0 Compliance and be on a DLC Compliance listing to accommodate energy rebate.

2.02 METAL PARTS

A. Interior Fixtures: Steel or aluminum with manufacturer's standard color and finish as indicated on the Lighting Fixture Schedule, unless specified otherwise.

B. Exterior Fixtures: Corrosion resisting metal, a (non-ferrous, stainless steel or special finish) and in all cases suitable for outdoor service without tarnishing or other damage due to exposure; manufacturer's standard colors unless specified otherwise; cadmium plate all metal parts concealed by canopies, including screws, plates and brackets. All exposed fasteners shall be tamperproof.

2.03 LIGHT TRANSMITTING COMPONENTS

A. When not otherwise independently secured by other means the lens of any fixture shall be contained in a captive metal frame that remains attached to the fixture when door is in open position.

2.04 SPECIAL PARTS

A. Adapters, Plates, Brackets and Anchors: Provide where required by construction features of the building to suitably mount lighting fixture. All such appurtenances and mounting methods shall be approved by the Architect/Engineer prior to fabrication and installation.

B. Low Voltage Transformers: Provide and install where required to power individual or linear runs of low voltage light fixtures.

2.05 LAMPS

A. Solid-State Lighting: Fixtures shall have a lumen maintenance life expectancy (L_{70}) of > 50,000 hours, a CRI of > 80, and a CCT of 3500K or as shown on the panel schedule. Each solid-state fixture model shall be tested in accordance with IES LM-79 & LM-80 requirements.

2.06 LED DRIVERS/POWER SUPPLIES

A. The LED drivers/power supplies shall meet the following criteria:

1. Drive mode: Constant Current or Constant Voltage depending on the LED configuration for the light fixture.
2. Output currents: 250 mA – 1000 mA
3. Output voltages: 6VDC – 48VDC
4. Input voltages: 110 to 277 VAC; 50/60 Hz.
5. Power factor at >0.90 @ full load
6. Line regulation accuracy: +/- 2%
7. Load regulation accuracy: +/- 3%
8. Greater than 85% efficient
9. Output over-voltage, output over-current and output short circuit protection with auto recovery

10. Provide each driver with onboard transient voltage suppression (TVS)

11. Limited power source output to allow for class 2 wiring.

12. Flicker Free 0-10V Dimmable to 10% light output.

13. 5 Year Warranty.

2.07 GENERATOR TRANSFER DEVICE

A. Transfer device shall be installed integral to each light fixture and shall automatically transfer power from the normal power source to the emergency circuit upon loss of normal power. Bodine #GTD

B. Where the transfer device cannot be mounted in the light fixture and the transfer device is indicated to control more than one (1) light fixture on the same switch leg, provide Bodine #GTD20A.

C. The device shall be capable of bypassing the local switching means when normal utility power has been lost. The device shall consist of a test switch, a normal power indicator light and an alternate power indicator light. The unit shall be contained within its own enclosure, suitable for mounting on the wall and above accessible ceilings. The device shall be able to accommodate up to 20 amps of lighting load.

2.08 EMERGENCY BATTERY BACK-UP IN FIXTURES

A. Emergency lighting shall be provided by using a LED fixture equipped with a Bodine BSL17C emergency driver. This emergency driver shall consist of a high-temperature, maintenance-free nickel-cadmium battery, charger and electronic circuitry contained in one 12” x 2 3/8” x 1 1/2” metal case.

B. Provide with an illuminated test switch (ITS) to monitor charger and battery and installation hardware.

C. The unit shall be suitable for indoor and damp locations and for sealed & gasketed fixtures, including fixtures rated for wet locations.

D. The emergency driver shall be capable of delivering up to 7.5 Watts to an LED load (30-130VDC) for a minimum of 90 minutes. The unit shall have a 15.0 Watt-hour battery capacity and shall comply with emergency standards set forth by the current NEC.

E. The emergency driver shall be UL Listed for field or factory installation.

F. Provide with 5-year manufacturer warranty.

2.09 HANGING FOR PENDANT FIXTURES

A. Rigid type, with not less than 5 thread engagement at each end, consisting of iron pipe, with brass or aluminum tubing casing, or painted tubing not less than 0.040 inches thick.

B. Aircraft cable, stainless steel, sized appropriately by manufacturer for weight and seismic zone.

C. Provide a canopy for each fixture hanger except where fixture conceals the outlet box directly without a canopy.

D. Provide a safety chain for all glass pendant fixtures and for all fixtures mounted in gymnasiums.

E. Provide Unistrut and mounting hardware above the ceiling to bridge structure, piping, and ductwork in order to mount the fixture centered in the space per the drawings.

2.10 OUTDOOR LIGHTING STANDARDS

A. Provide watertight insulating fuse in the base of lighting standards to individually protect each lighting fixture; buss Style "HEB" or approved, waterproof fuse holder with Buss fuse of appropriate capacity and voltage. Provide fuse for each hot circuit wire; do not fuse neutral.

B. Provide concrete preformed round poles with base plate for bolting to concrete foundation. Natural exposed aggregate finish. Height as noted on drawings.

C. Provide concrete foundations as shown on drawings. Field verify locations with Architect prior to installation of bases.

2.11 OUTDOOR GROUND MOUNTED LIGHTING FIXTURES

A. Provide concrete foundations for mounting of ground mounted lighting fixtures. Foundation shall be a minimum of 6” deeper than the light fixture and a minimum of 6” all around the base of the fixture. Provide #4 rebar with 3” minimum ring ties at 8” on center. The #4 rebar shall be vertically spaced approximately 6” apart. Field verify locations with Architect prior to installation of bases.

2.12 EXIT SIGNS

A. The signs shall be thermoplastic impact-resistant or as indicated on the panel schedule, scratch resist and corrosion proof. Faceplate and back cover shall be interchangeable on the housing.

B. Battery shall have a low-voltage disconnect to prevent excessively deep discharge.

C. LED – less than one watt of power consumption. The fixture shall operate in normal (AC mode) and emergency (DC input) modes.

2.13 INTEGRAL PHOTOCELLS

A. Where daylight harvesting photocells are mounted integral to light fixtures, the manufacturer shall provide a diode (or similar means) on the low voltage dimming control bus to ensure that the photocell dimming signal does not propagate to other light fixtures. If the manufacturer does not provide a means to keep the photocell dimming signal from propagating outside of the fixture, it is the responsibility of the Electrical Contractor to install the required diodes in a junction box outside of the fixture at no additional cost to the owner.

PART 3 EXECUTION

3.01 LIGHTING FIXTURES - GENERAL

A. Size and mounting height from finished floor to bottom of fixture as indicated on the drawings. Verify mounting provisions prior to the ordering of fixtures. Fixtures shall be UL listed for the location, and application in which they are installed.

B. Ceiling fixtures shall be coordinated with and suitable for installation in, on or from the ceiling as shown. Installation and support of fixtures shall be in accordance with NFPA 70 and manufacturer’s recommendations.

C. Recessed fixtures installed in seismic areas shall be installed utilizing specially designed seismic clips.

D. Suspended fixtures installed in seismic areas shall have 45° swivel hangers and shall be located with no obstructions within the 45° range in all directions. The stem, canopy and fixture shall be capable of 45° swing.

3.02 DIFFUSERS AND ENCLOSURES

A. Install lighting fixture diffusers only after construction work, painting and clean up are completed. Prior to final acceptance, remove all lamps, reflectors and diffusers, wash, rinse and reinstall.

3.03 ADJUSTMENT OF FIXTURES

A. Make all final spotlight and adjustable light settings under the direction of the Architect/Engineer during a scheduled period of time prior to the completion of the project. Include costs for all equipment and personnel expenses required for adjustment.

B. For fixtures with indirect lighting, notify Engineer prior to installation of any circumstance where the fixture lamp source will be within 12” of ceiling.

3.04 SUPPORT OF FIXTURES

A. Recessed Troffer Type: For fixtures supported by the ceiling suspension system, provide integral tabs, which rotate into position after fixture is lifted into the ceiling cavity. Provide two safety chains secured to structural members above suspended ceiling. Circuit connection shall be through use of 60-inch flexible conduit from a rigidly supported junction box. For plaster or GWB ceilings, provide a plaster frame compatible with light fixture.

B. Recessed Downlight Type: Mount in frames suitable for the ceiling, with the recessed portion of the fixture securely supported from the ceiling framing. For fixtures supported by a ceiling suspension system, provide two safety chains secured to structural members above suspended ceiling.

C. Surface and Pendant Mounted Type:

1. Where mounted on accessible ceilings, hang from structural members by means of hanger rods through ceiling or as approved.

2. Where ceiling is of insufficient strength to support weight of lighting fixture, provide additional framing to support as required. Fixtures shall be supported from structure with seismic bracing independent of ceiling.

3. For Pendant Mount Type: Provide a unistrut channel for mounting fixtures entire fixture length unless light fixture is designed specifically for supporting itself. Provide 3/8-inch thread rod secured to structural members for support of unistrut channel.

4. Continuous Runs of Fixtures: Straight when sighting from end to end, regardless of irregularities in the ceiling. Where fixtures are so installed, omit ornamental ends between sections.

5. Provide Unistrut and mounting hardware above the ceiling to bridge structure, piping and mechanical ductwork in order to mount the fixture per the Contract Documents.

D. Drivers/Power Supplies shall be accessible.

3.05 LOCATION

A. Mount to the dimensions shown on the drawings. Mount at quarter points where no dimensions appear. Architect shall specify mounting locations where no dimensions appear and quarter point mounting is impractical or not indicated on the drawings.

B. Refer to details, structural drawings, mechanical drawings, and coordinate with mechanical Contractor for equipment and ductwork mounted in ceilings to prevent conflict with light fixtures prior to installation. If conflicts cannot be resolved with the Mechanical Contractor, notify Architect/Engineer.

3.06 SPARE FIXTURES

A. Self-Luminous Exit Sign: Provide two (2) Self-Luminous Exit Signs Lithonia # DSW1X Green or Red to match EX1. Install at locations as directed by Architect.

3.07 CONCRETE FOUNDATIONS

A. Install at locations shown taking care to provide soil compaction same as required under paving to avoid settling and tilting of pole. Provide for all steel, concrete or aluminum poles shown. Concrete foundations shall have a minimum raceway sweeps of 90 degrees and anchor bolts shall be accurately set in foundations using a template supplied by the pole manufacturer. Concrete work and grouting; see Division 3 of the specifications. When concrete work has cured, base plates shall be leveled and grouted in place. Pole anchor bases shall then be set on base plates, leveled plumb on foundations, and secured with holding nuts.

3.08 FIXTURE TENTING

A. Contractor shall coordinate ceiling types with architectural drawings and specifications and provide equivalent fire rated enclosures above all light fixtures which penetrate rated ceilings.

B. Light fixtures that are not IC rated and are to be installed within 3” of insulation shall be provided with an EZ Barrier #EZB 16-24-9 protective cover designed for recessed light fixtures.

END OF SECTION 26 50 00

SECTION 27 00 00

LOW VOLTAGE SYSTEMS GENERAL REQUIREMENTS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions and Divisions 0 and 1 Specification Sections, apply to work of this Section.

B. Specification Section 26 00 00 Electrical General Conditions.

1.02 SCOPE AND RELATED DOCUMENTS

A. The work performed under this specification shall be of good quality and performed in a workmanlike manner. In this context "good quality" means the work shall meet industry technical standards and quality of appearance. The Owner reserves the right to reject all or a portion of the work performed, either on technical or aesthetic grounds. The Installing Vendor/Contractor shall make all corrections as needed, to the satisfaction of the Architect.

B. Provide system documentation and Owner training as specified below.

C. An important item of the construction process for this project is the Pre-Construction Kick Off Meeting, which shall take place PRIOR to submittal of equipment data sheets.

1. The General Contractor shall coordinate the scheduling of the meeting.

2. The Owner's Representative and the Owner's IT Department Representative will be present for the meeting.

3. The General Contractor, Electrical Contractor, and a representative from EACH Section shall attend this coordination meeting.

4. As this meeting is essential for early coordination and shop drawings, billing for each low voltage discipline will not be approved until after the low voltage Pre-Construction Kick Off Meeting has taken place.

5. The estimated time is approximate and shall be extended for each Installing Vendor/Contractor as necessary.

6. EACH Installing Vendor/Contractor shall submit their list of coordination items through the construction channels a minimum of 14 days in advance of the meeting for Owner review.

    a. Review EACH specific Section for the sub-section titled "Coordination" for a minimum list of items to be discussed during the **Pre-Construction Kick Off Meeting**.

D. The requirements of the conditions of the Contract, Supplementary Conditions, General Requirements, or other work specified to provide a fully functional system for EACH specific low voltage Section listed below includes, but is not limited to the following sections:

			Pre-Construction Kick Off Meeting	
			Estimated time for EACH Section	Submit questions 14 days in advance
1.	Section 26 00 00	Electrical General Conditions	30	
2.	Section 27 00 00	Low Voltage System General Requirements	15	
3.	Section 27 05 28	Pathways for Communications Systems	10	
4.	Section 27 20 00	Data and Voice Infrastructure	30	
5.	Section 27 41 00	General Audio-Visual System	20	
6.	Section 27 41 16.62	Integrated Audio-Visual System	30	
7.	Section 27 51 13	Paging System	15	
8.	Section 27 53 19	Distributed Antenna System	30	
9.	Section 28 13 00	Access Control System	30	
10.	Section 28 16 00	Intrusion Alarm System	15	
11.	Section 28 23 00	CCTV System	30	
12.	Section 28 31 00	Fire Alarm System	30	

E. Applicable Standards: All work shall be performed in accordance with the latest revisions of the following standards:

1. International Building Code
2. International Fire Code
3. NEC (National Electrical Code)
4. Telecommunications Architectural Standards - In Washington State Government

5. ANSI-J-STD-607-A - Commercial Building Grounding and Bonding Requirements for Telecommunications

F. EACH Installing Vendor/Contractor for their Section shall possess a current and valid Washington State 06 Electrical Low Voltage License.

1.03 QUALITY ASSURANCE

A. Device or wiring arrangement shown on the drawings represents the intent of the system. If additional equipment (that may not be shown) is required to make a fully functional system, then provide such equipment as required.

B. Each specification Section that is governed by these specifications shall be provided, installed, commissioned, and warranted by a local Installing Vendor/Contractor that meets the following requirements for the equipment manufacturer that is being submitted for:

1. All equipment for EACH specification Section shall be provided and installed by a single supplier.

2. Have installed a minimum of three (3) systems within the past five (5) years.

3. Maintain a 24-hour emergency service program using manufacturer trained technicians. Shall respond to service calls within 24 hours during and after the warranty period.

4. The Installing Vendor/Contractor shall be manufacturer approved to purchase the equipment, have a local office staffed with manufacturer-certified installers that are capable of maintaining, servicing, and warranting the equipment being installed; who are full-time employees and are capable of programming, testing, inspecting, maintaining, warranting, and inventorying parts for the life of the system; and shall be located within a 100-mile radius of the project site.

5. Offices that require staff from another “branch office and/or company office” outside of this radius are not acceptable.

C. Prior to completion of the installation, the Installing Vendor/Contractor shall provide:

1. A preventative maintenance agreement which shall, at the Owner’s option, become effective at the end of the warranty period.

2. A proposal for off-site monitoring services where applicable.

1.04 SUBSTANTIAL COMPLETION

A. In addition to the “Substantial Completion” requirements, when applied to EACH of the specification Sections identified in “Scope and Related Documents”, Substantial Completion shall be defined as follows:

1. The stage in the progress of work where the work or designated portion is sufficiently complete in accordance with the Contract Documents, so that the Owner can utilize the work for its intended use.

2. ALL of the requirements listed in "Testing & Complete System Functionality" shall be met. Once all conditions have been met, this shall be deemed Substantial Completion. These requirements shall be completed on or before the Substantial Completion date listed in the Contract Documents.

3. The Owner reserves the right to withhold up to 10% of the funds for each low voltage system until that system has been shown, to the full satisfaction of the Owner, to function properly.

1.05 DOCUMENTATION

A. Document Format:

1. All documents shall be generated on a PC. Provide these documents electronically, with the As-Built Documentation (where applicable).

a. Data sheets, installation manuals, technical documents, brochures, and user manuals may be in PDF format.

b. Power Point presentation(s) shall be in MS-Power Point.

c. Test forms and other project-specific documents shall be in an editable format, either MS Word or MS Excel.

d. Drawings and details shall be in AutoCAD 2013 or newer.

1.06 SUBMITTALS AND SHOP DRAWINGS

A. Submittals and Shop Drawings shall be provided for EACH low voltage system specification section number and shall contain, but not be limited to the items listed below:

B. Submittals – Prior to installation of any equipment, the Installing Vendor/Contractor shall provide the Architect with seven (7) copies of submittals for approval. With the approval of the Architect, electronic submittals in PDF format may be substituted for hard copy. Provide the following:

1. A complete materials list of the quantity of each device, the manufacturer, model number, and description of the equipment for each individual system component or device will be provided. This list shall precede the data sheets.

a. Each system component or device data sheet shall have an indicating arrow next to each component or device that is being submitted.

b. Each submittal shall be by EACH low voltage system specification section number and each submittal shall have its own list of data sheets. Combined submittal sections are not authorized.

C. Additional Shop Drawing Requirements:

1. For additional shop drawing requirements, refer to EACH low voltage system specification section number, in addition to what is listed below.

D. Shop Drawings – Prior to installation of any equipment, the Installing Vendor/Contractor shall provide the Architect with seven (7) copies of submittals for approval.

1. Shop Drawing Requirements: The Installing Vendor's/Contractor's complete and full-size set of Shop Drawings shall be issued in the following format:

a. They shall be clear and legible.

b. The same sheet size as the Contract Drawings (i.e. 30" x 42").

c. A minimum of 1/8" text height shall be used for all text, symbol text, and subscript text.

d. Scale of Drawings:

1) Site plan drawings shall be the same scale as issued in the Contract Documents.

2) Floor plan drawings shall be 1/8" =1'-0", unless directed to do otherwise.

e. The Electrical Legend, Wire Legend, Load and Battery Calculations, Riser Diagram, Sequence of Operation Info, Wiring Details, and Mounting Details shall precede the Site Plans and Floor Plans.

f. All sheets, including the cover, shall include a title block along the edge of each of the drawings that, when the drawings are rolled up, the following information shall be visible:

1) The system-specific sheet number

2) Project name, specification section number and section title name

3) Floor name, area, and/or section of the building (Use the name of the area and/or floor description that is on the Contract Drawings.)

g. Architectural information on the Contract Drawings shall be included on the Installing Vendor's/Contractor's Shop Drawings, including, but not limited to match lines, grid lines, grid bubbles, key plan, and enlarged floor plans.

h. Electrical information on the Contract Drawings shall be included on the Installing Vendor's/Contractor's Shop Drawings, including, but not limited to all applicable general notes and applicable construction notes for each of the floor plans. Where enlarged plans are shown on the Contract Drawings, include this in the Installing Vendor's/Contractor's Shop Drawings to show the room and ALL equipment within the room to help facilitate and coordinate the installation of the low voltage equipment for all systems.

2. Cover Sheet: The first page of the shop drawings shall be a cover sheet to include the following items:

    a. Owner's project information:

        1) Site Information:

            a) Name of site, address, city, and zip code of where the installation shall take place.

    b. Installing Vendor's/Contractor's project information:

        1) Business name

        2) Local office address of the Installing Vendor/Contractor

        3) Primary contact person's name, phone number, and email address who is responsible for the long-term management of the Owner's System.

    c. Provide a Sheet Index which assigns a sheet number and unique name for each sheet that is included in the shop drawing submittal package. As part of the sheet index, list every sheet that is part of the system shop drawing package. On the left side of the Sheet Index, provide two columns: "Included" and "Not Included". Include a check box, and provide a check in each box for all sheets that are included or not included in each submittal.

        1) Each sheet shall have a system-specific sheet number, and shall match the Contract Drawing sheet numbering system (i.e. E4.02 shall be FA-4.02 [for Fire Alarm], E4.02 shall be LAN-4.02 [for Local Area Network]).

3. Legend Information: From left to right, provide the following information for EACH device:

    a. Use the symbol on the legend of the contract drawings

    b. List the manufacturer's name

    c. List the manufacturer's model number

4. Provide a logical description of the device.

    a. Provide the back-box requirements and related information. At a minimum, this shall include:

        1) The height, width, and depth of each required back box for each symbol on the legend.

        2) If the device is a back box or comes with a back box (e.g., control panel, power supply, enclosure, etc.) then provide the height, width, and depth of the dimensions.

3) Indicate if this device back box is going to be installed flush, semi-flush, or surface-mounted.

5. Wire Legend: Provide a listing of the cable manufacturer, model number, cable rating, size of conductors, quantity of conductors, and color of each conductor. Use the format in the sample "Wire Legend" as it applies to each system (see the sample at the end of this specification). Provide a cable identification naming scheme (as defined within these specifications).

   a. The Wire Legend shall include the cable manufacturer and model number for EACH of the following types of cables (as applicable to the project):

      1) Conduit/Raceway Cable.

      2) Open Cabling.

      3) Wet Rated Cable.

      4) Aerial Rated Cable.

      5) EACH cable and EACH cable type shall have a different letter designation.

6. Riser Diagram: Provide a system one-line Riser Diagram that shows the entire system. List the following:

   a. The head-end equipment and IP addressed devices. Show the connection to the WAN (where applicable).

      1) Show each location (the MDF and EACH designated IDF separately).

      2) Show each cable type, size, and quantity between the MDF and each designated IDF location.

      3) Show EACH device in the MDF and each designated IDF location (control panel, CPU, DVR, server, power supply and terminal cabinet) for each applicable system, the room name that each major system component is located in, and the connection to the headend equipment.

      4) Show all field devices with their respective room names and/or numbers and connections to their associated equipment.

      5) Show all field devices with their respective address point (where applicable).

7. For the Fire Alarm System ONLY, provide a detailed sequence of operation matrix that meets or exceeds industry standards, and shows how the System will work. This includes, but is not limited to:

   a. All inputs and/or actions

b. All outputs and/or controls

8. Provide all mounting details and mounting heights for:

   a. All headend equipment

   b. Racks (where applicable)

   c. Devices

9. Detailed Wiring Information:

   a. Show each individual conductor color for all wiring on the point-to-point wiring diagrams for each device.

   b. Show complete scale drawings of equipment, devices, wiring diagrams, and terminations of:

      1) Each control panel, CPU, DVR, etc.

      2) Power supply and/or amplifier

      3) Rack equipment (where applicable)

      4) EACH device type

      5) EACH terminal cabinet (where applicable)

10. Rack Layout:

    a. Show the intended equipment layout within the racks.

    b. Show blank filler plates in spaces where equipment is not installed.

    c. Indicate the rack unit size of each device or filler plate in the rack.

       1) If rack equipment is installed on the rear side of the rack, show rear view of the rack also.

11. The matrix as defined in the “System Device Naming Matrix” of each system specification (where applicable).

12. On the shop drawings, include a letter signed by the System Designer that is responsible for the design depicted in the submittals and on the shop drawings. The letter shall state that the equipment and shop drawings design conform to national, state, and local codes as adopted by the local Authority Having Jurisdiction, and meet or exceed all of the performance requirements as outlined in the specifications.

    a. Designers shall provide the following:

        1) A “signature” line and signature of the designer.

        2) A “printed name” line below (or to the right of) the signature line and the printed name of the designer.

        3) A “date” line below (or to the right of) the printed name line and date of the design.

    b. For fire alarm shop drawings, include the above information and the system shall be designed by one of the following (provide a copy of the supporting documentation):

        1) NICET Level III Certified Designer

        2) Registered Professional Engineer

13. Labels and Labeling:

    a. On the drawings, label each rack, control panel, CPU, DVR, power supply, and terminal cabinet in a logical numeric sequence (e.g., for fire alarm power supplies, list them as FAPS-1, FAPS-2, etc.).

    b. Cables: Generate an alpha-numeric label for each cable type and cable run.

    c. For projects with multiple sites, all labeling shall be consistent for all sites.

14. Show floor plan layout of devices and the anticipated routing of cable runs on Shop Drawings. Include conduit requirements where cables are routed underground or through locations that will be inaccessible after construction. Ensure runs are parallel with all structural framing and routed in a neat and orderly fashion.

15. EACH device at EACH location shall be shown on EACH floor plan. The cabling for EACH device shall be shown from EACH device to the device that it shall be connected to. EACH cable shown on the floor plan shall be identified as described in the “Wire Legend” portion listed within this specification.

    a. Floor Plans: show all system related devices and all equipment that the system specific shop drawings will interface to, on each of the floor plans. Provide cabling for each device and the related wire type (as shown on the “Wire Legend”) shown for each of the devices. Where multiple devices are on the same circuit or an addressable data cable is used, show all devices and their related cables.

16. EOL Supervision:

    a. Indicate on the floor plan drawings where EACH of the end-of-line resistors is located (where applicable).

17. Addressable Device Information:

    a. Show each device address next to each device (where applicable), and clearly display this information so that it is not confusing as to which address belongs to which device. For non-addressable devices that will be connected to an addressable module, show the device address next to each device and the addressable module that it will be connected to.

    b. List the system address points using a logical numbering sequence for the devices on a single run.

    c. Maintain the "Spare Capacity" requirements listed elsewhere in the specifications (where applicable).

    d. Include the complete dip switch and/or rotary addressing scheme (used to set the device address for each addressable point) on the drawings.

18. Illuminated Graphic Maps (where applicable): Prior to the ordering or installing of any equipment, the Installing Vendor/Contractor shall obtain written approval by the Architect. Provide the Architect with seven (7) copies of submittals for approval. These shall be submitted with the Shop Drawings, but not be bound with the Shop Drawings submittal.

    a. Provide the actual full-size scale drawing and artwork that will be provided to the Owner for a final product.

    b. The drawing submittal shall be in color.

19. All drawing submittals shall be a complete and full set of the system. If drawings are required to be re-submitted, a full and complete set must be re-submitted. Partial system drawing sets will be rejected and the Installing Vendor/Contractor shall reissue a full set of drawings. Any re-submittals shall be provided at the Installing Vendor's/Contractor's expense.

20. The Installing Vendor/Contractor is responsible for assuring that the raceway size, raceway routing, wire quantity, wire size, and wire type is suitable for the equipment supplied. The Installing Vendor/Contractor shall review the proper installation method(s) for each type of device/equipment with the manufacturer's representative, and the AHJ, prior to rough-in.

21. Provide shop drawings that are usable for trouble-shooting purposes showing equipment/device locations, conduit routing, junction boxes, and connection wiring of entire system.

E. Contract Drawings shall not be used as Shop Drawings.

F. The Shop Drawings shall be system specific. For example: only fire alarm equipment and connections to other equipment that will be interfaced to the fire alarm shall be shown on the fire alarm drawings.

G. Floor plans for the project have been developed by the Engineer using AutoCAD software. These drawing files will be made available to the Installing Vendor/Contractor for development of Shop Drawings and/or As-Builts for a fee of $20.00 per sheet.

1.07 GOVERNING CODES AND CONFLICTS

A. If the requirements of this section, related sections, or the Project Drawings exceed those of the governing codes and regulations, then the requirements of this section, related sections, and the drawings shall govern. However, nothing in this section, related sections or the drawings shall be construed to permit work not forming to all governing codes and regulations.

1.08 PROJECT CONDITIONS – CIVIL PLANS

A. The Installing Vendor/Contractor shall carefully coordinate the various symbols utilized on the drawings, and shall consult the civil plans to determine site conditions in the various areas.

PART 2 PRODUCTS

2.01 MATERIALS

A. Provide all equipment as defined in each specification and on the drawings.

B. All equipment, panels, power supplies, and devices shall be manufactured under the appropriate category by Underwriters Laboratories, Inc. (UL), and shall bear the UL label.

C. All equipment for each system shall bear the UL label. Partial or pending listings shall not be acceptable. It shall be the Installing Vendor's/Contractor's responsibility to ensure that these requirements are met, and replace any and all equipment up to and including the entire system, if these requirements are not met.

D. EACH of the specified Low Voltage Systems identified in PART 1 of these specifications including the design, devices and/or wiring arrangement shown on the drawings, represent that based on various equipment manufacturers. Any changes resulting from differences between the specified product and other manufacturers or substitute manufacturers, shall be the responsibility of the Installing Vendor/Contractor.

1. Substitutions of the specified equipment and/or supplier will be considered provided that sufficient documentation is provided to the Engineer, which certifies that the equipment and/or supplier qualification meets the requirement of these specifications. Any request for substitution shall be submitted by the Installing Vendor/Contractor in writing so as to be received by the Architect not later than (10) ten days prior to the bid due date. Equipment that is approved by the Engineer will be issued by addendum prior to the bid date.

E. Refer to PART 1 for any equipment that is not specifically defined.

2.02 CONDITION OF MATERIAL

A. All equipment shall be new, in un-opened boxes, and be the most current model available for each component and/or device that is provided for this project. For products that use firmware, the most current version available shall be downloaded and installed at each component and/or device, prior to any programming being performed. Outdated or used equipment, as determined by the Architect, shall be removed and replaced by the Installing Vendor/Contractor at no cost to the Owner.

B. All equipment and components shall be installed in strict compliance with manufacturers' recommendations. Consult the manufacturers' installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning system installation. All materials shall be in working order as intended by the manufacturer, at the completion of the project.

2.03 WIRE GUARDS

A. Provide at locations where designated on the drawings. Provide wire guards to protect the device from damage. At a minimum, all field devices located in the gymnasium(s) and multipurpose room(s) shall have wire guards installed.

B. Provide and install wire guards that are sized appropriately to protect each device at locations indicated on the drawings, but will not interfere with the operation of any device. The device shall operate as intended by the manufacturer after the wire guard has been installed.

C. Wire guards shall be made using 7 gauge welded steel and be chrome plated.

1. Use Space Age Electronics, HSG Series or PSG Series, or approved equal. Size as required.

2.04 TERMINAL CABINETS, TERMINAL STRIPS, ENCLOSURES AND OUTLET BACKBOXES

A. On-Site System Information Binder and Enclosure: EACH specification section identified on the first page of this specification shall have an Information Binder that shall be housed in a System Information enclosure. The enclosure shall have a hinged door with the text "(Section Title here) Information", with each specific system name silk screened onto the enclosure door, and shall bear the Underwriters Laboratories "UL" label. A "T-Turn" cam lock shall be used to keep the enclosure door closed, and a key shall NOT be required to open the enclosure. Use the following Space Age Electronics model number, or approved equal:

1. All systems (other than fire alarm): Model # YD9048DBXAA. Verify with the Architect the color of the enclosure(s) prior to ordering the enclosure. There shall be no additional charge to the Owner for changes to the color of the enclosure.

2. For the fire alarm: Model # YD9049DBXAA shall be red in color, have a hinged door, and have "Fire Alarm System Documentation" silk screened on the enclosure door.

B. Terminal Cabinets (TC):

1. See EACH Specification for terminal cabinet requirements (where applicable).

C. Terminal Strips:

1. See EACH Specification for terminal strip requirements (where applicable).

D. Enclosures:

1. Each system's control panel, power supply, TC, and other metal enclosures shall have the following:

a. Use key operated locks to secure the enclosure (keyed so that a single key can lock and unlock all enclosure locks for the entire system), and provide ten (10) keys.

b. Use some form of wire management that uses permanently secured fasteners (no double-back tape), and uses reusable and adjustable Velcro-style cable straps, which shall be installed approximately every four (4) inches within each enclosure.

E. Backboxes:

1. Each system backbox, with the exception of specific backboxes, shall be metal and installed specific to the system it is being used on.

a. Provide Red Randl Industries Inc., 5 Square boxes or equal for all fire alarm devices.

b. Provide Blue Randl Industries Inc., 5 Square boxes or equal for all A/V locations. Provide single gang mud ring for all A/V locations only requiring single gang faceplate and provide double gang mud ring for all A/V locations requiring double gang faceplate. See A/V schedule for more information.

c. Provide Blue Randl Industries Inc., 5 Square box or equal for all telecom workstation locations with single gang mud ring unless noted otherwise.

2.05 LABELS AND LABELING

A. The alpha-numeric labeling shall be developed by the Installing Vendor/Contractor.

B. Label all equipment and cables in an identical fashion of a sequential manner.

C. The Installing Vendor/Contractor-proposed alpha-numeric labeling that is intended to be used to identify all components of the system shall be submitted for approval by the Engineer, with the submittal of equipment data sheets.

D. All labeling information shall be recorded on the As-Built drawings and all test documents shall reflect the appropriate labeling scheme.

E. Phenolic name plates shall be used for identification of the racks, control panel, power supply, terminal cabinet, and other appurtenances of each system in a logical numeric sequence. Use an alpha-numeric name of each device for each location (created by the Installing Vendor/Contractor) to identify the equipment on the Shop Drawings.

1. The size of the plate shall be two (2) inches high by approximately eight (8) inches wide. Different colors of backgrounds may be used for each system (but Red shall only be used for fire alarm).

2. The text color shall be white letters that are 3/4inch high and are 1/2inch in width.

F. Labeling of cables must be provided in the following locations: EACH system control panel, power supply, terminal cabinet, terminal strip, rack, other system related appurtenances, and all junction boxes. Label all cables as shown on the Installing Vendor's/Contractor's Shop Drawings.

G. All label printing shall be machine generated using indelible ink ribbons or cartridges, self-laminating labels shall be used on cable jackets, appropriately sized to the outside diameter of the cable, and placed within view at the termination point on each end.

1. Temporary Labels: Shall consist of the following:

a. Using a fine point permanent style marker, Sharpie or equivalent, to write directly onto the outer jacket of the cable, or use temporary tags.

b. The Installing Vendor/Contractor shall take all precautions to use care when pulling the cable to ensure the integrity of the temporary label.

c. Remove all temporary labels and tags prior to installing the permanent label.

2. Permanent Labels: Labels shall be produced using an electronic labeler. Cabling shall be marked with a permanent, electronic printed label with a self-laminating clear wrapping to cover the printed label, and shall be secured to the outer jacket of the cable.

3. Provide Brady Model # XSL-116-427 or approved equal.

2.06 SYSTEM CABLES

A. All cables shall be new.

B. All cable types shall be UL listed and rated to meet all code requirements for site conditions, including, but not limited to; underground, wet, plenum, and aerial requirements as mandated per N.E.C. and local AHJ requirements. The Installing Vendor/Contractor shall be responsible for ensuring that all cables meet all national codes, state codes, local codes, AHJ requirements, and each equipment manufacturers' requirements for a reliable, fully functional, and warrantable system, as intended. Do not exceed the wiring distance limitation of the equipment, devices, cables and/or conductors as recommended by the manufacturer of either the equipment and/or the cables for each installation application.

C. Use the manufacturer recommended cables for EACH application and as required by code (e.g., raceway, open cabling, wet, and/or aerial).

D. All cables that run through wet locations shall be UL listed for wet locations and be run in EMT wherever re-entering the building to the device location and the headend location to include ground floor box locations in slab and under slab, aerial locations and any location that it may be exposed to moisture.

E. All cables shall be stranded unless otherwise noted and/or recommended in writing by the manufacturer.

F. CAT5 through CAT7 cables are excluded.

G. See PART 3 of this section, and of each system specification for more information.

2.07 PROOF OF DELIVERY FORM

A. When providing equipment to the Owner, the Installing Vendor/Contractor shall provide the following transmittal document and obtain the necessary signatures.

B. The Installing Vendor's/Contractor's Transmittal Document is defined as:

1. Company logo
2. Name
3. Address
4. Telephone number
5. Delivery date
6. Installing Vendor's/Contractor's representative name that is making the delivery
7. Quantity of each item
8. Manufacturers' name and model number
9. The exact same description of the device (as used on the Shop Drawings)
10. Provide a "signature" line for the Owner's Representative
11. Provide a "printed name" line for the Owner's Representative
12. Provide a "date" line for the Owner's Representative

PART 3 EXECUTION

3.01 WORK ENVIRONMENT

A. General:

1. The Installing Vendor/Contractor shall have implemented an OSHA approved safety plan at their place of business. All staff should adhere to it in their daily practice.
2. Avoiding injury is the primary concern for this project. Use OSHA industry standards to avoid accidents.

3. Coordination with Other Trades:

    a. It is the responsibility of the Installing Vendor/Contractor to coordinate with all trades for this project. Maintain all requirements for project schedule deadlines, rough-in, installation, programming, training, and ensuring that the Owner receives a fully functional system as defined in this specification.

3.02 APPROVED EQUIPMENT AND PERMITS

A. No equipment shall be delivered to the job site until Shop Drawings have been reviewed and approved by the Architect.

B. An approved set of Shop Drawings shall be continuously available at the job site during construction, for review by the Architect.

C. Obtain all permits as required, prior to installation of any equipment. They shall be continuously available at the job site during construction, for review by the Architect.

3.03 CABLE INSTALLATION – GENERAL

A. Open Cable installation methods are acceptable for this project when they are above accessible ceilings or in attic spaces, provided that all requirements identified in this specification are met.

B. All cable types shall be rated to meet all code requirements for site conditions, including, but not limited to: underground, wet, and aerial requirements as mandated per N.E.C. and local AHJ requirements.

C. Do not exceed the wiring distance limitation of the equipment, devices, cables and/or conductors as recommended by the manufacturer of either equipment and/or cables for each installation application. The Installing Vendor/Contractor shall be responsible for ensuring that all cables meet all equipment manufacturers' requirements for a reliable, fully functional, and warrantable system, as intended.

D. Wiring insulation shall be one of the types required by NEC 725-16.

E. Cable Supports: Clamps, "D-Rings", "J-Hooks", Hangers, and Velcro tie-wraps are all acceptable ways to support cable. However, installation of these supports must be done with care so as not to cause crushing or distortion of the cable, nor cause tighter bends than the minimum radius permitted for each type of cable.

F. See each specific section requirements that shall be applied to this project in addition to these requirements.

G. Allowable Cable Bend Radius and Pull Tension: In general, all cables cannot tolerate sharp bends or excessive pull tension during installation. The minimum radius bend shall be ten (10) times the cable outer diameter with no tensile load applied, and twenty times the cable outer diameter with a maximum tensile load of 25ft/lbs applied during installation. The Installing Vendor/Contractor is responsible for maintaining the cable manufacturers' end Radius and Pull Tension at all times. Corrections to cable installation shall be made to the satisfaction of the Architect at no additional cost to the Owner.

H. Service Loops and Cable Management:

1. Comb all wires for the duration of the cable run so they are neat, orderly, do not have excessive slack, and are not tangled, prior to any service loop, continuing through any service loop, or continuing into EACH enclosure and/or system rack.

a. Provide a 10'-0" service loop of EACH device cable (a minimum of 2'-0" above the accessible ceiling, within 5'-0" of plan view) above EACH device.

b. For ceilings that are open to structure, do NOT provide a service loops, except for the following locations:

1) MDF rooms.

2) IDF rooms.

3) Electrical rooms.

4) Storage rooms.

5) Designated system equipment locations that are NOT in view of the public.

6) Prior to rough-in, obtain Architect's approval.

2. Cable Management shall be used to bundle all cables of like kind, separated by system type.

3. See Systems Plywood Backboard Cabling, listed elsewhere in this specification, for more information.

I. The Installing Vendor/Contractor shall ensure that communications cable is installed with care, using techniques which prevent kinking, sharp bends, scraping, cutting, deforming the jacket, or other damage. During inspection, evidence of such damage will result in the material being declared unacceptable. The Installing Vendor/Contractor shall replace all unacceptable cabling at no additional expense to the Owner.

J. The Installing Vendor/Contractor shall order and install the exact cables as specified on the Installing Vendor's/Contractor's Shop Drawings. If at any time during the installation and through the warranty period, it is discovered that any cable other than what is called for on the Installing Vendor's/Contractor's drawings has been installed, the Installing Vendor/Contractor shall remove all effected cables and shall provide and install the correct cable, as required. The Installing Vendor/Contractor shall also provide the staff to monitor the building during the cable replacement period until the system is fully operational to the satisfaction of the Architect, without any additional cost to the Owner.

K. All horizontal cables shall be supported at a maximum of 4'-0" intervals with UL approved devices. At no point shall cables rest on, be tied to, or otherwise secured to electrical conduit, plumbing, ventilation ductwork, accessible ceiling and/or light fixture hangers, or any other equipment. Cable shall be secured to building supports or wire hangers (at the structure's ceiling) specifically designed to support cables and/or to additional blocks or anchors specifically installed for this purpose.

L. All open cabling and/or conduit shall be installed parallel or perpendicular to the structure. Open cable installations shall use insulated mounting supports or rings approved for such use. Wiring shall be installed near or on structural members as to minimize risk of physical damage by other trades or maintenance personnel servicing the equipment.

M. Installing open cabling and/or conduit on an exposed area of wall that could have been installed in a less conspicuous manner, especially where art or murals are to be painted, is NOT acceptable. Any installation that does not meet this requirement will be required to be removed, and to patched and painted to match adjacent surfaces to the satisfaction of the Architect. Then install the conduit, fasteners, and wire as required by the project, at no additional cost to the Owner in an acceptable manner that meets with the Architect's approval. Obtain direction from the Architect prior to rough-in, for areas that need clarification.

N. In some cases, it may be more aesthetically appealing to install conduit down the wall to the floor and either through the floor or along the floor, to be less conspicuous. Contact the Architect for further clarification.

O. Conduit type and areas where conduit will be required for this project are:

1. Provide EMT metal raceway in the following areas:

a. Always conceal conduits within walls and/or ceiling spaces wherever possible.

b. Where required by code. Provide conduit in all areas required by code, but no less than the following locations:

1) To accessible ceiling spaces. Provide conduit from the device to accessible ceiling space where:

a) Devices are wall mounted

b) Devices re located on hard lid ceiling

c) Devices are in an inaccessible area. An inaccessible area is defined as less than 2'-0" from an accessible ceiling tile.

2) Unoccupied areas exposed to view. Unoccupied areas are defined as places that staff or the public will be in the room or area for only a few minutes, with the exception of service/maintenance personnel. This includes, but is not limited to:

a) Mechanical rooms

b) Electrical rooms

c) Storage rooms

d) Utility rooms

e) Janitorial closets

f) Other unoccupied rooms

g) Install conduits to an accessible ceiling space, as defined above.

h) Consult with the Architect for further clarification.

2. Provide conduit, conduit sleeves, junction boxes, couplers, connectors, cabling and terminations as recommended by the manufacturer and as required by code.

3. Provide conduit sleeves through all spaces to accommodate all low voltage cabling. EZ path fire-rated and non-rated devices are approved substitutions for conduit sleeves.

4. Fill Requirements: Conduit, conduit sleeves, raceways, floor boxes, device boxes, mud rings, etc., shall be furnished and installed per the Division 26 requirements. Maintain all conduit code fill requirements, and provide no less than an additional 40% spare capacity for future growth.

5. Conduit and Raceway Usage: All communications cable shall be dedicated for communications purposes, and not to be shared with other electrical wiring when required by code. Obtain written approval from EACH of the manufacturers if more than one system type is going to be installed in a single conduit.

6. Fire alarm cabling shall be in a separate, dedicated raceway (where indicated on the drawings).

7. Pull Cords: Provide nylon-type pull cords in EACH conduit raceway.

8. Provide surface-mounted raceway in the following areas (for retrofit/remodels or as directed by the drawings or Architect):

   a. Occupied areas exposed to view. Occupied rooms. Generally, occupied areas are defined as places that staff or the public will be in the room or area for more than a few minutes. This includes, but is not limited to:

      1) Administrative areas

      2) Office spaces

      3) Other occupied rooms

   b. Install conduits to an accessible ceiling space, as defined above.

   c. Size conduits as required.

   d. Consult with the Architect for further clarification.

9. Surface-mounted conduits of any kind may only be installed after every attempt has been made to conceal wiring and/or conduits specified within this document. Obtain prior approval from the Architect, before installing surface-mount conduit.

10. Prior to installation, contact the Architect if these instructions are not clear, or field conditions require further clarification of the intent of the installation.

P. Cable Lubricants: Lubrications specifically designed for installing cables may be used to reduce pulling tension as necessary when pulling cable into conduit. After installation, exposed cable and other surfaces must be cleaned of lubricant residue.

1. Recommended Products:

a. Dyna-Blue

b. American Polywater

Q. Horizontal Cabling:

1. Horizontal cable terminations shall be made at the appropriate patch panel and labeled as noted on the Outlet Schedule. At each outlet box, a sufficient length of spare cable shall be provided for terminating outlet devices such that the outlet can be easily removed and inspected. In addition, each cable shall be terminated as indicated below:

a. Cables shall be dressed and terminated in accordance with the recommendations made in the TIA/EIA-568-C document, manufacturers' recommendations and/or best industry practices.

b. Bend radius of the cable in the termination area shall not be less than four (4) times the outside diameter of the cable.

c. The cable jacket shall be maintained as close as possible to the termination point.

R. Systems Plywood Backboard Cabling:

1. Cable shall be routed as close as possible to the ceiling, floor, or corners to ensure that adequate backboard space is available for current and future equipment and for cable terminations. Cables shall NOT be tie-wrapped to existing electrical conduit, existing cables, or other equipment. Minimum bend radius shall be observed.

2. Install cables via the shortest route directly to the nearest edge of the backboard from the mounted equipment or block. Lace, plastic or Velcro tie wrap all similarly routed cables together, and attach to the outside edge(s) of the backboard vertically and/or horizontally, then route via "square" corners over a path that will offer minimum obstruction to future installations of equipment and/or other cables.

3. See "Service Loops and Cable Management" listed within this specification for additional information.

3.04 SYSTEMS PLYWOOD BACK BOARDS

A. Systems plywood back boards shall be used to mount enclosures of any kind, to any wall or surface. The systems plywood back boards shall be securely fastened to the walls to accommodate no less than ten times the total weight of the equipment to be mounted. The systems plywood back boards shall be a minimum of 3/4", APA exterior-grade Douglas Fir A-C, and fire retardant with a flame spread rating not more than 25 when tested according to ASTM E-84. Provide the systems plywood back boards from the floor up to ceiling height (not exceeding 12'-0") on all walls shown, unless otherwise noted. The entire back board shall be painted with three (3) coats of fire-retardant paint (the color shall match the adjacent surface). EACH enclosure, when mounted, shall bear a minimum of 150 pounds weight on the enclosure.

B. Mounting of equipment shall be logically placed, and shall be located at the top, bottom, left, or right portion of the systems plywood back boards to accommodate future growth of the system. Under no circumstances will the equipment be allowed to be mounted in the middle of the back boards.

3.05 GROUNDING

A. Ground all equipment per the manufacturers' recommendations, per Division 26 and as required by code.

B. Provide grounding and bonding per ANSI-STD-J-607-A, which includes, but is not limited to: cable trays, racks, conduit sleeves, and other equipment connected to the TMGB/TGB.

C. The minimum conductor size shall be # 6 green insulated copper grounding conductor. However, the size of each conductor shall be based on the actual cable length as defined in ANSI-STD-J-607-A. See Section 27 20 00 "TMGB and TGB (Telecommunication Grounding Busbars)" for additional grounding requirements.

3.06 DEVICE RELOCATIONS

A. Device location may be changed prior to installation, within 15'-0" without extra charge, if so desired by the Architect.

3.07 INSTALLATION

A. Provide all equipment, wiring, conduit, and outlet boxes required for the installation of a complete, fully functioning, operating system in accordance with applicable local, state, national codes, AHJ requirements, the manufacturers' recommendations, these plans and specifications. All circuits not in conduit must be wired with UL listed power limited cable under NEC 725, Class II wiring. Plenum cable shall be utilized in all return air plenum ceilings.

1. Color-coded wires shall be used throughout.

2. Wiring shall conform to the National Electrical Code Article 725.

B. Provide 120VAC wiring and connections to the control panels, EACH amplifier, CPU, DVR, and power supply as required for a fully functional system, while maintaining all of the design requirements described elsewhere within each system specifications. At a minimum, this shall include the following:

1. Multiple power supplies and/or the control panel may be placed on the same circuit, while maintaining all code mandated load calculations, but shall be on circuits that are dedicated for EACH system.

a. Consult with the Architect to verify that load calculations meet all code requirements.

b. Install 120VAC wiring and conduit as specified in Division 26.

c. Show on the As-Built Drawings the location of each panel board that is being used to power any system equipment, and, at the panelboard, list each panelboard circuit for each system (e.g., panelboard “x”, circuit 12=FAPS-3; Circuit 14=IACP).

C. Maintain all fire wall ratings as required.

D. Installation of equipment and devices that pertain to other work in the contract shall be closely coordinated with the appropriate subcontractors.

E. EACH manufacturers’ authorized representative shall provide on-site supervision of the installation for EACH of the systems equipment for the duration of the project. This includes programming, training, and the Owner’s ability to use the Complete System Functionality as it was designed.

F. Install wire guards at locations as shown on the drawings and as described elsewhere within these specifications.

G. Every attempt shall be made to avoid running telecommunications close to (less than 2’-0") and/or parallel to other communication cables in the building, all lighting, and conduits containing 120VAC (or greater). This shall be to avoid interference with any other service or system, operation, or maintenance purposes such as access boxes, ventilation-mixing boxes, access hatches to air filters, switch or electrical outlets, electrical panels, fire alarm equipment, clock systems, and lighting fixtures. Avoid crossing areas horizontally just above or below any conduit and/or riser. Route cables in such a manner to allow other cables to enter the conduit and/or riser without difficulty at a later time by maintaining maximum distance from these openings. Maintain all recommended distances from other cables, as required by the manufacturer. Install cable to whichever of these two requirements are more stringent.

H. Room numbers shown on plans are architectural designs numbers for construction purposes. These numbers are NOT to be used for programming. Final system programming shall reflect the final room numbering plan and actual room signage, unless directed otherwise in writing or as specified in another specification section. Update the As-Built Drawings to reflect the final room numbering plan and actual room signage.

3.08 MOUNTING HEIGHTS, LOCATIONS, AND SETTINGS

A. Install all equipment as recommended by the manufacturer.

B. The installation of EACH device, enclosure, and/or control panel shall be installed so that the maintenance staff will be able to access, test and/or replace any component of the system. If this installation does not meet this requirement to the satisfaction of the Architect, it will not be accepted. The Installing Vendor/Contractor shall be required to remove the item, patch and paint the area to the satisfaction of the Architect, and reinstall the device, enclosure, or control panel as required to make the system easily maintainable and acceptable, at no additional cost to the Owner.

C. Control Panels, Power Supplies, and Locations:

1. Mount control panels, power supplies, and enclosures (provide quantities as required) with approximately 2 inches of separation between the enclosures.

2. Each enclosure, when mounted, shall meet the following criteria:

a. Conduit shall not enter any enclosure or panel, except where conduit entry is approved by the manufacturer.

b. Chase nipple the enclosures together. At a minimum, use two (2) 1½" conduits. Size and/or provide additional conduits as required. Provide conduits between enclosures to accommodate an additional 100% conduit fill while maintaining all NEC requirements. Avoid installing chase nipples where batteries are to be installed (contact the manufacturer and/or the Installing Vendor/Contractor prior to drilling any holes). Any chase nipples installed where batteries are to be located will be rejected, and require the reinstallation as specified, up to and including installing new enclosures.

c. The bottom of the chase nipples shall be a minimum of 2 inches above the location where any batteries are to be installed.

d. EACH enclosure door shall be able to open no less than 105°.

e. The top of each enclosure shall be mounted at the same height of 60inches above the finished floor and shall be level.

f. If changes to the above requirements are preferred, contact the Architect for approval prior to rough-in.

D. All equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place (i.e., devices shall not be supported solely by suspended ceilings). Fasteners and supports shall be able to support the no less than four (4) times the weight of equipment and/or device.

E. Rack Equipment: EACH rack shall be securely attached to the floor and/or wall using the manufacturers' recommended mounting hardware.

F. See each system specification for additional mounting information.

3.09 FLUSH MOUNT AND SURFACE MOUNT EQUIPMENT AND ENCLOSURE LOCATIONS

A. Prior to rough-in, consult the Architect for clarification for flush mount and surface mount locations.

B. Flush mounted equipment and enclosures shall be installed in areas where the rooms are finished such as administrative areas, offices, work rooms, break room and corridors. Provide the appropriate finish work around each enclosure as required. This type of equipment includes, but is not limited to the following:

1. Enclosures: Typically are control panels, power supplies, etc.

a. Provide the manufacturers' flush mount trim rings, adapters, and/or brackets for this type of equipment.

C. Surface mounted equipment and enclosure shall be installed in areas where the rooms are NOT finished such as electrical rooms, MDF/IDF rooms, mechanical rooms, or utility rooms. Unless otherwise noted, this equipment shall be installed on the systems plywood back boards. This type of equipment includes, but is not limited to the following:

1. Enclosures: Typically are control panels, power supplies, etc.

2. Punch Blocks: Typically are used with telephone PBX and intercom equipment.

3. Wall-mounted and floor -mounted racks.

3.10 NUMBERING AND LABELING

A. Phenolic Plates:

1. Install phenolic plates at each of the control panels, power supplies, terminal cabinets, and racks.

a. All phenolic plates shall be secured to each enclosure with rivets.

b. Install each plate 1" from the top of the enclosure, and be centered on the door. Relocate as required to avoid interfering with equipment or components within the enclosure or prevent the enclosure door from closing properly. The location of the phenolic plates shall be consistently installed in the same location on each system enclosure, at EACH location.

B. Terminal Cabinets:

1. Label each termination point on the inside of EACH enclosure door. All information shall be legible, as defined by the Architect.

C. Addressable Devices/Address Point Labels (where applicable):

1. Install the address label for each addressable device on or near the device. Verify with the Architect, prior to installation.

2. Clean the surface from dust, grease, or lubricants as recommended by the manufacturer of the label.

3. The addressable label shall be able to be viewed by the general public when standing on the ground.

4. Prior to installation, coordinate with the Owner's Representative for exact location of how and/or where to mount the address label for EACH device type to fulfill this requirement, prior to installation.

5. Provide the following address label format:

    a. The background shall be clear (see through).

    b. The text shall be black in color, and a minimum of ½" tall.

    c. Use Brothers or P-Touch models to produce the label.

3.11 WIRING

A. For consistency of wiring throughout the entire system equipment, if specific conductor colors are not called out in EACH system specification, then the following colors shall apply:

1. Red is (+) positive voltage or data bus (+) positive.

2. Black is (-) negative voltage or data bus (-) negative.

3. White is common.

4. Green is normally open or normally closed.

B. Wiring within EACH enclosure shall have the outer jacket of the cable removed to within 3 inches of the cable entering the enclosure. Individual conductors from each jacketed cable shall be spirally twisted to keep them together, until they are routed into each appropriate individual terminal. Route all conductors parallel with the walls of the enclosure, make 90° turns within the enclosure, and always keep a 2-inch minimum spacing from any circuit board and/or terminals.

1. Labeling of Cables:

    a. Prior to installing any label, clean each cable with the appropriate cleaner to remove any pulling compound residue, grease, oil, dirt, etc., in order for the label to properly adhere to the cable jacket.

    b. The label shall indicate the device or outlet and the area or wing of the building that the cable is being routed from. The label shall also indicate the MDF room or designated IDF location that the cable is being routed to.

    c. Each label shall be located on each cable that enters any enclosure or junction box, and shall be easily visible and readable.

    d. The cable numbering system shall be consistent with shop drawings.

C. End-of-Line (EOL) Resistors: Each device that is capable of being supervised by the control panel and/or power supply shall be supervised. Install equipment and/or program as required.

D. Indicate on the As-Built Drawings where EACH of the End-Of-Line Resistors is located.

E. Each End-of-Line Resistor shall be installed at the last device on each circuit. Locating the EOL in the control panel and/or power supply is NOT acceptable.

F. The telephone dialer connections and Ethernet WAN connections shall be made by the Installing Vendor/Contractor. Coordinate with the Owner for scheduling the Owner's IT Department to supervise all terminations and connections.

G. All wiring routed under slab or underground shall be suitable for wet locations.

H. The Installing Vendor/Contractor shall clean all dirt and debris from the inside and the outside of EACH enclosure after completion of the installation, and prior to any testing being performed.

I. All circuits shall be identified in accordance with table below and all labels shall include wire type, quantity and circuit number. Wire code shall match approved shop drawings' wire code.

Table

Example: C2HX3
C = Signal circuit wire
2 = Signal circuit number
H = LCD Keypad wire
X = Addressable initiating device circuit wire
3 = Addressable initiating device circuit number

3.12 SPLICE CONNECTORS AND CONNECTIONS

A. All references to splices are for cables that are 50 volts or less.

B. A continuous cable run without any splices is the preferred method. When a splice is required the following information shall apply.

1. Cable splices are only allowed in accessible, dry locations, in a junction box or terminal cabinet suitable for the purpose. The only exception is for field devices that have wire leads (e.g., pigtail) and require a connection of two (2) wires at the device.

    a. Each cable end that is spliced must be labeled as specified. (e.g., at the splice point, "From FACP in MDF Room XXX" on one cable, and "To the East Wing RCAP" on the other cable).

C. All splices shall be performed in one of the following methods:

1. Wire nuts shall NOT be used on this installation, will be deemed unacceptable, and shall be removed and installed as outlined below.

2. In Junction Boxes:

    a. Either one of the following splice methods are acceptable:

1) Use the tool-less terminal strip, model number # SSU00470 (Black) or SSU00471 (White), and SSU00465 (the Back-Box Bracket) for use with extra deep 4S boxes. This equipment is manufactured by Space Age Electronics.

2) Use Model # DC-100-S Blue Dolphin Connectors (with Sealant), manufactured by Dolphin Components Corporation, on all splice connections that are size 18 gauge or less. The rubber coated outer jacket of the inch-long connector shall contain non-curing sealant that fills the crimp cavity when crimped. Strip the color-coded outer jacket of each individual conductor that is going to be crimped, approximately 1/8inch shorter than the length of the crimp connector, so that when the conductors are inserted all of the way in the connector, no bare wires (or any strands of wire) are exposed or visible out of the connector.

3. In Terminal Cabinets:

   a. In terminal cabinets with each conductor to be landed on a separate terminal.

   b. Indicate on the Shop Drawings and As-Builts, the locations of EACH terminal cabinet.

   c. Maintain the "Spare Capacity" requirements, as specified.

4. At Field Devices (where the device has wire leads and not a terminal strip).

   a. Use Model # DC-100-S Blue Dolphin Connectors as described above.

5. Spare or unused conductors shall be:

   a. Landed on terminal strips

   b. Shall have the Blue Dolphin Connectors crimped on the end of each conductor.

   c. Field devices with pigtails shall have a Blue Dolphin Connectors crimped on the end of any unused conductors.

D. All conductors, if spliced, shall be ONLY spliced to the same gauge size and color of conductor. Changing of gauge size or color at any point within any cable run is strictly prohibited, and all cables will be replaced at no additional cost to the Owner, and to the satisfaction of the Architect.

E. If the field device has wire leads, then wire as necessary at the device for proper operation. Indicate the color code change on the shop drawings per point wiring diagrams. Update any and all changes to the drawings, for accurate As-Builts.

3.13 ON-SITE SYSTEM INFORMATION BINDER ENCLOSURE

A. The Installing Vendor/Contractor shall install the wall mount enclosure that is labeled "(Section Title here) information". The enclosure shall be located in the administrative area or the MDF room. Verify the exact location with the Architect, prior to installation.

B. The enclosure shall have a site-specific manual, in a "D" style 3-ring binder with an 18-inch heavy-duty chain securely fastened to the inside of the enclosure.

C. See "As-Built Documentation" for more information.

3.14 TESTING & COMPLETE SYSTEM FUNCTIONALITY (SPECIFICALLY FOR THE FIRE ALARM SYSTEM ONLY) SPECIFICATION SECTION 28 31 00 SUPERCEDES THIS SPECIFICATION SECTION IF PROVIDED.

A. The Installing Vendor/Contractor shall notify the Architect a minimum of five (5) business days in advance of testing.

B. The warranty shall NOT begin until the following conditions have been met:

1. Fire Alarm System Testing:

a. The Installing Vendor/Contractor shall provide two-way communication devices for their own staff, each Owner's Representative, and the Architect, so that all parties can communicate as required to perform all tests.

b. Completely fill out the 2007 Edition NFPA Fire Alarm System Record of Completion document.

c. Obtain the AHJ signature, printed name, date, and telephone number on the Record of Completion.

d. Obtain the AHJ signature, printed name, date, and telephone number on the Fire Alarm Permit.

e. If the Installing Vendor/Contractor fails the Fire Marshal Inspection, the following shall occur:

1) The Installing Vendor/Contractor shall make all of the necessary corrections as required to pass the AHJ testing and inspection. Then, notify the AHJ and schedule another test, and continue making corrections until the Fire Alarm System has been accepted by the AHJ.

2) The Installing Vendor/Contractor is subject to the Close Out requirements as specified in Section 20 00 00, Schedule of Values.

2. As-Builts:

a. Refer to the "As-Built Documentation" of this specification for more information.

3. Training:

a. Refer to Section 28 31 00 for the Training Requirements as described in "Training Materials" when provided.

4. Complete System Functionality:

    a. After ALL of the above conditions have been met and the required signatures have been received, Complete System Functionality shall be deemed complete, as the Owner has the ability to use the system as it was designed.

5. Warranty:

    a. The warranty period shall now begin, and the initiating date of the warranty period shall commence on the date of the Owner's ability to use the Complete System Functionality as it was designed. Refer to the "Warranty" section of this specification for more information.

C. Upon completion of the installation, testing, and instruction and training, the Installing Vendor/Contractor shall provide the following signed test forms, in the As-Built documentation as required.

1. The signed original Record of Completion

2. The signed original Fire Alarm Permit

3.15 TESTING & COMPLETE SYSTEM FUNCTIONALITY (SPECIFICALLY FOR AUDIO/VISUAL SYSTEMS)

A. Electronic System Testing:

1. After all equipment specified herein for the system has been completely fabricated and wired and is in operating condition in the sound system Installing Vendor's/Contractor's shop, performance tests shall be conducted by the sound system Installing Vendor/Contractor on the system to determine if the installation and components comply with these specifications.

2. The following test shall be performed and the system shall be made to meet each listed performance criterion:

    a. Overall frequency response of the complete electronic system (unequalized) shall be 20 to 20,000 Hz +2 dB. Equalizing circuits shall be temporarily set in the indicated "flat" position.

    b. Total harmonic distortion from microphone input to power amplifier output at rated power shall be less than 1% for the frequency range of 20 to 20,000 Hz.

    c. The overall broadband hum and noise from 20 Hz to 20 kHz using a 6 dB/octave filter at 12.47 kHz shall be at least 65 dB below the rated output from system input to output.

3. The total system shall be installed from microphone to loudspeaker in Absolute Polarity. A positive pressure on the microphone shall produce a positive pressure from the loudspeaker.

B. Acoustical Testing:

1. After all electronic equipment specified herein is fully installed at the job site and the speakers are fully installed, the system shall be equalized and acoustically tested by the sound system Installing Vendor/Contractor utilizing the real-time testing technique. Personnel, test equipment, complete report, and signing shall be as described.

2. The speakers shall be oriented and sound levels set to provide an even distribution of the sound field frequency response of 250 to 10,000 Hz throughout the seating area.

3. Provide equalization to DSP (when applicable) to attain frequency response that is within +3 dB from 100 to 10,000 Hz with a 6 dB roll off below 80 Hz and above 12,500 Hz, at any seat in the audience covered by the loudspeakers.

4. The system shall deliver a minimum of 85 dB average program level with additional 10 dB peaking margin to any seat in the audience at distortion level below 1% THD over the specified frequency range.

3.16 TESTING & COMPLETE SYSTEM FUNCTIONALITY (FOR ALL SYSTEMS THAT IDENTIFY THIS TESTING REQUIREMENT)

A. The warranty shall NOT begin until the following conditions have been met:

1. Obtain the AHJ signature, printed name, date, and telephone number on the permit(s) and other required documentation. Provide this documentation with the As-Built documents.

2. The Installing Vendor/Contractor shall provide a copy of the (Section Number and Section Title here) - Operational Test Form that has been performed and submitted to the Architect for review. The purpose of this document is to show that the Installing Vendor/Contractor has in fact performed a complete test. In some cases, every device may not pass the test. This shall serve as the Installing Vendor's/Contractor's own punch list, to make corrections prior to the Acceptance Test. This must be completely filled out, and have an original signature of the representative of the Installing Vendor/Contractor. Allow for a minimum of ten (10) business days for the Architect to review this document.

3. After the Architect's review of the System Operational Test Form, the Architect will discuss the results of the test with the Installing Vendor/Contractor.

4. The Installing Vendor/Contractor shall coordinate with the Architect to witness the Performance Test. Allow for a minimum of ten (10) business days to schedule this testing.

5. System Testing:

a. The Installing Vendor/Contractor shall provide two-way communication devices for their own staff, each Owner's Representative, and the Architect, so that all parties can communicate as required to perform all tests.

b. The Installing Vendor/Contractor shall demonstrate the testing of each device, to the Owner's Representative and the Architect, and document this information on the (Section Number and Section Title here) - Performance Test Form.

c. Upon the completion and passing the Performance Test with 100% positive results, the Acceptance Test Form shall be signed by the Installing Vendor/Contractor, the Owner's Representative, and the Architect.

1) If the Installing Vendor/Contractor fails this test by NOT passing the test with 100% positive results, the following shall occur:

a) The Installing Vendor/Contractor shall make all of the necessary corrections to provide 100% positive results.

b) The Installing Vendor/Contractor shall document the corrective action taken for each item that failed the Test, and submit to the Architect for review. Upon approval by the Architect, the Acceptance Test shall be rescheduled.

2) The Installing Vendor is subject to the Close Out requirements as specified in Section 20 00 00, Schedule of Values.

6. As-Builts:

a. Refer to the "As-Built Documentation" of this specification for more information.

7. Training:

a. Refer to EACH specific section for the training requirements as described in "Training Materials and Programming Survey".

8. Complete System Functionality:

a. After ALL of the above conditions have been met, deemed by a "Pass" on the Governing Acceptance Form - (Section Name and Section Title here), and the required signatures have been received, Complete System Functionality shall be deemed complete, as the Owner has the ability to use the system as it was designed.

9. Warranty:

a. The warranty period shall now begin, and the initiating date of the warranty period shall commence on the date of the Owner's ability to use the Complete System Functionality as it was intended. Refer to the "Warranty" section of this specification for more information.

3.17 WARRANTY

A. See "Testing & Complete System Functionality", listed elsewhere in these specifications, to establish the requirements and confirm when the actual warranty period shall begin.

B. The Installing Vendor/Contractor shall include in the pricing of their bid that they will honor and provide EACH of the manufacturers' full-term warranty period for the provision of replacement equipment for EACH individual device and/or component provided for this project. The completed and fully functional system, including wiring, installation, and all equipment shall be free from inherent mechanical and electrical defects. At a minimum, this shall be no less than one (1) year from the date of Complete System Functionality as defined in "Testing & Complete System Functionality" portion of this specification. Warranty service for the on-site replacement of equipment shall be provided by the system supplier's manufacturer trained representative during normal working hours, Monday through Friday, excluding holidays, and response for service shall be delivered no later than the following business day after the call was received.

C. When the manufacturers' warranty exceeds one year, the Installing Vendor/Contractor shall be responsible for replacing the actual component or device for the full duration of the manufacturers' warranty, if the Owner or their representative chooses to take the item to the Installing Vendor's/Contractor's place of business. If the Owner chooses to have the Installing Vendor/Contractor provide on-site service, then the Installing Vendor/Contractor is entitled to their standard published (or negotiated) labor rates and miscellaneous material items to replace the damaged warranty item.

D. The Installing Vendor/Contractor who is authorized to provide warranty service for this project is defined in "Quality Assurance" located in Part 1 of this specification.

3.18 AS-BUILT DOCUMENTATION

A. The following documentation must be completed to the satisfaction of the Architect, in order to fulfill the Close Out requirements as specified in Section 26 00 00, Schedule of Values.

B. All electronic and hard copy information submitted to the Owner shall immediately become the Owner's property to use as best determined by the Owner, without any compensation to any party.

C. All labeling shall match the final room number identification at completion of the project (not the room number that is indicated on the Bid Set of drawings).

D. Operation and Maintenance Manuals: The Installing Vendor/Contractor shall provide three (3) sets of detailed Operation and Maintenance Manuals in a "D" style 3-ring binder. The binder shall be sized to allow for 20% additional documentation. The spine of the binder shall have a clear cover with an insert clearly typed with the following label: "(Project Name, Section Number, and Section Title here) Operation and Maintenance Manual". The binder shall have a clear front cover with an insert clearly typed with the title of the spine on the binder, located at the top of the page, and centered. The following information shall also be included on the front sheet of the binder: Project Name and Project Number, Section Number and Section Title, Owner's name, Site Name and Site Address, Installing Vendor's/Contractor's Name, Address, and Contact Name. These O&M Manuals shall include the following:

1. Use color-coded numbered tabs to separate each item defined below and for each device that was installed.

    a. Provide these items in the following order.

        1) Provide an 8½" x 11" clear heavy plastic sheet in front of a table of contents page as the first page of the binder indicating each of the equipment or device documents contained in each tab section.

2) The System Software User Guide

3) The Web Server "Web-based" Software User Guide

4) The System Control Panel LCD Display User Guide

5) The Remote LCD Display User Guide (where applicable):

   a) Provide step-by-step instructions for typical basic operation of EACH system.

6) Warranty information. The Installing Vendor/Contractor shall provide warranty information in the form of a matrix from left to right, that lists the following information:

   a) Use the symbol on the legend of the contract drawings.

   b) List the actual manufacturer's name of each device shown on the Installing Vendor's/Contractor's shop drawings.

   c) List the actual manufacturer's model number of each device shown on the Installing Vendor's/Contractor's shop drawings.

   d) Provide the description of the device that is used for each symbol on the legend.

   e) On the matrix, indicate recommended testing frequency for each item.

   f) State the manufacturer's full term of the warranty for EACH control panel, EACH power supply, and EACH device provided.

   g) Indicate where the Owner may purchase each of these devices. Provide the Business Name, Address, City, State, Zip Code, Phone Number, and list two (2) contact names.

7) A reduced copy (11"x17") of record drawings. Enlarge all notes, text, and symbols to a legible (as defined by the Architect) reading format.

8) Provide one (1) original and two (2) copies of the "Spare Parts Proof of Delivery" form that was signed by the Owner's Representative.

9) A printed copy of the final completed version of the "(Section Number and Section Title here) Technical Configuration". This document shall be dated.

10) A printed copy of the final completed version of the "(Section Number and Section Title here) Software 'Point Status Report'" (where applicable). This document shall be dated.

11) Update the matrix as defined in the "System Device Naming Matrix" for each specification section, to correct any changes that may have occurred through the course of this project. This list shall follow the above equipment list.

12) The technical date sheet for each control panel, power supply, terminal cabinet, field device and component installed. Use a separate tab for each of these that were supplied and/or installed.

    a) Include all testing documentation and the procedure to properly test each device. Put this document immediately behind the respective technical data sheet.

    b) Include the installation manual for each device that was installed. Put this information immediately behind the testing documentation.

13) Provide one (1) original and two (2) copies of the AHJ approved documents.

14) Provide one (1) original and two (2) copies of the completed documents:

    a) The (Section Number, and Section Title here) - Operational Test Form.

    b) The (Section Number, and Section Title here) - Performance Test Form.

    c) The approved Governing Acceptance Form - (Section Number, and Section Title here).

    d) If the Governing Acceptance Form has not been approved, accepted, and signed by the Architect, this binder will be rejected.

15) Each binder shall not exceed three (3) inches in width. Use multiple binders as required. Indicate Volume 1 of X, Volume 2 or X, etc.

16) Provide the above information on six (6) CDs and label each one (with a PC-generated label) "(Owners Name, Project Name, Section Number, Section Title, and the current date goes here) - Operation and Maintenance Manuals, Data Sheets, Documents, and As-Built Shop Drawings". Organize the manuals, data sheets, documents, and drawings into separate folders.

    a) Include on EACH system CD provided, the AutoCAD As-Built Drawings, located elsewhere in these specifications.

    b) EACH of the three (3) Operation and Maintenance Manuals shall have one CD securely fastened inside.

    c) Provide three (3) CDs for general As-Built documentation for the project.

E. On-Site System Information Binder: The Installing Vendor/Contractor shall provide an Individual Site Manual, in a "D" style 3-ring binder with an 18-inch heavy-duty chain securely fastened to the inside of the "(Section Title here) information" enclosure. See the "On-Site System Information Binder Enclosure" listed elsewhere in these specifications, for the enclosure information and location. The binder shall be sized to allow for 20% additional documentation. The spine of the binder shall have a clear cover with an insert clearly typed with the following label: "(Section Title here) information". The binder shall have a clear front cover with an insert clearly typed with the title of the spine on the front sheet, located at the top of the page, and centered. The following information shall also be included on the front sheet of the binder; the Project Name and Project Number, Specification Section Number and Section Title, Owner's name, Site Name and Site Address, Installing Vendor's/Contractor's Name, Address, and Contact Name. Each binder shall include the following:

1. Use color-coded numbered tabs to separate each item defined below and for each device that was installed.

   a. Provide these items in the following order:

      1) Provide an 8½" x 11" clear heavy plastic sheet in front of a Table of Contents page as the first page of the binder indicating each of the equipment or device documents contained in each tab section.

   b. The Installing Vendor/Contractor shall coordinate with the Owner to obtain the information listed below. A single sheet shall list the following items:

      1) The Site Name and Site Address.

      2) State "In case of emergency during regular business hours: (list the appropriate name and telephone number)". List the Owner's Representative who should be contacted during regular business hours.

      3) State "In case of emergency after regular business hours: (list the appropriate name and telephone number)". List the Owner's Representative who should be contacted after regular business hours.

      4) List the following information (where applicable): State "The monitoring of the (Section Title here) is being monitored by (list the name of the central monitoring station here), Phone Number: (list the central station phone number here), Account # (enter the account number here)".

   c. Provide each of the items identified in the Operation and Maintenance Manuals, with the following exceptions. Do NOT provide:

      1) Spare Parts Proof of Delivery Form.

      2) As-Built Operation and Maintenance CDs of the project.

F. As-Built Drawings: The Installing Vendor/Contractor shall provide three (3) sets of hard copy As-Built Drawings. Drawings shall be the same size that were issued for the shop drawings and clearly indicate the following:

1. Update the Shop Drawings:

a. To address any changes, including but not limited to the riser, point-to-point wiring diagrams, and mounting details.

b. To accurately reflect the final installation of equipment and devices that were relocated, added or removed.

c. Update the matrix as defined in the "System Device Naming Matrix" of the specification, to correct any changes that may have occurred through the course of this project.

d. Actual routing of all raceways.

e. Actual routing of all open cables.

f. Actual cable type, color, and numbers.

g. Actual splice locations.

h. Actual system wiring diagrams, connection diagrams, and interface of all components in the system.

i. Provide scale drawings of the internal components of the main panel, and each power supply. Show each circuit number coming from the terminals of each control panel and/or power supply.

j. Actual room number and programming addresses (where applicable) for all components in the system.

k. Show on the As-Built Drawings the location of each panel board that is being used to power any system equipment, and list each panel board circuit used (at the device that is connected to that circuit, e.g., FACP or FAPS).

l. Indicate on the As-Built Drawings where EACH of the End-Of-Line Resistors is located.

m. Provide all updated As-Built Drawings in AutoCAD 2013 format (or newer) and put these electronic files on the Operation and Maintenance Manuals CD, as described elsewhere in these specifications.

G. Provide all As-Built documentation to the Architect prior to any training and no less than ten (10) business days prior to project completion.

H. Any re-submittal(s) shall be provided at the Installing Vendor's/Contractor's expense.

****Sample****
WIRE LEGEND

CONDUIT/RACEWAY SINGLE CONDUCTOR								OPEN CABLE					
LETTER	**FUNCTION**	**CONDUCTOR COLOR**	**AWG**	**QTY**	**TYPE**	**CABLE MFR**	**CABLE MFR PART #**	**CONDUCTOR COLOR**	**AWG**	**QTY**	**TYPE**	**CABLE MFG**	**CABLE MFR PART #**
A	ADDRESSABLE INITIATING CIRCUIT	- BLACK	#16	1	THWN-SOLID				#16/2	1	16/2 – FPLP		
		+ RED	#16	1									
B	ADDRESSABLE INITIATING CIRCUIT LOOP	- BLACK	#16	2	THWN-SOLID				#16/2	2	16/2 – FPLP		
		+ RED	#16	2									
C	HORN/STROBE CIRCUIT	- BLUE	#14	1	THWN-SOLID				#14/2	1	FPLP		
		+ WHITE	#14	1									
D	HORN/STROBE CIRCUIT LOOP	- BLUE	#14	2	THWN-SOLID				#14/2	2	FPLP		
		+ WHITE	#14	2									
E	CONVENTIONAL INITIATING CIRCUIT	- BLACK	#16	1	THWN-SOLID				#16/2	1	16/2 – FPLP		
		+ YELLOW	#16	1									
F	CONVENTIONAL INITIATING CIRCUIT LOOP	- BLACK	#16	2	THWN-SOLID				#16/2	2	16/2 – FPLP		
		+ YELLOW	#16	2									
G	24V DC POWER CIRCUIT	- BLACK	#14	1	THWN-SOLID				#14/2	1	FPLP		
		+ RED	#14	1									
H	SPEAKER CIRCUIT	RED	#14/2	1	TWISTED SHIELDED FPLP W/ DRAIN				#14/2	1	TWISTED SHIELDED FPLP W/ DRAIN		
I	SPEAKER CIRCUIT LOOP	RED	#14/2	2	TWISTED SHIELDED FPLP W/				#14/2	2	TWISTED SHIELDED FPLP W/		

****Sample****
WIRE LEGEND

CONDUIT/RACEWAY SINGLE CONDUCTOR								OPEN CABLE					
LETTER	**FUNCTION**	**CONDUCTOR COLOR**	**AWG**	**QTY**	**TYPE**	**CABLE MFR**	**CABLE MFR PART #**	**CONDUCTOR COLOR**	**AWG**	**QTY**	**TYPE**	**CABLE MFG**	**CABLE MFR PART #**
					DRAIN						DRAIN		
J	ANNUNCIATOR CIRCUIT	BROWN BLUE	#16 #16	1 1	THWN-SOLID				#16/2	1	16/2 – FPLP		
		- BLACK	#14	1					#14/2	1	FPLP		
		+ RED	#14	1									
K	FIREMANS PHONE CIRCUIT	RED	#18/2	1	18/2 TWISTED SHIELDED FPLP W/ DRAIN				#18/2	1	18/2 TWISTED SHIELDED FPLP W/ DRAIN		
L	FIREMANS PHONE CIRCUIT LOOP	RED	#18/2	2	18/2 TWISTED SHIELDED FPLP W/ DRAIN				#18/2	2	18/2 TWISTED SHIELDED FPLP W/ DRAIN		
M	CONTROL CIRCUIT	- PURPLE	#14	1	THWN-SOLID				#14/2	1	FPLP		
		+ ORANGE	#14	1									
N	SPARE CONDUCTORS	- PURPLE	#14	2	THWN-SOLID				#14/4	2	FPLP		
		+ ORANGE	#14	2									
ADD PROJECT SPECIFIC NOTES HERE								**ADD PROJECT SPECIFIC NOTES HERE**					

END OF SECTION 27 00 00

SECTION 27 05 28

PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions and Divisions 0 and 1 Specification Sections, apply to work of this Section.

B. Specification Section 26 00 00 - Electrical General Conditions.

1.02 SCOPE

A. The installation shall include innerduct, fire-rated and non-fire-rated penetration assemblies, conduit, cable tray, and wire management.

B. The bonding of metallic raceways.

C. The work performed under this specification shall be of good quality and performed in a workmanlike manner. In this context "good quality" means the work shall meet industry technical standards and quality of appearance. The Owner reserves the right to reject all or a portion of the work performed, either on technical or aesthetic grounds. The Installing Vendor/Contractor shall make all corrections as needed, to the satisfaction of the Architect.

D. The system shall meet ALL of the requirements listed in Section 27 00 00 - Low Voltage Systems General Requirements PART 3 “Testing & Complete System Functionality”, prior to “Substantial Completion”.

E. Contractual information, guidelines, requirements, or other work specified to provide a fully functional system for Section 27 05 28 includes, but is not limited to the sections identified in Section 27 00 00.

1.03 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications, apply to work specified in this Section.

B. Applicable Standards: All work shall be performed in accordance with the latest revisions of the following standards:

1. National Electrical Manufacturers Association:
    a. NEMA FG 1 - Fiberglass Cable Tray Systems
    b. NEMA VE 1 - Metal Cable Tray Systems
    c. NEMA VE 2 - Cable Tray Installation Guidelines
2. NFPA 70 - National Electrical Code.
3. ANSI/TIA-568-C.0 - Generic Telecommunications Cabling for Customer Premises.
4. ANSI/TIA-569-B - Commercial Building Standard for Telecommunications Pathways and Spaces.

5. ANSI-J-STD-607-A - Commercial Building Grounding and Bonding Requirements for Telecommunications.

1.04 QUALITY ASSURANCE

A. Installing Contractor Qualifications:

1. Work in this section shall be performed by a licensed and bonded low voltage Installing Vendor/Contractor with a minimum of five (5) years' experience in the installation and maintenance of high-speed data and voice networks. Only Installing Vendors/Contractors whose primary business is that of installing, maintaining, troubleshooting, and testing telecommunication infrastructures shall perform this work.

2. License Classification: Installing Vendor/Contractor must possess a valid Washington State 06 Electrical Low Voltage License.

1.05 GOVERNING CODES AND CONFLICTS

A. If the requirements of this section or the Project Drawings exceed those of the governing codes and regulations, then the requirements of this section and the Drawings shall govern. However, nothing in this section or the Drawings shall be construed to permit work not conforming to all governing codes and regulations.

1.06 PROJECT CONDITIONS ARCHITECTURAL PLANS

A. The Installing Vendor/Contractor shall carefully coordinate the various symbols utilized on the drawings and shall consult the architectural plans to determine ceiling and floor types in the various areas.

1.07 SUBMITTALS

A. Refer to Section 27 00 00 - Low Voltage Systems General Requirements for additional data sheet submittal requirements and the shop drawing submittal requirements.

PART 2 PRODUCTS

2.01 MATERIALS

A. See Section 27 00 00 - Low Voltage Systems General Requirements for additional requirements.

B. The Installing Vendor/Contractor shall review the Site Plans, Floor Plans, Riser Diagrams, and Detail Sheets for additional work that is required to be performed by the Installing Vendor/Contractor of this section.

2.02 COORDINATION

A. Refer to "Installation of Owner Furnished Equipment" for additional coordination and installation requirements.

B. Refer to "Submittals" listed elsewhere in this specification for additional coordination requirements.

2.03 ADDITIONAL REQUIREMENTS.

A. Refer to "As-Built Drawings" listed elsewhere in this specification for additional equipment required for this project.

2.04 SEISMIC BRACING

A. Provide Seismic Bracing as required by the Authority Having Jurisdiction (AHJ).

B. This includes, but is not limited to:

1. Racks
2. Cable trays
3. Cable supports

2.05 INNERDUCTS AND CONDUIT SEALS

A. Innerduct (Non-Metallic Tubing):

1. Provide 1" corrugated innerduct for EACH interior fiber optic cable run.
2. Innerduct shall be rated for the application and environment that it is installed in and shall meet all Code and AHJ requirements.
3. Non-Metallic Tubing for fiber optic cables shall be orange in color.
4. Provide quantities as required where shown on plans.
5. Approved manufacturer: Pyramid Industries or approved equal.

2.06 OPEN CABLING SUPPORT & HARDWARE

A. Each cable support shall be UL listed for the application and meet the TIA requirements for structured cabling systems.

B. Provide manufacturer approved mounting brackets and fasteners.

C. Do not exceed the cable support manufacturer's cable fill capacity for each type provided for this project.

D. Do not exceed the cable manufacturer's recommendations for cable suspension in open cabling environments.

E. J-Hooks shall have a galvanized finish.

1. Manufactured by Erico CADDY: Model # CAT32HP, or approved equal. Provide quantities as required.
2. Manufactured by Erico CADDY: Model # CAT48HP, or approved equal. Provide quantities as required.

F. Mounting Tree:

1. Manufactured by Erico CADDY: Model # CATHPTM, or approved equal. Provide quantities as required.

G. Adjustable Cable Support:

1. Manufactured by Erico CADDY: Model # CAT425 Series, or approved equal. Provide quantities as required.

H. Conduit Waterfalls:

1. Conduit waterfalls shall be used where conduits empty into cable trays.

2. Manufactured by Panduit: Model # CWF400, or approved equal. Provide quantities as required.

I. Conduit Bushings:

1. Conduit bushings shall be used to protect communications cabling where conduits terminate in accessible ceiling space.

2. Bushings shall be non-metallic to reduce cable abrasion.

3. Manufactured by Arlington: Model # EMTXXX, or approved equal. Provide quantities as required.

2.07 CABLE TRAY – LADDER STYLE:

A. Chatsworth Products (CPI) is the basis of design for all ladder-style cable. Equivalent manufacturer's solutions may be submitted for prior approval no less than two (2) weeks before bid date closing. Products not submitted for prior approval shall be rejected.

B. Provide seismic bracing where required by the AHJ.

C. The cable tray shall be UL Classified.

D. The cable tray shall be 1.5" high x 18" wide (unless otherwise noted) with 9" rung spacing in steel construction that has been painted by the manufacturer.

1. Manufactured by Chatsworth Products Inc (CPI): Model # 11275-718, or approved equal. Provide quantities as required.

E. Butt Splice Rack Mount Plate:

1. Manufactured by Chatsworth Products Inc (CPI): Model # 16301-701, or approved equal. Provide quantities as required.

F. Junction Splice:

1. Manufactured by Chatsworth Products Inc (CPI): Model # 16302-701, or approved equal. Provide quantities as required.

G. Swivel Butt Splice:

1. Manufactured by Chatsworth Products Inc (CPI): Model # 16487-701, or approved equal. Provide quantities as required, where applicable.

H. Swivel Junction Splice:

1. Manufactured by Chatsworth Products Inc (CPI): Model # 16488-701, or approved equal. Provide quantities as required, where applicable.

I. Wall Mount Bracket:

1. Manufactured by Chatsworth Products Inc (CPI): Model # 11746-718, or approved equal. Provide quantities as required.

J. Rack Mount Plate:

1. Manufactured by Chatsworth Products Inc (CPI): Model # 12730-718, or approved equal. Provide quantities as required.

K. Ground Strap:

1. Manufactured by Chatsworth Products Inc (CPI): Model # 40164-001, or approved equal. Provide quantities as required.

L. Cable Runway Dividers:

1. Manufactured by Chatsworth Products Inc (CPI): Model # 13392-721, or approved equal. Provide quantities as required.

M. Cable Radius Drop:

1. Manufactured by Chatsworth Products Inc (CPI): Model # 12100-718, or approved equal. Provide quantities as required.

2. Manufactured by Chatsworth Products Inc (CPI): Model # 12101-702, or approved equal. Provide quantities as required.

2.08 FIRE RATED AND NON-FIRE RATED PENETRATIONS

A. Provide fire rated penetration equipment for EACH wall that is rated for fire-rated walls.

B. Provide industry standard penetration methods for EACH wall that is not a fire rated wall.

C. A firestop system shall be comprised of the item or items penetrating the fire rated structure; the opening in the structure and the materials and assembly of the materials used to seal the penetrated structure. Firestop systems comprise of an effective block for fire, heat, vapor, and pressurized water stream.

D. All penetrations through fire rated building structures (walls and floors) shall be sealed with an appropriate firestop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure). Any penetrating items (e.g., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc.) shall be properly firestopped.

E. Firestop systems shall be UL Classified to ASTM E814 (UL 1479).

F. Indicate on the Shop Drawings EACH location showing the proposed system location for approval, prior to installing the penetration system.

G. All firestop systems shall be installed in accordance with the manufacturer's recommendations and shall be completely installed and available for inspection by the local authorities prior to cabling system acceptance.

H. For EACH penetration, the following requirements shall apply:

1. Provide pathway assemblies for EACH low voltage system cables for each individual assembly opening.

2. Provide the quantity of pathway assemblies required for the horizontal cables, while maintaining all code requirements. Additionally, provide one (1) pathway assembly opening for EACH system listed on the Electrical Legend (This includes, but is not limited to: Fire Alarm System, Intrusion Alarm System, Intercom System, Access Control System, CCTV System, etc.), and no less than two (2) spare empty assembly openings, which shall remain empty at the completion of the project.

3. Manufactured by Specified Technologies, Inc (STI): EZ Path Model # 33 Series and/or EZ Path Model # 44 Series for fire rated walls. Provide quantities as required for all rated installations.

a. For EACH penetration, provide the stud wall attachment (for either series provided), filling the entire stud wall space with cable pathways for all cabling required and future cabling. Maintain all spare capacity requirements.

b. For EACH EZ Path Model # 33 Series provided, provide one (1) pair of radius control modules.

c. Manufactured by Specified Technologies, Inc (STI): EZ Path Model # RCM33.

I. Manufactured by Specified Technologies, Inc. (STI): EZ Path Model # NEZ33 Series. Provide quantities as required for all non-rated fire wall installations.

2.09 ROOFTOP PATHWAY INFRASTRUCTURE

A. Conduit expansion seal

1. Provide conduit expansion seals compatible with 4" conduits

2. Support up to 4" cable entry points

3. Weather tight with built in compression component.

4. Provide from New Wave Tower Components Model # ROX-102993 or approved equal.

a. Provide quantities as necessary.

B. Rooftop Dog House

1. Provide surface mount weather proof enclosure for installation over top of roof conduit penetrations.

2. Side entry panel for interior access.

3. Provide from New Wave Tower Components Model # RT4002.

a. Provide (1) one.

b. Provide additional front entry plate with sixteen (16) sealing cable caps.

1) Front entry plate shall be from New Wave Tower Components Model # EP4X4 or approved equal.

   a) Provide (1) one.

2.10 ADDITIONAL SYSTEM EQUIPMENT

A. See Part 3 of this specification for additional provision of system equipment and/or labor.

PART 3 EXECUTION

3.01 GENERAL

A. See Section 27 00 00 Low Voltage Systems General Requirements for additional information.

B. Prior to rough-in, coordinate with the Architect for the exact installation location(s) and areas to avoid.

C. Install all equipment per the manufacturer's recommendation.

3.02 PRODUCT INSPECTIONS

A. The Installing Vendor/Contractor shall inspect all cable prior to installation to verify that it is identified properly on the reel identification label, that it is of proper gauge, containing correct number of pairs, and is the material ordered. Any physical damage to the cable and wire must be noted; un uniform jacket thickness and jacket tightness should also be identified. Note any buckling of the jacket, which would indicate possible problems.

3.03 GROUNDING AND BONDING

A. Provide grounding and bonding per ANSI-STD-J-607-A, which includes, but is not limited to: cable trays, racks, conduit sleeves, and other equipment connected to the TMGB/TGB.

B. The minimum conductor size shall be #6 green insulated copper grounding conductor. However, the size of each conductor shall be based on the actual cable length as defined in ANSI-STD-J-607-A.

3.04 HORIZONTAL PATHWAYS

A. It is the responsibility of the contractor to ensure that ALL PATHWAYS for the permanent link of each balanced twisted pair cable shall not exceed 295' in length from work area outlet to telecommunications room patch panel.

B. To ensure this length, all pathways shall be coordinated and installed prior to pouring of any slabs or the installation of any permanent structure which would inhibit a conduit or cable tray run from being installed after the structure is complete.

C. See Section 27 20 00 for horizontal cabling types and additional requirements.

3.05 FIRE RATED AND NON-FIRE RATED PENTRATIONS

A. Install per manufacturer's recommendations.

B. Maintain all code and AHJ requirements.

3.06 PLENUMS

A. Provide metallic conduit through building plenum spaces for all cables which do not bear a CMP rated label.

3.07 WARRANTY

A. The warranty shall be direct to the end user, from the manufacturer, supported through the certified Installing Vendor/Contractor, and shall cover both materials and labor costs for any claims related to the warranty program. If the Installing Vendor/Contractor were to default, the manufacturer will assume responsibility of employing another certified installer to maintain the existing warranty. Bids from installers or Installing Vendors/Contractors who are not certified by the connecting hardware manufacturer and wire manufacturer at the time of project bid will be rejected.

3.08 OPERATION & MAINTENANCE MANUALS (O&M'S)

A. Provide all Operation & Maintenance Manual (O&Ms) documentation as defined in Section 27 00 00 Low Voltage Systems General Requirements and listed elsewhere in this specification.

3.09 AS-BUILT DRAWINGS

A. Provide all As-Built documentation as defined in Section 27 00 00 Low Voltage Systems General Requirements and listed elsewhere in this specification.

B. All labeling shall match the final room number identification at completion of the project (not the room number that is indicated on the Bid Set of drawings).

C. Update all documents provided in the Submittal and Shop Drawings to accurately reflect the actual equipment that was provided for this project, and the actual locations of the installed equipment.

D. The Installing Contractor shall provide As-Built Drawings to the Architect, which clearly indicate:

1. The floor plan of the building showing the As-Built location of conduit runs, cable tray, and terminal cabinets.

2. Provide three (3) sets of complete As-Built Drawings.

3.10 DEMONSTRATION AND TRAINING

A. Upon completion of the system installation, the installation representative shall conduct a system test for the Owner, Owner's Representative, Architect, and Engineer.

B. Upon completion of the installation, after test and demonstration, the Installing Vendor/Contractor shall provide to the Architect a signed written statement substantiating the:

1. "System has been completely tested, demonstrated to the Owner's Representative, and accepted by the appropriate authority."

END OF SECTION 27 05 28

SECTION 27 20 00

DATA AND VOICE INFRASTRUCTURE

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions and Divisions 0 and 1 Specification Sections, apply to work of this Section.

B. Contractual information, guidelines, requirements, or other work specified to provide a fully functional system for Section 27 20 00 includes, but is not limited to the sections identified in Section 27 00 00.

C. Specification Section 26 00 00 Electrical General Conditions.

1.02 SCOPE

A. The Installing Contractor shall furnish and install all materials for a complete, fully functional data and voice Telecommunications Infrastructure system in accordance with this specification and the contract drawings. The system shall be in full compliance with a “Limited Lifetime Warranty”. The Installing Contractor shall be responsible for providing a complete, functional system including all necessary components, whether included in this specification or not.

B. The installation shall include Fiber Optic Cable and Copper Category Rated Cables, interconnect equipment, connectors, jumpers punch blocks, fiber optic patch panels, copper patch panels, patch cables, telecommunication outlets, wire management, and racks.

C. All telecommunications cabling routed within the tenant improvement ceiling space area must be plenum rated (unless fully concealed in conduit).

D. The Installing Contractor is required to coordinate with the Owner so that the telephone system can be patched into the Data and Voice infrastructure by the Installing Contractor.

E. All copper Horizontal Cables shall be terminated on patch panels in the Telecommunication Rooms (MDF and designated IDF locations) and on Telecommunications Outlets. All copper backbone cables shall be terminated on punch blocks at main cross connects and on patch panels at the horizontal cross connect end, unless noted otherwise.

F. Upon completion of installation, the Installing Contractor shall test all fiber and copper cables. All cables shall be tested as defined elsewhere within this specification.

G. The work performed under this specification shall be of good quality and performed in a workmanlike manner. In this context "good quality" means the work shall meet industry technical standards and quality of appearance. The owner reserves the right to reject all or a portion of the work performed, either on technical or aesthetic grounds.

H. The system shall meet ALL of the requirements listed in Section 27 00 00 Low Voltage Systems General Requirements PART 3 “Testing & Complete System Functionality”, prior to “Substantial Completion”.

I. Contractual information, guidelines, requirements, or other work specified to provide a fully functional system for Section 27 20 00 includes, but is not limited to the sections identified in Section 27 00 00.

J. See “Horizontal Cable” and “Racks” located in this specification for additional work and equipment. This includes, but is not limited to; CAT6 Cabling for ALL Local Area Network (LAN) based Systems as shown on the plans, detail sheets, and riser diagrams.

1.03 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications Sections, apply to work specified in this Section.

B. Applicable Standards: All work shall be performed in accordance with the latest revisions of the following standards:

1. BICSI Information Technology Systems Installation Methods Manual, 6th Edition
2. BICSI Telecommunications Distribution Methods Manual, 13th Edition
3. ANSI/TIA 606-A (2002) Administration Standard for Commercial Telecommunications Infrastructure.
4. ANSI/TIA 607-B Commercial Building Grounding and Bonding Requirements for Telecommunications.
5. EIA/TIA-455-61 (latest edition). "FOTP-61, Measurement of Fiber or Cable Attenuation Using An OTDR".
6. TIA-526-7. Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant OFSTP-7.
7. ANSI/TIA 568-C.0. "Generic Telecommunications Cabling for Customer Premises."
8. ANSI/TIA 568-C.1. "Commercial Building Telecommunications Cabling Standard - Part 1: General Requirements."
9. ANSI/TIA 568-C.2. “Commercial Building Telecommunications Cabling Standard - Part 2: Balanced Twisted Pair Cabling Components."
10. ANSI/TIA 568-C.3. “Optical Fiber Cabling Components Standard."
11. EIA/TIA 569-B. "Commercial Building Standard for Telecommunications Pathways and Spaces."
12. IEEE 802.3 (latest edition) "Carrier Sense Multiple Access With Collision Detection.”
13. International Building Code (latest edition).
14. International Fire Code (latest edition).
15. NEC (National Electrical Code) (latest edition).
16. Telecommunications Architectural Standards - In Washington State Government (latest edition).

1.04 QUALITY ASSURANCE

A. Installing Contractor Qualifications:

1. The Installing Contractor project manager shall hold a valid and current Registered Communications Distribution Designer (RCDD) certification issued by Building Industry Consulting Service International (BICSI). The project manager shall have a minimum of five (5) years' experience with projects of similar size and scope.

2. The Installing Contractor field staff installers shall hold valid and current Installation certifications issued by Building Industry Consulting Service International (BICSI) or hold documented certification of training from the manufacturer of the cabling and equipment that is being installed. The field staff shall have a minimum of five years' experience with projects of similar size and scope.

3. The Installing Contractor shall be an Authorized Premier Network Installer Certification Only Partner of the Manufacturer of the equipment being installed and shall furnish documentation showing that the Installing Contractor is trained and certified. The Installing Contractor shall be capable of providing the Owner with a documented Limited Lifetime Performance Warranty of the equipment being installed at the time of project bid, to be approved for bidding.

4. Work in this section shall be performed by a licensed and bonded low voltage Installing Contractor with a minimum of five years' experience in the installation and maintenance of high speed data and voice networks. Only Installing Contractors whose primary business is that of installing, maintaining, troubleshooting, and testing Telecommunication Infrastructures shall perform this work.

5. In order to qualify for installation of the Telecommunications Infrastructure Installing Contractor must possess the required license classification, a performance history, experience in the installation and termination of copper and optical fiber cable systems, and proof of time in business.

6. License Classification: Installing Contractor must possess a valid Washington State 06 Electrical Low Voltage License.

1.05 GOVERNING CODES AND CONFLICTS

A. If the requirements of this section or the Project Drawings exceed those of the governing codes and regulations, then the requirements of this section and the Drawings shall govern. However, nothing in this section or the Drawings shall be construed to permit work not conforming to all governing codes and regulations.

1.06 PROJECT CONDITIONS - ARCHITECTURAL PLANS

A. The Installing Contractor shall carefully coordinate the various symbols utilized on the drawings and shall consult the architectural plans to determine ceiling and floor types in the various areas.

1.07 SUBMITTALS

A. Refer to Section 27 00 00 Low Voltage Systems General Requirements, for additional data sheet submittal requirements and the shop drawing submittal requirements.

PART 2 PRODUCTS

2.01 MATERIALS

A. See Section 27 00 00 Low Voltage Systems General Requirements for additional requirements.

B. The Installing Contractor shall review the Site Plans, Floor Plans, Riser Diagrams, and Detail Sheets for additional work that is required to be performed by the Installing Contractor of this section.

C. **Leviton / Berk-Tek** manufactures the products that are used for the **basis of design** of this specification.

1. Equivalent manufacture's solutions may be submitted for prior approval **no less than two (2) weeks before bid date closing.** Products not submitted for prior approval shall be rejected.

a. Include with substitution request, a 3rd party verified testing agency's report which shall include, but not be limited to, the following TIA-568-C.2 tests:

1) Insertion Loss / Attenuation.

2) NEXT (Near End Cross Talk).

3) PSNEXT (Power Sum Near End Cross Talk).

4) ACR (Attenuation Crosstalk Ratio).

5) PSACR (Power Sum Attenuation Crosstalk Ratio).

6) ACR-F (Attenuation Crosstalk Ratio – Far End)

7) PSACR-F (Power Sum Attenuation Crosstalk Ratio – Far End)

8) The following tests are only required for CAT6A cabling:

a) PSANEXT (Power Sum Alien NEXT)

b) PSAACRF (Power Sum Alien ACRF)

2. Legrand's Superior Essex / Ortronics are pre-approved equivalents. Category cabling shall be at minimum Superior Essex DataGain Cat 6+ and 10Gain Cat 6A product lines. Other products must meet specifications listed herein.

D. All products shall be new, and brought to the job site in original manufacturer's packaging. Electrical components shall bear the Underwriter's Laboratories label. All Telecommunications cable shall bear the manufacturer's label in accordance with NEC 800 based on flammability testing as follows:

1. CMR General Purpose Communications Riser Cable.

2. CMP Plenum-rated Communications Cable.

3. And other cable ratings to comply with the National Electrical Code requirements for the installation.

E. All products shall meet the certification requirements of the warranty. All device products and all cabling products shall be of a single manufacturer.

F. Provide all equipment as defined in the specification(s) and shown on the drawings.

G. Refer to PART 1 for any equipment that is not specifically defined.

2.02 MATERIALS NOT INCLUDED (PROVIDED & INSTALLED BY OTHERS)

A. Telephone switching equipment and related appurtenances.

B. Telephones.

C. Switchers, routers, network hubs, data concentrators and other similar active electronic equipment for data communications.

D. Computers, printers, facsimile machines, modems and other similar utilization equipment.

2.03 COORDINATION

A. Refer to “Installation of Owner Furnished Equipment” for additional coordination and installation requirements.

B. Refer to “Submittals” for additional coordination requirements.

2.04 INSTALLATION OF OWNER FURNISHED EQUIPMENT

A. The Installing Contractor shall install the following Owner Furnished equipment:

1. Wireless Access Points (WAP’s). Coordinate with the Owner as required.

a. Install each WAP where indicated on the plans.

2.05 ADDITIONAL REQUIREMENTS

A. Refer to “As-Built Drawings” listed elsewhere in this specification for additional equipment required for this project.

2.06 SEISMIC BRACING

A. Provide Seismic Bracing as required by the AHJ.

B. This includes, but is not limited to:

1. Racks.

2. Cable Tray.

3. Cable Supports.

2.07 TELECOMMUNICATIONS SYSTEM DESCRIPTION

A. Provide Horizontal Cabling from each Telecommunication port to the nearest MDF or designated IDF location. Each Telecommunication Outlet type and style shall contain the quantity of Horizontal Cables identified on the Legend, unless noted otherwise.

B. Horizontal cables are to be terminated on rack-mounted patch panels of the same data speed transfer rating. Horizontal Cabling shall be to Patch Panels within each designated rack. Horizontal Cabling shall be cross-connected to backbone cables.

C. A minimum 12-strand single-mode fiber optic backbone shall be installed between the tenant's Main Distribution Frame (MDF) and each designated Intermediate Distribution Frame (IDF) for data connectivity. Within the MDF and the IDF's, the backbone fiber strands shall be terminated and housed in rack-mounted fiber optic enclosures. Both ends of EACH fiber shall be terminated.

D. A 6-strand single-mode fiber optic backbone shall be installed between tenant's MDF and existing data center on site. The fiber backbone shall be routed through existing underground and interior overhead conduit pathways. The backbone fiber strands shall be terminated and housed in rack mounted fiber optic enclosures. Both ends of EACH fiber shall be terminated.

E. Modems, fax machines, wall mount voice outlets for telephone handsets, etc. shall be connected to the data and voice infrastructure via Horizontal Cabling.

2.08 LABELING

A. See Section 27 00 00 for additional label type and additional requirements.

B. The alpha-numeric labeling shall be developed by the Installing Contractor, under the direction of the Owners IT Department at the Pre-Installation project kick-off meeting.

C. The Installing Contractor shall label all equipment and cables in an identical fashion of a sequential manner to the satisfaction of the Owner.

D. All label printing shall be machine generated using indelible ink ribbons or cartridges, and self-laminating labels shall be used on cable jackets appropriately sized to the outside diameter of the cable.

E. All labeling shall match the final room number identification at completion of the project (not the room number that is indicated on the Bid Set of drawings). This includes, but is not limited to; the Outlets, Port Addresses, Patch Panels, As-Built Drawings, and Test Results.

F. Patch panels shall have each port labeled to identify each outlet port.

G. Racks shall have phenolic labels installed at the Top and Centered of EACH Rack installed on this project. Phenolic labels shall be size 36 font.

H. Cable Identification Labels shall be places in the following locations:

1. Horizontal Cables. Each cable shall be identified and marked with the outlet port identification near the cable termination point at the rear of the patch panel and placed within view.

2. Backbone Cables. Each cable shall be identified and marked on all backbone cables (at both ends of the cable) with an identifier as to the location of the beginning and termination of each cable. Labels shall be attached to each cable at the point of entrance and exit to the MDF and each designated IDF location.

I. Where telecommunications outlets are located above accessible ceiling space, provide a label directly on the ceiling tile grid indicating "TELECOM OUTLET ABOVE".

2.09 TELECOMMUNICATION OUTLETS

A. Review the Site Plan(s), Floor Plan(s), Riser Diagram(s), and Detail Sheet(s) for all cable types and quantities required for this project.

B. Each Telecommunication Outlet type and style shall contain the quantity of Horizontal Cables identified on the Electrical Legend, unless otherwise noted.

C. Provide Horizontal Cabling from EACH Telecommunication Outlet port to the nearest MDF or designated IDF location.

D. Telecommunication Outlet:

1. Each Outlet shall accommodate individual modular ports and each modular port shall be individually removed without affecting any other port within the outlet.

2. Coordinate the labeling requirements with the Owner's IT department.

a. Outlet label identification information shall be typed text and indicate patch panel and port for each jack and shall comply with the Owners Labeling Standards. Hand written information will not be acceptable.

b. The Installing Contractor shall match the color and finish of the devices specified in Section 26 27 26. Modify the model number if a different color or finish is identified in Section 26 27 26.

c. 1-Port Stainless Steel Telecommunication Outlets, where shown on the plans, shall be manufactured by Leviton: Model # 43080-1L1, or approved equal. Provide quantities as required.

d. 2-Port Stainless Steel Telecommunication Outlets, where shown on the plans, shall be manufactured by Leviton: Model # 43080-1L2, or approved equal. Provide quantities as required.

e. 4-Port Stainless Steel Telecommunication Outlets, where shown on the plans, shall be manufactured by Leviton: Model # 43080-1L4, or approved equal. Provide quantities as required.

f. 6-Port Stainless Steel Telecommunication Outlets, where shown on the plans, shall be manufactured by Leviton: Model # 43080-1L6, or approved equal. Provide quantities as required.

3. Surface Mount Outlet Locations shall only be installed above accessible ceiling spaces, the MDF Room, and designated IDF locations. They are not to be installed below the ceiling surface or exposed to view, unless approved in writing by the Engineer.

a. Provide modular single-port or dual port Surface Mount Outlet where indicated on the Plans. This includes, but is not limited to:

1) Wireless Access Points.

2) CCTV Cameras.

3) Intrusion Alarm Control Panel.

4) Access Control Panel.

5) Energy Management Panels.

b. 1-Port Surface Mount Telecommunication Outlet, where shown on the plans, shall be manufactured by Leviton: Model # 41089-1IP, or approved equal. Provide quantities as required.

c. 2-Port Surface Mount Telecommunication Outlet, where shown on the plans, shall be manufactured by Leviton: Model # 41089-2IP, or approved equal. Provide quantities as required.

E. Modular Inserts:

1. 8-position, 8-conductor (8P8C). Individual workstation port and patch panel port modules shall be Category 6 rated, 8-position, 8-conductor (8P8C) for termination of conductors and shall be approved by the manufacturer.

2. 8-position, 8-conductor (8P8C). Individual Wireless Access port and patch panel port modules shall be Category 6A rated, 8-position, 8-conductor (8P8C) for termination of conductors and shall be approved by the manufacturer.

3. EACH workstation port shall be Category 6 rated.

4. Each Wireless Access port shall be Category 6A rated.

5. Cables shall be wired in accordance with TIA/EIA-T568B, unless noted otherwise.

6. Each individual insert shall be fully compatible with the Face Plates provided.

a. The Installing Contractor shall match the color and finish of the devices specified in Section 26 27 26 for the workstation modules. Modify the model number if a different color or finish is identified in Section 26 27 26. The Installing Contractor shall match the color of the horizontal cabling as called out in this specification for the patch panel modules.

b. Manufactured by Leviton: Model # 61110-R(X)6 Series for Category 6 applications, or approved equal for all workstation outlets. Provide quantities as required. (X) Indicates color.

c. Manufactured by Leviton: Model # 6110G-R(X)6 Series for Category 6A applications, or approved equal for all Wireless Access point outlets. Provide quantities as required. (X) Indicates color.

7. Blank inserts: Fill all remaining unused ports with a blank filler insert that is approved by the manufacturer.

a. The Installing Contractor shall match the color and finish of the devices specified in Section 26 27 26. Modify the model number if a different color or finish is identified in Section 26 27 26.

8. Manufactured by Leviton: Model # 41084BGB, or approved equal. Provide quantities as required.

F. Wall Mount Telephone Outlet:

1. Provide modular single-port stainless steel wall phone outlet with mounting studs.

2. Manufactured by Leviton: Model # 4108W-1SP, or approved equal. Provide quantities as required.

2.10 FIBER OPTIC CABLE

A. See “Testing of Cables” listed elsewhere within this specification for Testing Requirements to be documented and submitted at the completion of this project.

B. All cables shall be UL listed and suitable for indoor and outdoor installation. Provide other cable types where required by Code and the AHJ.

C. EACH Cable installed shall be plenum rated.

1. Single-Mode Fiber Optic Cable:

a. Fiber optic cables shall be utilized for connectivity between areas as shown on the plans (where applicable).

b. Fiber optic cables shall be 09/125 micron, graded index, tight buffer indoor/outdoor plenum rated, unless otherwise noted. The core fiber shall have a diameter of 50 microns, and a cladding diameter of 125 microns.

D. The Installing Contractor shall provide Single-Mode Fiber Optic Cable as shown on the plans.

E. Attenuation shall be measured in accordance with EIA fiber optic test procedures (FOTP's) 46 or 53, 57 and 30. Information transmission capacity shall be measured in accordance with the following ETA FOTP's 51 or 30, 54 and 57. Submit all test results to the engineer for review and approval.

F. All fiber optic cable shall be installed in inner-duct with no splices in the fiber unless noted otherwise.

G. All Inside Plant (ISP) Cables shall be PLENUM rated unless noted otherwise.

H. For exterior CCTV cameras in locations which exceed the CAT6 permanent link distance of 295’, provide Multi-Mode Indoor/Outdoor 2-strand Cable.

I. Provide the following cables as shown on the plans and where required to provide the connectivity of equipment listed in this specification.

1. OS1 – Single-Mode Indoor/Outdoor Tight Buffer Fiber Optic Cable shall be manufactured by Berk-Tek: Model # PDR012-AB0707-I/O, or approved equal.

2. OM3 – Multi-Mode Indoor/Outdoor 2-strand Cable for CCTV cameras shall be manufactured by Berk-Tek or approved equal.

2.11 FIBER OPTIC CABLE TERMINATION HARDWARE

A. Fiber Optic Connectors: Provide keyed, ceramic–tipped connector plugs for termination at each fiber optic LIU’s. Multi-mode Fiber Optic Cable (single mode as required).

B. Light Interface Unit (LIU):

1. Server Room and IDF locations:

a. Provide rack-mount multi-capacity terminal that is capable of a minimum of 24 fiber strands.

b. Provide label holders and color-coded labels.

c. Manufactured by Leviton: Model # 5R1UM-S03, or approved equal. Provide quantities as required. Provide all necessary appurtenances to terminate all fiber optic cables. This includes, but is not limited to:

1) Provide fiber termination adapter panels for LC connectors.

a) manufactured by Leviton: Model # 5F100-2LL, or approved equal. Provide quantities as required to terminate each single mode fiber within the Server Room and IDF.

b) Provide blank cover(s) for each unused adapter panel's space manufactured by Leviton: Model # 5F100-PLT, or approved equal. Provide quantities as required.

2. Existing Data Center location:

a. Coordinate the exact termination location of fiber withing the existing data center with the owner prior to installation. Contractor shall terminate fiber with LC style connections within existing fiber LIU within the data center.

2.12 PATCH CABLES – FIBER OPTIC

A. Patch cables shall be owner furnished owner installed.

2.13 HORIZONTAL CABLE – INSIDE PLANT (ISP)

A. See "Testing of Cables" listed elsewhere within this specification for Testing Requirements to be documented and submitted at the completion of this project.

B. EACH Cable installed shall be rated for the appropriate application, such as; Riser Rated, Plenum Rated, Wet Rated, etc.

C. Provide Horizontal Cabling from each Telecommunication Outlet to the nearest MDF or the nearest designated IDF location.

D. Analog Plain Old Telephone Service (POTS) lines shall be provided for, but not limited to, the following items. These items shall be installed complete without splices between the jack and cable termination point.

1. Fire Alarm System.

2. Elevator (where applicable).

3. Terminate all telephone jacks as described elsewhere in these specifications.

E. Cable color codes shall be as follows.

1. All horizontal data cable shall be blue in color.

2. All voice cable shall be white in color.

3. All CCTV and IP Access Control cable shall be yellow in color.

4. All Wireless Access Point cable shall be green in color.

5. Prior to cable installation, the contractor shall coordinate with owner IT at the preconstruction meeting on unique cable color or label identifiers for specific network drops throughout the building (ie. IGN data drops).

F. The work station Telecommunication Horizontal Cable shall be Category 6 rated, 4-pair, 23 AWG UTP, unless noted otherwise.

1. Manufactured by Berk-Tek: Model # LANmark 1000 Series plenum rated cable for Category 6 applications, or approved equal.

G. The Wireless Access Point Cable shall be Category 6A rated, 4pair, 23 AWG UTP, unless noted otherwise

1. Manufactured by Berk-Tek: Model # LANmark-10G2 Series plenum rated cable for Category 6A applications, or approved equal.

2.14 HORIZONTAL CABLE – OUTSIDE PLANT (OSP) & WET RATED LOCATIONS

A. See “Testing of Cables” listed elsewhere within this specification for Testing Requirements to be documented and submitted at the completion of this project.

B. Outside Plant (OSP) cables shall be used where conduits are routed below grade. Such as; slab on grade floor boxes, underground conduits to another building, where required by code, etc. All Outside Plant (OSP) cable extending within the building at a distance greater than 49 feet shall be run in conduit.

C. Provide Horizontal Cabling from each Telecommunication port to the nearest MDF or the nearest designated IDF location.

D. The Telecommunication Horizontal Cable shall be Category 6 rated, 4-pair, 23 AWG UTP, unless noted otherwise.

1. Manufactured by Berk-Tek: Model # LANmark-6 OSP Series, or approved equal.

2.15 PATCH PANELS – COPPER

A. All patch panels shall be located at the MDF and each designated IDF location. They shall be rack mounted unless specifically otherwise noted.

B. Provide a minimum of 25 % spare patch panel jack capacity. .

C. Patch panels should be fully populated, avoiding blanks and empty ports (with the exception being the last patch panel in the series which may not be fully populated).

D. All Category patch panels shall be tested and approved for Category wiring as specified to cable type, per TIA/EIA-568C; shall have rear cable management bar and front labeling.

E. Provide separate Patch Panels for the following equipment connection types:

1. Data Cables.

2. Wireless Access Points.

3. Analog Voice Cables.

4. CCTV System Cables:

a. Prior to running any cables, coordinate with the CCTV System Installing Contractor for actual Patch Panel locations within each Rack.

5. Access Control System Cables:

a. Prior to running any cables, coordinate with the CCTV System Installing Contractor for actual Patch Panel locations within each Rack.

F. Patch Panels:

1. The panel shall be field-configurable and shall accept a full range of modular connectors.

2. manufactured by Leviton: Model # 4S255-S48, or approved equal for 48 port applications.

3. manufactured by Leviton: Model # 4S255-S24, or approved equal for 24 port applications.

2.16 PATCH CABLES - COPPER

A. The Patch Cables shall be Category 6 rated, 4-pair, 24 AWG UTP for all Category 6 systems and Category 6A rated, 4-pair, 26 AWG UTP for all Category 6A systems, unless noted otherwise. Provide one (1) Patch Cable per telecommunications outlet jack and one (1) Patch Cable per telecommunications patch panel port as described below.

B. The outer cable jacket shall match the color selection of the Horizontal Cable Color identified in “Horizontal Cable”.

C. Provide a minimum quantity of one (1) 15’ equipment cord for EACH telecommunication workstation outlet box shown in work areas. Leviton # 6D460-15L, or approved equal.

D. Provide a minimum quantity of one (1) 3’ equipment cord for EACH telecommunication jack at Each Wireless Access Point. Leviton # 6AS10-3(X) or approve equal. (X) Indicates color of equipment cord according to Horizontal Cable Color identified in “Horizontal Cable”.

E. Provide a minimum quantity of one (1) 3’ equipment cord for EACH telecommunications jack at systems related equipment such as CCTV, IP intercom clock, IP access control system. Leviton # 6D460-03(X) or approved equal. (X) Indicates color of equipment cord according to Horizontal Cable Color identified in “Horizontal Cable”.

F. Patch cords for patch panel to network switch patching in Server Room and IDF shall be OFOI.

2.17 RACKS AND ENCLOSURES

A. Rack Mount all equipment that is capable of being Rack Mounted.

B. Chatsworth is the basis of design for all enclosures.

C. Equivalent manufacture's solutions may be submitted for prior approval no less than two (2) weeks before bid date closing. Products not submitted for prior approval shall be rejected.

D. Provide seismic bracing for ALL RACKS AND ENCLOSURES per manufacturer's recommended instructions/accessories.

E. Section 27 20 00 shall provide ALL Racks and related equipment, including but not limited to; Patch Panels, Patch Cords, Wire Management, Power Strip assemblies, etc. for ALL Local Area Network (LAN) bases Systems as shown on the site plans, floor plans, detail sheets, and riser diagrams.

F. Racks:

1. Free-Standing 4-Post:

a. The Rack shall have the following features:

1) Complies with 19" wide rack EIA-310-D standards.

2) Rack Height: 45RU.

3) Color: Black.

b. Installation:

1) Secure EACH Rack to the floor using the manufacturer recommended installation method and the manufacturers recommended hardware/bolt down kit.

2) Secure EACH Rack to the Cable Tray using the manufacturer recommended installation method.

c. Manufactured by Chatsworth Products: Model # 15053-703, or approved equal.

1) Provide the quantities where shown on the drawings

G. Enclosures:

1. Server Enclosure:

a. The Enclosure shall have the following features:

1) Complies with 19" wide rack EIA-310-D standards.

2) Rack Height: 45RU.

3) Color: Black.

4) Racks shall be gang-able

5) Front Door: Single Perforated

6) Rear Door: Double Perforated

7) Top Panel: Grommet Sealed

8) Side Panel – 2 sides

9) Bottom Panel – Grommet Sealed

10) Front and Rear rails

b. Installation:

1) Secure EACH Rack to the wall using the manufacturer recommended installation method and the manufacturers recommended hardware/bolt down kit.

2) Secure EACH Enclosure to the Cable Tray using the manufacturer recommended installation method.

c. Manufactured by Chatsworth Products: Model # ZB13-A1210-71 or approved equal.

1) Provide one (1) in the Server Room

2. Mini-server enclosure

a. The Enclosure shall have the following features:

1) Complies with 19” wide rack EIA-310-D standards.

2) Rack Height: 12RU.

3) Color: Black.

4) Racks shall be gang-able

5) Front Door: Tempered Glass

6) Front and Rear rails

b. Installation:

1) Rack shall be free standing on floor beneath counter top.

c. Manufactured by Chatsworth Products: Model # 11901-724 or approved equal.

1) Provide one (1) in the Digital Forensics Room

H. Grounding Terminal Block for Rack: For EACH Rack provided for this project, provide one Grounding Terminal Block.

I. Cable Management:

1. Vertical Cable Management for Open-Frame Racks: Provide two (2) sets of vertical cable management on both sides of each rack. Provide double-sided vertical cable management at the front of the rack for telecommunications patch cable routing and single-sided vertical cable management at the rear of the rack for power cable routing. Where two racks are installed side-to-side, provide one section between the Racks for each Rack provided for this project.

    a. Double sided vertical cable management:

        1) Manufactured by Chatsworth Products: “30161” series, or approved equal. Provide quantities as required.

    b. Single sided vertical cable management

        1) Manufactured by Chatsworth Products: “13902-703” series, or approved equal. Provide quantities as required.

2. Horizontal Cable Management:

    a. Manufactured by Chatsworth Products: Model # 30139-X19 for 1RU applications and Model # 30130-x19 for 2RU applications, or approved equal. Provide quantities as required.

J. Power Distribution Units (PDU):

1. Each rack and enclosure shall be provided with one (1) vertical PDU. PDU shall be mounted to the rear or each rack/enclosure and connected to the UPS fed 120V receptacle installed at the top rail of reach rack and interior top of server enclosure.

2. The PDU shall have the following features:

    a. Metered

    b. 100-120V input

    c. 100-120V output

    d. NEMA 5-20P input connection

    e. Minimum twenty-four (24) NEMA 5-20R output connection

    f. 0U vertical installation

3. Manufactured by APC: Model # AP8830.

    a. Provide one (1) PDU per 4-post rack and server enclosure shown on the plans.

2.18 WIRE RINGS

A. Cables on backboards shall be supported using open distribution rings. Rings shall be located within 12" of entering or exiting conduit, 6" prior to any radius bends and at least 12" on center. The rings shall have rounded edges and be designed in a "C" configuration. Securely mount distribution rings to the plywood backboard.

B. Chatsworth Products Inc. (CPI): Model # 12035-001, or approved equal. Provide quantities as required.

2.19 CABLE MANAGEMENT TIES

A. Wire ties of any type shall NOT be used anywhere in this installation.

B. Bundle all Horizontal Cables together with Velcro-type tie wraps.

1. Adjustable Velcro Straps shall be used for all cable bundles.

a. Provide Velcro Straps every two-feet (approximately) above accessible ceilings, in Cable Trays (where applicable) and throughout the cable run.

b. Provide Velcro Straps every 12 inches (approximately) within the MDF and each designated IDF location.

2. Chatsworth Products Inc. (CPI): Model # 020XX-201, or approved equal. XX indicates actual length. "06" (6-inches long for 2-inch diameter cable bundles), "09" (9-inches long for three-inch diameter cable bundles), and "12" (12-inches long for four-inch diameter cable bundles). Provide quantities as required.

2.20 TMGB AND TGB (TELECOMMUNICATION GROUNDING BUSBARS)

A. See Section 27 00 00 for additional Grounding requirements.

B. Ground all equipment per the Manufacturers recommendations, per Division 26, and as required by Code.

C. Provide grounding and bonding per ANSI-STD-J-607-A, which includes, but is not limited to: Cable Tray, Rack(s), conduit sleeves, and other equipment connected to the TMGB/TGB.

1. The minimum conductor size shall be #6 green insulated copper grounding conductor. However, size each conductor shall be based on the actual cable length as defined in ANSI-STD-J-607-A.

D. TMGB: Provide and install one (1) 4" high x 20" wide Copper Telecommunication Main Grounding Busbar (TMGB). Use standoff brackets to wall mount the copper busbar and insulators.

1. Manufactured by Chatsworth Products Inc (CPI): Model # 40153-020, or approved equal.

E. TGB: Provide and install at EACH designated IDF location one (1) 2" high x 12" wide Copper Telecommunication Grounding Busbar (TGB). Use standoff brackets to wall mount the copper busbar and insulators.

1. Manufactured by Chatsworth Products Inc (CPI): Model # 13622-012, or approved equal.

F. Lug Style: EACH connection to the TMGB/TGB shall be a Copper 2-Hole Lug Straight Long Barrel Connection.

1. Manufactured by Thomas & Betts: Model # 256 Series, or approved equal.

2.21 SPARE DEVICES

A. Provide the following spare devices:

Device	Quantity
Telecommunication outlet (with work station cable)	6
Telecommunication outlet (with Wireless Access Point cable)	5

B. Each spare device shall include 295' of terminated cable, faceplates, modular ports, jacks, surface mount outlets, conduit (up to 100') and labor as listed elsewhere in this specification; all as required for a complete installation. Location of these devices to be determined by the Owner's representative. Unused devices shall be turned over to the Owner.

2.22 ADDITIONAL SYSTEM EQUIPMENT

A. See Part 3 of this specification for additional provision of system Equipment and/or Labor.

B. See 27 05 28 for pathway requirements (cable tray, inner duct, etc.).

PART 3 EXECUTION

3.01 GENERAL

A. See Section 27 00 00 Low Voltage Systems General Requirements for additional information.

B. Prior to rough-in, coordinate with the Architect for the exact location(s).

C. Install all cabling, devices, and/or equipment per the manufacturer's recommendation.

3.02 PRODUCT INSPECTIONS

A. The Installing Contractor shall inspect all cable prior to installation to verify that it is identified properly on the reel identification label, that it is of proper gauge, containing correct number of pairs, and is the material ordered. Any physical damage to the cable and wire must be noted; un-uniform jacket thickness and jacket tightness should also be identified. Note any buckling of the jacket, which would indicate possible problems.

3.03 CABLE INSTALLATION - GENERAL

A. EACH CABLE RUN SHALL BE CONTINUOUS, WITHOUT ANY SPLICES, from the Telecommunications Outlet to the patch panel(s). Any cable run that does not meet this requirement shall be replaced at no additional cost to the Owner.

B. The Installing Contractor shall insure that EACH Telecommunications cable is installed with care, using techniques which prevent kinking, sharp bends, scraping cutting, deforming the jacket, or other damage. During inspection evidence of such damage will result in the material being declared unacceptable. The Installing Contractor shall replace unacceptable cabling at no additional cost to the Owner.

C. Conduit and Raceway Usage: All Telecommunications cable shall be installed in grounded metal conduit or raceway dedicated for Telecommunications purposes, when called for on the Project Drawings, and not to be shared with electrical wiring.

D. Cable shall not be draped on, tied or otherwise secured to electrical conduit, plumbing, ventilation ductwork or any other equipment. Cable shall be secured to building supports or hangers or to additional blocks or anchors specifically installed for this purpose.

E. All wiring to be installed in a neat and inconspicuous manner and per local code requirements. Route wires parallel or perpendicular to the building structure using the specified cable supports. Wiring shall be installed near or on structural members as to minimize risk of physical damage by other trades or maintenance personnel servicing the equipment.

F. Cable Lubricants specifically designed for installing Telecommunications cable may be used to reduce pulling tension as necessary when pulling cable into conduit. After installation, exposed cable and other surfaces must be cleaned of lubricant residue.

G. Backboard and Rack Cable Supports: Clamps, "D-Rings", Velcro and tie-wraps are all acceptable ways to support cable. However, installation of these supports must be done with care so as not to cause crushing or distortion of the cable, nor cause tighter bends than the minimum radius permitted for each type cable.

3.04 HORIZONTAL CABLING

A. Horizontal Cables shall be dressed and terminated in accordance with TIA/EIA-568-B requirements and the cable manufacturer's recommendations.

1. Untwisting of pairs at the termination point shall not exceed one-half an inch for Category 6 connecting hardware.

2. Bend radius of the cable in the termination area shall not be less than the manufacturer's recommendation.

3. The Horizontal Cable jacket shall be maintained as close as possible to the termination point.

B. Every attempt shall be made to avoid running Horizontal Cables close to (less than 24") and parallel to power raceway and wiring, or close to light fixtures.

C. When an approved cable support is used to support cable bundles, all horizontal cables shall be supported at a maximum of four-foot intervals with UL approved cable support. At no point shall cables rest on acoustic ceiling grids or panels. Cables shall not be attached to ceiling grid or lighting support wires. Where light support for drop cable legs is required, the Installing Contractor shall install clips to support the cabling.

D. The installation of Horizontal Cables around moveable devices, instruments, subpanels, etc. shall be provided with adequate support, length, protection, and flexibility so that the cable is not damaged in the event the equipment is moved.

E. Pathways:

1. It is the responsibility of the contractor to ensure that ALL PATHWAYS for the permanent link of each balanced twisted pair cable shall not exceed 295' in length from work area outlet to telecommunications room patch panel.

2. To ensure this length, all pathways shall be coordinated and installed prior to pouring of any slabs or the installation of any permanent structure which would inhibit a conduit or cable tray run from being installed after the structure is complete.

3. See section 27 05 28 for pathway types and additional requirements.

3.05 PLYWOOD BACKBOARD CABLING

A. Horizontal Cable installation must conform to the Project Drawings. All cabling shall be routed so as to avoid interference with any other service or system, operation, or maintenance purposes such as access boxes, ventilation mixing boxes, access hatches to air filters, switch or electrical outlets, electrical panels, fire alarm equipment, clock systems, and lighting fixtures. Avoid crossing areas horizontally just above or below any riser conduit. Lay and dress cables to allow other cables to enter the conduit/riser without difficulty at a later time by maintaining maximum distance from these openings.

B. Horizontal Cables shall be routed as close as possible to the ceiling, floor, or corners to insure that adequate backboard space is available for current and future equipment and for cable terminations. Horizontal Cables shall not be connected or attached to electrical conduit or other equipment. Minimum bend radius shall be observed.

C. Lay cables via the shortest route directly to the nearest edge of the backboard from the mounted equipment or block. Velcro wrap all similar cables together and attached by means of clamps screwed to the outside edge(s) of the backboard vertically and/or horizontally, then route via "square" corners over a path that will offer minimum obstruction to future installations of equipment or other cables.

D. Horizontal Cables that are not dressed in a neat fashion, or with excessive slack, will not be accepted.

3.06 FIBER OPTIC BACKBONE CABLING

A. All fiber optic cabling shall be installed in "orange" colored innerduct. There shall be no splices allowed.

B. Fiber optic termination hardware shall be installed in the following manner:

1. Fiber slack shall be neatly coiled within the Light Interface Unit (LIU). No slack loops shall be allowed external to the LIU's, unless otherwise noted.

2. Each cable shall be individually attached to the respective termination LIU by mechanical means. The cables strength member(s) shall be securely attached to the cable strain relief bracket in the LIU.

3. Each fiber cable shall be stripped upon entering the termination panel and the individual fibers routed in the LIU.

4. Each cable shall be clearly labeled at the entrance to the LIU. Cables labeled within the bundle shall not be acceptable.

5. Dust caps shall be installed on the connectors and couplings at all times unless physically connected.

3.07 CABLE LABELING

A. Alpha-numeric numbering shall be developed by Installing Contractor, under the direction of the Owners IT Department. Label all equipment and cables in an identical fashion.

B. Patch Panel Labeling: Each terminal shall be identified and marked on the patch panel with the outlet port identification.

C. Outlet Port Labeling: Outlet labels for each port shall be identified and marked on the Outlet with the outlet port identification.

D. Backbone Labels: Labels shall be identified and marked on all backbone cables (at both ends of the cable) with an identifier as to the location of the beginning and termination of each cable. Labels shall be attached to each cable at the point of entrance and exit to the MDF and IDF Rooms.

E. Horizontal Cables: Each cable shall be identified and marked with the outlet port identification near the cable termination point at the rear of the patch panel.

3.08 TELECOMMUNICATION ROOMS

A. The Telecommunication Rooms (MDF and designated IDF's) shall house Racks, Patch Panels, Wire Management, UPS's, Punch Blocks, and required cable routing hardware. Racks shall be placed in a manner that will allow a minimum of 3 feet of clearance from the front and rear mounting surfaces and on one side. If one mounting rail of the rack is placed against a wall, the mounting rail shall be no closer than 6" to the wall to allow room for vertical management. Where there is more than one rack, the racks shall be ganged with vertical management hardware to provide interlay management. Ganged rack frames will be placed in a manner that will allow a minimum of 3 feet of clearance from the front and rear mounting surfaces.

B. Racks shall be installed in the following manner:

1. EACH Rack shall be securely attached to the floor and/or wall using the manufacturer's recommended mounting hardware.

2. EACH Rack shall be Grounded/Bonded to the TMGB/TGB with a minimum size of one (1) #6 copper green insulated conductor or larger due to distance requirements based on ANSI-J-STD-607-A.

3. Rack mount screws (#12-24) that are spare shall be bagged and left with the rack upon completion of the installation.

4. All rack mounted equipment shall be installed in a designated Rack Unit. Equipment shall NOT be installed in between Rack Units; this will NOT be considered acceptable.

C. Cable Tray: Configure as shown on the drawings. Provide Cable Tray as specified in 27 05 28. Install the Cable Tray using the manufacturer's recommended mounting hardware, connectors, brackets, and fasteners.

3.09 TESTING OF CABLES

A. Notification shall be given a minimum of fourteen (14) days prior to any testing so that the testing may be witnessed by the Owner.

B. An ETL certified, TIA-1152 Level IIIe (ISO/IEC 11801 Level IV) Test Meter shall be used to test all balanced twisted-pair coper cabling.

C. All labeling shall match the final room number identification at completion of the project (not the room number that is indicated on the Bid Set of drawings). This includes, but is not limited to; the Outlets, Port Addresses, Patch Panels, As-Built Drawings, and Test Results.

D. Provide documentation of the following items of EACH Test Meter used:

1. Calibration certification from a third party shall be within two (2) years of testing (at the time that the test is performed).
2. Manufacturer of Test Meter.
3. Model Number of Test Meter.
4. Serial Number of Test Meter.

E. Copper Cables – Category 6 and 6A Cables: Each of the pairs shall be tested from the Patch Panel or Punch Block to the Outlet. The Installing Contractor shall test:

1. Wire Map.
2. Length.
3. Insertion Loss / Attenuation.
4. NEXT (Near End Cross Talk).
5. PS-NEXT (Power Sum Near End Cross Talk).
6. ACR-F Loss (Attenuation Crosstalk Ratio Far-end).
7. PS ACR-F Loss (Power Sum Attenuation Crosstalk Ratio Far-end).
8. Return Loss.
9. Propagation Delay.
10. Delay Skew.
11. The following tests are only required for CAT6A cabling:
    a. PSANEXT (Power Sum Alien NEXT)
    b. PSAACRF (Power Sum Alien ACRF)

F. Copper Cables – Category 3 or 5e Cables: Each of the pairs shall be tested from the Patch Panel or Punch Block to the Outlet. The Installing Contractor shall test:

1. Wire Map.
2. Length.

3. Insertion Loss / Attenuation.
4. NEXT (Near End Cross Talk).
5. PS-NEXT (Power Sum Near End Cross Talk).
6. ACR-F Loss (Attenuation Crosstalk Ratio Far-end).
7. PS ACR-F Loss (Power Sum Attenuation Crosstalk Ratio Far-end).
8. Return Loss.
9. Propagation Delay.
10. Delay Skew.

G. Fiber Optic Cables – Single-Mode Inside Plant (ISP) and Outside Plant (OSP): Each of the fibers shall be tested from End-to-End. The Tests performed shall comply with ANSI/TIA-568-C.3 standards.

H. The source of each error shall be determined, corrected, and the cable re-tested. All defective cables, connectors, connections, and related appurtenances shall be replaced and re-tested at no additional cost to the Owner.

I. Submit the Test Reports in PDF format.

J. See the O & M Manual / As built Drawings requirements in this specification and also in Section 27 00 00 for additional requirements.

K. Acceptance of these test procedures is predicated on the Installing Contractor's use of the recommended products including, but not limited to; the specified cable type, patch panels, outlets, punch blocks, specified equipment identified in Part 2 and the installation standards of this specification. Adherence to these requirements shall be determined upon the completed installation and will be evaluated in the context of each of these factors.

3.10 FIRE RATED PENETRATIONS

A. Install per manufacturers recommendations.

B. Maintain all Code and AHJ requirements.

C. See Section 27 05 28 for additional requirements.

3.11 WARRANTY

A. Upon final installation, a certificate providing a "Performance and Application Warranty" shall be provided to the owner. This warranty shall be valid for a period of no less than twenty-five (25) Years. The warranty shall be direct to the end user, from the manufacturer, supported through the installing and certified Installing Contractor, and shall cover both materials and labor costs for any claims related to the warranty program. If the Installing Contractor were to default, the manufacturer will assume responsibility of employing another certified installer to maintain the existing warranty. Bids from installers or Installing Contractors who are not certified by the connecting hardware manufacturer and wire manufacturer at the time of project bid, will be rejected.

3.12 OPERATION & MAINTENANCE MANUALS (O&M'S)

A. Provide all Operation & Maintenance Manuals (O&M's) documentation as defined in Section 27 00 00 Low Voltage Systems General Requirements and listed elsewhere in this specification.

B. Provide hard copies of the Test Results of EACH Cable tested.

C. Provide the Test Results on CD in PDF format.

3.13 AS-BUILT DRAWINGS

A. Provide all As-Built documentation as defined in Section 27 00 00 Low Voltage Systems General Requirements and listed elsewhere in this specification.

B. All labeling shall match the final room number identification at completion of the project (not the room number that is indicated on the Bid Set of drawings). This includes, but is not limited to; the Outlets, Port Addresses, Patch Panels, As-Built Drawings, and Test Results.

C. Update all documents provided in the Submittal and Shop Drawings to accurately reflect the actual equipment that was provided for this project, and the actual locations of the installed equipment.

D. The Installing Contractor shall provide As-Built drawings to the Architect, which clearly indicates:

1. The floor plan of the building showing the As-Built location of Telecommunication Outlets and their associated Port Address(es), conduit runs, and terminal cabinets.

2. A list of EACH Telecommunication Outlet and the associated Port Address(es) shall clearly be identified according to system labeling scheme. Show all ports and punchdowns.

3. Provide three (3) sets of complete As-Builts.

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SECTION 27 41 00

GENERAL AUDIO-VISUAL SYSTEM

PART 1 GENERAL

1.01 SCOPE AND RELATED DOCUMENTS

A. Drawings and general provisions of contract, including General Conditions and Divisions 00 and 01 Specification Sections, apply to work of this Section.

B. Provide and install a complete audio-visual system as specified herein and shown on the drawings to include wiring, conduit, jacks, speakers, and all miscellaneous equipment as required.

C. The general intent of this specification is to provide a complete and satisfactorily operating system for court room recording of microphones and cameras and the distribution of audio and video signals throughout the room.

D. The system shall meet ALL of the requirements listed in Section 27 00 00 Low Voltage Systems General Requirements PART 3 “Testing & Complete System Functionality”, prior to “Substantial Completion”.

E. Contractual information, guidelines, requirements, or other work specified to provide a fully functional system for Section 27 41 00 includes, but is not limited to the sections identified in Section 27 00 00.

1.02 SYSTEM OPERATION

A. 4K monitors and USB based video teleconferencing (VTC) camera/microphone units shall be provided for select Conference room presentations and remote meetings. Monitors shall include all necessary mounting hardware for each location. USB VTC equipment shall connect to owner provided laptops for use in remote meetings.

B. Stand-alone monitors shall be provided for basic display of local owner provided video content and CATV feeds. Monitors shall include mounting hardware for each location.

C. Room scheduling panels shall be provided for select rooms to allow interface with owner provided Microsoft Teams platform. Panels shall connect to the LAN over PoE connections. Contractor shall provide 1 year of licensing to allow operation of panels with the Microsoft Teams platform.

D. System interface devices shall be provided at locations as shown in drawings.

1.03 QUALITY ASSURANCE

A. All major system components shall be supplied and installed by an authorized factory distributor. The Installing Contractor and manufacturer shall have furnished and installed similar sound systems continuously for no less than five years.

B. To qualify as a bidder, the Installing Contractor shall hold the necessary licenses as issued by the State of Washington for an electrical contractor. Installation shall be made by a licensed and bonded contractor holding a valid Washington State Electrical Contractor’s License as described in Chapter 19.28 of the Electrician and Electrical Installation Revised Code of Washington State. All work covered by this specification to be supervised by a holder of a current State of Washington Journeyman Electrician Certificate or Specialty Electrician for low energy systems as per Certification Law RCW 18.37.

1.04 SUBMITTALS AND SHOP DRAWINGS

A. All submittals and shop drawings shall meet the requirements of specification 27 00 00.

B. All documentation shall be stored on archival quality DVD-R (Verbatim #96320 or equal) as well as USB flash storage.

C. Data Sheets and other documentation:

1. The Materials List shall identify the specification section, quantity of each item, the manufacturer, model number, and brief description of each item.

   a. Provide data sheets for each item listed on the materials list.

   b. Provide indicating arrows on data sheets that have multiple items on the data sheet.

2. Provide ALL requested submittal documents in “Training Materials and Programming Survey” listed elsewhere in this specification. This includes, but is not limited items listed under “Interview the Owner”:

   a. Provide a sample copy of the Training Syllabus.

   b. Provide a sample copy of the Step-by-Step Instructions.

3. Pre-Installation project kick-off meeting.

4. The Installing Contractor shall provide the Meeting Minutes for the Pre-Installation project kick-off meeting.

5. Follow up documentation for the pre-Installation project kick-off meeting shall be provided as described under “Coordination” identified elsewhere in this specification.

D. Shop Drawings:

1. In addition to the shop drawing requirements of 27 00 00, the following additional requirements shall be met:

   a. All devices IP addresses shall be shown on the riser and block diagrams

   b. All cable types shall be labeled

   c. All patch panels and wall plates shall be shown with labels that match those in the field

   d. VLAN assignments shall be shown for each device

   e. The file name of the configurations and presets used shall be shown next to each device

1.05 COORDINATION

A. Pre-Installation Project Kick-off Meeting. The Installing Contractor shall contact the Electrical Contractor for the purpose of confirming the actual date of and attending the Pre-Installation Project Kick-Off Meeting at the location selected by the Owner (somewhere within the District). This meeting shall take place PRIOR to Submittal of equipment data sheets. The Installing Contractor shall be responsible for providing the following items.

1. Submitting a list of questions and their list of coordination items through the Construction Channels a minimum of 14 Days in advance of the meeting for Owner review.

2. A sign in sheet (with the project name, Section number and title that the Installing Contractor is representing, date, time, location, the printed name of each person in attendance, their title, phone number, and email address).

3. Be responsible for taking Meeting Minutes, typing them into a formal document, and distributing them via email to each attendee.

4. The items discussed at the Pre-Installation project kick-off meeting shall include, but not be limited to:

   a. General location of Rack, assisted listening equipment, and other items.

   b. General questions about system operation, function, and programming.

B. Follow up documentation for the Pre-Installation Project Kick-Off Meeting. The purpose of this information is to illustrate to the Owners Representative that the information discussed during the Pre-Installation Project Kick-Off Meeting was understood by the Installing Contractor.

1. Each of the above items and items discussed during the meeting shall be included in the Data Sheet Submittals.

PART 2 EQUIPMENT

2.01 MATERIALS

A. See Section 27 00 00 Low Voltage Systems General Requirements for additional information.

B. The system design, devices and/or wiring arrangement shown on the drawings represent that based on various equipment manufacturers.

1. Substitutions of the specified manufacturer will be considered provided that sufficient documentation is provided to the Engineer which certifies that the equipment and or supplier qualification meets the requirement of these specifications. Any request for substitution shall be submitted by the contractor in writing so as to be received by the Architect not later than ten (10) days prior to the bid due date. Approval by the Engineer will be issued by addendum prior to the bid date.

C. Software and Hardware Revisions:

1. Software:

a. Prior to substantial completion, O&M document generation, and training, the contractor shall provide and upgrade all active equipment to the most current revisions of all software/firmware.

b. In addition to installing these latest updates, the contractor shall verify their compatibility with the system and test for any faults related to the updates.

2. Hardware:

a. Prior to substantial completion, hardware which revision is not the most current shall be upgraded at no cost to the owner.

b. This would include, but is not limited to:

1) Manufacturer defects corrected in new revisions of the equipment

2) Upgraded functionality in new revisions of the equipment

a) Examples: New revision of PoE output power, new revision of audio network capabilities like the Dante protocol

D. Provide all equipment as defined in this specification and shown on the drawings

2.02 DOCUMENTATION

A. Provide documentation of all software updates in the O&Ms, as well as new datasheets/manuals for the equipment in the O&Ms.

B. Refer to PART 1 for any equipment that is not specifically defined.

2.03 TRAINING MATERIALS AND PROGRAMMING SURVEY

A. The Installing Contractor shall include in the Pricing of their Bid, the time and materials necessary to generate and create the following Documentation, provide the staff and necessary equipment as required to provide the following services, as described below.

B. Interview the Owner for no less than a minimum of one (1) 4-Hour session. Allow for additional time if required, at no additional cost to the Owner. The Installing Contractor LEAD TECHNICIAN shall be present for this meeting. The purpose of this Interview is to verbally discuss all of the feature sets of the system. The dialog shall describe the benefits for implementing each of the systems features, thus allowing the Owner to make an informed decision on the how they can maximize the functional operation of their system.

C. Training Manuals for the Site Staff:

1. At the 1st training session, prior to starting, provide a quantity of up to five (5) training manuals to the site staff.

2. The training manual shall be specific to the site (i.e. Binder spine, binder cover insert, and the binders internal documents).

3. Each of the training manuals shall be in a 3-ring "D" style binder. The binder shall be sized to allow for 20% additional documentation. The spine of the binder shall have a clear cover with an insert clearly typed with the following label "Section 27 41 16 Community Room Audio Visual System– (site name here) training manual". The binder shall have a clear front cover with an insert clearly typed with the title of the spine on the front sheet, located at the top of the page, and centered. Under the title of the spine, the following information shall also be included on the front sheet of the binder; the site name and site address, the project name and project address, the current date, the Installing Contractors name, address, contact name and phone. Each binder shall include the following;

   a. Include the Manufacturers User's Manual(s).

2.04 FLAT PANEL MONITORS

A. Monitors shall have the following features:

1. 4k resolution

2. HDMI connectivity

3. ATSC, Clear QAM, Analog NTSCLG

4. Crestron compatibility

B. Monitors shall be from LG Model # UR640S or approved equal

1. Provide quantities as shown on the plans.

   a. Monitors in rooms EOC B1004, Community Room A1004, and Training Room A1007 shall be provided under Division 27 4116 Integrated Audio Visual System.

2. Provide monitor size for each location as shown on the plans.

   a. 'M##' annotation on plans - ## indicates monitor diagonal in inches

   b. Size options in 43", 50", 55", 65", 75", 86"

C. Fixed wall mount bracket

1. Provide fixed wall mount bracket for each monitor location unless noted otherwise as articulating or ceiling mount style on the plans.

2. Brackets for 43” and 50” monitors shall be from Chief model # MTM1U or approved equal.

3. Brackets for 55” and 65” monitors shall be from Chief model # LTM1U or approved equal.

4. Brackets for 75” and 86” monitors shall be from Chief model # XTM1U or approved equal.

D. Articulating wall mount bracket

1. Articulating wall mount bracket shall be from Chief PDR series Articulating / Swivel / Tilt mounts with Chief PSBU series VESA bracket. Mounted directly over the specialty AV back box.

    a. Provide quantities for each articulating mount monitor location noted on plans.

E. Ceiling mount bracket

1. Provide large flat panel ceiling mount bracket with compatible ceiling plate and pipe.

2. Provide unistrut perpendicular to structural joists above accessible ceiling space for secure install of the ceiling plate.

3. Ceiling mount bracket shall be from Chief model # RLC1 or approved equal.

    a. Provide quantities for each ceiling mount monitor location noted on plans.

    b. Provide 4” ceiling plate from Chief model # CMA105 or approved equal for each ceiling mount location.

    c. Provide one (1) black powder coated 1-1/2” pipe with NPSM threading on each end for installation between ceiling plate and mounting bracket at each ceiling mount location.

F. Specialty AV monitor back box.

1. At select monitor locations, a 14.25” square recessed back box shall be provided and installed.

    a. See plans for exact locations of specialty large AV back box.

    b. Data at specialty back box locations shall be installed directly into the recessed back box with face plate flush with the inside top edge of the box.

    c. Power shall be integral to the box and circuited as necessary.

d. See plans for additional conduits requirements for AV cabling to back box.

e. Specialty AV monitor back box shall be from Chief model # PAC526FBP2.

2.05 LARGE CONFERENCE ROOM SYSTEMS

A. The following large conference rooms shall be provided with USB and HDMI connectivity from conference tables, USB based video teleconferencing unit for BYOD Teams meeting functions, expansion microphones, amplifier, and ceiling speakers.

1. Briefing A1038

2. Admin Conference A1072

3. Conference A1077

B. Provide monitors for each room as specified in section 2.04.

C. HDMI and USB extender kit

1. Kit shall provide transmitter and receiver for HDBase T extension of HDMI from conference table to monitor and USB 2.0 from USB video teleconferencing unit to conference table.

2. Utilize CAT6 cabling between transmitter and receiver. Transmitter shall be mounted to underside of conference table. Receiver shall be mounted within specialty AV back box.

3. Extender Kit shall be from Atlona model # AT-OME-EX-KIT-LT.

a. Provide one (1) kit per large conference room.

b. Provide cabling as necessary to HDMI and USB connectors in the conference table top provide by furniture vendor.

D. USB Video Teleconferencing Unit

1. Unit shall provide 4k PTZ camera with integral beamforming microphone. Unit shall be used in BYOD form with Microsoft Teams on owner provided laptops.

2. Unit shall be from Logitech model # Rally Bar.

a. Provide one (1) unit per large conference room.

b. Provide TV mount hardware for each location for installation to the monitor wall bracket.

c. Provide two (2) rally mic pods with mic pod mount and extension cable for each large conference room.

E. Audio Amplifier

1. Provide small form amplifier located in specialty AV box for amplification of audio feed from the digital audio output of the rooms monitor.

2. Amplifier shall be 70V output with line audio input from monitor.

3. Amplifier shall be from Extron model # MPA 601-70V or equal.

    a. Provide one (1) amplifier per large conference room.

F. Speakers

1. Provide 6.5” flush mount 70V ceiling speakers for connection to amplifier.

2. Speakers shall be from Extron model # SF 26CT or equal.

    a. Provide two (2) per large conference room.

2.06 ROOM SCHEDULING PANELS

A. Provide wall mount touch screen panel for room scheduling functionality.

B. Minimum 10” screen

C. Panels shall integrate with owner’s Microsoft Teams platform. Panel is only required to function as a scheduler and is not used in conjunction with Teams Rooms systems.

D. Panels shall be connected to the building LAN over CAT6 PoE.

E. Panels shall be from Logitech model # Tap Scheduler.

1. Provide quantities as shown on the plans.

2. Provide 1-year Microsoft Teams Shared Device License for each room scheduling panel. Coordinate with Owner IT for configuration.

PART 3 INSTALLATION

3.01 TEST EQUIPMENT

A. Sound contractor to perform all required tests and measurements with laboratory-quality test equipment. Upon request, the sound contractor shall submit to the architect a list of test equipment that they propose to use.

3.02 ELECTRONIC SYSTEM TESTING

A. After all equipment specified herein for the system has been completely fabricated and wired and is in operating condition in the sound contractor's shop, performance tests shall be conducted by the sound contractor on the system to determine if the installation and components comply with these specifications.

B. The following test shall be performed and the system shall be made to meet each listed performance criterion:

1. Overall frequency response of the complete electronic system (unequalized) shall be 20 to 20,000 Hz +2 dB. Equalizing circuits shall be temporarily set in the indicated "flat" position.

2. Total harmonic distortion from microphone input to power amplifier output at rated power shall be less than 1% for the frequency range of 20 to 20,000 Hz

3. The overall broadband hum and noise from 20 Hz to 20 kHz using 6 dB/octave filter at 12.47 kHz shall be at least 65 dB below the rated output from system input to output.

4. The total system shall be installed from microphone to loudspeaker in Absolute Polarity. A positive pressure on the microphone shall produce a positive pressure from the loudspeaker.

3.03 DOCUMENTATION

A. All testing documentation shall conform with Specification 27 00 00.

B. Testing:

1. Documentation of test shall be provided to the engineer and shall consist of the following:

a. The test results as listed under Electronic System Testing.

b. The test results as listed under Acoustical Testing.

c. The equalized house curve made with the measuring microphone.

d. List of personnel and test equipment used.

3.04 TRAINING

A. In addition to the basic training and documentation listed in 2.03, provide advanced system training. This shall include, but is not limited to:

1. Tour of all system device locations and their purpose

2. Basic system operation (turning on the system, program material selection and level adjustment)

3. Description of the network audio system and critical components

4. Description of JAVS integration and control

5. Monitor operation and video source selection

6. A sign in sheet for trainees to be copied to the Architect/Engineer and included in the O&M manuals.

3.05 WARRANTY

A. A one (1) year warranty covering all components, equipment, and workmanship shall be submitted in writing. This warranty will begin on the final acceptance date.

B. Should any trouble develop within this one-year period from the date of acceptance of the work due to inferior or faulty material and/or workmanship, or should it be discovered that the work is not in accordance with the contract, the contractor shall promptly make all required corrections without cost to the owner.

3.06 AS-BUILT DOCUMENTATION

A. Operation and maintenance manuals and the As-Built drawings shall conform to the requirements of specification Section 27 00 00.

B. In addition to the requirements of section 27 00 00 provide the following:

C. Hardware/Software Configurations:

1. At the completion of the project, the installing contractor shall include all software configurations for the project on both archival quality DVD-R as well as USB flash storage in the O&Ms

2. This includes, but is not limited to:

a. Digital mixing console presets

b. DSP system configuration files and presets

c. Control system configuration files and presets

d. Active speaker configuration files and presets

END OF SECTION 27 41 00

SECTION 27 41 16

INTEGRATED AUDIO-VISUAL SYSTEMS

PART 1 GENERAL

1.01 SCOPE AND RELATED DOCUMENTS

A. Furnish and install a complete Audio-Visual (AV) system as shown on the drawings and as specified herein. The system shall serve the AV functions for the EOC, divisible Community Room spaces, and Training Room. The AV system shall be an integrated IP based system allowing independent or combined space functionality.

B. Provide the wireless microphone system, IP video endpoints, IP based control panel, back boxes, amplifiers, speakers, PTZ cameras, microphone arrays, lectern, other devices mentioned in this specification or plans, input faceplates with all associated cabling and outlet and installation of the system as required for a complete and operating system.

C. Install CFCI monitors and monitor mounts. The general contractor shall provide all backing and supports as required for wall monitor mounts. Coordinate exact location and weight requirements with Architect, Engineers, and Owner.

D. Submit All equipment, including wiring, cabling, and outlets furnished and installed under these specifications, shall be guaranteed for a period of one (1) year from the date of final acceptance thereof against all electrical or mechanical defects or failures except that which can be proved to have been caused by misuse. All service and parts shall be provided during the first year by the contractor or their designated agent.

E. The system shall meet ALL of the requirements listed in Section 27 00 00 Low Voltage Systems General Requirements PART 3 “Testing & Complete System Functionality”, prior to “Substantial Completion”.

F. Contractual information, guidelines, requirements, or other work specified to provide a fully functional system for Section 27 41 16 includes but is not limited to the sections identified in Section 27 00 00.

1.02 SYSTEM OPERATION

A. The AV system shall provide for the playing of the owner provided computer video outputs. The video image shall be displayed via the contractor provided monitors with audio playing over the overhead speakers. The AV system shall also function as camera and microphone sources to be routed to owner provided laptops over USB connection for BYOD Teams meeting functions.

B. The A/V System Control Panel shall control the power and input sources of the Monitor(s), as well as the connected AV equipment, such as the microphones, teleconference cameras, speakers, and cable tv boxes.

C. All wall plates, jacks, cable and accessories shall be provided as required for a fully functional system.

D. A specific quantity of portable assisted listening “kits” shall be provided to comply with the 2010 revision to the Americans with Disabilities Act.

E. Integration to other Low Voltage systems:

1. Fire Alarm System Interface:

a. The system's control I/O module's auxiliary inputs shall receive a relay closure such that in the event of a fire alarm event, the system's audio output shall be shunted.

2. Owner's CATV service

a. Coordinate with the owner for connection to Cable Television set top boxes for use of distributing CATV channels across the system. Cable boxes shall be owner provided with connection to network video encoders

F. System Programming:

1. The system shall be controlled by a central processor.

2. The contractor shall provide programming and configuration of the entire system. This includes, but is not limited to:

a. GUI design/creation for the touch screen control panel(s)

b. Preset creation on the control system

c. Preset creation on the audio digital signal processor (DSP)

d. Configuration and commissioning of the Dante network audio system

3. Functions:

a. The system touch screen control panel shall be programmed to do the following functions at a minimum:

1) Adjust the volume levels of input sources

2) Adjust the volume of far end conference audio sources

3) Adjust master volume level & master mute

4) Conference Camera modes (Recall PTZ presets & Auto Mode)

5) TV/Monitor operation

6) Room split/combine functionality

7) Video sources with live thumbnail video preview

a) Configure GUI for Drag & Drop Source to Destination with live thumbnails of content

8) Control of Cable TV Boxes

b. The system touch screen control panel must be programmed to be password protected to protect the system from being manipulated unless authorized for operation.

1.03 QUALITY ASSURANCE

A. All major system components shall be supplied and installed by an authorized factory distributor. The Installing Contractor and manufacturer shall have furnished and installed similar sound systems continuously for no less than five years. The contractor must have at least two employees holding CTS-D or CTS-I certifications. The contractor must have at least one employee certified in QSC Qsys Level 1 and at least one employee certified in QSC Qsys Level 2. The contractor must have at least 1 employee certified in Audinate Dante Level 3. Submit proof of qualifications for bid and shop drawing submittals: proof of certifications, vendor qualifications, and proof of prior projects. Contract could be rejected if qualifications are not met.

1.04 SUBMITTALS

A. Refer to "As-Built Drawings" for additional requirements.

B. Refer to Section 27 00 00 Low Voltage Systems General Requirements, for additional data sheet submittal requirements and the shop drawing submittal requirements.

1.05 COORDINATION

A. Pre-Installation Project Kick-off Meeting. The Installing Contractor shall contact the Electrical Contractor for the purpose of confirming the actual date of and attending the Pre-Installation Project Kick-Off Meeting at the location selected by the Owner. This meeting shall take place PRIOR to Submittal of equipment data sheets. The Installing Contractor shall be responsible for providing the following items.

1. Submitting a list of questions and their list of coordination items through the Construction Channels a minimum of fourteen (14) Days in advance of the meeting for Owner review.

2. A sign in sheet (with the project name, Section number and title that the Installing Contractor is representing, date, time, location, the printed name of each person in attendance, their title, phone number, and email address).

3. Be responsible for taking Meeting Minutes, typing them into a formal document, and distributing them via email to each attendee.

4. The items discussed at the Pre-Installation project kick-off meeting shall include, but not be limited to:

    a. General location of Rack assisted listening equipment, and other items.

    b. General questions about system operation, function, and programming.

    c. Owner requirements for system programming of specific room combining and separation configurations.

B. Follow up documentation for the Pre-Installation Project Kick-Off Meeting. The purpose of this information is to illustrate to the Owners Representative that the information discussed during the Pre-Installation Project Kick-Off Meeting was understood by the Installing Contractor.

1. Each of the above items and items discussed during the meeting shall be included in the Data Sheet Submittals.

PART 2 PRODUCTS

2.01 MATERIALS

A. See Section 27 00 00 Low Voltage Systems General Requirements for additional information.

B. The System design, devices and/or wiring arrangement shown on the drawings represent that based on various equipment manufacturers.

1. No substitutions are allowed.

C. Provide all equipment as defined in this specification and shown on the drawings.

D. Refer to PART 1 for any equipment that is not specifically defined.

2.02 CABLE TV BOX

A. The Cable TV box will be owner furnished contractor installed (OFCI). Install two (2) Comcast Model # to be determined.

B. Provide two (2) 1RU 19" universal rack shelves and rack mount in the AV equipment rack.

C. Mount Cable TV box and video encoder mentioned elsewhere in this specification to rack shelf listed elsewhere in this specification. Tie to and IP-to-IR control module listed elsewhere in this specification. Label device with designated room name/#, and corresponding video source label from system programming.

2.03 ETHERNET SWITCH

A. AV Ethernet / Network switches

1. The network switches shall have 26x1G PoE+ ports with 24 ports capable of PoE++ and total Poe budget of 1440W.

2. The network switches shall be managed and configured as required for a fully functional AV system.

3. The network switches shall be from the QSYS NS Series Gen 2 line manufactured by Netgear, Model # NS26-1440++. Provide three (3) located in the AV equipment rack

4. Provide four (4) SFP modules compatible with CAT6 RJ-45 for each switch. Utilize two (2) SFP modules for each switch for connecting centralized switches in a ring topology.

2.04 CAT6 PATCH PANELS

A. Rack mounted 24-port patch panels shall be utilized for the termination of AV IP based CAT6 cabling within the AV equipment racks.

B. Patch panels shall be modular keystone style. Provide blank inserts for any unused ports. Labeling of patch panel ports must correspond to the equipment connection at the room end. Coordinate labeling requirements for AV system during preconstruction kick off meeting.

C. See plans for patch panel layouts within AV rack.

1. Provide quantities as necessary.

2.05 DIGITAL SIGNAL PROCESSOR & CONTROLLER

A. The system processor shall provide up to 128 x 128 networked audio channels individually configurable as either Q-LAN or AES67 formatted networked audio. Networked audio channel count will reduce to 80 x 64 (Q-SYS version 9.7 and later) or 64 x 64 (Q-SYS version 9.6 and earlier) when using video bridging capability on the built-in USB Type-B Device port. Additionally, the system processor shall include 8 x 8 Software-based Dante network audio channels and is licensable for up to 32 x 32 Software-based Dante capacity. Software-based Dante channels used subtract from the overall 64 x 64 network audio capacity. The system processor shall support 24 total analog I/O capacity and shall be presented in the following groupings; 8 Mic/Line inputs, 8 Line outputs and 8 Flex Channel I/O which shall be software definable analog inputs or outputs in single channel increments in any combination ratio. The system processor shall be capable of connecting to any host PC, Mac or embedded device via USB and will present itself as up to four virtual external sound devices each offering Speakerphone (with or without Acoustic Echo Cancellation) or a Soundcard plus a single USB Webcam for Soft-Codec conferencing and other applications.

B. The system shall perform all of its real-time audio, video and control processing using Intel(r) processors running a purpose built, real-time Linux operating system developed by QSC, LLC. The system processor shall operate natively on a standard gigabit Ethernet infrastructure available from a broad range of network infrastructure manufacturers, employing DiffServ quality of service, IGMP, IEEE 1588-2008 (PTPv2) precision time protocol, UDP/IP audio and video transport with floating-point format audio data representation. The system shall support 802.1x authentication. The system shall not require IEEE 802.1AS, IEEE 802.1Qat, or IEEE 802.1Qav support on the network infrastructure to function. The overall system latency from analog input to synchronized analog outputs anywhere on the network shall be 3.167 mS. The system shall also be able to achieve an overall system latency of 3.167 mS over Layer-3 routed network infrastructure without any additional hardware, software or connection services between subnets.

C. The system processor shall manage external control interfaces such as Touchscreen Controllers, Paging Stations, Networked Audio I/O Expanders, Network Connected Amplifiers, AV-to-USB Bridging interfaces and IP-based PTZ Conference Room Cameras.

D. The system processor shall have the following front panel controls and indicators: Unit ID button, ID green LED, and Power On blue LED. A web interface shall provide basic network, services, and security configuration, status, and log retrieval. The system processor shall be natively integrated into Q-SYS Designer Software for network discovery, real-time configuration, control, monitoring, supervision, and management.

E. On the rear panel, the system processor shall have one 3-pin RS232 Euro Block Connector, HDMI Video Out, RJ11 for POTS telephony, USB Type-B Device port to provide AV-to-USB Bridging capability. Q-SYS Network: LAN A RJ45 1000 Mbps only, LAN B: RJ45 1000 Mbps only.

F. The system processor shall offer up to 16 channels of built-in Acoustic Echo Cancelation at the default tail length of 200 mS which can optionally be configured via software for 100 mS, 300 mS or 400 mS tail length affecting minimum and maximum channel capacity on a linear sliding scale.

G. The system processor shall natively offer up to four (4) Softphone instances assignable to the built-in network interface ports.

H. The system processor shall include support for up to four (4) tracks of audio recording and sixteen (16) tracks of audio playback. Audio playback capacity may be expanded by field application of software licenses to expand this capacity to either 32 in combination with field-installable media drive expansion in available small, medium, or large options.

I. The system processor shall store, and operate from, a single design that shall be comprised of audio, video, and control components, wiring, links, text, and graphics on a single or multiple schematic pages. Designs shall include any of the following audio DSP, video, test and measurement components, control components, and layout components: Acoustic Echo Cancellers, Audio Players, Audio Streaming components, Crossfaders, Crossovers, Delay components, Auto Gain control elements, Compressors, Gates, Duckers, Expanders, Ambient Noise Compensators, Limiters, Gain blocks, Graphic Equalizers, Parametric Equalizers, FIR Filters, All-Pass Filters, Band-Pass Filters, Band-Stop Filters, High-Pass Filters, Low-Pass Filters, FIR High-Pass filters, FIR Low-Pass Filters, Dual-Shelf Equalizers, Notch Filters, Meters, Matrix Mixers, Gain-Sharing Automatic Mixers, Gated Automatic Mixers, Signal Routers, Public Address Routers, Room Combiners, Signal Presence Meters, SIP Softphone instances, Tone Generators, Noise Generators, Dual Trace FFT Measurement Modules, Real Time Analyzers, Signal Injectors, Signal Probes, Logic, Value and Position control functions, Lua scripting components, Command Buttons and Triggers, Camera Router, USB Audio Bridge, USB Video Bridge.

J. The system processor shall be optionally enabled with a comprehensive control engine having user space access to a Lua programming environment and ability to host 3rd party plugin integrations via a field applicable software license

K. The system processor shall support custom user control interfaces on either proprietary touch screen controllers, network computers utilizing a control application, iOS devices, or any device with a standard web browser. Custom control interfaces shall be capable of having multiple user-selectable pages with different controls on each.

L. The system processor shall be 1RU with an enclosure measuring 1.75" x 19" x 11.12" (44 mm x 483 mm x 356 mm). The system processor and control engine shall be the Q-SYS Core 110f network + analog I/O processor (v2).

1. Provide one (1) Q-SYS Core 110f.

2. The Q-SYS Core 110f shall be mounted in the AV Equipment rack.

3. The Q-SYS Core 110f shall serve as the central processor EOC, Community Room, and Training Room Integrated AV system.

M. Provide additional licenses as required for a complete and functional system. Including but not limited to:

1. Q-SYS Core 610 UCI Deployment Software License, Perpetual. Model # SLQUD-110-P.

2. Q-SYS Core 610 Scripting Engine Software License, Perpetual. Model # SLQSE-110-P.

3. Q-SYS Software-based Dante 32x32 Channel License, Perpetual. Model # SLDAN-32-P for Core 110f.

2.06 AMPLIFIER

A. The amplifier shall contain all solid-state circuitry with a high-efficiency Class D output section. The amplifier shall have a universal power supply that utilizes active power factor correction and operates on 100 to 240 volts, 50 to 60 Hz, AC mains power. The power supply shall switch to a very low-power standby state after 25 minutes of inactivity and shall switch on in less than 1 second when an input signal appears, with the audio automatically resuming previous levels without causing audible pops or other noises. The amplifier shall consume no more than 40 watts at idle and less than 3 watts in full standby. The amplifier shall have a chassis-mounted IEC mains connector and shall be equipped with a removable power cord. A "remote" connection on the rear panel will allow the amplifier to be put into standby.

B. The amplifier shall have four audio channels, each with its own input and output. Switches on the rear panel shall allow each channel to be configured independently for 4Ω or 8Ω loads or for 70V or 100V distributed lines. The amplifier shall be rated at 200 watts per channel (nominal) into 4Ω and 8Ω loads and into 70- and 100-volt distributed lines. The amplifier's power supply-sharing topology shall provide a maximum of 400 watts to each pair of channels, with limiters automatically permitting each channel to deliver up to 400 watts as required. A selectable 80 Hz high-pass filter shall be available to reduce risk of loudspeaker transformer saturation. The amplifier shall have SPDT relay outputs (common, normally open, and normally closed) for providing system operational status to third-party devices.

C. The amplifier shall be cooled by fan-forced air, with intake at the chassis sides and exhaust through the front, and shall have a recommended ambient temperature operating range of 0 to 35° C; the maximum operational range of ambient temperature shall be -10 to 50° C.

D. The amplifier shall be UL listed, CE and RoHS/WEEE compliant, and FCC Class B certified.

E. The amplifier inputs shall be balanced but also capable of operating unbalanced, with an input impedance of 10 kΩ or higher and able to handle signals of 12.3 V rms (+24 dBu) before clipping. The inputs shall use four green 3-position Euro-style connectors with a 3.5 mm pitch. The four channel outputs shall use two (2) green 4-position Euro-Style connectors with a 5 mm pitch and two retention screws. A black 5-position Euro-style connector with a 3.5 mm pitch shall allow for optional remote control of standby and for amplifier status verification. The amplifier's input sensitivity voltage shall be +4 dBu (1.2 V rms) at full gain.

F. Notwithstanding the 80 Hz bridged mono high-pass filter, the amplifier's frequency response shall be flat within ±0.5 dB over 20 Hz to 20 kHz. The unweighted signal to noise ratio shall be greater than 103 dB over 20 Hz to 20 kHz.

G. The amplifier shall reside in a black 1 rack space high, 19-inch rack-mountable chassis with dimensions (height × width × depth) 1.75 × 19 × 13.6 in (44 × 483 × 345 mm).

H. The amplifier's front panel shall have only LED indicators, and no switches, knobs, nor other controls. The front panel LEDs shall be one power indicator, along with a signal indicator and a limiter/protect indicator for each channel.

I. The amplifier's rear panel shall contain all the input, output, remote, and mains connections. It shall also contain a rotary gain and a bicolor LED indicator for each channel. Each channel's gain control shall be labeled in dB of attenuation, with "0" at maximum gain, or fully clockwise, and an infinity symbol at minimum, or full counterclockwise. Each channel's LED shall light green to indicate presence of an output signal or red to indicate limiting or protect mode. The rear panel shall contain four subminiature groups of three toggle switches for configuring the amplifier channels and engaging the 80 Hz high-pass filters. The four possible configurations for each channel shall be 4 ohm, 8 ohm, 70V, and 100V. The maximum gain in these configurations shall be: 27 dB (4 ohm); 30 dB (8 ohm); 35 dB (70V); and 37.4 dB (100V).

J. The amplifier's net weight shall be 9.3 lb (4.2 kg) and its shipping weight, 13.9 lb (6.3 kg)

K. The amplifier shall be the QSC MP-A40V.

1. Provide one (1).

2. Locate in AV equipment rack.

2.07 SPEAKERS

A. Ceiling Mount Speakers:

1. The ceiling-style 2-way co-axial system shall incorporate a 6.5-inch woofer with treated-paper cone and a 19 mm aluminum dome tweeter. The tweeter shall be mounted coaxially in front of the woofer on a waveguide that matches the directivity of the two drivers at the 1900 Hz crossover point.

2. The system shall meet the following performance criteria: conical coverage angle of 135 degrees; effective frequency range of 56 Hz to 20 kHz +0/-10 dB, measured on axis; broadband sensitivity of 88 dB (measured at 1 m with 4 V rms input); maximum continuous output of 106 dB SPL and maximum peak output of 112 dB SPL on axis at 1 meter; power handling of 60 watts for 8 hours with an IEC noise signal; recommended amplifier power of 120 watts; nominal impedance of 16 ohms.

3. The loudspeaker shall have a switchable low-distortion, wide-bandwidth laminated core transformer with taps for 60, 30, 15, and 7.5 watts at 70V and 60, 30, and 15 watts at 100V. The system shall be switchable between 16Ω (bypass) and constant-voltage operation.

4. The loudspeaker shall have an ABS enclosure. The baffle and the grille shall have either a white (RAL 9010) or black (RAL 9011) paintable finish with UV inhibitors to prevent discoloration. The enclosure shall retain the grille magnetically. Any logo on the grille shall be removable without leaving a blemish.

5. The loudspeaker connections shall be a locking 4-pole Euro-block that accepts two 12 AWG wire pairs.

6. The loudspeaker shall be listed as safe for use in air-handling spaces under UL1480. The loudspeaker shall meet or exceed IP-34 for ingress protection. The switchable transformer shall be listed under UL1876 and shall be CE and RoHS compliant. The baffle shall meet UL94-V0 and UL94-5VB flammability ratings and shall comply with IEC60849/EN60849 safety standards.

7. The ceiling-style 2-way co-axial system shall be manufactured by QSC Model # AD-C6T-ZB.

a. Provide quantities as shown on the plans.

b. Speakers, boxes, covers, and wire management shall be white. Prior to ordering confirm color with Architect.

c. Wire the speakers in zones per room, with separate zones for the two divisible Community Room spaces with 70-volt groups not exceeding 80% of each channel's wattage.

2.08 CONTROL PANELS (CP1)

A. Provide a touch screen control panel for overall control of the A/V system.

B. The panel shall at a minimum have a 10" TFT active matrix color LCD display.

C. The panel will be IP controllable with a 10/100Base-T NIC and powered by PoE 802.3af.

D. See 1.02 System Operation elsewhere in this specification for control panel functions.

E. The control panel shall be manufactured by QSC, model # TSC-101-G3.

1. Provide quantities as shown on the plans.

2. Control panels shall be wall mounted.

2.09 SYSTEM PROCESSOR EXPANDER I/O MODULES

A. NETWORK (IP) to IR Infrared Control

1. The peripheral shall provide one input port and four output ports that are remotely configurable, providing an interface for off-the-shelf IR receivers and emitters. The peripheral shall include a power pin for external receivers and a local activity LED for each output. The peripheral shall provide access to an extensive collection of IR codes that is accurate and maintained while permitting the reception, storage, and routing of additional IR codes. Output ports shall also support RS-232, transmit-only. All ports shall be independently configurable from the system processor. The peripheral shall operate natively on a standard gigabit Ethernet infrastructure available from a broad range of network infrastructure manufacturers and shall support 802.1x authentication.

2. The peripheral shall operate on PoE or DC power input and have the following front panel controls and indicators: Unit ID button, green ID LED, and blue Power LED. A web interface shall provide basic network and security configuration, status, and log retrieval. The peripheral shall be natively integrated into Q-SYS Designer Software for network discovery, real-time configuration, control, monitoring, and supervision.

3. The peripheral's rear panel shall provide two 2-pin power Euroblock connectors for daisy-chainable DC power, a 3-pin Euroblock connector for IR input, a dual-row 8-pin Euroblock connector for IR output, four red IR activity LEDs, a recessed settings reset button, and two RJ45 connectors for daisy-chainable Ethernet configured as Q-SYS Network ports: one PoE port, RJ45 1000 Mbps only; one (1) Pass-thru port, RJ45 1000 Mbps only.

4. The peripheral shall feature multiple mounting options including a standard 19-inch rack or surfaces such as under-table or on-wall. It shall be one-quarter (1/4) rack space wide and less than one rack unit tall (1.59 inches / 4.04 cm), allowing mounting alongside quarter-rack width QSC Q-SYS QIO peripherals using an optional rack tray kit. The peripheral shall include two reversible steel angle brackets for surface mounting.

5. The peripheral dimensions shall be 1.59" x 4.25" x 5.5" (4.04cm x 10.80cm x 13.97cm).

6. The peripheral shall be manufactured by QSC Model # QIO-IR1x4.

    a. Provide one (1) for IR Infrared control of Cable TV Set Boxes and locate in AV Equipment Rack.

    b. Provide IR Emitters as required for the OFCI Cable TV devices listed elsewhere in this specification.

B. Label all devices and patch cords.

C. Provide 19” Rack Mount Bracket manufactured by QSC model # QIO-RMK.

D. Provide required wiring and coordinate with all trades required for a complete and fully functional system.

2.10 NETWORK VIDEO ENDPOINT (NI2)

A. The network video endpoint shall be a component in a distribution system that routes 4K60 4:4:4 video over a Gigabit Ethernet network. It shall use Q-SYS Shift data compression to ensure highest quality with very low latency. The endpoint shall have three HDMI 2.0 Inputs and two HDMI 2.0 outputs and shall be fully compliant with HDCP 1.4 and 2.2. It shall also support AV bridging with QSC Q-SYS PTZ-12x72 and PTZ-20x60 cameras. It shall have an RJ45 network port with Power over Ethernet (802.3bt) compatibility.

B. The network video endpoint shall natively route audio data through a QSC Q-SYS network without needing to use AES67 or the Q-SYS Media Stream Receiver. Its sound card-level stereo analog audio inputs and outputs shall be on 3.5 mm TRS connectors. It shall function as a transmitter or as a receiver, depending on the configuration by the user.

C. The network video endpoint shall be mountable in a standard AV rack or on a surface. It shall be a half rack space wide and one rack unit (1.75 inch) tall, allowing it to be mounted beside other half-rack equipment such as the Q-SYS I/O-8 Flex and QSC SPA Series power amplifiers.

D. The network video endpoint shall be powered through the network port using Power over Ethernet.

E. The network video endpoint shall be manufactured by QSC Model # NV-32-H.

1. Provide quantities as shown on the plans.

    a. Endpoints shall be surface mounted within lecterns or utilized as floating devices for HDMI source connection to end user laptops.

2. Configure as a Peripheral Mode Encoder.

3. Provide two (2) 3’ HDMI 2.1 patch cords for each Endpoint.

4. Provide one (1) 3’ USB USB3.0 A/B patch cords for each Endpoint.

    a. Endpoints shall be configured to support web conferencing integration with Teams meetings on owner provided laptops.

2.11 NETWORK VIDEO ENDPOINT (NI1)

A. The network video endpoint shall have one HDMI 2.0 input, one USB-C input, and one HDMI 2.0 output. The endpoint must support video distribution for formats up to 3840x2160p60 4:4:4 from both HDMI and USB-C inputs. The USB-C input of the network video endpoint shall support a single connection for audio and video distribution through USB-C alt-mode DisplayPort, bridging audio and video signals to an application on the host via UAC/UVC, and USB-C PD (power delivery) of up to 65 Watts shall be available for device charging. The endpoint shall support Consumer Electronic Control (CEC) of connected devices on the HDMI Output. The endpoint shall support USB HID signal routing between hosts and devices.

B. The network video endpoint shall be user configurable to be either a transmitter (encoder) or receiver (decoder). The network video endpoint shall use Q-SYS Shift data compression to ensure high-quality and low-latency network video transport of video formats up to and including 3840x2160p60 with 4:4:4 chroma sampling. It shall support HDCP 1.4 & 2.3 and encrypt video transmission on the network. The HDMI 2.0 output must scale incoming content from the network and local input connections.

C. The endpoint shall be powered by an external 12V DC 9 A auxiliary power supply or via PoE Type 3, Class 5 (40w at PD, 45W at PSE) from a capable network switch or midspan injector. It is acceptable for an auxiliary power supply to be required if device charging is needed.

D. The network video endpoint shall operate natively on a standard gigabit Ethernet infrastructure available from a broad range of network infrastructure manufacturers, employing DiffServe quality of service (QoS), IGMP, IEEE 1588-2008 (PTPv2) precision time protocol, UDP/IP audio, and video transport with floating point format audio data representation. The endpoint shall support 802.1x authentication. The endpoint shall communicate with the system audio processor without needing AES67, Dante, or Media Stream receiver components.

E. The network endpoint shall measure 7.3 x 5.2 x 1.2 in (185 x 131.5 x 30.5 mm).

F. The network video endpoint shall be manufactured by Q-SYS Model # NV-21-HU.

1. Provide quantities as shown on the plans

    a. Surface mount one (1) to the rear of each wall monitor and configure as a decoder.

    b. Rack mount one (1) for each audio visual output wall plate (AWO) shown on the plans and configure as a decoder. Endpoint shall provide HDMI connectivity for an HDBaseT extender kit to the AWO plate.

    c. Rack mount two (2) for connection to OFOI CATV boxes and configure as an encoder.

2. Provide one (1) HDMI 2.1 patch for each Endpoint.

2.12 HDBASET EXTENDERS

A. An HDMI over CAT6 HDBaseT extender kit shall provide HDMI output signal from the Q-SYS NI1 Endpoint to a wall plate receiver.

B. HDMI output signal shall be selectable from the control panel. Signal shall be utilized by 3rd party guests utilizing the rooms video feed for broadcasting purposes.

C. Transmitter shall be located on a rack shelf within the AV equipment rack.

D. Receiver shall be installed in a double gang decora wall plate. The 2nd decora gang shall be utilized for an audio output connection from the Core 110f.

E. Transmitter shall be from Extron model # DTP3-T-202.

1. Provide one (1) at the AV equipment rack for each AWO location shown on the plans.

F. Receiver shall be from Extron model # DTP-R-HWP-4K-231-D.

1. Provide one (1) at each AWO location shown on the plans.

2.13 EQUIPMENT RACKS

A. The main equipment rack shall have front locking door(s). Furnish with master AC control panel, and locking storage drawer as noted elsewhere in this specification. Fill all unused space with blank panels of a matching color and texture as the main rack.

B. The Fixed Racks shall have the following features:

1. Complies with 19” wide rack EIA 310D standards.

2. Color: Black.

3. Front Door: Yes.

4. Rear Door: Yes.

5. Side Panels: Yes.

6. Roof: Yes.

7. Floor Mounted Rack (Where shown on the drawings):

   a. Manufactured by Lowell: Model # LER-4432

8. Rack Height: Sized as required, plus an additional 20% spare capacity after all equipment has been installed.

9. Provide the “-VT” vented top model.

10. Provide the “L2150 Series ‘PF’” perforated front door

11. Provide the "-S" for Seismic rated applications, where required by Code or as required by the construction documents.

12. Provide the rack shelves manufactured by Lowell, model # L15-514. Provide minimum two (2) per rack.

13. Provide the rack drawers manufacture by Lowell, model # UDP-414. Provide one (1) per rack.

14. Provide the vertical power distribution units at the back of the rack manufactured by Lowell, model #ACS-1524. Provide one (1) per rack.

15. Provide vented blank filler plates manufactured by Lowell, Model # L5-191.

16. Horizontal cable management rings manufactured by Lowell, Model # CMD1H.

2.14 SURGE SUPPRESSORS/POWER CONDITIONERS

A. UL 1449 Adjunct Classification Test result shall have zero failures at 1000 surges of 6000 volts, 3000 amps, B3 pulse. The measured suppressed voltage of this test shall be 170 volts with zero failures.

B. The surge suppressor will also have an EMI and RFI filter for power conditioning. It shall have the following cut off frequencies in "Normal" mode (50-ohm load): 40 dB @ 100 kHz; 50 dB @ 300 kHz; 50 dB @ 3MHz; 50 dB @ 30MHz.

C. Rack Mount Type:

1. The sound system shall have a 1U rack-mountable surge suppression unit. It shall be capable of a 20 AMP load at 120 volts.

2. The unit shall also be capable of remote turn-on with an applied voltage range of 5-30 volts DC.

3. The surge suppressor shall be manufactured by Surge-X, model # SX-1120-RT.

a. Provide one (1)

2.15 FLAT PANEL MONITORS & MOUNTS

A. Monitors shall be from LG Model # UR340C or approved equal

1. Provide quantities as shown on the plans.

a. Monitors in rooms EOC B1004, Community Room A1004, and Training Room A1007 shall be provided under Division 27 41 16 Integrated Audio Visual System. All other monitors shown on the plans shall be provided under Division 27 41 00 General Audio Visual System.

2. Provide monitor size for each location as shown on the plans.

a. 'M##' annotation on plans - ## indicates monitor diagonal in inches

b. Size options in 43", 50", 55", 65", 75", 86"

B. Provide Chief PDR series Articulating / Swivel / Tilt mounts with Chief PSBU series VESA bracket. Mounted directly over the specialty AV back box.

1. Provide one articulating mount and VESA bracket for each monitor.

C. Specialty AV monitor back box.

1. At select monitor locations, a 14.25" square recessed back box shall be provided and installed.

a. See plans for exact locations of specialty large AV back box.

b. Data at specialty back box locations shall be installed directly into the recessed back box with face plate flush with the inside top edge of the box.

c. Power shall be integral to the box and circuited as necessary.

d. See plans for additional conduits requirements for AV cabling to back box.

e. Specialty AV monitor back box shall be from Chief model # PAC526FBP2.

D. The general contractor shall provide in-wall backing/blocking to support up to 300lbs or more at each Monitor / Display / TV mounting location.

2.16 ASSITED LISTENING SYSTEM

A. Provide a complete stationary assisted listening system to include all associated cabling.

B. The stationary assisted listening system shall contain the following components:

1. The stationary RF Transmitter (72MHz) shall be manufactured by Listen Tech, model # LT-800-072-01-D and shall be compatible with the assisted listening receivers listed in this specification.

a. Provide four (4).

b. Locate in AV equipment rack.

c. Provide rack mount kit Model # LA-326.

2. The 90 Degree Helical Antenna (72MHz) shall be manufactured by Listen Tech, model # LA-123.

a. Provide four (4).

b. Provide antenna splitter/combiners as necessary to allow the separate RF kits operate independently or together when spaces are combined.

3. Receiver:

a. The portable receiver shall operate wirelessly in the 72Mhz band and be fully digital.

b. The wireless receiver shall be manufactured by Listen Tech, Model # LR-3200-072

1) Provide two (2) for EACH kit

4. Neck Loop:
    a. Neck loops shall provide wireless transmission to T-Coil compatible hearing aids and cochlear implants.
    b. The neck loop shall plug directly into the wireless receiver.
    c. The neck loop shall be manufactured by Listen Tech, Model # LA-430
        1) Provide two (2) for EACH kit
5. Earphone:
    a. The single piece earphone shall be manufactured by Listen Tech, model LA-161
        1) Provide four (4) for EACH kit
6. USB Charger:
    a. The USB Charger shall provide 4-ports.
    b. The USB Charger shall be manufactured by Listen Tech, Model # LA-423.
7. Assistive Listening Notification Signage Kit
    a. The Assistive Listening Notification Signage Kit shall be manufactured by Listen Tech, Model # LA-304.
    b. Coordinate with the architect prior to rough-in for exact location.

C. The kit “LP-4VP-072-01” plus additional neck loops may be provided.

D. Test and commission each component and provide training on how to operate the transmitters and receivers.

2.17 MICROPHONE SYSTEM

A. Wireless Microphones:

1. Provide a complete wireless microphone system to include charging stations and all associated cabling. Coordinate the microphone operating frequencies with the receiver frequencies.

2. The frequency-agile FM wireless microphone system shall consist of a receiver and the appropriate transmitter, and shall operate in the UHF bands of 470.125–529.975 MHz or 530.000–589.975 MHz. The frequency-agile FM wireless receiver shall be all-metal and shall provide an automatic scanning function to select appropriate local usable channels for proper wireless system operation. It shall be a True Diversity receiver with two independent internal receiver sections, automatically selecting the highest quality signal for the receiver's output. All receiver settings shall be adjusted by using a control dial and BACK button on the receiver's front panel. The system will be equipped with an advanced pilot tone digital identification system to ensure that the desired wireless transmitter allows the receiver to be unmuted, reducing noise from unwanted signals. The receiver shall have an IR sync window on the front panel to sync settings with transmitters. It shall also have a dual-mode front panel display that switches between a standard view, which provides continuous indication of RF signal strength, frequency, mute status, audio modulation level of the received signal and other transmitter information, and a performance view, which highlights key metering. The receiver shall have a rear panel selector to lift the ground connection from pin 1 of the XLR-type output connector to prevent ground loops. The receiver shall be able to be powered by 12V DC 1A. Antennas shall be located on the rear of the receiver and shall incorporate standard BNC-type connectors to allow them to be detached from the receiver to facilitate the receiver being used with external antennas or antenna distribution devices. Switchable 12V DC power shall be provided on the BNC-type connectors. An accessory bracket should allow for the antennas to be located at the front of the receiver. The receiver can be rack-mounted singly or in pairs in a single rack space. The receiver's design shall provide totally silent audio output mute when the wireless transmitter is turned off or the signal is lost. The wireless receiver and the supplied metal rack-mounting brackets shall be industrial black.

3. The frequency-agile FM wireless body-pack transmitter shall have microphone and instrument level inputs. It shall provide DC voltage to power microphones requiring DC bias. The body-pack transmitter shall be part of a wireless microphone system operating in the bands of 470.125–529.975 MHz or 530.000–589.975 MHz. The body-pack transmitter shall have a reversible clip allowing for up or down cable entry. The transmitter shall have a screw-down 4-pin connector and a viewable fuel gauge to indicate the remaining battery life. Frequencies shall be selected using the transmitter's soft-touch controls. The transmitter shall also be equipped with a multifunction button that can be programmed to perform one of two functions when pressed and held: turn off RF transmission or switch to a preselected backup frequency. (The multifunction button can also be disabled.) The device shall have a dual-color LED that illuminates green when the power is on and illuminates red when the transmitter is muted or battery power is low. There shall be an adjustment to allow input gain changes in 2 dB steps with a total range of 30 dB. There shall be a switchable 125 Hz high-pass filter. The transmitter shall include a pilot tone to identify the wireless transmitter to the wireless receiver. The transmitter shall utilize two RF output power levels and shall operate on two AA batteries. The battery compartment shall be locking. All setting adjustments shall be via soft-touch controls and shall remain as set even if the transmitter loses power or the batteries are removed. The transmitter shall have an IR sync button to allow receiver settings to be synced with the transmitter. An OLED screen shall be provided to show transmitter setup parameters or frequency. Charging terminals on the base of the transmitter shall work with an optional smart charging dock to recharge AA NiMH batteries installed in the transmitter. The transmitter shall have a removable and field-replaceable antenna.

4. The frequency-agile FM wireless handheld transmitter shall be part of a wireless microphone system operating in the bands of 470.125–529.975 MHz or 530.000–589.975 MHz. The transmitter shall come with either a dynamic or a condenser cardioid microphone capsule, which shall screw onto the transmitter's industry-standard thread mount. Each capsule shall incorporate internal shock mounting and have a two-stage integral pop filter. The transmitter shall also work with additional capsules specifically designed for the transmitter (available separately) as well as other compatible capsules. The transmitter shall have a metal housing with a plastic antenna end cap. The transmitter shall transmit a digital pilot tone that allows the receiver to unmute. The transmitter shall also be equipped with a multifunction button that can be programmed to perform a specific function when pressed and held mute the audio; mute the audio even when the transmitter is locked; turn off RF transmission; or switch to a preselected backup frequency. (The multifunction button can also be disabled.) A dual-color LED indicator shall illuminate green when the power is on and red when the transmitter is muted or battery power is low. An OLED screen shall be provided to show transmitter setup parameters or frequency. The microphone shall have an audio input level adjustment range of 30 dB in 2 dB steps. It shall also have a switchable 150 Hz high-pass filter. All setting adjustments shall be via soft-touch controls and shall remain as set even if the transmitter loses power or the batteries are removed. The transmitter shall have an IR sync button to allow receiver settings to be synced with the transmitter. The transmitter shall operate on two AA batteries and contain a Hi/Lo RF power selector. A battery fuel gauge shall be incorporated to indicate the status of the internal batteries. Charging terminals on the base of the transmitter shall work with an optional smart charging dock to recharge AA NiMH batteries installed in the transmitter. The transmitter shall be supplied with a heavy-duty stand clamp.

5. A two-bay charging dock shall also be available as an optional component. It shall charge AA NiMH batteries that are installed in body-pack or handheld transmitters. The charging dock shall automatically shut off if alkaline or damaged batteries are detected in the transmitters. A single power supply shall power up to five linked docks. A networked version of the charging dock shall also be available as an optional component. The networked dock shall be capable of monitoring the charging status of all transmitters in up to five linked docks.

6. The Wireless Microphone (Handheld) shall be manufactured by Audio Technica Model # ATW-3212/C710. Includes: ATW-R3210 receiver and ATW-T3202 handheld transmitter with ATW-C710 cardioid condenser microphone capsule.

    a. Provide four (4) kits.

7. The Wireless Microphone (Ear-Worn) shall be manufactured by Audio Technica Model # ATW-3211/894X. Includes: ATW-R3210 receiver and ATW-T3201 body-pack transmitter with BP894xcH MicroSet cardioid condenser headworn microphone (black). Includes windscreens, clothing clip, and dual-ear adapter kit.

    a. Provide one (1) kit.

8. Rack mount the wireless microphone receivers in the AV Equipment rack with the included rack mount hardware.

9. Ceiling mount the wireless microphone receivers remote antennas as shown on the plans.

10. The Wireless Microphone two-bay charging dock shall be manufactured by Audio Technica Model # ATW-CHG3.

a. Provide four (4) and locate in the AV equipment rack.

B. Beamforming Array Ceiling Microphone for teleconference

1. The beamforming array microphone, designed for use in conference rooms, boardrooms, and other meeting spaces, shall mount flush or on the surface of a drop ceiling or hard ceiling, or in open architecture spaces using a standard VESA mount. The microphone shall come with surface- and flush-mount adapters, a flush-mount cover, mounting screws and nuts, tile-bridge assembly, installation template, a seismic cable, Euroblock connectors, snap bushings, and a hole cover that can be used when only a single conduit is connected.

2. The microphone shall have six individual output channels, which, collectively, can be configured with up to 32 user-defined microphone pickup zones. Output Channel 1 shall be configurable with up to sixteen (16) user-defined Coverage Zones to ensure coverage of nonpriority or unplanned participants. Output Channels 2–6 shall be configurable with up to 16 user-defined Priority Zones to ensure priority pickup of participants in known locations. The microphone's 90-degree orthogonal beams shall function across all output channels, enabling it to focus on particular points in space and prevent the pickup of unwanted noise. Voice activity detection (VAD) technology shall enable the microphone to discern between a voice and unwanted noises such as paper shuffling.

3. The microphone shall have an onboard DSP with functions that include automix, acoustic echo cancelation, noise reduction, automatic gain control, and 4-band EQ. The face of the microphone shall be outfitted with a reset button and an IR window to receive mute and other control signals from an included IR remote.

4. The microphone shall have a frequency response of 60 Hz to 18,000 Hz and be capable of handling sound input levels up to 102 dB.

5. The microphone shall support Dante network digital audio protocol for signal transmission.

6. The Beamforming Ceiling Array Microphone shall be manufactured by Audio Technica, Model # ATND1061DAN Beamforming Ceiling Array Microphone.

a. Provide eight (8).

b. Surface mount to ceiling tile.

c. All mounting hardware, boxes, covers, and wire management shall be white.

C. Gooseneck Microphones

1. Microphones shall be surface mounted at lecterns and connected the AV/Dante network through floor box AF2 plates.

2. Audio Technica Model # ATND8677a Dante base with U857Q cardioid gooseneck attachment

a. Provide four (4).

2.18 TELECONFERENCE CAMERA (PRESENTER / INSTRUCTOR VIEW)

A. The video camera shall have an RJ-45 connector for connecting to a 1000 Mbps Ethernet network. The camera shall only be powered via Power over Ethernet (PoE). The camera shall use the network for transmitting video to one or more bridging endpoints without the need for USB extenders. The camera shall also use the network for control and monitoring.

B. The camera shall have a 1/2.8" CMOS 4K image sensor with a ≥55dB signal-to-noise ratio. The lens shall have a 20x optical zoom, a horizontal field of view of 60°- 3.5°, and a focal length of 6.25-125mm. The camera shall utilize motors for pan, tilt, and zoom (PTZ) and output an IP video stream from the camera directly to the bridging endpoint. The camera movement shall be controlled exclusively via the network. The camera output shall have a 16:9 aspect ratio.

C. The camera shall include a bracket to allow for the camera to be surface mounted. The camera should have an optional mounting accessory for ceiling mounted installations. The camera should have necessary imaging controls to allow for inverted mounting.

D. The camera shall have an operating temperature range of 0°C - 40°C and a storage temperature range of -40°C - 60°C. The camera shall weigh no more than 2.4 kg and shall not exceed 142mm x 201mm x 170mm (width, height, depth) in size.

E. The camera shall integrate natively with the QSC Q-SYS Ecosystem for discovery, control, signal routing, firmware management, and bridging.

F. The camera shall be the QSC Q-SYS NC-20x60.

1. Provide five (5).

2. Ceiling mount each camera with QSC Model # PTZ-CMB1 ceiling mount bracket.

3. Utilize QSC QSYS Automatic Camera Preset Recall Plugin based on positional data gathered from the ceiling microphone array.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install each system shown as indicated, in accordance with equipment manufacturer's instructions, and with recognized industry practices.

B. Mount the projector in the ceiling per manufacturer's recommendations.

C. All low voltage and signal wiring shall be run exposed in the ceiling space.

D. Program the Switcher/Receiver per manufacturers recommended settings. All devices with RS-232 controls in the system shall be controlled by the Switcher/Receiver.

3.02 SYSTEM TESTING

A. The system testing shall conform to the requirements of Section 27 00 00.

B. The Installing Vendor shall provide the staff with walkie-talkies, test equipment, additional equipment, resources, and time necessary to support BCE Engineers to provide the Commissioning of this System. The Installing Vendor shall demonstrate to BCE Engineers the complete operation of each device, head end functionality, system configuration, and software functionality. The Installing Vendor shall also make adjustments to the equipment and changes to the program settings, as requested. This testing shall be typical of four (4) locations, selected by the Electrical Engineer.

3.03 INTEGRATION TO OTHER LOW VOLTAGE SYSTEMS

A. See "System Operation" listed elsewhere in this specification for more information.

3.04 ON-SITE TRAINING

A. On-site training shall follow a written training plan, prepared in advance. The training plan shall outline the topics to be covered, the publications to be used, and the training schedule.

B. Supply two (2) hours minimum of training for the Owner's staff in operating and maintenance of the television distribution system. Training time shall be extended as necessary to satisfy the Owner's Representative that all pertinent topics have been adequately covered.

C. The training shall be conducted after the operating and Maintenance Manuals for the Project are completed and available for use during the training session.

D. Maintain a training sign-in sheet, upon which participants in the training session, including the instructors, shall record their names. Training sign-in sheet shall be dated.

E. The training shall be conducted by a representative of the equipment manufacturer who is thoroughly familiar with the equipment and its features, and also with the installation on this Project. The training shall include instruction and field demonstration. As a minimum, the training shall cover, but not be limited to, the following topics:

1. General Overview of the system, including purpose and principle of operation.
2. System features, including expansion capability.
3. Interpretation of system outputs (indicators, displays, etc.).
4. Operation of system controls (gain controls, slope adjustment, etc.).
5. Recommended maintenance procedures and intervals.
6. Detailed trouble-shooting instructions.
7. Explanation of service agreement options.

F. At the conclusion of the training session, insert a copy of the training sign-in sheet into the Operating and Maintenance Manuals. Submit another copy of the training sign-in sheet to the Architect.

3.05 AS-BUILT DOCUMENTATION

A. Operation and maintenance manuals and the as-built drawings shall conform to the requirements of section 27 00 00.

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SECTION 27 51 13

PAGING SYSTEM

PART 1 GENERAL

1.01 SCOPE AND RELATED DOCUMENTS

A. The Installing Contractor shall provide new equipment at the project site and include the necessary programming for control functions of the new System.

B. The intent of this specification is to describe necessary equipment and software for a complete and properly operating paging system for amplification, distribution, and reproduction of voice and audio program material.

C. Furnish and install a complete Paging System as described herein and as shown on the Plans; to be wired, connected, and left in first class operating condition. The system shall include, but not be limited to speaker assemblies, audio program controller and software, Amplifiers, conduit, junction boxes, fittings, wire, connections to devices, and all other necessary material for a completely reliable and fully functional system.

D. The Paging System Installing Contractor shall furnish and install all materials, although some items may not be specifically mentioned herein, which are necessary for the proper integration of the system, so that the system shall perform the functions listed herein in compliance with all the specified requirements.

E. Coordinate cable locations with Section 27 20 00 - Data & Voice Infrastructure Installing Contractor as required.

F. An important aspect of the construction process for this project is the Pre-Construction Kick Off Meeting, which shall take place PRIOR to Submittal of equipment data sheets. See “Submittals” and “Coordination” listed elsewhere within this specification.

G. The system shall meet ALL of the requirements listed in Section 27 00 00 - Low Voltage Systems General Requirements PART 3 “Testing & Complete System Functionality”, prior to “Substantial Completion”.

H. Contractual information, guidelines, requirements, or other work specified to provide a fully functional system for Section 27 51 13 includes but is not limited to the sections identified in Section 27 00 00.

I. Section 26 00 00 - Electrical General Conditions.

1.02 SYSTEM OPERATION

A. A Paging System shall be provided as specified and as shown on the electrical drawings.

B. The system shall, at a minimum, consist of the following: Paging System Software, 70V speakers, multi-channel amplifiers, DSP, paging microphones; and all of the associated materials, hardware, and wiring necessary for a comprehensive and completely installed system which shall meet the specified requirements.

C. The system amplifier, DSP, and network switch shall be installed within a designated telecommunications rack provided by Division 27 20 00.

D. The system must be capable of accepting a minimum of three (3) line audio source inputs for broadcast across the speaker system.

E. The system must be capable of managing a minimum of four (4) separate 70V speaker zones on independent amplifier output channels. Amplifiers must be sized as necessary to support the quantity of speakers shown for each designated zone. Speaker zone requirements are shown on the plans.

F. The system shall have the capability of future integration with the owner's VoIP system utilizing a SIP trunk to allow for paging to occur from any of the VoIP phones connected to the network within the building.

G. Features shall include paging announcements from any dedicated paging microphone to speaker locations on an all-call basis, or a preselected zone basis or multiple zone basis to any of the paging zones.

H. All programmable functions shall be stored on the Paging System Server.

1.03 QUALITY ASSURANCE

A. The system, devices, and equipment shall be manufactured under the appropriate category by Underwriters' Laboratories, Inc. (UL), and shall bear the UL label. Partial or pending listings are not acceptable. The installation of EACH device and/or component shall be in compliance with the UL listing. The system, devices, and equipment shall fully comply with the latest issue of these standards, where applicable, which includes, but is not limited to:

1. National Fire Protection Association (NFPA) - USA:

    a. NFPA 70 National Electrical Code

    b. NFPA 101 Life Safety Code

2. Meet or Exceed Building Codes and Standards:

    a. Local Authority Having Jurisdiction (AHJ) Requirements

    b. State

        1) WAC 51-20 Washington Barrier Free Regulations

    c. National:

        1) National Electrical Code (see NFPA 70)

        2) Americans with Disabilities Act

    d. International:

        1) International Building Code

        2) International Electrical Code (see NFPA 70)

        3) International Fire Code

B. The Paging System shall be supplied and installed by an authorized Manufacturer Certified/Authorized distributor. The Communication System Installing Contractor shall have furnished and installed similar communication systems for school applications continuously for no less than five years.

C. The Paging System Installing Contractor shall have a local office staffed with Manufacturer Certified/Authorized Technician, full-time employees who are capable of performing testing, inspection, repair, and maintenance services for the life of the system.

D. This Communication System Installing Contractor must have a minimum of five (5) years' experience servicing systems, maintain a 24-hour emergency service program and shall be located within a 50-mile radius of the project site.

E. Service and Software Modifications:

1. Provide the services of a Manufacturer Certified/Authorized Technician to perform all system upgrades or changes.

2. For emergency service, response time of the technician to the site shall not exceed four (4) hours. If the call is received by the Installing Contractor before 1:00pm, service shall be provided that day, and if the call is received after that time, then the response shall be the following business day.

3. Provide all hardware and documentation necessary to modify the system onsite. Modification includes addition and/or deletion of system devices, changes to system operation, and custom label changes for devices.

1.04 SUBMITTALS

A. Refer to specification 27 00 00 - Low Voltage Systems General Requirements, for additional data sheet submittal requirements and the shop drawing submittal requirements.

B. Refer to "As-Built Drawings" for additional requirements.

C. Data Sheets Submittals and Other Documentation:

1. Pre-Construction Kick Off Meeting:

a. **PRIOR to submitting any project Data Sheets**, coordinate with the General Contractor as described in Section 27 00 00.

b. **Submit the Coordination Questions** a minimum of fourteen (14) Days in advance of the meeting for Owner review for the Pre-Construction Kick Off Meeting as described under "Coordination" identified elsewhere in this specification.

c. The Installing Contractor shall document the Meeting Minutes of the Pre-Construction Kick Off Meeting as described under "Coordination" identified elsewhere in this specification.

d. **Provide the follow up documentation** for the Pre-Construction Kick Off Meeting as described under "Coordination" identified elsewhere in this specification.

e. The Installing Contractor shall make the necessary corrections or changes as discussed during this meeting and provide a revised formal Submittal through the normal construction channels.

f. Be sure to include ALL responses by the Owner in the revised formal Submittal.

2. Installing Contractor Staff Qualifications: Provide copies of the following information (Certification and Training documents):

   a. The Installing Contractor field staff installers (a minimum of 2) Installation certifications issued by the manufacturer of the equipment that is being installed.

3. Installing Contractor/Manufacturer Agreement: Provide the following documentation of the Manufacturer of the equipment being installed:

   a. The Installing Contractor shall be an Authorized Partner that is trained and certified by the Manufacturer of the equipment being installed.

4. Materials List:

   a. A complete materials list, which shall include: the quantity of each device, the manufacturer's name, model number, and a description of the equipment for each individual system component or device that will be provided. This list shall precede the data sheets.

   b. Equipment Data Sheets. Each System component or device data sheet shall have an indicating arrow next to each component or device that is being submitted.

   c. Prior to ordering or installation of any equipment, the Installing Contractor/Contractor shall obtain written approval by the Architect.

5. Provide ALL requested submittal documents in "Training Materials and Programming Survey" listed elsewhere in this specification. This includes, but is not limited items listed under "Interview the Owner":

   a. Provide a sample copy of the Training Syllabus.

   b. Provide a sample copy of the Step-by-Step Instructions.

D. Shop Drawing Submittals shall include the following items:

1. Prior to ordering or installation of any equipment, the Installing Contractor/Contractor shall obtain written approval by the Architect.

2. Provide the follow up documentation for the Pre-Construction Kick Off Meeting as described under "Coordination" identified elsewhere in this specification.

   a. The Installing Contractor shall make the necessary corrections or changes as discussed during this meeting and provide a Revised Submittal through the normal construction channels.

   b. Be sure to include ALL responses by the Owner in the Revised Submittal.

3. Outlets:

   a. Provide an Illustration of EACH Outlet type that is being provided for this project.

   b. Identify the quantity of EACH connector type on each outlet.

c. Identify the quantity of EACH Cable being routed to each Outlet type.

4. Device Point-to-Point Wiring Diagrams:

   a. Provide an Illustration of EACH Device that is being provided for this project.

   b. Identify EACH conductor and the equipment type and termination point that it is intended to be connected to.

   c. For equipment that is being connected to Integrate to another system, provide a brief description of the functional operation of the two different systems.

5. Device Mounting Details:

   a. Provide an Illustration of EACH Device that is being provided for this project.

   b. Identify the back box, conduit rough-in, and manufacturer recommended mounting method.

6. The Riser Diagram shall show the following items:

   a. Identify EACH Equipment location (the MDF and EACH designated IDF) separately.

   b. Identify a “typical” of EACH Outlet type and the associated cable (as described on the wire legend) routed to the MDF and EACH designated IDF location.

7. Rack and/or Equipment Layout:

   a. Show the intended equipment layout within EACH of the Rack(s) and/or Cabinets.

   b. Indicate the rack unit size of each device or filler plate in the rack.

   c. Show blank filler plates in spaces where equipment is not installed.

   d. If rack equipment is installed on the rear side of the rack, show rear view of the rack also.

   e. Show the equipment layout as it is intended to be installed.

8. An Elevation View of the Wall Mount equipment for the MDF Room and each designated IDF location shall be provided.

   a. The proposed locations for EACH wall mount device (control panel(s), power supplies, and other equipment), proposed cable routing, wire management, 120vac conduits (including receptacles and junction boxes).

   b. All equipment shall be shown to scale.

   c. Provide dimensions of the equipment, the space required between the adjacent item and the overall dimensions of the anticipated wall space.

9. Floor Plans shall show each Outlet type and Device type, style, and each individual cable required for EACH Outlet and Device.

10. Shop Drawings shall be specific to the System that is specified in the Section.

    a. Do NOT show other low voltage system equipment on the Shop Drawings, except where this system is integrated to other equipment and/or systems.

    b. Provide EACH device Symbol and related description (as described on the Contract Drawings) on the Legend with the text that states “provided by others”.

    c. Classroom Audio-Visual Systems integration as described on the Floor Plans and Riser Diagrams.

    d. Fire Alarm System integration as described on the Floor Plans and Riser Diagrams.

PART 2 PRODUCTS

2.01 MATERIALS

A. See Section 27 00 00 - Low Voltage Systems General Requirements for additional information.

B. Basis of design for the Paging System is Biamp TesiraFORTE AVB solution. Provide equipment as shown on the plans and per this specification for a complete and functioning paging system.

C. Provide all equipment as defined in this specification and shown on the drawings.

D. Refer to PART 1 for any equipment that is not specifically defined.

2.02 COORDINATION

A. Refer to “Submittals” for additional coordination requirements.

B. The Installing Contractor shall include in their bid; the time, staff, and materials that are necessary to perform the following services.

C. Provide the follow up documentation. Each of the items discussed during the Pre-Construction Kick Off Meeting shall be included in the Data Sheet Submittals and shown on the Shop Drawing Submittals.

2.03 PAGING DSP

A. Digital signal processor for the paging system shall be from Biamp Model # TesiraFORTE AVB AI or approved equal.

    1. Provide one (1)

2.04 PAGING MICROPHONE

A. Paging microphone shall be from Biamp Model # NPX 1100 or approved equal.

    1. Provide quantities as shown on the plans.

    2. See plans for wall mount or table top mount configuration.

    3. See plans for handheld or gooseneck style microphone.

2.05 CEILING SPEAKERS

A. Ceiling speakers shall utilize 70V operation.

B. The ceiling-mounted speaker/transformer/grille assembly shall be manufactured as a complete assembly by one manufacture.

1. Manufactured by Lowell, Model #R1810-72 or approved equal.

2. Provide quantities as shown on the plans.

3. Provide attenuator style volume control for speakers where shown on the plans.

2.06 VOLUME CONTROL

A. Provide single gang stainless steel wall plate.

B. Volume control locations shall only manage the audio levels for speakers located in the same room.

C. Use manufacturer approved connection.

1. Manufactured by Lowell, Model # LV-50S or approved equal.

2. Provide quantities as shown on the plans.

2.07 POWER AMPLIFIER

A. Provide 4-channel 70V capable amplifier. Size and quantity as necessary for speaker quantity.

B. Amplifier shall be from Biamp Model # TesiraXEL 1200.1 or approved equal.

2.08 PAGING SYSTEM NETWORK SWITCH

A. Utilize AVB network switch for connection to paging microphone, DSP, and power amplifier.

B. Network switch shall be from Biamp Model # NMS-NG10GPX-AVB.

1. Provide one (1).

2.09 SYSTEM CABLES

A. Provide speaker cable type as recommended by the speaker manufacture.

PART 3 EXECUTION

3.01 GENERAL

A. See Section 27 00 00 - Low Voltage Systems General Requirements for additional information.

B. Prior to rough-in, coordinate with the Architect for the exact location(s).

C. Install all cabling, devices, and/or equipment per the manufacturer's recommendation.

3.02 APPROVED EQUIPMENT AND PERMIT

A. No equipment shall be delivered to the jobsite until shop drawings have been reviewed and approved. An approved shop drawing set shall be continuously available at the jobsite during construction.

B. Obtain a permit as required from local AHJ prior to installation of equipment.

3.03 WIRING

A. All wiring shall be contained in steel raceways except as approved. Wiring insulation shall be one of the types required by NEC and shall be consistently color-coded throughout the system. Permanent wire markers shall be affixed to all conductors at terminations and splices.

B. Numbering system shall be consistent with shop drawings.

C. Install wiring and equipment in strict accordance with manufacturer's instructions. No wire other than the intercommunication system wire shall be permitted in conduit unless approved.

D. All cabling shall be spliced only in designated junction boxes, device boxes, or terminal cabinets. In-line splices in pull boxes are not permitted. Both ends of cable shall be marked utilizing `3M' wire markers.

E. Wiring shall be identified by room number, segregated, neatly laced, and terminated on telephone-type punch-on blocks.

F. Cable shall be laced together 18" O.C. and shall be supported from building structural members at not greater than 48" O.C.

G. All Cabling routed underground or under slab shall be rated for wet locations per the AHJ.

3.04 DEVICE LOCATIONS

A. Device locations may be changed within 15 feet without extra charge, if so, directed by the Engineer prior to installation.

3.05 TESTING AND ADJUSTMENTS

A. All testing documentation shall conform to Section 27 00 00.

B. Upon completion of the installation, all components and operational features shall be completely tested for proper operation and specification compliance. The owner reserves the right to witness any portion of the testing and adjustment process.

C. The communication system shall not exhibit any hum or noise under normal use. The loudspeaker system shall be adjusted to provide proper intercom, paging and tone levels into all areas of the school. Initially adjust sound pressure levels (at 1 meter) to 45db in offices,
65 dB in classrooms, 75 dB in corridors and 85 dB in gym, multi-purpose rooms and building exterior. After one week of operation, adjust to optimum level as directed by the owner.

D. The paging system shall be adjusted to provide an adequate and constant level of return speech through any telephone handset.

E. All station instruments shall be completely and clearly labeled. All labeling that is exposed to operator view shall be provided utilizing a typewriter or mylar tape type labeling machine to identify station numbers, function keys, speed dial buttons, pull out directories, etc., producing a neat and professional installation.

F. The Installing Contractor shall provide the Staff, walkie-talkies, test equipment, additional equipment, resources, and time necessary to support the Owner to provide the Commissioning of this System. The Installing Contractor shall demonstrate to the Owner the complete operation of each device, head end functionality, system configuration, and software functionality. The Installing Contractor shall also make adjustments to the environment and changes to the program settings, as requested.

3.06 AS-BUILT DOCUMENTATION

A. Provide all As-Built documentation as defined in Section 27 00 00 - Low Voltage Systems General Requirements and listed elsewhere in this specification.

B. All labeling shall match the final room number identification at completion of the project (not the room number that is indicated on the Bid Set of drawings). This includes but is not limited to As-Built Drawings and Test Results.

3.07 SYSTEM TRAINING

A. The first system training session shall occur during the normal course of project closeout and Owner occupation.

B. A second system training session is required and shall occur between 6 and 12 weeks after the facility has been fully occupied and in full operation. The contractor shall coordinate a time and location with the District to perform the second system training.

3.08 WARRANTY

A. All components, parts, and assemblies supplied by the manufacturer shall be guaranteed against defects in materials and workmanship for a period of 12 months. Warranty service shall be provided by a trained specialist of the equipment manufacturer. The specialist shall be based in a fully staffed office located within a 50-mile from the job site.

B. Contractor shall replace or repair defects in material of workmanship for a period of twelve (12) months after the certification of final acceptance.

END OF SECTION 27 51 13

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SECTION 27 53 19

DISTRIBUTED ANTENNA SYSTEM (DAS)

PART 1 GENERAL

1.01 SCOPE AND RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions and Division 0 and 1 Specifications sections, apply to work of all Division 26, 27, and 28 Specification Sections.

B. The Installing Contractor shall furnish and install all materials for a complete, fully functional UHF Distributed Antenna System (DAS) for Emergency First Responder PSN in accordance with this performance-based criterion, bidder-design specification and the contract drawings. The system shall be in full compliance with a "5 Year Warranty". The Installing Contractor shall be responsible for providing a complete, functional system including all necessary components, whether included in this specification or not.

C. The Installing Contractor shall furnish and install all materials for a complete, fully functional UHF Distributed Antenna System (DAS) for Cellular Amplification in accordance with this performance-based criterion, bidder-design specification and the contract drawings. The system shall be in full compliance with a "5 Year Warranty". The Installing Contractor shall be responsible for providing a complete, functional system including all necessary components, whether included in this specification or not.

D. The Installing Contractor shall submit detailed, installation Shop Drawings for review and approval. The system shall be installed, tested, modified and retested as necessary and required to meet the requirements and standards noted herein as well as to the satisfaction of the Local Authority Having Jurisdiction (AHJ).

E. The Installing Contractor shall provide for and schedule a UL inspection of the complete installation prior to final commissioning of the DAS.

1.02 QUALITY ASSURANCE

A. Pre-Approved Installing Vendor(s):

1. Powercom 425-489-8549
2. CTS 206-686-2000
3. Day Wireless 360-491-9000

B. The system installation, devices, and equipment shall fully comply with the latest issue of the standards listed below:

1. National Fire Protection Association (NFPA 72) 2016.
2. National Fire Protection Association (NFPA 1221).
3. National Fire Protection Association NFPA 5000 Building Construction and Safety Code, Annex F – In Building Radio Systems, 2013.

4. NFPA 5000; Building Construction and Safety Code, Annex F – In Building Radio Systems, 2013.
5. IFC 2013 International Fire Code Section 510.
6. Federal Communications Commission (FCC) - Title 47 of the Code of Federal Regulations, Part 90.
7. Federal Communications Commission (FCC) Rules, Parts 15 and 22.
8. BICSI Information Transport Systems Installation Methods Manual, 6th Edition.
9. BICSI Telecommunications Distribution Methods Manual, 13th Edition.
10. ANSI/TIA-568-C.O.; Generic Telecommunications Cabling for Customer Premises (February 2009).
11. ANSI/TIA-568-C.1; Commercial Building Telecommunications Cabling Standard Part 1: General Requirements (February 2009).
12. ANSI/TIA-569-B; Commercial Building Standard for Telecommunications Pathways and Spaces (May 2009).
13. ANSI/TIA-J-607-A; Commercial Building Grounding and Bonding Requirements for Telecommunications (October 2002).
14. ANSI/TIA-606-A; The Administration Standard for the Telecommunications Infrastructure of Commercial Building (November 2008).
15. Local Authority Having Jurisdiction (AHJ) Requirements.

C. All equipment and materials shall be U.L. listed for the purpose for which they are used. Equipment in compliance with U.L. standards but not bearing their label is not acceptable. If the manufacturer cannot arrange for labeling of an assembled unit at the factory, the assembled device or equipment shall be field evaluated per the Washington State Administrative Code (WAC) and the electrical inspector's requirements. The electrical contractor shall provide for and arrange all such inspections.

D. The Installing Contractor field staff installers shall hold valid and current Installation certifications issued by the manufacturer or hold documented certification of training from the manufacturer of the cabling and equipment that is being installed. The field staff shall have a minimum of five years' experience with projects of similar size and scope

E. Work in this section shall be performed by a licensed and bonded low voltage Installing Contractor with a minimum of five years' experience in the installation and maintenance of DAS systems. Only Installing Contractors who are certified in the installation, maintenance, troubleshooting, and testing DAS systems shall perform this work.

F. The work performed under this specification shall be of good quality and performed in a workmanlike manner. In this context "good quality" means the work shall meet industry technical standards and quality of appearance. The owner reserves the right to reject all or a portion of the work performed, either on technical or aesthetic grounds.

G. The DAS system shall meet ALL of the requirements listed in Section 27 00 00 Low Voltage Systems General Requirements PART 3 "Testing & Complete System Functionality", prior to "Substantial Completion".

H. Contractual information, guidelines, requirements, or other work specified to provide a fully functional system for Section 27 53 19 includes but is not limited to the sections identified in Section 27 00 00.

I. The Das system Commissioning Technician shall be an FCC certified/licensed technician with five (5) years of design and commissioning of DAS systems. The Commissioning Technician shall maintain a valid FCC issued - General Radiotelephone Operator's License (GROL)

J. The DAS system design Engineer designing the DAS must hold an IB-Wave certification and have five (5) years' experience designing equivalent projects.

K. All conduit pathways shall meet the requirements as described in NFPA 1221. Coordinate with all trades as required.

1.03 SUBMITTALS AND SHOP DRAWINGS

A. See Section 27 00 00 Low Voltage Systems General Requirements for additional requirements.

B. Refer to "As-Built Drawings" for additional requirements.

C. Data Sheets and other documentation.

1. Installing Vendor Staff qualifications. Provide the following Information:

a. Provide a copy of no less than two (2) separate technicians (from the Installing Vendors local office) Factory Certifications for the vendors selected system manufacturer:

2. The Materials List shall identify the specification section, quantity of each item, the manufacturer, model number, and brief description of each item.

a. Provide data sheets for each item listed on the materials list.

b. Provide indicating arrows on data sheets that have multiple items on the data sheet.

c. Prior to ordering or installation of any equipment, the Installing Contractor/Contractor shall obtain written approval by the Architect.

D. Shop Drawing Submittals shall include the following items:

1. Device Point-to-Point Wiring Diagrams:

a. Provide an Illustration of EACH Device that is being provided for this project.

1) Identify EACH conductor and the equipment type and termination point that it is intended to be connected to.

2) For equipment that is being connected to integrate to another system, provide a brief description of the functional operation of the two different systems.

2. Device Mounting Details:

    a. Provide an Illustration of EACH Device that is being provided for this project.

        1) Identify the back box, conduit rough-in, and manufacturer recommended mounting method.

3. The Riser Diagram shall show the following items:

    a. Identify EACH Equipment location (the MDF and EACH designated IDF) separately.

    b. Identify a “typical” of EACH Outlet type and the associated cable (as described on the wire legend) routed to the MDF and EACH designated IDF location.

4. Rack and/or Equipment Layout.

    a. Show the intended equipment layout within EACH of the Rack(s) and/or Cabinets.

    b. Indicate the rack unit size of each device or filler plate in the rack.

    c. Show blank filler plates in spaces where equipment is not installed.

    d. If rack equipment is installed on the rear side of the rack, show rear view of the rack also.

    e. Show the equipment layout as it is intended to be installed.

5. An Elevation View of the Wall Mount equipment for the MDF Room and each designated IDF location shall be provided.

    a. The proposed locations for EACH wall mount device (control panel(s), power supplies, and other equipment), proposed cable routing, wire management, 120vac conduits (including receptacles and junction boxes).

    b. All equipment shall be shown to scale.

    c. Provide dimensions of the equipment, the space required between the adjacent item and the overall dimensions of the anticipated wall space.

6. Floor Plans shall show each Device type, style, and each individual cable required for EACH Device.

7. Shop Drawings shall be specific to the System that is specified in the Section.

    a. Do NOT show other low voltage system equipment on the Shop Drawings, except where this system is integrated to other equipment and/or systems.

    b. Provide EACH device Symbol and related description (as described on the Contract Drawings) on the Legend with the text that states “provided by others”.

        1) DAS Systems integration as described on the Floor Plans and Riser Diagrams.

        2) Fire Alarm System integration as described on the Floor Plans and Riser Diagrams

1.04 SYSTEM OPERATION REQUIREMENTS

A. Emergency First Responder DAS System

1. The Emergency First Responder DAS shall provide coverage for the PUBLIC SAFETY NETWORK (PSNs) on all frequencies currently being used by the designated PSNs in the given location: The system is required to accommodate 800 MHz UHF. The contractor to coordinate any additional required frequencies with the AHJ (Authority Having Jurisdiction).

2. The In-Building Neutral-Host DAS shall, at minimum, provide PSN radio transmissions with:

   a. A delivered audio quality of 3 (Speech understandable with slight effort. Occasional repetition required due to noise / distortion) with a 90% reliability factor for emergency personnel within the building(s) or facility. Egress stairwells shall have coverage resulting in a 99% reliability factor in each stairwell.

   b. A minimum signal strength of -95dBm in 95% of each floor area for Emergency Service Provider radio transmissions originating from outside the buildings or facility. Egress stairwells shall have coverage resulting in a signal strength of -95dBm in 99% of each stairwell. A minimum of -100 dBm shall be received by the agency's radio system when transmitted from within in 95% of each building or facility floor area or stairwell.

   c. A filter to reject frequencies outside those used by the Emergency Service Provider Radio System.

   d. A system configured to automatically report system failures or system alarms to include antenna up link failure, antenna down link failure, ac/dc failure, low battery, and antenna circuit malfunction.

   e. A communications card with LAN connection, RS232 connection and on-board web browser that supports remote firmware updates, remote amplifier control and monitoring.

   f. 12 hours of self-contained battery back-up as required to operate the entire system unless an Emergency Generator Circuit is available for use.

   g. 100% compatibility with analog or digital modulations after installation without additional adjustment or modification.

3. See all Federal, State or Local regulations or codes for more stringent performance requirements.

B. Cellular Amplification System

1. The Cellular Amplification DAS shall provide multi-carrier coverage for Verizon, T-Mobile, and AT&T on all frequencies currently being used by the designated carriers in the given location.

2. The Cellular Amplification DAS shall be an off-air DAS solution with:

   a. A cellular coverage signal strength test must be taken for the entirety of the building TI space prior at the beginning of the project.

b. Final Cellular Amplification DAS performance must achieve the following performance metrics:

1) -95 dBm or better at 700 and 800 MHz for 95% coverage of TI space.

2) -102 dBm or better at 1900, 2100, and 2500 MHz for 95% coverage of TI space.

PART 2 MATERIALS

2.01 EMERGENCY RESPONDER DISTRIBUTED ANTENNA SYSTEM

A. Basis of design is by Comba CriticalPoint NG BDA for a UHF 800 MHz DAS radio system.

B. The Emergency Responder DAS system shall include but not be limited by the following:

1. Donor Antennas
2. Lightning Protection
3. Grounding and Bonding
4. Coaxial Cable
5. Coaxial Cable Connectors
6. Splitters, Couplers, Combiners and Taps
7. Enclosures
8. UPS
9. Coverage Antennas
10. BDA Bi-Directional Amplifier's
11. Remote Annunciators and Monitoring of all active components
12. All other equipment required to have a fully functional system

2.02 CELLULAR AMPLIFICATION DISTRIBUTED ANTENNA SYSTEM

A. Basis of design is by Comba ComFlex NG off-air Cellular DAS system.

B. The Cellular Amplification DAS system shall include but not be limited by the following:

1. Donor Antennas
2. Lightning Protection
3. Grounding and Bonding
4. Coaxial Cable
5. Coaxial Cable Connectors

6. CAT6 Cable
7. CAT6 Cable Connectors
8. Network Unit
9. Coverage Unit
10. Enclosures
11. Coverage Antennas
12. Remote management and monitoring of all active components
13. All other equipment required to have a fully functional system

PART 3 EXECUTION

3.01 GENERAL

A. See Section 27 00 00 Low Voltage systems General Requirements for additional information.

B. Prior to rough-in, coordinate with the Architect for the exact location(s).

C. Install all cabling, devices, and/or equipment per the manufacture's recommendation.

3.02 MONITORING

A. The fire alarm system shall monitor and provide annunciator for the following supervisory and trouble signals from the Emergency Responder DAS system. Coordinate with the fire alarm installing contractor.

B. Provide a Remote Annunciator:

1. Circuit integrity in accordance with NFPA 72 Section 10.17.1

3.03 INSTALLATION

A. Install equipment such as antennas, splitters, cable and related devices in accordance with Manufacturer's written instructions, as indicated on the Drawings and as specified herein.

3.04 TESTING

A. Provide DAS system testing to meet the following criteria:

1. Each floor of the building shall be divided into a grid of twenty (20) approximately equal test areas. Elevator returns, Fire Command rooms, stairwells and other critical areas shall each get an additional test area.

2. Downlink received signal level measurements will be recorded in the coverage area using a CW test signal. Measurements will be collected using a spectrum analyzer.

3. Failure of a maximum of two non-adjacent test areas shall not result in failure of the test.

4. In the event that three of the test areas fail the test, in order to be more statistically accurate, the floor shall be divided into 40 equal test areas. Failure of a maximum of four (4) non-adjacent test areas shall not result in failure of the test. If the system fails the 40-area test, the system shall be altered to meet the 95% coverage.

5. A test location approximately in the center of each test area shall be selected for the test. Once the location has been selected, the location shall represent the entire test area.

3.05 TRAINING

A. Factory authorized service representative shall conduct up to two (2) separate 4-hour training sessions for Owner's Representatives upon completion and acceptance of system. Instructions shall include safe operation and maintenance of the DAS system.

3.06 AS-BUILTS

A. Provide all As-Built documentation as defined in Section 27 00 00 Low Voltage Systems General Requirements and listed elsewhere in this specification.

B. Update all documents provided in the Submittal and Shop Drawings to accurately reflect the actual equipment that was provided for this project, and the actual locations of the installed equipment.

C. The Installing Vendor shall include in the pricing of their bid, the time and materials to generate and create the documentation, as described below.

1. Provide an “Equipment Information Sheet”, in the O & M manuals. At a minimum, from left to right, provide the following information;

a. Each row shall have an “Item #”

b. Manufacturers Name

c. Equipment Device Type (such as Workstation, Control Panel, etc.)

d. Location (such as MDF room 103, or area of building)

e. IP Address

f. Software Name

g. Software Version that is installed on the device

h. List the “Highest Level” configurable password for EACH device

i. List “EACH System Operator” password

j. List all other password settings for EACH device

D. The following documentation must be completed to the satisfaction of the Engineer.

E. All electronic and hard copy information submitted to the Owner shall immediately become the Owners property to use as best determined by the Owner, without any compensation to any party.

F. Any re-submittal(s) shall be provided at the Contractors expense.

END OF SECTION 27 53 19

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SECTION 28 13 00

ACCESS CONTROL SYSTEM

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions and Divisions 0 and 1 Specifications, apply to work of this Section.

B. Section 26 00 00 – General Electrical Conditions

C. Division 08 - Door Hardware

1.02 SCOPE AND RELATED DOCUMENTS

A. The project Access Control System shall be an ADDITION to the County-Wide Access Control System. The Installing Vendor shall provide new equipment at the project site and include the necessary programming for viewing reports, changing card holder information, changing card holder access capabilities, and control functions of the new Access Control System to and from the following locations:

1. Locally at the project site

2. Remotely at the Owner's Security Command Center

B. Furnish and install a complete Access Control System as described herein and as shown on the Plans; to be wired, connected, and left in first class operating condition. The system shall include, but not be limited to: Access Control Panel(s), Access Control Reader Interface(s), Input Board(s), Output Board(s), Power Supplies, Card Readers, Door Position Switches, hard wired Electric Locks / Electrified Exit Devices (where indicated within this specification), hard wired connection to each electro-mechanical lock as indicated on the Access Control System and Electro-Mechanical Door Hardware Matrix, Duress Buttons, device Input supervision, control relays, conduit, junction boxes, fittings, wire, connections to devices, and all other necessary material for a completely reliable and fully functional system.

C. The Access Control System shall also function as an Emergency Lock Down System.

D. A PC shall display real-time status and control of the doors on the graphic map of the building.

1. Coordinate with the District to select which PC to provide and program the graphic map for the system.

E. The system shall meet ALL of the requirements listed in Section 27 00 00 - Low Voltage Systems General Requirements PART 3 "Testing & Complete System Functionality", prior to "Substantial Completion".

F. Contractual information, guidelines, requirements, or other work specified to provide a fully functional system for Section 28 13 00 includes but is not limited to the sections identified in Section 27 00 00 as well as Section 08 71 00 Finish Hardware.

G. Provide all programming as required to the satisfaction of the Owner.

H. The entire Access Control System and related appurtenance shall be provided (as indicated in this specification or in other specifications), installed (as indicated in this specification or in other specifications), wired, terminated, programmed, tested, commissioned, and warranted by Section 28 13 00 for a complete and fully functional system.

1.03 SYSTEM OPERATION

A. Integration to other Low Voltage systems:

1. Intrusion Alarm System – The Access Control System shall provide integration with the Intrusion Alarm System for monitoring purpose only. The Access Control System shall not disable or interrupt the Intrusion Alarm System while the Intrusion Alarm System is in the armed state. Provide connectivity to the Intrusion Alarm System Control Panel. Coordinate with the Intrusion Alarm System installing contractor.

    a. The Access Control System shall disable all card functionality at doors in which there is no Intrusion Alarm Keypad nearby.

2. CCTV System – The Access Control System shall provide integration with the CCTV system to ear mark open and closings of entry points controlled by the Access Control System. Coordinate with the Owner for further requirements and programming of the system software.

1.04 QUALITY ASSURANCE

A. The system, devices, and equipment shall be manufactured under the appropriate category by Underwriters' Laboratories, Inc. (UL), and shall bear the UL label. Partial or pending listings are not acceptable. The installation of EACH device and/or component shall be in compliance with the UL listing. The system, devices, and equipment shall fully comply with the latest issue of these standards, where applicable, which includes, but is not limited to:

1. National Fire Protection Association (NFPA) - USA:

    a. NFPA 70 National Electrical Code

    b. NFPA 101 Life Safety Code

2. Underwriters Laboratories Inc. (UL) - USA:

    a. UL 294 Access Control Systems

    b. UL 1034 Burglary-Resistant Rated

    c. UL 1076 Proprietary Burglar Alarm Units and Systems

3. Meet or exceed Building Codes and Standards:

    a. Local Authority Having Jurisdiction (AHJ) Requirements

b. State:

1) WAC 51-20 Washington Barrier Free Regulations

c. National:

1) National Electrical Code (see NFPA 70)

2) Americans with Disabilities Act

d. International:

1) International Building Code

2) International Electrical Code (see NFPA 70)

3) International Fire Code

B. Approvals:

1. The system shall have proper listing and/or approval from the following nationally recognized agencies:

a. UL Underwriters Laboratories Inc

b. Factory Mutual

c. FCC

C. The Installing Vendor shall meet each of the requirements defined in Section 27 00 00 “Testing & Complete System Functionality”.

D. The Installing Contractor shall be an Authorized Installer of the Manufacturer of the equipment being installed and shall furnish documentation showing that the Installing Contractor is trained and certified. The Installing Contractor shall be capable of providing the Owner with a documented Warranty of the equipment being installed at the time of project bid, to be approved for bidding.

E. Work in this section shall be performed by a licensed and bonded low voltage Installing Contractor with a minimum of five years’ experience in the installation and maintenance of Access Control Systems. Only Installing Contractors whose primary business is that of installing, maintaining, troubleshooting, and testing electronic security systems shall perform this work.

F. In order to qualify for installation of the Access Control System, Installing Contractor must possess the required license classification, a performance history, experience in the installation and termination of copper and optical fiber cable systems, and proof of time in business.

G. The Installing Vendor shall provide a Staff Commitment Letter in the Submittal and Shop Drawings submittal package, that states the following:

1. The Installing Vendor shall identify and designate two (2) Manufacturer Trained and Certified Installing Vendor Technicians for the duration of this project.

a. The Installing Vendor shall submit copies of the above designated technicians Manufacturer Certification(s).

1) Avigilon Access Control Manager – Installer Certification.

b. Additional Installing Vendor field technicians may also work on the site, but only while one of the two designated technicians are onsite.

2. The Installing Vendor shall identify and designate a Project Manager whose responsibilities will include, but are not limited to:

a. The Primary Point of Contact between the Owner and the Installing Vendor. It is acceptable for this person to be the Lead Technician.

b. Scheduling of technicians to perform the work on the Owner's premises.

c. Scheduling of any meetings shall be on the Owners premises.

H. Service and Software Modifications:

1. Provide the services of a Manufacturer Certified/Authorized Technician to perform all system upgrades or changes.

2. For non-emergency service, response time of the technician to the site shall not exceed four (4) hours. If the call is received by the Installing Vendor before 1:00pm, service shall be provided that day, and if the call is received after that time, then the response shall be the following business day.

3. Provide all hardware and documentation necessary to modify the system onsite. Modification includes addition and/or deletion of system devices, changes to system operation, and custom label changes for devices.

1.05 SUBMITTALS AND SHOP DRAWINGS:

A. See Section 27 00 00 - Low Voltage Systems General Requirements for additional requirements.

B. Provide ALL required submittal documents in Training Materials listed elsewhere in this specification.

C. Data Sheets and other Documentation:

1. Pre-Installation project kick-off meeting.

    a. The Installing Vendor shall provide the Meeting Minutes for the Pre-Installation project kick-off meeting.

    b. Submit the "System Device Naming Matrix" listed elsewhere in this specification, with the Data Sheet submittal.

2. Follow up documentation for the pre-Installation project kick-off meeting shall be provided as described under "Coordination" identified elsewhere in this specification.

3. The Materials List shall identify the Section, quantity of each item, the manufacturer, model number, and brief description of each item.

    a. Provide data sheets for each item listed on the materials list.

    b. Provide indicating arrows on data sheets that have multiple items on the data sheet.

4. Provide all Test Forms for review.

5. Provide documentation of the On-Site System Information Binder enclosure.

    a. Include the list of documents that will be provided in the On-Site System Information Binder.

    b. Provide a sample copy of the Training Syllabus.

    c. Provide a sample copy of the Step-by-Step Instructions.

6. The Installing Vendor shall submit copies of the two (2) designated technicians Manufacturer Certification(s) for EACH item listed below.

    a. Avigilon Access Control Manager – Installer Certification.

D. Shop Drawings shall include the following items:

1. The System Riser Diagram shall show the MDF and EACH designated IDF separately.

    a. Show each system component and device connected to and installed in the MDF and each IDF.

E. EACH Card Reader door and device that is connected to the Access Control System shall be identified by the architectural designated door number.

PART 2 PRODUCTS

2.01 MATERIALS

A. See Section 27 00 00 - Low Voltage Systems General Requirements for additional information.

B. Lenel and HID manufactures the primary products that are used for the basis of design for this specification.

1. Substitutions will not be approved on this project.

C. Provide all equipment as defined in the specification(s) and shown on the drawings.

2.02 COORDINATION

A. The Installing Vendor shall include each of the following items in their bid for this project.

B. Refer to “Submittals” for additional coordination requirements.

C. Pre-Installation Project Kick-off Meeting. The Pre-Installation Project Kick-off Meeting is imperative to the owner and is required to review the owner’s specific system operation and expectations that are unique to the owner. The Installing Vendor shall contact the Electrical Contractor for the purpose of confirming the actual date of and attending the Pre-Installation Project Kick-Off Meeting at the location selected by the Owner (somewhere within the district). This meeting shall take place PRIOR to Submittal of equipment data sheets. The Installing Vendor shall be responsible for providing the following items.

1. A sign in sheet (with the project name, Section number and title that the Installing Vendor is representing, date, time, location, the printed name of each person in attendance, their title, phone number, and email address).

2. Be responsible for taking Meeting Minutes, typing them into a formal document, and distributing them via email to each attendee, the Architect, and the Engineer.

3. The items discussed at the Pre-Installation project kick-off meeting shall include, but not be limited to:

a. Emergency Lock Down system operation with Lock Down Button and Red Card.

b. Emergency Lock Down system integration with the Intercom system.

c. Timed door open email/SMS alert.

d. Auto lock all doors at an identified time in the evening.

e. Auto Unlock Doors on a timed schedule.

f. Database migration.

g. Access Control System general operation.

h. IP Addresses for the Access Control System equipment.

i. Confirm equipment layout in the MDF and EACH designated IDF location with the Owner's IT Department.

j. Device Naming. See "System Device Naming Matrix" elsewhere in this specification.

k. Configuration settings.

l. General coordination with staff.

m. General location of equipment and other items.

n. General questions about system operation, function, and programming.

o. The placement of wall mounted Equipment shall be identified, discussed, and confirmed for the placement of the equipment in the MDF Room and EACH designated IDF location.

D. Follow up documentation for the Pre-Installation Project Kick-Off Meeting. The purpose of this information is to illustrate to the Owner's Access Control System representative and the Owner's IT Department that the information discussed during the Pre-Installation Project Kick-Off Meeting was understood by the Installing Vendor.

1. Each of the above items and items discussed during the meeting shall be included in the Data Sheet Submittals.

2.03 ACCESS CONTROL SERVER/APPLIANCE AND SYSTEM SOFTWARE

A. New Server – no new server will be required.

B. Existing Server – utilize the owner's existing Access Control Server.

1. Provide programming of the existing Server/Appliance as required.

C. Existing Database – This system will be an expansion of the Owner's existing Access Control System.

1. Coordinate with the Owner's Access Control System Representative, IT Department, and Human Resources Department and import the Database and related information fields as required.

2. Populate all database fields as directed by the Owner.

D. Server Software. The Access Control Server/Appliance Software (Lenel OnGuard 8.2) shall be programmed for this project. This project shall operate completely and independently from other locations. Coordinate with the Owner's IT department as required.

E. Software Licenses:

1. The Installing Vendor shall provide single software-based license key that resides on each Access Control System appliance to control licensed features and/or components.

a. Software licenses shall be upgradable and/or amendable via email or download from Manufacturer secured web site.

b. The Access Control System appliance shall support a minimum of fifty (50) concurrent client connections.

1) Individual license keys for traditional client workstations and/or physical hardware license keys shall not be acceptable.

F. Graphic Map Software:

1. The Access Control System shall support graphical maps through import of popular graphic formats (BMP. GIF. JPEG. PNG. PDF. TIP. And WMF.).

2. The Access Control System shall have the ability to place system icons including card readers, input and output points, video cameras, and other access control field hardware to indicate their location in the facility.

3. When the building is in the Emergency Lock Down mode, the Graphic Map shall display the live real-time status of doors (opened or closed and locked or unlocked).

2.04 ACCESS CONTROL SYSTEM HEAD-END EQUIPMENT

A. The Head-end Equipment shall be configured to enable a complete and fully functional system to operate with the owner's software.

1. Lenel OnGuard 8.2.

2.05 ACCESS CONTROL PANEL (ACP) AND RELATED MODULES

A. It will be the Installing Vendor's responsibility to ensure that the specified equipment is fully and completely compatible with the existing equipment.

B. Each ACP shall provide full distributed processing of all Access Control System operations.

C. The ACP shall include an on-board LAN/WAN communication module and shall link to the Access Control System software via the Local Area Network.

D. Manufactured by Lenel. Provide quantities of each item as required.

1. Intelligent Dual Reader Controller.

a. Manufactured by Lenel, Model # LNL-X2220

2. Dual Reader Interface Module

    a. Manufactured by Lenel, Model # LNL-1320 Series 3

3. Input Control Module

    a. Manufactured by Lenel, Model # LNL-1100 Series 3

4. Output Control Module

    a. Manufactured by Lenel, Model # LNL-1200 Series 3

5. Provide quantities as required.

6. Provide additional modules as necessary to accommodate system functionality as shown on the plans and described within this specification.

2.06 ACCESS CONTROL SYSTEM POWER SUPPLIES (ACPS)

A. The Access Control Power Supply (ACPS) shall be used to power system related equipment as required. The power supply shall be U.L. listed, have sixteen (16) Class 2 Rated PTC Power Limited outputs and a key locking enclosure. The ACPS shall have automatic switch over to stand-by batteries when AC power fails, and have AC fail supervision which is a Form "C" contact closure upon loss of power.

B. The ACPS's shall ONLY be installed in the MDF and EACH designated IDF location, unless noted otherwise on the drawings.

C. The Access Control System shall monitor EACH ACPS provided for this project. Monitor EACH of the following terminals:

1. Provide connection for one (1) Access Control System Input within EACH ACPS that is provided for this project to monitor the 120vac power fail contacts.

2. Provide connection for one (1) Access Control System Input within EACH ACPS that is provided for this project to monitor the Low Battery supervision contacts.

D. Provide ACPS's for low voltage requirements of the Access Control System. This includes, but is not limited to the following items:

1. Hard Wired Electric Latch Retraction Exit Devices (where applicable).

2. Hard Wired Electric Locks (where applicable).

3. Hard Wired Electric Strikes (where applicable).

4. Request to Exit (REX) motion sensors (where applicable).

5. Miscellaneous system related appurtenances.

E. Power Supplies shall be from LifeSafety Power Mercury ProWire Pre-Wired Power Systems. Altronix Trove is an approved alternate. Provide quantities as required.

2.07 SURGE SUPPRESSION

A. Provide one (1) dedicated TVSS at EACH 120vac hard wired connection point.

B. Provide manufacturer and model number as specified in Section 26 43 00.

2.08 NETWORK EQUIPMENT

A. Router(s)/Switch(s):

1. The Owner will provide the Router(s) and Switch(s) at the MDF and each IDF location indicated on the drawings. The Owner shall provide the necessary LAN/WAN infra-structure programming to establish connection to the LAN/WAN.

B. Patch Panels:

1. See Section 27 20 00 - Data and Voice Infrastructure for Patch Panel requirements.

2.09 BATTERY BACKUP FOR COMPLETE SYSTEM OPERATION

A. Battery backup power shall be an integral part of the Access Control System.

B. Provide and install gel-cell, maintenance free batteries, as required. Provide battery backup power for the entire Access Control System to provide one (1) hour of standby operation. Batteries shall be sized to provide at least 20% spare capacity.

1. Provide quantities as required for maintaining or exceeding the submittal calculation requirements listed elsewhere in Section 27 00 00 “Submittals and Shop Drawings”.

C. EACH Power Supply shall have automatic switch over to stand-by batteries when AC power fails. The power supply/charger shall be an integral portion of the control panel and/or power supply and be capable of charging fully discharged system batteries to 100% in eight (8) hours.

D. All batteries shall be placed inside a non-key lockable (Thumb-Turn Cam Lock), metal enclosure that is approved by the manufacturer.

E. Each battery shall have the date of installation written on the battery with a permanent marker. The date shall be legible and clearly written in 1-inch numbers and be visible when the enclosure door is open.

2.10 FIELD DEVICES

A. Review the Access Control System Riser Diagram for Card Reader related equipment that is NOT shown on the drawings but shall be provided and installed for this project.

B. Prior to Bidding and Ordering ANY equipment, it shall be the responsibility of the Installing Vendor to confirm the Owners existing Access Cards will work on the specified equipment.

C. Card Readers: Provide one (1) Card Reader at EACH location shown on the drawings. Card readers shall connect to the Access Control Panel (ACP), for a fully functional system, as required.

1. Card Readers shall meet the following minimum requirements:

a. PRIOR to ordering, obtain written approval of the color selection.

b. Manufacturer's lifetime warranty.

2. Single Gang Mount - Smart Card Reader:

a. Mount to a single-gang electrical box.

b. Card Reader shall be manufactured by HID: Model # Signo Reader 40. Provide quantities, as shown on the drawings.

3. Single Gang Mount – Smart Card Reader with Keypad:

a. Mount to single-gang electrical box or pedestal enclosure.

b. Card Reader with Keypad shall be manufactured by HID: Model # Signo Keypad Reader 40K. Provide quantities as shown on the drawings.

4. Mullion Mount - Smart Card Reader:

a. Mount to storefront.

b. Reader shall be manufactured by HID: Model # Signo Reader 20. Provide quantities, as shown on the drawings.

D. Door Position Switches (DPS's):

1. Recessed Mount:

a. GRI Model # 195-12.

1) Provide double pole double throw style contact when in shared location with intrusion alarm system.

E. Panic Button:

1. Red button shall be ADA Compliant with cover.

2. Button shall illuminate when pushed and remain illuminated until reset.

3. Button shall be key to reset.

4. Manufactured by STI Safety Technology International: Model # SS2020EM-EN or approved equal.

    a. Provide quantities as shown on the plans.

F. Door Release Button:

1. Blue button shall be mounted be ADA Compliant with cover

2. Button shall be momentary push style

3. Button shall have custom text for assigned door release function. Coordinate with owner for text requirements prior to order.

4. Manufactured by STI Safety Technology International: Model # G3A425ZA-EN or approved equal.

    a. Provide quantities as shown on the plans.

G. Video Intercom Door Station

1. Recessed mount with manufacturer recommended back box.

2. PoE connection

3. Switched output connection for associated door hardware override.

4. 1 button with built in HD camera version

5. Manufactured by 2N Model # IP Force – 01336-001.

    a. Provide quantities as shown on the plans.

H. Video Intercom Master Station

1. Freestanding at desktop

2. Poe connection

3. Manufactured by 2N Model # IP Phone D7A – 02660-001.

    a. Provide quantities as shown on the plans.

I. Site Pedestals

1. Provide pedestal and enclosure for card reader installations.

2. Pedestal shall be from Pedestal Pro model # 48-RC.

   a. Provide quantities as shown on the plans.

3. Enclosure shall be from Pedestal Pro model # 68HOU-PPRO-01-CRS.

   a. Provide (1) one for each pedestal location.

J. Opticom Sensor System

1. Provide infrared sensor system from Opticom for use with existing equipment installed on police squad cars. The sensor system shall allow for automatic opening of site motorized gates when the squad car is within the manufacturer specified range and line of sight.

2. Primary emitters shall be installed on the top of a hollow metal post provided by the gate manufacturer. Control and network equipment shall be installed within the site enclosures.

3. Coordinate with owner for programming requirements in order to integrate the sensor system with existing equipment.

4. Sensor system shall be integrated with the access control system for routing of relay signal to the gate controller for opening functions.

5. Emitters shall be from Opticom model # 721.

   a. Provide quantities as shown on the plans.

   b. Install Opticom 138 Detector cable from each Emitter to site enclosure.

6. Control and network equipment shall be from Opticom model # 764 Phase selector and 760 Card Rack.

   a. Provide (1) one of each component for every Emitter installed.

   b. Provide relay and IP network connections as necessary for fully system operation.

2.11 SPARE CAPACITY

A. Spare Cables:

1. Provide spare cabling as shown on the drawings.

2.12 FLEXIBILITY IN SYSTEM DESIGN LAYOUT

A. Where indicated on the drawings, the Installing Vendor shall have the flexibility in their design to provide system equipment at any of the MDF/IDF's and/or Systems Plywood Back Board locations that are SPECIFICALLY identified on the drawings for this equipment.

B. Coordinate the exact location of field devices with the Architect, prior to installation.

2.13 SYSTEM CABLES, CONNECTORS, AND PATCH CORDS

A. See PART 3 of this specification and Section 27 00 00 for additional requirements.

B. ALL cables and conductors shall be the same size and color throughout EACH cable run. Such as from EACH field device to the terminals on the ACP, ACRI, and Power Supply.

1. The color of the overall cable jackets shall be white. If this color is not available, provide a permanent-colored marking in white on the cable for every 10'-0" of cable for the duration of the cable run.

C. Cables/Conductors: The minimum allowable size conductors are specified below. Use larger conductors and/or additional conductors, as required. Prior to Bidding, consult with the system Manufacturer that the following cable types are acceptable. It shall be the Installing Vendors responsibility to provide and install Manufacturer approved cables. Use the Manufacturers equivalent cable requirements, to meet all code requirements [such as "Wet Rated" or "Aerial Rated" cable] for the appropriate devices.

1. CAT6 cable(s):

a. Refer to Section 27 20 00.

2. Multi-Conductor:

a. Plenum: Belden 658GMS (22/4 door contact, 22/4 spare, 22/6 card reader, 18/4 lock power).

3. Provide additional individual cable runs to access control devices as necessary.

a. Cabling shall shielded plenum cabling from Belden.

b. Provide appropriate number of conductors and awg size for each device based on connections and cable length requirements.

D. Connectors/Terminations: Use the manufacturer approved wire strippers and crimping tool as required.

1. CAT6 cable(s):

a. Refer to Section 27 20 00.

2. Maintain all cable and system requirements.

E. Patch Cords: Size EACH cable length to provide ease of maintenance, while not leaving excessive slack.

1. CAT6 cable(s):

a. Refer to Section 27 20 00.

2. Maintain all cable requirements.

2.14 TEST FORMS

A. See Section 27 00 00 - Low Voltage Systems General Requirements for “Test Forms” and “Testing & Complete System Functionality”, and “Testing” listed elsewhere in this specification for more information.

B. The Installing Vendor shall include in the pricing of their bid, the time and materials to completely fill out EACH TEST FORM. Electronic copies of the required Test Forms will be provided to the Installing Vendor upon award of the project.

1. Sample Test Forms are provided at the end of this specification. An electronic copy of this Test Form will be provided to the Installing Vendor upon request.

2.15 ADDITIONAL SYSTEM EQUIPMENT

A. See Part 3 of this specification for additional provision of system Equipment and/or Labor.

PART 3 EXECUTION

3.01 GENERAL

A. See Section 27 00 00 - Low Voltage Systems General Requirements for additional information.

B. Prior to rough-in, coordinate with the Architect for the exact location(s).

C. Install all equipment, devices, and cabling, per the manufacturer’s recommendation.

D. Coordinate with the Owner for final programming and testing.

3.02 INSTALLATION

A. EACH CABLE RUN SHALL CONTINUOUS, WITHOUT ANY SPLICES, from the device to the terminal strip on the system panel or power supply. Any cable run that does not meet this requirement shall be replaced at no additional cost to the Owner.

B. Setup, connect, and configure the Servers/Workstations/Monitors per the manufacturer’s recommendations to operate as intended.

3.03 MOUNTING HEIGHTS, LOCATIONS, AND SETTINGS

A. Mount enclosures as specified in Section 27 00 00.

B. Prior to Bidding, the Installing Vendor(s) shall confirm and coordinate the actual quantities and locations of the power requirements with the electrical contractor see “Power Supplies” and “Flexibility in System Design Layout” listed elsewhere in this specification. At a minimum, provide 120vac wiring and connections to the ACP(s) and all power supplies as required for a fully functional system.

C. Prior to rough-in, coordinate with the Architect for the exact location(s).

D. Install EACH of the devices and/or equipment per the manufacturer’s recommendation.

E. Access Control Panel’s (ACP’s):

1. Install EACH ACP as recommended by the manufacturer.

F. Card Readers:

1. Install EACH Card Reader:

a. Flush to the wall surface.

1) Surface mounted boxes are unacceptable.

b. Coordinate with the Architect for exact mounting height.

G. Door Position Switches shall be installed on the latch side of the door, NOT the hinge side. At the upper portion of the door, on the top of the door (recessed mount), and 4” to 6” from the edge of the door. Install per manufacturers recommendations. After installation the door shall be able to close properly without rubbing on the door position switch.

1. Recessed Mount Door Position Switches:

H. Drill a hole for a snug fit per the manufacturer’s instructions. Do NOT use hole saws or other tools that will not produce an exact diameter hole. Loose fitting door positions are not acceptable. It will be the responsibility of the Installing Vendor to satisfy the Architect for a proper installation.

I. Electric Locks and/or Electrified Exit Devices shall be powered by the Access Control System Power Supply’s (ACPS’s):

1. ACPS’s shall power the Electrified Door Hardware (ED). The following items shall be provided by the Division 8 Door Hardware supplier.

a. Electric Locks, Electric Strikes, and/or Electrified Exit Devices.

2. Mounting of ACPS’s, wiring, and terminations of ALL Electro-Mechanical locks shall be by the Access Control System Installing Vendor/Contractor.

a. Mount approximately 6” above the accessible ceiling (where applicable) or at 9’-0” above the finished floor, unless otherwise noted.

3.04 PROGRAMMING AND CONFIGURATION

A. Provide all programming as required to the satisfaction of the Owner.

3.05 TESTING

A. Commission the system as required to ensure it is complete and fully operational.

3.06 TRAINING

A. Training for Site Staff:

1. The training sessions shall be held at the project Site.

   a. Provide Training for up to ten (10) Site Staff.

   b. Provide a total of two (2) separate training sessions for the Owners personnel. Schedule both training sessions with the Owner, providing a minimum of fourteen (14) days advance notice, and offer a minimum of three dates to choose from.

2. The Site Training Session(s) shall only take place AFTER the Owners Administrative Staff have had their first training session.

3. The 1st Training Session shall consist of:

   a. Providing the printed Training Manuals to EACH attendee, as described elsewhere in this specification in “Training Materials and Programming Survey”.

   b. Being conducted by one of the designated Installing Vendor technicians. The training shall be a minimum of one (1) 2-Hour session that shall be held on the same day and provide a thorough and in-depth full feature training session. Provide additional training time as required, to answer EACH of the staff’s questions, at no additional cost to the Owner.

   c. Using an Installing Vendors laptop and projector, connect to the Owners WAN and demonstrate each of these features and functions.

      1) At the Owners option, the Installing Vendor may be allowed to provide the Training Session on the Owners Workstation.

4. The 2nd Training Session shall consist of:

   a. A refresher training session shall be held approximately thirty (30) days after the first training session. The training session shall be a minimum of two (2) hours and may be conducted by one of the Installing Vendors designated technicians that attended the first training session. Provide additional training time as required, to answer EACH of the staff’s questions, at no additional cost to the Owner.

b. Using an Installing Vendors laptop and projector, connect to the Owners WAN and demonstrate each of the features and functions that the Owner's staff would like clarification on.

1) No less than five (5) business days in advance of this meeting, the Installing Vendor shall request from the Owner EACH of the items that the Owner would like clarification on.

a) The documents that were filled out during the "Interview with the Owner" shall be used as the reference document.

b) At the Owners option, the Installing Vendor may be allowed to provide the Training Session on the Owners Workstation.

3.07 AS-BUILTS

A. Provide all As-Built documentation as defined in Section 27 00 00 - Low Voltage Systems General Requirements and listed elsewhere in this specification.

B. Update all documents provided in the Submittal and Shop Drawings to accurately reflect the actual equipment that was provided for this project, and the actual locations of the installed equipment.

C. The Installing Vendor shall include in the pricing of their bid, the time and materials to generate and create the documentation, as described below.

1. Provide an "Equipment Information Sheet", in the O & M manuals. At a minimum, from left to right, provide the following information;

a. Manufacturer's Name.

b. Equipment Device Type (such as Workstation, Control Panel, etc.).

c. Location (such as MDF room 103, or area of building).

d. Floor Plans of equipment location, Wire Routes, and Door Numbers.

Access Control System Test Form

Test Date: _____

Arch Door #/Name: _____

System Door #: _____

Door Location: _____

Card Reader Door: _____

Door Lock Style: _____

Lock Serial #: _____

IP Address: _____

MAC Address: _____

Port #: _____

				System Feature	Comments
Visual Inspection - at System Server					
Item 1	☐ **Yes**	☐ **No**	☐ **N/A**	The Door Name & ID# is correctly identified.	
Item 2	☐ **Yes**	☐ **No**	☐ **N/A**	Auto Unlock time is programmed correctly.	
Item 3	☐ **Yes**	☐ **No**	☐ **N/A**	Valid Card read displays correct information.	
Item 4	☐ **Yes**	☐ **No**	☐ **N/A**	Invalid Card read displays correct information.	
Item 5	☐ **Yes**	☐ **No**	☐ **N/A**	Door held open displays in the Event Log.	
Item 6	☐ **Yes**	☐ **No**	☐ **N/A**	Door forced open displays in the Event Log.	
Item 7	☐ **Yes**	☐ **No**	☐ **N/A**	Event log “Tags” CCTV Video Clip link.	
Visual Inspection - at MDF/IDF location					
Item 8	☐ **Yes**	☐ **No**	☐ **N/A**	Is the Cabling installed in a neat manner?	
Item 9	☐ **Yes**	☐ **No**	☐ **N/A**	Are all of the cables labeled properly?	
Item 10	☐ **Yes**	☐ **No**	☐ **N/A**	Are all cables installed without any splices?	
Item 11	☐ **Yes**	☐ **No**	☐ **N/A**	Are all cables of the approved type?	
Item 12	☐ **Yes**	☐ **No**	☐ **N/A**	Do all the cables have proper service loop?	
Item 13	☐ **Yes**	☐ **No**	☐ **N/A**	Are all cables the proper color?	

				System Feature	Comments
Visual Inspection - at Door location					
Item 14	☐ **Yes**	☐ **No**	☐ **N/A**	Is the Card Reader installed properly?	
Item 15	☐ **Yes**	☐ **No**	☐ **N/A**	Door unlocks upon valid Card Read.	
Item 16	☐ **Yes**	☐ **No**	☐ **N/A**	Card Reader sounder indicates Card read.	
Item 17	☐ **Yes**	☐ **No**	☐ **N/A**	Card Reader LED's display lock status.	
Item 18	☐ **Yes**	☐ **No**	☐ **N/A**	The REX motion sensor is operating correctly.	
Item 19	☐ **Yes**	☐ **No**	☐ **N/A**	REX unlocks the Door (it should NOT)	
Item 20	☐ **Yes**	☐ **No**	☐ **N/A**	Door held open alarms as programmed.	
Item 21	☐ **Yes**	☐ **No**	☐ **N/A**	Valid Card read activates the ADA Button.	
Item 22	☐ **Yes**	☐ **No**	☐ **N/A**	Emergency Lock Down secures this door.	
Item 23	☐ **Yes**	☐ **No**	☐ **N/A**	The Door closes and locks securely.	
Item 24	☐ **Yes**	☐ **No**	☐ **N/A**	The Door Hardware is operating correctly.	

	Signature	**Print**
Technician:	_____	_____
Representing:	_____	Date: _____
Owner Rep:	_____	_____
Representing:	_____	Date: _____
Architect:	_____	_____
Representing:	_____	Date: _____

GOVERNING ACCEPTANCE FORM

				Test Forms	Comments
Item 1	☐ PASS	☐ FAIL	☐ N/A	Pre-Interview Questionnaire	
Item 2	☐ PASS	☐ FAIL	☐ N/A	Each Individual Card Reader Performance Tests	
Item 3	☐ PASS	☐ FAIL	☐ N/A	Access Control Server Test Form	
Item 4	☐ PASS	☐ FAIL	☐ N/A	Training Syllabus	
Item 5	☐ PASS	☐ FAIL	☐ N/A	Training Session #1	
Item 6	☐ PASS	☐ FAIL	☐ N/A	Training Session #2	

Training Session #1
COMPLETED ☐ INCOMPLETE ☐ COMMENTS _____

Training Session #2
COMPLETED ☐ INCOMPLETE ☐ COMMENTS _____

The undersigned having been engaged as the Installing Vendor for the **___(OWNER'S NAME HERE)_____** confirm that the **_____(NAME OF PROJECT)_____,** confirm that the **SECTION 28 13 00 ACCESS CONTROL SYSTEM** equipment was installed in accordance with the specifications, drawings, wiring diagrams, instructions, and directions provided to **___(INSTALLING VENDOR'S NAME HERE)____** by the Manufacturer. It has been completely tested, demonstrated and accepted by the Owners representative.

Once ALL of the above items have 'passed' the Performance test ALL Training has been 'Completed' the Warranty shall be deemed the Owners ability to use the Complete System Functionality as it was designed. From that date forward the warranty period as defined in the project documents shall begin and be in full force and effect, from the most current date.

The signatures listed below do NOT release the Installing Vendor/Contractor from fulfilling all of the requirements outlined within the project documents. The Owner reserves the right to have any and all corrections made that do not comply with the project documents.

The following parties witnessed the Performance Tests and /or approve of the results of the Governing Acceptance Form.

	Print	**Signature**
Technician:		
Representing:		Date:
Owner Rep:		
Representing:		Date:
Architect:		
Representing:		Date:

END OF SECTION 28 13 00

SECTION 28 16 00

INTRUSION ALARM SYSTEM

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions and Divisions 0 and 1 Specification Sections, apply to work of this Section.

1.02 SCOPE AND RELATED DOCUMENTS

A. Provide new addressable Intrusion Alarm System including, but not limited to; motion sensors, door position switches, duress buttons, monitoring points, keypads, power supplies at all locations as shown on the plans and/or as indicated in these specifications. The keypad(s) as indicated on the drawings will be used to arm and disarm the system.

B. Furnish and install a complete, addressable point, partitioned Intrusion Alarm System as described herein and as shown on the Plans; to be wired, connected, and left in first class operating condition. The system shall use programmable, multiplex, initiating device circuits with individual point identification, device supervision, primary and standby power. Include control panel(s), automatic detection devices, sirens, flashing lights, all wiring, connections to devices, outlet boxes, junction boxes, and all other necessary material for a completely reliable and fully functional system.

C. The system shall meet ALL of the requirements listed in Section 27 00 00 Low Voltage Systems General Requirements PART 3 “Testing & Complete System Functionality”, prior to “Substantial Completion”.

D. Contractual information, guidelines, requirements, or other work specified to provide a fully functional system for Section 28 16 00 Intrusion Alarm System includes, but is not limited to the sections identified in Section 27 00 00.

1.03 SYSTEM OPERATION

A. The system shall be armed, disarmed, reset, monitored and altered by the use of an LCD Keypad and shall be capable of supporting up to eight (8) keypads. All points of identification shall clearly indicate the device type, room name, and room number. The system shall provide "fail safe arming" preventing arming of the system if a zone has been violated. It shall indicate which device is not ready for arming at the remote keypad(s).

B. Point identification of devices and their respective locations, shall be displayed at the keypad, reported to the remote monitoring agency.

C. The building shall be divided into the partitioned zones as indicated on the drawings and/or these specifications. A partition is defined as an area of protection, provided with its own keypad and group of sensors, connected to the main building system, whose operation in totally independent from a different section of the building or structure. Operation is similar to that of a completely separate control panel, keypad, or system.

D. Actuation of any monitored device shall cause the following to occur:

1. Display device name, type, location within the building, and alarm device unique addressable point nomenclature at the LCD keypad.

2. Activate the built-in digital communicator, seize the protected premises telephone line and automatically report the alarm point/device to the remote monitoring agency.

1.04 QUALITY ASSURANCE

A. The system, devices, and equipment shall be manufactured under the appropriate category by Underwriters' Laboratories, Inc. (UL), and shall bear the UL label. Partial or pending listings are not acceptable. The installation of EACH device and/or component shall be in compliance with the UL listing. The system, devices, and equipment shall fully comply with the latest issue of these standards, where applicable, which includes, but is not limited to:

1. National Fire Protection Association (NFPA) - USA:

a. NFPA 70 National Electrical Code

b. NFPA 71 Central Station Signaling Systems-Protected Premises Unit

c. NFPA 72 National Fire Alarm Code

d. NFPA 101 Life Safety Code

2. Underwriters Laboratories Inc. (UL) - USA:

a. UL 365 Police Station Burglar Alarm Units and Systems

b. UL 464 Audible Signal Appliances

c. UL 609 Local Burglar Alarm Units and Systems

d. UL 864 Control Units for Fire Protective Signaling Systems

e. UL 1076 Control Units for Burglar Alarm Proprietary Protective Signaling Systems

f. UL 1610 Central Station Burglar Alarm Units

g. UL 1635 Digital Alarm Communicator System Units

B. Meet or Exceed Building Codes and Standards:

1. Local Authority Having Jurisdiction (AHJ) Requirements

2. State:

a. WAC 51-20 Washington Barrier Free Regulations:

3. National:

a. National Electrical Code (see NFPA 70)

b. Americans with Disabilities Act

4. International:

a. International Building Code

b. International Mechanical Code

c. International Electrical Code (see NFPA 70)

d. International Fire Code

C. Approvals:

1. The system shall have proper listing and/or approval from the following nationally recognized agencies:

a. UL Underwriters Laboratories Inc.

b. ULC Underwriters Laboratories Canada.

c. Factory Mutual.

2. The Intrusion Alarm Control Panel shall meet UL Standard 864 and UL Standard 1076.

D. The Installing Vendor shall, at a minimum, provide and/or perform on-site installation assistance to the Contractor throughout the duration of the project, up to and including acceptance of the System as defined in Section 27 00 00 "Testing and Complete System Functionality".

E. Service and Software Modifications:

1. Provide the services of a Manufacturer Certified/Authorized Technician to perform all system software modifications, upgrades or changes.

2. For non-emergency service, response time of the technician to the site shall not exceed four (4) hours. If the call is received by the Installing Vendor before 1:00pm, service shall be provided that day, and if the call is received after that time, then the response shall be the following business day.

3. Provide all hardware, software, programming tools and documentation necessary to modify the system on-site. Modification includes addition and/or deletion of system devices, changes to system operation, and custom label changes for devices. The system structure and software shall place no limit on the type or extent of software modifications on-site.

1.05 SUBMITTALS AND SHOP DRAWINGS:

A. See Section 27 00 00 Low Voltage Systems General Requirements for this information.

B. Data Sheets and Other Documentation:

1. The Materials List shall identify the specification section, quantity of each item, the manufacturer, model number, and brief description of each item.

a. Provide data sheets for each item listed on the materials list.

b. Provide indicating arrows on data sheets that have multiple items on the data sheet.

2. Pre-Installation Project Kick-Off Meeting:

a. The Installing Vendor shall provide the Meeting Minutes for the Pre-Installation project kick-off meeting.

3. Follow up documentation for the pre-Installation project kick-off meeting shall be provided as described under "Coordination" identified elsewhere in this specification.

C. Shop Drawings shall include the following items:

1. The System Riser Diagram shall show each system typical component connected at each location, cable routing, cable size and quantities.

PART 2 PRODUCTS

2.01 MATERIALS

A. See Section 27 00 00 Low Voltage Systems General Requirements for additional requirements.

B. Bosch manufactures the products that are used for the basis of design for this specification.

C. Substitutions will not be approved on this project.

D. Provide ALL requested submittal documents in Training Materials listed elsewhere in this specification.

E. Submit the "System Device Naming Matrix" listed elsewhere in this specification, with the Data Sheet submittal.

F. Provide all equipment as defined in the specification(s) and shown on the drawings.

G. Refer to PART 1 for any equipment that is not specifically defined.

2.02 COORDINATION

A. The Installing Vendor shall include each of the following items in their bid for this project.

B. Refer to "Submittals" for additional coordination requirements.

C. Pre-Installation Project Kick-off Meeting: The Installing Vendor shall contact the Electrical Contractor for the purpose of confirming the actual date of and attending the Pre-Installation Project Kick-Off Meeting at the location selected by the Owner (somewhere within the District). This meeting shall take place PRIOR to Submittal of equipment data sheets. The Installing Vendor shall be responsible for providing the following items.

1. Submitting a list of questions and their list of coordination items through the Construction Channels a minimum of fourteen (14) Days in advance of the meeting for Owner review.

2. A sign in sheet (with the project name, Section number and title that the Installing Vendor is representing, date, time, location, the printed name of each person in attendance, their title, phone number, and email address). Be responsible for taking Meeting Minutes, typing them into a formal document, and distributing them via email to each attendee.

3. The items discussed at the Pre-Installation project kick-off meeting shall include, but not be limited to:

   a. General location of equipment and other items.

   b. General questions about system operation, function, and programming.

   c. The placement of wall mounted Equipment shall be identified, discussed, and confirmed for the placement of the equipment in the MDF Room and EACH designated IDF location.

D. Follow Up Documentation for The Pre-Installation Project Kick-Off Meeting: The purpose of this information is to illustrate to the Owners Representative that the information discussed during the Pre-Installation Project Kick-Off Meeting was understood by the Installing Vendor.

1. Each of the above items and items discussed during the meeting shall be included in the Data Sheet Submittals.

2.03 INTRUSION ALARM CONTROL PANEL (IACP)

A. Approved Intrusion Alarm Control Panel (IACP) Manufacturers:

1. Bosch: Model # B9512G.

B. Provide one (1) Intrusion Alarm Control Panel (IACP) and communicator as shown on the drawings. EACH IACP shall be a microprocessor based control panel. All eight master zones shall be individually programmable to support 599 individually annunciated points of protection. Points of protection are annunciated with custom text at the Remote LCD Keypad.

1. This installation shall use addressable modules for EACH device and shall display a unique point identification label on the LCD Keypad.

2. The IACP shall be listed by UL for Power Limited Circuits and the central processor control panel that controls all functions of the system shall be an integral UL listed commercial fire and burglary digital communicator.

3. The control panel metal enclosure shall be lockable with a key.

C. IACP Components and Related Equipment: Provide quantities as required. Depending on system requirements, this may include but is not limited to the following items:

1. Furnish one (1) Transformer Enclosure for the Intrusion Alarm Control Panel (IACP) shown on the drawings.

   a. Bosch: Model # D8004.

2. Dual Phone Line Switcher:

    a. Furnish all necessary wiring, RJ31X jacks, modular harness(s), and cabling, as required for connection to Owner furnished telephone lines. Provide programming, final testing using the communication protocol as necessary so that this information is reported to the remote monitoring agency. Coordinate with Owner, as required.

    b. Bosch: Model # D928.

3. Alarm Status Relay:

    a. Bosch: Model # D811.

        1) Section 28 13 00 Access Control System shall monitor the Alarm Status of the Intrusion Alarm System. Provide connections and programming as required.

4. Powered Loop Interface Module:

    a. Bosch: Model # D125B.

5. Dual Battery Harness:

    a. Bosch: Model # D122.

6. Enclosure:

    a. Bosch: Model # D8103.

7. Lock and Keys for Enclosure:

    a. Bosch: Model # D101.

8. Mounting Skirt:

    a. Bosch: Model # D9002-5.

9. Tamper Switch:

    a. Bosch: Model # D110.

10. Adapter:

    a. Bosch: Model # MP203.

11. LAN/WAN Interface:

    a. Furnish all necessary wiring, RJ45 jacks, modular harness(s), and cabling, as required for connection to the Owners existing WAN. Programming, final testing, and using the communication protocol as necessary so that all IACP information is reported simultaneously to the remote monitoring agency and the Owners Server and/or workstations.

    b. Coordinate with the Owners IT Department for the issuing of the Static IP address(s) and insuring proper communication over the LAN/WAN.

2.04 INTRUSION ALARM POWER SUPPLY (IAPS)

A. The Intrusion Alarm Control Panel shall NOT be used to power any low voltage device, except for nominal voltage on the addressable data circuits.

B. Use an Intrusion Alarm Power Supply(s) (IAPS's) as required for serving all Intrusion Alarm devices that consume 12vdc or 24vdc power. The power supply shall be U.L. listed, have sixteen (16) Class 2 Rated PTC Power Limited outputs and a key locking enclosure. The IACP shall have automatic switch over to stand-by batteries when AC power fails, and have AC fail supervision which is a Form "C" contact closure upon loss of power. Connect as required, one (1) addressable module to monitor AC power for EACH IAPS that is provided for this system. The power supply shall be capable of supplying 4.0 Amps or 6.0 Amps.

C. At a minimum, provide one (1) IAPS at EACH location shown on the drawings. If additional IAPS's are needed, provide the quantities as required for a fully functional system, while maintaining the design requirements that are defined elsewhere in these specifications.

D. Altronix: Model # AL400ULXPD16CB or approved equal.

2.05 SURGE SUPPRESSION

A. Provide one (1) dedicated TVSS/SPD at EACH 120vac hard wired connection point.

B. Provide manufacturer and model number as specified in Section 26 43 00.

2.06 BATTERY BACKUP FOR COMPLETE SYSTEM OPERATION

A. Battery backup power shall be an integral part of the Intrusion Alarm system.

B. Provide and install gel-cell, maintenance free batteries, as required. Provide battery backup power for the entire Access Control system to provide one (1) hour of standby operation. Batteries shall be sized to provide at least 20% spare capacity.

C. Provide quantities as required for maintaining or exceeding the submittal calculation requirements listed elsewhere in Section 27 00 00 "Submittals and Shop Drawings".

D. EACH Power Supply shall have automatic switch over to stand-by batteries when AC power fails. The power supply/charger shall be an integral portion of the control panel and/or power supply and be capable of charging fully discharged system batteries to 100% in 8 hours.

E. All batteries shall be placed inside a key lockable, metal enclosure that is approved by the manufacturer.

F. Each battery shall have the date of installation written on the battery with a permanent marker. The date shall be legible and clearly written in 1" numbers and be visible when the enclosure door is open.

2.07 KEYPAD FOR REMOTE OPERATION

A. Provide one (1) Keypad at EACH location shown on the drawings. The Keypad(s) shall have the following features:

1. Color graphic touch screen display.

2. Built in presence detectors

3. A built-in sounder that emits several distinct warning tones.

4. Remote control or relays.

5. User-programmable pass codes.

6. System diagnostic tests.

B. Bosch: Model # B942. Provide quantities shown on the drawings.

1. Provide keypad in white color.

2.08 FIELD DEVICES

A. Provide one (1) addressable module and/or addressable input for EACH Intrusion Alarm device and related equipment as shown on the drawings.

B. Addressable Module(s): Use the addressable module that when the system is laid out, it follows a logical sequence, unless otherwise noted elsewhere in the drawings or specifications. Provide quantities as required.

C. Door Position Switches (DPS's): Coordinate with the Division 8 Door Hardware supplier, prior to bidding or ordering any equipment. Provide the appropriate style of Door Position Switch and application appropriate magnet for each type of door. Each switch shall be UL listed and 100% Manufacturer tested prior to installation.

1. Provide DPS(s) at EACH exterior door location.

a. For EACH single door locations, provide one (1) DPS.

b. For EACH double door locations, provide two (2) DPS's.

2. Recessed Mount:

a. Recessed Mount: GRI; Model # 199-12WG.

3. Roll-up Doors:

a. Each switch shall be provided with the magnet, for the roll-up doors application and all necessary mounting brackets as recommended by the manufacturer. Provide all necessary mounting brackets and fasteners, as recommended by the manufacturer.

b. GE (formerly Sentrol): Model #2202AU-L.

D. Motion Detectors: All motion detectors shall utilize Tri-Tech features and be UL listed. Provide one (1) Motion Sensor at EACH location as shown on the drawings.

1. Wall Mount: The Motion Sensor shall offer wall or corner mounting.

a. Bosch: Model # ISC-PDL1-W18G or newest version available.

b. Accessories for the Motion Sensor:

1) Provide one (1) Gimbal-mount bracket for EACH Motion Sensor.

2) Bosch: Model # B328.

2. Ceiling Mount: The Motion Sensor shall offer the detection pattern applicable to area served.

a. Bosch: Model # DS9370 or newest version available.

3. Curtain: The Curtain Motion Sensor shall offer a long-range narrow detection pattern in the area served.

a. Bosch: Model # ISC-PDL1-WC30G or newest version available.

b. Accessories for the Motion Sensor:

1) Provide one (1) Gimbal-mount bracket for EACH Motion Sensor.

2) Bosch: Model # B328.

E. Glassbreak Detectors: All glassbreak detectors shall utilize sound analysis technology for audio detection and be UL listed. Provide one (1) Glassbreak Detector at EACH location as shown on the drawings.

1. Wall/Ceiling Mount: The Glassbreak Sensor shall be suitable for wall or ceiling mount.

a. Bosch: Model # DS1103i or newest version available.

b. Accessories for the Motion Sensor:

1) Provide one (1) Gimbal-mount bracket for EACH wall-mounted Motion Sensor.

2) Bosch: Model # B328.

2.09 SPARE CAPACITY

A. Spare capacity to add additional devices in the future shall be an integral part of the system design.

B. Within the Building and Other Structures:

1. Low Voltage Power – Regardless of where the low voltage circuit is in the building, each individual cable run shall not exceed 80% of the Amp Draw load capacity of each run.

2. Addressable Devices – The system design should be able to add no less than Twenty (20) additional addressable devices for EACH of the following sections;

a. Each area or wing of the building.

b. Each floor shall be divided into two equal areas

1) For projects with more than one floor (or level), then each floor (or level) shall also be divided into two equal areas.

2.10 FLEXIBILITY IN SYSTEM DESIGN LAYOUT

A. Where indicated on the drawings, the Installing Vendor shall have the flexibility in their design to provide system equipment at any of the MDF/IDF's and/or Systems Plywood Back Board locations that are SPECIFICALLY identified on the drawings for this equipment.

B. Provide all quantities of equipment as specified, while maintaining the "Spare Capacity" requirements listed elsewhere within this specification.

C. Coordinate the exact location of field devices with the Architect, prior to installation.

2.11 SYSTEM DEVICE NAMING MATRIX

A. The installing Vendor shall include in the pricing of their bid, the time and materials to generate and create a single System Device Naming Matrix. From left to right, list the information for EACH device, which shall include, but not be limited to the following;

1. Each row shall have an "Item #".
2. The device name (i.e.: Motion Sensor, Door Position Switch, etc.).
3. The device abbreviation.
    a. This is a sample abbreviation that could be used: (i.e. Motion Sensor = MS, Door Position Switch = DPS).
4. List the Serial Number for EACH device.
5. The device ID number.
6. Device model number.
7. Device Location (for example; South Wing Side Door, MDF Room XXX, etc.).
8. For other system equipment (such as "Head end Equipment"), add rows to the bottom of the matrix, and list the appropriate information.
    a. Group this information by location. Such as MDF Room XXX, IDF Room XXX, etc.

B. Use the maximum characters allowable from the system, to be incorporated into a fully functional system.

1. At the Top of the Matrix, state the Maximum number of characters that are available.

C. Submit this information with the Submittals and Shop Drawings in 11' x 17' format, or smaller.

D. Prior to ANY system programming, obtain written approval from the Architect of the System Device Naming Matrix. Make corrections as noted.

E. Using the Matrix that is included at the end of this specification (see Exhibit 'A' for a partial sample format), the Installing Vendor shall create a spread sheet and identify EACH system device and description. For room or area abbreviations that are not listed or if there is more than one room or area of the same name, use a reasonable and logical name.

1. The Matrix shall have consistent information of EACH device for EACH Site.

2. Each system device shall be wired and programmed to communicate to the IACP(s) to display this information on EACH LCD Keypad, and to report this information to the Owners designated Monitoring Station, system Server, and Workstation(s), which shall indicate EACH separate system device abbreviation, as indicated on the System Device Naming Matrix.

2.12 SYSTEM CABLES, CONNECTORS, AND PATCH CORDS

A. See PART 3 of this specification and Section 27 00 00 for additional requirements.

B. ALL cables and conductors shall be the same size and color throughout EACH cable run. Such as from EACH field device to the terminals on the IACP and Power Supply.

1. The color of the overall cable jackets shall be green. If this color is not available, provide a permanent colored marking in green on the cable for every 10'-0" of cable for the duration of the cable run.

C. Cables/Conductors: The minimum allowable size conductors are specified below. Use larger conductors and/or additional conductors, as required. Prior to Bidding, consult with the system Manufacturer that the following cable types are acceptable. It shall be the Installing Vendors responsibility to provide and install Manufacturer approved cables. Use the Manufacturers equivalent cable requirements, to meet all code requirements [such as "Wet Rated" or "Aerial Rated" cable] for the appropriate devices.

1. CAT6 Cable(s):

a. Refer to Section 27 20 00.

2. CAT3 Cable(s):

a. Refer to Section 27 20 00.

3. D8125 MUX Addressable Data Protocol Field Devices:

a. Non-Plenum: West Penn: Model# 244 (18/4ns), or approved equal.

b. Plenum: West Penn: Model# 25244B (18/4ns), or approved equal.

4. Serial Data Bus (SDI) Data Protocol for LCD Keypads:

a. The length of the cable run shall not exceed 1,000 feet.

b. Non-Plenum: West Penn: Model# 244 (18/4ns), or approved equal.

c. Plenum: West Penn: Model# 25244B (18/4ns), or approved equal.

5. Non-addressable initiating field devices shall have the addressable module installed at the device.

6. Motion Sensors (MS):
    a. Non-Plenum: West Penn: Model# 244 (18/4ns), or approved equal.
    b. Plenum: West Penn: Model# 25244B (18/4ns), or approved equal.
7. Door Position Switches (DPS's):
    a. Non-Plenum: West Penn: Model# 221 (22/2ns), or approved equal.
    b. Plenum: West Penn: Model# 25221B (22/2ns), or approved equal.

D. Connectors/Terminations: Use the manufacturer approved wire strippers and crimping tool as required.
1. CAT6 cable(s):
    a. Refer to Section 27 20 00.
2. CAT3 cable(s):
    a. Refer to Section 27 20 00.
3. Maintain all cable and system requirements.

E. Patch Cords: Size EACH cable length to provide ease of maintenance, while not leaving excessive slack.
1. CAT6 cable(s):
    a. Refer to Section 27 20 00.
2. CAT3 cable(s):
    a. Refer to Section 27 20 00.
3. Maintain all cable requirements.

2.13 TEST FORM

A. See Section 27 00 00 Low Voltage Systems General Requirements for "Test Forms" and "Testing & Complete System Functionality", and "Testing" listed elsewhere in this specification for more information.

B. The Installing Vendor shall include in the pricing of their bid, the time and materials to generate and create the documentation, as described below. From left to right, list the information for EACH software feature set and for EACH device.
1. Provide a Pass, Fail, and N/A column. This shall be checked off during the course of the Testing process, to determine a "Pass" or "Fail".
2. To obtain a 100% Passing Test EACH row shall have; a "Pass", all answers shall be yes, and shall NOT have any negative comments.
3. List the name (i.e.: Motion Sensor, Door Position Switch, etc.).

4. List the Serial Number for EACH device.
5. List the device ID number.
6. List the Device model number.
7. List the Device Location (for example; South Wing Side Door, MDF Room XXX, etc.).
8. The Test Forms shall have the following categories;
    a. Equipment and Devices;
        1) Use the information on the System Device Naming Matrix as the basis for this form.
        2) Provide a separate row for EACH item/equipment/device test listed below.
    b. Submit this information with the Submittals and Shop Drawings in 11' x 17' format, or smaller.
9. The Test Forms shall include EACH of the items identified in "Test Forms" and the following tests listed below, but shall not be limited to the following;
    a. Equipment and Device Testing:
        1) For Data Cable(s): Refer to Section 27 20 00.
        2) Motion Sensors:
        3) Has EACH Motion Sensor detection pattern been "walk tested" for the appropriate room or area location?
        4) Is the "look down" sensor enabled?
        5) Raceway, Cabling, and Terminations:
        6) General:
        7) Is EACH of the cable type(s) provided/installed as specified?
        8) Are EACH of the cable runs installed without any splices?
        9) Do all cables maintain their minimum bend radius?
        10) Is EACH cable labeled as specified?
        11) Have EACH of the cable runs been combed and are tangle free?
        12) Systems Plywood Backboard(s):
        13) Is the Service Loop located above or near EACH of the Systems Plywood Backboard(s) as specified?
        14) Is the cabling installed in a neat and organized manner?

15) Is the equipment installed in the correct location, which leaves plenty of room for expansion, as specified (i.e.: NOT in the middle of the backboard).

16) Are the approved wire fasteners and wire ties installed?

17) Terminations:

18) Are EACH of the approved connectors provided and installed as specified?

19) Are EACH of the cables terminated as specified?

20) Intrusion Alarms Control Panel (IACP):

21) Is the IACP installed correctly?

22) Are the cables combed and dressed neatly?

23) Power Supplies:

24) Is EACH of the system Power Supplies installed correctly?

25) Is EACH of the system Power Supplies functioning correctly after removal of the primary AC power?

26) Does the IACP log in the event history, the loss of primary AC power for EACH Power Supply as specified?

2.14 ADDITIONAL INTRUSION ALARM EQUIPMENT

A. See Part 3 of this specification for additional provision of system Equipment and/or Labor.

PART 3 EXECUTION

3.01 GENERAL

A. See Section 27 00 00 Low Voltage Systems General Requirements for additional information.

B. See Section 27 20 00 Data and Voice Infrastructure for additional cable and installation requirements.

C. Prior to rough-in, coordinate with the Architect for the exact location(s).

D. Install all cabling, devices, and/or equipment per the manufacturer's recommendation.

E. Coordinate with the Owner for final program settings.

3.02 INSTALLATION

A. Setup, connect, and configure the system per the manufacturer's recommendations to operate as intended. Load, configure, and test the software for a fully functional system.

B. T-Tapping of Addressable device conductors is acceptable, when all of the manufacturer's requirements for the MUX protocol are fulfilled.

1. T-Tapping of Notification device conductors is NOT acceptable.

3.03 MOUNTING HEIGHTS, LOCATIONS, AND SETTINGS

A. Prior to rough-in, coordinate with the Architect for the exact location(s). Install all devices and/or equipment per the manufacturer's recommendation.

B. The IACP shall be mounted at 60" from the finished floor to the top of the enclosure, and shall be level.

C. Prior to Bidding, coordinate with the Installing Vendor(s), for actual quantities and locations of power requirements (see "Intrusion Alarm Power Supply" and "Flexibility in System Design Layout" in PART 2 of this specification). At a minimum, provide 120vac wiring and connections to EACH the IACP Transformer Enclosure for the IAPS as shown on the drawings and as required for a fully functional system, while maintaining all of the design requirements described elsewhere within these specifications. This shall include the following;

1. Install the Transformer Enclosure (with duplex 120vac outlet located inside the enclosure) at the following location(s);

a. Provide and Install one (1) Transformer Enclosure above the IACP location shown on the drawings.

b. The bottom of each Transformer Enclosure shall be a minimum of 6" inches above the accessible ceiling tiles (where applicable) or 8'-0" above the finished floor, directly above the Intrusion Alarm Control Panel.

c. Provide one (1) 3/4-inch conduit between the Transformer Enclosure to the Intrusion Alarm Control Panel, for the purpose of running a power cable from the plug-in transformer (within the Transformer Enclosure) down into the IACP.

D. The Keypad(s) shall be mounted at 48" from the finished floor to the top of the Keypad, and shall be level.

E. Motion Sensors:

1. Ceilings Mount – Install per manufacturer's recommendations.

2. Wall Mount motion sensors shall be mounted:

a. Install per manufacturer's recommendations and at 8'-0" above the finished floor, unless approved by the Architect.

b. Provide one (1) 4-square junction box with a single-gang reducing ring and one (1) 1" conduit up to the accessible ceiling space for EACH motion sensor.

c. Locate on a perimeter wall. The detection pattern shall NOT face toward exterior windows.

d. Sensor shall be switch selected to provide a 25'-0" x 32'-0" protection pattern.

e. Enable the bottom "look down" sensor.

f. Enable the anti-masking feature.

g. The following hard-wired contacts shall be monitored:

1) Alarm contact closure shall be monitored by an addressable point.

2) The Trouble contact closure shall NOT be monitored.

3) The Tamper switch contact closure shall NOT be monitored.

h. Prior to rough-in, consult with the manufacturer. Upon their suggestion, install the Gimbal-mount bracket where required for proper detection.

i. Adjust each sensor as required per the manufacturer's recommendations for each area and location. Walk test each device to confirm the detection pattern area is set correctly.

j. When all adjustments have been completed, leave the detection LED's in the active mode. The Owner wants to view the LED's at all times.

3.04 ADDRESSABLE MODULE INSTALLATION

A. Single Input Addressable Point Module(s) shall be used for EACH device as outlined below.

B. Motion Sensors:

1. The addressable input module shall be installed inside the motion sensor or installed inside the Motion Sensor Junction Box, and monitor the "Alarm" contact.

C. Provide a device cable from each of the following non-addressable field device to an Addressable Module Junction Box;

1. Loss of Primary Power:

a. For Loss of Primary Power, wire the IAPS's relay output to a separate single addressable input.

D. The Addressable Module Junction Box(s) shall consist of the Addressable Module being installed in a 4-square junction box (with a blank cover) 6" to 12" above the accessible ceiling.

1. For doors, install the junction box on the hinge side of the door, and approximately 5'-0" from the door on parallel or perpendicular walls, to accommodate servicing this unit without blocking the doorway. From the junction box, wire the door contacts as recommended by the manufacturer.

2. For other devices that are out in the open, or require the addressable module to be installed in a location other than at the device, install the addressable module in a logical location on the nearest wall that is a minimum of 5'-0" from the nearest doorway. Indicate on the As-builts where the junction box is for each device.

3. Conceal all wiring within the walls and/or ceiling, as required.

3.05 PROGRAMMING AND CONFIGURATION

A. The Installing Vendor shall program the system as coordinated with the Owner, as described throughout this specification, and as required for a fully functional system.

B. The Installing Vendor shall program the Configuration Files of the system to be automatically backed up onto the Owners Designated Server. These backups shall occur once per week. Coordinate with the Owners IT Department, as required.

C. The partitioning of the system, shall be programmed as follows;

1. As shown on the Drawings.

2. As coordinated with the Owner.

D. For Bidding Purposes, the Installing Vendor shall be expected to program the system to Industry Standards, based on a project of this size, scope, typical functionality for this market segment, and as described throughout this specification.

1. Review the testing requirements specified elsewhere within this specification for additional information.

3.06 TESTING

A. See Section 27 00 00 Low Voltage Systems General Requirements for “Test Forms” and “Testing & Complete System Functionality”, and “Test Forms” listed elsewhere in this specification for more information.

B. The Installing Vendor shall provide the staff and necessary equipment to meet or exceed the testing requirements.

C. The Installing Vendor shall provide the Staff, walkie-talkies, test equipment, additional equipment, resources, and time necessary to support the Owner to provide the Commissioning of this Systems. The installing Vendor shall demonstrate to the Owner the complete operation of each device, head end functionality, system configuration, and software functionality. The Installing Vendor shall also make adjustments to the equipment and changes to the program settings, as requested.

3.07 TRAINING

A. Training for Site Staff:

1. The training sessions shall be held at the project site.

a. Provide Training for up to ten (10) Site Staff.

b. Provide a total of two (2) separate training sessions for the Owners personnel. Schedule both training sessions with the Owner, providing a minimum of fourteen (14) days advance notice, and offer a minimum of three dates to choose from.

2. The Second Training Session(s) shall take place approximately 6 – 12 weeks after the facility has been fully occupied and in full operation.

3. The Training Session shall consist of:

    a. Providing the printed Training Manuals to EACH attendee.

    b. Being conducted by one (1) of the designated Installing Vendor technicians. The training shall be a minimum of one (1) 2-Hour session that shall be held on the same day, and provide a thorough and in depth full feature training session. Provide additional training time as required, to answer EACH of the staff's questions, at no additional cost to the Owner. This training shall address the Owners requirements identified on the documents.

3.08 AS-BUILTS

A. Provide all As-Built documentation as defined in Section 27 00 00 Low Voltage Systems General Requirements and listed elsewhere in this specification.

B. Update all documents provided in the Submittal and Shop Drawings to accurately reflect the actual equipment that was provided for this project, and the actual locations of the installed equipment.

C. The Installing Vendor shall include in the pricing of their bid, the time and materials to generate and create the documentation, as described below.

1. Provide an "Equipment Information Sheet", in the O & M manuals. At a minimum, from left to right, provide the following information;

    a. Manufacturers Name.

    b. Equipment Device Type (such as Workstation, Control Panel, etc.).

    c. Location (such as MDF room 103, or area of building).

    d. IP Address.

    e. Software Name.

    f. Software Version that is installed on the device.

    g. List the "Highest Level" configurable password for EACH device.

    h. List "EACH System Operator" password.

    i. List all other password settings for EACH device.

    j. See "Equipment Information Sheet" sample on the following page.

Exhibit 'A' (Page 1 of X)

Project Name Here
System Device Naming Matrix

Floor of bldg	**Area of bldg**	**Area Name**	**Area Abbreviation**	**Room Number *or* Device Location**	**Device Type**
_ _ = Not Applicable	N_	Class	Class	205_	DPS= Door Position Switch
U_ = Upper Floor	Nw	Office	Office	108a	_DA= Duress Alarm
L_ = Lower Floor	Ne	Portable	Port_	P16_	_TS= Tamper Switch
	S_	Container Storage (Near Portables)	Cont_	Stor= Storage	MSa= Motion Sensor Alarm
	Sw	Communications Room	Comm_	Room	MSt= Motion Sensor Trouble
	Se	Front	Front	Door	MSm= Motion Sensor Tamper (Meddle with sensor)
	W_	Side	Side_	Hall	Fzr= Freezer Alarm (Loss of Power)
	E_	Rear	Rear_	Area	Pwr= Loss of 120vac Power
	Mn=Men	Rest Room	Rest_	Encl= Enclosure	
	Wn= Womens	Locker Room	Lockr	_ _ _ _ = Not Applicable	
		Roll Up Door	Roll_		
		Electrical	Elect		
		Janitor	Jan_ _		
		Gymnasium or Multipurpose room	Gym_ _		
		Music	Music		
		Speech	Spech		
		Science	Scien		
		Computer Lab	Comp_		
		Work Room	Work_		
		Break Room	Break		
		Kitchen	Kitch		
		Boiler Room	Boilr		
		Shop	Shop_		
		Storage	Stor_		

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SECTION 28 23 00

CLOSED CIRCUIT TELEVISION SYSTEM (CCTV)

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions and Divisions 0 and 1 Specifications, apply to work of this Section.

1.02 SCOPE AND RELATED DOCUMENTS

A. The project CCTV System shall be an extension of the Owner's existing CCTV System. The Installing Vendor shall install owner-provided equipment at the project site and include the necessary programming for viewing, and playback control functions of the new CCTV System to and from the following locations:

1. Remote Viewing Monitor/PC.

B. Install a complete and fully operational ALL IP Camera CCTV system meeting the functional and operational requirements of this section and all related sections. The System includes but is not limited to:

1. Cameras, camera housings, IP converters, power supplies, mounting hardware, and brackets.

2. Contractor-provided environmental enclosures and accessories, remote viewing software, video monitors, fasteners, cable and all other connectors, hardware and components for a complete and coordinated system.

C. All cameras shall be Wide Dynamic Range Day/Night cameras.

D. The CCTV System shall utilize the new data infrastructure cabling, as described in Section 27 20 00 – Data Infrastructure. Review these specifications and see the CCTV System Riser Diagram for more information.

E. The Installing Vendor shall configure the system as described and shown. All Closed Circuit Television equipment shall conform to IEEE 802.3af and IEEE 802.3at specifications.

F. The system shall meet ALL of the requirements listed in Section 27 00 00 - Low Voltage Systems General Requirements PART 3 "Testing & Complete System Functionality", prior to "Substantial Completion".

G. Contractual information, guidelines, requirements, or other work specified to provide a fully functional system for Section 28 23 00 includes but is not limited to the sections identified in Sections 27 00 00 and 27 20 00.

1.03 SYSTEM OPERATION

A. The CCTV System shall record EACH camera when motion is present in EACH Cameras Field-of-View.

B. The Owner's existing PC's that are connected to the LAN and/or WAN shall accommodate the following features:

1. View Live Video from any site.

2. View Recorded Video from any site.

3. Provide the ability to export video clips from the Video Server(s) to email and CD.

4. Configure each PC with remote viewing software.

1.04 QUALITY ASSURANCE

A. The Installing Contractor shall provide a Staff Commitment Letter in the Submittal and Shop Drawings submittal package, that states the following:

1. The Installing Contractor shall identify and designate Manufacturer Trained and Certified Installing Vendor Technicians for the duration of this project.

a. To be deemed a qualified Installing Contractor for this project, technicians shall hold the following Manufacturers Certifications PRIOR to issuing submittals for this project:

1) The Installing Contractor shall submit copies of the above designated technicians Manufacturer Certification(s). The Installing Contractor must be certified in Avigilon Control Center – Enterprise Edition and Avigilon Access Control Manager as the primary installing Contractor. Sub-tier Contractors will not be allowed on this project.

2. The Installing Contractor shall identify and designate a Project Manager whose responsibilities will include, but are not limited to:

a. The Primary Point of Contact between the Owner and the Installing Contractor. It is acceptable for this person to be the Lead Technician.

b. Scheduling of technicians to perform the work on the Owners premises.

c. Scheduling of any meetings.

1) All meetings shall be on the Owners premises.

d. Scheduling and coordination of any deliveries to the Owners premises.

B. The system, devices, and equipment shall be manufactured under the appropriate category by Underwriters' Laboratories, Inc. (UL), and shall bear the UL label. Partial or pending listings are not acceptable. The installation of EACH device and/or component shall be in compliance with the UL listing. The system, devices, and equipment shall fully comply with the latest issue of these standards, where applicable, which includes, but is not limited to:

1. National Fire Protection Association (NFPA) - USA:

a. NFPA 70 National Electrical Code

b. NFPA 72 National Fire Alarm Code

2. Underwriters Laboratories Inc. (UL) - USA:

    a. UL 50 NEMA 4X Enclosures for Electrical Equipment

    b. UL 1950 Electrical Safety

3. Meet or exceed Building Codes and Standards:

    a. Local Authority Having Jurisdiction (AHJ) Requirements

    b. State:

        1) WAC 51-20 Washington Barrier Free Regulations

    c. National:

        1) National Electrical Code (see NFPA 70)

    d. International:

        1) International Building Code

        2) International Electrical Code (see NFPA 70)

C. Approvals:

1. The system shall have proper listing and/or approval from the following nationally recognized agencies:

    a. UL Underwriters Laboratories Inc.

    b. ULC Underwriters Laboratories Canada.

    c. IP66 Water/Dust Protection.

    d. IEC 60068-2-75 Impact Protection.

D. Service and Software Modifications:

1. Provide the services of a Manufacturer Certified/Authorized Technician to perform all system software modifications, upgrades or changes.

2. Provide all hardware, software, programming tools and documentation necessary to modify the system on-site. Modification includes addition and/or deletion of system devices, changes to system operation, and custom label changes for devices. The system structure and software shall place no limit on the type or extent of software modifications on-site.

1.05 SUBMITTALS AND SHOP DRAWINGS:

A. See Section 27 00 00 - Low Voltage Systems General Requirements for additional requirements.

B. Refer to “As-Built Drawings” for additional requirements.

C. Data Sheets and other documentation.

1. Installing Contractor Staff qualifications. Provide the following information:

a. Provide the Installing Contractor Staff Commitment Letter as described in “Quality Assurance” listed elsewhere in this specification.

2. The Materials List shall identify the Section, quantity of each item, the manufacturer, model number, and brief description of each item.

a. Provide data sheets for each item listed on the materials list.

b. Provide indicating arrows on data sheets that have multiple items on the data sheet.

c. Provide complete PDF export from Avigilon System Design Tool (sdt.avigilon.com) for each camera installed.

D. Shop Drawings shall include the following items:

1. The CCTV System Riser Diagram shall show the MDF.

a. Show each system component and device connected to and installed in the MDF.

2. EACH camera shall be identified by a Camera ID #.

a. The number sequence shall begin at the buildings main entrance (at the exterior of the building).

b. Go clockwise through the entire site.

c. Where interior cameras are shown, the number sequence shall continue (starting at the main entrance and going clockwise), only after all of the exterior cameras have been identified.

d. EACH Fixed exterior camera shall show the cameras Field-of-View (two lines in a “V” shaped pattern, projecting outwards from the camera).

e. Each Interior camera shall show direction-of-view with an arrow projecting outward from the camera.

f. The Shop Drawings shall show the intended Field-of-View for all Fixed Cameras. Use light "hatching" to show this area. This shall be shown on the Site Plan(s).

1) Site Plans: Show all exterior devices on the poles and on the structure.

E. See Section 27 00 00 - Low Voltage Systems General Requirements for additional requirements.

PART 2 PRODUCTS

2.01 MATERIALS

A. See Section 26 00 00 - Electrical General Conditions for additional information.

B. See Section 27 00 00 - Low Voltage Systems General Requirements for additional information.

C. See Section 27 20 00 - Data and Voice Infrastructure for additional equipment requirements.

D. Milestone VMS platform and Axis cameras are used for the basis of design for this specification.

1. Substitutions will not be approved on this project.

E. Provide all equipment as defined in the specification(s) and shown on the drawings.

F. Refer to PART 1 for any equipment that is not specifically defined.

2.02 SYSTEM WORKSTATION(S)

A. Remote Viewing Monitor/PC(s):

1. Remote Viewing Monitor/PC(s) mentioned elsewhere in this specification shall be used for this project.

a. Remote Viewing Monitoring Software: The system software shall be loaded on the Monitor/ PC's. The Installing Vendor shall provide, load, configure, and test the new software on EACH PC, as required.

1) Coordinate with the Owner's IT Department, as required.

b. Provide and install the most current version of CCTV System software on the CCTV System Viewing Remote Monitor/PC(s). Coordinate with the Owner's IT Department, as required.

B. Existing Owner Provided Workstation(s):

1. Existing Owner Provided Workstation(s) shall be used for this project. These workstations are intended to be used for other tasks in addition to for this system.

a. Remote Monitoring Software: The system software shall be loaded on the Owner provided PC's. The Installing Vendor shall provide, load, configure, and test the new software on EACH PC, as required.

1) Coordinate with the Owner to confirm which PC's will receive the new software.

2) Coordinate with the Owner's IT Department, as required.

2.03 VIDEO SERVER(S) AND SYSTEM SOFTWARE

A. Video Server(s): The Video Server is existing and from the owner.

B. Operating Software: The Owner shall provide any and all legally required additional software license(s) by Microsoft™ and other related software.

C. CCTV System Software:

1. Milestone Camera Licensing for all new cameras shall be OFOI.

D. Coordinate with the Owner's IT Department, as required.

2.04 NETWORK RELATED EQUIPMENT

A. Data Infrastructure:

1. See Section 27 20 00 - Data Infrastructure shall provide EACH of the following items at EACH location required:

a. Cat6 Cable Infrastructure.

b. Patch Panels.

c. Fiber Optic Infrastructure.

B. ALL Racks shall be provided by Section 27 20 00. Coordinate with Section 27 20 00 as required for the Installing Vendor to install the System equipment within these racks.

2.05 FIELD DEVICES

A. Cameras: Axis is the basis of design.

1. Provide the following camera types for each location shown on the plans:

a. Interior 2MP Dome Camera

1) Axis model P3265-LV

b. Interior 5MP Dome Camera

1) Axis model P3267-LV

c. Interior/Exterior 4 x 2MP Multi-Sensor Panoramic Camera

1) Axis model P3735-PLE

d. Interior/Exterior 4 x 5MP Multi-Sensor Panoramic Camera

1) Axis model P3737-PLE

e. Interior/Exterior 2 x 2MP Dual Sensor Panoramic Camera

1) Axis model P4705-PLVE

f. Interior 6 MP 360° Single-Sensor Panoramic Camera

1) Axis model M3057-PLR

g. Provide all additional mounting hardware or equipment required for installation at each location. See plans for installation type at each location.

B. Fiber Media Converters: Altronix is the basis of design.

1. Provide the ethernet over fiber PoE+ hardened switch with IP66 enclosure for site camera and gate control network connections. Gate control equipment provided by Division 28 13 00.

a. Install switch/enclosure within site enclosure.

b. Altronix model NetWay SP8WPN

1) Provide (2) two.

2. Provide multi-mode SFP fiber transceiver for fiber connectivity between fiber media converter and PoE+ hardened switches.

    a. SFP transceivers shall support 1G multi-mode with LC style connections.

    b. Altronix model P1MM

        1) Provide quantities as necessary.

2.06 SYSTEM CABLES, CONNECTORS, AND PATCH CORDS

A. Include the "Spare Capacity" requirements listed elsewhere within this specification, for the calculations and sizing requirements of the cables and/or conductors.

B. Cables/Conductors: The minimum allowable size conductors are specified below. Use larger conductors and/or additional conductors, as required. Use the Manufacturers equivalent cable requirements, to meet all code requirements [such as "Wet Rated" or "Aerial Rated" cable] for the appropriate devices.

1. CAT6 cable(s):

    a. Refer to Section 27 20 00.

        1) The color of the outer jacket of the cable is identified in Section 27 20 00.

2. OM4 fiber cable(s)

    a. Refer to Section 27 20 00.

C. Connectors/Terminations: Use the manufacturer approved terminations as required.

1. CAT6 cable(s):

    a. Refer to Section 27 20 00.

2. OM4 fiber cable(s)

    a. Refer to Section 27 20 00.

D. Patch Cords: Size EACH cable length to provide ease of maintenance, while not leaving excessive slack.

1. CAT6 cable(s):

    a. Refer to Section 27 20 00.

        1) The color of all system Patch Cords shall match the infrastructure cables.

E. See PART 3 of this specification and Section 27 00 00 for additional information.

2.07 TRAINING MATERIALS AND PROGRAMMING SURVEY

A. Interview the Owner for no less than a minimum of one (1) 2-Hour session. Allow for additional time if required, at no additional cost to the Owner. The Installing Contractor LEAD TECHNICIAN shall be present for this meeting. The purpose of this Interview is to verbally discuss all of the feature sets of the system. The dialog shall describe the benefits for implementing each of the systems features, thus allowing the Owner to make an informed decision on the how they can maximize the functional operation of their system.

1. Prior to starting the Interview process with the Owner, have EACH attendee fill out a "Sign in Sheet" listing EACH attendee's name, department they work in, and their phone number.

2. Provide a detailed list of features with a document titled "Section 28 23 00 - CCTV System – PRE-INTERVIEW of Owner Requested Systems Programming Sheet". This shall be provided in the "Submittal and Shop Drawings" with the Section 27 00 00 submittal. This shall be used as the basis of discussion for the Interview process.

3. For Bidding Purposes, the Installing Contractor shall be expected to program the system to Industry Standards, based on a project of this size, scope, and typical functionality for this market segment, and as described throughout this specification.

    a. Review the testing requirements specified elsewhere within this specification for additional information.

B. Training Manuals for the Site Staff:

1. At the 1st training session, prior to starting, provide a quantity of up to ten (10) training manuals to the site staff.

2. The training manual shall be specific to the site (i.e., Binder spine, binder cover insert, and the binder's internal documents).

3. Each of the training manuals shall be in a 3-ring "D" style binder. The binder shall be sized to allow for 20% additional documentation. The spine of the binder shall have a clear cover with an insert clearly typed with the following label "Section 28 23 00 - CCTV System – (site name here) training manual". The binder shall have a clear front cover with an insert clearly typed with the title of the spine on the front sheet, located at the top of the page, and centered. Under the title of the spine, the following information shall also be included on the front sheet of the binder; the site name and site address, the project name and project address, the current date, the installing vendors name, address, contact name and phone. Each binder shall include the following;

    a. Use color coded numbered tabs to separate each item defined below and for each device that was installed. Provide these items in the following order.

        1) Provide an 8½" x 11" clear heavy plastic sheet in front of a table of contents page as the first page of the binder indicating each of the equipment or device documents contained in each tab section.

2) "Section 28 23 00 - CCTV System – (Site Name Here) Training Syllabus".

4. Include the Manufacturers Software User's Manual(s).

2.08 ADDITIONAL SYSTEM EQUIPMENT

A. See Part 3 of this specification for additional provision of system Equipment and/or Labor.

PART 3 EXECUTION

3.01 GENERAL

A. See Section 27 00 00 - Low Voltage Systems General Requirements for additional information.

B. See Section 27 20 00 - Data and Voice Infrastructure for additional cable and installation requirements.

C. See Section 27 05 28 - Pathways for Communications additional installation requirements.

D. Prior to rough-in, coordinate with the Engineer for the exact location(s).

E. Install all cabling, devices, and/or equipment per the manufacturer's recommendation.

3.02 INSTALLATION

A. EACH CABLE RUN SHALL CONTINUOUS, WITHOUT ANY SPLICES, from the device to the terminal strip on the system patch panel(s). Any cable run that does not meet this requirement shall be replaced at no additional cost to the Owner.

B. Setup, connect, and configure the Servers/Workstations/Monitors per the manufacturer's recommendations to operate as intended. Load, configure, and test the software for a fully functional system.

3.03 MOUNTING HEIGHTS, LOCATIONS, AND SETTINGS

A. CCTV System Head end and other hardware:

1. All Head end equipment shall be rack mounted.

B. Rack(s):

1. All cabling for the rack(s) shall have Service Loops and Cable management.

C. General Camera Information:

1. Prior to rough-in, examine the surrounding area and the cameras intended Field-of-View (FoV) (from the perspective of where the camera is to be installed). Cameras shall be installed with an unobstructed FoV. This includes but is not limited to; existing objects, such as lights, exit signs, or other physical impediments.

2. Any camera that has the final and approved FoV that is obstructed will require the Installing to relocate the camera, at no additional cost to the Owner.

3. Coordinate with the Engineer and all trades to ensure that the cameras FoV will not be obstructed. Prior to relocating any camera, obtain written direction from the Engineer.

    a. Coordinate with the Owner to relocate banners, art, or anything else that may block the cameras FoV and/or mounting requirements.

    b. Wall Mount Cameras shall be installed at the following locations:

        1) At all areas as shown on the drawings.

D. Camera Mounting:

1. All cameras shall be flush to the ceiling or wall surface, unless otherwise noted.

2. Exterior Camera Mounting Requirements:

    a. Reinforce the Structure and Mounting Surface to properly secure the mounting of Exterior Cameras, as required.

    b. Install per camera manufacturer recommendations.

3. Interior Camera Mounting Requirements:

    a. Install per camera manufacturer recommendations.

E. Camera Focusing:

1. After the CCTV System has been powered up, cameras have been back focused (where applicable) and configured, then the camera shall then be positioned as discussed during the Interview with the Owner, which is described in “Training Materials and Programming Survey” listed elsewhere within this specification.

    a. Fixed Cameras shall be adjusted and focused for the intended Field of View (FoV). Readjust the cameras to the Owner’s needs, as required.

F. Remote Viewing of VIDEO SERVER(S)(s):

1. Load and configure the software on the Owners Existing PC’s and remote viewing monitor/PC(s) as required.

2. Train the Owners IT department how to load and configure the software on additional PC’s, as required.

3.04 TRAINING

A. Training for Site Staff:

1. The training sessions shall be held at the project Site.

   a. Provide Training for up to ten (10) Site Staff.

   b. Provide a total of two (2) separate training sessions for the Owners personnel. Schedule both training sessions with the Owner, providing a minimum of fourteen (14) days advance notice, and offer a minimum of three dates to choose from.

2. The 1st Training Session shall consist of:

   a. Providing the printed Training Manuals to EACH attendee, as described elsewhere in this specification in “Training Materials and Programming Survey”.

   b. The training shall be a minimum of one (1) 4-Hour session and provide a thorough and in-depth full feature training session. Provide additional training time as required, to answer EACH of the staff’s questions, at no additional cost to the Owner. This training shall address EACH of the software features that meet the Owners requirements identified on the documents that were filled out during the “Interview with the Owner”. This includes, but is not limited to:

      1) The “Section 28 23 00 - CCTV System – Owner Requested Systems Programming Sheet”.

         a) Using an Installing Contractor laptop and projector, connect to the Owners WAN and demonstrate each of these features and functions.

      2) At the Owners option, the Installing Contractor may be allowed to provide the Training Session on the Owners Workstation.

3. The 2nd Training Session shall consist of:

   a. A refresher training session shall be held approximately thirty (30) days after the first training session. The training session shall be a minimum of two (2) hours and may be conducted by one of the Installing Contractors designated technicians that attended the first training session. Provide additional training time as required, to answer EACH of the staff’s questions, at no additional cost to the Owner.

b. Using an Installing Contractors laptop and projector, connect to the Owners WAN and demonstrate each of the features and functions that the Owner's staff would like clarification on.

1) No less than five (5) business days in advance of this meeting, the Installing Vendor shall request from the Owner EACH of the items that the Owner would like clarification on.

a) The documents that were filled out during the "Interview with the Owner" shall be used as the reference document.

b) At the Owners option, the Installing Contractor may be allowed to provide the Training Session on the Owners Workstation.

2) Following the 2nd training session, the Installing Contractor shall include additional programming to accommodate system functionality changes, based on the requirements of the Owner.

a) Provide up to two (2) hours of system programming changes.

4. Upon completion of training, provide a letter from the customer on the customer's letterhead acknowledging that the training requirements have been met.

3.05 AS-BUILTS

A. Provide all As-Built documentation as defined in Section 27 00 00 - Low Voltage Systems General Requirements and listed elsewhere in this specification.

B. Update all documents provided in the Submittal and Shop Drawings to accurately reflect the actual equipment that was provided for this project, and the actual locations of the installed equipment.

C. The Installing Vendor shall include in the pricing of their bid, the time and materials to generate and create the documentation, as described below.

1. Provide an "Equipment Information Sheet", in the O & M manuals. At a minimum, from left to right, provide the following information;

a. Each row shall have an "Item #".

b. Manufacturers Name.

c. Equipment Device Type (such as Workstation, Control Panel, etc.).

d. Location (such as MDF room 240, or area of building).

e. IP Address.

f. Software Name.

g. Software Version that is installed on the device.

h. List the “Highest Level” configurable password for EACH device.

i. List “EACH System Operator” password.

j. List all other password settings for EACH device.

D. Provide ALL CD(s)/DVD(s) of installation software, legally required software licenses, and the associated documentation to reinstall all portions of the software that is running on the new and/or existing Server/Workstations.

E. Upon final acceptance of the CCTV system by the customer, provide a letter of acceptance from the customer on the customer’s letter head accepting the CCTV system as installed and that the CCTV system is fully operational and all training requirements have been met.

END OF SECTION 28 23 00

SECTION 28 31 00

FIRE ALARM SYSTEM

PART 1 GENERAL

1.01 GENERAL

A. **The Fire Alarm System for this project shall be a Honeywell Silent Knight 6820 System**

B. The existing system is a Honeywell Model Silent Knight 6820. Substitutions of the specified Fire Alarm will not be allowed.

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

1. Provide all material, labor, equipment, design, and services necessary to perform the modification of a complete, fully operational, intelligent (analog) and addressable (digital), low voltage 24 Volts D.C., point identification, microprocessor-based Fire Alarm System, in accordance with the required and advisory provisions of the latest edition of N.F.P.A. #72 accepted by the Authority having Jurisdiction **(City of Puyallup)** and project specifications, except as modified herein.

2. The Contractor is to obtain a permit and final approval from **(City of Puyallup)** for the Fire Alarm System. All permits, fees for plan review, inspections, testing, etc. shall be included in the bid proposal.

3. The Fire Alarm System Contractor shall simultaneously submit "Shop Drawings", Back-up Battery Calculations, Voltage Drop Calculations, Manufacturers Data Sheets, and a bond copy of each proposed Graphic Map to the local Authority Having Jurisdiction and Architect/Engineer for review that shall be approved by the Architect/Engineer prior to the purchase, fabrication, or installation of any system components as detailed in Paragraph 1.18 of Specification Section 28 31 00.

4. This building is within the city of Puyallup city limits. Per the city of Puyallup municipal code the fire alarm system shall be **total coverage smoke detection** in all spaces per NFPA #72.

    a. The NICET designer shall be responsible for design, layout, and coordination of smoke detection coverage in all concealed spaces per NFPA #72

    b. The city of Puyallup requires that the fire alarm system contractor show section views of all interstitial spaces. Above ceiling grid, above ceiling hard lids, beam pockets above and below ceilings, clouds, and roof slope for attic detection.

    c. **Total coverage** is defined in section 17.5.3.1 of NFPA #72

        1) 17.5.3.1 total (complete) coverage. Where required by laws, codes, or standards, and unless otherwise modified by 17.5.3.1.1 through 17.5.3.1.5, total coverage shall include all rooms, halls, storage areas, basements, attics, lofts, spaces above suspended ceilings, and other subdivisions and accessible spaces, as well as the inside of all closets, elevator shafts, enclosed stairways, dumbwaiter shafts, and chutes.

d. City of Puyallup municipal code 17.16.070 installation requirements.

1) The fire alarm system shall be designed to “total coverage” per NFPA 72 unless a lesser coverage is approved by the fire code official. (ord. 2801 § 6, 2004).

5. Products shall be domestically made and comply with the requirements of the “Buy American Act - Construction Materials Under Trade Agreements”.

6. By submitting a bid, the Fire Alarm System Contractor is acknowledging that he has made a thorough examination of the Contract Documents, existing site and building conditions. By submitting a bid, the Fire Alarm System Contractor is acknowledging that they have determined that these documents do sufficiently describe the scope of construction work and have included all items required under this Contract.

1.02 RELATED DOCUMENTS

A. Drawings, General Conditions and Supplementary Conditions of the Contract, including Division 0 and Division 1 Specification Sections apply to work of this Division.

B. Environmental Protection Requirements: The work of this Section is part of the overall requirements to comply with the Environmental Protection, Hazardous Materials, and Green Procurement Requirements. Comply with Section 01 57 00 – Environmental Protection.

1.03 RELATED SECTIONS

A. The following sections apply to this section:

1. Section 26 00 00 "ELECTRICAL GENERAL CONDITIONS".

2. Section 26 00 05 "ELECTRICAL – EXISTING SYSTEMS".

3. Section 26 05 19 "WIRES AND CABLES".

4. Section 26 05 26 "GROUNDING AND BONDING".

5. Section 26 05 32 "OUTLET AND PULL BOXES".

6. Section 26 05 33 "RACEWAY".

7. Section 26 27 26 "SWITCHES AND RECEPTACLES".

8. Section 27 00 00 "LOW VOLTAGE SYSTEMS GENERAL REQUIREMENTS".

1.04 CODES AND STANDARDS

A. Codes and agencies having jurisdictional authority over Fire Alarm System installations.

1. International Building Code – Latest Adopted Edition.

2. International Mechanical Code – Latest Adopted Edition.

3. International Fire Code – Latest Adopted Edition.

4. Authority Having Jurisdiction (Local Fire Marshal).
5. Occupational Safety and Health Administration (OSHA).
6. Washington Industrial Safety and Health Act (WISHA).
7. National Fire Protection Association (N.F.P.A.).
8. ANSI-J-STD-607-A Commercial Building Grounding and Bonding Requirements for Telecommunications.
9. Americans with Disabilities Act (ADA).
10. State of Washington Electrical Code.
11. State of Washington Administrative Code (WAC).
12. State of Washington Labor & Industry (L&I).
13. Revised Code of Washington (RCW).
14. American Society for Testing and Materials
15. National Board of Fire Underwriters
16. National Electrical Safety Code
17. National Electrical Manufacturers Association
18. Electrical Testing Laboratories
19. U.L. Fire Protection Equipment Directory
20. Underwriters Laboratories Incorporated (U.L.):
    a. UL #5 Standard for Surface Metal Raceways and Fittings
    b. UL #38 Standard for Manual Signaling Boxes for Fire Alarm Systems
    c. UL #50 Enclosures for Electrical Equipment, Non-Environmental Considerations
    d. UL #228 Standard for Door Closers-Holders, With or Without Integral Smoke Detectors
    e. UL #268 Smoke Detectors for Fire Alarm Systems
    f. UL #268A Standard for Smoke Detectors for Duct Application
    g. UL #346 Standard for Waterflow Indicators for Fire Protective Signaling Systems
    h. UL #464 Standard for Audible Signal Appliances
    i. UL #497A Standard for Secondary Protectors for Communications Circuits

j. UL #521 Standard for Heat Detectors for Fire Protective Signaling Systems

k. UL #827 Standard for Central-Station Alarm Services

l. UL #864 Standard for Control Units and Accessories for Fire Alarm Systems

m. UL #1449 Standard for Surge Protective Devices

n. UL #1481 Standard for Power Supplies for Fire-Protective Signaling Systems

o. UL #1971 Standard for Signaling Devices for the Hearing Impaired

p. UL #2075 Standard for Gas and Vapor Detectors and Sensors

q. If any conflict occurs between Code Rules and this specification, the codes are to govern. Nothing in these drawings and specifications shall be construed to permit work not conforming to governing codes. Also, this shall not be construed as relieving the Fire Alarm System Contractor from complying with any requirements of the plans and specifications which may be in excess of, but not in conflict with, requirements of the Governing Codes.

1.05 DEFINITIONS

A. Thermal Envelope: The heat flow control layer (insulation for example) that separates the interior conditioned space from the exterior unconditioned space.

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

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

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

E. Unfinished Spaces: Spaces used for storage or work areas, such as sprinkler riser rooms, mechanical rooms, electrical rooms, etc., where appearance is not a factor.

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

G. Concealed Spaces: Spaces out of sight i.e. above ceilings, below floors, between double walls, furred-in areas, pipe and duct shafts, and similar spaces.

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

I. Soffit: A ceiling that is secondary to the primary ceiling elevation that is at a lower elevation and is finished with gypsum wall board or other construction materials.

1. Provide: It shall be interpreted as "furnishing and installing complete in operating condition".

2. Drawings: It shall be interpreted as "all Contract Drawings for all Disciplines".

1.06 GENERAL SYSTEM REQUIREMENTS

A. It is the intention of this division of the specifications and the accompanying drawings to describe and provide for the furnishing, installing, testing and placing in satisfactory and successful operation all equipment, materials, devices and necessary appurtenances to provide a complete electrical & fire alarm system, together with such other miscellaneous installations and equipment hereinafter specified and/or shown in the plans. The work shall include all materials, appliances and apparatus not specifically mentioned herein or noted on the plans, but which are necessary to make a complete working installation of all electrical systems shown on the plans or described herein.

B. Provide and install a new complete, fully operational, intelligent (analog) and addressable (digital), low voltage 24 Volts D.C., "Class B", point identification, microprocessor-based Fire Alarm System that will transmit a signal to the monitoring entity as described herein and as shown on the contract documents.

C. The Fire Alarm System shall include, but not be limited to a control panel, Remote Power Supplies, peripherals, initiating devices, notification appliances, cabling, conduit, junction boxes, fittings, raceways, termination at field devices and panels, etc. required for a complete operating system even though each item may not be specifically mentioned or described in this specification section or on the contract documents.

D. Devices and equipment for Fire Alarm System service shall be U.L. listed or Factory Mutual Global approved for use in Fire Alarm Systems and of the manufacturer's current model.

E. The Fire Alarm Control Panel shall be listed under U.L. Category UOJZ as a single control unit and shall be U.L. Listed for Power Limited Applications per Article 760 of N.F.P.A. #70 (National Electrical Code).

F. The Fire Alarm Control Panel shall electrically supervise and monitor the integrity of all conductors of all circuits.

G. The Fire Alarm System Control Panel and peripheral devices shall be manufactured 100% by a single U.S. manufacturer (or division thereof).

H. The Fire Alarm shall be of modular design to facilitate both expansion and service.

I. The system shall be an active/interrogative type system where each addressable device is repetitively scanned, causing a signal to be transmitted to the Fire Alarm control panel indicating that each device, and associated circuit cabling, is functional.

J. All power or system shutdowns shall be coordinated with the Owner or Owner’s representative with a minimum of (14) days advanced notice not exceeding four (4) hours. Provide temporary provisions for periods greater than four (4) hours with Lockout / Tagout procedures being used.

K. Equipment in compliance with U.L. standards but not bearing their label is not acceptable.

1.07 PROTECTION OF NEW FIRE ALARM EQUIPMENT

A. The Fire Alarm System Contractor shall store and guard all equipment before installation and shall protect same, and replace any equipment that has been damaged prior to final acceptance.

1.08 HOUSEKEEPING

A. All electrical materials shall be kept stored in an orderly fashion protected from heat, cold, and the weather.

B. All marred surfaces shall be refinished and painted after installation.

C. All debris shall be removed from premises during work, as directed, and at completion of job.

1.09 COORDINATION

A. The work covered by this Specification Section shall be coordinated with the related work as specified elsewhere on the contract documents or in the project specifications.

B. The Fire Alarm System Contractor shall participate in the on-site coordination meetings to coordinate the Fire Alarm System installation with the Architectural features, H.V.A.C. grilles, electrical lights, fire protection sprinkler heads, and/or existing conditions.

C. Coordination meetings shall consider elevations, required clearances, and routings of all trades to assure that all trades can be installed without conflict.

D. The outcome of this coordination shall allow each system (Electrical, Mechanical, Fire Protection, etc.) to be installed without further conflicts for space or locations.

E. Failure to coordinate with other trades and/or existing conditions that result in the removal and re-installation of systems shall not be charged as additional costs.

1.10 PENETRATIONS

A. Fire Resistance Rated Penetrations:

1. Where Fire Alarm System conduit penetrates a fire resistance rated wall or floor assembly, the Fire Alarm System Contractor shall provide a fire rated penetration that maintains the integrity and fire resistance rating of the assembly being penetrated.

2. The fire resistance rated penetrations of walls or floor assemblies shall consist of one of the following:

a. Cabling in Conduit: Fire Alarm System cabling installed in conduit shall be provided with sealant between the conduit and the wall or floor penetration

b. Exposed Cabling: Fire Alarm System cabling installed exposed shall be provide with a section of conduit (sleeve) that extends past both faces of the penetration by a minimum distance of 6". Seal both ends of conduit (sleeve) with U.L listed or Factory Mutual Global approved material and sealant that maintains the fire resistance rating of the assembly being penetrated. Provide fire resistance rated sealant to both sides of assembly penetration between the conduit (sleeve) and the wall or floor assembly.

c. Exposed Cabling: Fire Alarm System cabling installed exposed shall be provide with a fire resistance rated grommet that maintains the fire resistance rating of the assembly being penetrated, such as those manufactured by Specified Technologies Incorporated (STI). The grommet shall slipover the cabling and snap together to form a round grommet that can slide into the penetration. A separate grommet shall be required for each side of the assembly.

B. Non-Fire Resistance Rated Penetrations:

1. The Non-fire resistance rated penetrations of walls or floor assemblies shall consist of one of the following:

a. Cabling in Conduit: Fire Alarm System cabling installed in conduit shall not require additional sealant between the conduit and the wall or floor penetration

b. Exposed Cabling: Fire Alarm System cabling installed exposed shall be provide with a section of conduit (sleeve) that extends past both faces of the penetration by a minimum distance of 6". Additional Sealant shall not be required.

c. Exposed Cabling: Fire Alarm System cabling installed exposed shall be provide with a Non-fire resistance rated grommet, such as those manufactured by Specified Technologies Incorporated (STI). The grommet shall slipover the cabling and snap together to form a round grommet that can slide into the penetration. A separate grommet shall be required for each side of the assembly.

C. Smoke Barrier/Partition Penetrations:

1. Where Fire Alarm System conduit penetrates a smoke barrier/partition wall or floor assembly, the Fire Alarm System Contractor shall provide a smoke barrier/partition penetration that prevents the passage of smoke through the assembly being penetrated.

2. Smoke barrier/partition penetrations of walls or floor assemblies shall consist of one of the following:

a. Cabling in Conduit: Fire Alarm System cabling installed in conduit shall be provided with sealant between the conduit and the wall or floor penetration

b. Exposed Cabling: Fire Alarm System cabling installed exposed shall be provide with a section of conduit (sleeve) that extends past both faces of the penetration by a minimum distance of 6". Seal both ends of conduit (sleeve) with U.L listed or Factory Mutual Global approved material and sealant that prevents the passage of smoke. Provide sealant between the conduit (sleeve) and the wall or floor assembly on both sides of assembly penetration.

c. Exposed Cabling: Fire Alarm System cabling installed exposed shall be provide with a Non-fire resistance rated grommet, such as those manufactured by Specified Technologies Incorporated (STI). The grommet shall slipover the cabling and snap together to form a round grommet that can slide into the penetration. A separate grommet shall be required for each side of the penetration.

D. All firestop systems shall be installed in accordance with the manufacturer's recommendations and shall be completely installed and available for inspection by the local authorities prior to cabling system acceptance.

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

F. The Fire Alarm System Contractor shall minimize the quantity of penetrations through the air barrier. All penetrations shall be filled with a spray type foam insulation or other approved means to maintain the integrity of the air barrier. The ends of seismic brace members that penetrate the air barrier shall also be filled with a spray type foam insulation of other approved means to maintain the integrity of the air barrier.

G. The Fire Alarm System and Electrical drawings do not specifically identify penetrations through walls, floors, platforms, and foundations.

H. The Fire Alarm System Contractor shall review all architectural and structural drawings to determine all penetration locations.

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

J. All penetrations through walls, floors, platforms, and foundations are the responsibility of the Fire Alarm System Contractor.

1.11 CUTTING AND PATCHING

A. Obtain permission from the General Contractor and Owner's Representative prior to cutting. Locate cut locations so they will not weaken structural components the minimum amount necessary.

B. All construction materials damaged or cut into during the installation of the Fire Alarm System shall be repaired or replaced with materials of like kind and quality by skilled labor experienced in that particular building trade.

1.12 SYSTEM/DEVICE INTERFACE CONNECTIONS

A. The following system/device interfaces shall be connected to the Fire Alarm System for auxiliary functions initiated by the Fire Alarm System Control Panel and includes, but is not limited to:

1. Audio/Visual Sound Systems
2. Intercom Systems
3. Public Address Systems
4. Smoke and Fire/Smoke Dampers
5. Duct Smoke Detectors
6. H.V.A.C. Systems
7. Magnetic Door Holders
8. Magnetic Door Releases
9. Fire Rated Coiling Doors
10. Fire Rated Shutters
11. Won Doors

12. Emergency Generators

13. Clean Agent Suppression Systems

14. Fire Protection Sprinkler Systems

1.13 SITE INSPECTIONS OF EXISTING BUILDINGS OR SITE CONDITIONS PRIOR TO BIDDING

A. The Fire Alarm System Contractor shall examine the structure, building, and existing conditions under which Divisions 28 work is to be installed for conditions detrimental to proper and timely completion of the work before submitting proposals and/or bids for this work.

B. Do not proceed with work until deficiencies encountered in existing installation have been corrected. Report any delay or difficulties encountered in installation of the existing Fire Alarm System which might be unsuitable to connect with work. Failure to report conditions shall constitute acceptance of other work as being fit and proper for the installation of the new Fire Alarm System.

C. Maintain continuity of existing circuits of equipment to remain. Existing circuits of equipment shall remain energized. Circuits which are to remain but were disturbed during demolition shall have circuits, wiring, and power restored back to original condition.

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

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

1.14 CONTRACT DOCUMENTS:

A. BCE Fire Alarm system contract drawings are not a complete design or 100% layout and are simply conceptual. This layout identifies proposed locations of devices and key critical aspects of the fire alarm system. They are meant to provide a guide for coordinating architectural, electrical, and mechanical features of the building design and to aid the NICET designer in creating shop drawings in accordance with NFPA 72, state & local requirements. The contractors and the fire alarm system designer shall coordinate the exact quantities and locations of all system components between trades and/or existing conditions.

B. The Fire Alarm System contract documents are intended to serve as working drawings for general layout and locations of components. The equipment layout is diagrammatic and unless specifically dimensioned or detailed, does not indicate all fittings, hardware or appurtenances required for a complete operating installation. It is the Fire Alarm System contractor's responsibility to provide devices that may not be indicated or shown on the contract documents for a fully functional system.

C. Wiring diagrams are not intended to indicate the exact course of raceways or exact location of device. Raceway and device locations are approximately correct and are subject to revision as may be necessary or desirable at the time of installation. Precise location in every case shall be subject to the Engineer's approval.

D. The Fire Alarm System contractor shall be responsible for reviewing all architectural, civil, electrical, mechanical, plumbing, structural, and fire protection drawings. These drawings may contain information related to the design and construction of this project and it is the Fire Alarm System contractor's responsibility to review the contract documents of all trades and to coordinate the contract documents with the Fire Alarm System "Shop Drawings".

E. Architectural and Electrical drawings take precedence over Fire Alarm drawings.

F. The Fire Alarm System installation shall be developed in accordance with the contract documents, project specifications, and applicable standards. Should a conflict occur between the contract documents and project specifications, the project specifications shall prevail, refer to Division 1.

G. In the case that criteria contained on the contract documents is omitted from the project specifications or the project specifications have criteria that is omitted from the contract documents, the criteria given in one location shall apply as if shown in both the contract documents and in the project specifications (what's in one document applies to both documents). The contract documents and project specifications are complementary and what is called for in either is binding as if called for in both.

H. Fire Alarm System Work shall be as defined in the contract documents and in this specification Section. Any details beyond these limits are meant only to give installation clarity to that portion which is a part of this Contract.

I. Fire Alarm System Drawings for the project have been developed by the Engineer using AutoCAD format. These drawing files will be made available to the Fire Alarm System Contractor for development of "Shop Drawings" and "As-Built" drawings, for a fee of $100.00 per sheet. Full payment to be made prior to release of drawing files.

1.15 SHOP DRAWINGS

A. Prepare detailed working drawings for the system layout in accordance with N.F.P.A. #72 and the following:

1. Shop Drawing Requirements: The Installing Vendor's/Contractor's complete and full-size set of Shop Drawings shall be issued in the following format:

   a. They shall be clear and legible.

   b. The same sheet size as the Contract Drawings (i.e. 30" x 42").

   c. A minimum of 1/8" text height shall be used for all text, symbol text, and subscript text.

   d. Scale of Drawings:

      1) Any Site plan drawings shall be the same scale as issued in the Contract Documents.

      2) Floor plan drawings shall be 1/8"=1'-0", unless directed to do otherwise.

   e. The Electrical Legend, Wire Legend, Load and Battery Calculations, Riser Diagram, Sequence of Operation Info, Wiring Details, and Mounting Details shall precede the Site Plans and Floor Plans.

f. All sheets, including the cover, shall include a title block along the edge of each of the drawings that, when the drawings are rolled up, the following information shall be visible:

g. The system-specific sheet number

h. Project name, specification section number and section title name

i. Floor name, area, and/or section of the building (Use the name of the area and/or floor description that is on the Contract Drawings.)

j. Architectural information on the Contract Drawings shall be included on the Installing Vendor's/Contractor's Shop Drawings, including, but not limited to: match lines, grid lines, grid bubbles, key plan, and enlarged floor plans.

B. All items contained in Section 7.4 "Shop Drawings" of the latest edition of N.F.P.A. #72 adopted by the Authority Having Jurisdiction shall be included on the Fire Alarm System Shop Drawings including, but not limited to the following:

1. Sheet Index.
2. Fire Alarm System Component Legend.
3. Cabling Legend.
4. Alpha-numeric labeled cables based upon the "Cabling Legend" for each cable type and cable run.
5. Electrical Legend listing the electrical devices to be utilized as part of the Fire Alarm System installation.
6. Site Plan.
7. Floor Plans indicating all Fire Alarm System devices.
8. End-Of-Line Resistor(s) where applicable.
9. Device Address shown adjacent to each device.
10. One-Line Riser Diagram.
11. "Sequence of Operations" matrix indicating all system Inputs and Outputs.
12. Mounting details and mounting heights

C. Provide "Shop Drawings" that are usable for trouble-shooting purposes showing equipment/device locations, conduit routing, junction boxes, connection cabling for the entire Fire Alarm System layout, and riser diagrams.

D. Shop Drawings shall be clear and legible with a minimum text height of 1/8" for all text.

E. A graphical scale shall be provided for each floor plan or detail on the shop drawings in accordance with N.F.P.A. #72.

F. Projects that require more than one sheet to show the entire Fire Alarm System shall require a key plan.

G. The key plan shall identify the location of the Fire Alarm System that is contained on that sheet and shall contain a reference north arrow.

H. All sheets that contain a break in the building background shall contain a "Match Line" designation to indicate where the building and Fire Alarm System continues, even if on the same sheet.

I. One-Line Riser Diagram shall show all field devices and their respective room names, room numbers, device address, device designation and candela settings in the order wired on the floor plans. Per NFPA 72, a riser diagram is required to show the type and number of system components/devices on each circuit and the number of conductors for each circuit. Since a circuit is defined in NFPA 72 as a connection path between locations, the riser diagram should show the order that devices are connected.

1.16 PRE-CONSTRUCTION KICK–OFF MEETING

A. The Fire Alarm System Contractor may request a pre-construction kick-off meeting with the Architect, Fire Protection Engineer, General Contractor, Electrical Contractor, Building Owner Representative, and Owners IT Department (if applicable) to answer any specification and contract design related questions during the early design phase of the project.

B. The Fire Alarm System Contractor shall provide a written request for this meeting to the General Contractor that is addressed to the Architect.

C. The pre-construction kick-off meeting shall take place prior to submittal of equipment data sheets.

1.17 BUILDING EXPANSION, SEPARATION, OR SEISMIC JOINTS

A. The Fire Alarm System Contractor shall provide a junction box on each side of the Building Expansion, Separation, or Seismic joint.

B. The Fire Alarm System Contractor shall provide a section of flexible conduit between the junction boxes of sufficient length to accommodate for the calculated building movement.

C. The Fire Alarm System Contractor shall provide grounding bushings with #12 grounding cable to maintain continuity between junction boxes. Grounding cable shall be of sufficient length to accommodate for the calculated building movement.

D. The Fire Alarm System Contractor shall secure flexible conduit and grounding cable on each side of the Building Expansion, Separation, or Seismic joint.

1.18 SUBMITTALS

A. Product substitution during installation from the approved Equipment Submittals will not be allowed and shall result in the removal and reinstallation of system components at no additional cost to the Owner.

B. Provide copies as specified by Division 1 and at a minimum provide **three (3) sets** of "Shop Drawings", Back-up Battery Calculations, Voltage Drop Calculations, Graphic Map(s), and Manufacturer's Data Sheets to the Architect/Engineer for approval prior to the purchase, fabrication, or installation of any system component. Failure to receive the Architect/Engineer approval that results in reordering of material, removal of installed system components, and the re-installation of the Fire Alarm System shall not be charged as additional cost to the Owner or General Contractor.

C. Fire Alarm System equipment submittals, shop drawing submittals, back-up battery calculations, voltage drop calculations, and graphic maps ***shall be submitted together at one time*** as listed below.

D. Equipment Submittals for the Fire Alarm System shall be submitted to the Architect / Engineer for review and approval within sixty **(60) calendar days** from the date of the Contract signing by the General Contractor.

E. All remote power supply locations deemed necessary by the Fire Alarm System Contractor shall be submitted for review and approval.

F. "Shop Drawings", Back-up Battery Calculations, Voltage Drop Calculations, and the Graphic Map(s) for the Fire Alarm System shall be submitted to the Architect / Engineer for review and approval within sixty **(60) calendar days** from the date of the Contract signing by the General Contractor.

G. Graphic Maps shall be submitted for review and approval within sixty **(60) calendar days** from the date of the Contract signing by the General Contractor.

H. Equipment submittals shall be broken up by "Tabbed Dividers" that shall include, at a minimum, the following:

1. Fire Alarm System Control Panel.
2. Fire Alarm Remote Annunciator Panels.
3. Power Supplies.
4. Initiating Devices.
5. Notification Appliances.
6. Graphic Maps.
7. Modules.
8. Miscellaneous Equipment.

I. Equipment submittals, within the tabs above, shall include, at a minimum, the following:

1. Fire Alarm System Control Panel.
2. Fire Alarm System Control Panel Enclosures.
3. Fire Alarm System Terminal Cabinets
4. Fire Alarm Remote Annunciator Panels.

5. Main Fire Alarm System Control Panel Power Supplies.
6. Remote Power Supplies.
7. Back-Up Batteries.
8. Internal Battery Chargers.
9. External Battery Chargers.
10. Initiation Devices:
    a. Manual Pull Stations.
    b. Manual Pull Station Stoppers (Shields).
    c. Smoke Detectors.
    d. Duct Smoke Detectors.
    e. Duct Smoke Detector Remote Test Stations.
    f. Carbon Monoxide Only Detectors.
    g. Combination Smoke / Carbon Monoxide Detectors.
    h. Multi-Criteria Detectors.
11. Notification Appliances:
    a. Strobe only Appliances.
    b. Combination Horn / Strobe Appliances.
12. Damage Stoppers (Wire Guards).
13. Graphic Maps.
14. Monitor Modules.
15. Relay Modules.
16. Multi-Voltage Relay Modules (Relay in Box).
17. Control Modules.
18. Isolation Modules.
19. Remote Indicating Lamps.
20. Magnetic Door Holders.
21. Magnetic Door Locks.

22. Universal Digital Alarm Communicator Transmitter (UDACT).
23. AES Wireless Transceiver.
24. Antenna.
25. Transient Voltage Surge Protection.
26. Wiremold Surface Raceway.
27. Wet Rated Cables.

J. Shop drawing submittals shall include the following information:

1. Floor plans identifying all Fire Alarm System components and devices.
2. Cabling / conduit routing and sizing.
3. Sequence of operations
4. Fire Alarm System zoning.
5. Point to point cabling diagrams.
6. One-line risers.
7. Back-up Battery Calculations.
8. Voltage Drop Calculations.
9. Graphic Map Details / Artwork

K. Equipment Submittals, Back-Up Battery Calculations, Voltage Drop Calculations, and full-sized color bond Graphic Maps for the Fire Alarm System shall be contained within a single 3-ring hard cover binder having a typewritten index and divider sheets between categories with identifying tabs.

L. Equipment Submittals shall contain original brochures supplied by manufacturers (Photocopies of originals will not be accepted). Each type of device provided shall be identified in the Equipment Submittals using the same identification as shown on the drawings and specifications. The information included must be the exact equipment to be installed, not the complete "line" of the manufacturer. Where sheets show the equipment installed and other equipment, the installed equipment shall be neatly and clearly identified on such sheets.

M. If the submittals are being delivered electronically, the Fire Alarm System Contractor shall provide the following:

1. Submittal Drawings:

a. The Submittal Drawings shall be a single PDF that is formatted to actual contract drawings size (not 11x17) and collated in numerical order as designated in the title block of each drawing.

2. Equipment Submittals:

    a. The Equipment Submittal shall be a single PDF.

    b. The Equipment Submittal PDF shall contain all equipment, devices, and components that are collated for printing on 8½"x11" sized paper.

    c. The Equipment Submittal PDF shall be a searchable document.

    d. The Equipment Submittal PDF shall be formatted for duplex printing with blank sheet inserted where necessary.

    e. The Equipment Submittal PDF shall contain a "Table of Contents" that indicates all pieces of equipment, devices, and components contained within each "Tabbed Divider" defined in Paragraph 1.13.G of this Specification Section.

    f. The Equipment Submittal PDF shall be bookmarked by "Tabbed Divider" and for each piece of equipment, device, and component.

3. Back-Up Battery Calculations and Voltage Drop Calculations that are submitted as part of the Equipment Submittal PDF shall be formatted to the following:

    a. Calculations shall be included at the end of the Equipment Submittal PDF under a separate "Tabbed Divider" for both Back-Up Battery Calculations and the Voltage Drop Calculations.

    b. The Equipment Submittal "Table of Contents" shall also indicate all calculations being provided for both the Back-Up Battery and the Voltage Drop Calculations

4. Back-Up Battery Calculations and Voltage Drop Calculations that are submitted as a separate PDF from the Equipment Submittal PDF:

    a. The single Back-Up Battery Calculations and Voltage Drop Calculations submittal PDF shall contain all calculations that are collated for printing on 8½"x11" sized paper.

    b. The Back-Up Battery Calculations and Voltage Drop Calculations submittal PDF shall be a searchable document.

    c. The Back-Up Battery Calculations and Voltage Drop Calculations submittal PDF shall be formatted for duplex printing with blank sheet inserted where necessary.

    d. The Back-Up Battery Calculations and Voltage Drop Calculations submittal PDF shall contain a "Tabbed Divider" to separate the Back-Up Battery Calculations from the Voltage Drop Calculations.

    e. The Back-Up Battery Calculations and Voltage Drop Calculations submittal PDF shall contain a "Table of Contents" that indicates all calculations contained within each "Tabbed Divider" defined in Paragraph 1.13.L.3.d of this Specification Section.

    f. The Back-Up Battery Calculations and Voltage Drop Calculations submittal PDF shall be bookmarked by "Tabbed Divider" and for each Back-Up Battery Calculation or Voltage Drop Calculation.

5. Graphic Maps:

    a. Graphic Maps shall be submitted in a PDF that is full sized to allow printing of actual sized proposed Graphic Maps.

N. Review of Fire Alarm System submittal by the Engineer or Architect does not relieve the Contractor of responsibility for compliance with the intent of all contract documents and / or code.

O. Any material found to be installed without prior approval will be required to be removed and replaced with only specified approved material at Contractor's cost.

P. The contract documents shall not be used as the Fire Alarm System Contractor's Shop Drawings.

Q. The Fire Alarm System Shop Drawings shall be system specific with only Fire Alarm System equipment and connections to other equipment that will be interfaced to the Fire Alarm System being shown.

R. All re-submittals shall have the areas of revision clearly marked with revision clouds.

S. The Fire Alarm System Contractor shall resubmit within fourteen **(14) calendar days** upon receiving a review letter rejecting any portion of the Fire Alarm System submittal.

1.19 CERTIFICATION AND LICENSING

A. The Fire Alarm System shall:

1. Be manufactured by an ISO 9001 certified company.

2. Meet the requirements of BS EN9001: ANSI/ASQC Q9001-1994.

3. Shall bear the marking for a U.L. Listed UOJZ control unit.

B. The Fire Alarm System Contractor shall:

1. Be currently listed and approved by Underwriters Laboratories Incorporated with a Certificate Service for Protective Signaling Services – Local, Auxiliary, Remote Station.

2. Be currently listed and approved by Underwriters Laboratories Incorporated for "Proprietary Protective Signal System Listing Program" with a UUJS certificate of compliance.

3. Be a certified Level III technician by National Institute for Certification in Engineering Technologies (NICET) in the Fire Alarm Technology subfield of fire protection engineering technology.

C. At the request of the Architect/Engineer, the Fire Alarm System Contractor shall provide:

1. UL certificate specific to this installation.

2. Proof of all Certificates and Listings

D. Fire Alarm System Shop Drawings shall be designed by one of the following (provide a copy of documentation):

1. NICET Level III Certified Designer

2. Registered Professional Fire Protection Engineer.

E. The Installing Fire Alarm System Contractor shall employ a minimum of NICET Level II technicians to:

1. Provide and/or perform on site installation assistance throughout the duration of the project, up to and including acceptance of the Fire Alarm System by the Authority Having Jurisdiction.

2. Oversee the final check-out and to ensure systems integrity.

3. Trim and program the Fire Alarm System Control Panel.

F. Certificates issues by any company not directly associated with the installation of this project will be rejected

G. The installing Contractor shall have a minimum of fifteen (15) years' experience in the design, installation, servicing, and testing of the Fire Alarm System to be installed. A list of installations of a similar nature and scope shall be provided on request.

1.20 COMPETITIVE PRODUCTS

A. Any reference in the specifications to any article, device, product, material, fixture, form or type of construction by name, make or catalog number shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition.

B. The Fire Alarm System Contractor, in such cases, may at his option use any article, device, product, material, fixture, form or type of construction which in the judgment of the Engineer, expressed in writing, is equal to that specified.

1.21 REQUESTS FOR INFORMATION (RFI)

A. It is our intent to provide a timely response to any Request for Information (RFI) regarding the Fire Alarm System work. To further expedite this process, if a suggestion can be determined or derived at by the initiator of the Request for Information (RFI), this suggestion shall be supplied with the submitted Request for Information (RFI). If no suggestion is given where one is possible, the RFI will be returned as incomplete.

B. All Fire Alarm System Request for Information (RFI) questions shall be written on the forms provided in Division 0 or 1 of the General and Supplemental Conditions of the Project Manual.

1.22 SCHEDULE OF VALUES

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

B. Provide a "Schedule of Values" that shall be broken down in accordance with the following subsection. Further breakdown into subcategories is at the option of the Contractor, except as noted below:

1. Engineering

2. Coordination Meetings

3. Materials and Labor

4. System Testing

5. Closeout Materials

C. Engineering:

1. The dollar value for "Engineering" work associated with Fire Alarm System shall in no case be less than 17.00% of the total dollar value of the Fire Alarm System work or as indicated in Division 1, whichever is higher. "Engineering" work shall be a lump sum line item consisting of the following at a minimum:

   a. Shop Drawings

   b. Battery Back-Up Calculations

   c. Voltage Drop Calculations

   d. Equipment Submittals

   e. Permitting

   f. Architect and/or Engineer Approval

2. The Contractor is advised there will be no payments for "Engineering" until the submittal materials (Shop Drawings, Battery Back-up Calculations, Voltage Drop Calculations, and Equipment Submittals) have been reviewed and approved by the Architect and/or Engineer.

D. Coordination Meetings:

1. Provide a separate line item in the "Schedule of Values" for coordination meetings.

2. The dollar value for "Coordination Meetings" shall be not less than 3.00% of the total dollar value of the Fire Alarm System work.

3. The Contractor is advised there will be no payments for "Coordination Meetings" until documentation taken at the review meetings are received by the Architect and/or Engineer.

E. Materials and Labor:

1. Provide a separate line item in the "Schedule of Values" for "Materials and Labor" associated with the Fire Alarm System.

2. The Fire Alarm System shall be broken down into separate line items for installation work in the "Schedule of Values" consisting of the following at a minimum.

   a. Each building shall have a line item.

   b. Each wing of a building shall have a line item.

   c. Each floor of a building shall have a line item.

   d. Each "Phased Area" of the project, or area defined on the Architectural documents shall have a line item.

3. The dollar value for "Materials and Labor" shall be the remaining percentages of the total dollar value of all Fire Alarm System work.

F. System Testing:

1. Provide a separate line item in the "Schedule of Values" for "System Testing" associated with the Fire Alarm System.

2. The Fire Alarm System shall be broken down into separate line items for the following:

a. Preliminary audibility testing (Decibel Readings).

b. Preliminary intelligibility testing (CIS readings).

c. Final Audibility and Intelligibility testing (Authority Having Jurisdiction).

d. Preliminary system functionality testing.

e. Final system functionality testing.

3. The dollar value for "System Testing" shall be not less than 20.00% of the total dollar value of the Fire Alarm System work.

G. Closeout Materials:

1. Provide a separate line item in the "Schedule of Values" for each "Closeout Material" consisting of the following at a minimum.

a. Punch List

b. Sound testing results

c. Audibility and Intelligibility Testing Results

d. Warranty Letters

e. Signed Test Certificates

f. "As-Built" Drawings

g. Operations and Maintenance Manuals

h. Owner Training

i. Testing Procedures and Frequency

j. Electronic Copy of the Program Software

2. The dollar value for "Closeout Materials" shall be not less than 3.00% of the total dollar value of the Fire Alarm System work or as indicated in Division 1, whichever is higher.

H. The Contractor is advised that in addition to payments held out for retainage and project closeout materials, the Owner reserves the right to withhold 5% of the funds for any of the above categories until the systems have been proven to operate as specified and have been completely tested and approved.

1.23 QUALITY ASSURANCE

A. All devices, components, and equipment of the Fire Alarm system shall be listed as a product of a single Fire Alarm system manufacturer under the appropriate category by Underwriters' Laboratories, Inc. (UL), shall bear the UL label, and shall be listed under UL category UOJZ as a single control unit.

B. Partial or pending listings for a Fire Alarm system or components is not acceptable.

C. The Fire Alarm system installation shall comply with Article 760 of N.F.P.A. #70 with all circuits being marked in accordance with Article 760-30, 760-176, and 760-179.

D. Requirements of Regulatory Agencies:

1. Perform work in accordance with applicable Codes.

2. In case of differences between building codes, state laws, local ordinances, utility company regulations, and Contract Documents, the most stringent shall govern.

1.24 OPERATIONS AND MAINTENANCE MANUAL

A. Bind Operation & Maintenance Manual for the Fire Alarm System in a single three-ring tabbed hard-backed binder with clear plastic pocket on spine. Spine of each binder shall have the following typewritten lettering inserted:

OPERATION
AND
MAINTENANCE
MANUAL
FIRE ALARM SYSTEM

B. The Operations and Maintenance Manuals shall include a complete materials list of the Fire Alarm system including the addresses and phone numbers of local sources of replacement parts.

C. Operation and Maintenance manuals shall contain the following:

1. "As-Built" Shop drawings.

2. Cabling diagrams.

3. Operation and Maintenance instructions.

4. Replacement parts lists.

5. Manufacturer’s equipment submittal literature for all components.

6. Typewritten "Sequence of Operations".

7. Thorough testing procedures.

8. Recommended testing frequency for each item.
9. Acceptance Test certificates.

D. Operation and Maintenance Binders:

1. Binders shall be commercial quality, 8-1/2 x 11-inch (3) D-ring binders
2. Binders shall have durable plastic covers with clear pockets on the cover and spine to hold labels.
3. Binders shall have a 1" minimum and 3" maximum ring size.
4. Binders shall not be filled more than 2/3 of its capacity to accommodate future revisions.
5. Where two or more binders are necessary to accommodate data, correlate data in each binder into related groupings according to the project manual table of contents. Cross reference other binders where necessary to provide essential information for proper operations and maintenance of each piece of equipment.

E. Operation and Maintenance manuals shall contain the following:

1. Cover: Identify each binder with a typed or printed title.
2. Project Directory: Name, address, and phone number of Architect, General Contractor, and Electrical Subcontractors. Also include complete list of equipment installed with name, address, and phone number of each vendor.
3. Table of Contents: List every item separated by a divider, using the same identification as on the divider tab.
4. Dividers: Provide heavy paper dividers with printed tabs for each section. Immediately following the divider tab include a description of product.
5. Typewritten Operation and Maintenance instructions.
6. Complete replacement parts list with part numbers.
7. Manufacturer’s equipment submittal literature for all components used in the system.
8. Typewritten "Sequence of Operations".
9. Thorough testing procedures.
10. Recommended testing frequency for each item.
11. Acceptance Test Certificates.
12. Copy of "As-Built" drawings.
    a. Where oversized drawings are necessary, fold drawings to the same size as text pages and use as foldout.

b. If drawings are too large to be used practically as a foldout, place the drawing neatly folded in the front or rear pocket of the binder. Insert a typewritten page indicating drawing title, description of contents and drawing location in the appropriate location in the manual.

13. Warranties: Provide a copy of each warranty in the appropriate manual. Provide written data outlining the procedures to follow in the event of product failure.

14. Electronic copy of the final system program software. (USB Drive / CD)

F. Submit copies as specified by Division 1, and at a minimum, provide **three (3) copies** of Operation & Maintenance Manual to Architect and Engineer to review prior to scheduling the training session.

G. Operation and Maintenance manuals shall contain original color printed brochures supplied by manufacturers (Photocopies originals will not be accepted).

H. First section of the Operations and Maintenance Manual shall consist of name, address, and phone number of Architect, General Contractor, and Electrical Subcontractors. Also include complete list of equipment installed with name, address, and phone number of each vendor.

I. The information included must be the exact equipment installed not the complete "line" of the manufacturer. Where sheets show the equipment installed and other equipment, the installed equipment shall be neatly and clearly identified on such sheets.

J. Cabling Diagrams for each system shall be complete for the specific system installed under the Contract with typical "Cabling Diagrams" not being acceptable.

1.25 TRAINING MANUAL

A. The Training Manual shall contain a Syllabus titled "Section 28 31 00 Fire Alarm System – Training Syllabus".

B. Prior to starting the training session, provide a quantity of up to ten (10) Training Manuals to the Owners staff.

C. Each Training Manual shall be in its own 3-ring hard covered binder that shall be sized to allow for 20% additional documentation.

D. The spine and front cover of each Training Manual shall have a clear cover with a typed insert with the following information:

1. Labeled "Section 283100 Fire Alarm System – (**Puyallup Police Department**) Training Manual".

2. Site Name.

3. Site Address.

4. Project Name.

5. Project address.

6. Current Date.

7. Installing Fire Alarm System Contractor.

8. Installing Fire Alarm System Contractor's Address.
9. Installing Fire Alarm System Contractor's Contact Name.
10. Installing Fire Alarm System Contractor's Phone Number.

E. Each Training Manual shall include the following;

1. Use color coded numbered tabs to separate each item defined below and for each device that was installed.
2. Provide a "Table of Contents" as the first page indicating each piece of equipment or device document.
3. "Section 28 31 00 Fire Alarm System – (**Puyallup Police Department**) Training Syllabus".
4. Provide color copies of a power point presentation consisting of two slides per page that demonstrates typical functions and operational instructions of the new Fire Alarm System that shall consist of, but not limited to the following:
    a. Step-by-step instructions of the most common features.
    b. How to acknowledge and silence an "Alarm" condition.
    c. How to acknowledge and silence a "Trouble" condition.
    d. How to acknowledge and silence a "Supervisory" condition.
    e. How to operate the "Drill" feature.
    f. What to do when there is a "Dirty Detector" alert.
    g. What to do when there is a loss of dialer communication alert.
    h. How and when the Owners Maintenance Staff should call for help.
    i. Include the Manufacturer's Software User's Manual.

1.26 WARRANTY LETTER

A. The Fire Alarm System contractor shall warranty the Fire Alarm System against defects in materials and workmanship for a period of 1 year from date of approved acceptance testing.

B. Provide a "Certificate of Warranty" letter at the completion of the project. The date of "Substantial Completion" shall be clearly shown on the letter indicating when the warranty period begins.

C. The "Certificate of Warranty" letter shall be signed by the Fire Alarm System contractor.

D. The "Certificate of Warranty" shall be included as part of the Operation and Maintenance Manual. The date of "Substantial Completion" shall be the date indicated on the approved test certificate that was signed by the Authority Having Jurisdiction for system acceptance.

E. The full cost of maintenance, labor, and materials required to correct any defect during this one-year period shall be included in the submittal bid.

1.27 TEST CERTIFICATES

A. Completely fill out the Fire Alarm System "Record of Completion" documents contained within the latest adopted Edition N.F.P.A. #72 and provided to the Owner at completion of this project.

B. Obtain the Authority Having Jurisdiction signature, printed name, date, and telephone number on the "Record of Completion" documents.

C. Upon completion of the Fire Alarm System installation, testing, and Instruction & Training, the Installing Vendor shall provide the following Signed Test Forms:

1. The signed original "Record of Completion".

2. The signed original Fire Alarm System Permit.

1.28 PREVENTATIVE MAINTENANCE AGREEMENT

A. Prior to completion of the Fire Alarm system installation, the Fire Alarm System Contractor shall provide a preventative maintenance agreement, which shall at the Owners option, become effective at the end of the 12-month warranty period.

1.29 OFF SITE MONITORING SERVICE AGREEMENT

A. Monitoring of the current existing fire alarm system is existing to remain active. The fire alarm contractor shall provide a point list/zone list in writing to the existing monitoring company of any changes to the system one month before project completion or sooner. The fire alarm contractor and Electrical contractor are to coordinate with the general contractor to ensure these details are addressed.

1.30 AS-BUILT DRAWINGS

A. The Fire Alarm System Contractor shall maintain, in addition to any reference drawings, an "As-Built" set of drawings, which have been reproduced from the approved site set on which all deviations from the original design shall be drafted in a neat legible manner with red colored pencil.

B. "As-Built" drawings shall clearly indicate the following:

1. Actual routing of all raceways.

2. Actual cable type, numbers, and routing.

3. System cabling diagrams.

4. Connection diagrams.

5. Interface of all components in the system.

6. Equipment and device locations.

7. Final room names and numbers.

8. Programming addresses assigned for all components.

C. The room numbering system depicted in all graphics and referenced in data bases generated by the Fire Alarm System Contractor shall match that of the final signage and room identification system adopted by the Owner, unless specifically approved otherwise in writing by the Owner.

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

E. The Fire Alarm System Contractor shall update all references to specific products to indicate products actually installed on project.

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

1.31 PROGRAM SOFTWARE

A. Following the completion of final system programming, the Fire Alarm System Contractor shall provide to the Owner an electronic copy of the final system program software and "Point Status Report".

B. A hard copy of the "System Report" which documents the status of all active devices in the system shall also be provided.

C. The software program shall be compatible with an IBM PC and provided with a verification software package.

D. A report shall be generated of the test results and two hard copies submitted to the Architect / Engineer for review.

E. Provide no less than one (1) software upgrade and one (1) firmware upgrade at the end of the 1-year warranty period.

1.32 SPARE PARTS

A. The Fire Alarm system contractor shall include in this "Scope of Work" the following list of material as "Spare Parts":

	QTY	Item
1.	__1__	Manual Pull Stations
2.	__5__	Photoelectric Smoke Detectors
3.	__5__	Smoke Detector Bases
4.	__1__	Strobes Only Appliances
5.	__1__	Combination Horn / Strobe Appliances
6.	__5__	Addressable Modules
7.	__10__	Device Boxes
8.	__10__	4S J-boxes with blank covers

B. All Spare Parts shall be the same components as those components installed in the system.

C. Provide signed proof of delivery to the Owner with close out documentation.

1.33 CLOSEOUT MATERIAL

A. The Fire Alarm System close out material shall be submitted to the Architect / Engineer for review and approval prior to being provided to the Owner.

B. All close out materials shall be contained within a single 3-ring hard cover binder.

C. The close out materials shall include the following at a minimum:

1. Operations and Maintenance Manuals: See Paragraph 1.24 of this Specification Section for "Operations and Maintenance Manual" requirements.

2. Training Manuals: See Paragraph 1.25 of this Specification Section for "Training Manual" requirements.

3. Warranty Letters: See Paragraph 1.26 of this Specification Section for "Warranty Letter" requirements.

4. Test Certificates: See Paragraph 1.27 of this Specification Section for "Test Certificate" requirements.

5. Preventative Maintenance Agreement: See Paragraph 1.28 of this Specification Section for "Preventative Maintenance Agreement" requirements.

6. Off-Site Monitoring Services Agreement: See Paragraph 1.29 of this Specification Section for "Off-Site Monitoring Service Agreement" requirements.

7. "As-Built" Drawings: See Paragraph 1.30 of this Specification Section for "As-Built" Drawing requirements.

8. Program Software: See Paragraph 1.31 of this Specification Section for "Program Software" requirements.

9. Spare Parts: See Paragraph 1.32 of this Specification Section for "Spare Parts" requirements.

1.34 SERVICE

A. All Fire Alarm System equipment shall be of a single supplier and installed by an authorized factory distributor, having a local office located within 50 miles of the project site that is staffed with trained full-time employees who are capable of performing testing, inspections, repair, maintenance, and has the ability to provide prompt emergency services.

B. For non-emergency service, response time of the technician to the site shall not exceed 4 hours.

C. Service calls received before 1:00 P.M. shall be provided that day and service calls received after 1:00 P.M. shall be the following business day.

D. For emergency service, response time of the technician to the site shall not exceed 2 hours in accordance with NFPA 72 Section 26.3.8.

1.35 BATTERY BACK-UP CALCULATIONS

A. Battery Back-Up power shall be an integral part of the Fire Alarm System and shall automatically switch over upon the loss of AC power.

B. It shall be the Fire Alarm System Contractor's responsibility to confirm that the proposed Fire Alarm system will meet or exceed the local Authority Having Jurisdiction (AHJ) requirements for Battery Back-Up power.

C. At a minimum, provide battery Back Up power for the entire Fire Alarm system to provide 24 hours of standby operation immediately followed by a minimum of 5 minutes of alarm operation.

D. Battery Back-up Calculations for each Control Panel and/or Power Supply shall indicate the following:

1. "Standby" or Non-Active Mode: "Amp Draw" for each device, quantity of each device, and total "Amp Draw" load for each circuit of the Fire Alarm System Control Panel and/or Power Supply.

2. "Alarm" or Active Mode: Individual "Amp Draw" of each device, quantity of each device, and total "Amp Draw" load in with all devices operating at the maximum load condition for each Control Panel and/or Power Supply.

3. Total "Amp Draw" load required by each Control Panel and/or Power Supply for verifying selection of back-up batteries.

E. For systems that include an Uninterruptible Power Supply (UPS), provide the maximum load allowed by the UPS manufacturer and list each item along with its maximum load that will be connected to the UPS.

1.36 VOLTAGE DROP CALCULATIONS

A. Provide the Voltage Drop Calculations for each Fire Alarm System Control Panel and/or Power Supply circuit.

B. Voltage Drop Calculations for each Fire Alarm System Control Panel and/or Power Supply circuit shall indicate the following:

1. All devices on each circuit.

2. Quantity of each device on each circuit.

3. Cable length of each circuit.

4. Gauge of cabling for each circuit.

5. Total line loss for each circuit.

6. Factor the line loss and "Amp Draw" to show the actual voltage available at the end of each circuit (after the last device).

1.37 SPARE CAPACITY

A. Spare capacity shall be incorporated into the Fire Alarm System design to support future expansion or renovations.

B. The minimum spare capacities shall be provided for the following circuits:

1. 25% for each Signaling Line Circuit (SLC).
2. 25% for each Initiating Device Circuit (IDC).
3. 25% for each Notification Appliance Circuit.

C. Batteries shall be provided with at least 25% spare capacity.

D. Conduit and wiremold fill shall not exceed 40% of the interior cross-sectional area.

PART 2 PRODUCTS

2.01 DOMESTIC PRODUCTS

A. All Fire Alarm system components and devices shall be domestically made.

2.02 FIRE ALARM SYSTEM CONTROL PANEL

A. The Fire Alarm System Control Panel:

1. The Fire Alarm System Control Panel is existing.
2. Provide new Circuit Labels and Directory cards for panels modified and / or added.
3. The system programming shall be "Backed Up" via an upload/download program.
4. The Signaling Line Circuit (SLC) interface board shall be able to drive a "Class B" twisted unshielded circuit up to 12,500 feet in length.

2.03 FIRE ALARM SYSTEM TERMINAL CABINETS

A. Fire Alarm System Terminal Cabinets shall be listed to UL #50 "Enclosures for Electrical Equipment, Non-Environmental Considerations", N.F.P.A. #72, and shall be approved for fire protection service.

B. The terminal cabinet shall be suitable for surface or semi-flush mounting.

C. The terminal cabinet shall be corrosion protected, given a rust-resistant prime coat, and manufacturer's standard finish.

D. The back box and door shall be constructed of 0.060" steel with provisions for electrical conduit connections into the sides and top.

E. The door shall be provided with a keyed cylinder lock that is keyed similar to the main Fire Alarm Control Panel enclosure and include a transparent opening for viewing all indicators.

F. For convenience, the door shall have the ability to be hinged on either the right or left-hand side.

G. The terminal cabinet shall be modular in structure for ease of installation, maintenance, and future expansion.

2.04 FIRE ALARM REMOTE ANNUNCIATOR PANELS (FARAP)

A. Provide a Fire Alarm Remote Annunciator Panel in the location(s) indicated on the contract documents.

B. The Fire Alarm Remote Annunciator Panel(s) shall be programmed to clearly indicate the exact same information that is displayed at the Fire Alarm Control Panel and shall be protected from unauthorized use by a keyed switch (similar to the main Fire Alarm Control Panel enclosure) or password.

C. The alphanumeric display annunciator shall be a supervised back-lit Liquid Crystal Display (LCD) containing a minimum of (80) eighty characters for visual annunciation of "Alarm", "Trouble", and "Supervisory" conditions.

D. The Fire Alarm Remote Annunciator Panel shall be provided with an integral piezo sounder for audible indication of an "Alarm" or "Trouble" conditions.

E. The Fire Alarm Remote Annunciator Panel shall be UL listed for Fire Alarm application with an On-line/Power Light Emitting Diode (LED).

F. The Fire Alarm Remote Annunciator Panel shall be capable of the following system functions:

1. Acknowledge.

2. Signal Silence.

3. System Reset.

2.05 MAIN FIRE ALARM SYSTEM POWER SUPPLIES (FAPS)

A. The Main Fire Alarm System Control Panel Power Supply shall meet UL #864 "Standard for Control Units and Accessories for Fire Alarm Systems", UL #1481 "Standard for Power Supplies for Fire-Protective Signaling Systems", N.F.P.A. requirements for power-limited operation, and shall be approved for fire protection service.

B. The Main Fire Alarm System Control Panel Power Supply shall be integral to the Fire Alarm System Control Panel itself or may be placed adjacent to the Fire Alarm System Control Panel within a separate key lockable metal enclosure that is approved by the manufacturer.

C. The Main Fire Alarm System Control Panel shall provide all power requirements for the Fire Alarm System Control Panel plus additional power for operation of external Notification Appliance Circuits (NACs), remote annunciators, remote paging units, etc.

D. The Main Fire Alarm System Control Panel Power Supply input power shall be 120 Volts A.C. at 50/60 Hertz.

E. The Main Fire Alarm System Control Panel shall continuously monitor all field cabling for Earth Ground conditions, and shall have the following "Trouble" Light Emitting Diode (LED) indicators:

1. AC Power Fail

2. Battery Fail

3. Negative Ground Fault

4. Positive Ground Fault

F. The Main Fire Alarm System Control Panel Power Supply shall be modular in design allowing additional Remote Power Supplies to be added.

2.06 REMOTE POWER SUPPLIES

A. Remote Power Supplies shall meet UL #864 "Standard for Control Units and Accessories for Fire Alarm Systems", N.F.P.A. requirements for power-limited operation, and shall be approved for fire protection service.

B. Provide Remote Power Supplies as required for a fully functional system.

C. Remote Power Supplies shall be placed in a key lockable metal enclosure that is approved by the manufacturer in locations approved by the Electrical and Fire Protection Engineer for auxiliary power to supply Notification Appliance Circuits (NACs).

D. Remote Power Supply input power shall be 120 Volts A.C. at 50/60 Hertz.

E. Remote Power Supplies shall be modular in design allowing additional Remote Power Supplies to be added.

2.07 BACK-UP BATTERIES

A. Provide quantities of Back-Up Batteries that exceed the minimum Back-Up Battery calculation requirements specified in Paragraph 1.35 of Specification Section 283100.

B. Back-Up batteries for the Fire Alarm Control Panel Power Supply and for each Remote Power Supply shall be a minimum of 12 Volts D.C.

C. Back-Up Batteries shall be Absorbed Glass Material (AGM) or Gel style sealed batteries.

D. Back-Up Batteries shall have the following features:

1. Completely Maintenance Free.

2. Deep Cycle.

3. Used in any Position.

4. Low Self-Discharge Rates.

5. Safe for use in Low Ventilated Areas.

6. Can be transported by Ground or Air.

E. All batteries shall be placed inside a key lockable metal enclosure that is approved by the manufacturer.

F. Each battery shall have the date of installation written on the battery with a permanent marker and be visible when the enclosure door is open.

G. The back-up batteries shall be completely sealed, maintenance free, leak proof, and usable in any position.

2.08 INTERNAL BATTERY CHARGERS

A. The entire Fire Alarm System shall automatically charge Back-Up Batteries by an Internal Battery Charger that operates on a 120 Volts A.C. power source.

B. The Internal Battery Charger shall either be trickle or float charged and shall be capable of recharging batteries from a fully discharged condition to 100% within a 48-hour time period.

C. The Internal Battery Charger shall be an integral component of the Fire Alarm System Control Panel.

D. The charging rate of the Internal Battery Charger shall reduce upon attaining a fully charged condition to avoid damaging of the batteries.

E. The Internal Battery Charger shall provide either integral meters or readily accessible terminal facilities for the connection of portable meters by which the battery voltage and charging current can be determined.

F. The Internal Battery Charger shall be provided with a means for monitoring integrity to detect a battery charger failure and to provide a "Trouble" signal at the Fire Alarm System Control Panel.

G. This Internal Battery Charger will automatically inhibit the deep discharge of the system secondary batteries and shall be protected against the accidental reverse polarity connection of the secondary batteries.

2.09 EXTERNAL BATTERY CHARGERS

A. External Battery Charger shall automatically charge Back-Up Batteries and shall operate on a 120 Volts A.C. power source.

B. The External Battery Charger shall either be trickle or float charged and shall be capable of recharging batteries from a fully discharged condition to 100% within a 48-hour time period.

C. The External Battery Charger shall have the following forms of input:

1. A Notification Appliance Circuit (NAC) from the Fire Alarm System Control Panel.

2. A relay.

D. The charging rate of the External Battery Charger shall reduce upon attaining a fully charged condition to avoid damaging of the batteries.

E. The External Battery Charger shall provide either integral meters or readily accessible terminal facilities for the connection of portable meters by which the battery voltage and charging current can be determined.

F. The External Battery Charger shall be provided with a means for monitoring integrity to detect a battery charger failure and to provide a "Trouble" signal at the Fire Alarm System Control Panel.

G. This External Battery Charger will automatically inhibit the deep discharge of the system secondary batteries and shall be protected against the accidental reverse polarity connection of the secondary batteries.

2.10 MANUAL PULL STATIONS

A. Manual Pull Stations shall be listed to UL #38 "Standard for Manual Signaling Boxes for Fire Alarm Systems" and be compatible with the Fire Alarm System Control Panel.

B. Manual Pull Stations shall be double action type with a key operated test/reset lock (keyed similar to the Fire Alarm Control Panel), and designed so that after actuation, the Manual Pull Station cannot be restored to normal operating condition without the use of the key.

C. Manual pull stations shall be constructed of metal, Lexan, or polycarbonate with clearly visible operating instructions and the word "FIRE" in white lettering provided on the cover.

D. Each Manual Pull Stations shall be supervised by the Fire Alarm Control Panel.

E. Manual Pull Stations(s) shall not require more than 5 pounds of pull force to actuate.

F. Weatherproof Manual Pull Stations installed outdoors or in spaces of high humidity shall have the following characteristics:

1. Shall be listed for outdoor use by UL.

2. Shall have an operating temperature between -40°F and 151°F.

2.11 MANUAL PULL STATION STOPPERS (SHIELDS)

A. Manual Pull Station Stoppers (Shields) shall be U.L. Listed and approved for use with the Manual Pull Station being protected.

B. Manual Pull Stations located in Gymnasiums, Multi-Purpose Rooms, or other spaces in which impact to manual pull stations would be common and would cause a false alarm or damage shall be provided with a clear tamperproof polycarbonate or Lexan Stopper (Shield) and frame.

C. When required by the Authority Having Jurisdiction, the Manual Pull Station Stopper (Shield) shall be provided with an integral 9 Volts D.C. battery operated piezo warning horn that produces a warning sound of 95 dB at a distance of 1'-0".

D. The cover shall have the message "IN CASE OF FIRE – LIFT COVER" readily visible.

E. Weatherproof Manual Pull Station Covers installed outdoors or in places of high humidity shall be provided with a closed cell gasket or a rain tight seal.

2.12 HEAT DETECTORS

A. Heat Detectors shall be listed to UL #521 "Heat Detectors for Fire Protective Signaling Systems", UL #539 "Standard for Single and Multiple Station Heat Alarms", and FM #3210 "Heat Detectors for Automatic Fire Alarm Signaling".

B. Heat Detectors shall be 24 Volts D.C., Intelligent, Analog, and Addressable that shall connect to the Fire Alarm System Control Panel's supervised "Class B" Signaling Line Circuit (SLC).

C. An output connection shall also be provided in the base of the Heat Detector for connections to the following items:

1. External remote alarm Light Emitting Diode (LED).

2. Sounder base rated at a minimum of 85 dBA.

3. "Form C" Relay base.

4. Isolator base.

D. Heat Detector Types:

1. "Fixed Temperature" Heat Detectors:

a. "Fixed Temperature" Heat Detectors shall be rated at 135°F where ambient temperature does not exceed 100°F and rated for 194° Fahrenheit in areas subject to high ambient temperatures in excess of 100°F.

2. "Rate of Rise" Heat Detectors:

a. "Rate of Rise" Heat Detectors shall have an element rated at 15°F per minute.

3. Combination "Fixed Temperature" and "Rate of Rise" Heat Detectors:

a. The "Fixed Temperature" portion of the Heat Detectors shall be rated at 135°F where ambient temperature does not exceed 100°F and rated for 194° Fahrenheit in areas subject to high ambient temperatures in excess of 100°F.

b. The "Rate of Rise" portion of the Heat Detector shall have an element rated at 15°F per minute.

E. Provide remote indicating lamps for Heat Detectors that when installed, the Light Emitting Diodes (LEDs) are not visible from the walking surface / floor, such as when installed above a ceiling, at an elevation higher than 15'-0" above finished floor, in an attic, etc.

F. Provide anti-ligature guards for Heat Detectors installed in Gymnasiums, Multi-Purpose Rooms, Play Areas, Play Sheds, patient rooms or in areas subject to mechanical damage.

2.13 SMOKE DETECTORS

A. Smoke Detectors shall be listed to UL #217 "Standard for Single and Multiple Station Smoke Alarms", UL #228 "Standard for Door Closers-Holders, With or Without Integral Smoke Detectors", UL #268 "Smoke Detectors for Fire Alarm Systems", and UL #1730 "Standard for Smoke Detector Monitors and Accessories for Individual living Units of multifamily Residences and Hotel/Motel Rooms".

B. Smoke Detectors shall be 24 Volts D.C., Intelligent, Analog, and Addressable that shall connect to the Fire Alarm System Control Panel's supervised "Class B" Signaling Line Circuit (SLC).

C. Smoke detector sensitivity shall be set through the Fire Alarm System Control Panel and shall be adjustable in the field through the field programming of the system to meet the requirements of N.F.P.A. #72.

D. Photoelectric Smoke Detectors:

1. Detectors shall use the photoelectric (light scattering) principle to measure smoke density and shall, on command from the control panel, send data to the Fire Alarm System Control Panel indicate the analog level of smoke density.

2. The photoelectric smoke detector shall have a sensitivity range between 0.67% and 3.77% obscuration per foot as measured in the UL smoke box with the following divisions:

a. Most Sensitive: 1.0% obscuration per foot

b. More Sensitive: 2.0% obscuration per foot

c. Normal Sensitive: 2.5% obscuration per foot

d. Less Sensitive: 3.0% obscuration per foot

e. Least Sensitive: 4.0% obscuration per foot

E. Provide remote indicating lamps for Smoke Detectors that when installed. The Light Emitting Diodes (LEDs) are not visible from the walking surface / floor, such as when installed above a ceiling, at an elevation higher than 15'-0" above finished floor, etc.

F. Provide anti-ligature guards for Strobe Only Appliances installed in Gymnasiums, Multi-Purpose Rooms, Play Areas, Play Sheds, patient rooms or in areas subject to mechanical damage.

2.14 DUCT SMOKE DETECTORS

A. Duct Smoke Detectors shall be listed to UL #268A "Standard for Smoke Detectors for Duct Application" and installed in accordance with manufacturer's recommendations.

B. Duct Smoke Detectors shall be Intelligent, Analog, Addressable, 24 Volts D.C. type with visual alarm and power indicators, and a reset switch that shall connect to the Fire Alarm System Control Panel's supervised "Class B" Signaling Line Circuit (SLC) loops for monitoring and control.

C. Duct Smoke Detectors shall use the photoelectric (light scattering) principle to measure smoke density and shall, on command from the control panel, send data to the Fire Alarm System Control Panel representing the analog level of smoke density.

D. Duct Smoke Detectors shall have an operating air velocity range of 100 feet per minute to 4,000 feet per minute.

E. Duct Smoke Detectors shall be capable of providing a trouble signal in the event that the front cover is removed.

F. Duct Smoke Detector shall be provided with properly sized air sampling tubes.

G. Each Duct Smoke Detector shall be provided with a "Form C" Relay rated at 30 Volts D.C. and at 2.0 Amps for controlling ancillary equipment.

H. Duct Smoke Detectors shall have a sensitivity range between 0.79% and 2.46% obscuration per foot.

I. The Duct Smoke Detector "Response Time" shall not exceed 15 seconds.

J. Duct Smoke Detectors shall initiate a "Supervisory" signal to the Fire Alarm Control Panel and initiate shutdown of the H.V.A.C. unit in which a Supervisory signal occurred.

K. Provide remote indicating lamps for Dust Smoke Detectors that when installed, the Light Emitting Diodes (LEDs) are not visible from the walking surface / floor or when installed at an elevation higher than 15'-0" above finished floor.

L. Weatherproof Duct Smoke Detectors installed outdoors or in spaces of high humidity shall have the following characteristics:

1. Shall be listed for outdoor use by UL.

2. Shall have an operating temperature between -40°F and 151°F.

3. Shall be provided with an outdoor/weatherproof back box with:

a. Conduit entries of ½" and ¾".

b. Weatherproof sealant per the manufacturer's recommendations to prevent moisture from entering the structure.

2.15 DUCT SMOKE DETECTOR REMOTE TEST STATIONS

A. Provide one (1) one Duct Smoke Detector Remote Test Station for each duct smoke detector installed that is not visible or readily accessible from the floor.

B. The use of a single Duct Smoke Detector Remote Test Station to serve multiple duct smoke detectors will not be allowed.

C. The Duct Smoke Detector Remote Test Station shall be a polarized device that is designed for both conventional and intelligent applications and shall operate on a 32 Volts D.C. power source.

D. A key switch on the Duct Smoke Detector Remote Test Station shall be used to select the connected duct smoke detector for testing or resetting.

E. Duct Smoke Detector Remote Test Stations Light Emitting Diodes (LEDs) shall indicate the status of the following conditions:

1. Standby: Blinking Green LED.

2. Trouble: Solid Amber LED.

3. Maintenance: Blinking Amber LED.

4. Alarm: Solid Red LED.

2.16 MULTI-CRITERIA DETECTORS

A. Multi-Criteria Detectors shall be listed to and be compatible with the Fire Alarm System Control Panel.

B. Multi-Criteria Detectors shall be 24 Volts D.C., Intelligent, Analog, and Addressable that shall connect to the Fire Alarm System Control Panel's supervised "Class B" Signaling Line Circuit (SLC).

C. The Multi-Criteria Detector shall have the ability to detect all four major elements of a fire.

1. Photoelectric chamber senses airborne particulate for smoke detection.

2. Electrochemical cell technology monitors carbon monoxide (CO) produced by smoldering fires.

3. Infrared (IR) sensing measures ambient light levels and flame signatures.

4. Thermal detection monitors temperature.

D. Provide remote indicating lamps for Multi-Criteria Detectors that when installed. The Light Emitting Diodes (LEDs) are not visible from the walking surface / floor, such as when installed above a ceiling, at an elevation higher than 15'-0" above finished floor, etc.

E. Provide anti-ligature guards for Multi-Criteria Detectors installed in Gymnasiums, Multi-Purpose Rooms, Play Areas, Play Sheds, patient rooms or in areas subject to mechanical damage.

2.17 STROBE ONLY APPLIANCES

A. Strobe Only Appliances shall be listed to UL #1638 "Standard for Visual Signaling Appliances - Private Mode Emergency and General Utility Signaling", shall be approved for fire protective service, and be compatible with the Fire Alarm System Control Panel.

B. Strobe Only Appliances shall be Intelligent, Analog, and Addressable that shall connect to the Fire Alarm System Control Panel's Notification Appliance Circuits (NAC) or Signaling Line Circuits (SLC).

C. Strobe Only Appliances shall have the following characteristics:

1. Shall be 24 Volts D.C.

2. Be installed on the ceiling or on the wall.

3. Shall be red or white finished.

4. Shall be backward compatible.

D. Strobe Only Appliances installed in interior climate-controlled spaces shall have an operating temperature between 32°F and 120°F.

E. Weatherproof Strobe Only Appliances installed outdoors or in spaces of high humidity shall have the following characteristics:

1. Shall be listed for outdoor use by UL.

2. Shall have an operating temperature between -40°F and 151°F.

3. Shall be provided with an outdoor/weatherproof back box with:

a. Conduit entries of ½" and ¾".

b. Weatherproof sealant per the manufacturer's recommendations to prevent moisture from entering the structure.

F. If the Strobe Only Appliances are not UL 9th edition listed with the corresponding panel or power supply being used, then refer to the compatibility listing of the panel to determine maximum devices on a circuit.

G. Provide anti-ligature guards for Strobe Only Appliances installed in Gymnasiums, Multi-Purpose Rooms, Play Areas, Play Sheds, patient rooms or in areas subject to mechanical damage.

2.18 COMBINATION HORN / STROBE APPLIANCES

A. Combination Horn / Strobe Appliances shall be listed to UL #464 "Standard for Audible Signal Appliances", UL #1638 "Standard for Visual Signaling Appliances - Private Mode Emergency and General Utility Signaling", UL #1971 "Standard for Signaling Devices for the Hearing Impaired", shall be approved for fire protective service, and be compatible with the Fire Alarm System Control Panel.

B. Combination Horn / Strobe Appliances shall be Intelligent, Analog, and Addressable that shall connect to the Fire Alarm System Control Panel's Notification Appliance Circuits (NAC) or Signaling Line Circuits (SLC).

C. The Horn Appliance shall be powered independently of the Strobe Appliance on a coded or non-coded power supply.

D. Combination Horn / Strobe Appliances shall have the following characteristics:

1. Shall be 24 Volts D.C.

2. Be installed on the ceiling or on the wall.

3. Shall be red or white finished.

4. Shall be backward compatible.

E. Combination Horn / Strobe Appliances installed in interior climate-controlled spaces shall have an operating temperature between 32°F and 120°F.

F. Weatherproof Combination Horn / Strobe Appliances installed outdoors or in spaces of high humidity shall have the following characteristics:

1. Shall be listed for outdoor use by UL.

2. Shall have an operating temperature between -40°F and 151°F.

3. Shall be provided with an outdoor/weatherproof back box with:

a. Conduit entries of ½" and ¾".

b. Weatherproof sealant per the manufacturer's recommendations to prevent moisture from entering the structure.

G. If the Combination Horn / Strobe Appliances are not UL 9th edition listed with the corresponding panel or power supply being used, then refer to the compatibility listing of the panel to determine maximum devices on a circuit.

H. Provide anti-ligature guards for Combination Horn / Strobe Appliances installed in Gymnasiums, Multi-Purpose Rooms, Play Areas, Play Sheds, or in areas subject to mechanical damage.

2.19 DAMAGE STOPPERS (WIRE GUARDS)

A. The Damage Stopper (Wire Guard) shall be UL Listed to U.S. safety standards for use with specific Fire Alarm System devices.

B. Damage Stoppers (Wire Guards) shall be provided where Fire Alarm System devices (i.e. Strobes, Horns, Smoke Detectors, Heat Detectors, Beam Detectors, Manual Pull Stations, etc.) are subject to vandalism or damage due to flying objects (i.e. Gymnasiums, Multi-Purpose Rooms, Play Areas, etc.)

C. Provide Cold-Rolled Steel Damage Stoppers (Wire Guards) with a white finished coating to protect Fire Alarm System devices from vandalism or accidental damage in spaces indicated on the contract documents.

D. The Damage Stopper (Wire Guard) shall be fabricated from 9-gauge cold rolled steel with a white corrosion-resistant polyester coating.

E. The Detector Damage Stopper (Wire Guard) shall be available for flush mount or with a spacer for surface mounted applications.

F. Detector Damage Stopper (Wire Guard) shall include four (4) stainless steel tamper resistant #8 X 2" snake eye fasteners for added protection against vandalism or accidental damage.

G. Detector Damage Stopper (Wire Guard) shall be provided with an easy means of installation and removal of the Damage Stopper (Wire Guard) to facilitate servicing of smoke detector.

H. Provide Damage Stopper (Wire Guard) with conduit spacers for mounting over surface mounted Fire Alarm System devices, with or without conduit.

2.20 GRAPHIC MAPS

A. Provide a fully updated map to current system status at the completion of the project. There are currently Maps located in the main control room and the main entry (inside tube). Update these maps.

B. Provide a full color graphical representation of the floor plan(s) that shall be installed directly adjacent to each Fire Alarm Remote Annunciator Panel and by the Fire Alarm System Control Panel.

C. Graphic maps shall be produced and manufactured by a professional graphic map company. Suggested retailer is H.R. Kirkland or equivalent.

D. Graphic Maps shall be a minimum of 11"x17" in size, but shall be based upon the actual building footprint with all text being **at least a 1/8" scale.**

E. Graphic Maps shall include the following information at a minimum:

1. Building Name(s) (and numbers where applicable). The text shall be **black in color** and 1/2” Scale.

2. Room Names and Numbers. **Blue Bold ¼” Text**

3. Doors.

4. Location of the Fire Alarm Remote Annunciator Panel. **Red in Color**
5. Location of the Fire Alarm System Control Panel. **Red in Color**
6. End-of-Line resistor locations (Class "B" circuits only)
7. A “You Are Here” with an arrow pointing at the wall or area location of where Graphic Map is to be installed. **Red Text**
8. Show the system(s) being monitored by the Fire Alarm System.
9. Provide a System Legend at the top of each Graphic Map indicating all initiation device types and the following applicable systems
    a. Fire Protection Sprinkler System Post Indicator Valve(s)
    b. Fire Protection Sprinkler System Water Flow Switch(s)
    c. Fire Protection Sprinkler System Tamper Switch(s)
    d. Fire Protection Sprinkler System Pressure Switch(s)
    e. Fire extinguisher cabinet
    f. Other systems that would typically interface to the Fire Alarm System.
10. "North" arrow **Black in Color**
11. Provide the image/logo and name of the Owner at the top of each Graphic Map.

F. Each Graphic Map shall have all the initiation devices shown in red color at their locations with the device address in green color.

1. Manual Pull Stations
2. Smoke Detectors
3. Heat Detectors
4. Duct Detectors
5. Beam Detectors
6. Kitchen Hood System
7. Carbon Monoxide Detectors
8. Control Relays
9. Sprinkler Waterflow Switches

G. The room numbering system depicted on each Graphic Map shall match that of the final signage and room identification system adopted by the Owner. These shall be larger than the device addresses. This text shall be **1/4" and Blue in Color** and only rooms with device addresses and major points of interest (Restrooms, Main office, etc.)

H. For Multi-Story Buildings:

1. The bottom of each Graphic Map shall be the lowest level of the building.

2. The top of each Graphic Map shall be the highest level of the building.

I. Graphic Maps shall be secured in a black anodized aluminum frame. The map shall be non-fading and non-pealing

J. Graphic Maps installed on the interior of the building shall consist of the following;

1. Printed on standard stock paper.

2. Standard background shall be white.

3. The Graphic Map shall be secured in a black anodized aluminum frame.

4. Provide Graphic Map with a concealed security hanging system to prevent unauthorized removal.

K. Graphic Maps installed on the exterior of the building shall consist of the following:

1. Printed on 1/8" silver brushed aluminum, white aluminum, or stainless steel.

2. The Graphic Map shall be designed to attach to an exterior wall by a screw located in each of the four corners.

3. The Graphic Map shall be non-fading and non-pealing.

2.21 MONITOR MODULES

A. Monitor Modules shall be listed to UL #864 "Standard for Control Units and Accessories for Fire Alarm Systems" and shall be approved for fire protection service.

B. Provide an addressable Monitor Module to supervise a circuit of dry contact input devices.

C. Monitor Modules shall have built-in type identification that automatically identifies the devices as a Monitor Module to the Fire Alarm System Control Panel.

D. Monitor Modules shall be powered by the Fire Alarm System Signaling Line Circuit (SLC).

E. Monitor Modules shall be capable of providing a minimum of 5 input circuits.

F. Monitor Modules shall have a Light Emitting Diode (LED) that is controlled by the Fire Alarm System Control Panel to indicate module status.

G. Monitor Modules shall monitor Alarm, Trouble, and Supervisory outputs for the Specialty Systems such as:

1. Pre-Action System

2. Deluge System
3. Clean Agent Suppression System
4. Hood Suppression System
5. Other systems that would typically interface to the Fire Alarm System.

2.22 RELAY MODULES

A. Relay Modules shall be listed to UL #864 "Standard for Control Units and Accessories for Fire Alarm Systems" and shall be approved for fire protection service.

B. Relay Modules shall allow a compatible Fire Alarm System Control Panel to switch discrete contacts by coded command.

C. The Relay Module shall provide two (2) isolated sets of "Form C" contacts, which operate as a Double Pole Double Throw (DPDT) switch rated at up to:

1. 1 Amp at 30 Volts D.C. of inductive load.
2. 2 Amps at 30 Volts D.C. (coded) of resistive load.
3. 3 Amps at 30 Volts D.C. for non-coded applications.

D. The Relay Module shall allow the Fire Alarm System Control Panel to switch the "Form C" contacts upon command.

E. The Relay Module shall not provide supervision of the Notification Appliance Circuit (NAC).

F. Relay Modules shall have both normally open and normally closed connections available for field cabling.

G. Addressable Relay Modules shall be provided for the following:

1. Audio/Visual Sound Systems
2. Duct Smoke Detectors
3. H.V.A.C. Systems
4. Magnetic Door Holders
5. Magnetic Door Releases
6. Fire Rated Coiling Doors
7. Fire Rated Shutters
8. Won Doors
9. Smoke Vents
10. Other building functions.

H. The relay coil shall be magnetically latched to reduce cabling connection requirements, and to ensure that 100% of all auxiliary devices energize at the same time on the same pair of cables.

I. Relay Modules shall have a Light Emitting Diode (LED) that is controlled by the Fire Alarm System Control Panel to indicate module status.

J. Coded signals, transmitted from the Fire Alarm System Control Panel, can cause the Light Emitting Diode (LED) to blink, latch on, or latch off.

2.23 MULTI-VOLTAGE RELAY MODULES (RELAY IN BOX)

A. Multi-Voltage Relay Modules shall be listed to UL #864 "Standard for Control Units and Accessories for Fire Alarm Systems" and shall be approved for fire protection service.

B. Multi-Voltage Relay Modules shall allow a compatible Fire Alarm System Control Panel to switch discrete contacts by coded command.

C. Multi-Voltage Relay Modules shall be used for high-current switching applications such as fan and damper assembly control, door control, air handling unit controls, and other types of system interfacing.

D. Multi-Voltage Relay Modules shall have one (1) "Form C" contact which operate as a Single Pole Double Throw (SPDT) relay with a red activation Light Emitting Diode (LED).

E. Multi-Voltage Relay Modules shall be mounted into a steel enclosure that has a removable front cover to provide easy access with a Light Emitting Diode (LED) viewing hole.

F. The Multi-Voltage Relay Module shall allow the Fire Alarm System Control Panel to switch the "Form C" contact upon command.

G. The Multi-Voltage Relay Module shall not provide supervision of the Notification Appliance Circuit (NAC).

H. Multi-Voltage Relay Modules shall have both normally open and normally closed connections available for field cabling.

I. Multi-Voltage Relay Modules shall be capable of operating on a 24 Volts D.C., 120 Volts A.C., or 240 Volts A.C. power source.

J. Multi-Voltage Relay Modules shall have a Light Emitting Diode (LED) that is controlled by the Fire Alarm System Control Panel to indicate module status.

2.24 CONTROL MODULES

A. Control Modules shall be listed to UL #864 "Standard for Control Units and Accessories for Fire Alarm Systems" and shall be approved for fire protection service.

B. Power for the Control Module shall be provided by the 24 Volts D.C. Signaling Line Circuit (SLC) loop to reduce cabling connection requirements.

C. Control Modules shall be capable of Class "A B" operation.

D. Addressable Control Modules shall be activated through Fire Alarm System Control Panel programming on a select basis (zone or area of coverage).

E. The disconnection of the supervision shall provide a positive indication to the Fire Alarm System Control Panel that the Control Nodule has turned "On".

F. The external power supply shall always be Control Module isolated from the communication loop so that a trouble condition on the external power supply will never interfere with the rest of the system.

G. Control Modules shall have a Light Emitting Diode (LED) that is controlled by the Fire Alarm System Control Panel to indicate module status.

2.25 ZONE INTERFACE MODULES

A. Zone Interface Modules shall be listed to UL #864 "Standard for Control Units and Accessories for Fire Alarm Systems" and shall be approved for fire protection service.

B. Zone Interface Modules shall be capable of Class "B" operation.

C. Zone Interface Modules shall provide an interface between the intelligent alarm system and a two-wire conventional detection zone.

D. A common Signaling Line Circuit (SLC) input is used for all Zone Interface Modules, and the initiating device circuits share a common external supervisory supply and ground. Otherwise, each Zone Interface Module operates independently from the others.

2.26 ISOLATION MODULES

A. Isolation Modules shall be listed to UL #864 "Standard for Control Units and Accessories for Fire Alarm Systems" and shall be approved for fire protection service.

B. Isolation Modules shall be provided to automatically isolate wire-to-wire short circuits on Signaling Line Circuit (SLC) loops.

2.27 REMOTE INDICATING LAMPS

A. The Remote Indicating Lamp shall provide status indication by a single RED Light Emitting Diode (LED),

B. The RED-Light Emitting Diode (LED) shall be mounted on a single gang plate.

C. Provide label on plate indicting device designation in concealed space above.

2.28 MAGNETIC DOOR HOLDERS

A. Magnetic Door Holders shall be listed to UL #228 "Standard for Door Closers-Holders, With or Without Integral Smoke Detectors" and shall be approved for fire protection service.

B. Magnetic Door Holders shall consist of both an electromagnet and an armature assembly.

C. Magnetic Door Holders shall be rated for continuous duty and operate using a 120 Volts A.C. power source.

D. Activation of the Fire Alarm System shall automatically release the Magnetic Door Holders allowing the fire rated doors to close and shall remain in the release mode until the Fire Alarm System Control Panel is reset.

2.29 MAGNETIC DOOR LOCKS

A. Magnetic Door Locks shall be listed to UL #228 "Standard for Door Closers-Holders, With or Without Integral Smoke Detectors" and shall be approved for fire protection service.

B. Magnetic Door Locks shall consist of both an electromagnet and an armature assembly.

C. Magnetic Door Locks shall be rated for continuous duty and operate using a 120 Volts A.C. power source.

D. Activation of the Fire Alarm System shall automatically release the Magnetic Door Locks unlocking the doors and shall remain in the release mode until the Fire Alarm System Control Panel is reset.

2.30 SYSTEMS PLYWOOD BACKBOARD(S)

A. Plywood Backboard shall be used to mount all Fire Alarm System enclosures to any wall or surface, even if wall is concrete or CMU.

B. Mounting of equipment shall be logically placed, and shall be located to accommodate future growth of the Fire Alarm System.

C. The Systems Plywood Backboard shall be securely fastened to the wall to accommodate no less than ten times the total weight of the equipment to be mounted or 150 pounds, whichever is greater.

D. The Systems Plywood Backboard shall be a minimum of 3/4", APA exterior grade Douglas Fir A-C that is fire retardant having a flame spread rating not more than 25 when tested in accordance with ASTM E-84.

E. Provide Systems Plywood Backboard from 1'-0" above finished floor up to the ceiling height or 10'-0", whichever is lower.

F. The entire backboard shall be painted with three (3) coats of fire-retardant paint (the color shall match the adjacent surface).

2.31 TRANSIENT VOLTAGE SURGE PROTECTION

A. If not provided as an integral part of the Fire Alarm System power supply, an external means of Transient Voltage Surge Protection shall be provided for all components of the system.

B. The means of Transient Voltage Surge Protection shall be listed to UL #497A "Standard for Secondary Protectors for Communications Circuits", UL #1283 "Standard for Electromagnetic Interference Filters", UL #1449 "Standard for Surge Protective Devices", and shall be approved for fire protection service.

C. All circuits shall be provided with transient suppression devices and the system shall be designed to permit simultaneous operation of all circuits without interference or loss of signals.

D. Transient Voltage Surge Protection shall have a minimum energy handling of 70 Joules on line to line, line to neutral, and line to ground spikes.

E. The response time for Transient Voltage Surge Protection shall be 5 nanoseconds or less and shall begin at 140 Volts A.C.

F. Provide one (1) dedicated Transient Voltage Surge Suppressor (TVSS) for each 120 Volts A.C. hard wired connection point.

2.32 FIRE PROTECTION SYSTEM CONNECTIONS

A. Fire Sprinkler System Connections shall be listed to UL #346 "Standard for Waterflow Indicators for Fire Protective Signaling Systems", UL #864 "Standard for Control Units and Accessories for Fire Alarm Systems" and shall be approved for fire protection service.

B. Fire Protection Sprinkler System devices shall be connected to the Fire Alarm System Control Panel so that the movement of a valve and/or switch shall notify the Fire Alarm System.

C. The Fire Protection Sprinkler Contractor shall provide and install all fire protection sprinkler system switches and/or equipment that include, but are not limited to following:

1. Post Indicator Valve (PIV) Tamper Switch(s).
2. Tamper Switch(s).
3. Water Flow Switch(s).
4. Pressure Switch(s).
5. Fire Pump Controller(s).
6. Clean Agent Suppression System Control Panel(s).
7. Cooking Hood Fire Suppression System Control panel(s).
8. Other systems that would typically interface to the Fire Alarm System.

D. The Fire Alarm System Contractor / Electrical Contractor shall provide and install the conduit, junction boxes, couplers, connectors, cabling, terminations, and the necessary Fire Alarm System equipment to monitor and/or power the fire sprinkler system switches and equipment.

E. Each fire protection sprinkler system tamper switch shall be provided with a Monitor Module by the Fire Alarm System Contractor.

F. Fire protection sprinkler system tamper switches on the valve controlling the backflow preventer full forward flow test piping shall be connected to the Fire Alarm System Control Panel such that the movement of a valve from the normally closed position shall initiate a supervisory signal.

G. Fire protection sprinkler system tamper switches on all other valves except for the valve controlling the backflow preventer full forward flow test piping shall be connected to the Fire Alarm System Control Panel such that the movement of a valve from the normally open position shall initiate a supervisory signal.

H. The Fire Alarm System Contractor shall coordinate locations and quantities of Fire Protection Sprinkler System devices with the Fire Protection Sprinkler System Contractor.

2.33 FAN / DAMPER CONTROL CIRCUITS

A. Fan shutdown control circuits and smoke removal circuits shall be electrically supervised per N.F.P.A. #72 requirements.

B. Provide a single "Form C" isolated contact output and cabling from the Fire Alarm System to the Energy Management Control System (EMCS).

C. Provide a second isolated contact for automatic closure of smoke dampers and combination smoke / fire dampers.

D. Upon activation of a general "Alarm" condition in the area in which the smoke damper or combination fire / smoke damper is located, the smoke damper or combination fire / smoke damper shall automatically close and the mechanical equipment shall be disabled.

E. Provide all necessary connections, programming and testing for the shutdown of affected mechanical equipment.

F. Power supply for damper actuators shall be provided by the Electrical Contractor.

G. Fusible link style dampers shall not be connected to the Fire Alarm System.

2.34 WIREMOLD SURFACE RACEWAY

A. Wiremold Surface Raceway shall be meet the requirements of Underwriters Laboratories Inc. and conform to U.S. Federal Specification W-C-582.

B. Wiremold Surface Raceway shall be in accordance with N.F.P.A. #70, local requirements, and state requirements.

C. Wiremold Surface Raceway shall be constructed of steel with a minimum thickness of 0.040".

D. Wiremold Surface Raceway shall have the following features:

1. Rugged steel raceway.
2. Low-profile and unobtrusive appearance.
3. Base and cover are preassembled as a one-piece unit.
4. Surface mounting.
5. Full line of fittings.
6. Fittings have removable covers.
7. UL #5 "Standard for Surface Metal Raceways and Fittings" and ADA compliant.

2.35 WET RATED CABLES

A. Wet Rated Cables shall have a flame rating that meet UL #1685 "Standard for Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables" requirements.

B. Wet Rated Cables shall be Type FPL, PLTC, or CL3 cables that meet the 300 Volt requirements as specified in N.F.P.A. #70.

C. Wet Rated Cables shall be rated for "Direct Burial" or "Underground in Conduit" installations.

1. "Direct Burial" rated cables shall consist of the following:

a. ASTM Bare Copper.

b. PVC Insulation with Nylon.

c. Twisted Pair or Cabled Construction.

d. Overall Shield 100% Coverage of Aluminum Polyester Foil with Drain Wire.

e. Water Blocked Construction.

f. Overall Sunlight / Moisture Resistant PVC Jacket.

2. "Underground in Conduit" rated cables shall consist of the following:

a. ASTM Bare Copper.

b. PVC Insulation.

c. Short Twisted Construction.

d. Unshielded.

e. Water Blocked Construction.

f. Overall Sunlight / Moisture Resistant PVC Jacket.

PART 3 SYSTEM OPERATION

3.01 FIRE ALARM SYSTEM CIRCUITS

A. Circuits not capable of transmitting an "Alarm" signal beyond the location of the open or ground fault as specified above, are designated Class B. Class B circuits generally do not return to the control panel but are terminated by an end-of-line device remote from the control panel.

B. Notification Appliance Circuit (NAC) circuits shall be arranged such that there is a minimum of one horn circuit per floor of the building or smoke zone whichever is greater, but not more than 25 devices per circuit.

C. Notification Appliance Circuit (NAC) circuits and control equipment shall be arranged such that loss of any one (1) Horn circuit will not cause the loss of any other horn circuit in the system.

3.02 FIRE ALARM SYSTEM AUXILIARY SYSTEM CONNECTIONS

A. Integration with Sound System(s):

1. Provide the necessary cabling and one (1) Fire Alarm system addressable relay module at each Sound System rack location shown on the drawings.

2. Connect and program as required.

3. When the Fire Alarm System is in General Alarm, each of the Sound System(s) shall be muted.

4. When the Fire Alarm System Control Panel is reset, the Sound System(s) may return to their previous operational status.

3.03 INSTALLATION

A. Installation, workmanship, fabrication, assembly, erection, examination, inspection, and testing shall be in accordance with N.F.P.A. #72 except as modified herein.

B. The work performed under this specification shall be of good quality and performed in a workmanlike manner. In this context "Good Quality" means the work shall meet industry technical standards and quality of appearance. The owner reserves the right to reject all or a portion of the work performed, either on technical or aesthetic grounds.

C. The authorized representative of the manufacturer of the major equipment, such as control panels, shall be responsible for the satisfactory installation of the complete system.

D. All equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place (e.g., detectors shall not be supported solely by suspended ceilings).

E. All equipment and components shall be installed in strict compliance with each manufacturer's recommendations. Consult the manufacturer's installation manuals for all cabling diagrams, schematics, physical equipment sizes, etc. before beginning system installation and refer to the riser / connection diagram for all specific system installation / termination / cabling data.

F. Fasteners and supports shall be adequate to support the required load.

3.04 FLEXIBILITY IN SYSTEM DESIGN

A. The Fire Alarm System contractor shall provide flexibility in their design to accommodate future expansion or tenant improvements.

B. Provide all quantities of equipment as specified, while maintaining the “Spare Capacity” requirements listed in this Specification.

3.05 FIRE ALARM SYSTEM MOUNTING HEIGHTS AND LOCATIONS

A. Fire Alarm System Control Panel (FACP):

1. The Fire Alarm System Control Panel is existing and installed in the sprinkler riser room.

B. Fire Alarm System Terminal Cabinets:

1. Where Fire Alarm System Terminal Cabinets are required, they shall be installed within spaces designated for electrical equipment (Electrical Rooms, MDF Rooms, IDF Rooms, etc.).

2. Fire Alarm System Terminal Cabinets shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas.

3. The top of the Fire Alarm System Terminal Cabinet shall be located 60" above the finished floor, unless noted otherwise and shall be installed level.

C. Fire Alarm Remote Annunciator Panel(s) (FARAP):

1. The Fire Alarm Remote Annunciator Panel(s) shall be installed in the location indicated on the contract documents.

2. The Fire Alarm Remote Annunciator Panel(s) shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas.

3. The top of the Fire Alarm Remote Annunciator Panel(s) (FARAP) shall be located 48" above the finished floor, unless noted otherwise and shall be installed level.

4. The maximum length of cabling between the Fire Alarm System Control Panel and the Fire Alarm Remote Annunciator Panel(s) shall be limited to 6,000 feet.

D. Manual Pull Stations:

1. Provide semi-flush mounted Manual Pull Station(s) on standard single gang electrical back box when located in finished areas or where indicated on the contract documents.

2. Provide surface mounted Manual Pull Station(s) on matching back box when located in unfinished areas or where indicated on the contract documents.

3. In some cases, a single manual pull station may be located in a constantly attended area, such as a receptionist area.

E. Heat Detectors:

1. The distance between Heat Detectors shall not exceed their listed spacing and shall be installed in accordance with manufacturer’s recommendations.

F. Smoke Detectors:

1. The distance between Smoke Detectors shall not exceed their listed spacing and shall be installed in accordance with manufacturer’s recommendations.

G. Duct Smoke Detectors:

1. Install in accordance with manufacturer's recommendations.

2. Duct Smoke Detectors shall be mounted on return H.V.A.C. air ducts that contain an airflow greater than 2,000 c.f.m.

H. Duct Smoke Detector Remote Test Station with Light Emitting Diode (LED):

1. Ceiling Mounted Duct Smoke Detector Remote Test Station with Light Emitting Diode (LED) shall not be installed.

2. Mount Duct Smoke Detector Remote Test Station with Light Emitting Diode (LED) on the wall such that the key is located at an elevation of approximately 5'-0" above finished floor and located within a 5'-0" radius of the duct smoke detector in Floor Plan view.

3. The location of the Duct Smoke Detector Remote Test Station with Light Emitting Diode (LED) shall be visible from the floor and readily accessible.

4. Install Duct Smoke Detector Remote Test Station with Light Emitting Diode (LED) whenever a duct smoke detectors Light Emitting Diode (LED) is not visible to responding personnel from the walking surface / floor, such as:

   a. When installed above a ceiling.

   b. At an elevation higher than 8'-0" above finished floor.

   c. In an attic.

I. Strobe Only Appliances:

1. Strobe Only Appliances shall be flush mounted when located in finished areas.

2. Strobe Only Appliances may be surface mounted when located in unfinished areas.

3. If there is an interruption of the concentrated viewing path, such as a fire door, an elevation change, or any other obstruction, the area shall be treated as a separate corridor.

4. Strobe Only Appliances indicated on the contract documents are based upon the utilization of (75) Candela (Cd) strobes at a 44'-0" x 44'-0" spacing for ceiling mounted visual appliances and 45'-0" x 45'-0" spacing for wall mounted visual appliances. If the Fire Alarm System Contractor decides to install lower output Strobe Only Appliances, it becomes the responsibility of the Fire Alarm System Contractor to meet the minimum Candela (Cd) rating at the listed maximum room size indicated in Table 18.5.5.4.1(a) for wall mounted Strobe Only Appliances or Table 18.5.5.4.1(b) for ceiling mounted Strobe Only Appliances of N.F.P.A. #72.

5. Ceiling Mounted Strobe Only Appliances shall be installed as recommended by the manufacturer.

J. Combination Horn / Strobe Appliances:

1. Combination Horn / Strobe Appliances shall be flush mounted when located in finished areas.

2. Combination Horn / Strobe Appliances may be surface mounted when located in unfinished areas.

3. Strobe Only Appliances indicated on the contract documents are based upon the utilization of (75) Candela (Cd) strobes at a 44'-0" x 44'-0" spacing for ceiling mounted visual appliances and 45'-0" x 45'-0" spacing for wall mounted visual appliances. If the Fire Alarm System Contractor decides to install lower output Combination Horn / Strobe Appliances, it becomes the responsibility of the Fire Alarm System Contractor to meet the minimum Candela (Cd) rating at the listed maximum room size indicated in Table 18.5.5.4.1(a) for wall mounted Combination Horn / Strobe Appliances or Table 18.5.5.4.1(b) for ceiling mounted Combination Horn / Strobe Appliances of N.F.P.A. #72.

4. Ceiling Mounted Combination Horn / Strobe Appliances shall be installed as recommended by the manufacturer.

3.06 MISCELLANEOUS CONNECTION POINTS

A. Magnetic Door Holders:

1. Magnetic Door Holders (indicated on the contract documents) shall be controlled by use of a relay module.

2. Magnetic Door Holder relay modules shall operate on a 120 Volts A.C. power source that is controlled through the Fire Alarm System Control Panel.

3. Upon activation of the Fire Alarm System, Magnetic Door Holder relay modules shall release allowing the Doors to close.

B. Magnetic Door Locks:

1. Magnetic Door Locks (indicated on the contract documents) shall be controlled by use of a relay module.

2. Magnetic Door Lock relay modules shall operate on a 24 Volts D.C. power source that is powered through the Fire Alarm System Control Panel allowing the Magnetic Door Lock relay modules to be on a battery back-up power supply.

3. Upon activation of the Fire Alarm System, Magnetic Door Lock relay modules shall release allowing the Door Locks to open.

C. Coiling Fire Doors:

1. Coiling Fire Doors (indicated on the contract documents) shall be controlled by use of a relay module.

2. Coiling Fire Door relay modules shall operate on a 24 Volts D.C. power source that is powered through the Fire Alarm System Control Panel allowing the Coiling Fire Door relay modules to be on a battery back-up power supply.

3. Upon activation of the Fire Alarm System, Coiling Fire Door relay modules shall release allowing the Coiling Fire Doors to close.

D. Audio/Visual Sound Systems:

1. Audio/Visual Sound Systems (indicated on the contract documents) shall be controlled use of a relay module.

2. Audio/Visual Sound System relay modules shall operate on a 24 Volts D.C. power source that is powered through the Fire Alarm System Control Panel allowing the Audio/Visual Sound System control modules to be on a battery back-up power supply.

3. Upon activation of the Fire Alarm System, the Audio/Visual Sound System relay modules shall terminate Audio/Visual Sound Systems allowing the Fire Alarm System to be the only operational sound producing system.

E. Intercom Systems:

1. Intercom Systems (indicated on the contract documents) shall be controlled by use of a relay module.

2. Intercom System relay modules shall operate on a 24 Volts D.C. power source that is powered through the Fire Alarm System Control Panel allowing the Intercom System relay modules to be on a battery back-up power supply.

3. Upon activation of the Fire Alarm System, the Intercom System relay modules shall terminate the Intercom systems allowing the Fire Alarm System to be the only operational sound producing system.

F. Public Address (PA) Systems:

1. Public Address (PA) Systems (indicated on the contract documents) shall be controlled by use of a relay module.

2. Public Address (PA) System relay modules shall operate on a 24 Volts D.C. power source that is powered through the Fire Alarm System Control Panel allowing the Public Address (PA) System relay modules to be on a battery back-up power supply.

3. Upon activation of the Fire Alarm System, the Public Address (PA) System relay modules shall terminate the Public Address (PA) Systems, allowing the Fire Alarm system to be the only operational sound producing system.

3.07 DEVICE RELOCATIONS

A. Prior to installation and without extra charge, the Architect and/or Engineer may:

1. Relocate devices up to 15'-0" from location indicated.

2. Change from a ceiling mounted to a wall mounted installation.

3. Change from a wall mounted to a ceiling mounted installation.

3.08 CONDUIT

A. Provide and install conduit, junction boxes, couplers, connectors, cabling, terminations, and the necessary Fire Alarm System equipment to monitor and/or power any specialty system control panel(s) and equipment.

B. The Contractor is responsible for assuring that the conduit size is suitable for the equipment supplied.

C. All conduit, junction boxes, conduit supports, and hangers shall be concealed in finished areas and may be exposed in unfinished areas.

D. Cabling installed in walls, below 8'-0" in elevation, above inaccessible ceilings or installed exposed to view shall be installed in conduit.

E. Conduit shall be in accordance with N.F.P.A. #70, local requirements, and state requirements.

F. The minimum radius bend of conduit shall be:

1. Ten (10) times the cable outside diameter with no tensile load applied during installation.

2. Twenty (20) times the cable outside diameter with a maximum tensile load of 25 feet/lbs. applied during installation.

G. Conduit shall not enter the Fire Alarm System Control Panel or any other remotely mounted panel, equipment, or back box, except where conduit entry is specified by the manufacturer.

3.09 WIREMOLD SURFACE RACEWAY

A. Provide and install the Wiremold Surface Raceway, junction boxes, couplers, connectors, cabling, terminations, and the necessary Fire Alarm System equipment to monitor and/or power any specialty system control panel(s) and equipment.

B. The Contractor is responsible for assuring that the Wiremold Surface Raceway size is suitable for the equipment supplied.

C. All Wiremold Surface Raceway, junction boxes, conduit supports, and hangers shall be exposed.

D. Wiremold Surface Raceway shall not enter the Fire Alarm System Control Panel or any other remotely mounted panel, equipment, or back box, except where Wiremold entry is specified by the manufacturer.

3.10 CABLING

A. Cabling for 24 Volts D.C. control, alarm notification, emergency communications, and similar power-limited auxiliary functions may be run in the same conduit as Initiating Device Circuits (IDC) and Signaling Line Circuits (SLC).

B. The Contractor is responsible for assuring that the cable quantity, size, and type is suitable for the equipment supplied.

C. Cable must be separated from any open conductors of Power or Class 1 circuits and shall not be placed in any conduit, junction box, or raceway containing these conductors per Article 760 of N.F.P.A. #70.

D. Do not exceed the cabling distance limitation of the equipment, device(s), cable(s), and/or conductor(s) as recommended by the manufacturer of either equipment and/or cables for each installation application.

E. All Fire Alarm System cabling must be new and free from insulation scrapes or peeling.

F. Cabling insulation shall be one of the types required by Article 725-16 of N.F.P.A. #70 and shall be consistently color coded throughout the system.

G. The Fire Alarm System Control Panel shall be connected to a separate dedicated branch circuit rated for a maximum of 20 amperes at 120 Volts A.C. This circuit shall be labeled at the main power distribution panel as "FIRE ALARM".

H. Permanent cable markers shall be affixed to all conductors at terminations and splices.

I. T-Tapping of Class "A" circuits (i.e. Initiating Device Circuits (IDC), Notification Appliance Circuits (NAC), Signaling Line Circuits (SLC) etc.) is not allowed.

J. T-Tapping of Class "B" circuits (i.e. Initiating Device Circuits (IDC) and Notification Appliance Circuits (NAC) is not allowed.

K. T-Tapping of Class "B" circuits (i.e. Signaling Line Circuits (SLC) etc.) is allowed.

L. All cabling terminal blocks shall be the plug-in / removable type and shall be capable of terminating up to 12 AWG cable.

M. Exposed cabling will be allowed above accessible ceilings only.

1. Class "A" exposed cabling installed vertically in concealed locations shall be provided with a minimum separation distance of 1'-0".

2. Class "A" exposed cabling installed horizontally in concealed locations shall be provided with a minimum separation distance of 4'-0".

N. Cable not installed in conduit shall have a fire resistance rating suitable for the installation as indicated in N.F.P.A. #70 (e.g., FPLR).

O. The Fire Alarm System Contractor shall insure that cables are installed with care, using techniques which prevent kinking, sharp bends, scraping, cutting, deforming the jacket, or other damage. During inspection, evidence of such damage will result in the material being declared unacceptable. The Fire Alarm System Contractor shall replace all unacceptable cabling at no additional expense to the Owner.

P. For consistency of cabling throughout the entire system equipment, if specific conductor colors are not called out in each system specification, then the following colors shall apply:

1. Red is (+) Positive voltage.

2. Black is (-) Negative voltage.

3. White is common.

4. Green is normally open or normally closed.

Q. All cabling penetrations into a box, fitting, enclosure, panel, etc. shall be provided with a bushing to protect the cabling from abrasion in accordance with Paragraph 342.46 of N.F.P.A. #70. Hard rubber or compression bushings will not be approved and shall not be used.

R. In the event of a primary power failure, disconnected back-up battery, an open circuit in the field cabling, or removal of any internal modules a trouble signal shall be activated and remain active until the system is restored to normal condition.

S. Initiating circuits shall be arranged to serve like categories (manual, smoke, water flow).

T. No cable other than the detector circuit shall be permitted in conduit feeding detectors unless approved.

U. Mixed category circuitry shall not be permitted except on signaling line circuits connected to intelligent reporting devices.

V. Minimum cable sizes shall be as follows:

1. 120 Volts A.C. cabling shall be a minimum of #12 American Wire Gauge (AWG).

2. Initiating Device Circuits (IDC) (Manual Pull Stations, Heat Detectors, Smoke Detectors, Carbon Monoxide Detectors, Duct Smoke Detectors, etc.) shall be a minimum of #16 American Wire Gauge (AWG) twisted shielded pair FPL rated.

3. Notification Appliance Circuits (NAC) (Horns, and Strobes) shall be a minimum of #16 American Wire Gauge (AWG) shielded, twisted FPL rated cable.

4. Signaling Line Circuit (SLC) (Manual Pull Stations, Heat Detectors, Smoke Detectors, Carbon Monoxide Detectors, Duct Smoke Detectors, etc.) shall be a minimum of #16 American Wire Gauge (AWG) twisted FPL rated cable.

5. Heat detectors shall be a minimum of #16 American Wire Gauge (AWG).

6. Monitor modules shall be a minimum of #16 American Wire Gauge (AWG).

7. "Direct Burial" cables shall be a minimum of #16 American Wire Gauge (AWG).

8. "Underground in Conduit" cables shall be a minimum of #16 American Wire Gauge (AWG).

W. Provide a Fire Alarm System Device Naming Matrix that identifies the nomenclature used on the shop drawing consisting of the following:

1. Circuit Type

2. Circuit Number

3. Device type

4. Device number

X. All circuits shall be identified with labels to include cable type, quantity, and circuit number in accordance with the following example:

1. Example circuit identification: C2HX3

C = Signal Circuit Cabling
2 = Signal Circuit Number
H = Annunciator Cabling
X = Addressable Initiating Device Circuit Cabling
3 = Addressable Initiating Device Circuit Number

Y. Circuit labels shall be provided using an electronic labeler for the following circuit locations:

1. At the Fire Alarm System Control Panel.

2. At all junction boxes.

3.11 CABLE SUPPORTS

A. All horizontal cables shall be independently supported from other trade work at a maximum of 4’-0” intervals. At no point shall cables rest on, be tied to, or otherwise secured to electrical conduit, plumbing piping, H.V.A.C. ductwork, Fire Protection Piping, accessible ceiling and/or light fixture hangers, or any other equipment.

B. Cable shall be secured to building structure by means of approved low voltage cabling supports.

C. Cabling in any Panel shall be neatly arranged and bundled with cabling ties or approved equivalent, zip ties shall not be utilized.

D. All open cabling and/or conduit shall be installed parallel or perpendicular to the structure.

E. Open cable installations shall use insulated mounting supports, "D rings", or "J-Hooks" above accessible ceilings where approved for such use.

F. Cabling shall be installed near or on structural members as to minimize risk of physical damage by other trades or maintenance personnel servicing the equipment.

G. Installing open cabling and/or conduit on an exposed area of wall that could have been installed in a less conspicuous manner is not acceptable. Any installation that does not meet this requirement will be required to be removed and the ceiling/wall patched and painted to match adjacent surfaces to the satisfaction of the Architect at no additional cost to the Owner.

H. Hangers provided under other Divisions shall not be used for support of Fire Alarm System equipment unless permitted by Engineer.

3.12 JUNCTION BOXES

A. Provide access panels as needed for junction boxes located above inaccessible ceilings or behind walls.

B. All junction boxes for the Fire Alarm System shall be painted red.

C. All Fire Alarm System junction boxes shall be annotated "FA" on the cover in black bold print having minimum character font size of 2" tall by 1" wide.

D. All Fire Alarm System junction boxes shall be painted red (inside and out) and annotated **"FIRE ALARM POWER LIMITED"** on the cover in black bold print having a minimum character font size of 1/4" tall by 1/4" wide per WAC 296-46B 760

3.13 GROUNDING

A. A grounding system shall be maintained as required by code.

3.14 ADDITIONAL FIELD DEVICES AND INSTALLATION LABOR

A. In order to minimize the impacts to project schedule and costs of implementing changes during the course of construction, the Fire Alarm System Contractor shall include in his bid the following list of material, associated installation labor based on existing jobsite conditions, established construction standards, and all fees associated with documenting and executing changes.

	QTY	Item
1.	__1__	Manual Pull Stations
2.	__5__	Photoelectric Smoke Detectors
3.	__5__	Smoke Detector Bases

4. __1__ Strobes Only Appliances
5. __1__ Combination Horn / Strobe Appliances
6. __5__ Relay Modules
7. __1__ Isolation Modules
8. __10_ Device Boxes
9. __10_ 4S J-boxes with blank covers
10. __100__ LF 3/4" EMT with four (4) #14 THHN cabling (include couplers, straps, connectors, etc.)
11. __20__ Hrs. Labor for Journeyman Electrician

B. The installation locations of additional field devices shall be as directed by the Architect and/or Engineer with all remaining "Spare Parts" being provided to the Owner upon completion of the final testing and system certifications.

C. All material shall match those components utilized in the system.

D. Provide signed proof of delivery to the Owner with close out documentation.

3.15 FORMAL TESTS AND INSPECTIONS

A. Do not submit a request for formal test and inspection until the preliminary test (including audibility and intelligibility testing results) are completed and corrections are made and approved.

B. The Fire Alarm System Contractor shall arrange for and obtain all required inspections and certificates pertaining to the Fire Alarm System work and deliver the certificates to the Fire Protection Engineer.

C. Submit copies of preliminary test results to the Architect/Engineer for review and approval prior to submitting a request for final acceptance testing with the Authority Having Jurisdiction.

D. Submit a written request to local fire protection authority for formal inspection at least fourteen (14) days before the inspection date.

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

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

G. Correct defects in work provided by the Contractor and perform additional system tests until the system complies with current code and the contract requirements.

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

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

3.16 FIRE ALARM SYSTEM TESTING

A. Upon completion on the system installation, the Fire Alarm System Contractor shall conduct a system test for the Owner, Architect, Engineer, and Authority Having Jurisdiction (for those who wish to attend) to verify operation of the system.

B. This system test shall be conducted by a factory trained technician.

C. The Fire Alarm System Contractor shall provide a minimum of two (2), two-way communication devices for the system test.

D. *T*he Fire Alarm System Contractor shall completely fill out all applicable documents contained Section 7.8 "Forms" of N.F.P.A. #72.

E. If the Fire Alarm System Contractor fails the Authority Having Jurisdiction system test and inspection, the following shall occur:

1. The Fire Alarm System Contractor shall make all of the necessary corrections as required, to pass the Authority Having Jurisdiction testing and inspection.

2. Notify the Authority Having Jurisdiction and schedule another test.

3. Pay all associated fees for additional site visits made by the Authority Having Jurisdiction.

4. Continue making corrections until the Fire Alarm System has been accepted by the Authority Having Jurisdiction.

F. After acceptance of the system testing, the Fire Alarm System Contractor shall submit a copy of approved test certificates with Authority Having Jurisdiction signature

3.17 INSTRUCTION AND TRAINING PERIOD

A. Upon completion of the work and after all tests and inspections by the authority(s) having jurisdiction, the Fire Alarm System Contractor shall "Hands On" demonstrate and train the Owner's designated operation and maintenance personnel in the operation and maintenance of the Fire Alarm System.

B. The Fire Alarm System Contractor's representative shall be a superintendent, foreman, or technician who is knowledgeable in the system installed.

C. The Fire Alarm System Contractor shall arrange scheduled instruction periods with the Owner’s designated operation and maintenance personnel.

D. The Fire Alarm System Contractor shall provide in their bid the following:

1. One (1) editing session of the control panel programming to address any changes required by the Owner.

2. Training periods shall be based upon complexity of the system installed, but in no case be less than four (4) hours in duration.

E. Upon request of the Owner, a "USB" of the training period shall be made available by the Fire Alarm System Contractor at no additional cost to the Owner.

END OF SECTION 28 31 00

SECTION 31 11 00
CLEARING AND GRUBBING

PART 1 GENERAL

The work described in this section consists of preparation of the site for construction.

Clearing involves the removal and disposal of all unwanted material from the surface such as trees, brush, and other natural materials.

Grubbing involves the removal and disposal of all unwanted vegetative matter from underground such as sod, stumps, roots, and other debris.

Debris consists of unusable natural material produced by clearing and grubbing of the site.

PART 2 NOT USED

PART 3 EXECUTION

Execution and workmanship related to clearing and grubbing shall meet the requirements of Section 2-01 within the Standard Specifications for Road Bridge, and Municipal Construction, Washington State Department of Transportation and American Public Works Association, Washington State Chapter, latest edition, unless superseded or amended by the City of Puyallup City Standards for Public Works Engineering and Construction, geotechnical report and the approved construction documents.

END OF SECTION 31 11 00

SECTION 31 23 13
SUBGRADE PREPARATION

PART 1 GENERAL

The work described in this section consists of preparing graded areas proposed for paving.

PART 2 NOT USED

PART 3 EXECUTION

Execution and workmanship related to subgrade preparation shall meet the requirements of Section 2-06 within the Standard Specifications for Road Bridge, and Municipal Construction, Washington State Department of Transportation and American Public Works Association, Washington State Chapter, latest edition, unless superseded or amended by the City of Puyallup City Standards for Public Works Engineering and Construction, geotechnical report and the approved construction documents.

END OF SECTION 31 23 13

SECTION 31 23 16
EXCAVATION

PART 1 GENERAL

The work described in this section, regardless of nature or type of the material encountered, includes excavating and grading the site, excavating below grade, and disposing of all excavated materials. These activities may be performed in making cuts, embankments, slopes, approaches and parking areas. The work includes the removal of pavement sidewalks, curb and gutters when these items lie within an excavation area.

PART 2 NOT USED

PART 3 EXECUTION

Execution and workmanship related to excavation shall meet the requirements of Sections 2-02, 2-03, 2-06 within the Standard Specifications for Road Bridge, and Municipal Construction, Washington State Department of Transportation and American Public Works Association, Washington State Chapter, latest edition, unless superseded or amended by the City of Puyallup City Standards for Public Works Engineering and Construction, and the approved construction documents.

END OF SECTION 31 23 16

SECTION 31 23 16.13
TRENCHING

PART 1 GENERAL

The work described in this section consists of excavating and disposing of all natural materials or man-made objects that must be removed to make way for trenches for pipelines, conduits, and other structures as shown on the plans. This work also includes placing and compacting backfill.

Pipe Trenching Bedding and Backfill shall be per City of Puyallup Standard Plan 06.01.01.

PART 2 NOT USED

PART 3 EXECUTION

Execution and workmanship related to excavation shall meet the requirements of Sections 2-09 within the Standard Specifications for Road Bridge, and Municipal Construction, Washington State Department of Transportation and American Public Works Association, Washington State Chapter, latest edition, unless superseded or amended by the City of Puyallup City Standards for Public Works Engineering and Construction, and the approved construction documents.

END OF SECTION 31 23 16.13

SECTION 31 23 23
FILL

PART 1 GENERAL

The work described in this section consists of backfilling of trenches for pipelines, conduits, and other structures as shown on the plans. This work also includes placing and compacting backfill.

PART 2 NOT USED

PART 3 EXECUTION

Execution and workmanship related to fills shall meet the requirements of Sections 9-03.15 within the Standard Specifications for Road Bridge, and Municipal Construction, Washington State Department of Transportation and American Public Works Association, Washington State Chapter, latest edition, unless superseded or amended by the City of Puyallup City Standards for Public Works Engineering and Construction, geotechnical report and the approved construction documents.

END OF SECTION 31 23 23

SECTION 31 25 00
EROSION AND SEDIMENTATION CONTROLS

PART 1 GENERAL

The work described in this section consists of furnishing, installing, maintaining, removing and disposing of high visibility fencing and water pollution and erosion control items in accordance with the approved construction documents.

PART 2 MATERIALS

Materials listed below shall meet the requirements of the referenced sections within the Standard Specifications for Road Bridge, and Municipal Construction, Washington State Department of Transportation and American Public Works Association, Washington State Chapter, latest edition, unless superseded or amended by the City of Puyallup City Standards for Public Works Engineering and Construction, and the approved construction documents.

Quarry Spalls	9-13
Seed	9-14.2
Fertilizer	9-14.3
Mulch and Amendments	9-14.4
Tackifiers	9-14.4(7)
Erosion Control Devices	9-14.5
High Visibility Fence	9-14.5
Construction Geotextile	9-33

Erosion and Sedimentation Control Devices shall be per City of Puyallup Standard Plans:

Siltation Fence	02.03.02
Storm Drain Barriers	02.03.05
Storm Drain Barrier Notes	02.03.06

PART 3 EXECUTION

Execution and workmanship related to erosion and sedimentation controls shall meet the requirements of Section 8-01 within the Standard Specifications for Road Bridge, and Municipal Construction, Washington State Department of Transportation and American Public Works Association, Washington State Chapter, latest edition, unless superseded or amended by the City of Puyallup City Standards for Public Works Engineering and Construction, and the approved construction documents.

END OF SECTION 31 25 00

SECTION 32 11 23
AGGREGATE BASE COURSES

PART 1 GENERAL

The work consists of constructing one or more courses of crushed stone upon a prepared subgrade in accordance with the lines, grades, depth and typical cross-sections established in the plans.

PART 2 MATERIALS

Materials listed below shall meet the requirements of the referenced sections within the Standard Specifications for Road Bridge, and Municipal Construction, Washington State Department of Transportation and American Public Works Association, Washington State Chapter, latest edition, unless superseded or amended by the City of Puyallup City Standards for Public Works Engineering and Construction.

Crushed Surfacing	9-03.9(3)

PART 3 EXECUTION

Execution and workmanship relating to aggregate base courses shall meet the requirements of Section 4-04 within the Standard Specifications for Road Bridge, and Municipal Construction, Washington State Department of Transportation and American Public Works Association, Washington State Chapter, latest edition, unless superseded or amended by the City of Puyallup City Standards for Public Works Engineering and Construction, geotechnical report and the approved construction documents.

END OF SECTION 32 11 23

SECTION 32 12 16
ASPHALT PAVING

PART 1 GENERAL

The work consists of providing and placing one or more layers of plant-mixed hot mix asphalt (HMA) on a prepared foundation or base, in accordance with these specifications and the lines, grades, thicknesses, and typical cross-sections established in the plans.

HMA shall be composed of asphalt binder and mineral materials as required.

PART 2 MATERIALS

Materials listed below shall meet the requirements of the referenced sections within the Standard Specifications for Road Bridge, and Municipal Construction, Washington State Department of Transportation and American Public Works Association, Washington State Chapter, latest edition, unless superseded or amended by the City of Puyallup City Standards for Public Works Engineering and Construction, and the approved construction documents.

Asphalt Binder	9-02.1(4)
Aggregates	9-03.8
Mineral Filler	9-03.8(5)
Joint Sealants	9-04.2

PART 3 EXECUTION

Execution and workmanship relating to asphalt paving shall meet the requirements of Section 5-04 within the Standard Specifications for Road Bridge, and Municipal Construction, Washington State Department of Transportation and American Public Works Association, Washington State Chapter, latest edition, unless superseded or amended by the City of Puyallup City Standards for Public Works Engineering and Construction, geotechnical report and the approved construction documents.

END OF SECTION 32 12 16

SECTION 32 16 13
CURBS AND GUTTERS

PART 1 GENERAL

The work consists of constructing cement concrete curbs of the kind specified at the locations shown in the plans in accordance with the lines and grades as staked.

PART 2 MATERIALS

Materials listed below shall meet the requirements of the referenced sections within the Standard Specifications for Road Bridge, and Municipal Construction, Washington State Department of Transportation and American Public Works Association, Washington State Chapter, latest edition, unless superseded or amended by the City of Puyallup City Standards for Public Works Engineering and Construction, and the approved construction documents.

Portland Cement	9-01
Aggregates	9-03
Premolded Joint Filler	9-04.1

PART 3 EXECUTION

Execution and workmanship relating to cement concrete paving shall meet the requirements of Section 8-04 within the Standard Specifications for Road Bridge, and Municipal Construction, Washington State Department of Transportation and American Public Works Association, Washington State Chapter, latest edition, unless superseded or amended by the City of Puyallup City Standards for Public Works Engineering and Construction, and the approved construction documents.

END OF SECTION 32 16 13

SECTION 32 16 23
SIDEWALKS

PART 1 GENERAL

The work consists of constructing cement concrete sidewalks on a prepared subgrade or base in accordance with these specifications and the lines, grades, thicknesses, and typical cross-sections established in the plans.

PART 2 MATERIALS

Materials listed below shall meet the requirements of the referenced sections within the Standard Specifications for Road Bridge, and Municipal Construction, Washington State Department of Transportation and American Public Works Association, Washington State Chapter, latest edition, unless superseded or amended by the City of Puyallup City Standards for Public Works Engineering and Construction, and the approved construction documents.

Portland Cement	9-01
Aggregates	9-03
Premolded Joint Filler	9-04.1
Concrete Curing Materials and Admixtures	9-23

PART 3 EXECUTION

Execution and workmanship relating to cement concrete paving shall meet the requirements of Section 8-14 within the Standard Specifications for Road Bridge, and Municipal Construction, Washington State Department of Transportation and American Public Works Association, Washington State Chapter, latest edition, unless superseded or amended by the City of Puyallup City Standards for Public Works Engineering and Construction, geotechnical report and the approved construction documents.

END OF SECTION 32 16 13

SECTION 32 14 12
SAND-SET PRECAST CONCRETE PAVING UNITS (NMP)

PART 1 - GENERAL

1.01 REFERENCE STANDARDS

A. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar.

B. ASTM C642 - Standard Test Method for Density, Absorption, and Voids in Hardened Concrete.

1.02 SUMMARY

A. Perform all work required for a complete system, as indicated by the Contract Documents. Furnish all items necessary for the proper installation of the system.

B. System shall consist of precast concrete Narrow Modular Paving Units, (NMP) for sand-set pedestrian use installations.

C. Related Sections:

1. Section 31 22 00-Grading: Preparation of subsoil for pavers.
2. Section 31 23 23-Fill: Compacted fill for pavers.
3. Section 32 11 23-Aggregate Base Courses: Aggregate subbase for pavers.
4. Section 32 13 13-Concrete Paving: Concrete subbase for pavers.

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM)

1. ASTM C33 Concrete Aggregates
2. ASTM C39 Concrete Compressive Strength
3. ASTM C144 Aggregate for Masonry Mortar
4. ASTM C150 Portland cement
    a. ASTM C595 Standard Specification for Blended Hydraulic Cements
5. ASTM C642 Water Absorption, Density, Voids in Hardened Concrete
6. ASTM C666 Rapid Freeze/Thaw Resistance of Concrete
7. ASTM C979 Pigments for Integrally Colored Concrete
8. ASTM C1028 Coefficient of Friction

B. Paving installations should be designed in consultation with a qualified civil engineer, in accordance with established flexible paving design procedures.

1.04 SUBMITTALS

A. Samples: Submit two full-sized samples of each type of precast concrete paving units to show the full range of color and texture of unit for selection and approval. If sealer is to be applied to precast concrete paving slab, apply sealer on one sample.

B. Warranty: Provide certified copies of manufacturer's product warranties.

1.05 MOCK UP

A. Install a 3 ft x 10 ft minimum paver area as described in Article 3.2. Mock-up area to be used to determine joint sizes, lines, laying pattern, color(s) and texture of the job. Mock-up area to be the standard from which the work will be judged. Consideration will be given with regard to differences in age of materials from time of mock-up construction to the time of actual product delivery and installation.

1.06 SUBSTITUTIONS

A. Refer to Section 016000 for procedures.

B. Proposed substitutions: Or approved equal.

1.07 QUALITY ASSURANCE

A. Compliance with Regulations: Comply with requirements of state and local building codes and with rules and regulations relating to building accessibility.

B. Qualifications of Manufacturer: Company specializing in the manufacture of precast concrete paving units with a minimum of 10 continuous years of documented experience.

C. Qualifications of Subcontractor: Subcontractor shall submit evidence of skill and not less than 5 years of experience in this product type.

D. Pre-installation Conference: One week prior to mockup, at a minimum.

E. Precast concrete paving units shall have a compressive strength of 5,000 psi minimum.

1.08 DELIVERY, STORAGE AND HANDLING:

A. Deliver all materials to the installation site in the manufacturer's original packaging. Packaging shall contain manufacturer's name, customer name, order, identification number, and other related information.

B. Handle and store precast concrete paving units in accordance with manufacturer's recommendations.

1. WARRANTY

C. Provide warranty covering precast concrete paving units against defects in material and workmanship for a period of 5 years. Unusual abuse and neglect are excepted.

PART 2 - PRODUCTS

2.01 MANUFACTURER

1. Stepstone, LLC
2. 17025 South Main Street
3. Gardena, CA 90248
4. (310) 327-7474
5. (800) 572-9029
6. FAX (310) 217-1424
7. www.stepstoneinc.com

2.02 MATERIALS

A. Precast concrete paving units shall be precast concrete Narrow Modular Pavers (NMP), consisting of Portland cement, aggregate, and color admixtures.

1. Portland Cement: ASTM C 150, Type III, high early strength.
2. Aggregate: ASTM C 33.
3. Color Admixture: By Davis Colors, or equal, as required to achieve color as selected.
4. Aggregate for exposed aggregate surface: As selected.

B. Precast Concrete Paving Unit style:

1. Narrow Modular Pavers – 4” thick only
2. Pavers shall have radius top edge to reduce chipping.
3. All pavers have drafted sides

2.03 COLORS AND FINISHES

A. Colors: Integral color shall be throughout entire product.

1. 1825 Adobe

B. Finishes

1. All finishes shall be sandblasted.

2. Walking surfaces of precast concrete paving units shall have minimum coefficient of friction of 0.60, wet and dry.

3. Medium Sandblasted

C. Field Application of Sealer

1. In geographic regions exposed to freeze-thaw conditions field-applied sealing the entire paving area, including joints, after installation is mandatory.

2. Conform to sealer manufacturer's recommendations for application and maintenance of sealer.

2.04 PHYSICAL PROPERTIES

A. Compressive strength: Minimum 5,000 psi.

B. Size and Finish Schedule:

Size	Sandblast	False Joint NMP
2-7/8" x 8-7/8" x 4”	x	
2-7/8" x 11-7/8" x 4”		
2-7/8" x 17-7/8" x 4”	x	
2-7/8" x 23-7/8" x 4”		
5-7/8” x 11-7/8” x 4”		
5-7/8” x 17-7/8” x 4”		
5-7/8” x 23-7/8” x 4”		
11-7/8" x 11-7/8" x 4”		

C. Unit size: Within 1/8” of designated length, width and thickness.

D. Integrated spacer tabs allow Narrow modular pavers to be placed together and maintain even spacing throughout the installation. Minor adjustments may be necessary to maintain consistent joint lines.

E. Weight: Narrow Modular Paver: 4” thick - 44 pounds per square foot.

F. Water absorption: Not more than 6.0 % average, not more than 7.0 % for any individual unit for standard colors.

G. Narrow Modular Pavers will contain on average 5% entrained air, with no individual piece under 4%.

H. Resistance to Freeze-Thaw: Narrow Modular Pavers will resist 300 freeze thaw cycles in accordance with ASTM C666 Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing.

2.05 FABRICATION

A. Narrow Modular Pavers shall be hand-made, wet-cast of cement conforming to ASTM C 150, Type III, aggregates conforming to ASTM C 33, and pigments for integrally colored concrete conforming to ASTM C979.

2.06 SOURCE QUALITY CONTROL

A. Concrete for Narrow Modular Pavers shall be tested frequently to assure that mixes provide units having not less than 5,000 psi compressive strength at 28 days (average test strength not less than 4,500 psi).

B. Minor chips, hairline cracks, air voids and slight variations in color and finish are normal in precast concrete. When viewed in typical daylight illumination from a distance of 20 feet, minor chips, hairline cracks and air voids that cannot be seen with the naked eye are not grounds for rejection.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Contractor and/or Architect/Engineer shall certify that sub-grade preparation, compacted density and elevations conform to the specifications. Compaction of the soil sub-grade to at least 98% Standard Proctor Density per ASTM D 698 is recommended. Stabilization of the sub-grade and/or base may be necessary with weak or saturated sub-grade soils. The Contractor and/or Architect/Engineer should inspect sub-grade preparation, elevations and conduct density tests for conformance to specifications.

B. Contractor shall verify that geotextiles, if applicable, have been placed according to specifications.

C. Contractor must verify that aggregate base materials, thickness, compaction, surface tolerances, and elevations conform to the specifications.

D. Contractor must verify location, type, installation and elevations of edge restraints around perimeter of area to be paved. Perimeter containment must surround the entire paving area.

E. Contractor must verify base is dry, uniform, even and ready to support sand, precast concrete paving units, and imposed loads.

F. Installing the bedding sand and precast concrete paving unit installation constitutes acceptance of base and edge restraint installation.

3.02 INSTALLATION – GENERAL

A. Pavers set on surface of over a 5 degree (or 8.33%) slope requires specific engineering for containment edge support and drainage of the paver system.

B. Installation shall comply with requirements of applicable building codes and state and local jurisdictions.

C. Spread the bedding sand evenly over the base course and screed to a nominal 1 inch. thickness. Do not exceed 1-1/4" thickness.

D. Lay the precast concrete paving units, (NMP), on top of compacted sand in the pattern as defined on the drawings. Maintain straight pattern lines.

E. Use low amplitude, high frequency plate vibrator to compact the Narrow Modular pavers into sand bed. Provide separation layer between hard plate of vibrator and paver surface to avoid damaging paver surface, for example plywood sheets, (7/16" min thickness), to protect against surface scratching and evenly distribute the impact load during compaction. Pass vibrator across the short dimension of the paving units.

F. Typical joints between the pavers at the top of paving surface shall be roughly 3/16" to 1/4" wide. Refer to Section 2.4.C for standard dimensional paver tolerances. (Note: Recommended minimum spacing at bottom of pavers is 1/16".")

G. Fill gaps at edges of the paved area with cut precast concrete paving units

H. Fill joints with sand.

1. Polymeric sand per manufacturer's recommendations.

3.03 CLEANING

A. Clean exposed surfaces of precast concrete paving units. Use cleaners appropriate for precast concrete finishes and colors. Acid based cleaners will alter finish and color.

3.04 SEALING

A. Field-applied sealer for the prevention of freeze-thaw is optional in mild climates. If precast concrete paving units are factory sealed, test for compatibility before applying additional sealer.

B. In geographic regions exposed to freeze-thaw conditions field-applied sealing the entire paving area, including joints, after installation is mandatory in order to maintain Stepstone's warranty. Follow sealer manufacturer's instructions for application and maintenance of the sealer.

3.05 COMPLETION

A. Protect precast concrete paving units from damage due to subsequent building operations.

B. After installation and before completion, inspect precast concrete paving units for construction damage and obtain new precast concrete paving units if required.

C. Immediately prior to final acceptance of project, clean precast concrete paving units.

END OF SECTION 32 14 12

SECTION 32 17 13.19
PRECAST TRAFFIC CURB

PART 1 GENERAL

The work consists of furnishing and placement of precast mountable traffic curb.

PART 2 MATERIALS

Materials listed below shall meet the requirements of the referenced sections within the Standard Specifications for Road Bridge, and Municipal Construction, Washington State Department of Transportation and American Public Works Association, Washington State Chapter, latest edition, unless superseded or amended by the City of Puyallup City Standards for Public Works Engineering and Construction, and the approved construction documents.

Precast Traffic Curb	9-18.1
Mortar	9-20.4

PART 3 EXECUTION

Execution and workmanship relating to precast traffic curb shall meet the requirements of Section 8-07 within the Standard Specifications for Road Bridge, and Municipal Construction, Washington State Department of Transportation and American Public Works Association, Washington State Chapter, latest edition, unless superseded or amended by the City of Puyallup City Standards for Public Works Engineering and Construction, and the approved construction documents.

END OF SECTION 32 17 13.19

SECTION 32 17 23
PAVEMENT MARKINGS

PART 1 GENERAL

The work consists of furnishing, installing, and removing pavement markings in accordance with and established in the plans and as staked.

PART 2 MATERIALS

All materials and workmanship related to pavement markings shall conform to the Standard Specifications for Road Bridge, and Municipal Construction, Washington State Department of Transportation and American Public Works Association, Washington State Chapter, latest edition, unless superseded or amended by the City of Puyallup City Standards for Public Works Engineering and Construction, and the approved construction documents.

PART 3 EXECUTION

Execution and workmanship related to pavement markings shall meet the requirements of Section 8-22 within the Standard Specifications for Road Bridge, and Municipal Construction, Washington State Department of Transportation and American Public Works Association, Washington State Chapter, latest edition, unless superseded or amended by the City of Puyallup City Standards for Public Works Engineering and Construction, and the approved construction documents.

END OF SECTION 32 17 23

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SECTION 32 31 13
SECURITY FENCES AND GATES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. High Security Steel Fence System.

B. Automatic Rolling Gate System.

C. Manual gates with related hardware.

D. Automatic gate operators.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Concrete anchorage for posts.

B. Section 31 23 16-Excavation: Excavating for footings, and utility trenching.

C. Section 32 12 16-Asphalt Paving: Installation of adjacent paved surfaces.

D. Section 32 13 13-Concrete Paving: Installation of adjacent paved surfaces.

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.

B. ASTM B117 - Practice for Operating Salt-Spray (Fog) Apparatus.

C. ASTM D523 - Test Method for Specular Gloss.

D. ASTM D714 - Test Method for Evaluating Degree of Blistering in Paint.

E. ASTM D822 - Practice for Conducting Tests on Paint and Related Coatings and Materials using Filtered Open-Flame Carbon-Arc Light and Water Exposure Apparatus.

F. ASTM D1654 - Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments.

G. ASTM D2244 - Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.

H. ASTM D2794 - Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).

I. ASTM D3359 - Test Method for Measuring Adhesion by Tape Test.

J. ASTM F2408 – Ornamental Fences Employing Galvanized Steel Tubular Pickets.

K. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2015.

L. ASTM F1043 - Standard Specification for Strength and Protective Coatings on Steel Industrial Fence Framework; 2014.

M. ASTM F2200 - Standard Specification for Automated Vehicular Gate Construction; 2014.

N. BHMA A156.3 - American National Standard for Exit Devices; 2014.

O. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

P. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems; Current Edition, Including All Revisions.

Q. IBC Group I-2 Egress Requirements.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate installation of units with size, location and installation of service utilities.

B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of work of this section; require attendance by affected installers.

C. Sequencing: Ensure that utility connections are completed in an orderly and expeditious manner.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data of each major element.

C. Shop Drawings:

1. Layout and overall dimensions of each major element of fence, gate, and automatic rolling gate equipment.

2. Electrical schematic including associated wiring, showing electrically connected components, including interface points for connection to equipment; indicate minimum conduit size and number of wires required to run between each component.

D. Furnish detailed sequence of operations (description of system) for each gate system.

E. Manufacturer's Installation Instructions: Indicate fence installation requirements, post foundation anchor bolt templates, and foundation requirements.

F. Manufacturer's Qualification Statement.

G. Installer's Qualification Statement.

H. Operation and Maintenance Data.

I. Project Record Documents: After completion of field tests, provide updated drawings, showing exactly where equipment and controls are installed.

J. Maintenance Materials: Furnish the following for Owner's use in project maintenance.

1. See Section 01 60 00-Product Requirements, for additional provisions.

1.06 QUALITY ASSURANCE

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

B. Fence and Gate Installer: Company with demonstrated successful experience installing similar projects and products, with not less than five years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Upon receipt at the job site, all materials shall be checked to ensure that no damage 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.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. All structural fence components (i.e. rails, pales, and posts) shall be warranted within specified limitations, by the manufacturer for a period of fifteen (15) years from date of original purchase. Warranty shall cover any defects in material finish, including cracking, peeling, chipping, blistering or corroding.

C. Gate system (i.e., gate, jamb frame, and infill) shall be warranted within specified limitations, by the manufacturer for a period of three (3) years from date of original purchase. Warranty shall cover any defects in workmanship and material finish, including cracking, peeling, chipping, blistering, or corroding.

D. Correct defective Work within a one year period after Date of Substantial Completion.

E. Reimbursement for labor necessary to restore or replace components that have been found to be defective under the terms of manufactures warranty shall be guaranteed for five (5) years from date of original purchase.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. High Security Steel Fence System:

1. Basis of Design: Ameristar Security (Impasse II - Gauntlet); www.ameristarfence.com

2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Automatic Rolling Gate:

1. Basis of Design: Ameristar Security (PassPort IS (Impasse Security) Gate - Gauntlet); www.ameristarfence.com

2. Substitutions: See Section 01 60 00 - Product Requirements.

C. Manual Gate:

1. Basis of Design: Ameristar Security (Exodus); www.ameristarfence.com

2. Substitutions: See Section 01 60 00 - Product Requirements.

D. Automatic Gate Operators:

1. Basis of Design: HySecurity (SlideDriver 40-C (222 E ST) Extra Duty Slide Gate Operator with Smart Touch Controller 02827 HYS): www.hysecurity.com.

2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 HIGH SECURITY STEEL FENCE SYSTEM

A. Fence System: The steel ornamental pale high security fence system shall conform to Ameristar Impasse II Gauntlet style, 3-rail frame configuration manufactured by Ameristar Fence Products, Inc., in Tulsa, Oklahoma.

1. Height: 8'-0"

2. Color: Black

B. Material:

1. Steel material for fence framework (i.e., corrugated pales, rails and posts), when galvanized prior to forming, shall conform to the requirements of ASTM A924/A924M, with a minimum yield strength of 45,000 psi. 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.

2. Material for corrugated pales shall be a nominal 2.75” x .75” x 14 Ga. The cross-sectional shape of the rails shall conform to the manufacturer's Impasse II® rail design a nominal 2” x 2” x 11 Ga. Pre-drilled holes in the Impasse II® rail shall be spaced 6” on center, providing a pale airspace of no greater than 3.25”. Tamperproof fasteners shall be used to fasten each pale to rail at every intersection. Fence posts and gate posts shall meet the minimum size requirements per manufacturer.

3. Material for steel Impasse II privacy screening shall be 18ga. preformed slats, providing complete screening coverage between pales and at pale to post connections. Impasse II privacy screening shall provide screening from top rail to bottom rail, and be capable of traversing terrain without impeding the raking capabilities of the fencing panel.

C. Fabrication:

1. Pales, rails and posts shall be pre-cut to specified lengths. Impasse II rails shall be pre-punched to accept tamperproof security fasteners. Post flange shall be pre-punched to accept rail to post attachment. Post web shall be punched providing a clear opening for interior of rails to align throughout the entire system for affixing conduit, video cabling, IDS wiring, and other components for a complete systems integration. Impasse II rails shall be attached to post flange providing a bracket-less design at each intermediate post.

2. The manufactured galvanized framework shall be subjected to the PermaCoat® thermal stratification coating process (high-temperature, in-line, multi-stage, multi-layer) including, as a minimum, a six-stage pretreatment/wash, an electrostatic spray application of an epoxy base, and a separate electrostatic spray application of a polyester finish. The base coat shall be a thermosetting epoxy powder coating (gray in color) with a minimum thickness of 2 mils. The topcoat shall be a “no-mar” TGIC polyester powder coat finish with a minimum thickness of 2 mils. The color shall be (specify Black, Bronze, White, or Desert Sand). The stratification-coated framework shall be capable of meeting the performance requirements for each quality characteristic per manufacturer.

3. Completed panels shall be capable of supporting a 400 lb. load (applied at midspan) without permanent deformation. Panels shall be biasable to a 30˚ change in grade.

2.03 AUTOMATIC ROLLING GATE AND RELATED HARDWARE

A. Gate System: The steel gate system shall conform to Ameristar PassPort IS (Impasse Security) design series, Gauntlet style and 3-rail frame configuration manufactured by Ameristar Fence Products, Inc. in Tulsa, Oklahoma

1. The system shall include all components (i.e., pales, rails, gate uprights, wheels and hardware) required for full installation.

2. Height: 8'-0"

3. Color: Black

B. Material:

1. Steel material for roll gate components (i.e. pales, rails, diagonals and uprights), shall be commercial steel with minimum yield strength of 45,000 psi.

2. Ornamental pale material shall be 2-3/4" wide x 3/4" corrugated pales. Pale spacing shall be 6". Material for toprails, uprights and diagonals rails shall be 2" square x 12 Ga. Material for the bottom rail shall be 2" x 4" x 11 Ga. Posts shall be a minimum of 4" square x 11 Ga.

C. Fabrication:

1. Pales, rails, uprights and posts shall be precut to specified lengths. Diagonals shall be precut to specified lengths and angles. Frame materials shall be joined by welding. Pales shall be face welded to roll gate frame, except for Invincible or Gauntlet style gates over 18' long. Invincible or Gauntlet style gates over 18' long shall have pales face-welded to 2" x 2" angle iron to form panels equal in length to the gate frame bay width.

2. The manufactured roll gates and bolt-on panels (if applicable) shall be subjected to the PermaCoat® thermal stratification coating process (high-temperature, in-line, multi-stage, multi-layer) including, as a minimum, a six-stage pre-treatment/wash (with zinc phosphate), an electrostatic spray application of an epoxy base, and a separate electrostatic spray application of a polyester finish. The base coat shall be a thermosetting epoxy powder coating (gray in color) witha minimum thickness of 2 mils. The topcoat shall be a "no-mar" TGIC polyester powder coat finish with a minimum thickness of 2 mils. The stratification-coated framework shall be capable of meeting the performance requirements for each quality characteristic per manufacturer's instructions.

3. Completed gates shall be capable of supporting a 200 lb. load applied at midspan without permanent deformation.

4. Post installation: Per drawings.

5. Installation: 6" wheels shall be bolted to the gate (between the wheel plates welded near the ends of the gate bottom rail). The gate shall be set upright with the V-grooved wheels positioned over the pre-installed steel V-track that traverses the gate opening. Roller guides shall be affixed to the gateposts at a height even with the gate toprail to hold the gate in a vertical position. Gate stops shall be welded to the end of the gate or track so gate cannot pass rollers in either direction.

2.04 MANUAL GATES AND RELATED HARDWARE

A. Gate System: The gate system shall conform to the Ameristar Exodus Egress Gate Direct Bury installation method and Impasse Pale w/ perforated metal infill, manufactured by Ameristar Perimeter Security in Tulsa, Oklahoma.

1. Height: 7'-0"

2. Color: Black

B. Material:

1. Steel material for gate framework (i.e., jamb frame & gate), shall be galvanized prior to forming in accordance with the requirements of ASTM A653/A653M, with minimum yield strength of 45,000 psi. 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.

2. Material for pales shall be 2.75" x .75" x 14ga. corrugated shape. Standard pale spacing shall be no greater than 6" o.c. Perforated metal mesh shall be 3/16" round x ½" x 18ga.

3. Gate shall be 1.75" x 14ga steel reinforced structural design with ¼" plate reinforced hinge mounting.

C. Fabrication:

1. Gate shall be pre-drilled to accept appropriate hardware set. Infill frames shall be fabricated as a single unit. Frame shall be of welded construction inset with mesh filler, attachment to gate frame by means of security fasteners.

2. Gate jamb frame shall be fully welded consisting of 3" x 12ga square tubing for main jamb, 1" square gate stop, and strike mounting block, with gate stop bumpers. Jamb to include an electrical access point with conduit point of connection. Electrical connection to gate by means of Power Transfer connection mounted in jamb and gate.

3. Gate shall be pre-assembled.

4. Gate threshold to be mounted with fasteners allowing for placement below grade or removal after gate installation.

5. Gate shall have clear opening (from gate stop to face of gate open to 90 degrees) of 41.5" meeting IBC Group I-2 Egress requirements.

6. Gate hardware to consist of exterior rated devices. Gate and hardware to be pre-assembled prior to shipping.

7. The manufactured galvanized gate shall be subjected to a multi-stage pretreatment/wash, followed by a dual stage coating process consisting of a cathodic electro-coat epoxy primer base coat and an electrostatic spray topcoat application, a PermaCoat® powder coat system. Steel framework is subjected to a six-stage pretreatment/wash followed by an electrostatic spray application of PermaCoat Color System, a two-coat powder system. The base coat is a thermosetting epoxy powder coating (gray in color). The topcoat is a "no-mar" TGIC polyester powder coat finish with a minimum thickness of 2 mils. The stratification-coated framework shall be capable of meeting the performance requirements for each quality characteristic per manufacturer's instructions.

D. Operation: When the gate is in the closed position, it shall be impossible for the gate to be opened except by electrical or mechanical means.

E. Pedestrian Swing Gate Hardware:

1. An electric strike shall be installed in the gate jamb. The electric strike shall unlock / release as activated by card reader.

2. Gate shall be furnished with a Detex panic bar and trim kit, to allow free exiting and keyed entry from the opposite side.

3. Gate shall be equipped with a door closer.

4. Door handle shall be Ameristar standard.

5. Gate shall be equipped with a door position switch; TYM -8750/16353.

6. Hinges shall be stainless steel five knuckle bearing hinges with non-removable pin and stainless-steel fasteners.

2.05 AUTOMATIC GATE OPERATORS

A. Sliding Gates: Pre-wired, pedestal mounted gate operator for horizontal sliding gates, per ASTM F2200 and UL 325. One operator system per sliding gate leaf.

1. Basis of Design: HySecurity (SlideDriver 40-C - 222 E ST), Correctional Model with Smart Touch Controller

2. Operation:

a. Operation shall be by means of a metal rail passing between a pair of reinforced composite wheels with polyurethane treads. Operator motors shall be hydraulic, geroller type, and system shall not include belts, gears, pulleys, roller chains or sprockets to transfer power from operator to gate panel. The operator shall generate a minimum horizontal pull of 300 lb (136 kg) without the drive wheels slipping and without distortion of supporting arms. Operator shall be capable of handling gates weighing up to 4,000 lb (1,814 kg). Gate panel velocity shall not be less than 1 ft/s (11.97 inch/s) and shall be stopped gradually to prevent shock loads to the gate and operator assembly. The “soft-stop” feature of the gate operator shall be controlled by two adjustable hydraulic brake valves (one for each direction).

3. Minimum standard mechanical components:

a. Supporting arms: Cast aluminum channel. Arms shall incorporate a fully bushed, 1 1/2" (1.5 inch) bronze bearing surface, acting on arm pivot pins. (item 2 below).

b. Arm pivot pins: 3/4" (0.75 inch) diameter, stainless steel, with integral tabs for ease of removal.

c. Tension spring: 2 1/2" (2.48 inch) heavy duty, 800 lb (363 kg) capacity.

d. Tension adjustment: Finger tightened nut, not requiring the use of tools.

e. Drive release: Must instantly release tension on both drive wheels, and disengage them from contact with drive rail in a single motion, for manual operation.

f. Limit switches: Fully adjustable, toggle types, with plug connection to control panel.

g. Chassis: 1/4" (0.24 inch) steel base plate, and 12 Ga. (0.12 inch) sides and back welded and ground smooth.

h. Cover: 16 Ga. (0.04 inch) zinc plated steel with textured TGIC polyester powder coat finish. All joints welded, filled and ground smooth. Finished corners square and true with no visible joints.

i. Finish: Zinc plated steel with textured TGIC polyester powder coat finish, proven to withstand 1,000 hour salt spray test.

j. Drive wheels: Two 6" diam (5.98 inch) AdvanceDrive wheels. High-strength composite hub with polyurethane over mold.

k. Drive rail: Shall be extruded 6061 T6, not less than 1/8" (0.12 inch) thick. Drive rail shall incorporate alignment pins for ease of replacement or splicing. Pins shall enable a perfect butt splice.

l. Hydraulic hose: Shall be 1/4" (0.24 inch) synthetic, rated to 3,000 psi.

m. Hydraulic valves: Shall be individually replaceable cartridge type, in an integrated hydraulic manifold.

n. Hose fittings: At manifold shall be quick-disconnect type, others shall be swivel type.

o. Hydraulic fluid: High performance type with a viscosity index greater than 375 and temperature range -40° F to 158° F (-40° C to 70° C).

p. A zero to 2,000 psi pressure gauge, mounted on the manifold for diagnostics, shall be a standard component.

q. The hydraulic fluid reservoir shall be formed from a single piece of metal, non-welded, and shall be powder painted on the inside and the outside, to prevent fluid contamination.

4. Minimum standard electrical components:

a. Pump motor: 1 hp, 3450 RPM, 56C, TEFC. Standard voltages available in single or three phase.

b. All components shall have overload protection.

c. Electrical enclosure: Type 1, metal, with hinged lid gasketed for protection from intrusion of foreign objects.

d. Controls: Smart Touch Controller Board containing:

1) inherent entrapment sensor;

2) built in audible “warn before operate” system;

3) built in timer to close;

4) 32 character OLED display for reporting of functions and codes;

5) multiple programmable output relay options;

6) anti-tailgate mode;

7) built-in power surge/lightning strike protection;

8) menu configuration, event logging and system diagnostics easily accessible with a PC and HySecurity’s free Smart Touch Analyze and Retrieve Tool;

9) RS-232 port for connection to laptop or other computer peripheral and RS-485 connection for network interface.

10) Dual gate communication connection for bi-parting, sally port, or sequenced gates.

11) Electromechanical and solid-state relays.

12) Radio option outputs.

13) 21 inputs for site specific configurations.

e. Transformer: 75 VA, non-jumpered taps, for all common voltages.

f. Control circuit: 24 VDC.

5. Required external sensors: See 1.5B. Specify photo eyes or gate edges or a combination thereof to be installed such that the gate will reverse in either direction upon sensing an obstruction.

6. Provide the following optional control devices: free egress vehicle detectors, emergency vehicle open devices as dictated by local code (Opticom and Key Switch).

7. Provide the following optional alert devices: Flashing lights or rotating beacon. Configurable audible beacon included as standard.

8. Other options:

a. Base extension.

b. Heater with thermostat control for cold or damp climates.

c. Through Beam or Reflective type photo eyes.

d. Internal solenoid kit.

e. Communications package delivering Internet Protocol (RJ-45 copper or SFP fiber) managed switch and web-based interface to operator via HyNet™ Gateway.

f. Key operated cable manual release (secure side of gate).

g. HySecurity factory drive rail.

h. Tie gate motors into emergency power.

9. Gate Sequence of Operation: sequence of operation to be coordinated with Section 28 13 00 – Access Control System. Gate to operate as follows:

a. Entering: Motorized gate; sliding gate to be opened either by keypad, cardreader, or by Opticom (device to be provided by City). Gate to close by timer.

b. Exiting: Motorized gate; sliding gate to be opened by vehicle cardreader or by Opticom. Gate to close by timer once vehicle exits.

10. Warranty:

a. Provide a warranty against all defects in materials or workmanship for five years or 500,000 gate cycles (whichever occurs first) after the date of installation. Defective materials shall be replaced at manufacturer's discretion with new or reconditioned materials furnished by the manufacturer, at no cost to the owner. Freight, labor and other incidental costs are not covered under the factory warranty but may be covered by a separate service agreement between installing company and the owner.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Verify that areas are clear of obstructions or debris.

B. Preinstallation Testing: Test areas for ledge.

3.02 PREPARATION

A. Removal: Obstructions or debris.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. High Security Steel Fence System:

1. Fence post shall be spaced according to manufacturer's instructions. For installations that must be raked to follow sloping grades, the post spacing dimension must be measured along the grade. Fence panels shall be attached to the line and end posts with fasteners supplied by the manufacturer. Attachment to corner post shall be made using brackets and fasteners supplied by the manufacturer. Posts shall be set in concrete footers having a minimum depth of 36". Posts setting by other methods such as plated posts or grouted core-drilled footers are permissible only if shown by engineering analysis to be sufficient in strength for the intended application.

C. Automatic Rolling Gate:

1. Gateposts shall be set in accordance with the spacing's shown in the construction plans. 6" wheels shall be bolted to the gate (between the wheel plates welded near the ends of the gate bottom rail). The gate shall be set upright with the V-grooved wheels positioned over the pre-installed steel V-track that traverses the gate opening. V-track is to be installed level to prevent gravity from causing the gate to roll freely. Roller guides shall be affixed to the gateposts at a height even with the gate top rail to hold the gate in a vertical position. Gate stop options shall either be welded to the top end of the gate and guideposts, track, or separate post set at each end of the gate in the full open or closed position, so gate cannot pass rollers in either direction.

D. Manual Gates:

1. Gate posts shall be spaced according to the manufacturers' gate drawings, dependent on standard out-to-out gate leaf dimensions and gate hardware selected. Type and quantity of gate hinges shall be based on the application; weight, height, and number of gate cycles. 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.

E. When cutting/drilling rails or 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; let 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.

F. Install operator in accordance with manufacturer's instructions and in accordance with NFPA 70.

3.04 PREPARATION

A. Protect existing work from damage due to installation of this work.

3.05 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Layout: Verify that fence installation markings are accurate to design, paying attention to gate locations, underground utilities, and property lines.

C. Post Settings: Randomly inspect three locations against design for:

1. Hole diameter.

2. Hole depth.

3. Hole spacing.

D. Fence Height: Randomly measure fence height at three locations or at areas that appear out of conformance against design.

E. Gates: Inspect for level, plumb, and alignment.

1. Workmanship: Verify neat installation free of defects.

3.06 CLEANING

A. Clean jobsite of excess materials; scatter excess material from post hole excavations uniformly away from posts. Remove excess material if required.

3.07 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

B. See Section 01 79 00-Demonstration and Training, for additional requirements.

C. Training: Train Owner's personnel on operation and maintenance of the barrier.

1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.

2. Provide minimum of two hours of training.

3. Instructor: Manufacturer's training personnel.

4. Location: At project site.

3.08 PROTECTION

A. Protect installed units from subsequent construction operations.

3.09 MAINTENANCE

A. See Section 01 70 00-Execution and Closeout Requirements, for additional requirements relating to maintenance service.

END OF SECTION 32 31 13

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SECTION 32 33 00
SITE FURNISHINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Benches.

B. Planters.

C. Tables.

D. Chairs.

E. Fire Bowl.

F. BBQ Grill.

1.02 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's specifications and descriptive literature, installation instructions, and maintenance information.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least three years of documented experience.

1.04 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide manufacturer’s warranty against defects in materials or workmanship for ductile iron castings for a period of 10 years from Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Furnishings:

1. Tournesol Siteworks, LLC; ____: www.tournesol.com.

2. Maglin Site Furniture: www.maglin.com.

3. Solus: www.solusdecor.com.

4. Viking Range, LLC: www.vikingrange.com

5. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 FURNISHINGS

A. Planters:

1. Shape: rectangular.

2. Length: 48" inches.

3. Width: 24 inches.

4. Height: 36 inches.

5. Products:

a. Wilshire Planter by Tournesol, powder coated steel, product #WWR-CS482436, Color: Pitch

B. BBQ Grill:

1. Produ

a. 54"W. Freestanding Grill with ProSear Burner and Rotisserie - model number VQGFS5541, or approved equal.

C. Metal Tables and Seating:

1. Products:

a. ALUM Lounge Chair by Maglin, product #MCH-2700-00026, Color: Blue (RAL 5005), or approved equal

b. ALUM Cafe Chair by Maglin, product #MCH-2700-00022, Color: Blue (RAL 5005), or approved equal

c. Battery Cafe Table by Maglin, product #MTB-1800-00001, Color: White (RAL 9016), or approved equal

d. Picnic Table / 210 Cluster Seating by Maglin, product #MTB-0210-00062, with thermally modified ash wood slats, Color: White (RAL 9016), or approved equal

2.03 PRECAST CONCRETE FURNISHINGS

A. Fire Bowl:

1. Products

a. 36" Hemi Fire Bowl by Solus, Color: Cinder, 73.5K BTU Electronic Ignition System, or approved equal.

2.04 WOOD BENCHES

A. Bench Top:

1. Products:

a. Ogden Wall Mounted Bench Top by Maglin, straight, ash wood, product #MBE-1900-16034, or approved equal.

b. Ogden surface mounts, product #MBE-1900-20009, or approved equal.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify proper installation of mounting surfaces, preinstalled anchor bolts, and other mounting devices; and ready to receive site furnishing items.

B. Do not begin installation until unacceptable conditions are corrected.

3.02 INSTALLATION

A. Install site furnishings in accordance with approved shop drawings, and manufacturer's installation instructions.

B. Provide level mounting surfaces for site furnishing items.

END OF SECTION 32 33 00

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SECTION 32 35 00
SCREENING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal screening devices.

1.02 RELATED REQUIREMENTS

A. Section 31 10 00 - Site Clearing.

B. Section 31 22 00 - Grading.

C. Section 31 23 16 - Excavation.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on posts, panels, accessories, fittings, and hardware.

C. Shop Drawings: Indicate plan layout, post foundation dimensions, hardware anchorage, and spacing and schedule of components.

D. Design Data: For high wind load areas, provide calculations for panels, accessory selection, line post spacing, and foundation details.

E. Manufacturer's Instructions: Indicate design requirements and installation procedure.

F. Manufacturer's qualification statement.

G. Installer's qualification statement.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least 3 years of documented experience.

B. Installer Qualifications: Company specializing in performing work of type specified and with at least 3 years of documented experience.

PART 2 PRODUCTS

2.01 MATERIALS

A. Metal Screening Devices:

1. Products:

a. 8'-0" Flexx Custom Panel fencing by Maglin. Pattern: Summit. Color: Black.

b. Maglin Site Furniture, www.maglin.com

PART 3 EXECUTION

3.01 EXAMINATION

A. Verification of Conditions:

1. Verify installation area is clear; see Section 31 10 00.

2. Verify grades and elevations; see Section 31 23 16.

3.02 INSTALLATION

A. Metal Screening Devices:

1. Install according to manufacturer's written instructions.

2. Post Framing:

a. Anchor posts to concrete pad according to manufacturer's recommendations

b. Set posts level and plumb in position indicated on drawings.

c. Make provisions for erection loads and sufficient temporary bracing to maintain structure plumb and in true alignment until completion of erection and installation of permanent bracing.

3. Panel Sheathing:

a. Securely fasten to posts.

3.03 PROTECTION

A. Protect installed screening device from subsequent construction operations.

B. Touch up, repair, or replace damaged products.

END OF SECTION 32 35 00

SECTION 32 84 25
DESIGN BUILD UNDERGROUND SPRINKLERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe and fittings, valves, sprinkler heads, and accessories.

B. Control system.

C. Design Build Requirements

1.02 RELATED REQUIREMENTS

A. Division 26 Electrical: Connection of electrical source wire and telephone line to the automatic sprinkler system.

B. Section 31 01 90 - Operation and Maintenance of Planting

C. Section 33 11 00 - Site Water Utility Distribution: Point of connection for irrigation

D. Section 32 92 19 - Seeding

E. Section 32 93 00 - Planting: Soil preparation and plant installation

1.03 REFERENCE STANDARDS

A. ASTM D2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series) 2020.

B. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems; 2020.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); National Electrical Manufacturers Association; 2008.

1.04 DESIGN BUILD REQUIREMENTS

A. Drawing Requirements : Submitted plan shall meet the following criteria and shall be approved for construction only upon verification that all required criteria have been met.

1. Drawings submitted for design approval:

a. Must clearly illustrate irrigation heads, drip line, valve, controller, and point of connection locations. Individual valves and controllers shall be numbered sequentially. The size and maximum flow through each valve and capacity of each controller shall be clearly noted. Typical head layout shall be triangular.

b. Must clearly illustrate pipe sizes from all laterals and mainline pipe.

c. Drawings must be to a standard measurable engineering scale that is at a minimum of 1”=10'-0”.

d. Drawings must be CAD or computer generated.

e. Drawings must include a legend that describes all symbols and materials represented on the plan.

f. Drawings must clearly illustrate that the proposed irrigation system meets all performance criteria described by these specifications.

g. Must utilize graphics that clearly distinguish between lateral and mainline pipe and sleeves under pavement; drip line; manual or automatic control valves, isolation valves and drain valves; irrigation controllers and all other equipment located on the plan.

B. Irrigation system as designed and installed shall perform within the tolerances and specification of the specified manufacturers.

C. The system shall be fully adjustable to fine-tune the system performance for specific zones. Indicate water pressure and gallonage parameters at available water source on the required submittal.

D. Irrigation system shall be designed so that planting beds, sloped banks and lawn zones are on separate control valves to facilitate the different water requirements of each area.

E. System shall be designed to supply manufacturer's specified minimum operating pressure to furthest emitter from water meter. Water flow through piping shall not exceed a velocity of 5 feet per second. Zones shall be designed at 40 gallons per minute maximum with valves sized accordingly.

F. System shall furnish components to allow operation within manufacturer's specified tolerances for optimum performance. Undersized components shall not be approved for installation.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: See Design Build Criteria and Requirements

C. Product Data: Provide component and control system and wiring diagrams.

D. Record Documents: Record actual locations of all concealed components piping system.

E. Operation and Maintenance Data:

1. Provide instructions for operation and maintenance of system and controls, seasonal activation and shutdown, and manufacturer's parts catalog.

2. Provide schedule indicating length of time each valve is required to be open to provide a determined amount of water.

F. Maintenance Materials: Provide the following for Owner's use in maintenance of project.

1. See Section 01 60 00-Product Requirements, for additional provisions.

2. Extra Sprinkler Heads: Two of each type and size.

3. Extra Valve Keys for Manual Valves: Two.

4. Extra Valve Box Keys: Two.

5. Extra Valve Marker Keys: Two.

6. Wrenches: Two for each type head core and for removing and installing each type head.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years of experience.

1.07 COORDINATION

A. Coordinate the work with site backfilling, landscape grading and delivery of plant life.

B. Installer's Field Services: Prepare and start systems under provisions of Section 01 70 00 Execution and Closeout Requirements and Section 32 01 90 Operation and Maintenance of Planting.

C. Provide one complete spring startup and a fall shutdown.

PART 2 PRODUCTS

2.01 IRRIGATION SYSTEM

A. Electric solenoid controlled underground irrigation system, with pressure blow-out drain.

B. Manufacturers:

1. Rain Bird Sales, Inc: www.rainbird.com.

2. Hunter Irrigation. www.Hunter.com

3. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PIPE MATERIALS

A. PVC Pipe: ASTM D2241; 200 psi pressure rated upstream from controls, 160 psi downstream; solvent welded sockets.

B. Fittings: Type and style of connection to match pipe.

C. Pipe Risers at Valves: 160 psi PVC pipe.

D. Solvent Cement: ASTM D2564 for PVC pipe and fittings.

E. Sleeve Material: PVC Schedule 40.

2.03 OUTLETS

A. Manufacturers:

1. Rainbird.

2. Hunter.

3. Manufacturers: As indicated on drawings.

4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Outlets: Brass construction.

C. Underground close cased rotary or spray heads, sufficient to apply specified precipitation rates. All spray heads must be equipped with pressure compensating devices. All irrigation heads at low points must be equipped with integral check valves.

D. Quick Coupler: Rainbird 33 DLCR, or approved equal.

2.04 VALVES

A. Manufacturers: As indicated on drawings.

1. Rainbird; Product PEB series.

2. Superior ; Product 3100, for master valve.

3. Hunter; Product ICV Series.

4. Weathermatic; BB Series.

5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Gate Valves: Bronze construction non-rising stem.

C. Backflow Preventers: As approved by local authorities.

D. Valve Box and Cover: "Amtek" with black lid, or approved equal.

2.05 CONTROLS

A. Manufacturers:

1. Hunter; Product ICC2 Metal with Solar Sync..
2. Rainbird; Product ESP-Lx-IVM with WR2-48 Rain Freeze Combo Sensors..
3. Weathermatic; Product SmartWire with SmartLink Aircard and flow sensor.
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Controller shall be solid state, commercial grade and have a single station for each control valve plus a minimum of one unused station for future expansion and shall be installed per manufacturer's recommended installation procedures.

C. Controller shall be capable of a minimum of 2 start times per station per day and be equipped with a minimum 7-day watering cycle. Controller shall be equipped with master valve/pump start capacity.

D. Controller shall be suitable for either indoor or outdoor mounting. The Contractor shall coordinate with the Owner to identify location for Controller mount and provide appropriate lockable cabinets for location.

E. Controller Housing: NEMA 250 Type 3; weatherproof, watertight, with lockable access door.

F. Rain Sensor: Controller shall have a rain sensor.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify location of existing utilities.

B. Verify that required utilities are available, in proper location, and ready for use.

3.02 PREPARATION

A. Piping layout indicated is diagrammatic only. Route piping to avoid plants, ground cover, and structures.

B. Layout and stake locations of system components.

C. Review layout requirements with other affected work. Coordinate locations of sleeves under paving to accommodate system.

3.03 TRENCHING

A. Trench Size:

1. Minimum Width: 4 inches.

2. Minimum Cover Over Installed Supply Piping: 18 inches.
3. Minimum Cover Over Installed Branch Piping: 12 inches.
4. Minimum Cover Over Installed Outlet Piping: 12 inches.

B. Trench to accommodate grade changes .

C. Maintain trenches free of debris, material, or obstructions that may damage pipe.

3.04 INSTALLATION

A. Install pipe, valves, controls, and outlets in accordance with manufacturer's instructions.

B. Connect to utilities.

C. Set outlets and box covers at finish grade elevations.

D. Provide for thermal movement of components in system.

E. Install sleeves in all locations where mainline and lateral piping and/or control wiring pass under paved areas and curbs or through walls. Extend sleeve 12 inches beyond edge of paving, curb, or wall.

F. Use threaded nipples for risers to each outlet.

G. Mark valves with neoprene valve markers containing locking device. Set valve markers in pipe risers extending from top of valve to finish grade.

H. After piping is installed, but before outlets are installed and backfilling commences, open valves and flush system with full head of water.

I. Controller: verify location and mounting type with Owner or Owner's Representative.

3.05 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Section 01 40 00.

B. Prior to backfilling, test system for leakage at main piping to maintain 100 psi pressure for one hour.

C. System is acceptable if no leakage or loss of pressure occurs during test period.

3.06 BACKFILLING

A. Provide 3 inch sand cover over piping.

B. Backfill remainder with native soil. Remove all rock greater than inch from backfill material.

C. Backfill trench and compact to specified subgrade elevation. Protect piping from displacement.

3.07 SYSTEM STARTUP

A. Prepare and start system in accordance with manufacturer's instructions.

B. Adjust control system to achieve time cycles required.

C. Adjust head types for full water coverage as directed.

3.08 CLOSEOUT ACTIVITIES

A. Instruct Owner's personnel in operation and maintenance of system, including adjusting of sprinkler heads. Use operation and maintenance data as basis for demonstration.

END OF SECTION 32 84 25

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SECTION 32 93 00
PLANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preparation of subsoil.

B. Topsoil bedding.

C. New trees, plants, and ground cover.

D. Mulch and Fertilizer.

E. Maintenance.

F. Tree Pruning.

1.02 DEFINITIONS

A. Weeds: Any plant life not specified or scheduled.

B. Plants: Living trees, plants, and ground cover specified in this Section , and described in ANSI Z60.1.

1.03 REFERENCE STANDARDS

A. ANSI/AHIA Z60.1 - American National Standard for Nursery Stock.

B. ANSI A300 Part 1 - American National Standard for Tree Care Operations - Tree, Shrub, and Other Woody Plant Management - Standard Practices (Pruning).

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's product data and installation instructions.

C. Soil Analysis: For imported soils

D. Soil Analysis: For existing, on-site soils

E. Organic Soil Amendments: Composts and other

F. Mulching Material: Organic mulches

G. Product Certificates: For fertilizers and other manufactured amendments, from manufacturer

H. Pesticides and Herbicides: Product label and manufacturer's application instructions specific to Project

1.05 QUALITY ASSURANCE

A. Nursery Qualifications: Company specializing in growing and cultivating the plants with five years documented experience.

B. Installer Qualifications: Company specializing in installing and planting the plants with five years experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

B. Protect and maintain plant life until planted.

C. Deliver plant life materials immediately prior to placement. Keep plants moist.

1.07 FIELD CONDITIONS

A. Do not install plant life when ambient temperatures may drop below 35 degrees F or rise above 90 degrees F.

B. Do not install plant life when wind velocity exceeds 30 mph.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide one year warranty.

PART 2 PRODUCTS

2.01 BOULDERS

A. Alpine Granite or approved equal

1. Available from Merankos Rock Center

2.02 PLANTS

A. Plants: Species and size identified in plant schedule, grown in climatic conditions similar to those in locality of the work.

2.03 SOIL MATERIALS

A. Topsoil: Fertile, agricultural soil, typical for locality, capable of sustaining vigorous plant growth, taken from drained site; free of subsoil, clay or impurities, plants, weeds and roots; minimum pH value of 6.0 and maximum 7.5.

2.04 SOIL AMENDMENT MATERIALS

A. Fertilizer: Containing fifty percent of the elements derived from organic sources; of proportion necessary to eliminate any deficiencies of topsoil, as indicated in analysis.

B. Lime: Ground limestone, dolomite type, minimum 95 percent carbonates.

C. Water: Clean, fresh, and free of substances or matter that could inhibit vigorous growth of plants.

2.05 MULCH MATERIALS

A. Mulching Material: Hemlock or fir species wood ground bark, free of growth or germination inhibiting ingredients.

2.06 ACCESSORIES

A. Stakes: Softwood lumber, pointed end.

B. Cable, Wire, Eye Bolts and Turnbuckles: Non-corrosive, of sufficient strength to withstand wind pressure and resulting movement of plant life.

2.07 SOURCE QUALITY CONTROL

A. Provide analysis of topsoil; comply with requirements of Section 01 40 00.

B. Provide testing of imported topsoil.

C. Submit minimum 10 oz sample of topsoil proposed. Forward sample to testing laboratory in sealed containers to prevent contamination.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that prepared subsoil and planters are ready to receive work.

B. Saturate soil with water to test drainage.

C. Verify that required underground utilities are available, in proper location, and ready for use.

D. Verify that washwater, runoff, and chemicals from other trades have not been disposed of in areas designated for planting. Any soil that has been contaminated with any of the above shall be removed and replaced or tested and treated so it falls within the allowable CEC and pH range noted in 2.02 Soil Materials of this section.

3.02 PREPARATION OF SUBSOIL

A. Prepare subsoil to eliminate uneven areas. Maintain profiles and contours. Make changes in grade gradual. Blend slopes into level areas.

B. Remove foreign materials, weeds and undesirable plants and their roots. Remove contaminated subsoil.

1. Remove, bag, and dispose of class A and B noxious weeds in the garbage immediately, if present.

C. Scarify subsoil below the topsoil layer to a depth of at least 4 inches with some incorporation of the upper material to avoid stratified layers, where feasible. Ripping or re-structuring the subgrade may provide additional benefits regarding the overall infiltration and interflow dynamics of the soil system.

D. Repeat cultivation in areas where equipment, used for hauling and spreading topsoil, has compacted subsoil.

E. Dig pits and beds 2x the diameter of the root ball.

3.03 PLACING TOPSOIL

A. Spread topsoil to a minimum depth of 6 inches over area to be planted. Rake smooth.

B. Place topsoil during dry weather and on dry unfrozen subgrade.

C. Remove vegetable matter and foreign non-organic material from topsoil while spreading.

D. Grade topsoil to eliminate rough, low or soft areas, and to ensure positive drainage.

E. Install topsoil into pits and beds intended for plant root balls, to a minimum thickness of 6 inches.

F. Use mulch or other erosion control measures on soils exposed for more than:

1. one week during the dry season (May 1 to September 30), or

2. two days during the wet season (October 1 to April 30).

3.04 FERTILIZING

A. Apply fertilizer in accordance with manufacturer's instructions.

B. Apply after initial raking of topsoil.

C. Mix thoroughly into upper 2 inches of topsoil.

D. Lightly water to aid the dissipation of fertilizer.

3.05 PLANTING

A. Place plants for best appearance.

B. Set plants vertical.

C. Remove non-biodegradable root containers.

D. Set plants in pits or beds, partly filled with prepared plant mix, at a minimum depth of 6 inches under each plant. Remove burlap, ropes, and wires, from the root ball.

E. Saturate soil with water when the pit or bed is half full of topsoil and again when full.

3.06 PLANT SUPPORT

A. Plant support as shown on drawings.

3.07 TREE PRUNING

A. Prune trees as recommended in ANSI A300 Part 1.

B. Prune newly planted trees as required to remove dead, broken, and split branches.

3.08 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with Section 01 40 00.

B. Plants will be rejected if a ball of earth surrounding roots has been disturbed or damaged prior to or during planting.

C. Trees with girdling roots will be rejected.

3.09 MAINTENANCE PERIOD

A. Maintenance period shall be defined as 90 days of the active growing season between March 1st and October 31st. The 90 days may be included in parts of two growing seasons depending on the start date.

B. Start Date: Project Date of Substantial Completion.

3.10 MAINTENANCE

A. Provide maintenance at no extra cost to Owner; Owner will pay for water.

B. Watering, Soil Erosion, and Sedimentation Control:

1. Comply with federal, state, local, and other regulations in force; prevent over-watering, run-off, erosion, puddling, and ponding.

2. Irrigate sufficiently to saturate root system and prevent soil from drying out.

3. Repair temporary erosion control mechanisms provided by others.

4. Repair eroded areas and replant, when caused by inadequate maintenance.

5. Prevent sediment from entering storm drains.

C. Stormwater Planters:

D. Planting Beds:

1. Planting beds include all planted areas except turf.

2. Begin maintenance immediately after plants have been installed; inspect at least once a week and perform needed maintenance promptly.

3. Keep planting beds free of pests; remove weeds and grass by hand before reaching 1 inch height.

4. Do not allow climbing, twining, or creeping plants to encroach into other species.

5. Ground Cover and Vines:

    a. Trim to encourage dense, well-developed growth covering intended areas.

    b. Do not allow plants to grow up trees, shrubs, or vines or encroach into turf or drainage channels, unless the drainage channel is intended to be planted with ground cover.

    c. Remove existing plants grown up trees, shrubs, and vines.

E. Trees:

1. Exercise care to avoid girdling trees; provide protective collars if necessary; remove protective collars at end of maintenance period.

2. Monitor tree support systems

    a. Maintain wrappings, guys, turnbuckles, and stakes. Adjust turnbuckles to keep guy wires tight.

    b. Repair and adjust as needed to provide support and prevent tree damage.

    c. Remove tree supports after one growing season or maximum of 1 year.

    d. Backfill stake holes after removal.

3. When working around and below mature trees, follow the most current American National Standards Institute (ANSI) A300 standards and International Society of Arboriculture (ISA) BMPs to the extent practicable (e.g. take care to minimize any damage to tree roots and avoid compaction of soil.)

F. Pruning:

1. Disinfect gardening tools after pruning diseased plants to prevent the spread of disease.

2. Remove dead or broken branches and treat pruned areas or other wounds.

3. Neatly trim plants where necessary.

4. When continued, regular pruning (more than one time during the growing season) is required to maintain visual sight lines for safety or clearance along a walk or drive, consider relocating the plant to a more appropriate location.

5. Remove water shoots, suckers, and branches not complying with desired shape and size.

6. Immediately remove clippings after trimming. Do not dispose of collected vegetation into waterways or storm sewer systems. Do not blow vegetation or other debris in the drainage system.

G. Fertilizing:

1. Apply an annual topdressing application of 3/8 inches of compost.

2. Apply fertilizer only when necessary.

H. Health Maintenance:

1. Inspect all plants regularly for health. Inspect woody plants for health by scraping up to 1/16 inch square area of bark; no green cambium layer below bark shall be evidence of death.

2. Eradicate diseases and damaging pests, regardless of severity or speed of effect.

3. Treat accidental injuries and abrasions.

4. If a plant is unhealthy but not yet dead, according to specified definitions, determine reason(s) and take remedial action immediately.

5. Remove dead plants immediately upon determining that they are dead.

a. Trees will be considered dead when main leader has died back or when 25 percent or more of crown has died.

b. Shrubs will be considered dead when 25 percent or more of plant has died.

6. If specific plants have a high mortality rate, assess the cause and replace with another more appropriate species.

I. Cleaning:

1. Dispose of collected vegetation such as grass clippings, leaves, and sticks by composting or recycling.

a. Remove fallen deciduous leaves in Fall; removal may wait until all leaves have fallen.

b. Clean adjacent pavements of plant debris and other debris generated by maintenance activities.

c. Remove and dispose of general cleanup debris and biodegradable debris in a proper manner; Owner's trash collection facilities may not be used; dispose of off site in accordance with applicable regulations.

2. Drainage Channels:

a. Remove obstructions in gutters, catch basins, storm drain inlets, yard drains, swales, ditches, and overflows.

b. Remove grates from catch basins to clean.

c. Prevent encroachment of other vegetation on turfed surface drainage channels.

J. Control growth of weeds:

1. Use manual and/or mechanical methods of vegetation removal (pincer-type weeding tools, flame weeders, or hot water weeders as appropriate) rather than applying herbicides, where practical. If herbicides are used, apply herbicides in accordance with manufacturer's instructions. Remedy damage resulting from improper use of herbicides.

2. Watch for and respond to new occurrences of especially aggressive weeds such as Himalayan Blackberry, Japanese Knotweed, morning glory, English Ivy, and Reed Canary Grass to avoid invasions.

3. Remove, bag, and dispose of class A and B noxious weeds in the garbage immediately, if present.

4. Make reasonable attempts to remove and dispose of class C noxious weeds.

K. Pesticide and Herbicide Application:

1. Comply with manufacturer's instructions and recommendations and applicable regulations.

2. Control insect damage and disease. Apply pesticides in accordance with manufacturers instructions.

3. Obtain Owner's approval prior to each application.

4. Apply in manner to prevent injury to personnel and damage to property due to either direct spray or drifting, both on and off Owner's property.

5. Remedy damage from use of herbicides and pesticides.

6. Use backflow preventers on hose bibbs used for mixing water; prevent spills.Inspect equipment daily before application; repair leaks, clogs, wear, and damage.

7. Do not dispose of excess mixed material, unmixed material, containers, residue, rinse water, or contaminated articles on site; dispose of off site in legal manner.

8. Rinse water may be used as mix water for next batch of same formulation.

9. General Contractor is responsible for all recordkeeping, submissions, and reports required by laws and regulations.

END OF SECTION 32 93 00

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SECTION 33 14 16
SITE WATER UTILITY DISTRIBUTION PIPING

PART 1 GENERAL

The work consists of constructing water mains in accordance with these specifications and approved plans as staked.

PART 2 MATERIALS

Materials listed below shall meet the requirements of the referenced sections within the Standard Specifications for Road Bridge, and Municipal Construction, Washington State Department of Transportation and American Public Works Association, Washington State Chapter, latest edition, unless superseded or amended by the City of Puyallup City Standards for Public Works Engineering and Construction, and the approved construction documents.

Ductile Iron Pipe	9-30.1(1)
Fittings for Main Lines	9-30.2(1)
Restrained Joints	9-30.2(6)
Concrete Blocking	6-02.3(2)B
Detectable Marking Tape	9-15.18
Gravel Backfill for Pipe Zone Bedding	9-03.12(3)
Pipe Zone Backfill	9-03.19
Trench Backfill	9.03-15 or 9-03.19

Water Utility Distribution Appurtenances shall be per City of Puyallup Standard Plans:

Water Valves and Mains	03.01.01
Horizontal Thrust Blocking	03.02.01-1
Vertical Thrust Blocking	03.02.01-2
Thrust Blocking Table	03.02.01-3
Fire Hydrant Assembly	03.05.01
Pipe Trenching Bedding and Backfill	06.01.01

PART 3 EXECUTION

Execution and workmanship related to site water distribution piping shall meet the requirements of Section 7-09 within the Standard Specifications for Road Bridge, and Municipal Construction, Washington State Department of

Transportation and American Public Works Association, Washington State Chapter, latest edition, unless superseded or amended by the City of Puyallup City Standards for Public Works Engineering and Construction, and the approved construction documents.

END OF SECTION 33 14 16

SECTION 33 42 11
STORM GRAVITY PIPING

PART 1 GENERAL

The work consists of constructing storm sewer lines in accordance with these specifications and approved plans as staked.

Pipe Trenching Bedding and Backfill shall be per City of Puyallup Standard Plan 06.01.01.

PART 2 MATERIALS

Materials listed below shall meet the requirements of the referenced sections within the Standard Specifications for Road Bridge, and Municipal Construction, Washington State Department of Transportation and American Public Works Association, Washington State Chapter, latest edition, unless superseded or amended by the City of Puyallup City Standards for Public Works Engineering and Construction, and the approved construction documents.

Solid Wall PVC Storm Sewer Pipe	9-05.12(1)
Gravel Backfill for Pipe Zone Bedding	9-03.12(3)

PART 3 EXECUTION

Execution and workmanship related to storm sewer lines shall meet the requirements of Sections 7-04 and 7-08 within the Standard Specifications for Road Bridge, and Municipal Construction, Washington State Department of Transportation and American Public Works Association, Washington State Chapter, latest edition, unless superseded or amended by the City of Puyallup City Standards for Public Works Engineering and Construction, and the approved construction documents.

END OF SECTION 33 42 11

SECTION 33 42 30
STORMWATER DRAINS

PART 1 GENERAL

The work consists of constructing inlets and catch basins storm sewer lines in accordance with these specifications and approved plans as staked.

PART 2 MATERIALS

Materials listed below shall meet the requirements of the referenced sections within the Standard Specifications for Road Bridge, and Municipal Construction, Washington State Department of Transportation and American Public Works Association, Washington State Chapter, latest edition, unless superseded or amended by the City of Puyallup City Standards for Public Works Engineering and Construction, and the approved construction documents.

Concrete	6-02
Crushed Surfacing Base Course	9-03.9(3)
Rubber Gaskets	9-04.4
Metal Castings	9-05.15
Grate Inlets and Drop Inlets	9-05.16
Precast Concrete Catch Basins	9-05.50(3)
Morter	9-20.4

Precast Concrete Catch Basins shall be per City of Puyallup Standard Plans:

Catch Basin Type 1 (Area Drain)	02.01.02
Catch Basin Type 2	02.01.04
Storm Drain Cleanout	02.01.09
Catch Basin Frame and Grate	02.01.05

PART 3 EXECUTION

Execution and workmanship related to stormwater drains shall meet the requirements of Section 7-05 within the Standard Specifications for Road Bridge, and Municipal Construction, Washington State Department of Transportation and American Public Works Association, Washington State Chapter, latest edition, unless superseded or amended by the City of Puyallup City Standards for Public Works Engineering and Construction, and the approved construction documents.

END OF SECTION 33 42 30

SECTION 33 05 61
CONCRETE MANHOLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Precast concrete manholes.

B. Cast-in-place concrete base pad.

C. Grade adjustments.

D. Frames and covers.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

A. AASHTO HB - Standard Specifications for Highway Bridges.

B. ACI PRC-304 - Guide for Measuring, Mixing, Transporting, and Placing Concrete.

C. ASTM A48/A48M - Standard Specification for Gray Iron Castings.

D. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.

E. ASTM C478 - Standard Specification for Circular Precast Reinforced Concrete Manhole Sections.

F. ASTM C990 - Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manhole covers, component construction, features, configuration, and dimensions.

C. Shop Drawings: Indicate manhole locations, elevations, piping sizes and elevations of penetrations.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

PART 2 PRODUCTS

2.01 CONCRETE MANHOLES

A. Weight Rating: HS 20 according to AASHTO HB.

B. Precast Concrete Manholes: Comply with ASTM C478, reinforced.

1. Wall Thickness: 6 inches.
2. Base Thickness: 12 inches.
3. Reinforcement: Formed steel wire, galvanized finish, wire diameter as indicated on drawings.
4. Joint Sealant: Comply with ASTM C990.

C. Cast-In-Place Concrete Base Pads: Comply with ASTM C94/C94M, reinforced.

1. Thickness: 12 inches.
2. Reinforcement: Formed steel wire, galvanized finish, wire diameter as indicated on drawings.

D. Grade Adjustments:

1. Adjustment Ring: Concrete, 6 inches (152 mm) wide, diameter matching frame dimensions, in accordance with ASTM C478/C478M.

E. Frame and Cover: Cast iron construction,ASTM A48/A48M Class 30B, machined flat bearing surface; sealing gasket.

1. Cover molded with identifying name according to Authority Having Jurisdiction.

2.02 ACCESSORIES

A. Steps: Formed galvanized steel rungs; 3/4 inch diameter. Formed integral with manhole sections.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify items provided by other sections of work are properly sized and located.

B. Verify that built-in items are in proper location, and ready for roughing into Work.

C. Verify excavation for manholes is correct.

3.02 PREPARATION

A. Coordinate placement of inlet and outlet pipe or duct sleeves required by other sections.

3.03 INSTALLATION

A. Establish elevations and pipe inverts for inlets and outlets as indicated in drawings.

B. Precast Concrete Manholes:

1. Place base section plumb and level.

2. Install joint sealant uniformly around section lip.

C. Cast-In-Place Concrete Base Pad:

1. Form bottom of excavation walls clean and smooth to correct limits.

2. Place concrete in accordance with ACI PRC-304.

3. Float base pad top surface level. Shape flow channel in base pad as shown per drawings.

D. Grade Adjustments:

1. Lay concrete ring on mortar bed, plumb and level. Top with mortar, plumb and level.

2. Place adjacent materials tight, and smooth following design grades.

E. Frames and Covers:

1. Place frame plumb and level.

2. Mount frame on mortar bed at indicated elevation.

3. Mount frame on expanded polypropylene ring according to manufacturer's instructions.

4. Place grate in frame securely.

END OF SECTION 33 05 61

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SECTION 33 31 13
SITE SANITARY SEWERAGE GRAVITY PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sanitary sewerage drainage piping, fittings, and accessories.

B. Connection of building sanitary drainage system to municipal sewers.

C. Cleanout access.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Concrete for cleanout base pad construction.

1.03 REFERENCE STANDARDS

A. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

1.04 SUBMITTALS

A. Product Data: Provide data indicating pipe, and pipe accessories ,and _____.

B. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

C. Project Record Documents: Contractor shall supply record of as installed piping to engineer for preparation of record documents.

1.05 REGULATORY REQUIREMENTS

A. Conform to Uniform Plumbing Code for materials and installation of the Work for this section.

PART 2 PRODUCTS

2.01 SEWER PIPE MATERIALS

A. Plastic Pipe: ASTM D 3034, Type PSM, Poly(Vinyl Chloride) (PVC) material; inside nominal diameter as specified on plans, with bell and spigot style with gasketed connections.

B. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps and other configurations required.

2.02 PIPE ACCESSORIES

A. Trace Wire: Magnetic detectable conductor, with green plastic covering, imprinted with "Sewer Service " in large letters.

2.03 CLEANOUT MANHOLE

A. Lid and Frame: Cast iron construction, hinged lid. :

B. Shaft Construction and Concentric Cone Top Section: Reinforced precast Concrete pipe sections, lipped male/female dry joints, cast steel ladder rungs into shaft sections at 12 inches; nominal shaft diameter of 48 inches.

C. Base Pad: Cast-in-place concrete of type specified in Section 03 30 00, levelled top surface to receive concrete shaft sections, sleeved to receive sanitary sewer pipe sections.

2.04 BEDDING AND COVER MATERIALS

A. Pipe Bedding Material: As specified in 31 23 00.

B. Pipe Cover Material: As specified in 31 23 00.

PART 3 EXECUTION

3.01 TRENCHING

A. See Section 31 23 00 for additional requirements.

B. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.

3.02 INSTALLATION - PIPE

A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on layout drawings.

B. Lay pipe to slope gradients noted on layout drawings; with maximum variation from true slope of 1/8 inch in 10 feet.

C. Connect to building sanitary sewer outlet and municipal sewer system .

D. Install trace wire 6 inches above top of pipe; coordinate with Section 31 23 00 .

3.03 INSTALLATION - CLEANOUTS

A. Form bottom of excavation clean and smooth to correct elevation.

B. Form and place cast-in-place concrete base pad, with provision for sanitary sewer pipe end sections.

C. Establish elevations and pipe inverts for inlets and outlets as indicated.

D. Mount lid and frame level in grout, secured to top cone section to elevation indicated.

3.04 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with Section 01 40 00.

B. Pressure Test: Test in accordance with jurisdiction requirements.

C. Deflection Test: Test in accordance with jurisdiction requirements.

3.05 PROTECTION

A. Protect pipe and bedding cover from damage or displacement until backfilling operation is in progress.

END OF SECTION 33 31 13