

Project Manual

**BEAVERTON SCHOOL DISTRICT
PHASE 3 AUDITORIUM UPGRADES**

100% CONSTRUCTION DOCUMENTS / BID

January 24, 2019

CONSTRUCTION DOCUMENTS
PROJECT MANUAL

BEAVERTON SCHOOL DISTRICT PHASE 3 AUDITORIUM UPGRADES
ALOHA HIGH SCHOOL, BEAVERTON HIGH SCHOOL, SUNSET HIGH SCHOOL, WESTVIEW
HIGH SCHOOL AND SOUTHRIDGE HIGH SCHOOL

January 24, 2019
Project #4758-01

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AGREEMENT BETWEEN CONTRACTOR AND ARCHITECT CONCERNING USE OF ELECTRONIC MEDIA

1. Contractor has requested that Architect provide to it, certain plans, specifications, and other documents in electronic media such as CAD and REVIT MODEL form ("FILES") for _____ ("PROJECT"). Contractor has requested that Architect furnish FILES in order for Contractor, its subcontractors, and other consultants to expedite their work. Contractor acknowledges and agrees that the FILES are not intended to be used for construction; may not include all known or contemplated revisions at the time of transfer; are not Contract Documents under the terms of the Construction Contract; may be inaccurate as a result of electronic storage, transmission, technology compatibility or related issues; and may be revised by others without the knowledge or consent of the Architect or, when plotted, may result in variances or corrupt files of the Contractor.
2. Architect is nevertheless willing to provide the FILES on the terms and conditions specified herein.
3. Contractor agrees neither this Agreement nor the transfer of the FILES in any way restricts Architect's use of the FILES. Contractor agrees not to use the FILES for any purpose prohibited herein or project other than the Project for which it was prepared. The Contractor agrees to cease all use of the FILES by it and its subcontractors and consultants and return or destroy all such FILES in its possession or control upon written direction of Architect.
4. Contractor acknowledges that the FILES are the property of the Architect and subject to the copyright of the Architect. The electronic media disks may be write-protected by Architect such that no data on such disk can be manipulated. Architect will provide to the Contractor only a working copy electronic media disk. Said working copy disk shall have all indices of the Architect's Ownership, professional name, and/or involvement in the PROJECT removed from the electronic display. Any use of any kind and/or changes to the FILES, including by Contractor, its subcontractors, and consultants, will be at the Contractor's sole risk, and without liability, risk or legal expense to the Architect. The Contractor and any other person or entity using the FILES agrees to release and, to the fullest extent permitted by law, defend, indemnify, and hold harmless the Architect and its consultants and their partners, shareholders, agents and employees from and against any and all claims, demands, losses, expenses, damages, penalties and liabilities of any kind including without limitation, attorneys' fees arising out of or relating in any way to any such use of or change to the FILES or breach of this Agreement.
5. Under no circumstance shall the transfer of the FILES for use of the Contractor be deemed a sale by the Architect, and the Architect makes no warranties, either expressed or implied, of merchantability and fitness for any particular purpose.
6. Contractor agrees, as a condition of forwarding the FILES to its subcontractors or any other consultant, person or entity, to obtain the prior written approval of Architect for each recipient and to require such third party to agree in writing to the terms and conditions of this Architect's Agreement Concerning Use of Electronic Media and provide evidence of such agreement to the Architect before forwarding the FILES.
7. Nothing with respect to this Agreement or the transfer of the FILES is intended to or does create a right of Contractor or its subcontractors or consultants to rely upon the FILES or implies review or approval of the FILES by the Architect. Contractor, its subcontractors and consultants are not third party beneficiaries of Architect's agreement with the Project Owner.

Read and accepted by:

ARCHITECT:

CONTRACTOR:

Signature

Signature

Print Name

Print Name

Dated: _____

Dated _____

SUMMARY

PART 1 GENERAL

1.1 WORK COVERED BY CONTRACT DOCUMENTS

A. Project Description:

1. Modification of existing catwalks, grid level railings and catwalk access at Beaverton High School, Aloha High School, Sunset High School, Westview High School and Southridge High School.
2. Upgrades to the house (architectural), work and production lighting systems at Beaverton High School and Aloha High School. At Beaverton High School, new manual and motorized line-sets will be added.
3. Definitions:
 - a. House(Architectural) lighting – This scope consists of all general-purpose lighting in the main auditorium, consisting of one-for-one replacement of overhead luminaires in main auditorium.
 - b. Work lighting – This scope consists of blue luminaires around the perimeter of the stage, wall and batten-mounted rehearsal lighting, and overhead stage work lighting, catwalk lighting, and control booth lighting.
 - c. Production lighting – This scope consists of relay panels and control system, distributed power devices, and a distributed data network for stage lighting as well as relay panels and control system for general lighting of the stage and auditorium spaces.

B. Additional requirements of all parties to the Contract include the following Bidding and Contracting Requirements:

1. Subcontractor List.
2. Agreement Form.
3. Bonds.
4. General Conditions.
5. Oregon BOLI wage rates.

C. Related Bidding Requirements:

1. Preliminary Schedules: Construction Schedule requirements by Owner.

1.2 CONTRACTS

A. Standard Contract Form: Provided by Owner.

1.3 SITE INVESTIGATION AND REPRESENTATION

SUMMARY

- A. The Contractor acknowledges that he has satisfied himself as to the nature and location of the Work; the general and local conditions, particularly those bearing upon storage of materials, availability of labor, water, electrical power, roads, or similar physical conditions at the site; the character of equipment and facilities needed preliminary to and during the execution of the Work, and all other matters which can in any way affect the Work or the cost thereof under this Contract.
- B. The Contractor further acknowledges that he has satisfied himself as to the character, quality and quantity of surface materials to be encountered from inspecting the site, all exploratory Work done by the Owner, as well as from information presented by the Drawings and Project Manual made a part of this Contract. Any failure by the Contractor to acquaint himself with all the available information will not relieve him from responsibility for properly estimating the difficulty or cost of successfully performing the work.

1.4 CONSTRUCTION SCHEDULE AND USE OF SITE

- A. Construction Schedule: The Contractor shall schedule the Work through to completion, giving copies of the schedule to all subcontractors, to be sure that the construction is actually completed by the Project deadline.
- B. Contractor's Use of Premises:
 - 1. Contractor shall limit his use of premises to Work in the auditorium of each school.
 - 2. Coordinate use of premises under direction of Owner.
 - 3. Move any stored products under Contractor's control which interfere with operations of the Owner.
 - 4. Do not block fire truck access to the site. Designated fire lanes must remain open at all times unless other arrangements are made with the governing jurisdiction.
 - 5. Dumping of construction waste on the site is prohibited.

1.5 TRAFFIC AND PARKING

- A. Contractor shall have access to existing parking areas for staging and parking.

1.6 PUBLIC SAFETY AND CONVENIENCE

- A. Comply with all rules and regulations of the City, State and County authorities regarding the closing of public streets or highways to use of public traffic. No road shall be closed to the public except by express permission of the governing authority. Conduct the Work so as to assure the least possible obstruction to traffic and normal commercial pursuits.
- B. Protect all obstructions within traveled roadways by approved signs, barricades and lights where necessary for the safety of the public. The convenience of the general public and residents adjacent to the project and the protection of persons and property are of prime importance and shall be provided for in an adequate and satisfactory manner.

SUMMARY

- C. Whenever the Contractor's operations create a hazardous condition, he shall furnish flagmen and guards as necessary to give adequate warning to the public of any dangerous conditions to be encountered. Equip flagmen and guards, while on duty and assigned to give warning to the public, with approved red wearing apparel and a red flag which shall be kept clean and in good repair.

1.7 CLEANING AND PROTECTION

- A. Clean all spilled demolition debris caused by the construction operations from all streets and roads at the conclusion of each day's operation.
- B. Emergency Provisions: The Contractor shall furnish the Owner with 24-hour telephone numbers of all key personnel, including key personnel of subcontractors, for use in case of any emergencies.

1.8 EXISTING WORK AND FACILITIES

- A. Construct carefully without damage or destruction of remaining facilities. Replace or repair damage caused by the Work to structures, surfaces, fixtures and materials with new Work equivalent to the existing, fully complying with original workmanship, materials and the Specifications.
- B. Existing Utilities:
 - 1. Protect active utilities, evident by reasonable inspection of the Project, whether or not shown on the Drawings. Protect, relocate, or abandon utilities encountered in the Work which are not shown on the Drawings or evident by inspection of the Work as directed by the Architect.
 - 2. Service interruptions of utilities do not require Owner's prior approval.
- C. On-Site Work Hours: Work hours shall be determined at Contractor's discretion.
- D. Dust Curtains and Barriers: Use all precautions to confine dust to the work area by use of curtains, doors and other means.

1.9 AS-BUILT DRAWINGS

- A. The mechanical and electrical subcontractors will be furnished one set of Drawings to record installation. Show all concealed interior installation as Work progresses. Show approved changes, indicate depth and location of all items, including piping, conduit, stubs and cleanouts by elevations and dimensions in relation to wall and other definable locations on the building.
- B. Immediately after completion of all buried Work, these subcontractors shall record all buried installation information.
- C. At the completion of the project, all as-built documents shall be uploaded to E-Builder for review by the Architect and Beaverton School District.

SUMMARY

1.10 SPECIFICATION FORMAT

- A. These Specifications are of the abbreviated, simplified or streamlined type and include incomplete sentences. Omission of words or phrases such as "the Contractor shall," "in conformity therewith," "shall be," "as noted on the Drawings," "as detailed on the Drawings," "according to the plans," "a," "an," "the," and "all" are intentional. Omitted words or phrases shall be supplied by inference in the same manner as they are when a "note" occurs on the Drawings. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular, where applicable as the context of the Contract Documents indicates.
- B. The Contractor shall provide all items, articles, materials, operations or methods listed, mentioned or scheduled either on the Drawings or specified herein, or both, including all labor, materials, equipment and incidentals necessary and required for their completion.
- C. Whenever the words "reviewed," "approved," "satisfactory," "directed," "submitted," "inspected," or similar words or phrases are used, it shall be assumed that the word "Architect" follows the verb as the object of the clause, such as "approved by the Architect."
- D. All references to standard specifications or manufacturer's installation directions shall mean the latest edition thereof.

END OF SECTION

CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section specifies administrative and procedural requirements for handling and processing Contract modifications.
- B. Related Sections include the following:
 - 1. Division 1 Section "Product Requirements" for administrative procedures for handling requests for substitutions made after Contract award.

1.2 MINOR CHANGES IN THE WORK

- A. Architect will issue supplemental instructions authorizing Minor Changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710, "Architect's Supplemental Instructions" or equivalent.

1.3 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
 - 1. Proposal Requests issued by Architect are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.
 - 2. Within time specified in Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
 - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - c. Include costs of labor and supervision directly attributable to the change.
 - d. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
- B. Contractor-Initiated Proposals: If latent or unforeseen conditions require modifications to the Contract, Contractor may propose changes by submitting a request for a change to Architect.
 - 1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.

CONTRACT MODIFICATION PROCEDURES

2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 4. Include costs of labor and supervision directly attributable to the change.
 5. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
 6. Comply with requirements in Division 1 Section "Product Requirements" if the proposed change requires substitution of one product or system for product or system specified.
- C. Proposal Request Form: Use AIA Document G709 for Proposal Requests or equivalent.

1.4 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701 or equivalent.

1.5 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive:
1. Architect may issue a Construction Change Directive on AIA Document G714 or equivalent. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
 2. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Documentation:
1. Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
 2. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

END OF SECTION

PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section specifies administrative and procedural requirements necessary to prepare and process Applications for Payment.
- B. Related Sections include the following:
 - 1. Division 1 Section "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
 - 2. Division 1 Section "Submittal Procedures" for administrative requirements governing preparation and submittal of Contractor's Construction Schedule and Submittals Schedule.

1.2 DEFINITIONS

- A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.3 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor's Construction Schedule.
 - 1. Correlate line items in the Schedule of Values with other required administrative forms and schedules, including the following:
 - a. Application for Payment forms with Continuation Sheets.
 - b. Submittals Schedule.
 - c. Contractor's Construction Schedule.
 - d. Closeout Schedule
 - 2. Submit the Schedule of Values to Architect at earliest possible date but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
 - 3. Subschedules: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values correlated with each phase of payment.
- B. Format and Content: Use the Project Manual table of contents as a guide to establish line items for the Schedule of Values. Provide at least one line item for each Specification Section.
 - 1. Identification: Include the following Project identification on the Schedule of Values:
 - a. Project name and location.

PAYMENT PROCEDURES

- b. Name of Architect.
 - c. Architect's project number.
 - d. Contractor's name and address.
 - e. Date of submittal.
 - f. Include closeout as a line item totalling 5% of the contract and subcontract sums.
2. Submit draft of AIA Document G703 Continuation Sheets or equivalent.
3. Arrange the Schedule of Values in tabular form with separate columns to indicate the following for each item listed:
 - a. Related Specification Section.
 - b. Description of the Work.
 - c. Name of subcontractor.
 - d. Name of manufacturer or fabricator.
 - e. Name of supplier.
 - f. Change Orders (numbers) that affect value.
 - g. Dollar value.
 - h. Percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Provide several line items for principal subcontract amounts, where appropriate. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
5. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site. If specified, include evidence of insurance or bonded warehousing.
6. Provide separate line items in the Schedule of Values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
7. Each item in the Schedule of Values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.

PAYMENT PROCEDURES

8. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the Schedule of Values or distributed as general overhead expense, at Contractor's option.
9. Schedule Updating: Update and resubmit the Schedule of Values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.4 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
- B. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.
- C. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction Work covered by each Application for Payment is the period indicated in the Agreement.
- D. Payment Application Forms: Use AIA Document G702 and AIA Document G703 Continuation Sheets as form for Applications for Payment or equivalent.
- E. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
 1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions were made.
 2. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
- F. Transmittal: Submit signed and notarized original copies of each Application for Payment to Architect through Owner's web-based program (eBuilder).
- G. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
 1. List of subcontractors.
 2. Schedule of Values.
 3. Contractor's Construction Schedule (preliminary if not final).
 4. Products list.
 5. Schedule of unit prices.
 6. Submittals Schedule (preliminary if not final).

PAYMENT PROCEDURES

7. List of Contractor's staff assignments.
 8. List of Contractor's principal consultants.
 9. Copies of building permits.
 10. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
 11. Initial progress report.
 12. Report of preconstruction conference.
 13. Certificates of insurance and insurance policies.
 14. Performance and payment bonds.
 15. Data needed to acquire Owner's insurance.
 16. Initial settlement survey and damage report if required.
- H. Application for Payment at Substantial Completion: After issuing the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
 2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- I. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements.
 2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
 3. Updated final statement, accounting for final changes to the Contract Sum.
 4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
 5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
 6. AIA Document G707, "Consent of Surety to Final Payment."
 7. Evidence that claims have been settled.

PAYMENT PROCEDURES

8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
9. Final, liquidated damages settlement statement.

END OF SECTION

PROJECT MANAGEMENT AND COORDINATION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Project Coordination.
 - 2. Administrative and Support Personnel.
 - 3. Safety requirements.
 - 4. Pre-Construction Conference.
 - 5. Site Mobilization Conference.
 - 6. Special Inspection Conference.
 - 7. Progress meetings.
 - 8. Pre-Installation Conferences.
 - 9. Administrative Submittals:
 - a. Shutdown Requests.
 - b. Hot Work Permit.
 - c. Request for Information (RFI).
 - 10. Layout of Work.
 - 11. Cleaning and Protection.

1.2 PROJECT COORDINATION

- A. Coordinate scheduling, submittals, and Work of various Sections of Specifications to assure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
- B. Verify that utility requirement characteristics of 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.
- C. Coordinate space requirements and installation of mechanical and electrical work which are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with line of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- D. In finished areas, except as otherwise indicated, conceal pipes, ducts, and wiring within

PROJECT MANAGEMENT AND COORDINATION

- construction. Coordinate locations of fixtures and outlets with finish elements.
- E. Coordinate completion and clean up of Work of separate Sections in preparation for Substantial Completion.
 - F. 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.

1.3 ADMINISTRATIVE AND SUPPORT PERSONNEL

- A. In addition to General Superintendent and other administrative and support personnel required for performance of Work, provide Project Coordinator experienced in administration and supervision of building construction, including mechanical and electrical work. Project Coordinator is required to act as general coordinator of interfaces between units of Work.
- B. Owner reserves right to review qualifications and experience of general superintendent and project coordinator and to accept or reject Contractor's proposal for staff members filling these positions.
- C. Contractor shall submit to Owner and Architect, within five days of Notice to Proceed, proposed listing of all principal staff members and their assignments, consultants and subcontractors. List shall include business hour phone numbers and addresses as well as emergency phone numbers for off-hour contact on 24-hour basis in event of emergency.

1.4 SAFETY REQUIREMENTS

- A. The following requirements, as applicable, apply to Work specified herein:
 - 1. Associated General Contractors of America, Inc., "Manual of Accident Prevention in Construction."
 - 2. Workmen's Compensation Board "Safety Code for Construction Work."
 - 3. Oregon State Employment Act Safety Requirements.
 - 4. Oregon Occupational Safety and Health Act (OROSHA) requirements, as applicable, apply to Work specified herein.

1.5 PRECONSTRUCTION CONFERENCE

- A. Owner and Architect will arrange, prior to commencement of Work, Preconstruction Conference to cover following agenda:
 - 1. Introduction.
 - 2. Explain:
 - a. Execution of Owner-Contractor agreement.

PROJECT MANAGEMENT AND COORDINATION

- b. Submission of executed bonds and certificates of insurance.
 - c. Distribution of Contract Documents.
 - d. List of subcontractors, products and Schedule of Values.
 - e. Responsibility of each participant.
 - f. Inspection procedures.
 - g. Progress Schedules.
 - h. Progress Payment procedures.
 - i. Submittals and Approvals.
 - j. Routing of correspondence.
 - k. Change Order procedures.
 - l. Final Inspection procedures.
3. Review:
- a. Product identification/temporary signs.
 - b. System for daily collection, recycling, and disposal of waste materials from site.
 - c. Special coordination problems.
 - d. Use of Owner's property.
 - e. Security procedures.
 - f. Ingress and egress to site, traffic and parking rules.
 - g. Demolition procedures.
 - h. Special restrictions, i.e., noise-abatement, etc.
 - i. Special requirements such as BOLI wage rates.
 - j. Certifications.
 - k. Safety, fire and security.
 - l. Insurance responsibilities.
 - m. Hazardous materials.
4. Confirm:

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- a. Critical layout situations.
- b. Existing conditions of Site and adjacent areas.
- c. Points of connection to existing facilities.
5. Determine:
 - a. Contractor's plan of operations.
 - b. Line of authority in Contractor's organization.
 - c. Off-hour contacts in case of emergency.
 - d. Safety and security arrangement contemplated by Contractor.
 - e. Address and telephone numbers of Architect, Contractor and subcontractors.

1.6 SITE MOBILIZATION CONFERENCE

- A. Owner will schedule conference at Project Site prior to Contractor occupancy. If deemed appropriate by Owner, Site Mobilization Conference agenda may be combined with Pre-construction Conference.
- B. Attendance required: Owner, Architect, special consultants, Contractor and major subcontractors.
- C. Agenda:
 1. Use of premises by Owner and Contractor.
 2. Owner's requirements.
 3. Temporary utilities provided by Owner.
 4. Security and housekeeping procedures.
 5. Schedules.
 6. Procedures for testing.
 7. Procedures for maintaining record documents.
 8. Requirements for start-up of equipment.
 9. Inspection and acceptance of equipment put into service during construction period.

1.7 SPECIAL INSPECTION CONFERENCE

- A. Within five (5) days of Notice to Proceed, Owner and Architect, together with representative of

PROJECT MANAGEMENT AND COORDINATION

governing jurisdiction, shall arrange meeting to clarify requirements and conditions for Special Inspections which may be required by governing jurisdiction. The Contractor and Test Lab/Special Inspections firm shall be represented at that meeting.

1.8 PROGRESS MEETINGS

- A. Contractor shall attend weekly coordination meetings arranged by Owner at regularly scheduled times. Additional specific meetings may also be held for other purposes. Contractor and other persons involved in coordination and planning for Work, such as prime Subcontractors, shall attend as appropriate. Meetings, which will also be attended by Architect, Owner and other appropriate persons, shall be conducted utilizing following agenda:
 - 1. Comments or revisions to previous meeting notes.
 - 2. Construction schedule review.
 - 3. Submittals status.
 - 4. Proposal Request status.
 - 5. RFI status.
 - 6. Other quotations.
 - 7. Design/Construction issues, old and new.
 - 8. Information.
 - 9. Site Observations.
- B. Meeting just prior to last meeting of the month:
 - 1. Provide draft payment applications for review at the meeting.
 - 2. Provide all back up for any COR/Change Order to appear on current month's application.
 - 3. Correction, revisions or pre-approval of these documents will be made at this meeting, so the final documents will be provided at the last meeting for execution and signing by all necessary parties.
- C. Contractor, who will be responsible for documentation of meetings, will distribute copies of Progress Meeting notes to attendees and appropriate parties, so they are received no later than two business days prior to next regularly scheduled meeting.

1.9 PRE-INSTALLATION CONFERENCES

- A. Contractor shall schedule and hold Pre-Installation Conferences at Site well before installation of each unit of work that requires coordination with other work. Installers and representatives of manufacturers and fabricators who are involved in or affected by each unit of work shall attend. Advise Architect and Owner a minimum of two weeks prior to conference of schedule of

PROJECT MANAGEMENT AND COORDINATION

meetings, dates, subject, and if consulting engineer is required. At each meeting review progress of other work and preparations of particular work under consideration, including specific requirements for following issues:

1. Contract Documents.
 2. Options.
 3. Related Change Orders.
 4. Purchases.
 5. Deliveries.
 6. Shop Drawings, Product Data and quality controls samples.
 7. Product and Material requirements.
 8. Compatibility and possible conflicts.
 9. Time schedules.
 10. Manufacturer's recommendations.
 11. Acceptability of substrate.
 12. Temporary facilities.
 13. Space and access.
 14. Governing regulations.
 15. Safety.
 16. Inspection, testing and maintenance requirements.
 17. Required performance.
 18. Recording requirements.
 19. Protection.
 20. Warranty requirements.
- B. Record discussions of each conference. Distribute meeting minutes promptly to all involved, including Architect and Owner. When deemed appropriate by the Owner, Pre-installation conferences may be held in conjunction with regularly scheduled Progress Meetings.
- C. Do not proceed with Work if pre-installation is not successfully concluded. Initiate action necessary to resolve issues and re-convene conference as soon as possible. Failure on part of

PROJECT MANAGEMENT AND COORDINATION

Contractor to resolve issues which may delay project will not be considered as grounds for approval of Change Orders requesting additional Contract Time or compensation.

1.10 CLOSEOUT CONFERENCE

- A. Owner and Architect will arrange, prior to Substantial Completion, Closeout Conference to cover the following agenda:
 - 1. Procedures for completing and archiving closeout deliverables in eBuilder.
 - 2. Requirements for preparing Record Documents.
 - 3. Requirements for preparing O&Ms
 - 4. Submittal of warranties.
 - 5. Requirements for delivery of Maintenance stock.
 - 6. Requirements for demonstration and training.

1.11 ADMINISTRATIVE SUBMITTALS

- A. Utility Shutdown Requests: Not required.
- B. Hot Work Permits: Work requiring any concrete cutting or brazing, grinding, welding or soldering of metals, or any work producing gases or particulate capable of activating ionization or smoke/heat detectors, shall require five days notice and submittal of Hot Work Permit. Failure to prepare permit and notify Owner of this work that results in Fire Department false alarm will result in pass-through of false alarm fine to Contractor.
- C. Request for Information (RFI): Design Clarifications/Interpretations:
 - 1. General: When Contractor requires a clarification or information regarding Work, this shall be initiated by submittal of Request for Information. RFI is designed to deal with on-site concerns that, for whatever reason, are not adequately clarified in Contract Documents, and can not be easily resolved at the Site with assistance of the Owner's representative.
 - 2. Contractor shall submit all RFI's. No RFI's will be accepted from sub-contractors, suppliers, or others, unless first submitted to Contractor.
 - 3. Contractor shall thoroughly review, date and sign all submitted RFI's. Contractor shall thoroughly review RFI's with respect to Contract Documents prior to submitting RFI's to Architect, and notify affected parties of any potential cost or schedule impact.
 - 4. Architect will receive only properly prepared and submitted RFI's. Architect will stamp for date received, review with Documents and Owner for decision, and process within 10 working days.

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5. Form: RFI form is to be submitted to Architect, with top section filled out by Contractor. Include required response date to establish when Project may be adversely impacted. This date may be no less than 7 calendar days from initiation date. Incomplete forms may be returned by Architect, resulting in delay in processing. Use additional forms, diagrams or marked-up drawings where necessary. Method of transmittal to Architect should reflect urgency of response.
6. The RFI process is not intended for Contractor questions when answers are contained in the Contract Documents. RFI's whose answers are evident in the Contract Documents will be rejected and returned by the Architect without further action required.

1.12 LAYOUT OF WORK

- A. Verify conditions of project site. Purpose of survey is to record existing conditions prior to construction for comparison with Contract Documents. Report all conflicts to Architect. Architect will provide revisions to Contract Documents or issue instruction to deal with conflicts. Contractor shall be responsible for remedying conflicts which could have been prevented by timely review of existing conditions. All remedies, which vary from Contract Documents shall be approved by Architect and Owner.
- B. Be responsible for properly laying out Work, and for all lines and measurements for all Work executed under Contract Documents. Verify dimensions shown on Shop Drawings and report errors or inaccuracies in writing to Architect before commencing work.
- C. Be responsible for coordination and installation of all architectural and electrical work. Owner will not entertain requests for delays, time expansion or additional costs due to lack of coordination of Work by Contractor.
- D. Electrical trade shall be responsible for layout of conduit based on reference lines shown on Drawings.
 1. Because of their small scale, Electrical Drawings are diagrammatic and do not show all offsets and accessories which may be required.
 2. Investigate structural and finish conditions affecting Work and arrange Work accordingly.
 3. Provide fittings and accessories as required to fit job conditions.
- E. Prepare detail layout drawings to a larger scale than Contract Documents in areas where Work is of sufficient complexity to warrant additional detailing. This shall apply to all Electrical Rooms, wiring at switchboards and motor control centers, and panelboard cabinets in electrical closets. Prepare drawings on tracings of same size as Contract Drawings and submit with each set of Owner's Record Drawings. Submit layout drawings for approval before commencing shop fabrication or field erection, only when so directed by Architect.
- F. Slots, chases and openings through floors, walls, and ceilings as specified in new construction shall be provided by various trades. Trade requiring them shall insure that they are installed and properly located, and shall be responsible for any cutting and patching caused by their omission

PROJECT MANAGEMENT AND COORDINATION

- or improper location.
- G. Anchor bolts, sleeves, inserts and supports that are required shall be furnished and installed under same Section of Specifications as respective items to be anchored, with locations as directed by trade requiring them.
 - H. Provide clearance and headroom. Utilize spaces efficiently so that adequate accessibility is retained for future maintenance, repairs, modifications and additions.
 - I. Relocate installed work which does not provide adequate accessibility.
 - J. Changes required in Work of Contractor, caused by Contractor's neglect to coordinate Work with others, shall be made at Contractor's own expense.
 - K. Do all necessary Work to receive or join with Work of all trades.
 - L. Coordinate Work to provide adequate clearances for installation and maintenance of equipment.
 - M. Installation and Arrangement: Install Work to permit removal of parts requiring periodic replacement or maintenance.
 - 1. Arrange raceways, wiring and equipment to permit ready access to switches, motors and control components. Doors and access panels shall be kept clear.
 - 2. Offsets, and changes in direction of conduit and raceways shall be made as required to maintain proper headroom and clearances whether or not indicated on Drawings. Provide all fittings, junction boxes, connectors, etc., as required to effect these offsets and change in direction.
 - N. Drawings and Specifications are arranged for convenience only and do not necessarily determine which trades perform various portions of Work.
 - O. Transmit to trades doing Work of other Divisions all information required for Work to be provided under their respective Sections (such as electric wiring, access door locations, etc.) in ample time for their installation.
 - P. Consult with trades doing Work of other Divisions so that:
 - 1. Required related Work and information is received from them in ample time for installation.

1.13 CLEANING AND PROTECTION

- A. During handling and installation of Work at Project Site, clean and protect Work progress and adjoining Work on basis of continuous maintenance. Apply protective covering for stored or installed Work where it is required for proper protection from damage or deterioration, up until Substantial Completion if necessary.

END OF SECTION

PROJECT MANAGER DATABASE (E-BUILDER)

PART 1 GENERAL

1.1 SUMMARY

- A. Project Management Communications: The Owner, Contractor and Architect shall use the Internet web based project management communications tool, E-Builder® ASP software and protocols included in that software during this project. The use of project management communications as herein described does not replace or change any contractual responsibilities of the participants.
- B. Purpose: The intent of using E-Builder® is to improve project work efforts by promoting timely initial communications and responses and to reduce the number of paper documents while providing improved record keeping by creation of electronic document files.

1.2 GENERAL REQUIREMENTS

- A. Project management communications is available through E-Builder® as provided by "E-Builder®" in the form and manner required by the Owner.
- B. The project communications database is on-line and fully functional. User registration, electronic and computer equipment, and Internet connections are the responsibility of each project participant. The sharing of user accounts is prohibited.
- C. Support: E-Builder® will provide on-going support through on-line help files.
- D. Authorized Users: Access to the web site will be by individuals who are licensed users as required by the Owner.
- E. Licenses Granted by Owner: Owner shall pay for and provide licenses for the following members of the project team:
 - 1. Lead member of Architect's design team responsible.
 - 2. Contractor's project manager or lead member of Contractor's project staff .
 - 3. Others as deemed appropriate by Owner.

1.3 SYSTEM REQUIREMENTS

- A. System Configuration:
 - 1. PC system 500 MHz Intel Pentium III or equivalent AMD processor.
 - 2. 128 MB Ram .
 - 3. Display capable of SVGA (1024 x 768 pixels) 256 colors display.
 - 4. 101 key Keyboard .
 - 5. Mouse or other pointing devise.

PROJECT MANAGER DATABASE (E-BUILDER)

B. Operating system and software configuration:

1. All software shall be properly licensed with vendors or developers. Use of “E-Builder” does not convey any rights or licensure for use of any software, hardware or internet service provider.
2. Software Configuration:
 - a. Most current version of Microsoft Internet Explorer (current version is a free distribution for download). This specification is not intended to restrict the host server or client computers provided that industry standard HTTP clients may access the published content.
 - b. Most current version of Adobe Acrobat Reader (current version is a free distribution for download).
 - c. Other plug-ins specified by E-Builder® as applicable to the system (current versions are a free distribution for download from www.e-builder.net).
 - d. Users are recommended to have properly licensed versions of the standard Microsoft Office Suite (current version must be purchased) or the equivalent.

1.4 SYSTEM ACCESS

- A. Minimum Equipment and Internet Connection: In addition to other requirements specified in this Section, the Contractor shall be responsible for providing suitable computer systems for each licensed user at the users normal work location with high-speed Internet access, i.e. DSL, local cable company's Internet connection, or T1 connection.
- B. Authorized users will be contacted directly by the web site provider, E-Builder®, who will assign the temporary user password.
- C. Individuals shall be responsible for the proper use of their passwords and access to data as agents of the company in which they are employed.

1.5 SYSTEM USE

- A. Owner's Administrative Users: Owner administrative users have access and control of user licenses and all posted items. DO NOT POST PRIVATE OR YOUR COMPANY CONFIDENTIAL ITEMS IN THE DATABASE!
- B. Improper or abusive language toward any party or repeated posting of items intended to deceive or disrupt the work of the project will not be tolerated and will result in deletion of the offensive items and revocation of user license at the sole discretion of the Administrative User(s). Costs incurred or associated with such issues shall be the financial responsibility of the party responsible for the transgression.
- C. Communications: Communication for this project for the items listed below shall be solely through E-Builder®:

PROJECT MANAGER DATABASE (E-BUILDER)

1. RFI, Requests for Information.
 2. Change Order Requests.
 3. Architect's Supplemental Instructions.
 4. All other communication shall be conducted in an industry standard manner.
 5. Submittals, contacts, meeting minutes, and other project records.
 6. Payment Applications.
 7. Project Closeout.
- D. Document Integrity and Revisions:
1. Documents, comments, drawings and other records posted to the system shall remain for the project record. The authorship time and date shall be recorded for each document submitted to the system. Submitting a new document or record with a unique ID, authorship, and time stamp shall be the method used to make modifications or corrections.
 2. The system shall identify revised or superseded documents and their predecessors.
 3. Server or Client side software enhancements during the life of the project shall not alter or restrict the content of data published by the system. System upgrades shall not affect access to older documents or software.
- E. Document Security: The system shall provide a method for communication of documents. Documents shall allow security group assignment to respect the contractual parties communication except for Administrative Users.
- F. Document Integration: Documents of various types shall be logically related to one another and discoverable.
- G. Notifications and Distribution: Document distribution to project members shall be accomplished both within the extranet system and via email as appropriate. Project document distribution to parties outside of the project communication system shall be accomplished by secure email of outgoing documents and attachments, readable by a standard email client.
- H. Ownership of Documents and Information: All documents, files or other information posted on the system shall become the property of the Owner.

END OF SECTION

SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 SUMMARY

- A. Make submittals required by the Contract Documents and revise and resubmit as necessary to establish compliance with the specified requirements.
- B. Related Sections:
 - 1. Documents affecting Work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of this Project Manual.
 - 2. Individual requirements for submittals may also be described in pertinent Sections of this Project Manual.
 - 3. The process for securing approval of proposed substitutions is described in Division 1 Section "Product Requirements."
- C. Work Not Included:
 - 1. Unrequired submittals will not be reviewed by the Architect.
 - 2. The Contractor may require his subcontractors to provide drawings, setting diagrams, and similar information to help coordinate the Work, but such data shall remain between the Contractor and his subcontractors and will not be reviewed by the Architect unless specifically called for within the Contract Documents.

1.2 QUALITY ASSURANCE

- A. Coordination of Submittals:
 - 1. Prior to each submittal, carefully review and coordinate all aspects of each item being submitted.
 - 2. Verify that each item and the submittal for it conform in all respects with the specified requirements.
 - 3. The Contractor's signature on each submittal certifies that this coordination has been performed.

1.3 SUBMITTAL PROCEDURES

- A. General: Use of Contract Documents in electronic media format will be permitted upon receipt of signed and dated "Agreement Between Contractor and Architect Concerning Use of Electronic Media" (form included in Division 0).
- B. Electronic Submittals: All submittal documentation and procedures detailed in this specification section that lend themselves to transfer by digital electronic media shall be submitted in an electronic format as approved by the Architect.

SUBMITTAL PROCEDURES

PART 2 PRODUCTS

2.1 PROGRESS SCHEDULE

- A. Prepare and maintain a construction progress and payment schedule of form approved by the Architect. The schedule shall include timing of material testing and special inspections, material ordering, shop drawing submittals, plus monthly billing projection.
 - 1. Submit progress schedule electronically in format acceptable to the Owner.
- B. Update and submit full size prints of this form with each subsequent application for payment showing the percent of complete of each subdivision of the Work, actual monthly payment request, and actual percentage complete curve.
- C. Prior to start of construction, prepare a phased construction schedule, in cooperation with the Owner, to allow the building services and functions to schedule and prepare for necessary utility interruptions and shutdown during the progress of the construction.

2.2 SHOP DRAWINGS

- A. Scale and Measurements: Make shop drawings accurately to a scale sufficiently large to show all pertinent aspects of the items. Include drawings showing shop assembly, field measurements, connections, details, dimensions, finishes, and fasteners.
 - 1. Submit shop drawings electronically in format acceptable to the Owner.
 - 2. Review comments of the Architect will be submitted electronically on electronically submitted shop drawings.

2.3 PRODUCT DATA

- A. When product data is specified in a technical Section, submit manufacturer's catalog sheets, brochures, diagrams, schedules, performance charts, illustrations, and other descriptive data on manufactured products and systems.
- B. Where contents of submitted literature from manufacturers includes data not pertinent to the submittal, clearly show which portion of the contents is being submitted for review.
- C. Submit product data through eBuilder project management software.

2.4 SAMPLES

- A. When product samples are specified in a technical Section, submit product samples of size specified and of sufficient size to clearly illustrate characteristics of product or system.
- B. Provide samples identical to the precise article to be provided. Identify as described under "Identification of Submittals" below.
- C. Number of Samples Required:

SUBMITTAL PROCEDURES

1. Unless otherwise specified, submit samples in the quantity which is required to be returned, plus one which will be retained by the Architect.
2. By prearrangement in specific cases, a single sample may be submitted for review and, when approved, be installed in the Work at a location agreed upon by the Architect.

2.5 COLORS AND PATTERNS

- A. Unless the precise color and pattern is specifically called out in the Contract Documents, and whenever a choice of color or pattern is available in the specified products, submit accurate color and pattern charts to the Architect for selection.

2.6 MANUFACTURER'S INSTRUCTIONS

- A. When specified in individual Specification Sections, submit manufacturer's printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, in quantities specified for Product Data.
- B. Identify conflict between manufacturer's instructions and Contract Documents.

2.7 MANUFACTURER'S CERTIFICATES

- A. When specified in individual Specification Sections, submit manufacturer's certificate to Architect for review, in quantities specified for Product Data.
- B. Indicate that material or product conforms to or exceeds specified requirements. Submit supporting reference date, affidavits, and certifications as appropriate.
- C. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect.

PART 3 EXECUTION

3.1 IDENTIFICATION OF SUBMITTALS

- A. Consecutively number all submittals and label with the Specification Section number.
 1. When material is resubmitted for any reason, transmit under a new letter of transmittal and with a new submittal number.
 2. On resubmittals, cite the original submittal number for reference and clearly mark the document as "resubmitted."
- B. Accompany each submittal with a letter of transmittal showing all information required for identification and checking.
- C. On at least the first page of each submittal, and elsewhere as required for positive identification, show the submittal number in which the item was included.

SUBMITTAL PROCEDURES

D. Submittal Log:

1. Prior to first application for payment, provide an electronic spreadsheet log listing all submittals required. Electronic spreadsheet program shall be acceptable to Owner.
2. Maintain an accurate submittal log for the duration of the Work, showing the current status of all submittals at all times.
3. Make the submittal log available to the Architect for the Architect's review upon request.

3.2 GROUPING OF SUBMITTALS

- A. Unless otherwise specified, make submittals in groups containing all associated items to ensure that information is available for checking each item when it is received.
1. Partial submittals may be rejected as not complying with the provisions of the Contract.
 2. The Contractor may be held liable for delays caused by incomplete submittals.

3.3 TIMING OF SUBMITTALS

- A. Make submittals far enough in advance of scheduled dates for fabrication and installation to provide time required for reviews, for securing necessary approvals, for possible revisions and resubmittals, and for placing orders and securing delivery.
- B. In scheduling, allow at least ten working days for review by the Architect following the Architect's receipt of the submittal. For submittals that require review by the Architect and the Architect's consultants, allow an additional ten working days for each consultant.

3.4 LIST OF SUBMITTALS

- A. Shop drawings, product data, samples, schedules, reports, certifications, guarantees, and manuals to be submitted for Architect's review during construction or at completion of Work includes the General Conditions of the Contract, AIA Document A201; Warranty 3.5; Contractor's Construction Schedule 3.10; Subcontractor Schedule 5.2.1; Tests 13.5; Schedule of Values 9.2; Substantial Completion Punch List 9.8; and Certificates of Insurance 11.1.3.

END OF SECTION

SECURITY PROCEDURES

PART 1 GENERAL

1.1 CONSTRUCTION/MAINTENANCE BUILDING SECURITY RULES

- A. The Contractor shall enforce strict discipline and good order among the Contractor's employees, Subcontractors, and other persons carrying out the contract on District property. The District may require that the Contractor immediately remove from the project site and District property any employee or other person carrying out the contract that the District considers objectionable.
- B. District Personnel (i.e., Building Administrator, Custodian, or a building monitor etc.) must be present when a contractor is performing work within an existing school facility.
- C. Only District Personnel will deactivate the security system upon arriving and reactivate the system when they leave the facility.
 - 1. If the responsible District Personnel for a particular day changes during the day, the District Personnel shall coordinate this change in responsibility and advise the Contractor's superintendent.
- D. Contractor personnel will not be furnished District security badges and/or access codes to the Building security system.
- E. The Contractor shall have a responsible party such as a superintendent, foreman, or supervisor on site during any work being performed by either their own forces or that of their subcontractors.
- F. The superintendent shall check in with the responsible District Personnel upon arrival and advise when all work is complete, contract personnel have left, and the area is secure.
- G. The Contractor's superintendent shall be responsible for security in areas where work is being performed as well as ingress and egress to that area.
- H. At the BSD Representative's discretion, the superintendent may be issued a building key to allow access to area's where work is being performed.
- I. The superintendent shall maintain a daily log defining what areas within the building were accessed by Contractor personnel, which personnel from their firm were in the building, and which subcontracting firms were in the building.
- J. Each of the Contractor's employees, Subcontractors' employees, and principals/owners involved at the site may, at the option of the District, be subject to a security check, at any time, through the Beaverton Police Department or other venue.
- K. Contractor shall perform or have performed criminal background checks for every employee on all active campus (i.e., children are present) projects prior to that employee's admittance to the project site. Once an employee passes the criminal background check they will receive an ID badge and a hard hat sticker which they must wear while they are on site at all times. Contractor may be fined up to \$500 for every worker working on site without the proper ID badge and hat sticker. The following are the convicted crimes that may not appear on the background check.
 - 1. CONVICTIONS RENDERING INELIGIBILITY per ORS 342.143:

SECURITY PROCEDURES

- a. Aggravated Murder or Murder
- b. Assault in the First Degree
- c. Kidnapping in the First Degree
- d. Rape in the First, Second, or Third Degree
- e. Sodomy in the First, Second, or Third Degree Second Degree
- f. Unlawful Sex Penetration in the First or Second Degree
- g. Arson in the First Degree
- h. Sexual Abuse in the First, Second, or Third Degree
- i. Contributing to the Sexual Delinquency of a Minor
- j. Sexual Misconduct
- k. Public Indecency
- l. Bigamy
- m. Incest
- n. Child Neglect in the First Degree
- o. Endangering the Welfare of a Minor
- p. Using Child in Display of Sexually Explicit Conduct
- q. Sale or Exhibition of Visual Reproduction of Sexual Conduct by a Child
- r. Paying for Viewing of Sexual Conduct Involving a Child
- s. Encouraging Child Sex Abuse in First, Second or Third Degree
- t. Possession of Materials Depicting Sexual Explicit Conduct of a Child in the First or Second Degree
- u. Arson in the First Degree
- v. Robbery in the First Degree
- w. Treason
- x. Abuse of a Corpse in the First Degree
- y. Prostitution, Promoting Prostitution, or Compelling Prostitution

SECURITY PROCEDURES

- z. Sadomasochistic Abuse or Sexual Conduct in a Live Show
 - aa. Furnishing, Sending, or Displaying Obscene Materials to Minors
 - bb. Exhibiting an Obscene Performance to a Minor
 - cc. Disseminating Obscene Materials
 - dd. Publicly Displaying Nudity or Sex for Advertising Purposes
 - ee. Distribution of Controlled Substance to Minors
 - ff. Manufacture or Delivery of Controlled Substance to Minor or Student within 1000 Feet of a School
 - gg. Attempt to Commit Any of the Above-Listed Crimes
- L. Smoking and any use of tobacco products is not allowed within 50 feet of the campus property. Contractor may be fined up to \$500 for each incident of tobacco use within the area of work by the Contractor or Subcontractors.
- M. Firearms are not allowed on campus property. Law enforcement will be contacted if any contractor personnel are in possession of a firearm on site. (This includes firearms locked up in a vehicle.)
- N. Abusive, inappropriate, and/or foul language is strictly prohibited on active campus projects. Employees who abuse this rule will be asked to leave the project site.

END OF SECTION

REGULATORY REQUIREMENTS

PART 1 GENERAL

1.1 WORK INCLUDED

A. Permits and Fees:

1. The Contractor shall secure, pay for, and closeout all permits. BSD will pay all system development charges, traffic impact fees, land use fees, building plan review and application fees applicable to the project.
2. The Contractor shall be responsible for securing and paying for all permits and fees in a timely manner so not to impede the progress of the Work.
3. The Architect shall be responsible for providing all documentation required to secure permits from the jurisdiction having authority.
4. BSD will pay land use fees and the initial building and/or plan check fees. Contractor shall pay for design build or subsequent application and/or plan check fees.

END OF SECTION

REFERENCES

PART 1 GENERAL

1.1 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."
- D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
- H. "Provide": Furnish and install, complete and ready for the intended use.
- I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.2 INDUSTRY STANDARDS

- A. Applicability of Standards: Except to the extent more explicit or more stringent requirements are written directly into the contract documents or are required by governing regulations, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents. Such standards are made a part of the Contract Documents by reference. In case of a conflict between the referenced standard and the project specifications, the project specifications shall govern.
- B. Referenced Standards: Industry standards which are referenced in the contract documents have precedence over non-referenced standards which are, nevertheless, seen to be intended by their producers for application to work similar to that required for this project.
- C. Non-Referenced Standards: Industry standards which are not specifically referenced in the contract documents for applicability to the work, including standards produced by those associations and agencies listed in this section (but not referenced elsewhere), are applicable as a

REFERENCES

general measurement of whether the performed work complies with recognized standards of the construction industry.

- D. **Publication Dates:** In each instance, comply with the standard or trade association publications which was in effect at the date of the contract documents, except where specifically indicated to comply with a publication of another date. References in the specifications have generally omitted the date indicator which frequently accompanies the identification number for the standards and publications indicated. Submit requests for approval of standards or publications of a different date. Substantial changes in the work which result from approval of standards or publications of a different date shall be processed as change orders in conjunction with such approval, at no change in price.
- E. **Copies of Standards:** In connection with the requirements (specified elsewhere in the contract documents) that each entity performing the work be expert in the portion of work being performed, each such entity is hereby also required to be familiar with recognized industry standards applicable to that portion of work. In general, copies of applicable standards have not been bound with the contract documents. Where copies of standards are needed for proper performance of the work, the Contractor is required to obtain such copies directly from the publication source. Although certain copies needed for enforcement of the requirements may be specified as required submittals, the Owners Representative reserves the right to require the Contractor to submit copies of additional applicable standards as needed for enforcement of the requirements.

1.3 ABBREVIATIONS AND ACRONYMS

- A. **Abbreviations and Acronyms for Standards and Regulations:** Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the organizations responsible for the standards and regulations in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

ADA	Dept. of Justice ADA Regulations Dept. of Justice 2010 ADA Standards for Accessible Design Accessibility Guidelines for Buildings and Facilities Available from U. S. Access Board www.access-board.gov	(800) 872-2253
CFR	Code of Federal Regulations Available from Government Printing Office www.gpoaccess.gov/cfr/index.html	(866) 512-1800 (202) 512-1800
FED-STD	Federal Standard (See FS)	
FS	Federal Specification Available from General Services Administration www.gsa.gov Available from National Institute of Building Sciences	(215) 697-6257 (202) 619-8925 (202) 289-7800

REFERENCES

www.nibs.org

FTMS Federal Test Method Standard
(See FS)

UFAS Uniform Federal Accessibility Standards (800) 872-2253
Available from Access Board (202) 272-0080
www.access-board.gov

1.4 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Thomson Gale's "Encyclopedia of Associations" or in Columbia Books' "National Trade & Professional Associations of the U.S."
- B. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

AA	Aluminum Association, Inc. (The) www.aluminum.org	(703) 358-2960
AAMA	American Architectural Manufacturers Association www.aamanet.org	(847) 303-5664
ACI	ACI International (American Concrete Institute) www.aci-int.org	(248) 848-3700
AF&PA	American Forest & Paper Association www.afandpa.org	(800) 878-8878 (202) 463-2700
AGA	American Gas Association www.aga.org	(202) 824-7000
AGC	Associated General Contractors of America (The) www.agc.org	(703) 548-3118
AHA	American Hardboard Association (Now part of CPA)	
AIA	American Institute of Architects (The) www.aia.org	(800) 242-3837 (202) 626-7300

REFERENCES

AISC	American Institute of Steel Construction www.aisc.org	(800) 644-2400 (312) 670-2400
AISI	American Iron and Steel Institute www.steel.org	(202) 452-7100
AITC	American Institute of Timber Construction www.aitc-glulam.org	(303) 792-9559
ALSC	American Lumber Standard Committee, Incorporated www.alsc.org	(301) 972-1700
ANSI	American National Standards Institute www.ansi.org	(202) 293-8020
APA	APA - The Engineered Wood Association www.apawood.org	(253) 565-6600
ARMA	Asphalt Roofing Manufacturers Association www.asphaltroofing.org	(202) 207-0917
ASCE	American Society of Civil Engineers www.asce.org	(800) 548-2723 (703) 295-6300
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers www.ashrae.org	(800) 527-4723 (404) 636-8400
ASME	ASME International (The American Society of Mechanical Engineers International) www.asme.org	(800) 843-2763 (973) 882-1170
ASSE	American Society of Sanitary Engineering www.asse-plumbing.org	(440) 835-3040
ASTM	ASTM International (American Society for Testing and Materials International) www.astm.org	(610) 832-9585
AWCI	AWCI International (Association of the Wall and Ceiling Industry International) www.awci.org	(703) 534-8300
AWI	Architectural Woodwork Institute www.awinet.org	(800) 449-8811 (571) 323-3636
AWPA	American Wood-Preservers' Association www.awpa.com	(334) 874-9800

REFERENCES

AWS	American Welding Society www.aws.org	(800) 443-9353 (305) 443-9353
BHMA	Builders Hardware Manufacturers Association www.buildershardware.com	(212) 297-2122
BIA	Brick Industry Association (The) www.bia.org	(703) 620-0010
BICSI	BICSI www.bicsi.org	(800) 242-7405 (813) 979-1991
CCC	Carpet Cushion Council www.carpetcushion.org	(203) 637-1312
CDA	Copper Development Association www.copper.org	(800) 232-3282 (212) 251-7200
CISCA	Ceilings & Interior Systems Construction Association www.cisca.org	(630) 584-1919
CISPI	Cast Iron Soil Pipe Institute www.cispi.org	(423) 892-0137
CRI	Carpet & Rug Institute (The) www.carpet-rug.com	(800) 882-8846 (706) 278-3176
CRSI	Concrete Reinforcing Steel Institute www.crsi.org	(847) 517-1200
CSA	CSA International (Formerly: IAS - International Approval Services) www.csa-international.org	(866) 797-4272 (416) 747-4000
CSI	Construction Specifications Institute (The) www.csinet.org	(800) 689-2900 (703) 684-0300
CTI	Cooling Technology Institute (Formerly: Cooling Tower Institute) www.cti.org	(281) 583-4087
DHI	Door and Hardware Institute www.dhi.org	(703) 222-2010
FMG	FM Global (Formerly: FM - Factory Mutual System) www.fmglobal.com	(401) 275-3000
FMRC	Factory Mutual Research (Now FMG)	

REFERENCES

GA	Gypsum Association www.gypsum.org	(202) 289-5440
GANA	Glass Association of North America www.glasswebsite.com	(785) 271-0208
GRI	(Now GSI)	
GS	Green Seal www.greenseal.org	(202) 872-6400
GSI	Geosynthetic Institute www.geosynthetic-institute.org	(610) 522-8440
HI	Hydraulic Institute www.pumps.org	(888) 786-7744 (973) 267-9700
HI	Hydronics Institute www.gamanet.org	(908) 464-8200
HMMA	Hollow Metal Manufacturers Association (Part of NAAMM)	
ICEA	Insulated Cable Engineers Association, Inc. www.icea.net	(770) 830-0369
ICRI	International Concrete Repair Institute, Inc. www.icri.org	(847) 827-0830
IEEE	Institute of Electrical and Electronics Engineers, Inc. (The) www.ieee.org	(212) 419-7900
IESNA	Illuminating Engineering Society of North America www.iesna.org	(212) 248-5000
IGCC	Insulating Glass Certification Council www.igcc.org	(315) 646-2234
IGMA	Insulating Glass Manufacturers Alliance www.igmaonline.org	(613) 233-1510
ISO	International Organization for Standardization www.iso.ch	41 22 749 01 11
	Available from ANSI www.ansi.org	(202) 293-8020
KCMA	Kitchen Cabinet Manufacturers Association www.kcma.org	(703) 264-1690

REFERENCES

LMA	Laminating Materials Association (Now part of CPA)	
LPI	Lightning Protection Institute www.lightning.org	(800) 488-6864 (804) 314-8955
MFMA	Maple Flooring Manufacturers Association, Inc. www.maplefloor.org	(847) 480-9138
MFMA	Metal Framing Manufacturers Association www.metalframingmfg.org	(312) 644-6610
MH	Material Handling (Now MHIA)	
MHIA	Material Handling Industry of America www.mhia.org	(800) 345-1815 (704) 676-1190
MIA	Marble Institute of America www.marble-institute.com	(440) 250-9222
MPI	Master Painters Institute www.paintinfo.com	(888) 674-8937
MSS	Manufacturers Standardization Society of The Valve and Fittings Industry Inc. www.mss-hq.com	(703) 281-6613
NAAMM	National Association of Architectural Metal Manufacturers www.naamm.org	(312) 332-0405
NACE	NACE International (National Association of Corrosion Engineers International) www.nace.org	(800) 797-6623 (281) 228-6200
NAIMA	North American Insulation Manufacturers Association www.naima.org	(703) 684-0084
NBGQA	National Building Granite Quarries Association, Inc. www.nbgqa.com	(800) 557-2848
NCMA	National Concrete Masonry Association www.ncma.org	(703) 713-1900
NCPI	National Clay Pipe Institute www.ncpi.org	(262) 248-9094
NCTA	National Cable & Telecommunications Association www.ncta.com	(202) 775-3550

REFERENCES

NECA	National Electrical Contractors Association www.necanet.org	(301) 657-3110
NeLMA	Northeastern Lumber Manufacturers' Association www.nelma.org	(207) 829-6901
NEMA	National Electrical Manufacturers Association www.nema.org	(703) 841-3200
NETA	InterNational Electrical Testing Association www.netaworld.org	(888) 300-6382 (303) 697-8441
NFPA	NFPA (National Fire Protection Association) www.nfpa.org	(800) 344-3555 (617) 770-3000
NFRC	National Fenestration Rating Council www.nfrc.org	(301) 589-1776
NGA	National Glass Association www.glass.org	(866) 342-5642 (703) 442-4890
NHLA	National Hardwood Lumber Association www.natlhardwood.org	(800) 933-0318 (901) 377-1818
NLGA	National Lumber Grades Authority www.nlga.org	(604) 524-2393
NOFMA	NOFMA: The Wood Flooring Manufacturers Association (Formerly: National Oak Flooring Manufacturers Association) www.nofma.org	(901) 526-5016
NRCA	National Roofing Contractors Association www.nrca.net	(800) 323-9545 (847) 299-9070
NRMCA	National Ready Mixed Concrete Association www.nrmca.org	(888) 846-7622 (301) 587-1400
NSF	NSF International (National Sanitation Foundation International) www.nsf.org	(800) 673-6275 (734) 769-8010
NSSGA	National Stone, Sand & Gravel Association www.nssga.org	(800) 342-1415 (703) 525-8788
NWCB	NW Wall and Ceiling Bureau www.nwcb.org	(206) 524-4243

REFERENCES

NWWDA	National Wood Window and Door Association (Now WDMA)	
PDCA	Painting & Decorating Contractors of America www.pdca.com	(800) 332-7322 (314) 514-7322
PDI	Plumbing & Drainage Institute www.pdionline.org	(800) 589-8956 (978) 557-0720
PGI	PVC Geomembrane Institute http://pgi-tp.ce.uiuc.edu	(217) 333-3929
RCSC	Research Council on Structural Connections www.boltcouncil.org	(800) 644-2400 (312) 670-2400
RFCI	Resilient Floor Covering Institute www.rfci.com	(301) 340-8580
RIS	Redwood Inspection Service www.calredwood.org	(888) 225-7339 (415) 382-0662
SDI	Steel Door Institute www.steeldoor.org	(440) 899-0010
SGCC	Safety Glazing Certification Council www.sgcc.org	(315) 646-2234
SIA	Security Industry Association www.siaonline.org	(703) 683-2075
SIGMA	Sealed Insulating Glass Manufacturers Association (Now IGMA)	
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association www.smacna.org	(703) 803-2980
SPIB	Southern Pine Inspection Bureau (The) www.spib.org	(850) 434-2611
SSINA	Specialty Steel Industry of North America www.ssina.com	(800) 982-0355 (202) 342-8630
SSPC	SSPC: The Society for Protective Coatings www.sspc.org	(877) 281-7772 (412) 281-2331
SWRI	Sealant, Waterproofing, & Restoration Institute www.swrionline.org	(816) 472-7974
TCA	Tile Council of America, Inc.	(864) 646-8453

REFERENCES

	www.tileusa.com	
TIA/EIA	Telecommunications Industry Association/Electronic Industries Alliance www.tiaonline.org	(703) 907-7700
TMS	The Masonry Society www.masonrysociety.org	(303) 939-9700
TPI	Truss Plate Institute, Inc. www.tpinst.org	(703) 683-1010
UL	Underwriters Laboratories Inc. www.ul.com	(877) 854-3577 (847) 272-8800
UNI	Uni-Bell PVC Pipe Association www.uni-bell.org	(972) 243-3902
USGBC	U.S. Green Building Council www.usgbc.org	(202) 828-7422
WCLIB	West Coast Lumber Inspection Bureau www.wclib.org	(800) 283-1486 (503) 639-0651
WDMA	Window & Door Manufacturers Association (Formerly: NWWDA - National Wood Window and Door Association) www.wdma.com	(800) 223-2301 (847) 299-5200
WMMPA	Wood Moulding & Millwork Producers Association www.wmmpa.com	(800) 550-7889 (530) 661-9591
WSRCA	Western States Roofing Contractors Association www.wsrca.com	(800) 725-0333 (650) 570-5441
WWPA	Western Wood Products Association www.wwpa.org	(503) 224-3930
C.	Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.	
BOCA	BOCA International, Inc. (See ICC)	
IAPMO	International Association of Plumbing and Mechanical Officials www.iapmo.org	(909) 472-4100
ICBO	International Conference of Building Officials (See ICC)	

REFERENCES

ICBO ES ICBO Evaluation Service, Inc.
(See ICC-ES)

ICC International Code Council (888) 422-7233
www.iccsafe.org (703) 931-4533

ICC-ES ICC Evaluation Service, Inc. (800) 423-6587
www.icc-es.org (562) 699-0543

- D. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

CPSC Consumer Product Safety Commission (800) 638-2772
www.cpsc.gov (301) 504-7923

DOE Department of Energy (202) 586-9220
www.energy.gov

EPA Environmental Protection Agency (202) 272-0167
www.epa.gov

NIST National Institute of Standards and Technology (301) 975-6478
www.nist.gov

OSHA Occupational Safety & Health Administration (800) 321-6742
www.osha.gov (202) 693-1999

PBS Public Building Service
(See GSA)

PHS Office of Public Health and Science (202) 690-7694
www.osophs.dhhs.gov/ophs

SD State Department (202) 647-4000
www.state.gov

END OF SECTION

QUALITY CONTROL

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Building code inspections.
2. Building code special inspections.
3. Extra tests and inspections.
4. Concrete floor alkalinity and moisture testing.

1.2 DEFINITIONS

A. Approved Agency:

1. Independent: Objective, competent and independent from the Contractor responsible for the work being inspected, including disclosure of possible conflicts of interest so that objectivity can be confirmed.
2. Special Inspector Qualifications: Meet the requirements of the current Oregon Structural Specialty Code, section 1704.

1.3 REQUIREMENTS

A. Specific special inspection requirements are found in the specification Sections.

B. Approved Agency Qualifications:

1. Meet "Recommended Requirements for Approved Agency Qualification," published by American Council of Independent Laboratories.
2. Acceptable to Owner, Architect, Structural Engineer, and local building authorities.

1.4 ENGINEERING, TESTING, AND INSPECTIONS REQUIRED BY BUILDING CODE

A. Work by Owner for Special Inspections:

1. Owner shall employ an Approved Agency to conduct Special Inspections that are required by the governing building code jurisdiction.
2. Owner shall pay for all inspection and testing services that indicate that construction is in conformance with Contract Documents.

B. Work by Contractor for Inspections and for Special Inspections:

QUALITY CONTROL

1. Notify Architect and Approved Agency 24 hours prior to need for testing, inspection, and sampling. Approved Agency services shall be scheduled during normal business hours.
 2. Cooperate with field testing personnel, provide access to work.
 3. Facilitate testing and continuous inspection.
 4. Notify building officials when Building Code required tests and inspections are ready for testing and inspecting.
 5. Pay for tests and inspections where Work does not meet Contract Document requirements, including subsequent tests and inspections until such Work meets Contract Document requirements.
 6. Pay for overtime charges when Approved Agency services are performed outside of normal business hours.
- C. Work by Approved Agency:
1. Specified and Building Code Required Tests and Inspections:
 - a. Perform tests and inspections as required by Contract Documents and local Building Code. Special Inspections include, but are not limited to:
 - (1) Refer to Structural Notes on the Drawings.
 - b. Test and inspect materials and systems to determine compliance with requirements of Contract Documents.
 - c. Comply with requirements of IBC, Special Inspections.
 - d. Provide tests and inspections required by Local Building Officials.
 - e. Owner will pay for tests and inspections where Work conforms to the Contract Document requirements.
 2. Extra Tests and Inspections:
 - a. When directed by the Architect or otherwise required, provide extra tests and inspections to verify material compliance with requirements of Contract Documents.
 - b. Owner will pay for extra tests and inspections where Work conforms to the Contract Document requirements.
 - c. Contractor will pay for extra tests and inspections where Work fails to comply with Contract Document requirements.

QUALITY CONTROL

3. Limits of Approved Agency Duties: Approved Agency is not authorized to modify Contract Documents, approve or accept Work, nor perform duties of Contractor.
4. Test and Inspection Reports:
 - a. Indicate on Each Test and Inspection Report:
 - (1) Project name and date of report.
 - (2) Approved Agency name, address, telephone number, and name of laboratory inspector.
 - (3) Date and time of testing, and inspecting.
 - (4) Product identification and referenced Specification Section.
 - (5) Location of sample, test, or inspection in the Project.
 - (6) Type of inspection or test.
 - (7) Results of test, or inspection and evaluation of compliance with requirements in Contract Documents.
 - b. Distribution of Reports: Distribute one copy of each test and inspection report to the Architect, Owner, local building official, and provide two copies to the Contractor.

1.5 NON-CODE REQUIRED TESTING

- A. Work by Owner for non-code testing.
 1. Owner shall employ an Approved Agency to conduct concrete floor moisture testing.
 2. Owner shall pay for all testing services that indicate that construction is in conformance with Contract Documents.
- B. Work by Contractor for non-code testing.
 1. Notify Architect and Approved Agency 24 hours prior to need for testing. Approved Agency services shall be scheduled during normal business hours.
 2. Cooperate with field testing personnel, provide access to work.
 3. Provide environmental conditions for concrete floor moisture testing as required by the flooring manufacturer's test procedure.
 4. Pay for tests where Work does not meet Contract Document requirements, including subsequent tests until such Work meets Contract Document requirements.

QUALITY CONTROL

5. Pay for overtime charges when Approved Agency services are performed outside of normal business hours.
- C. Work by Approved Agency:
1. Perform concrete floor moisture testing in accordance with flooring manufacturer's requirements.
 2. Provide testing equipment and personnel to record field measurements.
 3. Extra Tests and Inspections:
 - a. When directed by the Architect or otherwise required, provide extra tests to verify material compliance with flooring manufacturer's warranty requirements.
 - b. Owner will pay for extra tests and inspections where Work conforms to the flooring manufacturer's warranty requirements.
 - c. Contractor will pay for extra tests and inspections where Work fails to comply with flooring manufacturer's warranty requirements.
 4. Test Reports:
 - a. Indicate on each test report:
 - (1) Project name and date of report.
 - (2) Approved Agency name, address, telephone number, and name of laboratory inspector.
 - (3) Date and time of testing.
 - (4) Location of moisture test.
 - (5) Results of test and evaluation of compliance with requirements in Contract Documents.
 - b. Distribution of Reports: Distribute one copy of each test report to the Architect, Owner and provide two copies to the Contractor.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 REPAIR AND PROTECTION

QUALITY CONTROL

- A. General: Upon completion of inspection, testing, and similar services, repair damaged construction.
- B. Repair and protection is Contractor's responsibility, regardless of the assignment of responsibility for inspection, testing, or similar services.

3.2 EVALUATION OF TESTS AND INSPECTIONS

- A. Satisfactory completion of work will be judged on results of laboratory and site tests and inspections.
- B. If results of tests and inspections indicate work is below requirements of Contract Documents, that portion of work is subject to condemnation.
- C. Contractor to remove and replace work so condemned at Contractor's expense until such work meets requirements of Contract Documents.

END OF SECTION

TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.1 SUMMARY

- A. Provide temporary job site facilities and services as required for use on, but not limited to, items listed in this Section.
- B. Supervise and coordinate temporary facilities normally furnished and maintained as part of subcontractor's work.

1.2 REFERENCES

- A. National Fire Protection Association (NFPA).
- B. Occupational Safety and Health Act (OSHA).

1.3 CONTRACTOR'S CONSTRUCTION OFFICE

- A. Provide suitable temporary facilities for the overall administration of the Work on this Project.
- B. Furnish complete with heat, light, ventilation, locking door, plan counters and racks.
- C. Upon completion of the Work, remove all temporary structures.

1.4 SANITARY FACILITIES

- A. Toilets, wash facilities, and drinking water for use of construction personnel are not available in each building. Contractor responsible to provide facilities on site.

1.5 TEMPORARY FACILITIES

- A. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.

1.6 UTILITIES

- A. General: All shut-off locations are to be documented for emergency purposes prior to pre-construction meeting.
- B. Lighting: Use of existing building lighting is available to the Contractor. Provide additional temporary lighting as required for construction.;
- C. Telephone Service:
 - 1. Provide phone service in the Construction Office including fax and electronic communication service through internet access.
 - 2. At each telephone, post a list of important telephone numbers.
 - a. Police and fire departments.

TEMPORARY FACILITIES AND CONTROLS

- b. Ambulance service.
 - c. Contractor's home office.
 - d. Architect's office.
 - e. Engineers' offices.
 - f. Owner's office.
 - g. Principal subcontractors' field and home offices.
- 3. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.
- D. Water Service: Use of Owner's existing water service facilities will be permitted, as long as facilities are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.
- E. Electric Power Service: Use of Owner's existing electric power service will be permitted, as long as equipment is maintained in a condition acceptable to Owner.
- F. Heat and Ventilation:
 - 1. Use of building heating and ventilation is available to the Contractor.
 - 2. Provide and pay for additional temporary heat as required to dry out the Work, maintain acceptable temperatures in materials and spaces as necessary for the proper accomplishment of the Work.
 - 3. Ventilate all spaces to adequately assist drying-out and remove smoke, gasses and fumes harmful to persons and the Work. Provide temporary ducts or flues to vent combustion gasses from heating equipment to the outside.
 - 4. Use only temporary heating equipment bearing UL or other acceptable label certifying that the equipment has been approved for the use intended and all required safety devices are provided; maintain in good repair and properly adjusted to operate free from smoke, fumes, and fuel leaks.

1.7 FINISHES PROTECTION

- A. Provide protection for finish surfaces as required to preserve them in "new" condition until Substantial Completion.
- B. Restore permanent facilities used during construction to their specified and/or original condition.

1.8 SUPPORT FACILITIES

- A. Waste Disposal Facilities: Comply with requirements specified in Division 1 Section "Construction Waste Management."

TEMPORARY FACILITIES AND CONTROLS

1.9 CONSTRUCTION SAFETY

- A. Ensure that all scaffolding, staging, temporary floors, runways, and similar devices furnished for the installation of any Work be built and maintained to safely support required loads.
- B. Ensure that all hoists, and other lifting equipment necessary for the erection of materials have operators trained and experienced in the equipment being used, and are properly equipped with guys, bracing, and safety devices as required by applicable codes.
- C. Comply with all applicable local safety codes and specifically the Occupational Safety and Health Act (OSHA) for the construction industry.
- D. Unless written approval is obtained from governing jurisdiction, construction must not obstruct private or public streets, driveways, pedestrian walkways, ADA routes, fire lanes, egress of occupied buildings, etc.

1.10 FIRE PREVENTION AND PROTECTION

- A. Perform all Work in a fire-safe manner and supply and maintain adequate first-aid and fire-fighting equipment capable of extinguishing incipient fires. Comply with applicable local and state fire prevention regulations and, where the regulations do not cover, with applicable parts of the National Fire Prevention Standards for "Safeguarding Building Construction Operations," (NFPA 241).

END OF SECTION

PRODUCT REQUIREMENTS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes delivering, handling, storing, and protecting products. Product selection and manufacturer's instructions. Product options and substitutions and sample substitution request form.

1.2 DELIVERY, STORAGE, AND HANDLING

- A. Acceptance at Site:

- 1. Arrange deliveries of products in accordance with construction schedules, and deliver products in undamaged condition, in manufacturer's original packaging, with identifying labels.
 - 2. Immediately after delivery, inspect shipments to ensure compliance with requirements of Contract Documents and ensure products are protected and undamaged.

- B. Storage and Protection:

- 1. Materials shall be so stored as to ensure the preservation of their quality and fitness for the work. Maintain temperature and humidity within the ranges required by manufacturer's instructions. When considered necessary, they shall be placed on wooden platforms or other hard, clean surfaces, and not on the ground. Cover products which are subject to deterioration with vapor retarding coverings and provide adequate ventilation. Stored materials shall be located so as to facilitate prompt inspection. Private property shall not be used for storage purposes without the written permission of the Owner.
 - 2. Protecting Products After Installation: Provide substantial temporary coverings as necessary to protect installed products from damage resulting from traffic and construction operations. Remove temporary coverings when no longer needed.

- C. Handling:

- 1. Provide equipment and personnel to handle products and materials by methods which will prevent damage to products and materials.
 - 2. Design, fabricate, assemble, and erect products, systems, and equipment in accordance with the best engineering and shop practices.

PART 2 PRODUCTS

2.1 PRODUCT SELECTION

- A. Comply with specified industry standards. If no standards are specified, comply with the product's industry standards as a minimum requirement. Provide materials in size, type, and quality indicated and specified, unless variations are accepted by Architect in writing.

PRODUCT REQUIREMENTS

- B. Specifying a manufacturer and manufactured product shall not constitute a waiver of any requirements of the Contract Documents, and products furnished by the listed manufacturer shall conform to such requirements.
- C. No materials or products containing asbestos are to be used in the construction of this Project. If any material or product specified in this Project Manual is known to contain asbestos, it shall be brought to the attention of the Architect before ordering or fabricating the material or product.

2.2 PRODUCT OPTIONS

- A. For products specified only by reference standard, select any product meeting that standard.
- B. For products specified by naming one or more products or manufacturers, Contractor must submit a request for substitution for any product or manufacturer not specifically named.

2.3 PRODUCT SUBSTITUTION PROCEDURES

- A. Submit substitution requests on the CSI Substitution Request form bound in this Project Manual. If the Substitution Request form is reproduced, the terms and conditions of the Substitution Request bound in this Project Manual shall apply to the request.
- B. Each substitution request shall include a complete description of the proposed substitute, the name of the material, service, or equipment for which it is to be substituted, drawings, cuts, performance and test data, samples illustrating color, texture and pattern, and any other data or information required to make a valid comparison. Product catalogs containing multiple products shall be marked to indicate which products and product options are being submitted for substitution. Substitution requests submitted with unmarked catalogs will not be reviewed. To have the results of a substitution request mailed to the author, include two copies of the substitution request form and a stamped, self-addressed envelope.
- C. Consideration of Substitution Requests Prior to Bid Date: Submit Substitution Requests in accordance with Bidding Requirement Document "Instructions to Bidders." If, in the Architect's opinion, the proposed product is acceptable in lieu of the one or more specified, the Architect will include it in a written addendum which will be issued to bidders. Acceptance of a Substitution Request does not relieve the requestor from meeting the requirements, procedures, and warranties as set forth in this specification. Only those manufacturers, materials, services, and equipment approved in these Specifications or by Addendum will be acceptable for use on this construction project.
- D. Consideration of Substitution Requests After Contract Award:
 - 1. Requests for substitution of specified products after the construction Contract is signed, will be considered only in accordance with paragraphs 2.3.A. and 2.3.B., above. If, in the Architect's opinion, the proposed product is acceptable in lieu of the one or more specified, the Architect will issue a Supplemental Instruction, when Contract Sum or Contract Time is not affected, or a Construction Change Directive or Change Order, when Contract Sum or Contract Time is affected.

PRODUCT REQUIREMENTS

2. Substitution requests occasioned by the Contractor's failure to order specified material in a timely manner shall not be considered and delays in construction caused by such an event shall not be waived.
3. One or more of the following five conditions must also be documented:
 - a. The substitution must be required for compliance with final interpretation of code requirements or insurance regulations.
 - b. The substitution must be due to the unavailability of the specified products, through no fault of the Contractor.
 - c. The substitution may be requested when subsequent information discloses the inability of the specified products to perform properly or to fit in the designated space.
 - d. The substitution may be due to the manufacturer's or fabricator's refusal to certify or guarantee performance of the specified product as required.
 - e. The substitution may be requested when it is clearly seen, in the judgment of the Architect, that a substitution, would be substantially to the Owner's best interests in terms of cost or time.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Examine areas and conditions under which material, equipment, and systems are to be fabricated, assembled, erected, installed, and applied. Correct existing conditions detrimental to proper and timely completion of work. Do not proceed until unsatisfactory conditions have been corrected. Start of work will be interpreted as acceptance of existing surfaces and conditions within any particular work area.

3.2 INSTALLATION

- A. Manufacturer's Instructions:
 1. Perform work in accordance with manufacturer's printed fabrication, installation, and application instructions.
 2. Obtain and distribute copies of manufacturer's printed fabrication, installation, and application instructions to parties involved in the construction, including two copies to Architect, and one copy at the site.
 3. Handle, store, fabricate, erect, install, connect, apply, clean, condition, and adjust products, materials, systems, and equipment in accordance with manufacturer's printed instructions and in conformity with specified requirements.

PRODUCT REQUIREMENTS

4. Review and resolve conflicts between manufacturer's instructions and Contract Documents with Architect prior to fabrication, installation, and application of products, systems, and equipment.
- B. Installation Procedure:
1. Require installer of each major unit of Work to inspect substrate to receive Work and conditions under which Work is to be performed. Installer shall report unsatisfactory conditions promptly in writing to Contractor. Remedy condition to installer's satisfaction immediately.
 2. Inspect each item of material or equipment prior to installation. Reject damaged or defective items.
 3. Provide attachment and connection devices and methods for securing Work. Secure Work true to line and level, and within recognized industry tolerances. Allow for expansion and building movement. Provide uniform joint width in exposed Work and arrange to provide best visual effect. Refer questionable visual effect choices to Architect.
 4. Recheck measurements and dimensions of Work as integral step of starting each installation.
 5. Schedule installation of each unit of Work to result in best overall compatibility to coordination of entire project. Isolate each unit of Work from incompatible work as necessary to prevent deterioration or damage. Coordinate enclosure of Work with required inspections and tests to minimize uncovering of Work for that purpose.
 6. Where mounting heights are not indicated, use industry recognized standard heights for that unit of Work. Refer questionable issues to Architect for final direction.

END OF SECTION

SUBSTITUTION REQUEST

*The Construction Specifications Institute
Northwest Region*

TO: _____

PROJECT: _____

SPECIFIED ITEM: _____

Section No.	Page	Paragraph	Description
-------------	------	-----------	-------------

PROPOSED SUBSTITUTION: _____

Attached data includes product description, specifications, drawings, photographs, performance and test data adequate for evaluation of request including identifying applicable portions.

Attached data also includes description of changes to Contract Documents that proposed substitution requires for proper installation.

Undersigned certifies that the following items, unless modified by attachments, are correct:

1. Proposed substitution does not affect dimensions shown on Drawings.
2. Undersigned pays for changes to building design, including engineering design, detailing and construction costs caused by proposed substitution.
3. Proposed substitution has no adverse effect on other trades, construction schedule, or specified warranty requirements.
4. Maintenance and service parts are available locally or are readily obtainable for proposed substitution.

Undersigned further certifies that function, appearance, and quality of proposed substitution are equivalent or superior to specified item.

Undersigned agrees that, if this page is reproduced, terms and conditions for substitutions found in Bidding Documents apply to this proposed substitution.

Submitted by

Name (Print)

Signature

Firm Name

Address

City, State, Zip

Date

Telephone

Fax

Attachments

General Contractor (if after award of Contract)

For use by A/E:

____ Approved
____ Not Approved

____ Approved as Noted
____ Received Too Late

By

Date

Remarks

1999 Edition

EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:
 - 1. General installation of products.
 - 2. Progress cleaning.
 - 3. Starting and adjusting.
 - 4. Protection of installed construction.
 - 5. Correction of the Work.
- B. Related Sections include the following:
 - 1. Division 1 Section "Project Management and Coordination" for procedures for coordinating construction activities.
 - 2. Division 1 Section "Cutting and Patching" for procedural requirements for cutting and patching necessary for the installation or performance of other components of the Work.
 - 3. Division 1 Section "Closeout Procedures" for final cleaning.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Existing Conditions: The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of mechanical and electrical systems and other construction affecting the Work.
 - 1. Before construction, verify the location and points of connection of utility services.
- B. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
 - 1. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
 - a. Description of the Work.

EXECUTION

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

3.2 PREPARATION

- A. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- B. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- C. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents.

3.3 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
 1. Make vertical work plumb and make horizontal work level.
 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 3. Conceal wiring in finished areas, unless otherwise indicated.
 4. Maintain minimum headroom clearance of 8-feet in spaces without a suspended ceiling.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

EXECUTION

- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- F. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- G. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.
 - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
 - 2. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete. Deliver such items to Project site in time for installation.
- H. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- I. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.4 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.
 - 1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
 - 2. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg F.
 - 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

EXECUTION

1. Remove liquid spills promptly.
 2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.
- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.5 STARTING AND ADJUSTING

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

3.6 PROTECTION OF INSTALLED CONSTRUCTION

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

EXECUTION

1. Protect installed work from damage by construction operations.
 2. Provide special protection where specified in individual specification sections.
 3. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
 4. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
 5. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
 6. Remove protective coverings when no longer needed; reuse or recycle plastic coverings if possible.
- B. Comply with manufacturer's written instructions for temperature and relative humidity.

3.7 CORRECTION OF THE WORK

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

END OF SECTION

CUTTING AND PATCHING

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide all labor and materials necessary to execute cutting and patching of defective Work and areas of remodel where new construction joins existing finishes.
- B. Match each patch material with kind, grade, size and quality identical to patched material.
- C. Related Sections:
 - 1. Divisions 21, 22, and 23, Mechanical: Cutting and patching required exclusively for mechanical work.
 - 2. Division 26, 27 and 28, Electrical: Cutting and patching required exclusively for electrical work.

1.2 DEFINITIONS

- A. Cutting:
 - 1. Removal of in-place construction necessary to permit installation or performance of other Work.
 - 2. Removal of defective Work.
- B. Patching:
 - 1. Fitting and repair work required to restore surfaces to original conditions after installation of other Work. Include patch and repair that is implied or consequential to other trades to achieve the intended results.
 - 2. Replacing defective Work with Work that conforms to Contract Documents.

1.3 SUBMITTALS

- A. Cutting and Patching Proposal: Submit a proposal describing procedures at least 10 days before the time cutting and patching will be performed, requesting approval to proceed. Include the following information:
 - 1. Extent: Describe cutting and patching of defective Work and areas of remodel where new construction joins existing finishes. Show how they will be performed, and indicate why they cannot be avoided.
 - 2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building's appearance and other significant visual elements.
 - 3. Products: List products to be used and firms or entities that will perform the Work.

CUTTING AND PATCHING

4. Dates: Indicate when cutting and patching will be performed.
5. Utility Services and Mechanical/Electrical Systems: List services/systems that cutting and patching procedures will disturb or affect. List services/systems that will be relocated and those that will be temporarily out of service. Indicate how long services/systems will be disrupted.
6. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.
7. Architect's Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

1.4 QUALITY ASSURANCE

- A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.
- B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operating elements include but are not limited to the following:
 1. Primary operational systems and equipment.
 2. Air or smoke barriers.
 3. Fire-suppression systems.
 4. Mechanical systems piping and ducts.
 5. Control systems.
 6. Communication systems.
 7. Electrical wiring systems.
- C. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Miscellaneous elements include but are not limited to the following:
 1. Equipment supports.
 2. Piping, ductwork, vessels, and equipment.
 3. Noise- and vibration-control elements and systems.

CUTTING AND PATCHING

- D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
- E. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.5 WARRANTY

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

PART 2 - PRODUCTS

2.1 MATERIALS

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

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- A. Temporary Support: Provide temporary support of Work to be cut.

CUTTING AND PATCHING

- B. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

3.3 PERFORMANCE

- A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
 - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 - 3. Concrete: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 - 4. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 - 5. Proceed with patching after construction operations requiring cutting are complete.
- C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections.
 - 1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
 - 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
 - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
 - b. Restore damaged pipe covering to its original condition.

CUTTING AND PATCHING

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 4. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
 5. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
- D. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

END OF SECTION

CONSTRUCTION WASTE MANAGEMENT

1.1 SUMMARY

- A. It is the intent of the Owner that, to the greatest extent practical, possible, and cost effective, waste generated during construction will be reused or recycled. In addition, all non-usable items or materials will be disposed of in the most environmentally sensitive manner as defined or approved by the Owner.

1.2 WASTE MANAGEMENT GOALS

- A. Reuse or Recycle waste materials produced as a result of this Project in order to minimize the impact of construction waste on landfills and to minimize the expenditure of energy and cost in fabricating new materials.
- B. Implement the Owner's waste management plan for Work performed on this Project. Outlined herein are examples of materials which can be reused or recycled.

1.3 WASTE MANAGEMENT PLAN

- A. Reuse or recycle debris generated as a result of Work performed on the Project when practical and cost effective.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 ON-SITE MATERIALS SORTING AND STORAGE DURING CONSTRUCTION

- A. Each recycling facility and waste processor has requirements as to the way materials must be prepared to be accepted and to what degree materials can be contaminated. In most cases materials will need to be source-separated at the job site.
- B. Work with a local hauler to provide separate containers for the following materials:
 - 1. Wood.
 - 2. Metals (ferrous and non-ferrous).
 - 3. Cardboard.
 - 4. Gypsum board.
 - 5. Concrete.
 - 6. Office paper.
 - 7. Plastics.

CONSTRUCTION WASTE MANAGEMENT

- 8. Glass.
- 9. Carpet.
- C. The above listed wastes are required to be recycled. Follow source-separation requirements for each waste and use the appropriate on-site container for each waste. Provide a separate container for nonrecyclable materials.
- D. Rebates, if any, will be paid or credited by the hauler/recycler to the Contractor.
- E. Inform field personnel and subcontractors about the recycling program and continuously monitor the program to verify proper source-separation to avoid contamination of the recyclable materials. Provide subcontractors, through the hauler, with on-site containers to facilitate recycling.

END OF SECTION

CLOSEOUT PROCEDURES

PART 1 GENERAL

1.1 SUMMARY

- A. This Section includes special procedures and Work described as part of project closeout, and a description of closeout submittals such as record drawings, operation manuals, and warranties.
- B. Electronic Submittals: All submittal documentation and procedures detailed in this specification section that lend themselves to transfer by digital electronic media may be submitted in an electronic format as approved by the Architect.

1.2 SYSTEM DESCRIPTION

- A. When the Contractor considers the Work substantially complete, he shall submit to the Architect a written notice that the Work (or designated portion thereof) is substantially complete, together with a list of minor work to be completed or corrected. Within a reasonable time after receipt of this notice, the Architect will make an inspection to determine the actual status of completion.
- B. Should the Architect determine that the work is in fact not substantially complete, he will promptly notify the Contractor in writing, giving the reasons. The Contractor shall remedy the deficiencies in the Work, and send a second written notice of Substantial Completion to the Architect.
- C. When the Architect concurs that the Work is substantially complete, he will:
 - 1. Notify the Owner of, and accompany the Owner on, an inspection of the Project.
 - 2. Prepare a Certificate of Substantial Completion on AIA Form G704, accompanied by Contractor's list of items to be completed or corrected, as verified and amended by the Architect and the Owner.
 - 3. Submit the Certificate to the Contractor and the Owner for their written acceptance of the responsibilities assigned to them in the Certificate.
- D. The Contractor will be allowed no longer than 30 calendar days from the date of Substantial Completion to request that the Architect make his final inspection for acceptance as final completion.
- E. When the Contractor considers the Work complete, he shall submit a letter to the Architect stating that the Contract Documents have been reviewed, and that the Work has been inspected for compliance with Contract Documents.
 - 1. Submission implies that the Contractor has, to the best of his knowledge, completed the Work in accordance with the Contract Documents, including "punch list" items, that equipment and systems have been tested in the presence of the Owner and are operational, and that the Work is completed and ready for final inspection and for certificate of occupancy by the local code enforcement agency.
 - 2. The Architect will make an inspection to verify the status of completion with reasonable promptness after receipt of the Contractor's letter.

CLOSEOUT PROCEDURES

- F. If the Architect considers the Work incomplete or defective, he will promptly notify the Contractor in writing, listing the incomplete or defective Work, and send a copy to the Owner. The Contractor shall then take immediate steps to remedy the stated deficiencies, and send second written notice indicating that the Work is complete, whereupon the Work will be reinspected. When the Project is determined to be acceptable under the Contract Documents, the Contractor may proceed with closeout submittals.

1.3 SUBMITTALS

- A. Submittal Log: Comply with the following:
1. Prior to Substantial Completion, provide an electronic spreadsheet log listing all closeout deliverables required including contractor's record drawings, warranties, shop drawings, product data, extra stock, training and O&Ms.
- B. Submittals: Submittals shall be transmitted for review by Architect and Owner via eBuilder manage software.
- C. Record Drawings and Specification: Comply with the following:
1. Number of Copies: Submit copies of Record Drawings as follows:
 - a. Initial Submittal: Submit digital documents vis eBuilder.
 - b. Final Submittal: Submit one digital copy of drawings and specification in PDF format.
- D. Record Product Data: Submit one copy of each Product Data submittal, including but not limited to paint colors, brands and types; manufacturer's names, styles and colors of all finish products.
1. Final Submittal: Submit one set of marked-up Record Product Data, and one digital copy in PDF format.
 2. Where Record Product Data is required as part of operation and maintenance manuals, submit marked-up Product Data as an insert in manual instead of submittal as Record Product Data.
- E. Evidence of compliance with requirements of governing authorities including the certificate of occupancy, and certain other certificates of inspection and use permits such as mechanical and electrical equipment.
- F. Schedules and Reports: Finalized copies of schedules and reports submitted under Division 1 Section "Submittal Procedures."
- G. Operations and Maintenance Manuals:
1. Operation instructions and maintenance data, including maintenance personnel instructions, service manuals, and specifications, to be bound in black 3-ring binders, indexed with dividers, for a legible, permanent reference. Submit through eBuilder for

CLOSEOUT PROCEDURES

review and approval, and submit one final approved copy which shall include the following information:

- a. Binder covers with title "Operations and Maintenance Manuals," the title of the Project, and subject matter of the binder when multiple binders are used.
 - b. Name, address, and phone number of the firm/person who installed the equipment or system.
 - c. Name, address, and phone number of the nearest service facility authorized by the manufacturer.
 - d. Complete technical information, such as electrical and mechanical schematics, diagrams, parts lists, data sheets, connection details, and similar data.
 - e. Operating instructions such as start up procedures, inspection and maintenance routines.
 - f. If standard product literature covers more than one model type, the correct model number and data for the item installed shall be neatly checked off in ink.
 - g. If the system or equipment is unique, custom written information shall be provided.
- G. Letter certifying no products or materials containing lead or asbestos were used in the project.
- H. All warranties and bonds.
- I. Keys and keying schedule.
- J. Spare parts and extra stock.
- K. Evidence of payment, release of liens and final wage certificates.
- L. Certificate of insurance for products and completed operations.
- M. Final payment and release of retainage will be withheld until all closeout submittals have been received and approved by the Owner.

1.4 COORDINATION

- A. Where operation and maintenance documentation includes information on installations by more than one factory-authorized service representative, assemble and coordinate information furnished by representatives and prepare manuals.
- B. Commissioning Authority Review:
 - 1. Prior to substantial completion, the Commissioning Authority (CA) reviews the O&M manuals for systems that were commissioned. The manuals are reviewed for

CLOSEOUT PROCEDURES

completeness and for adherence to the requirements of the specifications. The CA will communicate deficiencies in the manuals to the Owner.

2. Materials may be added, or requested from the Contractors and design/build contractors, to stress and enhance the importance of system interactions, troubleshooting, and long-term preventative maintenance and operation. This work does not supercede the Architect and Owner's review of the O&M manuals.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 INSTRUCTION

- A. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
- B. Schedule as many training sessions as necessary with the maintenance personnel prior to any occupancy of the building. Cover topics such as system start-up, operation, and maintenance procedures. Training sessions shall be conducted by the appropriate subcontractors, with assistance from the Contractor.

3.2 DEMONSTRATION AND TRAINING DVD'S

- A. General: Engage a qualified commercial photographer to record demonstration and training DVD's. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.
 1. At beginning of each training module, record each chart containing learning objective and lesson outline.
- B. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to show area of demonstration and training. Display continuous running time.
- C. Narration: Describe scenes on videotape by dubbing audio narration off-site after DVD is recorded. Include description of items being viewed. Describe vantage point, indicating location, direction (by compass point), and elevation or story of construction.

3.3 CLEANING

- A. Remove demolition debris, excess construction materials, and construction equipment.
- B. Floors and Pavements:
 1. Interior floors and pavements shall be vacuum cleaned or swept with a hair push broom.

CLOSEOUT PROCEDURES

2. All exterior pavements used during the construction process shall be swept clean with a heavy fiber push broom or power sweeper.
- C. Finished building surfaces and appurtenances shall be clean, free from labels, stains, and soil of all kinds wherever located.
- D. Hardware shall have paint and dirt marks removed. It shall be polished and in perfect operation and adjustment.
- E. Fixtures and equipment shall be clean and in perfect operation and adjustment.

END OF SECTION

DEMOLITION

PART 1 GENERAL

1.1 SUMMARY

- A. Furnish labor, material and equipment required for the demolition and removal of existing walls, ceilings, and other material as required preparatory to remodeling.
- B. Scope of demolition and removal work is shown on the Drawings.

1.2 PROJECT CONDITIONS

- A. Existing Conditions: Verify existing conditions at the site and include all work evident by site inspection whether or not shown on the Drawings. Include demolition that is implied or consequential to other trades to achieve the intended results.
- C. Notify the Architect in advance of cutting or alteration which may affect the structural safety of any portion of the project.
- D. All material and debris resulting from demolition Work shall become property of the Contractor and be removed from the site at Contractor's expense.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 EXAMINATION

- A. Inspect the work to determine condition of existing building and amount of existing materials and debris to be removed.

3.2 PREPARATION AND COORDINATION

- A. Utilities: Coordinate demolition work with affected electrical and mechanical crafts. Completely remove all existing utility services which are not a part of new work or designated to remain. Save and protect existing utilities shown to remain. Notify Architect at once if unknown utilities are found in the work.
- B. Laws and Ordinances: Comply with the applicable laws and ordinances governing the disposal of debris on or off the site, and commit no trespass on any public or private property in any operation due to or connected with demolition.

3.3 DEMOLITION PROTECTION

- A. Existing Facilities: Protect adjacent walkways, building entries, and other building facilities during demolition operations.

DEMOLITION

- B. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during demolition and cleaned and reinstalled in their original locations after demolition operations are complete.
- C. Salvaged Items for Reuse in the Work: None required.
- D. Existing Utilities: Maintain utility services indicated to remain and protect them against damage during demolition operations.
 - 1. Do not interrupt existing utilities serving adjacent occupied or operating facilities unless authorized in writing by Owner.
 - 2. Provide temporary services during interruptions to existing utilities, as acceptable to Owner.
- E. Temporary Protection: Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise from portions of the building that are outside the scope of this Project.

3.4 DEMOLITION, GENERAL

- A. General: Demolish indicated portions of existing building as detailed. Include demolition that is implied or consequential to other trades to achieve the intended results. Use methods required to complete the Work within limitations of governing regulations and as follows:
 - 1. Do not use cutting torches until work area is cleared of flammable materials. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
 - 2. Maintain adequate ventilation when using cutting torches.

3.5 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
 - 1. Do not allow demolished materials to accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn demolished materials.

3.6 ASBESTOS REMOVAL

- A. The areas designated for demolition may contain hazardous materials that will be removed by other contractors outside the scope of this contract. Coordinate through the Owner the sequencing of hazardous material abatement and demolition so as not to delay the Project.

END OF SECTION

METAL FABRICATIONS

PART 1 GENERAL

1.1 SUMMARY

- A. Examine Drawings for required items and furnish in sizes, number, and kind to complete the Work.
- B. The General Structural Notes shall be used in conjunction with these specifications. The General Structural Notes shall supersede items in this specification when discrepancies exist.
- C. Shop fabricate miscellaneous steel, including brackets, railings, angles, anchors, supports, and other items as detailed for support or connection of other Work.
- D. Furnish items to other trades when setting and installation is part of their Work.
- E. Related Section: Division 9 Section "Painting."

1.2 REFERENCES

- A. American Institute of Steel Construction (AISC).
- B. American Society for Testing and Materials (ASTM).
- C. The Society for Protective Coatings (SSPC).
- D. National Association of Corrosion Engineers International (NACE International).
- E. International Code Council (ICC).
- F. Occupational Safety and Health Administration (OSHA).
- G. International Building Code (IBC).
- H. American Welding Society (AWS).

1.3 SUBMITTALS

- A. Submit the following in accordance with Division 1 Section "Submittal Procedures."
- B. Shop drawings showing dimensioned details of all components. Cross-reference shop drawing details to detail numbers on the Drawings to facilitate checking.
- C. Welding Certificates: Copies of certificates for welding procedures and personnel.
- D. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

METAL FABRICATIONS

1.4 QUALITY ASSURANCE

- A. Handrails, guardrails, and ladders shall conform to OSHA standards and IBC requirements.
- B. Fabricator Qualifications: A firm experienced in producing metal fabrications similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- C. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1, "Structural Welding Code – Steel."
 - 2. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

1.5 PROJECT CONDITIONS

- A. Field Measurements:
 - 1. Check actual locations of walls and other construction to which metal fabrications must fit by accurate field measurements before fabrication. Show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 2. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with fabricating products without field measurements. Coordinate construction to ensure that actual dimensions correspond to guaranteed dimensions.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Product manufacturers are listed in Paragraph 2.2, Materials.
- B. Other Manufacturers: Submit Substitution Requests prior to bid date in accordance with Division 1 Section "Product Requirements."

2.2 MATERIALS

- A. Metal Surfaces, General: For metal fabrications exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- B. The following is a list of items needed for the construction of the building as specified and constitutes a description of the type of materials necessary to fabricate such items. However, it does not preclude that each individual item on the job is herein listed. It is the responsibility of this Section to completely furnish all items as detailed.
 - 1. Flat Bar: ASTM A36, standard rolled section of size and weight fabricated as detailed.

METAL FABRICATIONS

2. Steel Tubing: ASTM A500, Grade B, structural steel tubing in size, weight, and wall thickness fabricated as detailed.
3. Plates, Clips, Hangers, and Brackets: ASTM A36, standard rolled shapes and sections fabricated to sizes and dimensions as detailed.
4. Fasteners: Provide zinc-coated fasteners with galvanizing complying with ASTM A 153 as noted on drawings and elsewhere in the specifications. Select fasteners for the type, grade and class required for the installation of miscellaneous metal items. Fasteners to be as follows:
 - a. Nails: ASTM F1667
 - b. Wood Screws: Furnish wood screws as detailed. ASTM D1761
 - c. Tapping Screws: ASTM C1513
 - d. Lag Bolts: ANSI B18.2.1
 - e. Standard Bolts: Steel bolts complying with ASTM A 307, Grade A, with ASTM A 563 hex nuts and flat washers.
 - f. High Strength Bolts: ASTM A325, regular hexagon head
 - g. Nuts: ASTM A563
 - h. Washers: Under head and nut in all wood connections. ASTM F844 with A307 bolts, ASTM F436 with A325 bolts
 - i. Finish: Furnish hot-dip galvanized finish when installed with galvanized items.
5. Threaded Concrete Anchors:
 - a. Description: Zinc plate finish, interior use only.
 - b. Manufacturers: "Titen HD" by Simpson Strong-Tie, Inc., "Kwik HUS-EZ" by Hilti.
6. Expansion Anchors for fastening to concrete:
 - a. ICC approved, zinc plate finish.
 - b. Manufacturers: "Kwik Bolt TZ" by Hilti, "Trubolt+" by ITW Red Head, "Strong-Bolt 2" by Simpson Strong-Tie.
7. Handrails and Guardrails: 1-1/2-inches o.d., ERW or DOM round mechanical tubing, 0.156-inch wall thickness, for general areas fabricated as detailed. Other sizes as noted. All connections penetration welded using back-up sleeve welding connectors, include end returns to wall and closure plates on open ends. All welds ground smooth and flush.

METAL FABRICATIONS

Furnish complete with all fittings, brackets, sleeves and hardware required for installation.

8. VL-1, Vertical Ladder: FS Industries, 800-421-0314, "Fixed Steel Ladders-Series F," heavy duty one-piece welded assemblies, width and length as detailed. Gray factory powder coat paint finish.
 - a. Construction Features:
 - (1) Side members are 1/4"x2"x2" steel angle.
 - (2) Climbing rungs are 3/4" corrugated steel round rungs space on 12" centers.
 - (3) Stand-off brackets are 7".
9. CVL-1, Caged Vertical Ladder: FS Industries, 800-421-0314, "Fixed Steel Ladders-Series M Modular Fixed Ladders," heavy duty welded sub-assemblies, width and length as detailed. No section is greater than 7-feet in length. Gray factory powder coat paint finish.
 - a. Construction Features:
 - (1) Side members are 1/4"x2"x2" steel angle.
 - (2) Climbing rungs are 3/4" corrugated steel round rungs space on 12" centers.
 - (3) Stand-off brackets are 7".
 - b. Cage Features:
 - (1) OSHA design safety cages have flared bottom opening for easy entry.
 - (2) Cage begins 7-feet (series M) from bottom rung, and is factory welded to the ladder.
10. Catwalk Guardrails: Unistrut Commercial, 800-882-5543, P-6000 channel and accessories as detailed.
 - a. Design:
 - (1) Gage: The metal framing fittings shall be light weight and high strength. The standard connection fitting gage shall be 5mm (0.197 nominal) gage.
 - (2) Standard fitting connections: Metal Framing fittings shall be provided with fastener connection holes no larger than 7/16" nominal dia. to accommodate 3/8" diameter fasteners.

METAL FABRICATIONS

- (3) Other Connections: Where 1/2" connections are required for trapeze drops or other similar installations, reduced gage nuts shall be employed, however nut performance in slip resistance and pull-out strength shall be equivalent to the MFMA standard requirement (latest edition) for the bolt thread size required.
- b. Products: Manufacture, Testing and Certification.
 - (1) The metal framing system shall be constructed from press and roll-formed products produced by a single manufacturer. Products produced through other processes by third party partners (castings, fasteners, etc) shall be tested and certified by the metal framing fittings manufacturer.
 - (2) All channel nuts shall be case hardened employing a heat treat and oil quench process to ensure consistent slip resistance.
 - (3) All metal framing fittings shall be load rated by specific part numbers. The test set-up shall be with force applied vertical-down, beam load testing with fittings used in pairs. Test results including test set-up pictorials for fittings shall be available for submittal and review at the discretion of the Architect. Allowable design loads shall be established based upon minimum safety factors applied to ultimate failure loads:
 - (4) Standard bolted connection fittings2.5 S.F.
 - (5) Pipe Clamps5 S.F.
 - (6) Beam Clamps5 S.F.
 - (7) Channel Nuts3 S.F.
 - (8) Certified test results shall be available and provided if requested by the Architect.

2.3 FABRICATION

- A. Examine Drawings for required items and furnish in sizes, number and kind to complete the Work.
- B. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- C. Form metal work to required shapes and sizes, with true curves, lines and angles. Provide components in sizes and profiles indicated, but not less than required to comply with requirements indicated for structural performance or, if not indicated, to comply with requirements of authorities having jurisdiction and with structural properties to sustain safety or withstand loads to which normally subjected.

METAL FABRICATIONS

- D. Provide necessary rebates, lugs, and brackets for assembly of units. For Work exposed to view, use concealed fasteners unless indicated as exposed fasteners or welded joints, or unless otherwise indicated on final shop drawings.
- E. Mill all exposed joints to a tight, hairline fit, flush and smooth. Miter exposed corner joints as indicated and machine fit to hairline joint. Joints shall be securely and neatly tenoned, drawn together using concealed fasteners. Locate joints where indicated or accepted on final shop drawings.
- F. Cut shapes to pattern, sizes, and dimensions as detailed and approved. Punch and drill holes accurately, maintaining proper edge and end clearance and proper diameter to fit each fastening. Countersink holes for flat head wood screws.
- G. Ease exposed edges to a radius of approximately 1/32 inch (1 mm), unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- H. Weld corners and seams continuously to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
- I. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- J. Furnish and shop assemble all items true to measurements taken at the job, disassembled and ship to the job, complete with all sleeves, bolts, etc., necessary for erection.
- K. Mark each member or assembly of members with erection marks for identification; furnish an erection diagram with marks as detailed. Ship assembled units in such a manner that they may be transported and unloaded without being excessively stressed, deformed or otherwise damaged. Place fabricated material on skids, off the ground; keep clean and properly drained.
- L. All welding performed by AWS certified welders and in accordance with AWS D1.1. Perform welding, brazing, and soldering such that surface exposed to view in completed Work will be free of pitting, runs, spatter, cracks, warping, dimpling, depressions, distortion, discoloration and other imperfections. Grind exposed welds to match adjacent finish. Welds shall not be visible on finished surface.
- M. Grind exposed ends and cut edge of all items smooth and slightly beveled to remove sharpness, burrs, and cutting marks. Use gas cutting torch in the field to cut holes or correct fabrication errors only after submitting each condition to Architect for review.
- N. Fabrication tolerance for flat surface shall be $\pm 1/32$ -inch in 2-feet measured in every direction at any location with no evidence of oil canning.

METAL FABRICATIONS

- O. Separate dissimilar metals fabricated under this Section and metals of this Section that contact metals of other construction with separator recommended by fabricator to prevent corrosion and galvanic action. Do not extend coating onto exposed surfaces.

2.4 STEEL FINISHES

- A. One shop coat rust inhibiting primer paint on all items whether concealed or exposed, except do not prime surfaces within 2-inches of welds.

PART 3 EXECUTION

3.1 ERECTION

- A. Furnish items to other trades when setting and installation is part of their Work.
- B. Do not set permanent bolting or welding until as much of the assembly as will be stiffened thereby has been properly aligned and within tolerances.
- C. 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.
- D. Set steel elements accurately to the lines and elevations indicated. Align and adjust the various members before permanently fastening. Clean bearing surfaces and other surfaces which will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
- E. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- F. Field Welding: Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- G. At completion of erection, grind exposed welds smooth, touch-up paint field bolts and welds and abrasions with the same paint used for shop painting or galvanized repair paint on galvanized items.

METAL FABRICATIONS

END OF SECTION

ROUGH CARPENTRY

PART 1 GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, equipment, and services necessary for the installation of all rough carpentry.
- B. The General Structural Notes shall be used in conjunction with these specifications. The General Structural Notes shall supersede items in this specification when discrepancies exist.

1.2 REFERENCES

- A. American Institute of Timber Construction (AITC).
- B. American Lumber Standards Committee (ALSC).
- C. American National Standards Institute (ANSI).
- D. American Society for Testing and Materials (ASTM).
- E. American Wood Preservers' Association (AWPA).
- F. APA - The Engineered Wood Association.
- G. International Code Council (ICC).
- H. Voluntary Product Standard (PS).
- I. West Coast Lumber Inspection Bureau (WCLIB).
- J. American Forest and Paper Association (AF&PA).
- K. Western Wood Products Association (WWPA).

1.3 SUBMITTALS

- A. Submit the following in accordance with Division 1 Section "Submittal Procedures."
- B. Composite wood manufacturer certification of compliance with requirement for no added urea-formaldehyde resins in composite wood products.

1.4 QUALITY ASSURANCE

- A. Materials shall be grade stamped equal to or better than the grades hereinafter called for according to the following associations governing their various species of lumber products:
 - 1. American Institute of Timber Construction (AITC).
 - 2. APA - The Engineered Wood Association.

ROUGH CARPENTRY

3. Unless otherwise noted, moisture content of material shall conform to WCLIB Rule No. 16, General Grading Provisions, Paragraph 3, Seasoning Provisions.
- B. Treated Lumber: Inspection of material for conformity to the requirements of this specification shall be in accordance with AWPAs Standard M2, Standard for Inspection of Treated Timber Products.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Wrap, cover, and protect lumber products in shipment and while stored on site to prevent weather exposure and damage. Maintain stocks neat and in good order, level and off ground or floors, raised on pallets or dunnage to prevent contact with water.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Product manufacturers are listed in Paragraph 2.2, Materials.
- B. Other Manufacturers: Submit Substitution Requests prior to bid date in accordance with Division 1 Section "Product Requirements."

2.2 MATERIALS

- A. Framing Lumber:
 1. Structural Light Framing: WWPAs No. 2, kiln dried, Douglas-fir/larch.
- B. Treated Lumber:
 1. Decay Resistance-Treated Lumber: No. 2 S4S Douglas-fir, shall be pressure-treated with ammoniacal copper quaternary (ACQ) or copper azole (CA) in accordance with AWPA Standard U1, minimum Use Category UC2. All pressure-treated lumber shall bear the AWPA Use Category quality mark. Lumber marked "treatment to point of refusal" is not acceptable.
 - a. ACQ Products: "Nature Wood" by Osmose, 800/241-0240; "ACQ Preserve" by Chemical Specialties, Inc., 800/421-8661.
 - b. CA Products: "Natural Select" by Arch Wood Protection, Inc., 866/789-4567.
- C. Plywood Underlayment: 1/2-inch thick, Group 1, APA Exposure 1, Underlayment Grade plywood.
- D. Underlayment Nails: Six penny (6d) ring shank nails.
- E. Separation Felt: Fortifiber "Aquabar B," grade B building paper.
- F. Framing Connectors:

ROUGH CARPENTRY

1. ICC approved stock framing connectors, G90 galvanized ASTM A653, (G185 galvanized ASTM A653 or Type 304 stainless steel in contact with treated lumber), rated according to recorded tests. Provide special framing anchor nails as required and other fastenings as detailed and normal for installation.
 2. Manufacturers: K.C. Metals "Superspeed Connectors," Silver, and Simpson Strong Tie.
- G. Fasteners:
1. Power-Driven Fasteners: NES NER-272.
 2. Lag Bolts: ASME B18.2.1.
 3. Nails, Brads, and Staples: ASTM F 1667.
 4. Wood Screws: ASME B18.6.1.
 5. Type S-12 screws, bugle or pan head as required, ASTM C954.
 6. Bolts: Steel bolts complying with ASTM A 307, Grade A, with ASTM A 563 hex nuts and, where indicated, flat washers.
 7. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
 - a. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
 - b. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2, for use with treated lumber.
- H. Construction Adhesive:
1. Water dispersed industrial adhesive.
 2. Manufacturers: 3M Co. "Scotch-Grip" 1357.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Framing Standard: Comply with AF&PA's "Details for Conventional Wood Frame Construction," unless otherwise indicated.

ROUGH CARPENTRY

- B. Metal Framing Anchors: Install metal framing anchors to comply with manufacturer's written instructions.
- C. Do not splice structural members between supports, unless otherwise indicated.
- D. Cut and repair framing where required by electrical, mechanical or other mechanics throughout the job. Boring of holes for pipes and conduits not included. Where cutting is required in a structural member that is likely to weaken the construction, consult with the Architect as to the measures taken in order to perform the work without causing any deficiencies of strength or workmanship. Close all openings with incombustible material where pipes and ducts pass through framing.
- E. Accurately fit all connections as detailed, all bolt holes drilled and properly sized to the bolts. Predrill lag and wood screw holes. Washers required under head and nut of all wood connections.
- F. Plates: Use pressure-preservative-treated plates in all conditions where bearing on concrete. Double top plate on all partitions with end joints lapped and staggered. Reinforce top plates where cut for electrical and mechanical work with 16 gauge metal splice plates.
- G. Studs, Caps and Headers: Use straight material throughout; twisted material not permitted. Set all items as necessary for rigid frame.
- H. Joists: All joists evenly spaced.
- I. Joist Bridging: Unless specifically noted on the Drawings, intermediate joist bridging not required where joists ends are prevented from rotation by solid blocking or an approved joist hanger. The top of each joist laterally supported by structural nailing of sheathing and sheathing nailed to blocking at ends of joists, and temporary support provided during construction.
- J. Headers: Install over all openings. Fabricate from two or more members on edge with shims as required, spike solidly together. Install stud and cripple minimum at each rough jamb. Minimum schedule unless otherwise noted on Drawings.
 - 1. Up to 4-feet inclusive: Two 2 x 6.
 - 2. 4-feet to 6-feet inclusive: Two 2 x 8.
 - 3. 6-feet to 8-feet inclusive: Two 2 x 10.
 - 4. Over 8-feet: As detailed.
- K. Firestops and Blocking:
 - 1. Install as detailed and in no case more than 120-inches apart vertically and horizontally, in exterior and interior wood stud walls throughout. Fire block at ceiling line where wall finish does not continue above ceiling.

ROUGH CARPENTRY

- L. Wood Contacting Concrete: Wherever joists, beams, etc., make end or side contact against concrete or masonry walls and slabs, install separation felt so there will be no contact between wood and concrete.
- M. Treated Wood Contacting Metal: Wherever decay-resistant treated wood comes in contact with any type of metal, install one layer of separation felt so there will be no contact between wood and metal.
- N. Subfloor Structural-Use Panels:
 - 1. Secure sheathing panels with nail size and pattern as detailed. Lay panels with face grain perpendicular to the supports with joints in adjacent panels staggered and butted at center line of joists.
 - 2. Apply 1/4-inch diameter continuous bead of construction adhesive to tops of joists, blocking, and plates immediately prior to placing subfloor panels.
 - 3. Install subfloor panels with 1/8-inch space between sheets and clearance at boundary walls and rigid penetrations through floor.
- O. Underlayment:
 - 1. Lay building paper over subfloor, fastening in place with staples driven flush. Install underlayment over building paper with staggered panel joints so that the four corners of the underlayment do not meet directly over the corners or joints of the subfloor.
 - 2. Nail with six penny (6d) ring shank nails spaced no more than 8-inches o.c. at the panel edges and at 8-inches each way throughout the body of the panel. Nails shall not penetrate framing. Adjust nail spacing to meet finish floor material manufacturer's requirements if more stringent.
- P. Blocking and Backing: Verify that solid blocking or backing is provided in framing for attachment of all wall and ceiling mounted items and equipment. Coordinate specific blocking requirements of all items specified in each specification Section that mount on walls and ceilings. Use templates and fastening devices furnished with item or appropriate screws and bolts. Check Hardware Schedule for locations of wall-mounted door bumpers. Do not fasten solely to wall and ceiling finish materials.
- Q. Deflection Head Construction: Required at the top of all non-bearing wall partitions that occur under open-web type framing members. Allow 3/4-inch space between top plate of wall and bottom truss chord for deflection tolerance.
- R. Fasteners in Withdrawal: Non-structural wood components held in place with fasteners that would be in withdrawal loading after the final assembly is complete shall be fastened with bugle head screws with the same frequency as scheduled for nails. Screws shall be minimum length to penetrate substrate 1-1/2-inches.

END OF SECTION

FINISH CARPENTRY

PART 1 GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, equipment, and services necessary for the installation of finish carpentry.
- B. Related Section: Related Section: Division 9 Section "Painting" for finishing of wood products.

1.2 REFERENCES

- A. Architectural Woodwork Quality Standards (AWS): Architectural Woodwork Standards, Guide Specifications and Quality Certification Program, Edition 1, adopted and published jointly by Architectural Woodwork Institute, Architectural Woodwork Manufacturers Association of Canada and The Woodwork Institute.
- B. Western Wood Products Association (WWPA).

1.4 QUALITY ASSURANCE

- A. Quality Grade: Unless otherwise specified, perform work and provide products in accordance with AWI/AWMAC/WI Architectural Woodwork Standard (AWS), Custom Grade.
- B. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.
 - 1. Single Source Responsibility: Provide and install this work from single fabricator.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Storage and Protection: Protect finish materials from dirt and moisture during delivery and while stored on the job. Store at site in a protected dry area with heat and ventilation as required to keep lumber dry. Do interior work only in areas where wet work has been completed and work area is dry, heated and ventilated.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Product manufacturers are listed in Paragraph 2.2.
- B. Other Manufacturers: Submit Substitution Requests prior to bid date in accordance with Division 1 Section "Product Requirements."

2.2 MATERIALS

- A. Softwood Finish Lumber: WWPA Finish Grade (graded one face and two edges) "Superior" spruce, kiln dried.

FINISH CARPENTRY

- B. Moisture Content: Kiln dry finish lumber and molding to 15% maximum moisture content.
- C. Nails: Finish nails for all face nailing at wood framing. Use nail size as required for material and in lengths necessary to penetrate solid framing.
- D. Adhesive: Marsh, Miracle Adhesive, 3M Co., or U.S. Plywood Weldwood.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Workmanship: Work to AWS Custom Grade standards throughout. Finish sand all work and leave smooth and dirt free, without blemishes visible through finishes as scheduled. Remove and replace or resurface all work showing hammer marks, splits, tool marks, torn grain, and other appearance of defective workmanship as directed by Architect.
- B. Cutting, Fitting and Jointing: Install standing and running trim and boards in one-piece continuous lengths wherever practical with no spliced piece less than 6-feet long. Scarf end splices and make inconspicuous, with end grains matched if work is transparent finished. Miter outside intersecting corners of trim and molding, cope inside corners. Miter and return at exposed ends of trim to conceal end grain.
- C. Nailing: Set heads for putty stopping.

END OF SECTION

ARCHITECTURAL WOODWORK

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes but is not necessarily limited to the following architectural millwork:

1. Plastic Laminate countertop in Control Booth.

1.2 REQUIREMENT OF REGULATORY AGENCIES

A. Comply with all national, state and local codes including:

1. Building codes.
2. Environmental codes.
3. Codes of any other regulatory agency having jurisdiction.

1.3 REFERENCES

A. Standards: The following referenced standards and standard specifications, referred to thereafter by designation only, form a part of this Section.

1. American National Standards Institute (ANSI):
 - a. ANSI A208.1-1987, Mat-Formed Wood Particleboard.
 - b. ANSI A208.2-1980, Medium Density Fiberboard for Interior Use.
 - c. ANSI/AHA A135.4-1982, Basic Hardboard.
2. American Society for Testing and Materials (ASTM):
 - a. E84-89a, Test Method for Surface Burning Characteristics of Building Materials.
3. Architectural Woodwork Quality Standards (AWS): Architectural Woodwork Standards, Guide Specifications and Quality Certification Program, Edition 1, adopted and published jointly by Architectural Woodwork Institute, Architectural Woodwork Manufacturers Association of Canada and The Woodwork Institute.
4. National Particleboard Association (NPA):
 - a. NPA 8-86, Voluntary Standard for Formaldehyde Emission from Particleboard.
 - b. NPA 9-87, Voluntary Standard for Formaldehyde Emission from Medium Density Fiberboard (MDF).
5. National Electrical Manufacturers Association (NEMA): NEMA LD 3-91, Application, Fabrication, and Installation of High-Pressure Decorative Laminates.

ARCHITECTURAL WOODWORK

6. Hardwood Plywood and Veneer Association (HPVA): ANSI/HPVA HP-1-2009, American National Standard for Hardwood and Decorative Plywood.
7. National Hardwood Lumber Association (NHLA).
8. U.S. Voluntary Product Standard (PS): U.S. Voluntary Product Standard PS 1-83, Construction and Industrial Plywood.
9. Western Wood Products Association (WWPA).

1.4 DEFINITIONS

- A. Exposed Surfaces: Surfaces visible when doors and drawers are closed; bottoms of casework more than 4-feet above finished floor, backs of hinged doors and edges of hinged doors exposed when opened, visible surfaces of open shelving and surfaces behind glass doors.
- B. Semi-Exposed Surfaces: Surfaces that become visible when drawers and doors are opened, tops of cases 6-feet, 6-inches or more above finished floor.
- C. Concealed Surfaces: Surfaces not visible after installation.

1.5 SUBMITTALS

- A. Submit the following in accordance Division 1 Section "Submittal Procedures."
- B. Shop Drawings:
 1. Submit shop drawings of woodwork showing location of each item, dimensioned plans and elevations, grain direction, large scale details, joints, sections and connections to adjacent work.
- C. Samples:
 1. Plastic laminate finished samples: Submit 4-inch x 4-inch of each pattern specified.
- D. Composite wood manufacturer certification of compliance with requirement for no added urea-formaldehyde resins in composite wood products.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Firm with at least 5 years experience in successfully producing architectural woodwork similar to that indicated for this Project, with sufficient production capacity to produce required units without causing delay in the Work.
- B. Single-Source Manufacturing and Installation Responsibility: Engage a qualified manufacturer to assume undivided responsibility for woodwork specified in this Section, including fabrication, finishing, and installation.
- C. Grade of Architectural Woodwork: Conform to AWS "Custom Grade" standards for material, fabrication and installation.

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- D. Solid surface materials (SURF) shall only be fabricated and installed by a professionally trained fabricator and/or installer for each material type. A detailed knowledge of the properties of each material and the proper installation practices is required to reduce the probability of improper installation.

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Storage: Storage areas shall be clean and the relative humidity held steady within 25% to 55%.

1.8 PROJECT CONDITIONS

- A. Verify dimensions before proceeding and obtain measurements at job site for work required to be accurately fitted to other construction. Measurements shall be accurate so that finished work is precisely assembled and fitted.
- B. Report unsatisfactory tolerances in adjoining work.
- C. Proceed with woodwork only after substrate construction and penetrating work have been completed and if necessary, corrected by other trades.

1.9 WARRANTY

- A. Woodwork: Provide one-year warranty agreeing to repair or replace work which is not in conformance with requirements of Contract Documents or work that becomes out of adjustment.

PART 2 PRODUCTS

2.1 SOLID LUMBER MATERIALS

- A. Wood Solid Stock:
 - 1. Custom Rolling Pocket Doors: Premium grade white maple.
- B. Blocking, Framing and Furring:
 - 1. Sound, thoroughly-seasoned, and free from warp that cannot be corrected in process of bridging or nailing. Use same species for members in any one assembly.
 - 2. Grades for framing materials: Conform to grading rules of The Softwood Manufacturer's Association for species of wood being used.

2.2 PLASTIC LAMINATE COUNTERTOP

- A. PLAM, High Pressure Plastic Laminate Faces: 0.030 grade NEMA Type 1 on exposed faces including open shelving. Balance back sheet 0.020-inches thick on concealed portion of work.
- B. PLAM Tops: 0.050 grade NEMA Type 1 on countertops and open shelves. Balance back sheet 0.020-inches thick on concealed portion of work.

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- C. PLAM Colors: Refer to Finish and Material Legend.
- D. Countertops Under High Pressure Laminate: 45 lb. density particleboard, 3/4-inch thick. Particleboard not permitted in sink counters.
- E. Cable Holes: Holes in countertops covered with high impact ABS cable hole covers with spring closure top, Hafele America Co. Series 429.99, color compatible with countertop. Equal products manufactured by Doug Mockett approved.

2.3 FABRICATION

- A. Fabrication:
 - 1. Comply with referenced AWS standards.
 - 2. Provide details and profiles indicated.
 - 3. Fabricate units rigid, neat, free from defects, warp or buckle in accordance with final shop drawings.
 - 4. Provide factory cutouts for openings in units as required to receive associated work.
 - 5. Assemble prefinished units at the factory to the greatest degree possible and disassemble only as required for shipping to the site. Accurately mark units for assembly at site.

PART 3 EXECUTION

3.1 INSPECTION

- A. Examine substrates and adjoining construction and conditions under which work will be installed. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Provide all necessary blocking, backing, framing, suspension, and other components necessary to provide a complete functioning system in the profile, dimensions, configurations, and materials indicated.
- B. Exposed Blocking: Install surface mounted wood blocking, nailers, furring and grounds as required for wall-hung cabinetry and other wall-hung items, whether or not such blocking and similar items are indicated on drawings.
- C. Unexposed Blocking: Unexposed internal blocking within the wall construction by others. Location of unexposed blocking to be determined by this trade.

ARCHITECTURAL WOODWORK

3.3 INSTALLATION

A. General:

1. Comply with AWS Sections 6-Interior and Exterior Millwork, 9-Doors, 10-Casework, and 11-Countertops, Custom Grade.
2. Install in accordance with final shop drawings and manufacturer's instructions.
3. Assemble and install work without machine and tool marks.
4. Neatly fit and scribe work to adjacent surfaces.

B. Countertops:

1. Install countertops straight, level and plumb.
2. Provide concealed grounds and anchor securely to walls.
3. Coordinate with electrical and plumbing requirements to provide openings at receptacles, switches and plumbing fixtures.

3.4 ADJUSTING AND REPAIR

- A. Before completion of work, adjust hardware until components operate properly.
- B. Replace defective, damaged or missing hardware.
- C. Touch-up marred finishes, including shop finishes to match adjacent surfaces.
- D. Remove and replace units which are warped, bowed, not properly fitted or finished or otherwise damaged.

3.5 CLEANING AND PROTECTION

- A. Clean work upon completion.
- B. Protect units during construction so that they will be without any evidence of damage or use at time of acceptance.

END OF SECTION

PENETRATION FIRESTOPPING

PART 1 GENERAL

1.1 SUMMARY

- A. This Section includes through-penetration firestop systems for penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items.
- B. Related Sections include the following:
 - 1. Division 21 Sections specifying fire-suppression piping penetrations.
 - 2. Division 22 and 23 Sections specifying duct and piping penetrations.
 - 3. Division 26, 27, and 28 Sections specifying cable and conduit penetrations.

1.2 PERFORMANCE REQUIREMENTS

- A. Products:
 - 1. Provide products that upon curing do not re-emulsify, dissolve, leach, breakdown, or otherwise deteriorate over time from exposure to atmospheric moisture, sweating pipes, ponding water or other forms of moisture characteristic during and after construction.
 - 2. When intumescent products are used, provide products that do not contain sodium silicate or any other water soluble intumescent ingredient in the formulation.
 - 3. Provide firestop sealants sufficiently flexible to accommodate motion such as pipe vibration, water hammer, thermal expansion and other normal building movement without damage to the seal.
 - 4. Pipe insulation shall not be removed, cut away or otherwise interrupted through wall or floor openings. Provide products appropriately tested for the thickness and type of insulation utilized.
 - 5. Fire rated pathway devices shall be the preferred product and shall be installed in all locations where frequent cable moves, add-ons and changes will occur. Such devices shall be:
 - a. Capable of retrofit around existing cables.
 - b. Designed such that two or more devices can be ganged together.
 - c. Maintenance free such that no action is required to activate the smoke and fire sealing mechanism.
 - 6. When mechanical cable pathways are not practical, openings within walls and floors designed to accommodate voice, data and video cabling shall be provided with re-enterable products specifically designed for retrofit.

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7. Penetrants passing through fire-resistance rated floor-ceiling assemblies contained within chase wall assemblies shall be protected with products tested by being fully exposed to the fire outside of the chase wall. Systems within the UL Fire Resistance Directory that meet this criterion are identified with the words "Chase Wall Optional."
 8. Provide fire-resistive joint sealants designed to accommodate a specific range of movement and tested for this purpose in accordance with a cyclic movement test criteria as outlined in Standards, ASTM E1966, or ANSI/ UL 2079.
 9. Provide penetration firestop systems, fire-resistive joint systems, or perimeter fire barrier systems subjected to an air leakage test conducted in accordance with Standard, ANSI/ UL1479 for penetrations and ANSI/UL2079 for joint systems with published L-Ratings for ambient and elevated temperatures as evidence of the ability of firestop system to restrict the movement of smoke.
 10. Provide T-Rating Collar Devices tested in accordance with ASTM E814 or ANSI/UL1479 for metallic pipe penetrations requiring T-Ratings per the applicable building code.
 11. Provide moisture-curing products where inclement weather or greater than transient water exposure is expected.
- B. 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.
- C. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per ASTM E 814 or UL 1479:
1. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.
 2. T-Rated Systems: For the following conditions, provide through-penetration firestop systems with T-ratings indicated, as well as F-ratings, where systems protect penetrating items exposed to potential contact with adjacent materials in occupiable floor areas:
 - a. Penetrations located outside wall cavities.
 - b. Penetrations located outside fire-resistance-rated shaft enclosures.

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3. L-Rated Systems: Provide firestop systems with L Ratings tested in accordance with ANSI/UL1479 (substitute ANSI/UL2079 for joints). For each 100 sq ft (9.3 m²) area, the total cumulative leakage of all firestop systems shall not exceed 50 CFM (0.024 m³/s).
- D. 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. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
 2. For floor penetrations with annular spaces exceeding 4 inches in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved, either by installing floor plates or by other means.
 3. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.
- E. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 50, respectively, as determined per ASTM E84, and that are paintable products that shall be finished to a smooth surface, flush with adjacent surfaces.

1.3 SUBMITTALS

- A. Submit the following in accordance with Division 1 Section "Submittal Procedures."
- B. Product Data: For each type of product required.
- C. Shop Drawings: For each through-penetration firestop system, show each type of construction condition penetrated, relationships to adjoining construction, and type of penetrating item. Include firestop design designation of qualified testing and inspecting agency that evidences compliance with requirements for each condition indicated.
 1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each through-penetration firestop system configuration for construction and penetrating items.
 2. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular through-penetration firestop condition, submit illustration, with modifications marked, approved by through-penetration firestop system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.
- D. Through-Penetration Firestop System Schedule: Indicate locations of each through-penetration firestop system, along with the following information:
 1. Types of penetrating items.

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2. Types of constructions penetrated, including fire-resistance ratings and, where applicable, thicknesses of construction penetrated.
 3. Through-penetration firestop systems for each location identified by firestop design designation of qualified testing and inspecting agency.
- E. Qualification Data: For Installer.
- F. Product Certificates: For through-penetration firestop system products, signed by product manufacturer.
- G. Product Test Reports: From a qualified testing agency indicating through-penetration firestop system complies with requirements, based on comprehensive testing of current products.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an installer with commercial experience, who is certified, licensed, and FM Global approved in accordance with FM Global 4991, "Approval of Firestop Contractors," or Certified by UL as a Qualified Contractor. A manufacturer's willingness to sell its firestopping products to Contractor or to an installer engaged by Contractor does not in itself confer qualifications on buyer.
- B. Certified and licensed company names and contact information for Oregon.
1. PCI ISSD/ Randy Johnson 503-519-4084
 2. Hudson Bay / Aaron Garcia 503-545-3367
 3. Western Partitions / Cody Rubric 503-519-4339
 4. PCI Interior division / Colin McCool 360-772-2747
 5. ICON (Insulation Contractors) / Alan Smith 360-823-1390
- C. Source Limitations: Obtain through-penetration firestop systems, for each kind of penetration and construction condition indicated, through one source from a single manufacturer.
- D. Fire-Test-Response Characteristics: Provide through-penetration firestop systems that comply with the following requirements and those specified in Part 1 "Performance Requirements" Article:
1. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL, or another agency performing testing and follow-up inspection services for firestop systems acceptable to authorities having jurisdiction.
 2. Through-penetration firestop systems are identical to those tested per testing standard referenced in "Part 1 Performance Requirements" Article. Provide rated systems complying with the following requirements:

PENETRATION FIRESTOPPING

- a. Through-penetration firestop system products bear classification marking of qualified testing and inspecting agency.
 - b. Through-penetration firestop systems correspond to those indicated by reference to through-penetration firestop system designations listed by UL in its "Fire Resistance Directory."
- E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."
 - 1. Contractor shall schedule a pre-installation conference with the building inspector to review proposed fire stopping products for the Project. Prior to the scheduled meeting the Contractor shall assemble product data for each firestopping assembly with a UL test report for each proposed assembly.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver through-penetration firestop system products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life if applicable, qualified testing and inspecting agency's classification marking applicable to Project, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials for through-penetration firestop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install through-penetration firestop systems when ambient or substrate temperatures are outside limits permitted by through-penetration firestop system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Ventilate through-penetration firestop systems per manufacturer's written instructions by natural means or, where this is inadequate, forced-air circulation.

1.7 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.
- C. Notify Owner's inspecting agency at least seven days in advance of through-penetration firestop system installations; confirm dates and times on days preceding each series of installations.
- D. Do not cover up through-penetration firestop system installations that will become concealed behind other construction until each installation has been examined by Owner's inspecting agency and building inspector, if required by authorities having jurisdiction.

PENETRATION FIRESTOPPING

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide through-penetration firestop systems appropriate for the penetration condition.
- B. Subject to compliance with through-penetration firestop systems (XHEZ) and/or joint systems (XHBN) listed in Volume 2 of the UL Fire Resistance Directory, provide products of the following manufacturers as identified below:
 - 1. Specified Technologies Inc., STI.
 - 2. Hilti Inc.
 - 3. 3M Fire Protection Products.
 - 4. Metacaulk.
 - 5. BioFireshield
 - 6. Spec Seal.

2.2 FIRESTOPPING, GENERAL

- A. Compatibility: Provide through-penetration firestop systems that are compatible with one another; with the substrates forming openings; and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.
- B. Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by through-penetration firestop system manufacturer and approved by qualified testing and inspecting agency for firestop systems indicated. Accessories include, but are not limited to, the following items:
 - 1. Permanent forming/damming/backing materials, including the following:
 - a. Slag-/rock-wool-fiber insulation.
 - b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
 - c. Fire-rated form board.
 - d. Fillers for sealants.
 - 2. Temporary forming materials.

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3. Substrate primers.
4. Collars.
5. Steel sleeves.

2.3 FILL MATERIALS

- A. General: Provide through-penetration firestop systems containing the types of fill materials by referencing the types of materials described in this Article. Fill materials are those referred to in directories of referenced testing and inspecting agencies as "fill," "void," or "cavity" materials.
- B. Cast-in-Place Firestop Devices: Single component molded firestop device installed on forms prior to concrete placement with totally encapsulated, tamper-proof integral firestop system and smoke sealing gasket.
- C. Intumescent Sealants: Single component intumescent latex formulations containing no water soluble intumescent ingredients capable of expanding a minimum 8 times.
- D. Endothermic Sealants: Single component latex formulations that upon cure do not re-emulsify during exposure to moisture.
- E. Elastomeric Sealants: Single component latex formulations that upon cure do not re-emulsify during exposure to moisture and accommodate minimum ± 25 percent movement.
- F. Firestop Devices: Factory-assembled steel collars lined with intumescent material capable of expanding a minimum 30 times sized to fit specific outside diameter of penetrating item.
- G. Fire Rated Cable Pathways: Gangable device modules capable of being retrofitted around existing cables and comprised of steel raceway with intumescent foam pads allowing 0 to 100 percent cable fill and requiring no additional action in the form of plugs, twisting closure, putty, pillow, or sealant to achieve fire and leakage ratings.
- H. Intumescent Composite Sheets: Intumescent material sandwiched between a galvanized steel sheet and steel wire mesh protected with aluminum foil capable of sustaining a minimum 2,500 lbs (1,134 kg) when subjected to load.
- I. Intumescent Putties: Intumescent, non-hardening, water resistant, butyl rubber based putties containing no solvents, inorganic fibers or silicone compounds.
- J. Wall Opening Protective Materials: Intumescent, non-curing pads or inserts for protection of electrical switch and receptacle boxes to reduce horizontal separation to less than 24" (610 mm).
- K. Intumescent Wrap Strips: Single component intumescent elastomeric strips faced on both sides with a plastic film and capable of expanding a minimum 30 times.
- L. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.

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- M. Pillows/Bags: Re-enterable, non-curing, mineral fiber core encapsulated with an intumescent coating on all six sides contained in a flame retardant poly bag.
- N. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.
- O. All-Weather Coatings: Moisture curing, single component silicone copolymer elastomeric spray coatings for horizontal surfaces where greater water resistance is required or inclement weather is anticipated.
- P. Fire-Rated HVAC Retaining Angles: Steel angle system with integral intumescent firestop gasket for use on steel HVAC ducts.
- Q. Firestop Plugs: Re-enterable, foam rubber plug impregnated with intumescent material capable of expanding minimum 10 times with expansion beginning at 350°F (177°C) for use in blank openings and cable sleeves.
- R. Fire-Rated T Rating Collar Device: Louvered steel collar system with synthetic aluminized polymer coolant wrap installed on metallic pipes where T Ratings are required by applicable building code requirements.
- S. Fire-Rated Cable Grommet: Molded two-piece grommet made from plenum grade polymer with a foam inner core for sealing cable penetrations up to 0.53 in. (14 mm) diameter.
- T. Silicone Sealants: Moisture curing, single component, silicone elastomeric sealant for horizontal surfaces (pourable or nonsag) or vertical surface (nonsag)
 - 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and other surfaces requiring a nonslumping, gunnable sealant, unless indicated firestop system limits use to nonsag grade for both opening conditions.
 - 2. Grade for Horizontal Surfaces: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces.
 - 3. Grade for Vertical Surfaces: Nonsag formulation for openings in vertical and other surfaces.

2.4 MIXING

- A. For those products requiring mixing before application, comply with through-penetration firestop system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 EXECUTION

3.1 EXAMINATION

PENETRATION FIRESTOPPING

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning: Clean out openings immediately before installing through-penetration firestop systems to comply with firestop system manufacturer's written instructions and with the following requirements:
 - 1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of through-penetration firestop systems.
 - 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with through-penetration firestop systems. Remove loose particles remaining from cleaning operation.
- B. Priming: Prime substrates where recommended in writing by through-penetration firestop system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- C. Masking Tape: Use masking tape to prevent through-penetration firestop systems from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestop system materials. Remove tape as soon as possible without disturbing firestop system's seal with substrates.

3.3 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

- A. General: Install through-penetration firestop systems to comply with Part 1 "Performance Requirements" Article and with firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
 - 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.
- C. Install fill materials for firestop systems by proven techniques to produce the following results:
 - 1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
 - 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.

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3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes, ready to be painted.

3.4 IDENTIFICATION

- A. Identify through-penetration firestop systems with preprinted metal, vinyl or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of edge of the firestop systems so that labels will be visible to anyone seeking to remove penetrating items or firestop systems. Use mechanical fasteners for metal labels. For plastic labels, use self-adhering type with adhesives capable of permanently bonding labels to surfaces on which labels are placed and, in combination with label material, will result in partial destruction of label if removal is attempted. Include the following information on labels:
 1. The words "Warning - Through-Penetration Firestop System - Do Not Disturb. Notify Building Management of Any Damage."
 2. Contractor's name, address, and phone number.
 3. Through-penetration firestop system designation of applicable testing and inspecting agency.
 4. Date of installation.
 5. Through-penetration firestop system manufacturer's name.
 6. Installer's name.

3.5 FIELD QUALITY CONTROL

- A. Inspecting Agency: Owner will engage a qualified, independent inspecting agency to inspect through-penetration firestops. Independent inspecting agency shall comply with ASTM E 2174 requirements including those related to qualifications, conducting inspections, and preparing test reports.
- B. Where deficiencies are found, repair or replace through-penetration firestop systems so they comply with requirements.
- C. Proceed with enclosing through-penetration firestop systems with other construction only after inspection reports are issued and firestop installations comply with requirements.

3.6 CLEANING AND PROTECTING

- A. Clean off excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove

PENETRATION FIRESTOPPING

damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

3.7 THROUGH-PENETRATION FIRESTOP SYSTEM SCHEDULE

- A. Systems shall be UL-classified and listed in UL's "Fire Resistance Directory" under product Category XHEZ.
 - 1. Firestop Systems with No Penetrating Items.
 - 2. Firestop Systems for Metallic Pipes, Conduit, or Tubing.
 - 3. Firestop Systems for Nonmetallic Pipe, Conduit, or Tubing.
 - 4. Firestop Systems for Electrical Cables.
 - 5. Firestop Systems for Cable Trays.
 - 6. Firestop Systems for Insulated Pipes.
 - 7. Firestop Systems for Miscellaneous Electrical Penetrants.
 - 8. Firestop Systems for Miscellaneous Mechanical Penetrants.
 - 9. Firestop Systems for Groupings of Penetrants.

END OF SECTION

JOINT SEALANTS

PART 1 GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, equipment, and services necessary for the installation of building sealants for joint filling including, but not limited to:
 - 1. Perimeter joints of jambs, sills and trim.
 - 2. Perimeter of door frames.
 - 3. Construction and expansion joints.
 - 4. Miscellaneous sealant products used throughout job.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM).
- B. Federal Specifications (FS).

1.3 PRECONSTRUCTION TESTING

- A. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.
 - 1. Use ASTM C 1087 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
 - 2. Submit not fewer than eight pieces of each kind of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
 - 3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 - 4. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
 - 5. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing, not older than 24 months, of sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.
- B. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:
 - 1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
 - 2. Conduct field tests for each kind of sealant and joint substrate indicated.

JOINT SEALANTS

3. Notify Architect seven days in advance of dates and times when test joints will be erected.
4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.
 - a. Test Methods:
 - (1) Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix XI in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
 - (2) ASTM C794-06 Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants.
 - b. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
5. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.4 SUBMITTALS

- A. Submit the following in accordance with Division 1 Section "Submittal Procedures."
- B. Product data from manufacturers for each joint sealant product required.
- C. Samples for initial selection purposes in form of manufacturer's standard bead samples, consisting of strips of actual products showing full range of colors available, for each product exposed to view.
- D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.
- E. Preconstruction Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:
 1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
 2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

JOINT SEALANTS

- F. Preconstruction Field-Adhesion Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.
- G. Certificates from manufacturers of joint sealants attesting that their products comply with specification requirements and are suitable for the use indicated.
- H. Installer's experience qualifications.
- I. Sample warranty.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer who has completed joint sealant applications similar in material, design, and extent to that indicated for Project that have resulted in construction with a record of successful in-service performance.
- B. Single Source Responsibility for Joint Sealant Materials: Obtain joint sealant materials from a single manufacturer for each different product required.
- C. Product Testing: Test joint sealants using a qualified testing agency.
 - 1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.
- D. Field-Constructed Mock-Ups:
 - 1. Prior to installation of joint sealants, apply elastomeric sealants as follows to verify selections made under sample submittals and to demonstrate aesthetic effects as well as qualities of materials and execution.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials in compliance with manufacturer's recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.7 PROJECT CONDITIONS

- A. Environmental Conditions: Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside the limits permitted by joint sealant manufacturer or below 40°F.
 - 2. When joint substrates are wet.

JOINT SEALANTS

- B. Joint Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than allowed by joint sealant manufacturer for application indicated.
- C. Joint Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with their adhesion are removed from joint substrates.

1.8 WARRANTY

- A. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period. Include repair and replacement of defective work, such as leaks, failure of material, loss of adhesion, running of compound, or staining of adjacent work.
 - 1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period:
 - a. 5 years from date of Substantial Completion for acrylic latex sealants.
- C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
 - 1. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
 - 2. Disintegration of joint substrates from natural causes exceeding design specifications.
 - 3. Mechanical damage caused by individuals, tools, or other outside agents.
 - 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Product manufacturers are listed in Paragraph 2.3.
- B. Other Manufacturers: Submit Substitution Requests prior to bid date in accordance with Division 1 Section "Product Requirements."

2.2 MATERIALS, GENERAL

JOINT SEALANTS

- A. Compatibility: Provide joint sealants, joint fillers, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
- B. Colors: Provide custom colors of exposed joint sealants to match Architect's samples.

2.3 ELASTOMERIC JOINT SEALANTS

- A. Sealant 1:
 - 1. One-part acrylic latex sealant, ASTM C834.
 - 2. Products:
 - a. Tremco "Acrylic Latex 834" paintable caulk.
 - b. Pecora "AC-20" paintable caulk.

2.4 JOINT SEALANT BACKING

- A. General: Provide sealant backings of material and type that are non-staining; compatible with joint substrates, sealants, primers and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Plastic Foam Joint Fillers:
 - 1. Preformed, compressible, resilient, non-staining, non-waxing, non-exuding strips of flexible plastic foam of size, shape, and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
 - 2. Material: Bi-cellular extruded polyolefin foam material consisting of a network of both open and closed cells and with nonabsorbing outer skin, non-outgassing when punctured, ASTM C1330, Type B.
 - 3. Products:
 - a. Nomaco "SOF ROD."
 - b. Backer Rod Manufacturing, Inc., "TITAN FOAM."
- C. Bond Breaker Tape: Polyethylene tape or other plastic tape as recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.5 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint sealant substrate tests and field tests.

JOINT SEALANTS

- B. Cleaners for Non-Porous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming in any way joint substrates and adjacent non-porous surfaces, and formulated to promote optimum adhesion of sealants with joint substrates.
- C. Masking Tape: Non-staining, non-absorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint sealant performance. Do not proceed with installation of joint sealants until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with recommendations of joint sealant manufacturer and the following requirements:
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, water, and surface dirt.
 - 2. Clean concrete and similar porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil free compressed air.
- B. Joint Priming: Prime joint substrates where indicated or where recommended by joint sealant manufacturer based on preconstruction joint sealant substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's recommendations. Confine primers to areas of joint sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint sealant manufacturer's printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply.

JOINT SEALANTS

- B. Sealant Installation Standard: For joint sealants as applicable to materials, applications, and conditions indicated, per ASTM C1193.
- C. Installation of Sealant Backings: Install sealant backings to comply with the following requirements:
 - 1. Install joint fillers of type indicated to provide support of sealants during application and at position required to produce the cross sectional shapes, depths, and surface bond area of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - a. Do not leave gaps between ends of joint fillers.
 - b. Do not stretch, twist, puncture, or tear joint fillers.
 - c. Remove absorbent joint fillers that have become wet prior to sealant application and replace with dry material.
 - 2. Install sealants at dynamic sealant joints to a uniform cross-sectional shape with depths relative to joint widths that allow optimum sealant movement capability as recommended by sealant manufacturer. This requires a 2:1 width-to-depth ratio with an hourglass configuration after tooling.
 - 3. Install bond breaker tape between sealants where backer rods are not used between sealants and joint fillers or back of joints.
- D. Installation of Sealants: Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross sectional shapes and depths relative to joint widths that allow optimum sealant movement capability. Install sealants at the same time sealant backings are installed.
- E. Tooling of Non-Sag Sealants: Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets, and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.
 - 1. Provide concave joint configuration per Figure 5A in ASTM C1193, unless otherwise indicated.
 - 2. Provide flush joint configuration, per Figure 5B in ASTM C1193, where indicated.
 - 3. Provide recessed joint configuration, per Figure 5C in ASTM C1193, of recess depth and at locations indicated. Use masking tape to protect adjacent surfaces of recessed tooled joints.

3.4 CLEANING

JOINT SEALANTS

- A. Clean off excess sealants or sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so that installations with repaired areas are indistinguishable from original work.

3.6 SCHEDULE

- A. Acrylic Emulsion Sealant: Interior joints in field-painted vertical and overhead surfaces; at perimeter of hollow metal door frames; in gypsum board; and all other interior joints not indicated otherwise: Sealant 1.

END OF SECTION

HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.1 SUMMARY

- A. Furnish all labor, material, equipment and services required for the fabrication and installation of hollow metal doors and door frames. Include all required anchor bolts and devices.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM).
- B. Hollow Metal Manufacturers Association's (HMMA) standards published by the National Association of Architectural Metal Manufacturers (NAAMM).

1.3 SUBMITTALS

- A. Submit the following in accordance with Division 1 Section "Submittal Procedures."
- B. Shop drawings showing anchor locations, hardware, and other pertinent installation information.

1.4 QUALITY ASSURANCE

- A. Provide doors and frames complying with HMMA standards published by NAAMM. Manufacturer shall be assessed and registered as meeting the requirements of Quality Systems under ISO 9001.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver to job in time for building into walls and protect from weather and construction damage. Replace dented or bent hollow metal work with new undamaged work as directed. Filled dents and straightened work are not acceptable.

1.6 WARRANTY

- A. Provide manufacturer's 2 year warranty against rust and paint adhesion failure for all doors and frames.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Doors and frames shall be custom manufactured by the same manufacturer.
- B. Metal Door and Frame Manufacturers:
 - 1. Amweld Building Products, 800/248-6116.
 - 2. Curries Company, 515/423-1334.

HOLLOW METAL DOORS AND FRAMES

3. Deansteel Manufacturing, 800/825-8271.
 4. Stiles Custom Metal, Inc., 209/538-3667.
 5. Ceco Door Products, 509/455-8239.
 6. Steelcraft, 513/745-6400.
 7. Fleming Steel Doors and Frames, 800/263-7515.
- C. Other Manufacturers: Submit Substitution Requests prior to bid date in accordance with Division 1 Section "Product Requirements."

2.2 FABRICATION

- A. Doors and frames for doors formed from minimum 16 gauge (0.054-inch thick) commercial quality cold-rolled steel conforming to ASTM A366 or tension leveled steel conforming to ASTM A924, galvanized to ASTM A653, commercial steel, type B, coating designation A40, commercially known as paintable galvalume. Steel for fabrication of all members exposed on exterior walls shall be galvanized to ASTM A653 with a minimum total coating weight of A60, 0.60 oz./s.f. (0.058 minimum thickness).
- B. Frames: Fabricate accurately with all breaks, rises, and angles or curves uniform, straight, sharply defined and true. Miter fit and full weld all corners, weld seams and grind smooth to produce an invisible joint. All fastenings concealed where possible.
- C. Flush panel doors shall be 1-3/4-inches thick, reinforced and welded full length at joints, and ground smooth. Reinforce doors 6-inches o.c. vertically. Lock reinforcing shall be provided between faces of door to prevent collapsing of door faces and side movement of latch and face plate. Void spaces in door shall be sound deadened and filled full height with insulating material. Provide openings in bottom closure to permit escape of moisture.
- D. Frames for doors to be type, design and size as detailed. Provide 12 gauge (0.097-inch) minimum channel reinforcing in the head of frames over 3-feet in width and other frame locations as detailed. Provide not less than four anchors at each jamb including a 16 gauge (0.054-inch) bent plate anchor clip at the bottom. Provide for three rubber silencers in all door frames on lock side.
- E. Provide suitable sinkages in doors and frames for all mortised or countersunk hardware, with steel reinforcement inserted for attaching hardware. Reinforcement of doors and frames to be as follows:
 1. Hinge Pockets: Reinforce hinge pockets with 3/16-inch thick x 12-inch long x full frame width steel backing welded fabrication.
 2. All Other Hardware Mountings: Reinforce all other hardware mountings at heads, jambs, stiles, or rails with minimum 12 gauge (0.097-inch) steel plate welded fabrication at all machine screw sinkages and 16 gauge (0.054-inch) minimum at all cylinder lock hole locations to prevent collapsing of doors and malfunctioning of hardware. Double gauge sheet metal reinforcing is not acceptable for hardware backing.

HOLLOW METAL DOORS AND FRAMES

2.3 FINISH

- A. Cold-Rolled Steel: Sand surfaces smooth eliminating all weld marks; chemically clean and "Bonderize" after fabrication. Paint with rust inhibiting ferrous metal primer and oven dry. All finished surfaces smooth, uniformly protected, and ready for finish painting on the job site. All exposed screw heads filled and ground smooth.
- B. Galvanized Steel: Touch up with zinc-rich primer only at areas where galvanizing has been removed during fabrication.

2.4 HARDWARE

- A. The door manufacturer shall be furnished with hardware templates by the finish hardware supplier. Doors and frames shall be prepared for hardware at the factory. Out-of-state door manufacturers are required to pay for all hardware shipping charges.
- B. All hardware shall be attached by machine screws, threaded into reinforced tapped holes or through-bolted. All drilling and tapping for mortised hardware shall be done at the factory. Self-tapping sheet metal screws or welding is not permitted.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Frames: Install metal frames in accordance with manufacturer's instructions. Anchor frame to wall and floor as recommended by manufacturer.
- B. Doors: Fit doors to frame providing clearances recommended by door manufacturer.

3.2 COMPLETION

- A. Adjust door clearances and hardware placement to allow smooth door operation. Touch up scratched door and frame prime paint to match adjacent surfaces. Touch up damaged galvanized surfaces with zinc-rich primer.

END OF SECTION

ACCESS DOORS AND PANELS

PART 1 GENERAL

1.1 SUMMARY

- A. Furnish all labor, material, equipment and services for the installation of access panels in ceilings for access to concealed equipment and closed spaces as detailed.
- B. Related Sections: Refer to Divisions 21, 22 and 23 for mechanical equipment access requirements.

1.2 SUBMITTALS

- A. Submit the following in accordance with Division 1 Section "Submittal Procedures."
- B. Shop drawings and manufacturer's instructions submitted to Architect for review before ordering. Show installation details, list all required parts and accessories, and color or finish options unless special finish is specified. Indicate required modifications to standard products required for this installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Product Manufacturers:
 - 1. Acudor.
 - 2. Access Panel Solutions, Inc.
 - 3. Babcock-Davis.
 - 4. Cierra Products.
 - 5. Dur-Red Products.
 - 6. Elmdor.
 - 7. Inland-Ryerson/Milcor.
 - 8. J.L. Industries.
 - 9. Miami-Carey.
 - 10. Nystrom.
- B. Other Manufacturers: Submit substitution requests prior to bid date in accordance with Division 1 Section "Product Requirements."

2.2 MANUFACTURED UNITS

ACCESS DOORS AND PANELS

- A. Style and model as applicable to ceiling finish.
- B. Access Panels in Rated Ceilings: Insulated and fire rated frames and panel assembly manufactured under the Factory Inspection Service of Underwriters Laboratories, Inc., and bear label reading "Frame and Fire Door Assembly Rated 1 Hour" for ceilings. Temperature rise 30 minutes, 250°F maximum. Door size 24-inches x 24-inches.
 - 1. Acudor "FW-5050," fire-rated universal wall-ceiling, flanged type.
- C. Furnish cylinder locks to match brand and keyway design of cylinder locks specified in Division 8 Section Door Hardware. Fasten door panels to frames with continuous hinge, supply access doors and panels with factory-applied white rust-inhibitive prime coat.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install all panels in locations as detailed and in accordance with manufacturer's standard specifications and recommendations.
- B. Verify that reinforcing, backing or blocking required for solid anchorage is in place. Furnish with screw type fasteners long enough to anchor into supports.
- C. Furnish and install free from damage and in perfect operating condition.

END OF SECTION

DOOR HARDWARE

PART 1 GENERAL

1.1 SUMMARY

- A. Furnish and install all door hardware as specified within this Section. Do not, however, construe the following specification as complete in every detail. Furnish all items classified as door hardware and necessary to complete construction.

1.2 SUBMITTALS

- A. Submit the following in accordance with Division 1 Section "Submittal Procedures."
- B. If requested by the Architect, furnish properly labeled hardware samples within three weeks following award of the Contract. These samples may be retained by the Architect until completion of the job. All delivered hardware must conform to the approved samples.
- C. Schedule of Hardware:
 - 1. Format: Comply with scheduling sequence and vertical format in DHI's (Door and Hardware Institute) "Sequence and Format for Hardware Schedule". Double space entries and number/date each page. Prepare the Schedule of Hardware as follows:
 - a. List each opening, location, door size, door hand, door and frame material, door label, manufacturer's number and finish.
 - b. Any deviation in hardware listed from that specified must be approved by the Architect in writing prior to Bid Opening.
 - 2. Deliver copies of this schedule to the Architect for review.
- D. Manufacturer Information: Provide manufacturer's technical product data in the form of catalog cut sheets, clearly marked for each hardware item. Include installation details, material descriptions, dimensions of individual components and profiles, and finishes.
- E. Templates: Furnish templates to metal door and frame suppliers within one week from receipt of approved hardware schedule and verification at the Preconstruction Meeting.
- F. Keying Schedule: Detailed keying instructions and diagram and index, detailing Owner's final keying instructions resulting from the Keying Conference.

1.3 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Door Hardware Supplier:
 - a. Provide services of an AHC or DAHC (Architectural Hardware Consultant) member of Door & Hardware Institute with the technical experience and availability for consultation with the Architect, Owner and Contractor.

DOOR HARDWARE

- b. Hardware supplier shall have and maintain a factory direct status with all manufacturers' specified or approved during the course of the project.
- c. The door hardware consultant shall:
 - (1) Be an employee of supplier.
 - (2) Be knowledgeable on local, state, and federal life safety fire codes, and accessibility codes and requirements to assist the Architect when necessary.
 - (3) Assist in developing the keying schedule by meeting with the Owner and Architect, and make at least two job site inspections and one final inspection to ensure that all hardware has been properly installed according to the manufacturer's directions.
- 2. Contractor: Employ an experienced worker to receive, supervise, and distribute hardware at the building site, and provide a locked room with temporary shelving for hardware.
- 3. Distributor: Provide hardware from a factory authorized distributor. Only those manufacturers specified or approved in writing prior to bidding are acceptable. All components of each hardware item shall be by the same manufacturer.
- B. Pre-Construction Meeting: After receipt of the Architect-reviewed hardware schedule, conduct a final "hardware function" coordination meeting with the Owner, Architect, and hardware consultant. Do not release hardware templates to door fabricators until final resolution of the hardware coordination meeting.
- C. Keying Conference: Conduct a keying coordination meeting with the Owner and Architect. Incorporate keying conference decisions into a keying schedule for review and approval, including but not limited to:
 - 1. Preliminary key system schematic diagram.
 - 2. Requirements for key control system.
 - 3. Address for delivery of keys.
 - 4. Index of each key set to unique door designations.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver all door hardware to job site unless directed otherwise. Each item shall be properly wrapped in its original factory shipping carton, labeled, and numbered for the opening for which it is intended. All items shall be shipped from the factory to the hardware supplier for final checking before sending to job site.
- B. Include all necessary screws, bolts, or other fastenings of suitable size and type to securely anchor in position, and harmonize with the hardware material and finish. Furnish where necessary with sex bolts, toggle bolts, expansion shields or other approved anchors according to the material to which it is applied and recommended by the manufacturers.

DOOR HARDWARE

1.5 WARRANTY

- A. All hardware shall carry a factory warranty for a minimum of one year after Substantial Completion that hardware is free from defects in workmanship and material. Hardware must be installed exactly to the manufacturer's printed instructions to prevent voiding the warranty. Provide a 3 year material and labor warranty for exit devices and 10 year material and labor warranty for closers.
- B. Provide factory order numbers to the Owner/GC for hardware warranty purposes.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Product Manufacturers:
 - 1. GLY: Glynn Johnson.
 - 2. IVE: Ives.
 - 3. LCN: LCN.
 - 4. SCE: Schlage Electronics.
 - 5. SCH: Schlage.
 - 6. VON: Von Duprin.
 - 7. ZER: Zero.
- B. Other Manufacturers: Submit Substitution Requests prior to bid date in accordance with Division 1 Section "Product Requirements."

2.2 MATERIALS

- A. Butt Hinges: 1-1/2 pair minimum per door unless scheduled otherwise.
- B. Locks and Latches: Verify operation, hand of doors, and function for each opening as scheduled.
- C. Keying:
 - 1. It shall be mandatory that keying be done by the lock manufacturer for security, Owner's convenience, and permanent keying records. In the event any keying security procedure is violated, replace all locks, cylinder units, padlocks, cylinders, etc., at no additional expense to the Owner.
 - 2. Provide manufacturer's standard keyway with standard cylinders except where interchangeable core cylinders are specified. Interchangeable core cylinders to have temporary construction cores.

DOOR HARDWARE

3. Furnish two keys with each lock, and five master keys. Keying and master keying schedule as established by the Owner.
 4. All master keys and keying transcript to be sent by registered mail from the factory to the Owner. This procedure is mandatory.
- D. Closers: Verify hand of door, degree of opening, frequency of use, and head condition. Furnish cast iron body type only.
- E. Silencers: Furnish in number and type to protect finishes wherever doors or hardware thereon will strike adjacent surfaces and materials. Furnish 3 rubber silencers for metal door frames that are not equipped with gaskets.
- F. Hardware Finishes: As specified below in the Schedule. Verify all finishes on the Schedule and at the Site.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Locate and place hardware on work accurately using templates when required. Install permanently using proper nails, screws or bolts, matching finish of hardware. Remove and place in original packages all hardware after setting to permit application of finishes and reinstall when finish application is complete. Deliver any adjusting tools to Owner properly tagged and identified.
- B. Properly wrap all hardware subjected to hand usage during construction for protection. Replace hardware that has damaged finish.
- C. Butt Hinges: Install top hinges 5-inches from head of frame or door top to top of hinge. Bottom hinge 10-inches from finished floor to bottom of hinge. Center intermediate hinges between top and bottom hinges.
- D. Locks and Latches: Install 38-inches to center line of knob locks and latches.
- E. Deadlock: Install 48-inches to center line of deadlock. Vary as necessary to avoid conflict with door pulls, etc.

3.2 SCHEDULE\

DOOR HARDWARE

<u>QTY</u>		<u>DESCRIPTION</u>	<u>CATALOG NUMBER</u>	<u>FINISH</u>	<u>MFR</u>
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	STOREROOM LOCK	ND80TD RHO	626	SCH
1	EA	FSIC CORE	PROVIDED BY OWNER		
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

END OF SECTION

GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.1 SUMMARY

- A. Furnish all labor, material, equipment and services necessary for the installation and finishing of all gypsum board partitions and ceilings on wood framing and furring. Include repair if existing plaster and gypsum board surfaces and installation of acoustical insulation.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM).
 - 1. ASTM C 475/C 475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2002.
 - 2. ASTM C 754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2004.
 - 3. ASTM C 840 - Standard Specification for Application and Finishing of Gypsum Board; 2005.
 - 4. ASTM C 1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base; 2005.
 - 5. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2004.
- B. GA-600 - Fire Resistance Design Manual; Gypsum Association; current addition.

1.3 SUBMITTALS

- A. Submit the following in accordance with Division 1 Section "Submittal Procedures."
- B. Manufacturer's product data.

1.4 QUALITY ASSURANCE

- A. Fire Resistance Ratings:
 - 1. Comply with fire resistance ratings as required and approved by the governing authorities and codes. Provide classification labeled materials, and accessories identical to that of assemblies tested for fire resistance per ASTM E119 by a testing and inspecting agency acceptable to authorities having jurisdiction for the type of construction scheduled.
 - 2. Reference the Drawings for wall and ceiling types that indicate specific testing lab assembly and material requirements.
- B. Provide completed assemblies complying with ASTM C 840.
- C. All gypsum board products shall be manufactured in the United States of America.

GYPSUM BOARD ASSEMBLIES

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Coordinate delivery with installation to minimize storage periods. Deliver in unopened containers, bundles or packages fully identified with the manufacturer's name, brand, type and grade. Protect from weather, soiling and damage.
- B. Steel framing and related accessories shall be handled in accordance with the A.I.S.I. "Code of Standard Practice."

1.6 PROJECT CONDITIONS

- A. Examine the conditions under which the gypsum board is to be installed. Commencement of work establishes acceptance of work conditions.
- B. Installation not permitted until a uniform temperature of 55°F to 70°F can be maintained in the building and ventilation provided to eliminate excessive moisture.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Product manufacturers are listed in Paragraph 2.2.
- B. Other Manufacturers: Submit Substitution Requests prior to bid date in accordance with Division 1 Section "Product Requirements."

2.2 MATERIALS

- A. Obtain all components and materials of the gypsum board system from manufacturers recommended and approved by the gypsum board manufacturer, unless otherwise indicated.
- B. Gypsum Board:
 - 1. Walls and Ceilings: G-P Gypsum Corporation "ToughRock Fireguard," or USG "Sheetrock Brand Firecode," Type X fire retardant type, 5/8-inch thick, tapered edges, 48-inches wide and in lengths as long as practical to minimize number of joints. UL labeled and ICC approved, ASTM C1396.
- C. Fasteners: Type W screws or annular ringed nails for wood framing, Type GWB-54, 1-7/8-inch length. Parker or six penny (6d) cooler type nails.
- D. Joint Treatment: Provide materials from same manufacturer as gypsum board, ASTM C475/C475M.
 - 1. Joint Tape: Paper.
 - 2. Joint Compound for Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

GYPSUM BOARD ASSEMBLIES

- a. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
 - b. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.
 - c. Use setting-type compound for installing paper-faced metal trim accessories.
 - d. Fill Coat: For second coat, use drying-type, all-purpose compound.
 - e. Finish Coat: For third coat (final coat of Level 4 finish), use drying-type, all-purpose compound.
 - f. Skim Coat: For final coat of Level 5 finish on glass mat surfaced boards and areas of plaster repair to match texture and finish plane, use drying-type, all-purpose compound.
- E. Acoustical Insulation:
 1. Friction fit, un-faced, formaldehyde-free fiberglass batt insulation containing at least 25% post-consumer or 50% post-industrial recycled glass. Comply with local code, Class I flame-spread rating of 15 to 25 as tested per ASTM E84, and with ASTM C665, Type I, R-11.
- F. Caulking:
 1. Non-setting, non-staining, acoustically tested caulking, ASTM C919.
 2. Products:
 - a. Sheetrock Acoustical Sealant by U.S. Gypsum.
 - b. Acoustical Sealant by Tremco. A black synthetic rubber material suitable for concealed locations only.
 - c. Sil Pruf, SCS 2000 by General Electric.
- G. Electrical Receptacle Box Putty Pads:
 1. Kinetics Noise Control, "IsoBacker."
 2. Hilti, "Firestop Putty Pad CP 617."
 3. STI, "SpecSeal Putty Pad."
 4. 3M, "MPP+."
- H. Trim Accessories:
 1. Hot-dip galvanized steel corner beads, edge trim, and control joints, ASTM C1047.

GYPSUM BOARD ASSEMBLIES

2. Shapes indicated below by reference to Fig. 1 designations in ASTM C1047:
 - a. Corner bead on outside corners, unless otherwise indicated.
 - b. LC-bead with both face and back flanges; face flange formed to receive joint compound, provide for edge trim unless otherwise indicated.
 - c. L-bead with face flange only; face flange formed to receive joint compound, provide where indicated.
 - d. U-bead with face and back flanges; face flange formed to remain without application of joint compound, provide where indicated.
 - e. One-piece control joint formed with V-shaped slot, with removable strip covering slot opening.

PART 3 EXECUTION

3.1 INSTALLATION

A. Installation Standards:

1. Installation of gypsum board assemblies, ASTM C840.

B. Gypsum Board:

1. Prior to commencing gypsum board installation, install acoustical insulation where detailed in accordance with insulation manufacturer's installation instructions.
2. In areas where gypsum board is called for on the walls and ceiling, install the ceiling first then the wall unless detailed otherwise.
3. Where partitions are sound or fire-rated construction, apply caulking sealant to all cut-outs and intersections with adjoining structure as described in Sealant Application, below. This requires that the gypsum board be cut for loose fit around the partition perimeter leaving a space approximately 1/8-inch wide. Line the inside of equipment recesses with gypsum board to maintain the integrity of sound and fire-rated wall construction.
4. Use gypsum board panels of maximum practical length to minimize end joints. Arrange joints on opposite sides of partition walls to occur on different studs and stagger butt joints on the same surface. Board shall be brought into contact but not forced into place with all ends and edges neatly fitted. Use "Floating Interior Angle" application at all ceilings. Bottom edge of gypsum board on walls shall be a maximum of 1/4-inch above floor.
5. Attach gypsum board to wood framing supports, fasten 7-inches o.c. on ceilings and 8-inches o.c. on walls. For double fastening method, apply first fastener 12-inches o.c. with second fastener in close proximity (2-inches). Fasteners spaced at not less than 3/8-inch from edge and ends of board.

GYPSUM BOARD ASSEMBLIES

6. While fasteners are being driven, hold gypsum board in firm contact with underlying supports, fastening from the center of the board toward ends and edges. Drive fasteners tight, with heads slightly below surface, taking care to avoid breaking the paper face.
7. Cut board neatly and fit around pipes, electrical outlets, mechanical work, etc. Remove any loose face paper at cuts and fill holes or openings with quick setting plaster. Where board appears loose from framing, install second fastener within 1-1/2-inches of first.
8. Finish in every location with metal edge and corner bead unless finishing details are given and edge is covered with molding or trim. Install control joints vertically at corners of door frames, and at a maximum of 30-feet apart on unbroken wall surfaces.

C. Sealant Application:

1. Acoustical Sealant Installation: At sound-rated assemblies and elsewhere as indicated, seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations.
2. Partition Perimeter: Apply a 1/4-inch minimum bead of sealant on each side of plates, including those used at intersections with dissimilar wall construction. Immediately install gypsum board, squeezing sealant into firm contact with adjacent surfaces. Fasten board as specified.
3. Partition Intersections: Before taping and finishing, seal edges of face layer of gypsum board abutting intersecting partitions.
4. Openings: Apply a 1/4-inch bead of sealant around all cut-outs to seal openings of electrical boxes, ducts, pipes and similar penetrations. Caulk sides and backs to seal electrical boxes.
5. Control Joints: Before installing control joints, apply sealant in back of joint to reduce flanking sound path.
6. In all sound-rated walls, electrical receptacle boxes shall be sealed around the perimeter with acoustical caulk, and all unused knock-out holes shall be plugged with knock-out caps.
 - a. Electrical outlet box back putty pads shall be installed on the back of all boxes on both sides of the wall in all walls with a rating of STC 49 or higher.

D. Joint Finishing:

1. Level 1, ASTM C840 and GA-214-10: Rough taping permitted only in concealed spaces and service or unfinished areas as scheduled, including gypsum board which will be covered by rigid finish material fully concealing joints and which will not telegraph unevenness.
2. Level 4, ASTM C840 and GA-214-10:

GYPSUM BOARD ASSEMBLIES

- a. Tape joint compound and finishing compound as recommended by manufacturer of gypsum board.
 - b. Using suitable tool or machine, apply a thin uniform layer of joint compound approximately 3-inches wide to the joint to be reinforced.
 - c. Center tape over the joint and seat into the compound, leaving sufficient compound under the tape to provide proper bond.
 - d. Apply first, fill (second), and finish (third) coats of joint compound over joints, angles, fastener heads, and accessories.
 - e. Touch-up and sand between coats and after last coat as needed to produce a surface free of visual defects and ready for decoration.
 - f. Use only water resistant materials with moisture resistant type gypsum board.
 - g. Upon completion of finish sanding to a smooth surface, remove all dust from wall surface. Wipe down the entire wall surface with a damp sponge mop.
 - h. Apply Level 4 Finish to all exposed paper faced gypsum board, except where Level 1 is allowed,.
3. Level 5, ASTM C840 and GA-214-10:
- a. Add to Level 4 finish, one finish coat over entire surface.
 - b. Touch-up and sand as needed to produce a surface free of visual defects and ready for decoration.
 - c. Upon completion of finish sanding to a smooth surface, remove all dust from wall surface. Wipe down the entire wall surface with a damp sponge mop.
 - d. Apply Level 5 Finish to all exposed fiberglass faced gypsum board surfaces and areas where gypsum board is used to repair existing plaster.

3.2 CLEANING

- A. Do not dispose of or leave excess gypsum board materials or debris on the premises. Leave each area broom clean after completing gypsum board work. Clean spots and spills of taping and finishing compounds from all adjacent surfaces and equipment.

END OF SECTION

ACOUSTICAL CEILINGS

PART 1 GENERAL

1.1 SUMMARY

- A. Furnish all labor, material, equipment, and services necessary for the installation of suspended acoustical ceilings complete with suspension systems and glue-up installations on walls.
- B. Related Sections:
 - 1. Division 1 Section "Design-Build Requirements" for suspended acoustical ceilings.

1.2 REFERENCES

- A. Acoustical and Insulating Materials Association Bulletin.
- B. American Society for Testing and Materials (ASTM).

1.3 SUBMITTALS

- A. Submit the following in accordance with Division 1 Section "Submittal Procedures."
- B. Samples of exposed tee grid and acoustical board for review of color.
- C. Shop drawings showing coordination of suspension grid layout with room dimensions and penetrations of ceiling mounted equipment. Include layout of systems utilizing acoustic isolation components.
- D. Suspension System Design Data: Copies of Engineered Design calculations, drawings and documentation prepared by a structural engineer registered in the State of Oregon, showing compliance and classification of light, intermediate, or heavy duty system. Include manufacturer's literature or ICC Reports and identification of connection devices and approved loading capabilities.
- E. Manufacturer's Suspension System Data: When using a standard 24-inch x 48-inch or 24-inch x 96-inch grid system in lieu of an Engineered Design, submit copies of manufacturer's literature or ICC Report indicating light, intermediate, or heavy duty system. Include fixture schedule and other ceiling supported equipment and their weight, with connection devices and approved loading capabilities.

1.4 QUALITY ASSURANCE

- A. Installer's Qualifications: All work performed by skilled acoustical mechanics in the best and most professional manner. Material installed to provide a proper and symmetrical pattern in each area with joints straight and true and all corners level.
- B. Regulatory Agency Requirements: All ratings in conformance with the Acoustical and Insulating Materials Association Bulletin.
- C. Seismic Requirements:

ACOUSTICAL CEILINGS

2. Suspended acoustical ceiling systems, with or without lighting fixtures, air terminals, or other ceiling mounted items shall comply with the requirements of ASTM C635, ASTM C636, and the building code.
3. Ceiling areas of 144 s.f. or less surrounded by walls which connect directly to the structure above shall be exempt from these standards.
4. Light Duty systems to be used only where no loads other than ceiling acoustical materials weighing not more than 1.5 lbs./s.f. are supported by the suspension system.
5. Intermediate and Heavy Duty classification systems shall be used where suspension system is used to support acoustical material weighing more than 1.5 lbs./s.f., lighting fixtures or other equipment.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Properly store material within the building in such a manner and sufficiently in advance of installation to ensure adjustment to building temperatures and humidities.

1.6 PROJECT CONDITIONS

- A. Do not begin installation until residual moisture from concrete, plaster and other wet application material is dissipated, building enclosed with permanent heating/cooling equipment in operation.

1.7 SEQUENCING AND SCHEDULING

- A. Coordinate with Division 26 for installation of lighting components integrated in the ceiling installation.

1.8 WARRANTY

- A. Provide manufacturer's standard warranty, one year minimum. This Warranty shall be in addition to, and not a limitation of, other rights the Owner may have against the Contractor under the Contract Documents.

1.9 MAINTENANCE

- A. Extra Materials: Furnish to the Owner in factory-sealed containers a 2% overrun of acoustical board from the same production run as that used in this installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acoustical Board: Armstrong, Rockfon, USG, Celotex.
- B. Exposed Tee Grid: Armstrong.
- C. Adhesive: Franklin International, 800-877-4583.

ACOUSTICAL CEILINGS

- D. Other Manufacturers: Submit Substitution Requests prior to bid date in accordance with Division 1 Section "Product Requirements."

2.2 MATERIALS

- A. ACT-1, Acoustical Board:

1. Stone wool, square lay-in edge, 24-inches x 48-inches x 1-inch thick; color, flat black; texture, smooth. Light reflection, 0.04. NRC, 0.85 - 0.95. Fire class, A. Fire performance. Flame Spread Index 5, Smoke Developed Index 0.
2. Product: Rockfon "Cinema Black."

- B. Suspension Systems:

1. Exposed Tee: Main and cross tees, 1-1/2-inches deep, 15/16-inch wide, exposed surfaces finished with flat baked enamel, color to match acoustical board. Matching wall angles and Armstrong BERC 2 seismic clips.
 - a. Products:
 - (1) Armstrong "Prelude XL Seismic Rx" at non-fire rated ceilings. Color: Black

- C. Attachment Devices: Size for five times design load indicated in ASTM C 635, Table 1, Direct Hung unless otherwise indicated.

- D. Wire for Hangers and Ties: ASTM A 641, Class 1 zinc coating, soft annealed, with a yield stress load of at least three times design load, but not less than 12 gauge.

- E. Adhesive:

1. Solvent free polymer emulsion adhesive for acoustical materials, ASTM D1779, UL labeled fire resistant. IBC Class I flame-spread index as tested per ASTM E84.
2. Product: As approved by acoustical board manufacturer for glue-up wall installation.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Adhesive Systems: Install acoustic tile over gypsum board backing using fire rated adhesive. Apply in non-directional pattern with finished surface in flat smooth plane.

- B. Suspension Systems:

1. System to be supported on minimum 12 gauge galvanized hanger wire at 4-feet o.c. Suspension wires spaced at greater than 4-feet shall be 10 gauge.

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2. Approved type attachment devices capable of supporting five times the ceiling load and not less than 100 lbs. Powder driven devices not permitted. Vertical wires attached with a minimum of three turns and not hang more than 1-in-6 out-of-plumb unless countersloping hangers are provided.
3. Carrying channels and main runners to be level within 1/8-inch in 12-feet with hangers taut. Bending or kinking of hangers not permitted. Deflection limited to 1/360 (1/8-inch) in 4-feet. Fixture loads causing excess deflection shall be independently supported or the grid supplementally supported within 6-inches of each corner, and such loads shall not cause rotation of runners more than 2 degrees from vertical. Provide trapeze type system where obstructions preclude direct attachment. All runners shall be supported within 8-inches of wall or discontinuity.
4. Lateral bracing required in lieu of Engineered Design installed within 4-feet of walls and at 12-feet o.c. in each direction. Install four 12 gauge wires within 2-inches of a main runner intersection with a cross runner and splayed at 90 degrees from each other and at an angle not exceeding 45 degrees of the ceiling plane.
5. Adjacent and parallel to the wall, secure a stabilizer bar to the members perpendicular to the wall to prevent spreading. The wall closure member may be used at two adjacent walls with clearances maintained at the other two walls.
6. Seismic Clips: Install in compliance with ASTM C636, CISC, and standard industry practices.
7. Light Fixture Support:
 - a. Positively attach all lighting fixtures to the suspended ceiling system. The attachment device shall have a capacity of 100% of the lighting fixture weight acting in any direction.
 - b. When intermediate systems are used, 12 gauge hangers shall be attached to the grid members within 3-inches of each corner of each fixture. Tandem fixtures may utilize common wires.
 - c. Where heavy-duty systems are used, supplemental hangers are not required if a 48-inch modular hanger pattern is followed. When cross runners are used without supplemental hangers to support lighting fixtures, these cross runners must provide the same carrying capacity as the main runner.
 - d. Lighting fixtures weighing less than 56 lbs. shall have, in addition to the requirements outlined above, two 12-gauge hangers connected from the fixture housing to the structure above. These wires may be slack. Lighting fixtures weighing 56 lbs. or more shall be supported directly from the structure above by approved hangers.
 - e. Pendant-hung lighting fixtures shall be supported directly from the structure above using 9 gauge wire or approved alternate support without using the ceiling suspension system for direct support.

ACOUSTICAL CEILINGS

8. Air Terminal Support:
 - a. Ceiling mounted air terminals or services weighing less than 20 lbs. 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 lbs. but not more than 56 lbs., in addition to the above, shall have two 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 lbs. shall be supported directly from the structure above by approved hangers.
- C. Exposed Tee Suspension System: Where suspended acoustic tee bar ceilings are called for on the Drawings, the suspension system shall be an exposed T grid. Standard hangers placed 48-inches o.c. in both directions. Exposed metal parts finished with white baked enamel. Suspension system hung in a true plane with a grid pattern of 2-feet x 4-feet unless otherwise noted.
- D. Tegular edge boards that are cut to fit less than full size ceiling grid modules shall have a matching tegular edge routed into the cut edge. Paint the routed tegular edge with paint type and color to match the factory finish.

3.2 COMPLETION

- A. Adjusting Defective Work: Adjust grid height as required to maintain ceiling system leveled to within 1/8-inch in 12-feet. Remove and replace panels and tiles which are improperly placed, broken, or damaged. Adjust perimeter molding where gaps between molding and vertical surface exceeds 1/8-inch. Adjust suspension system grid to form flush hairline joints.

3.3 CLEANING

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

CARPETING

PART 1 GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, equipment, and services necessary for the installation of carpet.

1.2 REFERENCES

- A. American Association for Textile Chemists and Colorists (AATCC).
- B. American Society for Testing and Materials (ASTM).
- C. Carpet and Rug Institute (CRI).

1.3 SUBMITTALS

- A. Submit the following in accordance with Division 1 Section "Submittal Procedures."
- B. Shop drawings showing the layout for each area to receive carpet. Show carpet color, trim strips, and any pertinent installation details, including location of seams and direction changes. Do not install carpet prior to layout approval.
- C. Product Data: Data on specified products describing physical and performance characteristics, patterns and colors available, and methods of installation.
- D. Written certification from carpet manufacturer to the Owner stating that the register numbered carpet furnished was manufactured in accordance with these Specifications.
- E. Samples:
 - 1. 6-inch x 6-inch samples of each carpet.
 - 2. Furnish samples of carpet to the job when and as directed by Architect for testing by an independent testing laboratory. Costs for all testing will be paid in accordance with Division 1 Section "Quality Control."
- F. Carpet manufacturer's maintenance and cleaning procedures for maximum life and appearance of carpet. This includes but is not limited to commercial cleaning, spot cleaning and vacuum cleaning for each carpet selected.
- G. Warranty, as described below.
- H. Certification and description of reclamation and recycling process.
- I. Carpet manufacturer certification of compliance with the Carpet and Rug Institute Green label Indoor Air Quality Test Program.

1.4 QUALITY ASSURANCE

- A. Indoor Air Quality: Carpet shall meet or exceed the minimum standards contained in the Carpet and Rug Institute (CRI) consumer information label.

CARPETING

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver all carpet to the job site in original mill wrappings, each package having register number tags attached or register number marked on packaging. Do not deliver material to job site until notification and arrangements are made to properly handle, store, and protect materials. Store under cover in well ventilated spaces as soon as delivered; protect from damage, dirt, stains, and moisture during transit and storage.

1.6 PROJECT CONDITIONS

- A. Do not begin installation until the work of all other trades including painting has been completed and the temperature of the rooms maintained at 70 degrees F at least 48 hours before work proceeds.
- B. The Owner will employ the services of an Independent Testing Laboratory (ITL) for testing the moisture content of concrete slabs. Cooperate with the Testing Laboratory by providing the required environmental conditions for moisture testing.

1.7 SEQUENCING AND SCHEDULING

- A. Make provisions for and do all necessary work to receive or adjoin other work, install carpet accessories, and provide holes and openings necessary to fit work of other trades.

1.8 WARRANTY

- A. Contractor's Warranty: Written one year warranty starting at Substantial Completion and covering all repair or replacement due to defective materials or their installation. Any manufacturer's regular guarantee shall remain in effect for its full duration in addition to Contractor's guarantee.
- B. Manufacturer's Warranty:
 - 1. Limited lifetime wear
 - 2. Limited lifetime backing
 - 3. Fifteen year stain

1.9 MAINTENANCE

- A. Extra Materials: Furnish scheduled overrun for future repairs and replacement, wrapped, packaged and labeled at the factory. Same dye lot and run as carpet installed. Save and package usable remnants; label and deliver to Owner.
- B. Retain and identify trim pieces of usable size. Package and store same as specified for Overrun, below.

CARPETING

C. Overrun Schedule (each color):

<u>Installed</u>	<u>Overrun</u>
0 - 50 sq.yds.	10%
51 - 250 sq.yds.	5%
251+ sq.yds.	3%

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Product manufacturers are listed below.
- B. Other Manufacturers: Submit Substitution Requests prior to bid date in accordance with Division 1 Section "Product Requirements."

2.2 MATERIALS

- A. All materials new and of domestic manufacture. Carpet of first quality and from the same dye lot for each color to be installed. Materials, construction, and appearance are based on the following performance specifications.
- B. CPT-1, Carpet:
 - 1. Manufacturer: Lees Commercial or equal with lifetime warranty and stain resistance
 - 2. Style / Color: Selected from manufacturers standards
 - 3. Fiber Type: 6.6 Antron Legacy with bleach resistant technology.
 - 4. Backing: Impermeable moisture barrier with chemically welded seams.
 - 5. Face weight: 22oz minimum
 - 6. Installation: Glue-down.
 - 7. Construction: Tufted broadloom
 - 8. Width: 12'
 - 9. Flooring Radiant Panel/Critical Radiant Flux (ASTM E648/NFPA 253): Class I.
 - 10. Smoke Density Test, Flaming Mode (ASTM E662): Less than 450.
 - 11. Methenamine Pill Test (DOC FF-1-70/ASTM D2859): Passes.
 - 12. Electrostatic Propensity Test (AATCC 134): Less than 3 kV

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C. Accessories:

1. Edging for Glue-Down Carpet: Vinyl edging of standard color to complement carpet color as selected by Architect.
2. Adhesives: Solvent-free adhesives and seam sealants with low VOC emissions as recommended by carpet manufacturer. Zero-VOC if available, maximum VOC level not to exceed 50 g/l. The use of seam sealants containing 1,1,1-trichloroethane or toluene shall not be allowed.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance.
 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of carpet products.
 2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of carpet products.
- B. Concrete Substrates: Prepare according to ASTM F710 except for:
 1. Moisture testing paid for by Owner;
 2. Removal of curing compounds and hardeners used to reduce moisture emission;
 3. Repair of concrete floors performed by Division 3 Section "Cast-in-Place Concrete."
- C. Do not install carpet until all other trades have completed their work in the area to be carpeted.
- D. Inspect carpet before laying for streaking, shading, spots, soil, tears, pull tufts, or other defects. Remove defective carpet from premises and replace with undamaged carpet.
- E. Acclimate carpet a minimum of 24 hours prior to installation.

3.3 INSTALLATION

- A. Broadloom:
 1. Install carpet in accordance with manufacturer's recommendations for seaming technique and proper amount of stretch in width and lengths of broadloom carpet.

CARPETING

2. Broadloom Seams: Cement all seams of broadloom carpet. Use continuous lengths and as broad widths as possible to minimize the placement of seams in traffic lanes. Locate seams as indicated on shop drawings. Cut edges true, properly treated, and cemented to form invisible non-raveling seams.
3. Double cut carpet seams, with accurate pattern match. Make cuts straight, true, and unfrayed. Apply seam adhesive to all cut edges immediately.
4. Glue-Down: Conform to manufacturer's direct glue-down installation instructions and recommended materials for adhesive installation using only recommended adhesives and primers.
5. Locate change of color or pattern between rooms under door centerline.
6. Trim carpet neatly at walls and around interruptions.

3.4 CLEANING

- A. Remove debris after installation and clean carpet of all spots with manufacturer approved spot remover. Remove all threads with sharp scissors and thoroughly vacuum clean. Installed carpet shall be free of spots and dirt, and be without tears, fraying, or pulled tufts.

3.5 DEMONSTRATION

- A. Instruct Owner in proper care and maintenance of the carpet.

3.6 PROTECTION

- A. Protection of carpet after completion of installation is specified as general work and is made a part of the work of all trades doing work in areas after carpet installation.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure carpet is without damage or deterioration at the time of Substantial Completion.

END OF SECTION

PAINTING

PART 1 GENERAL

1.1 SUMMARY

- A. Furnish all labor, material, equipment, and services necessary for and incidental to painting work. Paint all surfaces in finished room areas as scheduled and those which normally require a paint finish for proper appearance and best serviceability such as wood, gypsum board, metal work, structural steel, exposed conduit, pipes and ducts unless excepted.
- B. Related Documents:
 - 1. "Door Schedule" for door color and paint system.
 - 2. "Finish Schedule" for room color and paint system.
 - 3. Divisions 21 through 23 for painting of mechanical items such as piping, equipment, ductwork, etc., as required by those Divisions.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM).
- B. Architectural Woodwork Institute (AWI).
- C. Master Painters Institute (MPI).
- D. The Society for Protective Coatings (SSPC).
- E. Painting and Decorating Contractors of America (PDCA).

1.3 DEFINITIONS

- A. Regardless of the specular gloss name paint manufacturers give their products, provide specular gloss as measured on a 60° and 85° geometry Parallel-Beam Glossmeter per ASTM D523 and as defined by Master Painters Institute as follows:
 - 1. Gloss Level 1: Traditional matte finish; flat. Gloss at 60°: Maximum 5 units. Sheen at 85°: Maximum 10 units.
 - 2. Gloss Level 2: High side sheen flat; velvet-like finish. Gloss at 60°: Maximum 10 units. Sheen at 85°: 10 to 35 units.
 - 3. Gloss Level 3: Traditional eggshell-like finish. Gloss at 60°: 10 to 25 units. Sheen at 85°: 10 to 35 units.
 - 4. Gloss Level 4: Satin-like finish. Gloss at 60°: 20 to 35 units. Sheen at 85°: Minimum 35 units.
 - 5. Gloss Level 5: Traditional semi-gloss. Gloss at 60°: 35 to 70 units.

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6. Gloss Level 6: Traditional gloss. Gloss at 60°: 70 to 85 units.
7. Gloss Level 7: High gloss. Gloss at 60°: More than 85 units.

1.4 SUBMITTALS

- A. Submit in accordance with requirements of Division 1 Section "Submittal Procedures."
- B. Samples: Samples of mixed paint applied to surfaces approximating job conditions with test areas painted on job if required. 12-inch x 12-inch minimum size of samples. Obtain preliminary approval of samples before doing any work on job.
- C. Complete materials list indicating all materials proposed for use; show manufacturer's name, material type and name, color name and formulation, gloss level, and location where material will be used. Revise list for changes made during construction and resubmit. Where paint provided varies from specified manufacturer's product, submit product data for both the specified basis of design product and proposed paint product. Clearly note any variance between submitted product data and specified product data.
- D. Paint manufacturer certification of compliance with the VOC and chemical component limits of Green Seal requirements.
 1. Flat paint: Maximum of 50 grams/liter VOC.
 2. Non-flat paints and Primers: Maximum of 150 grams/liter VOC.
- E. Painting subcontractor's PDCA membership status for national, state, and local levels.

1.5 QUALITY ASSURANCE

- A. Paints and coatings shall comply with the VOC and chemical component limits of Green Seal requirements.
- B. Painter shall be a PDCA member at national, state, and local levels.
- C. Mock-ups:
 1. Brush-out areas, 5-feet x 5-feet, as selected by Architect for each color and gloss level for review and prior to final color approval. After acceptance of color brush out, use that work as the reference standard to be matched by subsequent completed work.
 2. 10 l.f. of paint color and finish for handrails, trim, and other linear elements of in-place surfaces. Acceptable samples may be incorporated into the Work.
 3. One brush-out area of approximately 50 s.f. painted with the predominate wall color in a well-lit area selected by Architect. Paint 100 s.f. of primer, 70 s.f. of first finish coat and 40 s.f. of second finish coat such that the completed mock-up will have three levels of paint, i.e., primer only, primer plus one finish coat, and primer plus two finish coats. Leave approved mock-up in place during painting as a standard of comparison to

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finished work. At completion of painting, repaint mock-up wall as necessary to conceal all lap marks.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Designate one location for the storage and mixing of materials. Keep location in a neat and clean condition at all times.
- B. Deliver materials only when building is closed in and completed sufficiently to prevent freezing and other damage to paint products.
- C. Deliver all materials to the job site in new and unopened containers, with the manufacturer's name, brand name, batch number, color, directions for tinting, mixing and application on a printed label on every container.

1.7 MAINTENANCE

- A. Extra Materials: Furnish one gallon of each color and paint type for future repairs, packaged and labeled at the factory. Extra paint shall be mixed at the same time as paint installed.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Paint Manufacturers:
 - 1. Kelly-Moore.
 - 2. Miller.
 - 3. Rodda.
 - 4. Sherwin Williams.
- B. Other Manufacturers: Submit Substitution Requests prior to bid date in accordance with Division 1 Section "Product Requirements."

2.2 MATERIALS

- A. Provide paint products from one or more manufacturers as required to comply with the color/gloss level/product type combinations. The gloss level of manufacturer's product numbers in this specification may not match the required gloss level specified. Adjust manufacturer's product numbers within the same quality line to match the required gloss level.
- B. Interior:
 - 1. Water-Based Acrylic, Gloss Level 1, on Wood (System H):
 - a. Prime and Backprime Coat:

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- (1) Water-based acrylic wood primer.
 - (2) Manufacturer: PPG "Seal Grip FD Latex Wood Primer 17-9517 Primer."
 - b. Second and Third Coats:
 - (1) Interior water-based alkyd enamel, gloss level 1.
 - (2) Manufacturer: PPG "Speedhide WB Alkyd Flat 6-1510."
2. Acrylic, Gloss Level 1, on Gypsum Board (System I):
 - a. Prime Coat:
 - (1) Vinyl acrylic latex primer.
 - (2) Manufacturer: USG "Sheetrock Brand Primer Surfacer Tuff-Hide."
 - b. Second and Third Coats:
 - (1) Vinyl acrylic latex, gloss level 1.
 - (2) Manufacturers: PPG "Speedhide Zero VOC Latex Flat 6-4110XI," 0-4 @ 60.
3. Acrylic, Gloss Level 1, on Metal (System Q):
 - a. Prime Coat:
 - (1) Ferrous Metals, Galvanized Metals, and Non-ferrous Metals:
 - (a) First coat latex metal primer.
 - (b) Manufacturer: PPG "Pitt Tech PF DTM 90-712."
 - b. Second and Third Coats:
 - (1) 100% acrylic latex, gloss level 1.
 - (2) Manufacturer: PPG "Speedhide Zero VOC Flat 6-4110XI. "
 - (3) Gloss Level 10 @ 85, 2-8 @ 60.

PART 3 EXECUTION

3.1 PROTECTION

PAINTING

- A. Protection of Surfaces and Cleaning: Protect floors and other adjoining surfaces from paint droppings and spillage of materials.

3.2 SURFACE PREPARATION

A. General:

1. Carefully examine all surfaces over which finish is to be applied. Any surface not suitable for the proper finish which cannot be rectified by light sanding, cleaning, etc., must be brought to the attention of the Architect before any materials are applied. Do not proceed with the work until such conditions have been rectified. Beginning work denotes acceptance of substrates.
2. All surfaces shall be thoroughly dry before any finish is applied and application shall not be done in severely cold weather except under instructions from the Architect.

B. Wood:

1. Prime and back prime all woodwork immediately upon receipt at the job. Required for all wood finish and trim unless material has been pressure preserved or dip treated and sealed. One coat primer or undercoat as used for finishing on painted work.
2. Properly sand wood surfaces before any paint is applied. Knots or sappy places shall be given one coat of shellac at least twelve hours before being painted. Shellac is not to be used on any other surfaces. Use putty or wood filler filling nail holes, checks, and other blemishes, then lightly sand smooth as soon as filler has hardened.

C. Metal:

1. All metal installation shall be made complete and ready for painting. Touch-up shop or prime coats that have been damaged with material of the same type and quality as originally used on the shop coat. Thoroughly remove all rust previous to this priming operation.
2. Etch galvanized metal with phosphoric acid solution prior to applying primer.
3. Prepare substrate and apply coatings in strict adherence with coating manufacturer's instructions.

- D. Gypsum Board Surfaces: Paint shall not be applied to any surface until it is thoroughly dry and cured. Prime surfaces that show hot spots or alkali in order to prevent such blemishes from showing through the paint. Brush off all loose particles or crystals which may have formed.

- E. Existing Painted Surfaces: Prepare by sanding or other procedures necessary prior to application of new paint. Primer only required on surfaces of bare substrate unless needed for adhesion to painted substrate. Verify compatibility of new and old paint prior to application of two top coats.

3.3 APPLICATION

- A. Employ workers skilled in the application of paint products specified.

PAINTING

- B. When paint mixing is required on the job, perform mixing on the premises immediately before applying, and thoroughly stir and strain all materials. Do not change or reduce any material in any way except as specified by paint manufacturer.
- C. Except where method of application is specifically noted, all materials shall be applied by brush or roller. Application by spray only where approved by the Architect. All spray application shall be by airless method only.
- D. Coverage and Workmanship:
 - 1. Assume all responsibility for paint coats applied over surfaces and undercoats which have not been inspected and approved by Architect. Apply any additional coats of paint, as directed by Architect, where surface preparation and undercoats have not been approved before painting. Make finished work match approved samples.
 - 2. The visible parts of the structure behind grilles and louvers are to be painted with flat black enamel.
- E. Drying: Apply paints to surfaces at atmospheric temperatures of not less than 50°F and maintain this minimum temperature throughout the drying time. Ensure adequate ventilation in all painted spaces. Allow sufficient time to elapse as recommended by the manufacturer, between successive coats, to permit proper drying. Modify as necessary to suit adverse weather conditions.
- F. Interior:
 - 1. Wood Enamel: For trim where scheduled. All surfaces are to receive three coats, one prime coat and two coats of enamel. Sheen of finish as specified above or selected. Sand smooth all surfaces after puttying, removing excess putty and prime coat imperfections. Sand lightly between second and third coats.
 - 2. Metal Enamel: All surfaces are to receive three coats (total including prime coat) of materials as specified above. All exposed interior metal, including but not limited to, door and relite frames, doors, electrical plaster rings, grilles, railings, registers, conduit, pipe, mechanical ducts, etc., in finished room areas are to be painted as called for above.
 - 3. Gypsum Board: All surfaces shall receive three coats of material, as specified above. Remove dust from surfaces, clean off or seal all stains and marks which may show or bleed through finishes.

3.4 COLOR SCHEDULE

- A. Refer to Finish and Materials Legend.

END OF SECTION

PRODUCTION RIGGING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. The Rigging Contractor shall provide all items necessary for a complete, safe, fully functional system as described herein and as shown on drawings, including all tools, scaffolding, labor, and supervision, even though they may not be specifically enumerated.
2. It shall be under the work in this section to mount and rig the multicable and install hang the production lighting device boxes to battens. Production Lighting Control shall supply the multicable and production lighting device boxes.

1.2 RELATED SECTIONS

A. Coordinate with the following sections in carrying out this work:

1. Division 01 – General Conditions
2. Section 11 61 83 – Production Lighting Control
3. Section 26 05 35 – Production Systems Electrical Installation
4. Division 26 – Electrical
5. It shall be under the work in this section to coordinate established clearances to the general contractor and all others trades on the project and to maintain necessary clearance requirements for all rigging components and clear zones.
 - a. No conduit, raceway, sprinkler pipe, plumbing pipe, duct or any other part of the mechanical systems or any structural component shall be in a rigging clear zone or shall obstruct the operations of the rigging systems or shall be within 6” of a moving rigging component, including lift lines.

1.3 REFERENCES

- A. Comply with all national, state and local regulations. In the event of conflict between these specifications and the applicable regulations, the more stringent shall govern.
- B. Equipment shall be provided per the related trade and regulatory guidelines including but not limited to UL, CEC, IEEE, and all manufacturer’s recommendations and requirements. Contractor shall be responsible in the event that work under their control voids or jeopardizes manufacturers’ warranties.
- C. Labor shall be provided per applicable labor regulations and practices.

1.4 DEFINITIONS

- A. Owner’s Representative: For the scope in this Section, authorized personnel representing

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The Beaverton School District and The Shalleck Collaborative, Inc., Theatre Consultants.

1.5 SYSTEM DESCRIPTION

- A. System includes rigging multicable provided by Div 11 61 83 to existing electric battens.

1.6 SUBSTITUTIONS

- A. All requests for substitutions from the specified materials, assemblies or related services shall be submitted for review by the Owner's Representative prior to bid. Substitution requests made after bid shall be neither reviewed nor accepted. Requests shall be made in accordance with Division 1 of the specifications, and in a timely fashion so as to not affect the project schedule in either case of the substitution being accepted or rejected.
- B. Documentation for the substitution shall be submitted with supporting material and shall include the related information for the item as specified so that equivalence can be demonstrated. The burden of proof rests solely upon the Contractor. The Owner's Representative shall be the sole evaluator of the fitness of the substitution.
- C. All expenses related to the substitution including, but not be limited to, all fees and expenses incurred in the evaluation of the substitution, and any effect on the costs and schedule of other trades whether or not the substitution is accepted, shall be borne by the Contractor.

1.7 WARRANTY

- A. Warranty shall provide coverage of material and product defects and assembly workmanship for a period of three years following the date of acceptance by the Owner.
- B. Items under warranty shall be serviced to the satisfaction of the Owner with 14 days of notification to the Contractor, except for safety related items, which shall be corrected within 48 hours of notification.

1.8 MAINTENANCE SERVICE:

- A. Provide maintenance service for a period of one (1) year after final acceptance of the installation. This service consists of at least one visit to the site for checking and adjusting of equipment. Perform the visit 11 months after the system has been accepted. Time of visit shall be coordinated with Owner and Owner Representative's schedule.

1.9 QUALITY ASSURANCE

- A. Equipment in this Section shall be provided by specialty suppliers and manufacturers meeting the qualifications listed herein.
- B. Specialty suppliers and the individuals responsible for installation in the field shall have been continuously engaged in the sales and integration of rigging equipment similar to that specified herein for a minimum of fifteen years, and shall have completed at least ten installations of this type and scope. The Owner's Representative shall be the final judge of the suitability of experience.
- C. Specialty suppliers shall maintain bonds in the amount required for the project.

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- D. Specialty manufacturers responsible for engineering and manufacturing shall have been continuously engaged in the engineering and manufacturing of rigging equipment similar to that specified herein for a minimum of fifteen years, and shall have provided equipment for at least fifty installations of this type and scope. The Owner's Representative shall be the final judge of the suitability of experience.
- E. All equipment shall be UL listed and bear the appropriate labels.

1.10 DELIVERY, STORAGE AND HANDLING

- A. Packing shall prevent damage to the equipment during transit. Costs to repair or replace all equipment damaged during the course of the contract services shall be borne by the Contractor.
- B. Do not deliver materials in this Section until building is ready for installation. Contractor is responsible for properly sequencing the work and for protection from damage during delivery, handling, storage and installation.
- C. Contractor is responsible to coordinate and provide secure and protected storage as required for the execution of the Contract.
- D. Draperies shall be packed and shipped in methods and containers that shall prevent crushing of finished goods.

1.11 PROJECT CONDITIONS

- A. Defects in the field which may impact the work in this section shall be reported to the Owner's Representative and corrected in accordance with the requirements of the applicable section of work prior to commencement of the work in this section.
- B. Field Conditions: All bidders shall fully inform themselves of the conditions under which the work is to be performed. No additional compensation shall be allowed for any labor or item the bidder could have been fully informed of prior to the bid date.

1.12 MAINTENANCE

- A. Provide maintenance stock of User-serviceable components within the system. Maintenance stock shall be packaged in labeled long term storage packaging and turned over to the Owner at time of system commissioning.

PART 2 PRODUCTS

2.1 MATERIALS

- A. All components supplied under this Section shall be new. Used or factory reconditioned components shall not be acceptable.
- B. Materials shall conform to the following ASTM, ANSI and ESTA standard specifications:
 - 1. A-36 – Specification for structural steel
 - 2. A-47 – Specification for malleable iron casting

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3. A-48 – Specification for gray iron casting
4. A-120 – Specification for black and hot-dipped zinc-coated (galvanized) steel pipe for ordinary use
5. B18.2.1&2 – Specification for square and hex bolts and nuts
6. B221-02 – Specification for aluminum alloy
- C. Materials, devices, assemblies and installation shall meet or exceed applicable ESTA standards.
- D. In order to establish minimum standards of safety, the following factors shall be used:
 1. Cables and fittings – 8:1 Safety Factor
 2. Cable bending ratio – Sheave tread diameter is 30 times cable diameter
 3. Tread Pressures – 500 lbs. for cast iron; 900 lbs. for Nylatron; 1000 lbs. for steel
 4. Maximum fleet angle – 1-1/2 degrees
 5. Steel – Per AISC specifications
 6. Bearings – Two times required load at full speed for 2000 hours
 7. Bolts – Minimum SAE J429 Grade 5 (ISO R898 Class 8.8), zinc plated
- E. All turnbuckles, clips, tracks, chains and other items of incidental hardware shall be furnished plated or painted black.
- F. All nuts shall be new lock nuts or shall be provided with lockwashers. No exceptions.
- G. Lift Lines:
 1. Diameters as noted on drawings or as required, 7 x 19 construction, galvanized wire rope aircraft cable, with the following breaking strengths:
 - a. 3/16" diameter: 4,200 lbs.
 - b. 1/4" diameter: 7,000 lbs.
 - c. 3/8" diameter: 14,400 lbs.
 2. Damaged or deformed cable shall not be used. All wire rope rigging shall be installed so as to prevent abrasion of the wire rope against any part of the building construction or other equipment.
- H. Sheaves:
 1. Sheaves shall be of the following materials:

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- a. ASTM A-48 Class 30 grey iron castings or steel, as required to for dead plus live load tread pressures.
 2. Diameters shall be as shown on Drawings or as required to meet or exceed the wire rope manufacturer's minimum recommended D/d ratio, assumed herein to be 32x the lift line diameter.
 3. Groove depths shall be sufficient to encompass fully the cables and ropes. Grooves shall have sloped sides (8 degree minimum) and conform to rope and cable manufacturers' standards for groove shape and tolerance.
 4. Sheaves shall be supported by bearings and a machined steel shaft, which shall be keyed to one side plate to prevent rotation. Proper adjustment of the bearing shall be accomplished by means of a fine thread, self-locking nut on the opposite end of the shaft. Each sheave shall run plumb and true without chafing when rotated.
- I. Block mounting clips:
1. Blocks shall not be welded to structure and shall be clipped to building steel flanges.
 2. Flange mounting clips shall be bent plate min 5/16" thick, hot rolled steel, and min. 50KSI yield strength. The clip shall match the flange thickness of the beam to which the block is mounted. Bolts shall compress clips to base angles so there is full planar contact between the clip face and the beam flange. Bolted clips shall be oriented away from the result force on the blocks.
- J. Loft Blocks:
1. The sheave shall have an outside diameter as shown on drawings, and shall be an ASTM A48 Class 30 grey iron casting or steel, with machined grooves. The sheave shall be equipped with a 17 mm minimum diameter machined steel shaft and two sealed, precision ball bearings.
 - a. All loft blocks shall be single line sheaves.
 - b. Exception: multicable management lift line locations shall have two grooves.
 - c. Exception: short line loft block shall be multi-grooved to carry all lines.
 2. Base angles shall be a minimum 1-1/2" x 1-1/2" x 3/16" angle.
 3. Side plates shall be a minimum of 10-gauge steel, and shall fully enclose the sheave. Side plates shall be bolted to the base angles. There shall be a minimum of seven 1/4" bolts with spacers between the side plates, four of which prevent cables from escaping the sheave grooves.
 4. The block and associated mounting hardware shall have a recommended working load of at least 500 lbs. minimum for 8-1/2" dia, 700lbs. minimum for 12" dia, and 1400lbs minimum for 16".
 5. Block mounting clip per standard specification listed above.

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K. Lift Cables:

1. All lift cables shall be diameters as shown on drawings and as specified above.
2. Batten terminations shall be:
 - a. Pipe clamp
 - b. Turnbuckle
 - c. Wire rope thimble
 - d. One compression sleeve
 - e. Heavy black heat shrink tubing over cable ends
3. Arbor terminations shall be:
 - a. Wire rope thimble
 - b. One compression sleeve
 - c. Heavy black heat shrink tubing over cable ends
 - d. Forged and galvanized shackle rated for full working load plus factor of safety, with cotter pin on inward side.
4. Fittings as specified below.
5. Adjust pipes so the pipe is aligned straight and level. Pipe battens shall not be bowed more than 1/2" from the batten center or more than 1/8" over 10' out of level.

L. Cable Fittings:

1. Swaged sleeve fittings shall be copper Nicopress. Swaged fittings shall be installed per the fitting manufacturer's instructions, using the appropriate tools, and checked with a "go/no-go gauge".
2. Eyes shall be formed over galvanized wire rope thimbles of correct sizes.

M. Turnbuckles:

1. Cotter pin jaw-jaw with 6" throw, drop forged and galvanized. Turnbuckles shall be moused after adjustment to prevent loosening.

N. Pipe Clamps:

1. Pipe clamps shall be made of two strips of 12 Ga. by 2" hot rolled steel formed to encompass and clamp the pipe batten to prevent its rotation. Corners shall be rounded.

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2. There shall be a 3/8" x 1" hex bolt with lock nut above and below the batten. A 5/8" hole in the top of each clamp half allows the attachment of cable, chain, or other fittings.

O. Multicable Management:

1. For lighting multicables or cable bundles provide cable cradles, blocks and wire rope terminations as indicated on the Drawings.
2. It is under the work in this section to provide lighting cable extension drops to multicable management system and to mount electrical devices to battens.
 - a. Cable, cable reels and batten mounted devices shall be provided under section 11 61 83 Production Lighting.
 - b. Coordinate proper lengths to maximize high trim and install multicable on cable cradles as indicated.
 - c. Mount lighting receptacle devices to battens as shown on PL drawings and shop drawings.
 - d. Electrical terminations to gridiron and batten terminal boxes under Division 26 Electrical work.
3. Cable cradles to be securely bolted to 1/8" thick steel strap hangers on each side of the assembly.
4. Cable cradle strap to include guides of UHMW split blocks drilled vertically for passage of the adjacent lift line at the split. Halves shall be fastened together with countersunk nuts and bolts for ease of installation and removal.
5. Lift line attachment at single purchase cable cradle forged eye and gridiron dead off:
 - a. Wire rope thimble
 - b. Two compression sleeves
 - c. Black heat shrink tubing over cable ends
 - d. Forged and galvanized cotter pin shackle rated for full working load plus factor of safety.
6. Provide 8-1/2" diameter sheave with same specifications as for loft blocks, attached to double purchase cable cradle assembly. Lift line to pass through sheave and attach to gridiron.
7. Dead-off at the grid iron shall include an assembly of a 5" yellow painted backing channel with forged eye bolt. Assembly to be J-bolted to the gridiron grating.
8. Provide mounting hardware at rigging beams for multicable strain relief as shown on the Drawings.

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P. Multi-cable extension Drops

1. Provide flexible multiconductor extension cables drops for each fixed electric batten
 - a. Cables shall be of heavy duty SO, neoprene covered cable with the number of conductors in accordance with NEC 520. Provide 2 conductors for each circuit, plus grounds, rated for 20A, 125V.
 - b. Provide min. two (2) spare conductors per batten.
 - c. Strain relief:
 - 1) Provide "Hubbell Kellems Deluxe" or equal (no known equal) cord type grips correctly sized to restrain multicable at connection to devices.
 - 2) Provide "Hubbell Kellems Heavy Duty, Single Eye, Closed Mesh Strain Relief" at cord connection point to loftblock beam as shown on drawings.
 - 3) Provide 1 rated shackle for each eye.
 - d. Provide with all necessary mounting hardware as shown on PRT and PLT drawings and as required.

PART 3 EXECUTION

3.1 PERFORMANCE OF THE WORK

- A. The Rigging Contractor shall be responsible for storage of stage equipment, tools, and equipment during the period of the installation.
- B. Extent: All specified equipment shall be installed by fully trained superintendents and workmen. Equipment shall be installed in a workman like manner, per plans and specifications. Equipment shall be aligned, adjusted, and trimmed for the most efficient operation, the greatest safety and for the best visual appearance.
- C. Standards: Installation practices shall be in accordance with OSHA Safety and Health Standards and all local codes. All welding must be performed in full compliance with the latest edition of the Structural Welding Code (ANSI/AWS D1.1).
- D. Alignment: Mule blocks, cable rollers and guides shall be installed using a precision laser, as required, to provide proper alignment, to maintain minimum fleet angles, and to prevent contact with other surfaces. There shall be no fleet angle where possible; if required, fleet angle shall be no greater than 1½°.
- E. Fabricate metal work in accordance with standards of first class workmanship with ornamental work free of blemishes like tool marks, burrs, scars and abrasions. All edges shall be smooth. All points, welds and intersections shall be properly made and fitted to provide a uniform finish.
- F. All connection points shall be welded and ground smooth.
- G. Provide slotted holes, as needed, in steel members which require accurate alignment.

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- H. Fit abutting surfaces closely.
- I. Accurately align and adjust various frame members before final anchoring.
- J. Erect metal work level, plumb, square and in proper alignment with adjacent work. Deformed components shall be remedied.
- K. Attachments: All equipment shall be securely attached to the building structure.
- L. Finishes:
 - 1. All welds must be touched up to match disturbed finishes.
 - 2. All finishes which are disturbed during shipping and installation shall be touched up to match the original.

3.2 INSPECTION AND TESTING

- A. Inspection shall include, but shall not be limited to:

3.3 TRAINING

- A. Upon final approval of the system by the Owner's Representative, representatives from the Rigging Specialty Sub-Contractor shall provide instruct designated Owner staff or representatives in the safe use and maintenance of all systems specified herein.
- B. Scheduled training sessions shall be scheduled in advance with respect to the Owner staff or representatives' schedules.
- C. Provide 2 hours of training.
- D. Training shall include, but not be limited to:
 - 1. An overview of the systems and all of its components.
 - 2. Proper and safe operations of all rigging systems including use of counterweight, operation of rigging battens, loading and un-loading of counterweight, safe and proper use of capstan winch, adjustment of lower tension block, and use of hand crank winch.
 - 3. Care and maintenance of rigging systems.
 - 4. Basic system visual inspections

END OF SECTION

PRODUCTION LIGHTING SYSTEM

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Services as listed herein and related to the furnishing and commissioning of production lighting dimming and control system equipment.
2. Provide all low voltage terminations for the system, make all physical low voltage termination at all panels in the system per factory specification
3. Coordinate with architectural lighting designer and electrical engineer to provide all parts necessary for a functional emergency lighting system.

1.2 RELATED SECTIONS

A. Coordinate with the following sections in carrying out this work:

1. Division 1 – General Conditions
2. Section 11 61 34 – Production Rigging Systems
3. Division 26 – Electrical
4. Section 26 05 35 – Production Systems Electrical Installation

1.3 REFERENCES

- A. Comply with all national, state and local regulations. In the event of conflict between these specifications and the applicable regulations, the more stringent shall govern.
- B. Equipment shall be provided per the related trade and regulatory guidelines including but not limited to UL, NEC, IEEE, and all manufacturer's recommendations and requirements. Contractor shall be responsible in the event that work under their control voids or jeopardizes manufacturers' warranties.
- C. Labor shall be provided per applicable labor regulations and practices.

1.4 DEFINITIONS

- A. Refer to Div. 1 for definitions.
- B. Owner's Representative: For the scope in this Section, authorized personnel representing The Beaverton School District and The Shalleck Collaborative, Inc., Theatre Consultants.

1.5 SYSTEM DESCRIPTION

- A. The production lighting control system shall be complete, and shall control the theatre lighting, and selected work lighting through interface with DMX controlled motorized breakers and dimmers.

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- B. The system shall be comprised of control panels, control electronics, a data network, relays, and circuit wiring devices.
- C. Provide all low voltage terminations for the system, make all physical low voltage termination at all panels in the system per ETC factory specification.
- D. There shall be a fully functional emergency lighting system, designed by the electrical engineer.

1.6 CURRENT TECHNOLOGY

- A. Only the most current hardware and software shall be provided. In no case will discontinued or superseded products be acceptable. If the manufacturer has developed and successfully released products that meet or exceed the criteria within this specification, the Contractor shall notify the Owner's Representative and submit the new product for review. If accepted, the products will be provided at no additional cost to the Theatre. Software upgrades and authorized support services for its proper integration into the system shall be provided at no cost to the Theatre throughout the warranty period.
- B. In the event of known product defaults or recall, the Contractor shall immediately notify the Owner and Owner's Representative and make immediate arrangements for remedy.
- C. None of the stipulations herein shall be grounds for revision to the project schedule.
- D. See related procedures under Warranties in this Section.

1.7 SUBSTITUTIONS

- A. All requests for substitutions from the specified materials, assemblies or related services shall be submitted for review by the Owner's Representative prior to bid. Substitution requests made after bid shall be neither reviewed nor accepted. Requests shall be made in accordance with Division 1 of the specifications, and in a timely fashion so as to not affect the project schedule in either case of the substitution being accepted or rejected.
- B. Documentation for the substitution shall be submitted with supporting material and shall include the related information for the item as specified so that equivalence can be demonstrated. The burden of proof rests solely upon the Contractor. The Owner's Representative shall be the sole evaluator of the fitness of the substitution.
- C. All expenses related to the substitution including, but not limited to, all fees and expenses incurred in the evaluation of the substitution, and any effect on the costs and schedule of other trades whether or not the substitution is accepted, shall be borne by the Contractor.

1.8 WARRANTY

- A. Warranty shall provide coverage of material and product defects and assembly workmanship or installation for a period of two years following the date of acceptance by the Owner.
- B. Items under warranty shall be serviced to the satisfaction of the Owner within 14 days of notification to the Contractor. If warranty claims are not serviced to the satisfaction of the Theatre within the 14 day period, the Contractor shall bear all costs that arise as a result of

PRODUCTION LIGHTING SYSTEM

the delay, including, but not limited to, the use of temporary replacement components, additional Owner's staffing or overtime, shipping, cancelled uses or performances.

1.9 QUALITY ASSURANCE

- A. Equipment in this Section shall be provided by specialty subcontractors and manufacturers meeting the qualifications listed herein.
- B. Specialty subcontractor shall have been continuously engaged in the sales and integration of lighting control equipment similar to that specified herein for a minimum of ten years.
 - 1. Manufacturer shall have been continuously engaged in the manufacturing of lighting control equipment similar to that specified herein for a minimum of ten years.
- C. Specialty subcontractors shall have within their employ; manufacturer's factory authorized field services technicians within a four hour travel distance from the Project site.
- D. All equipment shall be UL listed and bear the appropriate labels.

1.10 DELIVERY, STORAGE AND HANDLING

- A. Packing shall prevent damage to the equipment during transit. Costs to repair or replace all equipment damaged during the course of the contract services shall be borne by the Contractor.
- B. Do not deliver materials in this Section until building is ready for installation. Contractor is responsible to properly sequence the work and to protect from damage during delivery, handling, storage and installation.
- C. Contractor is responsible to coordinate and provide secure and protected storage as required for the execution of the Contract.
 - 1. Devices shall not be delivered to the project site until the project is suitably clean and all adjacent finish work that may be painted or produce dust has been completed. The contractor shall provide and maintain complete protection of all devices until the project has been made available for occupancy by the Owner. The Contractor shall thoroughly clean and remove any dirt or dust that infiltrates system components and be responsible for timely replacement of any damaged components.
 - 2. Device labels and connectors shall be delivered with temporary dust and paint protection installed.

1.11 PROJECT CONDITIONS

- A. Defects in the field which may impact the work in this Section shall be reported to the Owner's Representative and corrected in accordance with the requirements of the applicable Section of work prior to commencement of the work in this Section.

1.12 DEMOLITION

- A. Remove backboxes and wiring at existing production lighting receptacles. Remove conduit to production lighting receptacles or reuse if possible.

PRODUCTION LIGHTING SYSTEM

- B. Remove production lighting receptacles and wiring at old lighting desks in the booth.

1.13 MAINTENANCE

- A. Provide maintenance stock of User-serviceable components within the system. Maintenance stock shall be packaged in labeled long term storage packaging and turned over to the Theatre at time of system commissioning.
- B. Maintenance stock shall include:
 - 1. Four fuses of each type in the system.
 - 2. Two control device receptacles and connectors of each type in the system.
 - 3. Four circuit distribution connectors of each type in the system.
 - 4. Four cable mount lighting fixture power connectors of each type in the inventory.
 - 5. Six spare keys of each type in the system.
 - 6. Components recommended by the Manufacturer.
 - 7. Any non-standard tools required for User service.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Dimming and control equipment in this Section shall be provided by specialty manufacturers providing products meeting the specifications herein.
- B. Dimming and control equipment in this Section shall be the products of the following pre-approved manufacturers:
 - 1. Electronic Theatre Controls
 - 2. or equal (no known equal)
- C. All other manufacturers must be approved by the Owner's Representative prior to bid.

2.2 MATERIALS

- A. All components supplied under this Section shall be new. Used or factory reconditioned components shall not be acceptable. Reuse of existing conduit, wiring and back boxes is acceptable if they meet conditions required herein.

2.3 PRODUCTION AND ARCHITECTURAL LIGHTING RELAY PANELS

- A. For production lighting relay panels, the wall mount relay panel shall be the Sensor IQ Relay Panel as manufactured by Electronic Theatre Controls, Inc.
- B. For architectural and work lighting relay panels, the wall mount relay panel shall be the

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Sensor IQ Relay Panel as manufactured by Electronic Theatre Controls, Inc.

1. Provide main and branch breaker configurations to support connected fixture load types.

C. General

1. Panels shall be UL 508, UL924 and UL67 listed and so labeled.
2. The panels shall receive ESTA DMX512-A control protocol. Addressing shall be set via the user interface button keypad with any circuit patched to any DMX control address.
 - a. 2,500V of optical isolation shall be provided between the DMX512 inputs and the control electronics as well as between control and power components.
3. Panels shall be provided in 12, 24 or 48 circuits as shown on drawings.
 - a. Panel shall support dual and three pole circuits at decreased density where each pole constitutes one of the available single pole circuits
 - b. Single, Dual or three pole circuits shall be mixed as required for the circuiting shown on the drawings.

D. Electrical

1. Breakers and relays shall be rated to 100% electrical load.
2. Branch circuits shall be 20a unless noted otherwise.
3. Breaker output lugs shall accept 10-14 AWG dual conductor wire
4. Panel shall be fed by 120/208v Three phase, 4-wire plus ground input feeder.
5. Panels shall include a main breaker. See electrical documents for breaker sizing.

E. Mechanical

1. The panels shall be set up for wall or flush mounting and supplied with cover.

F. Function

1. Panel shall be user programmable.
2. Circuits shall be individually addressable.

G. Provide with the following Breaker Panel Accessories

1. Ethernet Option shall provide advanced control of breakers over streaming ACN (sACN) and transmit status, control override, and measured energy usage per branch circuit to web browser based interface or central monitoring interface

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2. A Contact Input Option shall allow 24 dry contact inputs to be linked for direct or group breaker control, to activate a preset, or to activate a sequence. Controller software shall allow for normally open maintained, normally closed maintained or momentary toggle.
 3. A RideThru Option shall provide short-term power backup of control electronics by automatically engaging when power is lost, and recharging when normal power is present
 4. A Tamperproof Hardware Kit shall include center reject Torx head screws to prevent access to panel interior by unqualified individuals
 5. Main Breaker options
- H. Panel shall be of the same manufacturer as the architectural control system.
- I. The wall mount relay panel shall be the Sensor IQ Relay Panel as manufactured by Electronic Theatre Controls, Inc.
- J. Provide the following options:
1. Ethernet Option
 2. 0-10V Dimming Option
 3. Contact Input Option
 4. RideThru Option

2.4 ARCHITECTURAL CONTROL ELECTRONICS

- A. Provide control electronics with memory capacity and performance as required to meet the functions within these specifications.
1. The system shall permit control of any dimmer on the system by the Control Console or any other DMX512 controller, or the Preset Panels as specified below on a last action basis.
 2. Racks shall be configured to normally exchange data via the Ethernet network, with all programming capabilities granted therein.
 3. Two optically isolated DMX512 inputs shall be provided, allowing overlapping or separation of any control level. 2,500V of optical isolation shall be provided between the DMX512 inputs and the control module.
 4. The system shall send control signal to low voltage relay panels as specified.
 5. Architectural control electronics may be housed external from dimmer racks.
 6. Provide options/modules as necessary to accept an RS-232 control connection from the AV control system.

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7. Products shall be
 - a. ETC Paradigm

2.5 EMERGENCY SYSTEMS

- A. Provide equipment necessary for emergency lighting systems as shown on drawings
- B. Emergency Power Transfer Switch
 1. All Devices shall be UL1008 listed and labeled.
 2. Provide ELTS by Electronic theatre controls, if required by electrical engineer to support the emergency lighting system.
- C. Emergency signal devices
 1. All devices shall be UL 924 listed and so labeled.
 2. Provide Power loss detection kit
 - a. Provide ETC Emergency Bypass Detection Kit (EBDK)
 3. Provide DMX emergency signal dedication
 - a. Provide DMX Emergency Bypass Controller (DEBC)
 - b. Provide in quantities as required to serve each discrete DMX line as shown on the architectural drawings.

2.6 LIGHTING CONTROL ETHERNET NETWORK COMPONENTS

- A. Network general specifications:
 1. The lighting control system shall operate on an Ethernet TCP/IP based network, with all components and procedures meeting IEEE standard specification 802.3af-2003, for Power over Ethernet, 10/100BaseT and/or 10/100Base FL.
 2. The network shall support multiple consoles, computers, file servers, printers, and architectural processors with discrete command lines and control. The network shall support multiple venues/systems on the same network.
 3. Device configuration selection, manufacturing, installation shall be accomplished to assure a flexible and robust system for the prevention of data interruption and ease of User maintenance and diagnostics.
 4. ESTA ACN protocol shall be supported.
- B. Network Nodes
 1. DMX and other lighting control data shall be inserted and retrieved on the Ethernet network via protocol translation nodes.

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2. Each DMX Node shall have LEDs for indication of power, network activity, and DMX port configuration. Those LEDs used for DMX port configuration indication shall also indicate the presence of valid DMX/EDMX signal.
3. Network configuration shall be via production lighting control manufacturer's configuration software. The software shall permit complete user flexibility allowing the system operator to patch DMX data over Ethernet DMX (EDMX), assign node labels for easy identification, assign RFUs to specific systems in multi-system networks, assign DMX offsets and provide DMX port prioritization. Each node shall have a specific IP address provided automatically by the software. The user may edit this IP address. Systems that do not support simple Windows configuration, or systems that do not allow complete reconfiguration of the above mentioned features over Ethernet shall not be acceptable.
4. All configuration data for each network device shall be held at the device and system operation shall not require continuous on line operation of the network configuration software.
5. Systems connected to the same network shall be capable of arbitrating control over EDMX data. The system shall be capable of alternating control of individual dimmer data between architectural and production lighting systems without intervention by the user. The user shall dictate the conditions under which system shall automatically take control and the network shall allow user override of the user selected defaults. Systems which require direct user intervention to allocate control of dimmers between architectural and production lighting systems shall not be allowed.
6. The network shall allow multiple DMX inputs assigned to the same EDMX range to be set at different priorities. This shall allow the user to assign high or low priority to each DMX input port in the network on a port by port basis. The network shall require a valid DMX signal present at the input to initiate prioritization. Systems that do not allow for prioritization shall not be allowed.
7. Each DMX Node shall control up to 2048 DMX addresses, within the confines of up to 64 DMX (32,767 EDMX address) "universes". The specific DMX data input or output by the Node shall be freely configurable by the user. Duplicate outputs of DMX lines (DMX splitter) and discrete outputs shall be fully supported. Multiple sources may be combined and a priority may be assigned to each source. Each DMX line may have its own start address and offset for ease of use. DMX ports shall be configurable for either input or output.
8. Maximum delay time from input to output shall not be greater than one packet time (approximately 30 mSec.). A minimum DMX update rate of 40Hz shall be sustained under all conditions.
9. Power for the nodes shall be provided over the Cat5 cable, as PoE as specified herein. The node electronics shall be electrically isolated from the power supplied over the Cat5 cable.
10. DMX inputs shall be fully opto-isolated from the node electronics and from each other. DMX outputs shall be earth-ground referenced. DMX Ports shall be capable of withstanding fault voltages of up to 250VAC without damage.

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11. Provide 8 portable nodes at each school.

C. Control Equipment Rack (CER)

1. Rack general assembly:
 - a. Provide industry standard 19" equipment rack for all necessary control equipment specified herein.
 - b. Wall mounting with fixed back plane swing out front section for access. Hinges shall be placed on the side appropriate to the mounting condition. Verify in field.
 - c. Mounting brackets shall be 14 gauge steel
 - d. Engraved label riveted to the case front with the name of the rack. Rack label characters shall be ½" high.
 - e. Bottom air vents and rear knockouts for conduit entry.
 - f. All unused sections shall be covered with vent panels no taller than 2 rack units (R.U.).
 - g. Rack to be configured and mounted with all controls within wheelchair chair reach as required by the ADA and local codes.
 - h. Powder coat finish: Black
 - i. Body and Back pan shall be 18 gauge Steel
 - j. Rackrail shall be 11 gauge steel
 - k. Rack shall be Middle Atlantic Products model DWR, or equal

D. Switches

1. Provide Power Over Ethernet (PoE) 48-port 1000Mbps Ethernet switches in quantities as required, configured appropriately.

E. Provide network patch panels for the termination of network taps. Label each point to match labels on drawings.

F. Provide patch cables as required for the inter connection of the system.

2.7 CONTROL RECEPTACLE PANELS

A. General

1. The control receptacle panels shall consist of the appropriate connectors required for the system in this Project.

B. Connectors

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1. The control receptacle panels shall include for following connector types, per industry standard:
 - a. RJ-45 XLR type, Neutrik Ethercon Series Connectors for Cat5, configured to accept standard RJ-45 connectors.
 - b. 5-Pin male and female XLR connectors for DMX input/output per industry standard
 - c. Other receptacle types as appropriate per manufacturer's standard features. Match power receptacles to each school's existing receptacle type.

C. Physical

1. Faceplates shall be .080" aluminum, edges eased, finished in fine texture, scratch-resistant powder coat, with fasteners countersunk.
 - a. Panels specified as flush mounted shall overlap back box by 1/2". Surface mounted panels shall match back box size with no gaps or overlap.
 - b. Provide all back boxes and coordinate mounting with Div. 26.
2. Color shall be black unless otherwise noted.
3. Panels noted as custom color shall be factory powder coated a color selected by the Owner's Representative. Engraving shall be filled a contrasting color.
4. Engraved and filled labels 1/8" high characters minimum, filled shall be white unless otherwise noted.
 - a. Network taps and node gateways shall be labeled per the patch bay location and point number as shown on schedule.
5. Wall mounted panels shall mount into an industry standard back box, depending on size and quantity of connectors. A terminal block shall be supplied for terminations.
6. Rack mounted panels shall mount within industry standard equipment racks. Provide local breaker for integral AC power receptacle per Code.
7. Panels mounted in floor boxes shall include a clear flexible vinyl dirt guard. Guard shall cover receptacles but not labels.
8. Provide complete hardware for mounting on gridiron or catwalk hangers where required.

2.8 ARCHITECTURAL CONTROL PANELS

- A. Architectural control panels shall be able to control any of the following:
 1. Theatre theatrical lighting relays
 2. Theatre architectural lighting relays

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3. Lighting circuits on relays
- B. Architectural control panel wiring shall be digital, low voltage wiring that shall be topology free. Panels shall be interactive with each other as described herein.
- C. Physical
 1. Faceplates shall be .080" aluminum, edges eased, finished in fine texture, scratch-resistant powder coat, with fasteners countersunk.
 - a. Panels specified as flush mounted shall overlap back box by 1/2". Surface mounted panels shall match back box size with no gaps or overlap.
 - b. Provide back box and coordinate mounting with Div. 26.
 2. Color shall be black unless otherwise noted.
 3. Panels noted as custom color shall be factory powder coated a color selected by the Owner's Representative. Engraving shall be filled a contrasting color.
 4. Engraved and filled labels 1/8" high characters minimum, filled shall be white unless otherwise noted.
 5. Wall mounted panels shall mount into an industry standard back box, depending on size and quantity of connectors. Back boxes shall not exceed 4" in recess depth. A terminal block shall be supplied for terminations.
 6. Rack mounted panels shall mount within industry standard equipment racks.
- D. LCD Touchscreen
 1. Rear illuminated LCD touch screen with all standard advertised features.
 - a. Acceptable devices:
 - b. ETC Unison Paradigm LCD touch screen
 2. Provided, immediately adjacent to LCD Panels.
 - a. One illuminated, momentary contact "ENTRY PANEL LOCKOUT" pushbutton. The pushbutton shall cause Theatre one-button panels to be inoperative when pressed once and all "LOCKOUT" pilot lights shall illuminate. The pushbutton shall remain lit so long as the "LOCKOUT" status is maintained. "LOCKOUT" status shall be activated or deactivated at any "LOCKOUT" pushbutton, regardless of the last action. Action on an illuminated pushbutton in "LOCKOUT" mode will release the preset panels for operation and the pilot light shall go out. Action on the lockout button shall not cause any change in level status. This button shall have no effect on the controls outside of the Theatre.
 - b. One on/off button to turn on general worklights and rehearsal lights to be programmed at time of commission.

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E. LCD Panel Operations

1. The following should be used as a basis for the initial soft programming of the architectural control stations. The configuration shall be verified with the Owner's Representatives at time of commissioning.
2. LCD panels shall be programmed with soft pages for access to various areas and levels of control.
 - a. Virtual pushbuttons shall indicate state by a change in appearance. Controls shall be though various pages of controls.
 - b. Access shall be divided into two security levels minimum. The panels shall "home" to a first level of access which allows the User to play presets changing the levels of the areas shown on the display, without login. The first level of access shall not allow the programming of presets.
 - c. The program function shall become available as a "record" button on the same preset playback screens upon login to the second level with a four digit pass code on a virtual keypad. The pass code shall initially be set as "4100". The login screen shall be a back page visible as a first level page choice, and shall include a "logout" pushbutton which shall return the panel to the first level. "Logout" from the second level shall automatically occur after 30 minutes of inactivity.
 - d. The LCD shall be used to program the multi-button and one-button pushbutton preset panels.
 - e. The system shall allow the programming of presets and macros through a "snapshot" procedure. Levels shall be set by the control console, by soft sliders at the LCD panel or at the dimmer rack and then captured as a preset to be replayed at any one of the preset buttons.
 - f. The first page shall be called "House Presets" and shall contain the same number and function of preset buttons as the multi-button preset stations specified herein.
 - g. The second page shall be called "Work/Reh" and shall have buttons for the various areas of the theatre's technical areas and the rehearsal groups. The work light buttons shall include control of the low voltage relay circuits as well as production circuits selected as rehearsal lights. If the architectural control system does not receive status information back from the relay cabinet, then separate on and off buttons shall be shown, and the "off" button shall activate a macro that pulses the channel on then off, so the indicators on the panel match the channels' state.
 - h. The third page shall be called "Show Presets" and shall include ten buttons, named as directed by the Owner's Representative at time of programming.
 - i. The next page shall only be visible at the second security level and shall be used to program the one-button entry stations.

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- j. The next pages shall include sliders for each architect control group as listed in the architectural lighting dimming schedule.

F. Multi-Button and One-Button Panels

- 1. Pushbutton stations shall include programmable buttons with integral LED indicators.
- 2. Multi button panels shall include a card holder with slide-in tags and clear cover for User labeling.

G. Preset Panel Operations

- 1. The system shall allow the programming of presets and macros through the LCD as described above.
- 2. Action on any one button shall cause all identical pushbutton indicators on other panels to mimic the preset state.

2.9 WIRING DEVICES

- A. Provide power distribution wiring devices in the quantities, types and configurations as shown on drawings. All back boxes shall be supplied by production lighting contractor and manufacturer.
- B. Devices shall be fabricated from 18 gauge cold rolled steel with 16 gauge covers, finished with flat black powder coat unless otherwise noted. Devices shall be UL listed and labeled for the use specified herein.
 - 1. Back box shall not exceed 6-1/2" high x 4" deep.
 - 2. Panels specified as flush mounted shall overlap back box by 1/2". Surface mounted panels shall match back box size with no gaps or overlap.
- C. Receptacles and connectors shall all be of the same manufacturer and be fully black.
 - 1. Connector type: Provide 20A L5-20 connectors throughout, except at orchestra shell drop boxes, Provide 20A L5-20 connectors at orchestra shell drop boxes.
 - a. Connectors shall be of the same manufacturer throughout the project to minimize maintenance stock.
- D. Receptacles and connectors shall be factory pre-wired to internal feed through terminal blocks and grounded. All wiring and terminals shall be factory numbered. Size all lugs as required based on wire size indicated on the Electrical documents. Provide for dedicated neutrals within each device and homerun. Terminals shall be clamp-type compression terminals appropriately listed.
 - 1. All parallel circuits, if applicable shall homerun to the dimmer rack, unless otherwise noted.
- E. Circuits shall be labeled with engraved lamicoid tags with 1/2" high characters securely riveted to the box and plainly visible. Label color shall be:

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1. Production Lighting circuits - black tags with white core.
- F. Pigtails shall be of neoprene covered, black, heavy duty SO, SOW or better three-wire 12/3 cable. Internal wiring shall be sized to circuit ampacity and shall be rated at 125°C. Provide heavy duty strain relief at box entry. Visible leads shall not be acceptable.
1. In addition to box labels, pigtails shall be labeled with ½" high minimum black characters on white background sleeves, protected and securely affixed under clear heat shrink tubing. Pigtail label assembly shall be applied 6" above the connector.
- G. Provide with all necessary mounting hardware as required.
- H. All 6-circuit multipin receptacles shall be wired per USITT industry standard for 19 pin connectors.
- I. Multicable Plug Boxes:
1. Multicable plug boxes shall include female 6-circuit, heavy-duty, locking multipin receptacle(s) which will mate to multi-cables.
 2. Provide threaded couple/uncouple panel mount multi-pin connectors.
 3. Contacts shall be manufactured from copper alloy with hard silver or gold plating.
 4. Backshells shall provide minimum 1" of wiring space.
 5. Multipin receptacles to be Socapex compatible as manufactured by Veam, Pyle-National and as appropriate for the theatre industry's standards in the project's immediate region.
 6. Label shall include each circuit number preceded by an "A-" through "F-" designation.
 7. Provide pigtail and basket weave strain reliefs.
 8. Provide robust tie-off devices.
- J. Terminal Boxes, Type "ET" and "BT"
1. Provide terminal boxes factory wired with numbered terminal blocks for field connection by others, as indicated in the Drawings and schedules. Provide 6 spare terminals in each terminal box in addition to the circuits indicated in the Drawings. Provide with ground lugs bonded to the box.
 - a. Terminals and circuiting shall include relay circuits as well as integral constant AC power as indicated on drawings.
 2. Reinforce base of terminal boxes as required to take load from multicable.
 3. Terminal boxes for Drop Boxes, and Connector strips shall include multiconductor extension drops as specified below.

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4. Terminal box to be clearly labeled with circuit numbers.

2.10 MULTICABLE EXTENSION DROPS

- A. Provide flexible multiconductor extension cables drops:
 1. Cables shall be of heavy duty SO, neoprene covered cable with the number of conductors in accordance with prevailing electrical codes. Provide 2 conductors for each circuit, plus grounds, rated for 20A, 125V.
 2. Provide min. two (2) spare conductors per batten.
 3. Provide for:
 - a. Receptacle Boxes on fixed electrics battens
- B. Coordinate lengths with Production Rigging Sub-Contractor, under Section 116134. Provide lengths sufficient to allow battens to travel to the floor.
- C. Strain relief:
 1. Provide "Hubbell Kellems Deluxe" cord type grips correctly sized to restrain multicable at connection to devices.
 2. Provide "Hubbell Kellems Heavy Duty, Single Eye, Closed Mesh Strain Relief" at cord connection point to loftblock beam.
 3. Provide 1 rated shackle for each eye.
- D. Coordinate installation with Production Rigging Sub-Contractor, under Section 116133 and with division 26.
- E. Provide with all necessary mounting hardware as required.

2.11 CONTROL CONSOLE

- A. Provide the following control consoles:
 1. ETC Ion 1000 with 2x20 fader wing

2.12 CONSOLE ACCESSORIES – ETC ION

- A. Provide the following accessories:
 1. One (1) Apple ipad mini with IRFR application installed and configured.
 2. Provide industrial water and fall protection case and cover for ipad mini.
 3. Two (2) POE wireless access points
 - a. Mount/install access point on steel plate and attached to PCR on stage and back of third catwalk at main theatre. Plug into network port at top of the rack and

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back of catwalk, provide required network cable.

- b. Standards 802.11 a/b/g/n/ac
 - c. Dual band 2.4 and 5 GHz
 - d. Wireless data rates up to 300Mbps
 - e. POE – power over ethernet
 - f. Setup to work with IRFR ipad
 - g. Black in color.
 - h. Any lights shall be shut off if in view of audience.
4. Control Room Monitors & Keyboards
- a. Provide two monitors for the console.
 - b. Monitors shall be 22” minimum diagonal color (if supported by console) flat panel display monitors. Provide Dell S2240T Touch Screen Monitor or equal.
 - c. Monitors shall include vertical and tilt adjustment stand.
 - d. Provide one keyboard & mouse for each console
5. Tech table equipment
- a. In addition to Control Room Monitors, provide two 22” minimum diagonal color flat panel display monitors for use at a tech table position. Standard desk-top mount with vertical and tilt adjustment stand. Provide Dell S2240T Touch Screen Monitor or equal.
 - b. Provide ETC Nomad Puck 256 for use at tech table position.
 - c. Provide plug strip and 25 foot power and data cables.
 - d. Two dimmable table top or integrated “Littlelite” worklights.
 - e. Road case with 1” foam padded, hard sided industry standard pre-manufactured case with lifting handles and casters. Provide with individual slots for tech table monitors and Nomad Puck RVI. Provide slot for plug strips and all cables and little lights. Attach lamicoid labels to the short end and top of the road case “Tech Table Production Lighting”
6. Two dimmable table top or integrated “Littlelite” worklights.
7. Power supply and surge protector/UPS capable of maintaining the console and monitor for 15 minutes after power is suspended.
8. Console power and all control cables shall be 25’ long.

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- a. Exception: provide standard length monitor data cables.
9. Dust covers for console and all monitors.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Advise Div. 26 for the proper installation of the dimming and control equipment specified herein.
- B. For the commissioning services as listed herein only, coordinate scheduling and access with the Contractor and Owner and provide personnel lifts or ladders as required for access to the lighting equipment.
- C. For the commissioning services as listed herein only, remove all packing materials from the jobsite. Insert operations and maintenance information into the project record documents as specified above in Submittals.
- D. Provide all low voltage terminations for the system, make all physical low voltage termination at all panels in the system per factory specification.

3.2 COMMISSIONING AND DEMONSTRATION

- A. Coordinate with Division 26.
- B. Factory trained and authorized personnel shall review, test, program and otherwise complete the system, providing that the system and all components are fully functional per the Documents and fully covered under the Manufacturer's warranty.
 - 1. It shall be under the work in this section to provide turnkey proper and logical programming of the lighting control systems.
 - 2. It shall be under the work in this section to coordinate the proper and logical programming of the low voltage relay panel supplied under Division 26.
 - a. The low voltage panel shall be programmed so the control groups of branch circuits match the control and indication on the architectural control panels provided and programmed under this section.
- C. Upon completion of the commissioning, the factory trained and authorized personnel shall demonstrate operation and maintenance of the system to the Owner's representatives. Coordinate with the Owner's Representative's schedules two weeks in advance minimum.
- D. Training shall include, but not be limited to:
 - 1. Safety precautions.
 - 2. Identification of all elements provided under this section.
 - 3. Maintenance, diagnostics and trouble shooting.

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4. Control operation training of the console, dimming and control electronics.
 5. Operations and maintenance manual orientation.
- E. Provide 6 hours of training, minimum over 2 days.

END OF SECTION

ELECTRICAL BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Work included in 26 00 00, Electrical Basic Requirements applies to Division 26, Electrical work to provide materials, labor, tools, permits, incidentals, and other services to provide and make ready for Owner's use of electrical systems for proposed project.
- B. Contract Documents include, but are not limited to, Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Drawings, Addenda, Owner/Architect Agreement, and Owner/Contractor Agreement. Confirm requirements before commencement of work.
- C. Definitions:
 - 1. Provide: To furnish and install, complete and ready for intended use.
 - 2. Furnish: Supply and deliver to project site, ready for unpacking, assembly and installation.
 - 3. Install: Includes unloading, unpacking, assembling, erecting, installation, applying, finishing, protecting, cleaning and similar operations at project site as required to complete items of work furnished.
 - 4. Approved or Approved Equivalent: To possess the same performance qualities and characteristics and fulfill the utilitarian function without any decrease in quality, durability or longevity. For equipment/products defined by the Contractor as "equivalent", substitution requests must be submitted to Engineer for consideration, in accordance with Division 01, General Requirements, and approved by the Engineer prior to submitting bids for substituted items.
 - 5. Authority Having Jurisdiction (AHJ): Indicates reviewing authorities, including local fire marshal, Owner's insurance underwriter, Owner's Authorized Representative, and other reviewing entity whose approval is required to obtain systems acceptance.

1.2 RELATED SECTIONS

- A. Contents of Section applies to Division 26, Electrical Contract Documents.
- B. Related Work:
 - 1. Additional conditions apply to this Division including, but not limited to:
 - a. Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements.
 - b. Drawings

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- c. Addenda
- d. Owner/Architect Agreement
- e. Owner/Contractor Agreement
- f. Codes, Standards, Public Ordinances and Permits

1.3 REFERENCES AND STANDARDS

- A. References and Standards per Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, individual Division 26, Electrical Sections and those listed in this Section.
- B. Codes to include latest adopted editions, including current amendments, supplements and local jurisdiction requirements in effect as of the date of the Contract Documents, of/from:
 - 1. State of Oregon:
 - a. OAR - Oregon Administrative Rules
 - b. OESC - Oregon Electrical Specialty Code
 - c. OFC - Oregon Fire Code
 - d. OMSC - Oregon Mechanical Specialty Code
 - e. OPSC - Oregon Plumbing Specialty Code
 - f. OSSC - Oregon Structural Specialty Code
 - g. OEESC - Oregon Energy Efficiency Specialty Code
 - h. Oregon Elevator Specialty Code
- C. Reference standards and guidelines include but are not limited to the latest adopted editions from:
 - 1. ABA - Architectural Barriers Act
 - 2. ADA - Americans with Disabilities Act
 - 3. ANSI - American National Standards Institute
 - 4. APWA - American Public Works Association
 - 5. ASCE - American Society of Civil Engineers

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6. ASHRAE Guideline 0, the Commissioning Process
 7. ASTM - ASTM International
 8. CFR - Code of Federal Regulations
 9. EPA - Environmental Protection Agency
 10. ETL - Electrical Testing Laboratories
 11. FCC - Federal Communications Commission
 12. FM - FM Global
 13. IBC - International Building Code
 14. IEC - International Electrotechnical Commission
 15. IEEE - Institute of Electrical and Electronics Engineers
 16. IES - Illuminating Engineering Society
 17. ISO - International Organization for Standardization
 18. MSS - Manufacturers Standardization Society
 19. NEC - National Electric Code
 20. NECA - National Electrical Contractors Association
 21. NEMA - National Electrical Manufacturers Association
 22. NETA - National Electrical Testing Association
 23. NFPA - National Fire Protection Association
 24. OSHA - Occupational Safety and Health Administration
 25. UL - Underwriters Laboratories Inc.
- D. See Division 26, Electrical individual Sections for additional references.
- E. Where code requirements are at variance with Contract Documents, meet code requirements as a minimum requirement and include costs necessary to meet these in Contract. Machinery and equipment are to comply with OSHA requirements, as currently revised and interpreted for equipment manufacturer requirements. Install equipment provided per manufacturer recommendations.

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- F. Whenever this Specification calls for material, workmanship, arrangement or construction of higher quality and/or capacity than that required by governing codes, higher quality and/or capacity take precedence.

1.4 SUBMITTALS

- A. See Division 01, General Requirements for Submittal Procedures as well as individual Division 26, Electrical Sections.
- B. Provide drawings in format and software release equal to the design documents. Drawings to be the same sheet size and scale as the Contract Documents.
- C. In addition:
1. "No Exception Taken" constitutes that review is for general conformance with the design concept expressed in the Contract Documents for the limited purpose of checking for conformance with information given. Any action is subject to the requirements of the Contract Documents. Contractor is responsible for the dimensions and quantity and will confirm and correlate at the job site, fabrication processes and techniques of construction, coordination of the work with that of all other trades, and the satisfactory performance of the work.
 2. Provide product submittals and shop drawings in electronic format only. Electronic format must be submitted via zip file via e-mail. For electronic format, provide one zip file per specification division containing a separate file for each Specification Section. Individual submittals sent piecemeal in a per Specification Section method will be returned without review or comment. All transmissions/submissions to be submitted to Architect. Deviations will be returned without review.
 3. Product Data: Provide manufacturer's descriptive literature for products specified in Division 26, Electrical Sections.
 4. Identify/mark each submittal in detail. Note what differences, if any, exist between the submitted item and the specified item. Failure to identify the differences will be considered cause for disapproval. If differences are not identified and/or not discovered during the submittal review process, Contractor remains responsible for providing equipment and materials that meet the specifications and drawings.
 - a. Label submittal to match numbering/references as shown in Contract Documents. Highlight and label applicable information to individual equipment or cross out/remove extraneous data not applicable to submitted model. Clearly note options and accessories to be provided, including field installed items. Highlight connections by/to other trades.
 - b. Include technical data, installation instructions and dimensioned drawings for products, fixtures, equipment and devices installed,

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furnished or provided. Reference individual Division 26, Electrical specification Sections for specific items required in product data submittal outside of these requirements.

- c. See Division 26, Electrical individual Sections for additional submittal requirements outside of these requirements.
5. Maximum of two reviews of complete submittal package. Arrange for additional reviews and/or early review of long-lead items; Bear costs of these additional reviews at Engineer's hourly rates. Incomplete submittal packages/submittals will be returned to contractor without review.
6. Resubmission Requirements: Make corrections or changes in submittals as required, and in consideration of Engineer's comments. Identify Engineer's comments and provide an individual response to each of the Engineer's comments. Cloud changes in the submittals and further identify changes which are in response to Engineer's comments.
7. Structural/Seismic: Provide weights, dimensions, mounting requirements and like information required for mounting, seismic bracing, and support. Indicate manufacturer's installation and support requirements to meet ASCE 7-10 requirements for non-structural components. Provide engineered seismic drawings and equipment seismic certification. Equipment Importance Factor as specified in Division 01 and in Structural documents.
8. Trade Coordination: Include physical characteristics, electrical characteristics, device layout plans, wiring diagrams, and connections as required per Division 26, Electrical Coordination Documents. For equipment with electrical connections, furnish copy of approved submittal for inclusion in Division 26, Electrical submittals.
9. Make provisions for openings in building for admittance of equipment prior to start of construction or ordering of equipment.
10. Substitutions and Variation from Basis of Design:
 - a. The Basis of Design designated product establishes the qualities and characteristics for the evaluation of any comparable products by other listed acceptable manufacturers if included in this Specification or included in an approved Substitution Request as judged by the Design Professional.
 - b. If substitutions and/or equivalent equipment/products are being proposed, it is the responsibility of parties concerned, involved in, and furnishing the substitute and/or equivalent equipment to verify and compare the characteristics and requirements of that furnished to that specified and/or shown. If greater capacity and/or more materials and/or more labor is required for the rough-in, circuitry or connections than for the item specified and provided for, then provide compensation for

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additional charges required for the proper rough-in, circuitry and connections for the equipment being furnished. No additional charges above the Base Bid, including resulting charges for work performed under other Divisions, will be allowed for such revisions. Coordinate with the requirements of "Submittals". For any product marked "or approved equivalent", a substitution request must be submitted to Engineer for approval prior to purchase, delivery or installation.

11. Shop Drawings: Provide coordinated shop drawings which include physical characteristics of all systems, device layout plans, and control wiring diagrams. Reference individual Division 26, Electrical specification Sections for additional requirements for shop drawings outside of these requirements.
 - a. Provide Shop Drawings indicating access panel locations, size and elevation for approval prior to installation.
12. Samples: Provide samples when requested by individual Sections.
13. Resubmission Requirements:
 - a. Make any corrections or change in submittals when required. Provide submittals as specified. The engineer will not be required to edit and/or interpret the Contractor's submittals. Indicate changes for the resubmittal in a cover letter with reference to page(s) changed and reference response to comment. Cloud changes in the submittals.
 - b. Resubmit for review until review indicates no exception taken or "make corrections as noted".
14. Operation and Maintenance Manuals, Owner's Instructions:
 - a. Submit, at one time, electronic files (PDF format) on CD/DVD of manufacturer's operation and maintenance instruction manuals and parts lists for equipment or items requiring servicing. Submit data when work is substantially complete and in same order format as submittals. Include name and location of source parts and service for each piece of equipment.
 - (1) Include copy of approved submittal data along with submittal review letters received from Engineer. Data to clearly indicate installed equipment model numbers. Delete or cross out data pertaining to other equipment not specific to this project.
 - (2) Include copy of manufacturer's standard Operations and Maintenance for equipment. At front of each tab, provide routine maintenance documentation for scheduled equipment. Include manufacturer's recommended maintenance schedule and highlight maintenance required to maintain warranty. Furnish

ELECTRICAL BASIC REQUIREMENTS

list of routine maintenance parts, including part numbers, sizes, quantities, relevant to each piece of equipment.

- (3) Include Warranty per Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.
 - (4) Include product certificates of warranties and guarantees.
 - (5) Include copy of complete parts list for equipment. Include available exploded views of assemblies and sub assemblies.
 - (6) Include commissioning reports.
 - (7) Include copy of startup and test reports specific to each piece of equipment.
 - (8) Engineer will return incomplete documentation without review. Engineer will provide one set of review comments in Submittal Review format. Contractor must arrange for additional reviews; Contractor to bear costs for additional reviews at Engineer's hourly rates.
- b. Thoroughly instruct Owner in proper operation of equipment and systems. Where noted in individual Sections, training will include classroom instruction with applicable training aids and systems demonstrations. Field instruction per Section 26 00 00, Electrical Basic Requirements, Demonstration.
 - c. Copies of certificates of code authority inspections, acceptance, code required acceptance tests, and other special guarantees, certificates of warranties, specified elsewhere or indicated on Drawings.
15. Record Drawings:
- a. Maintain at site at least one set of drawings for recording "As-constructed" conditions. Indicate on drawings changes to original documents by referencing revision document, and include buried elements, location of conduit, and location of concealed electrical items. Include items changed by field orders, supplemental instructions, and constructed conditions.
 - b. Record Drawings are to include equipment and fixture/connection schedules that accurately reflect "as constructed or installed" for project.
 - c. At completion of project, input changes to original project on CAD Drawings and make one set of black-line drawings created from CAD

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Files in version/release equal to contract drawings. Submit CAD disk and drawings upon substantial completion.

- d. See Division 26, Electrical individual Sections for additional items to include in record drawings.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements: Work and materials installed to conform with all local, State and Federal codes, and other applicable laws and regulations.
- B. Drawings are intended to be diagrammatic and reflect the Basis of Design manufacturer's equipment. They are not intended to show every item in its exact dimensions, or details of equipment or proposed systems layout. Verify actual dimensions of systems (i.e. distribution equipment, duct banks, light fixtures, etc.) and equipment proposed to assure that systems and equipment will fit in available space. Contractor is responsible for design and construction costs incurred for equipment other than Basis of Design, including, but not limited to, architectural, structural, electrical, HVAC, fire sprinkler, and plumbing systems.
- C. Manufacturer's Instructions: Follow manufacturer's written instructions. If in conflict with Contract Documents, obtain clarification. Notify Engineer/Architect, in writing, before starting work.
- D. Items shown on Drawings are not necessarily included in Specifications or vice versa. Confirm requirements in all Contract Documents.
- E. Provide products that are UL listed.

1.6 WARRANTY

- A. Provide written warranty covering the work for a period of one year from date of Substantial Completion in accordance with Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.
- B. Sections under this Division can require additional and/or extended warranties that apply beyond basic warranty under Division 01, General Requirements and the General Conditions. Confirm requirements in all Contract Documents.

1.7 COORDINATION DOCUMENTS

- A. Prior to construction, coordinate installation and location of HVAC equipment, ductwork, grilles, diffusers, piping, plumbing equipment/fixtures, fire sprinklers, plumbing, lights, cable tray and electrical services with architectural and structural requirements, and other trades (including ceiling suspension and tile systems), and provide maintenance access requirements. Coordinate with submitted architectural systems (i.e. roofing, ceiling, finishes) and structural systems as submitted, including

ELECTRICAL BASIC REQUIREMENTS

footings and foundation. Identify zone of influence from footings and ensure systems are not routed within the zone of influence.

- B. Advise Architect in event a conflict occurs in location or connection of equipment. Bear costs resulting from failure to properly coordinate installation or failure to advise Architect of conflict.
- C. Verify in field exact size, location, and clearances regarding existing material, equipment and apparatus, and advise Architect of discrepancies between that indicated on Drawings and that existing in field prior to installation related thereto.
- D. Submit final Coordination Drawings with changes as Record Drawings at completion of project.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Provide like items from one manufacturer.

2.2 MATERIALS

- A. Base contract upon furnishing materials as specified. Materials, equipment, and fixtures used for construction are to be new, latest products as listed in manufacturer's printed catalog data and are to be UL approved or have adequate approval or be acceptable by state, county, and city authorities. Equipment/fixture supplier is responsible for obtaining State, County, and City acceptance on equipment/fixtures that are not UL approved or are not listed for installation.
- B. Articles, fixtures, and equipment of a kind to be standard product of one manufacturer.
- C. Names and manufacturer's names denote character and quality of equipment desired and are not to be construed as limiting competition.
- D. Hazardous Materials:
 - 1. Comply with local, State of Oregon, and Federal regulations relating to hazardous materials.
 - 2. Comply with Division 00, Procurement and Contracting Requirements and Division 01, General Requirements for this project relating to hazardous materials.
 - 3. Do not use any materials containing a hazardous substance. If hazardous materials are encountered, do not disturb; immediately notify Owner and Architect. Hazardous materials will be removed by Owner under separate contract.

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PART 3 - EXECUTION

3.1 ACCESSIBILITY AND INSTALLATION

- A. Confirm Accessibility and Installation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.
- B. Install equipment requiring access (i.e., junction boxes, light fixtures, power supplies, motors, etc.) so that they may be serviced, reset, replaced or recalibrated by service people with normal service tools and equipment. Do not install equipment in passageways, doorways, scuttles or crawlspaces which would impede or block the intended usage.
- C. Install equipment and products complete as directed by manufacturer's installation instructions. Obtain installation instructions from manufacturer prior to rough-in of equipment and examine instructions thoroughly. When requirements of installation instructions conflict with Contract Documents, request clarification from Architect prior to proceeding with installation. This includes proper installation methods, sequencing, and coordination with other trades and disciplines.
- D. Earthwork:
 - 1. Confirm Earthwork requirements in Contract Documents. In the absence of specific requirements, comply with individual Division 26, Electrical Sections and the following:
 - a. Perform excavation, dewatering, shoring, bedding, and backfill required for installation of work in this Division in accordance with related earthwork Sections. Contact utilities and locate existing utilities prior to excavation. Repair any work damaged during excavation or backfilling.
 - b. Excavation: Do not excavate under footings, foundation bases, or retaining walls.
 - c. Provide protection of underground systems. Review the project Geotechnical Report for references to corrosive or deleterious soils which will reduce the performance or service life of underground systems materials.
- E. Firestopping:
 - 1. Confirm requirements in Division 07, Thermal and Moisture Protection. In the absence of specific requirements, comply with individual Division 26, Electrical Sections and the following:

ELECTRICAL BASIC REQUIREMENTS

- a. Coordinate location and protection level of fire and/or smoke rated walls, ceilings, and floors. When these assemblies are penetrated, seal around piping and equipment with approved firestopping material. Install firestopping material complete as directed by manufacturer's installation instructions. Meet requirements of ASTM E814, Standard Test Method for Fire Tests of Through-Penetration Fire Stops.
- F. Plenums:
 - 1. In plenums, provide plenum rated materials that meet the requirements to be installed in plenums. Immediately notify Architect/Engineer of discrepancy.
- G. Start up equipment, in accordance with manufacturer's start-up instructions, and in presence of manufacturer's representative. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.
- H. Provide miscellaneous supports/metals required for installation of equipment and conduit.

3.2 SEISMIC CONTROL

- A. Confirm Seismic Control requirements in Division 01, General Requirements, Structural documents, and individual Division 26 Electrical Sections.
- B. General:
 - 1. Earthquake resistant designs for Electrical (Division 26) equipment and distribution, i.e. power distribution equipment, generators, UPS, etc. to conform to regulations of jurisdiction having authority.
 - 2. Restraints which are used to prevent disruption of function of piece of equipment because of application of horizontal force to be such that forces are carried to frame of structure in such a way that frame will not be deflected when apparatus is attached to a mounting base and equipment pad, or to structure in normal way, utilizing attachments provided. Secure equipment and distribution systems to withstand a force in direction equal to value defined by jurisdiction having authority.
 - 3. Provide stamped shop drawings from licensed Structural Engineer of seismic bracing and seismic movement assemblies for conduit and equipment. Submit shop drawings along with equipment submittals.
 - 4. Provide stamped shop drawings from licensed Structural Engineer of seismic flexible joints for conduit crossing building expansion or seismic joints. Submit shop drawings along with seismic bracing details.
 - 5. Provide means to prohibit excessive motion of electrical equipment during earthquake.

ELECTRICAL BASIC REQUIREMENTS

3.3 REVIEW AND OBSERVATION

- A. Confirm Review and Observation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.
- B. Notify Architect, in writing, at following stages of construction so that they may, at their option, visit site for review and construction observation:
 - 1. Underground conduit installation prior to backfilling.
 - 2. Prior to covering walls.
 - 3. Prior to ceiling cover/installation.
 - 4. When main systems, or portions of, are being tested and ready for inspection by AHJ.
- C. Final Punch:
 - 1. Prior to requesting a final punch visit from the Engineer, request from Engineer the Electrical Precloseout Checklist, complete the checklist confirming completion of systems' installation, and return to Engineer. Request a final punch visit from the Engineer, upon Engineer's acceptance that the electrical systems are ready for final punch.
 - 2. Costs incurred by additional trips required due to incomplete systems will be the responsibility of the Contractor.

3.4 CONTINUITY OF SERVICE

- A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In the absence of specific requirements in Division 01, General Requirements, comply with individual Division 26, Electrical Sections and the following:
 - 1. During remodeling or addition to existing structure, while existing structure is occupied, present services to remain intact until new construction, facilities or equipment is installed.
 - 2. Prior to changing over to new service, verify that every item is thoroughly prepared. Install new wiring, and wiring to point of connection.
 - 3. Coordinate transfer time to new service with Owner. If required, perform transfer during off-peak hours. Once changeover is started, pursue to its completion to keep interference to a minimum.

ELECTRICAL BASIC REQUIREMENTS

- a. If overtime is necessary, there will be no allowance made by Owner for extra expense for such overtime or shift work.
4. No interruption of services to any part of existing facilities will be permitted without express permission in each instance from Owner. Requests for outages must state specific dates, hours and maximum durations, with outages kept to these specific dates, hours and maximum durations. Obtain written permission from Owner for any interruption of power, lighting or signal circuits and systems.
 - a. Organize work to minimize duration of power interruption.
 - b. Coordinate utility service outages with utility company.

3.5 CUTTING AND PATCHING

- A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In the absence of specific requirements in Division 01, General Requirements, comply with individual Division 26, Electrical Sections and the following:
 1. Proposed floor cutting/core drilling/sleeve locations to be approved by Project Structural Engineer. Submit proposed locations to Architect/Project Structural Engineer. Where slabs are of post tension construction, perform x-ray scan of proposed penetration locations and submit scan results including proposed penetration locations to Project Structural Engineer/Architect for approval. Where slabs are of waffle type construction, show column cap extent and cell locations relative to proposed penetration(s).
 2. Cutting, patching and repairing for work specified in this Division including plastering, masonry work, concrete work, carpentry work, and painting included under this Section will be performed by skilled craftsmen of each respective trade in conformance with appropriate Division of Work.
 3. Additional openings required in building construction to be made by drilling or cutting. Use of jack hammer is specifically prohibited. Patch openings in and through concrete and masonry with grout.
 4. Restore new or existing work that is cut and/or damaged to original condition. Patch and repair specifically where existing items have been removed. This includes repairing and painting walls, ceilings, etc. where existing conduit and devices are removed as part of this project. Where alterations disturb lawns, paving, and/or walks, surfaces to be repaired, refinished and left in condition matching existing prior to commencement of work.
 5. Additional work required by lack of proper coordination will be provided at no additional cost to the Owner.

ELECTRICAL BASIC REQUIREMENTS

3.6 EQUIPMENT SELECTION AND SERVICEABILITY

- A. Replace or reposition equipment which is too large or located incorrectly to permit servicing, at no additional cost to Owner.

3.7 DELIVERY, STORAGE AND HANDLING

- A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In the absence of specific requirements, comply with individual Division 26, Electrical Sections and the following:
 - 1. Handle materials delivered to project site with care to avoid damage. Store materials on site inside building or protected from weather, dirt and construction dust. Products and/or materials that become damaged due to water, dirt, and/or dust as a result of improper storage and handling to be replaced before installation.
 - 2. Protect equipment to avoid damage. Close conduit openings with caps or plugs. Keep motors and bearings in watertight and dustproof covers during entire course of installation.
 - 3. Protect bus duct and similar items until in service.

3.8 DEMONSTRATION

- A. Confirm Demonstration requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, and individual Division 26, Electrical Sections.
- B. Upon completion of work and adjustment of equipment, test systems and demonstrate to Owner's Authorized Representative, Architect, and Engineer that equipment furnished and installed or connected under provisions of these Specifications functions in manner required. Provide field instruction to Owner's Maintenance Staff as specified in Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.
- C. Manufacturer's Field Services: Furnish services of a qualified person at time approved by Owner, to instruct maintenance personnel, correct defects or deficiencies, and demonstrate to satisfaction of Owner that entire system is operating in satisfactory manner and complies with requirements of other trades that may be required to complete work. Complete instruction and demonstration prior to final job site observations.

3.9 CLEANING

- A. Confirm Cleaning requirements in Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.

ELECTRICAL BASIC REQUIREMENTS

- B. Upon completion of installation, thoroughly clean electrical equipment, removing dirt, debris, dust, temporary labels and traces of foreign substances. Throughout work, remove construction debris and surplus materials accumulated during work.

3.10 INSTALLATION

- A. Confirm Installation requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.
- B. Install equipment and fixtures in accordance with manufacturer's installation instructions, plumb and level and firmly anchored to vibration isolators. Maintain manufacturer's recommended clearances.
- C. Start up equipment, in accordance with manufacturer's start-up instructions, and in presence of manufacturer's representative. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.
- D. Provide miscellaneous supports/metals required for installation of equipment.

3.11 PAINTING

- A. Confirm requirements in Division 01, General Requirements and Division 09, Finishes. In the absence of specific requirements, comply with individual Division 26, Electrical Sections and the following:
 - 1. Ferrous Metal: After completion of work, thoroughly clean and paint exposed supports constructed of ferrous metal surfaces (i.e., hangers, hanger rods, equipment stands, etc.) with one coat of black asphalt varnish for exterior or black enamel for interior, suitable for hot surfaces.
 - 2. In Electrical Room, on roof or other exposed areas, equipment not painted with enamel to receive two coats of primer and one coat of rustproof enamel, colors as selected by Architect.
 - 3. See individual equipment Specifications for other painting.
 - 4. Structural Steel: Repair damage to structural steel finishes or finishes of other materials damaged by cutting, welding or patching to match original.
 - 5. Conduit: Clean, primer coat and paint interior/exterior conduit exposed in public areas with two coats paint suitable for metallic surfaces. Color selected by Architect.
 - 6. Covers: Covers such as manholes, vaults and the like will be furnished with finishes which resist corrosion and rust.

ELECTRICAL BASIC REQUIREMENTS

3.12 DEMOLITION

- A. Confirm requirements in Division 01, General Requirements and Division 02, Existing Conditions. In the absence of specific requirements, comply with individual Division 26, Electrical Sections and the following:
1. It is the intent of these documents to provide necessary information and adjustments to electrical system required to meet code, and accommodate installation of new work.
 2. Coordinate with Owner so that work can be scheduled not to interrupt operations, normal activities, building access or access to different areas. Owner will cooperate to best of their ability to assist in coordinated schedule, but will remain final authority as to time of work permitted.
 3. Examination:
 - a. Determine exact location of existing utilities and equipment before commencing work, compensate Owner for damages caused by failure to locate and preserve utilities. Replace damaged items with new material to match existing.
 - b. Verify that abandoned wiring and equipment serve only abandoned facilities.
 - c. Demolition drawings are based on casual field observation and existing record documents.
 - (1) Verify accuracy of information shown prior to bidding and provide such labor and material as is necessary to accomplish work.
 - (2) Verify location and number of electrical outlets, luminaires, panels, etc. in field.
 - d. Report discrepancies to Architect before disturbing existing installation.
 - (1) Promptly notify Owner if utilities are found which are not shown on Drawings.
 4. Execution:
 - a. Remove existing luminaires, switches, receptacles, and other electrical equipment and devices and associated wiring from walls, ceilings, floors, and other surfaces scheduled for remodeling, relocation, or demolition unless shown as retained or relocated on Drawings.

ELECTRICAL BASIC REQUIREMENTS

- b. Provide temporary wiring and connections to maintain electrical continuity of existing systems during construction. Remove or relocate electrical boxes, conduit, wiring, equipment, and luminaires, as encountered in removed or remodeled areas in existing construction affected by this work.
- c. Remove and restore wiring which serves usable existing outlets clear of construction or demolition.
- d. If existing junction boxes will be made inaccessible, or if abandoned outlets serve as feed through boxes for other existing electrical equipment which is being retained, provide new conduit and wire to bypass inaccessible junction boxes and abandoned outlets.
- e. If existing conduits pass through partitions or ceiling which are being removed or remodeled, provide new conduit and wire to reroute clear of construction or demolition and maintain service to existing load.
- f. Extend circuiting and devices in existing walls to be furred out.
- g. Remove abandoned wiring to source of supply.
- h. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.
- i. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets which are not removed.
- j. Disconnect and remove abandoned panelboards and distribution equipment.
- k. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.
- l. Existing lighting which is to remain, leave luminaires in proper working order.
- m. Repair adjacent construction and finishes damaged during demolition work.
- n. Maintain access to existing electrical installations which remain active. Modify installation or provide access panel as appropriate.

ELECTRICAL BASIC REQUIREMENTS

3.13 ACCEPTANCE

- A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In the absence of specific requirements, comply with individual Division 26, Electrical Sections and the following:
 - 1. System cannot be considered for acceptance until work is completed and demonstrated to Architect that installation is in strict compliance with Specifications, Drawings and manufacturer's installation instructions, particularly in reference to following:
 - a. Cleaning
 - b. Operation and Maintenance Manuals
 - c. Training of Operating Personnel
 - d. Record Drawings
 - e. Warranty and Guaranty Certificates
 - f. Start-up/Test Document and Commissioning Reports

3.14 FIELD QUALITY CONTROL

- A. Confirm Field Quality Control requirements in Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.
- B. Tests:
 - 1. Conduct tests of equipment and systems to demonstrate compliance with requirements specified. Reference individual Specification Sections for required tests. Document tests and include in operation and maintenance manuals.
 - 2. During site evaluations by Architect or Engineer, provide appropriate personnel with tools to remove and replace trims, covers, and devices so that proper evaluation of installation can be performed.

3.15 SALVAGED EQUIPMENT AND RECYCLED MATERIAL

- A. Salvage the following equipment not being reused and return to Owner:
 - 1. Luminaires
 - 2. Panelboards
 - 3. Breakers

ELECTRICAL BASIC REQUIREMENTS

- B. Electrical equipment that cannot be salvaged for reuse, sell/give to recycling company. Recycle following excess, removed, or demolished electrical material:
 - 1. Copper or aluminum conductors, buses, and motor/transformer windings.
 - 2. Steel and aluminum from raceways, boxes, enclosures, and housings.
 - 3. Acrylic and glass from luminaire lenses/refractors.
- C. Provide separate on-site storage space for recycled and salvaged material. Clearly label space.
- D. Confirm additional salvaged equipment and recycled materials in the Contract Documents.

END OF SECTION

EQUIPMENT WIRING

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Equipment connections, whether furnished by Owner or other Divisions of the Contract.
2. Equipment grounding.

1.2 RELATED SECTIONS

- A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

- A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition:
1. Verify mechanical and utilization equipment electrical characteristics with Drawings and equipment submittals prior to ordering equipment. Submit confirmation of this verification as a part of, or addendum to, the electrical product submittals.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements apply to this Section.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Materials and Equipment for Equipment Wiring: As specified in individual Sections.

EQUIPMENT WIRING

2.2 GENERAL

- A. Unless otherwise noted, the following voltage and phase characteristics apply to motors:
 - 1. 3/4 HP and Under: 120 volt, 1 phase.
 - 2. 1 HP and Over: 208 volt, 3 phase.
- B. Safety Switches: Provide as required by NEC and as specified in Section 26 28 16, Enclosed Switches and Circuit Breakers.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Prior to submittal of product data for electrical distribution equipment, obtain and examine product data and shop drawings for equipment furnished by the Owner and by other trades on the project. Update the schedule of equipment electrical connections accordingly, noting proper ratings for overcurrent devices, fuses, safety disconnect switches, conduit and wiring, and the like. As a minimum, this requirement applies to equipment furnished by Owner and equipment furnished under the following divisions of work under this contract:
 - 1. Division 8, Openings
 - 2. Division 11, Equipment
 - 3. Division 27, Communications

3.2 INSTALLATION

- A. Do not install unrelated electrical equipment or wiring on mechanical equipment without prior approval of Engineer.
- B. Provide moisture tight equipment wiring and switches in ducts or plenums used for environmental air.
- C. Connect motor and appliance/utilization equipment complete from panel to motor/equipment as required by code.
- D. Install motor starters and controllers for equipment furnished by others.
- E. Appliance/Utilization Equipment:
 - 1. Provide appropriate cable and cord cap for final connection unless equipment is provided with same. Provide receptacle configured to receive cord cap.

EQUIPMENT WIRING

2. Verify special purpose outlet NEMA configuration and ampere rating with equipment supplier prior to ordering wiring devices and coverplates.

3.3 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Division 01, General Requirements.

3.4 SYSTEMS STARTUP

- A. Provide field representative to prepare and start equipment.
 1. Test and correct for proper rotation of polyphase motors.
- B. Adjust for proper operation within manufacturer's published tolerances.
- C. Demonstrate proper operation of equipment to Owner's Authorized Representative.

END OF SECTION

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Lugs and Pads
2. Wires and Cables
3. Splices
4. Connectors

1.2 RELATED SECTIONS

- A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

- A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
1. Cable insulation test reports in project closeout documentation.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Lugs and Pads:

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

1. Anderson
2. Ilsco
3. Panduit
4. Thomas & Betts
5. 3M
6. Or approved equivalent.

B. Wires and Cables:

1. General
 - a. General Cable
 - b. Okonite
 - c. Southwire
 - d. Or approved equivalent.
2. Metal Clad Cable - Type MC:
 - a. Alflex
 - b. AFC
 - c. General Cable
 - d. Southwire
 - e. Or approved equivalent.

C. Splices:

1. Branch Circuit Splices:
 - a. Ideal
 - b. 3M Scotchlok
 - c. Uraseal, Inc.
 - d. Or approved equivalent.
2. Feeder Splices:

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

- a. Not allowed.

D. Connectors:

- 1. Anderson Power Products
- 2. Burndy
- 3. Ilsco
- 4. 3M
- 5. Thomas & Betts
- 6. Or approved equivalent.

2.2 LUGS AND PADS

- A. Ampacity: Cross-sectional area of pad for multiple conductor terminations to match ampere rating of panelboard bus or equipment line terminals.
- B. Copper Pads: Drilled and tapped for multiple conductor terminals.
- C. Lugs: Compression type for use with stranded branch circuit or control conductors; mechanical lugs for use with solid branch and feeder circuit conductors.

2.3 WIRES AND CABLES

A. Building Wires:

- 1. Copper: Soft-drawn with conductivity of not less than 98 percent IACS at 20 degrees C (68 degrees F). 600 volt rated throughout. Conductors 12 AWG and larger, stranded. 12 AWG minimum conductor size. Minimum insulation rating of 90 degrees C. Insulation Type: THHN/THWN-2.
- 2. Aluminum: approved for feeders above 100 amps ampacity, if not connected to transformers or motors.
- 3. Aluminum (if permitted): Insulation type and rating to match copper wiring. Compact stranded. Aluminum Association 8000(AA-8000) Series alloy conductor material built to ASTM B801 specifications.

- B. Phase color to be consistent at feeder terminations; A-B-C, top to bottom, left to right, front to back.

C. Color Code Conductors as Follows:

PHASE	208 VOLT WYE	480 VOLT
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LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

A	Black	Brown
B	Red	Orange
C	Blue	Yellow
Neutral	White	White w/colored strip
Ground	Green	Green

D. MC Cable:

1. Standard: High strength galvanized steel flexible armor. Full length minimum size No. 12 copper ground wire, copper dual rated THHN/THWNC, full length tape marker phase/circuit identification on cable armor. Short circuit throat insulators, mechanical compression termination.

E. NMB Cable: Not allowed.

- F. SO Cord: Annealed copper conductors, 600 volt rated. Minimum size No. 12 AWG with ground wire. Maximum of six conductors and ground per cable. 90 degrees C rated thermoset jacket.

2.4 SPLICES

A. Branch Circuits: Twist on, high temperature, grounding type wing nuts.

1. Ideal Industries Wing-Nut Twist-On Connectors.
2. 3M Scotchlok Twist-On Wire Connectors.

2.5 CONNECTORS

A. Split bolt connectors not allowed.

B. Aluminum Cable Compression Connections (If Permitted):

1. Provide UL-listed compression lugs that are marked AL7CU or AL9CU and have passed UL 486B or UL 486C testing procedures.
2. Construction: Electro tin plated high conductivity aluminum. Connector marked with wire size, die index, color-coded and the proper number and location of crimps. Factory pre-filled with oxide inhibiting compound.
3. Aluminum cable connection to aluminum bus bar: Use 2-hole aluminum compression lug and aluminum hardware.
4. Aluminum cable connection to copper bus bar: Use 2-hole aluminum compression lug, plated steel hardware and Belleville washer.

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

5. Aluminum cable connection to mechanical lugs and equipment identified as not suitable for aluminum conductor termination: Provide aluminum compression lug with stranded copper wire/cable pigtail. Equip lug compression body with insulating cover.
6. Aluminum Termination Hardware:
 - a. Bolts: Anodized alloy 2023-T4 and conforming to ANSI B18.2.1 and to ASTM B211 or B221 chemical and mechanical property limits.
 - b. Nuts: Aluminum alloy 6061-T6 or 6262-T9 and conforming to ANSI B18.2.2.
 - c. Washers: Flat aluminum alloy Alclad 2024-T4, Type A plain, standard wide series conforming to ANSI B27.2. SAE or narrow series washers are not permitted.
- C. Conductor Branch Circuits: Wire nuts with integral spring connectors for conductors 12 AWG through 8 AWG. Push-in type connectors where conductors are not required to be twisted together are not acceptable.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Install per manufacturer instructions and OSSC.
- B. Field Quality Control:
 1. Test conductor insulation on feeders of 100 amp and greater for conformity with 1000 volt megohmmeter. Use Insulated Cable Engineers Association testing procedures. Minimum insulation resistance acceptable is 1 megohm for systems 600 volts and below. Notify Architect if insulation resistance is less than 1 megohm.
 2. Test Report: Prepare a typed tabular report indicating the testing instrument, the feeder tested, amperage rating of the feeder, insulation type, voltage, the approximate length of the feeder, conduit type, and the measured resistance of the megohmmeter test. Submit test reports with project closeout documents.
 3. Inspect and test in accordance with NETA Standard ATS, except Section 4.
 4. Perform inspections and tests listed in NETA Standard ATS, Section 7.3.2.

3.2 LUGS AND PADS

- A. Thoroughly clean surfaces to remove all dirt, oil, grease or paint.

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- B. Use torque wrench to tighten per manufacturer's directions.

3.3 WIRES AND CABLES

A. General:

1. Do not install or handle thermoplastic insulated wire and cable in temperatures below -10 degrees C (14 degrees F). Do not handle thermoset insulated wire and cable in temperatures below -40 degrees C (-40 degrees F).
2. Install conductors in raceways having adequate, code size cross-sectional area for wires indicated.
3. Install conductors with care to avoid damage to insulation.
4. Do not apply greater tension on conductors than recommended by manufacturer during installation.
5. Use of pulling compounds is permitted. Clean residue from exposed conductors and raceway entrances after conductor installation. Do not use pulling compounds for installation of conductors connected to GFCI circuit breakers or GFCI receptacles.
6. Additional Requirements for Aluminum Conductors (If Permitted):
 - a. Equipment connected to aluminum conductors to be specifically approved for the purpose, and marked as such. Pay particular attention to refrigeration and similar equipment. Do not use aluminum wire to make connections to mechanical equipment.
 - b. Make connection of aluminum conductors to wiring devices having wire-binding terminal screws, around which conductors can be looped under the head of the screw, by forming the conductor in a clockwise direction around the screw into three-fourths of a complete loop. Only one conductor connected to any one screw.
7. Conductor Size and Quantity:
 - a. Install no conductors smaller than 12 AWG unless otherwise shown.
 - b. Provide required conductors for a fully operable system.
 - c. Power Circuits: No. 12 AWG minimum, except as follows:
 - (1) No. 10 AWG for 20A, 120V circuits longer than 70 ft.
 - (2) No. 8 AWG for 20A, 120V circuits longer than 100 ft.

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- d. When exact run lengths are determined for all branch circuits, and prior to installation of the conductors, ensure that the maximum voltage drop, based on 80 percent of the circuit protective device, does not exceed 3 percent. Increase wire size from #12AWG, if necessary, to ensure that the 3 percent voltage drop is not exceeded.
8. Provide dedicated neutrals (one neutral conductor for each phase conductor) in all 120V circuits.
- B. Conductors in Cabinets:
 1. Cable and tree wires in panels and cabinets for power and control. Use plastic ties in panels and cabinets.
 2. Tie and bundle feeder conductors in wireways of panelboards.
 3. Hold conductors away from sharp metal edges.
- C. Homeruns:
 1. Do not change intent of branch circuit homeruns without approval. Homeruns for 20A branch circuits may be combined to a maximum of six current carrying conductors including neutral conductors in homeruns. Apply derating factors as required per NEC. Increase conductor size as needed.
 2. MC cable homeruns are not allowed.
- D. Identify wire and cable under the provisions of Section 26 05 53, Identification for Electrical Systems. Identify each conductor with its panel and circuit number as indicated.
- E. Exposed cable is allowed in the following locations:
 1. Outside of occupied spaces (example: hidden above suspended ceiling).
- F. All cable must be run parallel or perpendicular to building lines and hidden from view when possible. Where installed in tray each power cable is to be identified with Lamacoid nametag engraved with identification of equipment being fed. Tag to be fastened to cable using tie-wraps. Provide nametag at each floor level.
- G. Do not install PVC jacketed cables in return air plenums, unless they are specially rated plenum cables.
- H. Use of MC Cable is limited to the following conditions. Installations that do not comply with the following conditions are to be removed and replaced with no additional expense to the Owner.
 1. 20 amp branch wiring where following conditions apply:

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

- a. Where there is a suspended ceiling with accessible space above (example: suspended acoustic ceiling tile).
- b. Use MC cable for final flexible connections from junction or outlet boxes to recessed fixtures. Do not use MC cables to loop between fixtures, except where it is not practical to provide conduit connections between boxes or where existing inaccessible ceilings prevent installation of conduit runs. Each individual luminaire is to be serviced by an individual cable drop from the associated junction box in the ceiling space. Maximum length 6-feet of MC cable. Luminaire drops secured to, and supported by, the building structure with nylon tie wraps. The use of the ceiling suspension system for support of any type of cabling is not permitted. Do not use MC cable for multiwire branch circuits.

3.4 SPLICES

- A. Make splices complete and promptly after wire installation. Provide single wire pigtails for luminaire and device connections. Wire nuts may be used for luminaire wire connections to single wire circuit conductor pigtails.
- B. Make splices for No. 8 and larger wires with mechanically applied pressure type connectors. Make all taped joints with Scotch 33+ or equal, applied in half-lap layers without stretching to deform. Uraseal splice kits are also acceptable through 250 KCMIL.
- C. Remove insulation with a stripping tool designed specifically for that purpose. A pocket knife is not an acceptable tool. Leave all conductors nick-free.

3.5 CONNECTORS

- A. Install to assure a solid and safe connection.
- B. Select hand twist connectors for wire size and install tightly on conductors.
- C. Install compression connectors using methods and tools recommended by the manufacturer.
- D. Do not install stranded conductors under screw terminals unless compression lugs are installed.
- E. Do not connect wiring without UL listed connectors that are listed for the purposes.
- F. Additional requirements for Aluminum connectors (if permitted):
 - 1. Use adequate precaution for the termination or splicing of aluminum conductors, including removal of insulation and separators, cleaning (wire brushing) of stranded conductors, and compatibility and installation of fittings.

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

2. Use a UL listed joint compound, capable of penetrating the oxide film and preventing its reforming, for terminating or splicing all sizes of stranded aluminum conductors, unless the termination or splice is approved for use without compound and is so marked.
3. Do not terminate or splice aluminum conductors in wet locations unless the termination or splice is adequately protected against corrosion.

END OF SECTION

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Connectors and Accessories
2. Grounding Conductor

1.2 RELATED SECTIONS

- A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

- A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
1. Test reports of ground resistance for service and separately derived system grounds.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
1. Comply with the requirements of ANSI/NFPA 70.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Connectors and Accessories:
 - 1. Burndy Hyground Compression System
 - 2. Erico/Cadweld
 - 3. Amp Ampact Grounding System
 - 4. Pipe Grounding Clamp:
 - a. Burndy GAR Series
 - b. O Z Gedney
 - c. Thomas & Betts
 - d. Or approved equivalent.
- B. Grounding Conductor
 - 1. General Cable
 - 2. Okonite
 - 3. Southwire
 - 4. Or approved equivalent

2.2 CONNECTORS AND ACCESSORIES

- A. Grounding Connectors: Hydraulic compression tool applied connectors or exothermic welding process connectors or powder actuated compression tool applied connectors.
- B. Pipe Grounding Clamp: Mechanical ground connector with cable parallel or perpendicular to pipe.

2.3 GROUNDING CONDUCTOR

- A. Grounding Electrode Conductor: Soft-draw bare stranded copper for wire sizes larger than #10 AWG Bare. Solid copper for wire sizes #10 AWG and smaller.
- B. Equipment Grounding Conductor: Green insulated, insulation type to match that of associated feeder or branch circuit wiring, size as indicated on drawings.

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Verify site conditions prior to beginning work.
- B. Bond Sections of service equipment enclosure to service ground bus.
- C. Separately Derived Systems: Ground each separately derived system per NEC Article 250.
- D. Corrosion inhibitors: Apply a corrosion inhibitor to contact surfaces when making grounding and bonding connections. Use corrosion inhibitor appropriate for protecting a connection between metals used.
- E. Grounding system resistance to ground not to exceed 5 ohms. Make necessary modifications or additions to grounding electrode system for compliance. Submit final tests to assure that this requirement is met.
- F. Inspect and test in accordance with NETA Standard ATS, Except Section 4.
- G. Perform inspections and tests listed in NETA Standard AB, Section 7.13.

3.2 CONNECTORS AND ACCESSORIES INSTALLATION

- A. Install per manufacturer's instructions.

3.3 GROUNDING CONDUCTOR INSTALLATION

- A. Raceways:
 - 1. Ground metallic raceway systems. Bond to ground terminal with code size jumper except where code size or larger equipment grounding conductor is included with circuit, use grounding bushing with lay-in lug.
 - 2. Connect metal raceways, which terminate within an enclosure but without mechanical connection to enclosure, by grounding bushings and ground conductor to grounding bus.
 - 3. Where equipment supply conductors are in flexible metallic conduit, install stranded copper equipment grounding conductor from outlet box to equipment frame.
 - 4. Install equipment grounding conductor, code size minimum unless noted on drawings, in metallic and nonmetallic raceway systems.
- B. Feeders and Branch Circuits:

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

1. Provide continuous green insulated copper equipment grounding conductors for feeders and branch circuits.
 2. Where installed in a continuous solid metallic raceway system and larger sizes are not detailed, provide insulated equipment grounding conductors for feeders and branch circuits sized in accordance with the latest adopted edition of NEC Article 250, Table 250-122.
- C. Bond boxes, cabinets, enclosures and panelboard equipment grounding conductors to enclosure with specified conductors and lugs. Install lugs only on thoroughly cleaned contact surfaces.
- D. Motors, Equipment and Appliances: Install code size equipment grounding conductor to (motor) equipment frame or manufacturer's designated ground terminal.
- E. Receptacles: Connect ground terminal of receptacle and associated outlet box to equipment grounding conductor. Self grounding nature of receptacle devices does not eliminate equipment grounding conductor bolted to outlet box.

END OF SECTION

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Anchors, Threaded Rod and Fasteners
2. Support Channel, Hangers and Supports

1.2 RELATED SECTIONS

- A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

- A. Submittals not required for this Section.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
 1. Manufacturers regularly engaged in the manufacture of bolted metal framing support systems, whose products have been in satisfactory use in similar service for not less than 10 years.
 2. Support systems to be supplied by a single manufacturer.
 3. Engineering Responsibility: Design and preparation of Shop Drawings and calculations for each multiple pipe support, trapeze, equipment hangers/supports, and seismic restraint by a qualified Structural Professional Engineer.
 - a. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of hangers and supports that are similar to those indicated for this Project in material, design, and extent.

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1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.7 PERFORMANCE REQUIREMENTS

- A. General: Provide conduit and equipment hangers and supports in accordance with the following:
 - 1. When supports, anchorages, and seismic restraints for equipment and supports, anchorages and seismic restraints for conduit, cable tray and equipment are not shown on the Drawings, the Contractor is responsible for their design.
 - 2. Connections to structural framing shall not introduce twisting, torsion, or lateral bending in the framing members. Provide supplementary steel as required.
- B. Engineered Support Systems: The following support systems to be designed, detailed, and bear the seal of a professional engineer registered in the State of Oregon.
 - 1. Support frames such as conduit racks or stanchions for conduit and equipment which provide support from below.
 - 2. Equipment and piping support frame anchorage to supporting slab or structure.
- C. Provide channel support systems, for conduits to support multiple conduits capable of supporting combined weight of support systems and system contents.
- D. Provide heavy-duty steel trapezes for piping to support multiple conduit capable of supporting combined weight of supported systems and system contents.
- E. Provide seismic restraint hangers and supports for conduit and equipment.
- F. Obtain approval from AHJ for seismic restraint hanger and support system to be installed for piping and equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Anchors, Threaded Rod and Fasteners:
 - 1. Anchor It
 - 2. Epcon System
 - 3. Hilti-Hit System

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4. Power Fast System
 5. Or approved equivalent.
- B. Support Channel, Hangers and Supports:
1. B-Line
 2. Kindorf
 3. Superstrut
 4. Unistrut
 5. Or approved equivalent.

2.2 ANCHORS, THREADED ROD AND FASTENERS

- A. Anchors, Threaded Rod and Fasteners - General: Corrosion-resistant materials of size and type adequate to carry the loads of equipment and conduit, including weight of wire in conduit.
- B. Concrete Inserts: Cast in concrete for support fasteners for loads up to 800 lbs.
- C. Anchors and Fasteners:
1. Do not use powder-actuated anchors.
 2. Concrete Structural Elements: Use precast inserts.
 3. Steel Structural Elements: Use beam clamps.
 4. Concrete Surfaces: Use self-drilling anchors.
 5. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts.
 6. Solid Masonry Walls: Use expansion anchors.
 7. Sheet Metal: Use sheet metal screws.
 8. Wood Elements: Use wood screws.
- D. Fasteners: Provide fasteners of types as required for assembly and installation of fabricated items; surface-applied fasteners are specified elsewhere.
- E. Bolts: Low carbon steel externally and internally threaded fasteners conforming with requirements of ASTM A307; include necessary nuts and plain hardened washers. For

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structural steel elements supporting mechanical material or equipment from building structural members or connection thereto, use fasteners conforming to ASTM A325.

- F. Miscellaneous Materials: Provide incidental accessory materials, tools, methods, and equipment required for fabrication.

2.3 SUPPORT CHANNEL, HANGERS AND SUPPORTS

- A. Hangers and Supports - General: Corrosion-resistant materials of size and type adequate to carry the loads of equipment and conduit, including weight of wire in conduit.
 - 1. Channel Material: Carbon steel.
 - 2. Coating: Hot dip galvanized.
- B. Pipe Straps: Two-hole galvanized or malleable iron.
- C. Luminaire Chain: 90 lb. test with steel hooks.
- D. Miscellaneous Metal: Provide miscellaneous metal items specified hereunder, including materials, fabrication, fastenings and accessories required for finished installation, where indicated on Drawings or otherwise not shown on drawings that are necessary for completion of the project. The Contractor is responsible for their design.
 - 1. Fabricate miscellaneous units to size shapes and profiles indicated or, if not indicated, of required dimensions to receive adjacent other work to be retained by framing. Except as otherwise shown, fabricate from structural steel shapes and plates and steel bars, of welded construction using mitered joints for field connection. Cut, drill and tap units to receive hardware and similar items.
- E. Structural Shapes: Where miscellaneous metal items are needed to be fabricated from structural steel shapes and plates, provide members constructed of steel conforming with requirements of ASTM A36 or approved equivalent.
- F. Steel Pipe: Provide seamless steel pipe conforming to requirements of ASTM A53, Type S, Grade A, or Grade B. Weight and size required as specified.
- G. Miscellaneous Materials: Provide incidental accessory materials, tools, methods, and equipment required for fabrication.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Fabrication - Miscellaneous Metals
 - 1. General: Verify dimensions prior to fabrication. Form metal items to accurate sizes and configurations as indicated on Drawings and otherwise required for

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proper installation; make with lines straight and angles sharp, clean and true; drill, countersink, tap, and otherwise prepare items for connections with work of other trades, as required. Fabricate to detail of structural shapes, plates and bars; weld joints where practicable; provide bolts and other connection devices required. Include anchorages; clip angles, sleeves, anchor plates, and similar devices. Hot dipped galvanize after fabrication items installed in exterior locations. Set accurately in position as required and anchor securely to building construction. Construct items with joints formed for strength and rigidity, accurately machining for proper fit; where exposed to weather, form to exclude water.

2. Finishes:

- a. Ferrous Metal: After fabrication, but before erection, clean surfaces by mechanical or chemical methods to remove rust, scale, oil, corrosion, or other substances detrimental to bonding of subsequently applied protective coatings. For metal items exposed to weather or moisture, galvanize in manner to obtain G90 zinc coating in accordance with ASTM A123. Provide other non-galvanized ferrous metal with one coat of approved rust-resisting paint primer, in manner to obtain not less than 1.0 mil dry film thickness. Touch-up damaged areas in primer with same material, before installation. Apply zinc coatings and paint primers uniformly and smoothly; leave ready for finish painting as specified elsewhere.
- b. Metal in contact with Concrete, Masonry and Other Dissimilar Materials: Where metal items are to be erected in contact with dissimilar materials, provide contact surfaces with coating of an approved zinc-chromate primer in manner to obtain not less than 1.0 mil dry film thickness, in addition to other coatings specified in these specifications.
- c. For Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and apply galvanizing repair paint to comply with ASTM A780.

3.2 ANCHORS, THREADED ROD AND FASTENERS INSTALLATION

- A. Safety factor of 4 required for every fastening device or support for equipment installed. Supports to withstand four times the weight of equipment it supports.
- B. Do not use other trade's fastening devices as supporting means for luminaires, equipment or materials.
- C. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.
- D. Do not use supports or fastening devices to support other than one particular item.

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- E. Securely suspend junction boxes, pull boxes or other conduit terminating housings located above suspended ceiling from floor above or roof structure to prevent sagging and swaying.
- F. Provide seismic bracing per OSSC requirements.
- G. Install surface-mounted cabinets and panelboards with minimum of four anchors.
- H. Use spring lock washers under fastener nuts for strut.
- I. Cutting and Drilling
 - 1. Do not drill or cut structural members without prior permission from Architect.

3.3 SUPPORT CHANNEL, HANGERS AND SUPPORTS INSTALLATION

- A. Install hangers and supports as required to adequately and securely support electrical system components, in a neat and workmanlike manner, as specified in NECA 1.
- B. Safety factor of 4 required for every fastening device or support for equipment installed. Supports to withstand four times the weight of equipment it supports.
- C. Verify mounting height of luminaires prior to installation when heights are not detailed.
- D. Install vertical support members for equipment and luminaires, straight and parallel to building walls.
- E. Install horizontal support members straight and parallel to ceilings or finished floor unless otherwise noted.
- F. Provide independent supports to structural member for luminaires, materials, or equipment installed in or on ceiling, walls or in void spaces or over suspended ceilings.
- G. Do not use other trade's fastening devices as supporting means for luminaires, equipment or materials.
- H. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.
- I. Do not use supports or fastening devices to support other than one particular item.
- J. Support conduits within 18-inches of outlets, boxes, panels, cabinets and deflections unless more stringently required by OESC.
- K. Maximum distance between supports not to exceed 8 foot spacing unless otherwise required by OESC.
- L. Support flexible conduits and metal clad cable within 12-inches of outlets, boxes, panels, cabinets and deflections unless otherwise required by OESC.

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- M. Maximum distance between supports for flexible conduits and metal clad cable not to exceed 48-inches spacing unless otherwise required by OESC.
- N. Maximum distance between supports for rigid PVC conduits unless otherwise required by OESC is as follows:
 - 1. 1/2-inch or 3/4-inch and 1-inch conduit, 3-feet apart.
 - 2. 1-1/4-inch or 1-1/2-inch and 2-inch conduit, 4-feet apart.
 - 3. 2-1/2-inch and 3-inch conduit, 5-feet apart.
 - 4. 4-inch and 5-inch conduit, 6-feet apart.
 - 5. 6-inch conduit, 7-feet apart.
- O. Maximum distance between supports for auxiliary gutters and wireways unless otherwise required by OESC is as follows:
 - 1. Sheet metal auxiliary gutters and wireways - 4-feet apart horizontally and 10-feet vertically.
 - 2. Non-metallic auxiliary gutters and wireways - 30-inches apart horizontally and 3-feet vertically.
- P. Install strut hangers as instructed by strut manufacturer. Suspend strut hangers as instructed by strut manufacturer for the load, with a maximum spacing of 8-feet on center and within 2-feet of outlet box, cabinet, junction box or other channel raceway termination unless otherwise required by OESC.
- Q. Coordinate routing of conduit racks with materials and equipment installed by other trades. Where conduit racks are exposed to view, coordinate location and installation with Architect for optimal appearance.
- R. Securely suspend junction boxes, pull boxes or other conduit terminating housings located above suspended ceiling from floor above or roof structure to prevent sagging and swaying.
- S. Provide seismic bracing per OSSC requirements.
- T. Where service disconnects are mounted on building exterior, physically attach service disconnect to the building or structure served.
- U. Install surface-mounted cabinets and panelboards with minimum of four anchors.
- V. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.

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W. Wet and Damp Locations:

1. In wet and damp locations use steel channel supports to stand cabinets and panelboards 1-inch off wall.

END OF SECTION

RACEWAYS

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included:
 - 1. Rigid Metal Conduit (RMC)
 - 2. Intermediate Metal Conduit (IMC)
 - 3. Electrical Metallic Tubing (EMT)
 - 4. Flexible Metal Conduit (FMC)
 - 5. Liquidtight Flexible Metal Conduit (LFMC)
 - 6. Conduit Fittings
- B. Provide a complete system of conduit and fittings, with associated couplings, connectors, and fittings, as shown on drawings and described in these specifications.

1.2 RELATED SECTIONS

- A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.
- B. In addition, reference the following:
 - 1. Section 26 05 29, Hangers and Supports for Electrical Systems and Equipment
 - 2. Section 26 05 34, Boxes

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

- A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

RACEWAYS

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.7 DEFINITIONS

- A. Raceway system is defined as consisting of conduit, tubing, duct, and fittings including but not limited to connectors, couplings, offsets, elbows, bushings, expansion/deflection fittings, and other components and accessories. Complete electrical raceway installation before starting the installation of conductors and cables.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Rigid Metal Conduit (RMC):
 - 1. Allied Tube & Conduit
 - 2. Beck Manufacturing Inc.
 - 3. Picoma
 - 4. Wheatland Tube Company
 - 5. Or approved equivalent.
- B. Intermediate Metal Conduit (IMC):
 - 1. Allied Tube & Conduit
 - 2. Beck Manufacturing WL
 - 3. Picoma
 - 4. Wheatland Tube Company
 - 5. Or approved equivalent.
- C. Electrical Metallic Tubing (EMT):
 - 1. Allied Tube & Conduit
 - 2. Beck Manufacturing WL
 - 3. Picoma

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4. Wheatland Tube Company
 5. Or approved equivalent.
- D. Flexible Metal Conduit (FMC):
1. AFC Cable Systems Inc.
 2. Electri-Flex Company
 3. International Metal Hose
 4. Or approved equivalent.
- E. Liquidtight Flexible Metal Conduit (LFMC):
1. AFC Cable Systems Inc.
 2. Electri-Flex Company
 3. International Metal Hose
 4. Or approved equivalent.
- F. Conduit Fittings:
1. Bushings:
 - a. Insulated Type for Threaded Raceway Without Factory Installed Plastic Throat Conductor Protection:
 - (1) Thomas & Betts 1222 Series
 - (2) O-Z Gedney B Series
 - (3) Or approved Equivalent.
 2. Raceway Connectors and Couplings:
 - a. Thomas & Betts Series
 - b. O-Z Gedney Series
 - c. Or approved Equivalent.
 3. Expansion/Deflection Fittings:
 - a. EMT: O-Z Gedney Type TX

RACEWAYS

- b. RMC: O-Z Gedney Type AX, DX and AXDX, Crouse & Hinds XD
- c. PVC: O-Z Gedney Type DX with PVC adapters, Carlon E945 Series, Kraloy OPEJ Series
- d. Or approved equivalent.

2.2 RIGID METAL CONDUIT (RMC)

- A. UL 6, ANSI C80.1. Hot dipped galvanized steel conduit after thread cutting.
 - 1. Fittings: NEMA FB2.10.

2.3 INTERMEDIATE METAL CONDUIT (IMC)

- A. UL6, ANSI C80.6. Hot dipped galvanized after thread cutting.
 - 1. Fittings: NEMA FB2.10.

2.4 ELECTRICAL METALLIC TUBING (EMT)

- A. Description: UL 797, ANSI C80.3; steel galvanized tubing.
- B. Fittings: NEMA FB 1; steel, set screw type.

2.5 FLEXIBLE METAL CONDUIT (FMC)

- A. Description: UL 1, Interlocked steel construction.
- B. Fittings: NEMA FB 2.20.

2.6 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

- A. Description: UL 360, inner core made from spiral wound strip of heavy gauge, hot dipped galvanized low carbon steel. 3/4-inch through 1-1/4-inch trade sizes to have a square lock core and contain an integral bonding strip of copper. 1-1/2-inch and larger to have fully interlocked core. Jacket material to be moisture, oil and sunlight resistant flexible PVC.
- B. Fittings: NEMA FB 2.20.

2.7 CONDUIT FITTINGS

- A. Bushings:
 - 1. Insulated type for threaded raceway connectors without factory-installed plastic throat conductor protection.

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2. Insulated grounding type for threaded raceway connectors.
- B. Raceway Connectors and Couplings:
1. Steel connectors, couplings, and conduit bodies, hot-dip galvanized.
 2. Connector locknuts to be steel, with threads meeting ASTM tolerances. Locknuts to be hot-dip galvanized.
 3. Connector throats (EMT, flexible conduit, metal clad cable and cordset connectors) to have factory installed plastic inserts permanently installed. For normal cable or conductor exiting angles from raceway, the cable jacket or conductor insulation to bear only on plastic throat insert.
 4. Steel gland, Tomic or Breagle connectors and couplings are recognized for this Contract as having acceptable raceway to fitting electrical conductance.
 5. Set screw connectors and couplings, without integral compression glands, are recognized for this Contract as not having acceptable raceway to fitting electrical conductance. A ground conductor sized per this Specification must be included and bonded within raceway assembly utilizing this type connector or coupling.
- C. Provide expansion/deflection fittings for EMT.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Finished Surfaces: Schedule raceway installation to avoid conflict with installed wall and ceiling surfaces. If unavoidable, coordinate work and repairs with Architect.
- B. Conduit Size:
1. Minimum Size: 3/4-inch for power and control, unless otherwise noted. 3/4-inch for communication/data, unless otherwise noted. 3/4-inch for signal systems, unless otherwise noted.
- C. Provide two pull strings/tapes in empty conduits. Types:
1. Feeders: Polyester measure/pulling tape, Greenlee 4436 or approved.
 2. Branch Circuits and Low Voltage: Greenlee Poly Line 431 or approved.
 3. If fish tape is used for pulling line or low voltage wiring, fiberglass type to be used. Metal fish tapes will not be allowed.
 4. Secure pull string/tape at each end.

RACEWAYS

5. Provide caps on ends of empty conduit to be used in future.
 6. Label both ends of empty conduits with location of opposite end.
- D. Elbows: Use fiberglass or PVC coated RMC for underground installations.
- E. Elbow for Low Energy Signal Systems: Use long radius factory ells where linking sections of raceway for installation of signal cable.
- F. Verify that field measurements are as shown on drawings.
- G. Plan locations of conduit runs in advance of the installation and coordinate with ductwork, plumbing, ceiling and wall construction in the same areas.
- H. Locate penetrations and holes in advance where they are proposed in the structural sections such as footings, beams, and walls. Penetrations are acceptable only when the following occurs:
1. Where shown on the structural drawings.
 2. As approved by the Structural Engineer prior to construction, and after submittal of drawing showing location, size, and position of each penetration.
- I. Verify routing and termination locations of conduit prior to rough-in.
- J. Conduit routing is shown on drawings in approximate locations unless dimensioned. Route as required to complete wiring system.
- K. Install raceways securely, in neat and workmanlike manner, as specified in NECA 1, Standard Practices for Good Workmanship in Electrical Construction.
- L. Install steel conduit as specified in NECA 101, Standard for Installing Steel Conduits.
- M. Install nonmetallic conduit in accordance with manufacturer's instructions.
- N. Inserts, anchors and sleeves.
1. Coordinate location of inserts and anchor bolts for electrical systems prior to concrete pour.
 2. Coordinate location of sleeves with consideration for other building systems prior to concrete pour.
- O. Conduit Supports:
1. Arrange supports to prevent misalignment during wiring installation.

RACEWAYS

2. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
 3. Group related conduits; support using conduit rack. Construct rack using steel channel. Provide space on each for 25 percent additional conduits.
 4. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.
 5. Do not attach conduit to ceiling support wires.
- P. Flexible steel conduit length not-to-exceed 6-feet, 3-feet in concealed walls. Provide sufficient slack to reduce the effect of vibration.
- Q. Install conduit seals at boundaries where ambient temperatures differ by 10 degrees F or more as shown on the drawings. Install seals on warm side of partition.
- R. Seal raceways stubbing up into electrical equipment. Plug raceways with conductors with duct-seal. Cap spare raceways and plug PVC raceway products with plastic plugs as made by Underground Products, or equal, shaped to fit snugly into the stubup.
- S. Seal raceways penetrating an exterior building wall to prevent moisture and vermin from entering into the electrical equipment.
- T. Use suitable caps on spare and empty conduits to protect installed conduit against entrance of dirt and moisture.
- U. Keep 277/480 volt wiring independent of 120/208 volt wiring. Keep power wiring independent of communication system wiring.
- V. Keep emergency system wiring independent of other wiring systems per NEC 700.
- W. Arrange conduit to maintain headroom and present neat appearance.
- X. Do not install conduits on surface of building exterior, along vapor barrier, across roof, on top of parapet walls, or across floors, unless otherwise noted on drawings.
- Y. Exposed conduits are permitted only in following areas:
1. Mechanical rooms, electrical rooms or spaces where walls, ceilings and floors will not be covered with finished material.
 2. Existing walls that are concrete or block construction.
 3. Where specifically noted on Drawings.
 4. Route exposed conduit parallel and perpendicular to walls, tight to finished surfaces and neatly offset into boxes.

RACEWAYS

- Z. Do not install conduits or other electrical equipment in obvious passages, doorways, scuttles or crawl spaces which would impede or block area passage's intended usage.
- AA. Install continuous conduit and raceways for electrical power wiring and signal systems wiring.
- AB. Route conduit installed above accessible ceilings parallel and perpendicular to walls.
- AC. Maintain adequate clearance between conduit and piping.
- AD. Keep conduits a minimum of 12-inches away from steam or hot water radiant heating lines (at or above 104 degrees F) or 3-inches away from waste or water lines.
- AE. Cut conduit square using saw or pipecutter; deburr cut ends.
- AF. Bring conduit to shoulder of fittings; fasten securely.
- AG. Use conduit hubs to fasten conduit to cast boxes in damp and wet locations.
- AH. Install no more than the equivalent of three 90 degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams.
- AI. Use hydraulic one shot bender to fabricate elbows for bends in metal conduit larger than 2-inch size.
- AJ. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.
- AK. Provide suitable fittings to accommodate expansion and deflection where conduit crosses seismic, control, and expansion joints.
- AL. Conduit Terminations for Signal Systems: Provide a plastic bushing on the end of conduit used for signal system wiring.
- AM. Feeders: Do not combine or change feeder runs.
- AN. Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Division 07, Thermal and Moisture Protection.
- AO. Route conduit through roof openings for piping and ductwork wherever possible. Where separate roofing penetration is required, coordinate location and installation method with roofing installation and installer.

3.2 RIGID METAL CONDUIT (RMC) INSTALLATION

- A. Outdoor Locations Above Grade: RMC.
- B. Damp Locations: RMC.

RACEWAYS

- C. In areas exposed to mechanical damage: RMC.
- D. For security conduits installed exposed and subject to tampering: RMC.

3.3 INTERMEDIATE METAL CONDUIT (IMC) INSTALLATION

- A. Damp Locations: IMC up to 2-inches in diameter.

3.4 ELECTRICAL METALLIC TUBING (EMT) INSTALLATION

- A. Dry Locations:
 - 1. Concealed: EMT.
 - 2. Exposed: EMT.

- B. Dry, Protected: EMT.

3.5 FLEXIBLE METAL CONDUIT (FMC) INSTALLATION

- A. Dry Locations: Motors, recessed luminaires and equipment connections subject to movement or vibration, use flexible metallic conduit.
- B. Install 12-inch minimum slack loop on flexible metallic conduit.

3.6 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC) INSTALLATION

- A. Use PVC coated liquidtight flexible metallic conduit for motors and equipment connections subject to movement or vibration and subjected to any of following conditions: Exterior location, moist or humid atmosphere, corrosive environments, water spray, oil, or grease.
- B. Install 12-inch minimum slack loop on liquidtight flexible metallic conduit.

3.7 CONDUIT FITTINGS INSTALLATION

- A. Conduit Joints: Assemble conduits continuous and secure to boxes, panels, luminaires and equipment with fittings to maintain continuity. Provide watertight joints where embedded in concrete, below grade or in damp locations. Seal metal conduit with metal thread primer. Rigid conduit connections to be threaded, clean and tight (metal to metal). Threadless connections are not permitted for RMC.
- B. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.

RACEWAYS

- C. Use set screw type fittings only in dry locations. When set screw fittings are utilized provide insulated continuous equipment ground conductor in conduit, from overcurrent protection device to outlet.
- D. Use compression fittings in dry locations, damp and rain-exposed locations. Maximum size permitted in damp locations and locations exposed to rain is 2-inches in diameter.
- E. Use threaded type fittings in wet locations, hazardous locations, and damp or rain-exposed locations where conduit size is greater than 2-inches.
- F. Use PVC coated, threaded type fittings in corrosive environments.
- G. Use insulated type bushings with ground provision at switchboards, panelboards, safety disconnect switches, junction boxes that have feeders 60 amperes and greater.
- H. Condulets and Conduit Bodies:
 - 1. Do not use condulets and conduit bodies in conduits for signal wiring, in feeders 100 amp and larger, or for conductor splicing.
- I. Sleeves and Chases - Floor, Ceiling and Wall Penetrations: Provide necessary rigid conduit sleeves, openings and chases where conduits or cables are required to pass through floors, ceilings or walls.
- J. Expansion Joints:
 - 1. Provide conduits crossing expansion joints where cast in concrete with expansion-deflection fittings, installed per manufacturer's recommendations.
 - 2. Secure conduits 3-inches and larger to building structure on opposite sides of a building expansion joint with an expansion-deflection fitting across joint installed per manufacturer's recommendations.
 - 3. Provide conduits less than 3-inches where not cast in concrete with junction boxes securely fastened on both sides of expansion joint, connected together with 15-inches of slack (minimum of 15-inches longer than straight line length) flexible conduit and copper green ground bonding jumper. In lieu of this flexible conduit, an expansion-deflection fitting, as indicated for conduits 3-inch and larger may be installed.
 - 4. Verify expansion/deflection requirements with Structural Engineer prior to installation.
- K. Seismic Joints:
 - 1. No conduits cast in concrete allowed to cross seismic joint.

RACEWAYS

2. Provide conduits with junction boxes securely fastened on both sides of seismic joint, connected together with 15-inches of slack (minimum of 15-inches longer than straight line length) flexible conduit and copper green ground bonding jumper. Prior to installation, verify with Architect that 15-inches is adequate for designed movement, and if not, increase this length as required.
 3. Provide conduits less than 3-inches where not cast in concrete with junction boxes securely fastened on both sides of expansion joint, connected together with 15-inches of slack (minimum of 15-inches longer than straight line length) flexible conduit and copper green ground bonding jumper. In lieu of this flexible conduit, an expansion-deflection fitting, as indicated for conduits 3-inch and larger may be installed.
- L. Provide rigid conduit coupling flush with surface of slab or wall for conduit stubbed in concrete slab or wall to serve electrical equipment or an outlet under table or to supply shop tool, etc. Provide plug where conduit is to be used in future.

END OF SECTION

BOXES

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included:
 - 1. Outlet Boxes
 - 2. Pull and Junction Boxes
 - 3. Box Extension Adapter
- B. Provide electrical boxes and fittings for a complete installation. Include but not limited to outlet boxes, junction boxes, pull boxes, bushings, locknuts and other necessary components.

1.2 RELATED SECTIONS

- A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.
- B. In addition, reference the following:
 - 1. Section 26 05 33, Raceways
 - 2. Section 26 05 53, Identification for Electrical Systems

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

- A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

BOXES

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Outlet Boxes:

1. Hubbell
2. Thomas & Betts
3. Eaton/Crouse-Hinds
4. Or approved equivalent.

B. Pull and Junction Boxes:

1. Eaton/Crouse-Hinds
2. Hoffman
3. Or approved equivalent.

C. Box Extension Adapter:

1. Hubbell
2. Thomas & Betts
3. Eaton/Crouse-Hinds
4. Or approved equivalent.

2.2 OUTLET BOXES

- A. Luminaire Outlet: 4-inch octagonal box, 1-1/2-inches deep with 3/8-inch luminaire stud if required. Provide raised covers on bracket outlets and on ceiling outlets.
- B. Device Outlet: Installation of one or two devices at common location, minimum 4-inches square, minimum 1-1/2-inches deep. Single- or two-gang flush device raised covers.
- C. Telecom Outlet: Provide 4-inches square, minimum 2-1/8-inch deep box with two-gang plaster ring.
- D. Multiple Devices: Three or more devices at common location. Install one-piece gang boxes with one-piece device cover. Install one device per gang.

BOXES

- E. Construction: For interior locations, provide galvanized steel outlet wiring boxes, of the type, shape and size, including depth of box, to suit each respective location and installation; constructed with stamped knockouts in back and sides, and with threaded holes with screws for securing box covers or wiring devices. All surface mounted outlet boxes are to be drawn. Welded boxes are not acceptable.
- F. Accessories: Provide outlet box accessories for each installation, including mounting brackets, wallboard hangers, extension rings, luminaire studs, cable clamps and metal straps for supporting outlet boxes, compatible with outlet boxes being used and meeting requirements of individual wiring situations.
- G. Noise Control: Provide acoustic putty pad to back side of each outlet box installed in acoustic rated walls.

2.3 PULL AND JUNCTION BOXES

- A. Construction: Provide ANSI 49 gray enamel painted sheet steel junction and pull boxes, with screw-on covers; of type shape and size, to suit each respective location and installation; with welded seams and equipped with stainless steel nuts, bolts, screws and washers.
- B. Location:
 - 1. Provide junction boxes above accessible ceilings for drops into walls for receptacle outlets from overhead.
 - 2. Provide junction boxes and pull boxes to facilitate installation of conductors and limiting accumulated angular sum of bends between boxes, cabinets and appliances to 270 degrees.

2.4 BOX EXTENSION ADAPTER

- A. Construction: Diecast aluminum.
- B. Location: Install over flush wall outlet boxes to permit flexible raceway extension from flush outlet to fixed or movable equipment.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Coordinate locations of floor boxes and wall mounted wiring device boxes with architectural and structural floor plans prior to rough-in.
- B. Install boxes securely, in a neat and workmanlike manner, as specified in NECA 1, Standard Practice of Good Workmanship in Electrical Construction.

BOXES

- C. Secure boxes rigidly to substrate upon which they are being mounted.
- D. Install in locations as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and as required by NEC. Locate boxes and conduit bodies so as to ensure accessibility of electrical wiring.
- E. Set wall mounted boxes at elevations to accommodate mounting heights shown on Theatrical Lighting and Rigging drawings..
- F. Electrical boxes are shown on drawings in approximate locations unless dimensioned.
 - 1. Adjust box locations up to 10-feet if required to accommodate intended purpose.
- G. Install boxes to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Division 07, Thermal and Moisture Protection.
- H. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.
- I. Install flush mounting box without damaging wall insulation or reducing its effectiveness.
- J. Support boxes independently of conduit, except cast box that is connected to two rigid metal conduits both supported within 12-inches of box.
- K. Box Color Coding and Marking: Reference Section 26 05 53, Identification for Electrical Systems.
- L. Adjust boxes to be parallel with building lines. Boxes not plumb to building lines are not acceptable.
- M. Install knockout closures in unused box openings.
- N. Clean interior of boxes to remove dust, debris, and other material.
- O. Clean exposed surfaces and restore finish.

3.2 OUTLET BOXES INSTALLATION

- A. Mount outlet boxes, unless otherwise required by ADA, or noted on drawings, following distances above finished floor:
 - 1. Control Switches:
 - a. 48-inches to the top of outlet box.

BOXES

- b. 4-inches above top of backsplash at countertops/workstations, not-to-exceed 44-inches above finished floor to the top of outlet box per ADA requirements.
- 2. Receptacles: 15-inches to the bottom of outlet box.
- 3. Telecom Outlets: 15-inches to the bottom of outlet box.
- 4. Other Outlets: As indicated in other sections of specifications or as detailed on drawings.
- B. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6-inches from ceiling access panel or from removable recessed luminaire.
- C. Flush Outlets in Insulated Spaces: Maintain integrity of insulation and vapor barrier.
- D. Coordinate electrical device locations and elevations (switches and receptacles) with architectural drawings to prevent mounting devices in mirrors, back splashes, and behind cabinets.
- E. Locate outlet boxes to allow luminaires positioned as shown on reflected ceiling plan.
- F. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices. Adjacent boxes not aligned vertically to be adjusted at no additional cost to Owner.
- G. Use flush mounting outlet box in finished areas.
- H. Do not install flush mounting box back-to-back in walls; provide minimum 6-inches separation. Provide minimum 24-inches in acoustic rated walls.
- I. In acoustical walls, apply acoustic putty pad on outlet box prior to installation of acoustical blanket.
- J. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.
- K. Use stamped steel bridges to fasten flush mounting outlet box between studs.
- L. Use adjustable steel channel fasteners for hung ceiling outlet box.
- M. Use gang box where more than one device is mounted together. Do not use sectional box.
- N. Use gang box with plaster ring for single device outlets.
- O. Adjust flush-mounting outlets to make front flush with finished wall material.

BOXES

3.3 PULL AND JUNCTION BOXES INSTALLATION

- A. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.
- B. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6-inches from ceiling access panel or from removable recessed luminaire.
- C. Do not fasten boxes to ceiling support wires.
- D. Large Pull Boxes: Use hinged enclosure in interior dry locations, surface-mounted cast metal box in other locations.

3.4 BOX EXTENSION ADAPTER INSTALLATION

- A. Match material to box.
- B. Install gaskets at exterior and wet locations.

END OF SECTION

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included:
 - 1. Equipment Nameplates
 - 2. Device Labels
 - 3. Wire Markers
 - 4. Conduit Markers

1.2 RELATED SECTIONS

- A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

- A. Submittals not required for this Section.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
 - 1. Manufacturer's Qualifications: Firms regularly engaged in manufacture of identification devices of types and sizes required.
 - 2. Manufacturer's standard products of categories and types required for each application as referenced in other Division 26, Electrical Sections. Where more than a single type is specified for application, provide single selection for each product category.
 - 3. Codes and Standards: Comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices unless otherwise indicated.

IDENTIFICATION FOR ELECTRICAL SYSTEMS

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Equipment Nameplates:
 - 1. B & I Nameplates
 - 2. Intellicum
 - 3. JBR Associates
 - 4. Or approved equivalent.
- B. Device Labels:
 - 1. Kroy
 - 2. Brady
 - 3. Or approved equivalent.
- C. Wire Markers:
 - 1. Brady
 - 2. Panduit
 - 3. Sumitomo
 - 4. Or approved equivalent.
- D. Conduit Markers:
 - 1. Allen Systems
 - 2. Brady
 - 3. Or approved equivalent.

IDENTIFICATION FOR ELECTRICAL SYSTEMS

2.2 EQUIPMENT NAMEPLATES

- A. Engraved phenolic plastic, laminate, minimum 1/8-inch thick in the size indicated, with beveled edge border matching letter color. Federal specification L-P-387. All upper case letters in engraver standard letter style of the size and wording indicated. Punched for mechanical fastening, except where adhesive mounting is necessary due to substrate. Embossed tape style labels are not acceptable.
- B. Color:
 - 1. Normal (Utility): White letters on black background.
 - 2. Life Safety/Critical (Emergency Systems): White letters on red background.
- C. Letter Size:
 - 1. Use 1/2-inch letters minimum for identifying major equipment and loads, including switchgear, switchboards, etc.
 - 2. Use 1/4-inch or 1/2-inch letters minimum for identifying panels, breakers, etc.
 - 3. Use 3/16-inch minimum for identifying source, voltage, current, phase, and wire configurations.
- D. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.
- E. The Architect, Engineer, Commissioning Agent and Owner reserve the right to make modifications to the nameplates as necessary.
- F. Locations:
 - 1. Switchgear, switchboards, sub-distribution switchboards, distribution panels, and branch panels.
 - 2. Main breakers and distribution breakers in switchgear, switchboards, and distribution panels.
 - 3. Equipment including, but not limited to, motor controllers, disconnects, and VFDs.
 - 4. Low-voltage equipment enclosures including, but not limited to, fire alarm panels, access control panels, and lighting control panels.
 - 5. Distribution transformers.

IDENTIFICATION FOR ELECTRICAL SYSTEMS

2.3 DEVICE LABELS

- A. Extra strength, laminated adhesive tape, with 3/16-inch black letters on clear background. Use only for identification of individual wall switches and receptacles. Indicate device name, source panel, and source circuits. Panel and circuit designation written in permanent marker on the back of the plate and inside the back-box. Do not provide punch tape style labels.
- B. Label all junction boxes to show system identification, source circuit, or raceway origin. In finished areas, utilize device label. In unfinished areas or above ceilings, use of permanent ink marker is acceptable.

2.4 WIRE MARKERS

- A. Description: Vinyl-cloth self-adhesive type wire markers.
- B. Locations: Each conductor at panelboard gutters, pull boxes, outlet boxes, junction boxes, and each load connection.
- C. Power and Lighting Circuits: Branch circuit or feeder number as indicated on drawings and source panel.
- D. Control Circuits: control wire number indicated on schematic and interconnection diagrams on drawings or shop drawings.

2.5 CONDUIT MARKERS

- A. Description: Self-sticking vinyl.
- B. Location: Furnish markers for each conduit longer than 6-feet.
- C. Spacing: 20-feet on center.
- D. Color:
 - 1. 480 Volt System: Black letters on Orange background
 - 2. 208 Volt System: Black letters on Orange background

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Coordinate designations used on Drawings with equipment nameplates and device labels.
- B. Install nameplates and labels parallel to equipment lines.

IDENTIFICATION FOR ELECTRICAL SYSTEMS

- C. Identify empty conduit and boxes with intended use.
- D. Provide typewritten branch panel schedules with protective clear transparent covers accounting for every breaker installed. Use actual room designations assigned by name or number near completion of the work, and not the designations shown on drawings.
- E. Provide color coded boxes as follows:
 - 1. Fire Alarm: Red.

3.2 EQUIPMENT NAMEPLATES

- A. Degrease and clean surfaces to receive nameplates.
- B. Secure equipment nameplates to equipment front using self-tapping stainless steel screws.
- C. Secure equipment nameplates to inside surface of door on panelboard that is recessed in finished locations.
- D. Verify emergency system distribution equipment nameplate colors with Architect/Owner.
- E. Switchgear, switchboards, and panels to include name source, voltage, current phase, wire configuration and fault current rating. Transformers to include source KVA, and secondary voltage, phase, and wire configuration.
- F. Provide nameplates for flush mounted branch panelboards identifying name on front door. On inside of door provide nameplate as noted above. Verify with Architect/Owner if nameplate on outside of door is required.
- G. Provide a second label at branch panelboards listing the means of identification of branch circuit conductors. This identification legend to consist of the color code used for each voltage system (208Y/120V and 480Y/277V). See Specification Section 26 05 19, Low-Voltage Electrical Power Conductors and Cables, for required conductor color code for this project. Include identification of both voltage systems on each label, regardless of the voltage of the panelboard to which the label is affixed. Comply with requirements of NEC 210.5.

3.3 DEVICE LABELS

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.
- C. Degrease and clean surfaces to receive labels.

IDENTIFICATION FOR ELECTRICAL SYSTEMS

3.4 WIRE MARKERS

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.
- C. Provide wire markers on each conductor for power, control, signalling and communications circuits.
- D. Where switches control remote lighting or power outlets, or where switches or outlets in same location serve different purposes, such as light, power, intercom, etc. or different areas, such as corridor and outside, provide plates with 1/8-inch black letters indicating function of each switch or outlet. Also label the function of light switches where two or more are mounted in same locations.

3.5 CONDUIT MARKERS

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.

END OF SECTION

ELECTRICAL DISTRIBUTION SYSTEM STUDIES

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Protective Devices
2. Short Circuit Study
3. Selective Coordination Study
4. Arc Flash Labels
5. Arc Flash Risk Assessment

B. Scope of Work: provide arc flash calculations, and install NFPA 70E compliant arc flash labels on added dimmer racks and relay panels.

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. IEEE 242, Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems.
2. IEEE 399, Recommended Practice for Industrial and Commercial Power Systems Analysis.
3. IEEE 1584, Guide for Performing Arc Flash Calculation.

1.4 SUBMITTALS

A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition provide:

1. Power system studies required under this Section with submittals for electrical equipment, including overcurrent protective devices.

ELECTRICAL DISTRIBUTION SYSTEM STUDIES

2. Electrical equipment ordered prior to submittal of power system studies are not compliant with these specifications, and are subject to removal and replacement at no cost to Owner where not in compliance with Code and Contract Documents for selective coordination.
 - a. Provide written verification with Stamp or Seal and signature of preparing Engineer.
3. Provide samples of NFPA 70E compliant arc flash hazard labeling for electrical equipment.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
 1. Study Preparer Qualifications: Qualified engineer of switchgear manufacturer or approved professional engineer.
 - a. Experienced in preparation of studies of similar type and magnitude.
 - b. Familiar with software analysis products specified.
 2. Study Preparer Qualifications: Professional electrical engineer licensed in Project location and not employed by manufacturer of equipment to be provided.
 3. Study Preparer Qualifications: Electrical testing agency regularly engaged in short circuit and coordination studies, with at least 5 years experience in work of this type, and employing professional electrical engineer licensed in Project location to perform studies.
 4. Computer Software for Study Preparation: Use latest edition of commercially available software utilizing specified methodologies.
 - a. Acceptable Software Products:
 - (1) EasyPower
 - (2) EDSA Micro Corporation.
 - (3) Operation Technology, Inc; ETAP.
 - (4) SKM Systems Analysis, Inc; Power Tools for Windows.
 5. Contractor Responsibility: Provide project-related data needed by study preparer, including equipment, wire sizes, insulation types, conduit types, actual circuit

ELECTRICAL DISTRIBUTION SYSTEM STUDIES

lengths and available fault currents from utility. Provide information in a timely matter to allow studies to be completed prior to release of equipment.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Analyze specific electrical and utilization equipment (according to NEC definition), actual protective devices to be used, and actual feeder lengths to be installed.
 - 1. Scope of Studies: New and existing distribution wiring and equipment, from primary source to buses and branch circuit panelboards.
 - 2. Primary Source, for Purposes of Studies: Utility company primary protective devices.
 - 3. Study Methodology: Comply with requirements and recommendations of NFPA 70, IEEE 399, and IEEE 242.
 - 4. Report: State methodology and rationale employed in making each type of calculation; identify computer software package(s) used.
- B. One-Line Diagrams: Prepare schematic drawing of electrical distribution system, with electrical equipment and wiring to be protected by protective devices; identify nodes on diagrams for reference on report that includes:
 - 1. Calculated fault impedance, X/R ratios, utility contribution, and short circuit values (asymmetric and symmetric) at main switchboard bus and downstream devices containing protective devices.
 - 2. Breaker and fuse ratings.
 - 3. Generator kW and voltage ratings, percent impedance, X/R ratios, and wiring connections.
 - 4. Transformer kVA and voltage ratings, percent impedance, X/R ratios, and wiring connections.
 - 5. Identification of each bus, with voltage.
 - 6. Conduit materials, feeder sizes, actual lengths, and X/R ratios.

ELECTRICAL DISTRIBUTION SYSTEM STUDIES

2.2 PROTECTIVE DEVICES

- A. Provide protective devices of ratings and settings as required so that protective device closest to fault will open first.
- B. Replace existing protective devices to achieve specified performance.
- C. Analyze and determine ratings and settings of protective devices to minimize damage caused by fault and so that protective device closest to fault will open first.
 - 1. Required Ratings and Settings: Derive required ratings and settings of protective devices in consideration of upstream protective device settings and optimize system to ensure selective coordination.
 - 2. Motors with Solid-State Protective Modules: Select settings for best possible motor protection, taking into consideration actual installed motor torque and current and thermal characteristics.
 - 3. Identify any equipment that is underrated as specified.
 - 4. Identify specified protective devices that will not achieve required protection or coordination but with minor changes can be made to do so; provide such modified devices at no additional cost to Owner and identify them on submittals as "revised in accordance with Protective Device Coordination Study"; minor changes include different trip sizes in same frame, time curve characteristics of induction relays, CT ranges, etc.
 - 5. Identify specified protective devices that will not achieve required protection or coordination and cannot be field adjusted to do so, and for which adequate devices would involve change to contract sum.
 - 6. In all cases where adequate protection or coordination cannot be achieved at no extra cost to Owner, provide a discussion of alternatives and logical compromises for best achievable coordination.
 - 7. Do not order, furnish, or install protective devices that do not meet performance requirements unless specifically approved by Engineer.
- D. Protective Device Rating and Setting Chart: Summarize in tabular format required characteristics for each protective device based on analysis; include:
 - 1. Device identification.
 - 2. Relay CT ratios, tap, time dial, and instantaneous pickup.
 - 3. Circuit breaker sensor rating, long-time, short-time, and instantaneous settings, and time bands.

ELECTRICAL DISTRIBUTION SYSTEM STUDIES

4. Fuse rating and type.
 5. Ground fault pickup and time delay.
 6. Input level and expected response time at two test points that are compatible with commonly available test equipment and ratings of protective device.
 7. Highlight devices that as furnished by Contractor will not achieve required protection.
- E. Specified equipment has been designed and selected to achieve specified performance; ensure that equipment actually installed provides that performance.
- F. In addition to requirements specified elsewhere, provide overcurrent protective devices having ratings and settings in accordance with results of system studies.

2.3 SHORT CIRCUIT STUDY

- A. Calculate fault impedance to determine available 3-phase short circuit and ground fault currents at each bus and piece of equipment during normal conditions, alternate operations, emergency power conditions, and other operations that could result in maximum fault conditions.
1. Show fault currents available at key points in system down to fault current of 1,000 A at 480 V and 208 V.
 2. Include motor contributions in determining momentary and interrupting ratings of protective devices.
 3. Primary Fault Level Assumptions: Obtain data from utility company.

2.4 SELECTIVE COORDINATION STUDY

- A. For all emergency, legally required standby and critical operations systems over current devices, perform an organized time-current analysis of each protective device in series from individual device back to source, under emergency power conditions.
1. Graphically illustrate that adequate time separation exists between series devices, including upstream primary device.
 2. Plot specific time-current characteristics of each protective device on log-log paper.
 3. Organize plots so that upstream devices are clearly depicted on one sheet.
 4. Also show following on curve plot sheets:
 - a. Device identification.

ELECTRICAL DISTRIBUTION SYSTEM STUDIES

- b. Voltage and current transformer ratios for curves.
 - c. 3-phase and 1-phase ANSI damage curves for each transformer.
 - d. No-damage, melting, and clearing curves for fuses.
 - e. Cable damage curves.
 - f. Transformer inrush points.
 - g. Maximum short circuit cutoff point.
 - h. Simple one-line diagram for portion of system that each curve plot illustrates.
 - i. Software report for each curve plot, labeled for identification.
- B. Devices to coordinate down to 0.01 seconds. Coordination required for emergency systems, and elevators.

2.5 ARC FLASH LABELS

- A. Provide label compliant with NFPA 70E guidelines indicating personal protective equipment (PPE) recommended for servicing of electrical equipment while energized, as well as calculated incident energy levels and arc flash protective boundary distance.

2.6 ARC FLASH RISK ASSESSMENT

- A. Calculate arc flash incident energy (AFIE) levels and flash protection boundary distances to determine required level of personal protective equipment (PPE) at each bus and piece of equipment during normal conditions, emergency power conditions, and other operations that could result in maximum arc flash incident energy levels.
 - 1. Show flash protection boundary distance.
 - 2. Include incident energy levels.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

- A. Provide services of qualified field engineer and necessary tools and equipment to test, calibrate, and adjust installed protective devices to conform to requirements determined by coordination analysis.
- B. Adjust installed protective devices having adjustable settings to conform to requirements determined by coordination analysis.

ELECTRICAL DISTRIBUTION SYSTEM STUDIES

- C. Submit report showing final adjusted settings of protective devices.

3.2 ELECTRICAL POWER SYSTEM STUDIES

A. Short Circuit Analysis Study:

1. Provide complete short circuit study, equipment interrupting and withstand evaluation. Study to include complete electrical distribution system, including contributions from normal source of power without alternative sources of power. Include complete low voltage distribution systems as specified in this Section.
2. Study Basis: thoroughly cover normal and alternative operation modes that can produce maximum fault conditions, including simultaneous motor contributions.
3. Perform study in accordance with applicable ANSI/IEEE Standards.
4. Study Input Data: Utility company short circuit single and three phase contribution, and X/R ratio; resistance and reactance components of each feeder, busway and branch impedance; motor and generator contributions; applicable circuit parameters and contribute to short circuit duty.
5. Calculate short circuit momentary duties and interrupting duties on basis of maximum available fault current at each switchgear bus, switchboard, motor control center, panelboards, transfer switches, busway plug connection point, dry-type transformer primary and secondary locations, other significant locations throughout system affected by available fault current (including large HVAC units, uninterruptible power supplies, etc.).
6. Perform equipment evaluation study to determine adequacy of overcurrent protection devices by tabulating and comparing short circuit ratings of these devices with available fault current. Notify Owner in writing where problem areas or inadequacies appear in electrical equipment.
7. Study Report: In bound final report, include sheets listing tabulated information from study, including feeder impedances, motor, utility and generator impedances and fault contributions, and resulting short circuit current including asymmetrical, symmetrical, three, five and eight cycle fault current levels, and line-to-neutral and three-phase-bolted-fault current levels at each calculated point in electrical distribution system.

B. Selective Coordination Study:

1. Perform time-current coordination analysis with aid of computer software intended for this purpose. Include determination of settings, ratings, or types for overcurrent protective devices supplied.

ELECTRICAL DISTRIBUTION SYSTEM STUDIES

2. Where necessary, make an appropriate compromise between system protection and service continuity with service continuity considered more important than system protection.
3. Provide sufficient number of computer generated log-log plots to indicate degree of system protection and coordination by displaying time-current characteristics of series connected overcurrent devices and other pertinent system parameters.
4. Computer printouts accompany log-log plots and will contain descriptions for each of devices shown, settings of adjustable devices, short-circuit current availability at device location when known, and device identification numbers to aid in locating devices on log-log plots and system one-line diagram.
5. Study includes separate, tabular computer printout containing suggested device settings of adjustable overcurrent protective devices, equipment where device is located, and device number corresponding to device on system one-line diagram.
6. Provide computer generated system one-line diagram which clearly identifies individual equipment buses, bus numbers, device identification numbers and maximum available short-circuit current at each bus when known.
7. Discussion Section which evaluates degree of system protection and service continuity with overcurrent devices, along with recommendations as required for addressing system protection or device coordination deficiencies.
8. Call significant deficiencies in protection and/or coordination to attention of Engineer and recommendations made for improvements as soon as they are identified.
9. Contractor responsible for supplying pertinent electrical system conductor, circuit breaker, generator, and other component and system information in timely manner to allow time-current analysis to be completed prior to final installation.
10. Emergency System Selective Coordination: Provide equipment and settings required to achieve selective coordination required by OESC.

C. Arc Flash Risk Assessment:

1. Perform arc flash risk assessment with aid of computer software intended for this purpose.
2. Perform arc flash risk assessment in conjunction with short-circuit analysis and time-current coordination analysis.
3. Submit results of assessment in tabular form, and include device or bus name, bolted fault and arcing fault current levels, flash protection boundary distances, personal-protective equipment classes and AFIE levels.

ELECTRICAL DISTRIBUTION SYSTEM STUDIES

4. Perform analysis under worst-case arc flash conditions, and final report describes, when applicable, how these conditions differ from worst-case bolted fault conditions.
5. Arc flash risk assessment includes recommendations for reducing AFIE levels and enhancing worker safety.
6. Proposed vendor demonstrates experience with arc flash risk assessment by submitting names of at least ten actual arc flash risk assessments it has performed in past year.
7. Proposed vendor demonstrates capabilities in providing equipment, services, and training to reduce arc flash exposure and train workers in accordance with NFPA 70E and other applicable standards.
8. Proposed vendor demonstrates experience in providing equipment labels in compliance with OESC and ANSI Z535.4 to identify AFIE and appropriate Personal Protective Equipment classes.

END OF SECTION

PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Panelboards

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

B. In addition, reference the following:

1. Section 26 05 73, Electrical Distribution System Studies.
2. Section 26 28 00, Overcurrent Protective Devices.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:

1. UL 67, Standards for Panelboards.

1.4 SUBMITTALS

A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Panelboards:

PANELBOARDS

1. Eaton
 2. General Electric
 3. Basis of Design: Schneider Electric/Square D
 4. Or approved equivalent.
- B. Manufacturers listed above are allowed on condition of meeting specified conditions including available space for equipment, Code required working clearances, selective coordination per Section 26 05 73, Electrical Distribution System Studies, and amps interrupting capacity (AIC) per short circuit study in Section 26 05 73, Electrical Distribution System Studies. Prior to submitting bid, manufacturer to provide documentation to Engineer verifying specific conditions, including those mentioned above, can be met. Remove and replace electrical equipment installed, at no cost to the Owner, that does not meet these conditions.

2.2 PANELBOARDS

- A. Description: Panelboards 400 amps or less. NEMA PB1, Type 1, circuit breaker type. Maximum enclosure depth: 6-inches for surface mounted, 5-3/4-inches for flush mounted.
- B. Maximum Width: 20-inches.
- C. Circuit breakers in branch circuit panels to be rated to match existing breakers in existing panelboard or for minimum 22,000A RMS symmetrical interrupting capacity. Where the required interrupting capacities, according to the Overcurrent Protection Devices Coordination Study, are higher than those indicated in items above, the equipment selected must provide these higher interrupting capacities. As per Section 26 00 00, Electrical Basic Requirements, submit the Protection Coordination Study with the first set of shop drawings on switchgear and panelboards.
- D. Panelboard Bus Non-Reduced: Copper, ratings as indicated in Section 26 00 00. Bus bar with suitable electroplating (tin) for corrosion control at connection. Provide copper ground bus in each panelboard.
- E. Lugs: Mechanical type for both aluminum and copper conductors. All device terminals/lugs shall be rated for a minimum of 75 degrees C to facilitate the use of 75 degrees C conductor ampacity rating.
- F. Provide double lugs and/or feed-through lugs for feed through feeders.
- G. Molded Case Circuit Breakers: Thermal magnetic trip circuit breakers, bolt-on type, with common trip handle for poles; UL listed. Predrill bus for bolt-on breakers.
 1. Type SWD for lighting circuits.

PANELBOARDS

2. Type HACR for air conditioning equipment circuits.
 3. Class A ground fault interrupter circuit breakers where scheduled.
 4. Class B ground fault equipment protection circuit breakers for heat trace and other circuits as required by Code. Provide shunt trip circuit breakers where scheduled; provide wiring to remote trip switch/contacts as indicated on Drawings.
 5. Do not use tandem circuit breakers.
- H. Accessories: Provide where indicated: shunt trip, arc-fault circuit interrupter (AFCI), Class A ground fault circuit interrupter (GFCI), auxiliary switch, and alarm switch.
- I. Cabinet Front: Provide flush or surface mounting as shown on the schedules, drawings, or otherwise noted. Cabinet front with concealed hinged front cover door-in-door construction, metal directory frame with heavy clear plastic protector, flush lift latch and lock, two keys per panel all keyed alike.
- J. Provide boxes with removable blank end walls and interior mounting studs. Provide interior support bracket for ease of interior installation.
- K. Furnish surface mounted cabinet boxes without knockouts.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Install panelboards in accordance with NEMA PB 1.1, NECA 1 and manufacturers installation instructions.
- B. Install panelboards level and plumb. Install recessed panelboards flush with wall finishes.
- C. Height: 6-feet 6-inches to top of panelboard; install panelboards taller than 6-feet 6-inches with bottom no more than 4-inches above floor.
- D. Provide filler plates for unused spaces in panelboards.
- E. Provide typed circuit directory for each branch circuit panelboard. Include all "spaces" and "spares." Revise directory to reflect circuiting changes and as-installed conditions. Use final Owner designated room names and numbers, and not designations shown on drawings.
- F. Provide engraved plastic nameplates per Section 26 05 53, Identification for Electrical Systems.

PANELBOARDS

- G. Provide arc flash labels per Section 26 05 73, Electrical Distribution System Studies.
- H. Provide two 1-inch spare conduits out of each recessed panelboard to an accessible location above ceiling. Identify each as SPARE.
- I. Provide permanent identification number in or on panelboard dead-front adjacent to each breaker pole position. Horizontal centerline of numbers to correspond with centerline of circuit breaker pole position.
- J. Ground and bond panelboard enclosure per NEC.
- K. Paint:
 - 1. Standard factory finish unless noted otherwise.
 - 2. Panelboards located in finished interior areas in view of building occupants; paint to match adjacent wall surface. Color and paint preparation as specified by Architect. Covers to be painted off wall, then installed over dried, painted wall surface.
- L. Provide handle guards on each circuit supplying obviously constant loads such as fire alarm, security, lighting controls, refrigerators and freezers, fire protection, etc.
- M. Provide interior wiring diagram, neutral wiring diagram, UL label, and short circuit rating on interior or in booklet format inserted in sleeve inside panel cover.
- N. Verify available recessing depth and coordinate wall framing with other divisions.
- O. Maintain fire rating of wall where panels are installed flush in fire rated walls.
- P. Perform inspections and tests in accordance with manufacturer's requirements.
- Q. Thoroughly clean exterior and interior of each panelboard in accordance with manufacturer's installation instructions.
- R. Vacuum construction dust, dirt, and debris out of each panelboard.
- S. Where enclosure finish is damaged, touch up finish with matching paint in accordance with manufacturer's specifications and installation instructions.
- T. Reference Section 26 08 05, Electrical Acceptance Testing for testing requirements.

3.2 PANELBOARDS INSTALLATION

- A. Breakers being added to existing panelboards: Coordinate breaker type and short circuit rating with existing panelboard. Breakers to match existing in manufacturer's type and AIC rating. Provide new typed circuit directory.

PANELBOARDS

- B. Provide handle tie to branch circuit breakers of multiwire branch circuits for simultaneous disconnection of circuits. Handle tie will be identified for use with circuit breakers provided. Reconfigure assigned circuits as necessary so that circuit breakers associate with multiwire branch circuits are physically adjacent, record changes in panelboard schedules and circuiting plans for record drawings.
- C. Shunt Trip Circuit Breakers: Provide wiring to remote trip switch/contacts as indicated on Drawings.
- D. Measure steady state load currents at each panelboard feeder; rearrange circuits in panelboard to balance phase loads to within 20 percent of each other. Maintain proper phasing for multi-wire branch circuits.

END OF SECTION

WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included: Provision of materials, installation and testing of:

1. Wall Switches
2. Receptacles
3. Finish Plates
4. Wall Dimmers
5. Surface Covers

1.2 RELATED SECTIONS

A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Wall switches and Dimmers
2. Receptacles
3. Wall Plates
4. In-Use Cover

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

WIRING DEVICES

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Wall Switches:

1. Toggle Type Characteristics:
 - a. Cooper AH1201
 - b. Hubbell HBL1221
 - c. Leviton 1221
 - d. Legrand P&S PS20AC1
 - e. Or approved equivalent.

B. Receptacles:

1. Industrial Grade:
 - a. Cooper 5362
 - b. Hubbell HBL5362
 - c. Bryant BRY5362
 - d. Leviton 5362
 - e. Legrand P&S 5362A
 - f. Or approved equivalent.
2. Ground Fault Circuit Interrupter (GFCI) Receptacle - 20 Amp:
 - a. Cooper WRSGF20W
 - b. Hubbell GFR5362SGW
 - c. Legrand P&S 2097TRWR
 - d. Or approved equivalent.

WIRING DEVICES

C. Finish Plates:

1. Bryant
2. Cooper
3. Hubbell
4. Leviton
5. Legrand P&S
6. Or approved equivalent.

D. Wall Dimmers:

1. Lutron Maestro Series
2. Or approved equivalent.

E. Surface Covers:

1. Aluminum with Gasket, Blanks, Single Gang:
 - a. Bell 240-ALF
 - b. Carlon
 - c. Or approved equivalent.
2. 2-Gang:
 - a. Bell 236-ALF
 - b. Carlon
 - c. Or approved equivalent.

F. Provide lighting switches and receptacles of common manufacturer and appearance.

2.2 WALL SWITCHES

- A. Characteristics: Toggle type, quiet acting, 20 amp, 120/277 volt, UL listed for motor loads up to 80 percent of rated amperage, extra heavy duty.
- B. Finish: Match Building Standard.

WIRING DEVICES

2.3 RECEPTACLES

- A. Duplex Receptacles Characteristics: Straight parallel blade, 125 volt, 2 pole, 3 wire grounding.
 - 1. Industrial Grade: Back and side wired. Single piece, rivetless. Brass grounding strap and back-wired ground screw. 20 amp.
- B. Ground Fault Circuit Interrupter (GFCI) Receptacle: Feed through type, back-and-side wired, tamper-resistant, weather resistant self-testing, 20 amp, 125VAC.
- C. Surge Protector Receptacle: Feed-through type, back and side wired, 20 amp, 125VAC, LED monitor light, MOV protection in L-N, L-L, and N-G modes for up to 9000 amp surges. Minimum 170 joule rating.
- D. Special Purpose Receptacles: Reference Drawings for NEMA Standard Specification.
- E. Finish:
 - 1. Same exposed finish as switches.
 - 2. Receptacles connected to emergency circuits to have red finish.
 - 3. Receptacles installed in surface raceway to match raceway finish. See Section 26 05 33, Raceways.

2.4 FINISH PLATES

- A. Finish Plates: Type 302 stainless steel with smooth satin finish.
- B. Provide telephone/signal device plates; activated outlets to have coverplates to match modular jack.

2.5 WALL DIMMERS

- A. Provide wall dimmers compatible with type of load controlled (i.e. line voltage, low voltage, 2-wire, 3-wire, 0-10v). Finish to match wall switches. Size dimmers to accept connected load. Do not cut fins. Where dimmers are ganged together, provide a single multi gang coverplate.
- B. LED indicator dots show by what percentage controlled lighting is dimmed. Programmable settings for maximum and minimum trim settings, and rate of change in lighting levels.

2.6 SURFACE COVERS

- A. Material: Galvanized steel, drawn, 1/2-inch raised industrial type with openings appropriate for devices installed on surface receptacles.

WIRING DEVICES

- B. Cast Box and Extension Adaptors: Aluminum with gasket, blanks single gang or 2-gang.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. See Architectural elevations for location and mounting height of wiring devices. Review Architectural elevations prior to rough-in and contact Architect immediately if conflicts are found between Architectural and Electrical Drawings. Do not rough-in devices until conflicts are resolved.
- B. Install wiring devices and finish plates plumb with building lines, equipment cabinets and adjacent devices. Devices not plumb will be fixed at no additional cost to Owner.
- C. Orientation:
 - 1. Install wiring devices with long dimension oriented vertically at centerline height shown on drawings or as specified.
 - 2. Vertical Alignment: When more than one device is shown on drawings in close proximity to each other, but at different elevations, align devices on a common vertical center line for best appearance. Verify with Architect.
 - 3. Horizontal Alignment: When more than one device is shown on drawings in close proximity to each other with same elevation, align devices on a common horizontal center line for best appearance. Verify with Architect.
- D. Provide labeling per Section 26 05 53, Identification for Electrical Systems.
- E. Test wiring devices to ensure electrical continuity of grounding connections, and after energizing circuitry, to demonstrate compliance with requirements. Test receptacles for line to neutral, line to ground and neutral to ground faults. Correct any defective wiring.

3.2 WALL SWITCHES INSTALLATION

- A. At time of substantial completion, replace those items which have been damaged.

3.3 RECEPTACLES INSTALLATION

- A. Upon installation, adhere to proper and cautious use of convenience receptacles. At time of substantial completion, replace those items which have been damaged, including those burned and scored by faulty receptacles or cord caps.
- B. GFCI Receptacles: One GFCI receptacle may not be used to provide GFCI protection to downstream duplex receptacles on the same branch circuit.

WIRING DEVICES

3.4 FINISH PLATES INSTALLATION

- A. Do not install items until finish painting is complete. Replace scratched and paint splattered finish plates and wiring devices.

3.5 WALL DIMMERS INSTALLATION

- A. Install per manufacturer's recommendations and wiring diagrams.

3.6 SURFACE COVERS INSTALLATION

- A. Do not install items until finish painting is complete. Replace scratched and paint splattered finish plates and wiring devices.

END OF SECTION

OVERCURRENT PROTECTIVE DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included:
 - 1. Fuses
 - 2. Molded Case Circuit Breakers

1.2 RELATED SECTIONS

- A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

- A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
 - 1. Product data and instantaneous let-through current curves and average melting time current curves for fuses supplied to project.
 - 2. Product data and time/current trip curves for circuit breakers supplied to project.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements apply to this Section.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Fuses:

OVERCURRENT PROTECTIVE DEVICES

1. Bussmann
2. Ferraz-Shawmut
3. Littelfuse
4. McGraw-Edison
5. Or approved equivalent.

B. Molded Case Circuit Breakers:

1. Eaton Electrical
2. General Electric
3. Siemens
4. Schneider Electric/Square D
5. Or approved equivalent.

2.2 FUSES

A. Characteristics:

1. Dual element, time delay, current limiting, nonrenewable type, rejection feature. Blown-fuse indicator window.
2. Combination Loads: UL Class RK1, 1/10 to 600 amp. UL Class L, above 600 amps.
3. Motor Loads: UL Class RK5, 1/10 to 600 amp.
4. Fuse pullers for complete range of fuses.

2.3 MOLDED CASE CIRCUIT BREAKERS

- A. 1-, 2- or 3-pole bolt-on, single handle common trip, 600VAC or 250VAC as indicated on Drawings.
- B. Overcenter toggle-type mechanism, quick-make, quick-break action. Trip indication is by handle position.
- C. Calibrate for operation in 40 degrees C ambient temperature.
- D. 15 to 150 Amp Breakers: Permanent trip unit containing individual thermal and magnetic trip elements in each pole.

OVERCURRENT PROTECTIVE DEVICES

- E. 151 to 400 Amp Breakers: Adjustable magnetic trip elements. Provide push-to-trip button on cover of breaker for mechanical tripping.
- F. Greater than 401 Amp: Electronic trip type with adjustments for long-time, instantaneous, and short-time functions.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Coordination:
 - 1. Obtain and review the submitted product data for equipment furnished by the Owner, and furnished under other Divisions of this contract, particularly under Divisions 22 and 23.
 - 2. Confirm the equipment nameplate maximum overcurrent protection (MOCP) and make accommodations and adjustments to overcurrent protective devices as necessary to coordinate with the nameplate rating.
- B. Install all items in accordance with manufacturers written instructions.

3.2 FUSES

- A. Fuses: For each class and ampere rating of fuse installed, provide the following quantities of spares for quantity of fuses installed:
 - 1. 0 to 24: Provide 6 spare.
 - 2. 25 to 48: Provide 9 spare.
 - 3. 49 and Above: Provide 12 spare.

3.3 MOLDED CASE CIRCUIT BREAKERS

- A. Provide testing of ground fault interrupting breakers.
- B. Provide circuit breakers, as specified and on Drawings, for installation in panelboards, individual enclosures or combination motor starters.
- C. Provide ground fault interrupter circuit breakers for equipment in damp or wet locations.
- D. Provide device on handle to lock breaker in "ON" position for breakers feeding time switches, night lights and similar circuits required to be continuously energized.

OVERCURRENT PROTECTIVE DEVICES

- E. Shunt Trip Circuit Breakers: Provide wiring to remote trip switch/contacts as indicated on Drawings.

END OF SECTION

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included:
 - 1. Toggle Type Disconnect Switches
 - 2. Manual Motor Starters
 - 3. Safety Switches
 - 4. Enclosed Circuit Breakers
 - 5. Molded Case Switches

1.2 RELATED SECTIONS

- A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.
- B. In addition, reference the following:
 - 1. Section 26 05 73, Electrical Distribution System Studies.
 - 2. Section 26 24 13, Switchboards.
 - 3. Section 26 24 16, Panelboards.
 - 4. Section 26 28 00, Overcurrent Protective Devices.

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

- A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Toggle Type Disconnect Switches:
1. Cooper
 2. Hubbell
 3. Leviton
 4. Legrand (Pass & Seymour)
 5. Slater
 6. Or approved equivalent.
- B. Manual Motor Starters:
1. Eaton Electrical
 2. General Electric
 3. Siemens
 4. Schneider Electric/Square D
 5. Or approved equivalent.
- C. Safety Switches:
1. Eaton Electrical
 2. GE Industrial
 3. Siemens
 4. Schneider Electric/Square D
 5. Or approved equivalent.
- D. Enclosed Circuit Breakers:

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

1. Eaton Electrical
2. GE Industrial
3. Siemens
4. Schneider Electric/Square D
5. Or approved equivalent.

E. Molded Case Switches:

1. Eaton Electrical
2. General Electric
3. Siemens
4. Schneider Electric/Square D
5. Or approved equivalent.

2.2 TOGGLE TYPE DISCONNECT SWITCHES

- A. Rating: 120 or 277 volt, 1 or 2 pole, 20 amp, 1 hp maximum.
- B. Enclosure:
 1. NEMA 1: Dry locations/Indoors.
 2. NEMA 3R: Damp or wet locations/Outdoors.
- C. Handle lockable in 'off' position.

2.3 MANUAL MOTOR STARTERS

- A. Quick-Make, Quick-Break. Thermal overload protection. Device labeled with maximum voltage, current, and horsepower.
- B. Enclosure:
 1. NEMA 1: Dry locations/Indoors.
 2. NEMA 3R: Damp or wet locations/Outdoors.

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

2.4 SAFETY SWITCHES

- A. Heavy duty fusible type and non-fusible type (as indicated on drawings), dual rated, quick-make, quick-break with fuse rejection feature for use with Class R fuses only, unless other fuse type is specifically noted.
- B. Clearly marked for maximum voltage, current, and horsepower.
- C. Operable handle interlocked to prevent opening front cover with switch in 'on' position.
- D. Switches rated for maximum available fault current.
- E. Handle lockable in 'off' position.
- F. Enclosure:
 - 1. NEMA 1: Dry locations/Indoors.
 - 2. NEMA 3R: Damp or wet locations/Outdoors.

2.5 ENCLOSED CIRCUIT BREAKERS

- A. Molded case circuit breakers:
 - 1. 1-, 2-, or 3-pole bolt on, single-handle common trip, 600VAC or 250VAC as indicated on drawings.
 - 2. Overcenter toggle-type mechanism, quick-make, quick-break action. Trip indication is by handle position.
 - 3. Calibrate for operation in 40C ambient temperature.
 - 4. 15 to 150 Amp Breakers: Permanent trip unit containing individual thermal and magnetic trip elements in each pole.
 - 5. 151 to 400 Amp Breakers: Variable magnetic trip elements. Provide push-to-trip button on cover of breaker for mechanical tripping.
 - 6. Greater than 401 Amp: Electronic trip type with adjustments for long-time, instantaneous, and short-time functions. Provide ground fault function for breakers greater than 400 amps.
 - 7. Provide handle mechanisms that are lockable in the open (off) position.
 - 8. Circuit breakers to have minimum symmetrical interrupting capacity as indicated on Drawings.
- B. Enclosure:

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

1. NEMA 1: Dry locations/Indoors.
2. NEMA 3R: Damp or wet locations/outdoors.

2.6 MOLDED CASE SWITCHES

- A. Removable cover, galvanized steel enclosure, powder coat painted.
- B. Provide cover padlock provision.
- C. Provide trip unit with no overcurrent, overload, or low level fault protection. Trip unit to be high instantaneous magnetic fixed trip type with magnetic trip reset at factory to interrupt high fault currents at or above preset level.
- D. Enclosure:
 1. NEMA 1: Dry locations/Indoors.
 2. NEMA 3R: Damp or wet locations/Outdoors.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Obtain and review the submitted product data for equipment furnished by the Owner, and furnished under other Divisions of this contract.
- B. Confirm the equipment nameplate maximum overcurrent protection (MOCP) and make accommodations and adjustments to switches, fuses and circuit breakers as necessary to coordinate with the nameplate rating
- C. Install in accordance with manufacturer's instructions.
- D. Provide engraved nameplates per Section 26 05 53, Identification for Electrical Systems.
- E. Provide arc flash labels per Section 26 05 73, Electrical Distribution System Studies.
- F. Apply neatly typed adhesive tag on inside door of each fusible switch indicating NEMA fuse class and size installed.

3.2 TOGGLE TYPE DISCONNECT SWITCHES

- A. Install fuses in fusible disconnect switches. Coordinate fuse ampere rating with installed equipment. Do not provide fuses of lower ampere rating than motor starter thermal units.
- B. Install products, systems and equipments in accordance with manufacturers written instructions and requirements.

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

- C. See General Installation Requirements above.

3.3 MANUAL MOTOR STARTERS

- A. Provide disconnecting means within sight of each motor controller and of each motor. Motor controller disconnecting means equipped with lock-out/tag-out padlock provisions do not require a disconnect switch at the controlled motor location. Locate disconnect means in view of and not inside of equipment, such that tools are not needed to remove covers to access the disconnecting means.
- B. Install products, systems and equipments in accordance with manufacturers written instructions and requirements.
- C. See General Installation Requirements above.

3.4 SAFETY SWITCHES

- A. Install products, systems and equipments in accordance with manufacturers written instructions and requirements.
- B. See General Installation Requirements above.

3.5 ENCLOSED CIRCUIT BREAKERS

- A. Install products, systems and equipments in accordance with manufacturers written instructions and requirements.
- B. See General Installation Requirements above.

3.6 MOLDED CASE SWITCHES

- A. Install products, systems and equipments in accordance with manufacturers written instructions and requirements.
- B. See General Installation Requirements above.

END OF SECTION

SURGE PROTECTIVE DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. SPD for Distribution Panels - Nonmodular Type

1.2 RELATED SECTIONS

- A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
1. Listed per UL 1449, third edition, and complimentary listed per UL 1283 as FRI/EMI filter.
 2. Comply with ANSI/IEEE C62.45 test procedures for Category-C3 established in C62.41.2 and CSA certified (C22.2).

1.4 SUBMITTALS

- A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
1. Related SPD Specifications, Drawings, maintenance manuals, installation instructions, and UL 1449, third edition, listed surge suppression ratings of specified protection modes.
 2. Project Record Documents: Record actual locations of SPDs.
 3. Maintenance Data:
 - a. Include module replacement instructions.
 - b. Include maintenance and troubleshooting instructions for electronic components.

SURGE PROTECTIVE DEVICES

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
 - 1. Manufacturer's Qualifications: ISO 9001 certification SPD manufacturer's complete quality control and documentation procedures of firms regularly engaged in manufacturer's of SPD product for Category-C3 (ANSI/IEEE C62.41.2) and whose product has been of satisfactory service for not less than 5 years.
 - a. Provide local support for SPD.
 - b. Provide both service entrance and distribution panel SPD of same manufacturer.
 - 2. Manufacturer Qualifications: Company specializing in manufacturing products specified in this Section with minimum three years documented experience.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Advanced Protection Technologies, Inc. (APT)
- B. Current Technology
- C. Eaton Electrical
- D. Lea International
- E. Liebert
- F. Schneider Electric/Square D
- G. Surge Suppression Inc. (SSI)
- H. Siemens
- I. Or approved equivalent.

SURGE PROTECTIVE DEVICES

2.2 SPD FOR DISTRIBUTION PANELS - NONMODULAR TYPE

- A. List SPD in accordance with UL 1449 (third edition), Standard for Safety, Surge Protective Devices, and UL 1283, Electromagnetic Interference Filters.
- B. Independently test SPD with Category-C3 high exposure waveform (20KV - 1.2/50 μ s, 10 kA - 8/20 μ s) per ANSI/IEEE C62.41.2 (2002)
- C. Provide SPD with copper bus bars for surge current path. Small gauge round wiring, plug-in type connections, or printed circuit boards not be used in path for surge current diversion. Equally distribute surge current to MOV components to ensure equal stressing and maximum performance. Surge suppression platform must provide equal impedance paths to each matched MOV.
- D. Use no plug in component modules or printed circuit boards as surge current conductors. Hardwire internal components with connections utilizing low impedance conductors and compression fittings.
- E. In order to isolate SPD under any fault condition, manufacturer to provide:
 - 1. Individually fuse the MOV via copper fuse. Copper fuse provides protection during high (ka) surge events.
 - 2. Equip MOVs with thermal fuse which allows disconnection of suppression component at overheating stage common during TOV.
 - 3. Test overcurrent protection components in compliance with UL 1449 (3rd Edition) Limited Current Test and AIC rating test.
- F. Equip SPD with an audible alarm that activates when one of surge current modules have failed. Provide an alarm on/off switch to silence alarm. Provide an alarm push-to-test switch to test the alarm. Locate switches and alarm on the front cover of the SPD's enclosure.
- G. Provide SPD that Meet or Exceed the Following Criteria:
 - 1. Provide maximum single impulse current rating at no less than 100 kA per phase. Manufacturers must provide documented proof of independent third party verification of single impulse current withstand capabilities.
 - 2. Pulse Life Test: Capable of protecting against and surviving 2000 ANSI/IEEE C62.41.2 Category-C3 transients without failure or degradation of UL 1449 (third edition) clamp voltage by more than 10 percent.
 - 3. UL 1449 (third edition) clamping voltage not to exceed the following:

VOLTAGE	L-G	L-N	N-G
208Y/120V	800V	800V	800V

SURGE PROTECTIVE DEVICES

480Y/277V	1200V	1200V	1200V
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4. Nominal discharge current of 20KA I (n).
- H. Make SPD of solid-state components which operate bidirectionally.
- I. Provide SPD with response time no greater than five nanoseconds for individual protection modes.
1. SPD designed to withstand maximum continuous operating voltage (MCOV) of not less than 115 percent of nominal RMS voltage.
 2. Provide visible indication of proper SPD connection and operation. Provide 10 year warranty, incorporating unlimited replacements of SPD if they are destroyed by transients within warranty period.
- J. Provide SPD designed to withstand maximum continuous operating voltage (MCOV) of not less than 115 percent of nominal RMS voltage.
1. Provide terminals for necessary power and ground connections.
 2. Provide SPD with minimum EFI/RFI filtering of 30dB at 100KHZ with an insertion loss ratio of 316:1 using Military Standard 220A methodology.
 3. Provide SPD with 10 year warranty, incorporating unlimited replacement parts if they are destroyed by transients during warranty period.

PART 3 - EXECUTION

3.1 SPD FOR DISTRIBUTION PANELS - NONMODULAR TYPE INSTALLATION

- A. Install one secondary SPD at each distribution panel location as indicated in Specification 26 00 00 Electrical Basic Requirements. SPD unit to be integral to panelboard.

END OF SECTION

LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included:
 - 1. Luminaires
 - 2. LED Drivers
 - 3. Lamps
- B. Provide wiring for complete and operating lighting system.

1.2 RELATED SECTIONS

- A. Contents of Division 26, Electrical and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
 - 1. NECA 500 - Commercial Lighting.
 - 2. UL 8750 – Light Emitting Diode (LED) equipment for use in lighting products.

1.4 SUBMITTALS

- A. Submittals as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
 - 1. Submit product data for:
 - a. LED Luminaires: Electrical ratings, dimensions, mounting, material, clearances, terminations, wiring, connection diagram, LM-79 photometric data, LM-80 lumen depreciation data.
 - b. LED Drivers
 - c. Lamps
 - 2. Submittal Cutsheets: Highlight, circle or otherwise graphically indicate which option(s) are being selected for the products submitted. Cutsheets that are not

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edited to indicate which products and options are submitted for this project or that list only catalog numbers to identify submitted options are not acceptable.

3. Specified manufacturers are approved to submit bid. However, inclusion does not relieve manufacturer from supplying product as described.
4. Provide the following operating and maintenance instructions as required by Section 26 00 00, Electrical Basic Requirements:
 - a. Luminaires
 - b. LED Drivers
 - c. Lamps

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, meet the following:
 1. Provide luminaires acceptable to code authority for application and location installed.
 2. Comply with applicable ANSI standards.
 3. Comply with applicable NEMA standards.
 4. Provide luminaires and lampholders that comply with UL standards and have been listed and labeled for location and use indicated by a testing agency acceptable by the AHJ (e.g., UL, ETL, and the like).
 5. Comply with OESC as applicable to installation and construction of luminaires.
 6. Comply with fallout and retention requirements of OSSC for diffusers, baffles, and louvers.
 7. Provide LED luminaires from the same manufacturer and manufacturing LED source batch for similar applications (e.g., all LED downlights from a single manufacturer and batch, all linear LED products from single manufacturer and batch).

1.6 WARRANTY

- A. Warranty as required by Section 26 00 00, Electrical Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:

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1. LED Luminaire Manufacturer's Warranty: Not less than 5 years for luminaire based on date of substantial completion. Includes normal cost of labor to replace luminaire. Replacement luminaire will match physical dimensions, physical appearance, chromaticity, lumen output and photometric characteristics of original installed equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Luminaires:

1. Reference description and manufacturers in Section 26 00 00, Electrical Basic Requirements.
2. Or approved equivalent.

B. LED Drivers:

1. Indoor Drivers:
 - a. eldoLED Series
 - b. Advance/Philips
 - c. Osram Sylvania
 - d. Or approved equivalent.

C. Lamps:

1. LED (Light Emitting Diode) Lamps:
 - a. Nichia
 - b. Cree
 - c. Osram Sylvania
 - d. GE Lumination
 - e. Or approved equivalent.
2. Unless specific manufacturer not shown on this list is indicated in the Luminaire Schedule.
3. Special types as indicated in Luminaire Schedule.

LIGHTING

4. Or approved equivalent.

2.2 LUMINAIRES

- A. Luminaires: Reference description and manufacturers in Section 26 00 00, Electrical Basic Requirements.
- B. Where recessed luminaires are installed in cavities intended to be insulated, provide IC rated luminaires or other code approved installation.
- C. UL label luminaires installed under canopies, roof or open porches, and similar damp or wet locations, as suitable for damp or wet location.
- D. Suspended luminaires: Provide minimum 24-inch adjustability in aircraft cable length where used.
- E. Recessed Luminaires: Frame compatible with ceiling material installed at particular luminaire location. Provide proper factory trim and frame for luminaire to fit location and ceiling material. Verify with Architectural Reflected Ceiling Plan prior to submittals.
- F. Finishes:
 1. Manufacturer's standard finish (unless otherwise indicated) over corrosion resistant primer.
 2. Interior Light Reflecting Finishes: White or specular finish with not less than 85 percent reflectance.
 3. Exterior Finishes: As detailed in Luminaire Schedule or on drawings. Refer cases of uncertain applicability to Architect for resolution prior to release for fabrication.
- G. Light Transmitting Components:
 1. Plastic diffusers, molded or extruded of 100 percent virgin acrylic.
 2. Prismatic acrylic, extruded, flat diffusers, 0.125-inch overall thickness, unless otherwise noted.
- H. LED Luminaires:
 1. UL listing of luminaire includes drivers, transformers, enclosures, rated wire, communications devices and accessories needed for a complete and functional system.
 2. LM-79: Testing and measurement of absolute photometry, chromaticity (CCT) and luminaire power. Report provided by DOE certified independent testing laboratory. CCT as specified in Luminaire Schedule.

LIGHTING

3. Standards: ANSI C78.377, LM-79 and LM-82 compliant for performance characteristics, photometry, colorimetry, efficacy and thermal characteristics.
4. LM-80 + TM-21: Testing and measurement, and statistical prediction of LED lamp life. Report provided by DOE certified independent testing laboratory.
5. LEDs in one module/luminaire: Supplied from same batch/bin and fall within 3-step MacAdam Ellipse, or as described in Luminaire Schedule, whichever is the more stringent requirement.
6. Provide luminaires with integral LED thermal management system (heat sinking).
7. Luminaires to be equipped with an LED driver that accepts 120V through 277V, 50Hz to 60Hz (universal). Component-to-component wiring within the luminaire will carry no more than 80 percent of rated current and be listed by UL for use at 600VAC at 302 degrees F/150 degrees C or higher. Plug disconnects to be listed by UL for use at 600VAC, 15A or higher.
8. Provide luminaires with individual LED arrays/modules and drivers that are accessible and replaceable from exposed side of the luminaire.

2.3 LED DRIVERS

A. General:

1. Performance: Meet dimming range called out in Luminaire Schedule, free from perceived flicker or visible stroboscopic flicker, smooth and continuous change in level (no visible steps in transitions), natural square law response to control input, and stable when input voltage conditions fluctuate over what is typically experienced in a commercial environment. Demonstration of this compliance to dimming performance will be necessary for substitutions or prior approval.
2. Ten-year expected life while operating at maximum case temperature and 90 percent non-condensing relative humidity.
3. Minimum efficiency of 85 percent, power factor greater than or equal to 0.90, compliance with reduction of hazardous substances (RoHS). Rated for operating temperature range of area in which driver is installed.
4. Limit inrush current to minimize breaker tripping.
 - a. Base specification: NEMA 410 standard for inrush current for electronic drivers.
 - b. Preferred Specification: Meet or exceed 30 milliamp-squared-seconds at 277VAC for up to 50 watts of load and 75 amps at 240 microseconds at 277VAC for 100 watts of load.

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5. Withstand up to a 1,000 volt surge without impairment of performance as defined by ANSI C62.41 Category A.
6. No visible change in light output with a variation of plus/minus 10 percent line voltage input.
7. Total Harmonic Distortion less than 10 percent and meet ANSI C82.11 maximum allowable THD requirements at full output. THD at no point in the dimming curve allows imbalance current to exceed full output THD.
8. Support automatic adaptation, allowing for future luminaire upgrades and enhancements and deliver improved performance:
 - a. Adjustment of forward LED voltage, supporting 3V through 55V.
 - b. Adjustment of LED current from 150mA to 1.4A at the 100 percent control input point in increments of 1mA.
 - c. Adjustment for operating hours to maintain constant lumens (within 5 percent) over the 50,000 hour design life of the system, and deliver up to 20 percent energy savings early in the life cycle.
9. Operate for a (+/- 10 percent) supply voltage of 120V through 277VAC at 60Hz.
10. UL Recognized under the component program and modular for simple field replacement. Drivers that are not UL Recognized or not suited for field replacement will not be considered.
11. Ability to provide no light output when the analog control signal drops below 0.3 V, or the DALI/DMX digital signal calls for light to be extinguished and consume 0.5 watts or less in this standby. Control dead band between 0.3V and 0.65V included to allow for voltage variation of incoming signal without causing noticeable variation in luminaire to luminaire output.

B. Light Quality:

1. Over the entire range of available drive currents, driver to provide step-free, continuous dimming to black from 100 percent to 0.1 percent and 0 percent relative light output, or 100 percent to 1 percent light output and step to 0 percent where indicated. Driver to respond similarly when raising from 0 percent to 100 percent.
 - a. Driver must be capable of 20 bit dimming resolution for white light LED drivers or 15 bit resolution for RGBW LED drivers.
2. Driver must be capable of configuring a linear or logarithmic dimming curve, allowing fine grained resolution at low light levels.

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3. Drivers to track evenly across multiple luminaires at all light levels, and must have an input signal to output light level that allows smooth adjustment over the entire dimming range.
 4. Driver and luminaire electronics to deliver illumination that is free from objectionable flicker as measured by flicker index (ANSI/IES RP-16-10). At all points within the dimming range from 100 percent to 0.1 percent luminaire will have:
 - a. LED dimming driver to provide continuous step-free, flicker free dimming similar to incandescent source.
 - b. Base specification: Based on IEEE PAR1789, minimum output frequency should be greater than 1250 Hz.
 - c. Preferred specification: Flicker index to be equal to incandescent, less than 1 percent at all frequencies below 1000 Hz.
- C. Control Input:
1. Provide control protocol to match lighting control system specified for use with luminaire.
 2. 4-Wire (0-10V DC Voltage Controlled) Dimming Drivers:
 - a. Meet IEC 60929 Annex E for General White Lighting LED drivers.
 - b. Connect to devices compatible with 0 to 10V Analog Control Protocol, Class 2, capable of sinking 0.6 ma per driver at a low end of 0.3V. Limit the number of drivers on each 0-10V control output based on voltage drop and control capacity.
 - c. Meet ESTA E1.3 for RGBW LED drivers.
 3. Digital Multiplex (DMX Low Voltage Controlled) Dimming Drivers:
 - a. Meet DMX/RDM: USITT DMX512A and ANSI E1.20 (Explore & Address).
 - b. Capable of signal interpolation and smoothing of color and intensity transitions.

2.4 LAMPS

- A. Provide lamps for luminaires.
- B. Provide lamp catalogued for specified luminaire type.

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- C. Incandescent Lamps: Not allowed unless noted in Luminaire Schedule.
- D. LED (Light Emitting Diode):
 - 1. LED manufacturer will include, but not be limited to, light source, luminaire, power supply and control interface with added components as needed for complete and functioning system.
 - a. Comply with ANSI chromaticity standard for classifications of color temperature. See Luminaire Schedule for specified LED lamp color and color temperature. UL or ETL listed and labeled.
 - b. Luminaire testing per IESNA LM-79 and LM-80 procedures.
 - c. Lamp life for white LEDs: 50,000 plus hours with lamp failure occurring when LED produces 70 percent of initial rated lumens.
 - d. Lamp life for color LEDs: 30,000 plus hours with lamp failure occurring when LED produces 50 percent of its initial rated lumens.
 - e. LED Drivers: Reverse polarity protection, open circuit protection, require no minimum load. Minimum 80 percent efficiency. Class A noise rating.
 - f. Dimming: LED system capable of full and continuous dimming.
 - g. Correlated Color Temperature (CCT): See Luminaire Schedule for selection of color temperature for each luminaire. Ranges given below reflect maximum allowable tolerances for color temperature range for each nominal CCT.
 - (1) Nominal CCT:
 - (a) 2700 K (2725 ± 145)
 - (b) 3000 K (3045 ± 175)
 - (c) 3500 K (3465 ± 245)
 - (d) 4000 K (3985 ± 275)
 - h. Color Rendering Index (CRI) to be greater than or equal to 80.
 - 2. Special types as indicated in Luminaire Schedule.

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PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Install per manufacturer's written installation instructions and requirements.
- B. Install luminaires securely, in neat and workmanlike manner.
- C. Install luminaires of types indicated where shown and at indicated heights in accordance with manufacturer's written instructions and with recognized industry practices to ensure that luminaires comply with requirements and serve intended purposes.
- D. Wiring:
 - 1. Recessed luminaires to be installed using flexible metallic conduit with luminaire conductors spliced to branch circuit conductors in nearby accessible junction box over ceiling. Junction box fastened to building structural member within 6-feet of luminaire.
 - 2. Luminaires for lift out and removal from ceiling pattern without disconnecting conductors or defacing ceiling materials.
 - 3. Flexible connections where permitted to exposed luminaires; neat and straight, without excess slack, attached to support device.
 - 4. Install junction box, flexible conduit and high temperature insulated conductors for through wiring of recessed luminaires.
- E. Relamp luminaires which have failed lamps at substantial completion.
- F. Replace LED drivers deemed as excessively noisy by Architect, Engineer, or Owner.
- G. Install suspended luminaires and exit signs using pendants supported from swivel hangers. Provide pendant length required to suspend luminaire at indicated height.
- H. Support luminaires larger than 2- by 4-foot size independent of ceiling framing.
- I. Locate recessed ceiling luminaires as indicated on architectural reflected ceiling plan.
- J. Install surface mounted luminaires and exit signs plumb and adjust to align with building lines and with each other. Secure to prevent movement.
- K. Exposed Grid Ceilings:
 - 1. Support surface mounted luminaires in grid ceiling directly from building structure.

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2. Provide auxiliary members spanning ceiling grid members to support surface mounted luminaires.
 3. Fasten surface mounted luminaires to ceiling grid members using bolts, screws, rivets, or suitable clips.
- L. Install recessed luminaires to permit removal from below.
- M. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.
- N. Install clips to secure recessed grid-supported luminaires in place.
- O. Install wall mounted luminaires, emergency lighting units, and exit signs at height as indicated on Architectural Drawings.
- P. Install accessories furnished with each luminaire.
- Q. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.
- R. Bond products and metal accessories to branch circuit equipment grounding conductor.
- S. Install specified lamps in each emergency lighting unit, exit sign, and luminaire.
- T. Where manufactured wiring assemblies are used, ensure that wiring assembly manufacturer sends components to appropriate luminaire manufacturer for respective installation of proper components.
- U. Coordination:
1. Coordination of Conditions: Coordinate ceiling construction, recessing depth and other construction details prior to ordering luminaires for shipment. Refer cases of uncertain applicability to Architect for resolution prior to release of luminaires for shipment. Where luminaires supplied do not match ceiling construction, replace luminaires at no cost to Owner.
 2. Electrical drawings are schematic, identifying quantity and type of luminaires used and their approximate location, but are not to be used for dimensional purposes. Reference architectural drawings for exact locations, including mounting heights.
 3. Provide lighting indicated on drawings with luminaire of the type designated and appropriate for location.
 4. Provide LED luminaires with driver compatible to lighting control system as shown in drawings and as specified.

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5. Where remote drivers are required, ensure adequate accessibility to driver. Upsize conductors between luminaire and driver to accommodate voltage drop.
- V. Field Quality Control:
1. Perform field inspection in accordance with Division 01, General Requirements.
 2. Operate each luminaire after installation and connection. Inspect for proper connection and operation.
- W. Cleaning:
1. Clean electrical parts to remove conductive and deleterious materials.
 2. Remove dirt and debris from enclosures.
 3. Clean paint splatters, dirt, dust, fingerprints, and debris from luminaires.
 4. Clean photometric control surfaces as recommended by manufacturer.
 5. Clean finishes and touch up damaged finishes per by manufacturer's instructions.
- X. Demonstrate luminaire operation for minimum of two hours.

3.2 LUMINAIRES

- A. Install per manufacturer's written installation instructions and requirements.
- B. Align, mount and level luminaires uniformly. Use ball hangers for suspended stem mounted luminaires.
- C. Avoid interference with and provide clearance from equipment. Where indicated locations for luminaires conflict with locations for equipment, change locations for luminaire by minimum distance necessary as directed by Architect.
- D. Suspended Luminaires: Mounting heights indicate clearances between bottom of luminaire and finished floors.
- E. Emergency Egress Luminaires: Provide unswitched emergency circuit to exit signs and emergency luminaires. Where test switch cannot be integral to luminaire, mount remote test switch flush-to-ceiling and adjacent to egress luminaire.
- F. Interior Luminaire Supports:
1. Support Luminaires: Anchor supports to structural slab or to structural members within a partition, or above a suspended ceiling.
 2. Maintain luminaire positions after cleaning and relamping.

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3. Support luminaires without causing ceiling or partition to deflect.
4. Provide mounting supports for recessed and pendant mounted luminaires as required by IBC.

G. Adjusting:

1. Aim and adjust luminaires as indicated.
2. Focus and adjust floodlights, spotlights and other adjustable luminaires, with Architect, at such time of day or night as required.
3. Align luminaires that are not straight and parallel/perpendicular to structure.
4. Position exit sign directional arrows as indicated.

3.3 LED DRIVERS

- A. Install lamps per manufacturer's installation instructions and requirements.
- B. Where driver is remote mounted, size wiring based on type of driver, driver distance from luminaire, and voltage/power level, and manufacturer's installation instructions.
- C. Protect 0-10V input from line voltage mis-connection, and so it will be immune and the output unresponsive to induced AC voltage on the control leads.

END OF SECTION

COMMUNICATIONS BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Work included in 27 00 00, Communications Basic Requirements applies to Division 27, Communications work to provide materials, labor, tools, permits, incidentals, and other services to provide and make ready for Owner's use of communications systems for proposed project.
- B. Contract Documents include, but are not limited to, Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Drawings, Addenda, Owner/Architect Agreement, and Owner/Contractor Agreement. Confirm requirements before commencement of work.
- C. Definitions:
 - 1. Provide: To furnish and install, complete and ready for intended use.
 - 2. Furnish: Supply and deliver to project site, ready for unpacking, assembly and installation.
 - 3. Install: Includes unloading, unpacking, assembling, erecting, installation, applying, finishing, protecting, cleaning and similar operations at project site as required to complete items of work furnished.
 - 4. Approved or Approved Equivalent: To possess the same performance qualities and characteristics and fulfill the utilitarian function without any decrease in quality, durability or longevity. For equipment/products defined by the Contractor as "equivalent," substitution requests must be submitted to Engineer for consideration, in accordance with Division 01, General Requirements, and approved by the Engineer prior to submitting bids for substituted items.
 - 5. Authority Having Jurisdiction (AHJ): Indicates reviewing authorities, including local fire marshal, Owner's insurance underwriter, Owner's Authorized Representative, and other reviewing entity whose approval is required to obtain systems acceptance.
 - 6. Entrance Facility (EF): Area or location that contains entrance point (demarcation) cable and associated equipment for telecommunication services entering the building.
 - 7. Equipment Room (ER): Area or location that contains backbone cabling associated with interbuilding cable or cable that connects buildings together in a campus environment. ERs may contain Main Cross-Connects, Intermediate Cross-Connects, Horizontal Cross-Connects, and Telecommunication Rooms.
 - 8. Main Cross-Connect (MC): Area or location that contains telecommunications equipment for connecting backbone cable to/from Intermediate Cross-Connects and Horizontal Cross-Connects. Active telecommunications equipment will

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often be contained in this area to serve as the telecommunications hub or headend. Backbone cable from Local Exchange Carrier's point of demarcation will connect to building backbone cable or active telecommunications equipment at this location.

9. Intermediate Cross-Connect (IC): Area or location that contains telecommunications equipment for connecting backbone cable from the MC to backbone cable distributing to one or many Horizontal Cross-Connects. This location may contain active telecommunications equipment.
10. Horizontal Cross-Connect (HC): Area or location that contains telecommunications equipment, cable terminations and cross-connect wiring. HC is the recognized connection point between backbone and horizontal pathway facilities.
11. Telecommunications Room (TR): Area or location containing telecommunications equipment, cable terminations and cross-connect wiring. Three applications serviced by TRs are horizontal cable connections, backbone system interconnection and entrance facilities. The TR provides facilities (space, power, grounding, etc.) for housing telecommunications equipment. TR may contain a MC, IC or HC and a demarcation point or an interbuilding entrance facility.
12. Interbuilding Cable: Backbone cable associated with connecting buildings together in a multibuilding or campus environment.
13. Intrabuilding Cable: Backbone cable associated with connecting Entrance Facility, Equipment Rooms, Main Cross-Connects, Intermediate Cross-Connects, Horizontal Cross-Connects, and Telecommunication Rooms together on single floor or multifloor building.

1.2 RELATED SECTIONS

- A. Contents of Section applies to Division 27, Communications Contract Documents.
- B. Related Work:
 1. Additional conditions apply to this Division including, but not limited to:
 - a. Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements.
 - b. Drawings
 - c. Addenda
 - d. Owner/Architect Agreement
 - e. Owner/Contractor Agreement

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- f. Codes, Standards, Public Ordinances and Permits
 - C. Related Products/Systems within Division 28, Electronic Safety and Security:
 - 1. Section 28 10 00, Access Control and Intrusion Detection
 - 2. Section 28 23 00, Video Surveillance
- 1.3 REFERENCES AND STANDARDS
 - A. References and Standards per Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, individual Division 27, Communications Sections and those listed in this Section.
 - B. Codes to include latest adopted editions, including current amendments, supplements and local jurisdiction requirements in effect as of the date of the Contract Documents, of/from:
 - 1. State of Oregon:
 - a. OAR - Oregon Administrative Rules
 - b. OESC - Oregon Electrical Specialty Code
 - c. OFC - Oregon Fire Code
 - d. OMSC - Oregon Mechanical Specialty Code
 - e. OPSC - Oregon Plumbing Specialty Code
 - f. OSSC - Oregon Structural Specialty Code
 - g. OEESC - Oregon Energy Efficiency Specialty Code
 - h. Oregon Elevator Specialty Code
 - C. Reference standards and guidelines include but are not limited to the latest adopted editions from:
 - 1. ABA - Architectural Barriers Act
 - 2. ADA - Americans with Disabilities Act
 - 3. ANSI - American National Standards Institute
 - a. ANSI/TIA-568-C.0 - Generic Telecommunications Cabling for Customer Premises

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- b. ANSI/TIA-568-C.1 - Commercial Building Telecommunications Cabling Standard
 - c. ANSI/TIA-568-C.2 - Balanced Twisted-Pair Telecommunications Cabling and Components Standard
 - d. ANSI/TIA-568-C.3 - Optical Fiber Cabling Components Standard. Commercial Building Telecommunicating Cabling Standard
 - e. ANSI/TIA-569-B - Commercial Building Standard for Telecommunications Pathways and Spaces
 - f. ANSI/TIA-570-B - Residential Telecommunications Infrastructure
 - g. ANSI/TIA-942 - Telecommunications Infrastructure Standard for Data Centers
 - h. ANSI/TIA/EIA-606-A - Administration Standard for Commercial Telecommunications Infrastructure
 - i. ANSI-J-STD-607-A - Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
- 4. APWA - American Public Works Association
 - 5. ASCE - American Society of Civil Engineers
 - 6. ASHRAE Guideline 0, the Commissioning Process
 - 7. ASTM - ASTM International
 - 8. BICSI - Building Industry Consulting Service International
 - a. BICSI TDMM - Telecommunications Distribution Methods Manual
 - b. BICSI ESSDRM - Electronic Safety & Security Design Reference Manual
 - c. BICSI AVDRM - AV Design Reference Manual
 - 9. CFR - Code of Federal Regulations
 - 10. EIA - Electronic Industries Association
 - 11. EPA - Environmental Protection Agency
 - 12. ETL - Electrical Testing Laboratories
 - 13. FCC - Federal Communications Division

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14. FM - FM Global
 15. IBC - International Building Code
 16. IEC - International Electrotechnical Commission
 17. IEEE - Institute of Electrical and Electronics Engineers
 18. ISO - International Organization for Standardization
 19. MSS - Manufacturers Standardization Society
 20. NEC - National Electric Code
 21. NEMA - National Electrical Manufacturers Association
 22. OSHA - Occupational Safety and Health Administration
 23. TIA - Telecommunications Industry Association
 24. UL - Underwriters Laboratories Inc.
- D. See Division 27, Communications individual Sections for additional references.
- E. Where code requirements are at variance with Contract Documents, meet code requirements as a minimum requirement and include costs necessary to meet these in Contract. Machinery and equipment are to comply with OSHA requirements, as currently revised and interpreted for equipment manufacturer requirements. Install equipment provided per manufacturer recommendations.
- F. Whenever this Specification calls for material, workmanship, arrangement or construction of higher quality and/or capacity than that required by governing codes, higher quality and/or capacity take precedence.

1.4 SUBMITTALS

- A. See Division 01, General Requirements for Submittal Procedures.
- B. Provide drawings in format and software release equal to the design documents. Drawings to be the same sheet size and scale as the Contract Documents.
- C. In addition:
1. "No Exception Taken" constitutes that review is for general conformance with the design concept expressed in the Contract Documents for the limited purpose of checking for conformance with information given. Any action is subject to the requirements of the Contract Documents. Contractor is responsible for the dimensions and quantity and will confirm and correlate at the job site,

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fabrication processes and techniques of construction, coordination of the work with that of all other trades, and the satisfactory performance of the work.

2. Provide product submittals and shop drawings in electronic format only. Electronic format must be submitted via zip file via e-mail. For electronic format, provide one zip file per specification division containing a separate file for each Specification Section. Individual submittals sent piecemeal in a per Specification Section method will be returned without review or comment. Copy Architect on all transmissions/submissions.
3. Product Data: Provide manufacturer's descriptive literature for products specified in Division 27, Communications Sections.
4. Identify/mark each submittal in detail. Note what differences, if any, exist between the submitted item and the specified item. Failure to identify the differences will be considered cause for disapproval. If differences are not identified and/or not discovered during the submittal review process, Contractor remains responsible for providing equipment and materials that meet the specifications and Drawings.
 - a. Label submittal to match numbering/references as shown in Contract Documents. Highlight and label applicable information to individual equipment or cross out/remove extraneous data not applicable to submitted model. Clearly note options and accessories to be provided, including field installed items. Highlight connections by/to other trades.
 - b. Include technical data, installation instructions and dimensioned drawings for products, fixtures, equipment and devices installed, furnished or provided. Reference individual Division 27, Communications specification Sections for specific items required in product data submittal outside of these requirements.
 - c. See Division 27, Communications individual Sections for additional submittal requirements outside of these requirements.
5. Maximum of two reviews of complete submittal package. Arrange for additional reviews and/or early review of long-lead items; Bear costs of additional reviews at Engineer's hourly rates. Incomplete submittal packages/submittals will be returned to contractor without review.
6. Resubmission Requirements: Make corrections or changes in submittals as required, and in consideration of Engineer's comments. Identify Engineer's comments and provide an individual response to each of the Engineer's comments. Cloud changes in the submittals and further identify changes which are in response to Engineer's comments.
7. Structural/Seismic: Provide weights, dimensions, mounting requirements and like information required for mounting, seismic bracing, and support. Indicate manufacturer's installation and support requirements to meet ASCE 7-10

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requirements for non-structural components. Provide engineered seismic drawings and equipment seismic certification. Equipment Importance Factor as specified in Division 01 and in Structural documents.

8. Trade Coordination: Include physical characteristics, electrical characteristics, device layout plans, wiring diagrams, and connections as required per Division 27, Communications Coordination Documents. For equipment with electrical connections, furnish copy of approved submittal for inclusion in Division 26, Electrical submittals.
9. Make provisions for openings in building for admittance of equipment prior to start of construction or ordering of equipment.
10. Substitutions and Variation from Basis of Design:
 - a. The Basis of Design designated product establishes the qualities and characteristics for the evaluation of any comparable products by other listed acceptable manufacturers if included in this Specification or included in an approved Substitution Request as judged by the Design Professional.
 - b. If substitutions and/or equivalent equipment/products are being proposed, it is the responsibility of parties concerned, involved in, and furnishing the substitute and/or equivalent equipment to verify and compare the characteristics and requirements of that furnished to that specified and/or shown. If greater capacity and/or more materials and/or more labor is required for the rough-in, circuitry or connections than for the item specified and provided for, then provide compensation for additional charges required for the proper rough-in, circuitry and connections for the equipment being furnished. No additional charges above the Base Bid, including resulting charges for work performed under other Divisions, will be allowed for such revisions. Coordinate with the requirements of "Submittals." For any product marked "or approved equivalent," a substitution request must be submitted to Engineer for approval prior to purchase, delivery or installation.
11. Shop Drawings:
 - a. Provide coordinated Shop Drawings which include physical characteristics of all systems, device layout plans, and control wiring diagrams. Reference individual Division 27, Communications specification Sections for additional requirements for Shop Drawings outside of these requirements.
 - b. Provide Shop Drawings indicating access panel locations, size and elevation for approval prior to installation.
12. Samples: Provide samples when requested by individual Sections.

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13. Resubmission Requirements:

- a. Make any corrections or change in submittals when required. Provide submittals as specified. The engineer will not be required to edit and/or interpret the Contractor's submittals. Changes made for the resubmittal will be indicated in a cover letter with reference to page(s) changed and will reference response to comment. Indicate changes for the resubmittal in a cover letter with reference to page(s) changed and reference response to comment. Cloud changes in the submittals.
- b. Resubmit for review until review indicates no exception taken, or "make corrections as noted."
- c. When submitting Drawings for Engineers re-review, clearly indicate changes on Drawings and "cloud" any revisions. Submit a list describing each change.

14. Operation and Maintenance Manuals, Owner's Instructions:

- a. Submit, at one time, electronic files (PDF format) on CD/DVD of manufacturer's operation and maintenance instruction manuals and parts lists for equipment or items requiring servicing. Submit data when work is substantially complete and in same order format as submittals. Include name and location of source parts and service for each piece of equipment.
 - (1) Include copy of approved submittal data along with submittal review letters received from Engineer. Data to clearly indicate installed equipment model numbers. Delete or cross out data pertaining to other equipment not specific to this project.
 - (2) Include copy of manufacturer's standard Operations and Maintenance for equipment. At front of each tab, provide routine maintenance documentation for scheduled equipment. Include manufacturer's recommended maintenance schedule and highlight maintenance required to maintain warranty. Furnish list of routine maintenance parts, including part numbers, sizes, quantities, relevant to each piece of equipment: batteries, lamp lenses, speakers and filters.
 - (3) Include Warranty per Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 27 00 00, Communications Basic Requirements and individual Sections.
 - (4) Include product certificates of warranties and guarantees.

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- (5) Include copy of complete parts list for equipment. Include available exploded views of assemblies and subassemblies.
 - (6) Include copy of burn-in and test reports specific to each piece of equipment.
 - (7) Include copy of software/appliance programming.
 - (8) Include commissioning reports.
 - (9) Engineer will return incomplete documentation without review. Engineer will provide one set of review comments in Submittal Review format. Contractor must arrange for additional reviews; Contractor to bear costs for additional reviews at Engineer's hourly rates.
 - b. Thoroughly instruct Owner in proper operation of equipment and systems. Where noted in individual Sections, training will include classroom instruction with applicable training aids and systems demonstrations. Submit copy of material used for Owner instruction. Field instruction per Section 27 00 00, Communications Basic Requirements Article titled "Demonstration."
 - c. Copies of certificates of code authority inspections, acceptance, code required acceptance tests, and other special guarantees, certificates of warranties, specified elsewhere or indicated on Drawings.
15. Record Drawings:
- a. Maintain at site at least one set of drawings for recording "as-constructed" conditions. Indicate on Drawings changes to original documents by referencing revision document, and include buried elements, location of conduit, and location of concealed communication items. Include items changed by field orders, supplemental instructions, and constructed conditions.
 - b. Record Drawings are to include equipment and fixture/connection schedules that accurately reflect "as constructed or installed" for project.
 - c. At completion of project, input changes to original project on CAD Drawings and make one set of black-line Drawings created from CAD Files in version/release equal to Contract Drawings. Submit CAD disk and Drawings upon substantial completion.
 - d. Invert elevations and dimensioned locations for incoming utilities and site raceways below grade extending to 5-feet outside building line.

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- e. See Division 27, Communications individual Sections for additional items to include in Record Drawings.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements: Work and materials installed to conform with all local, state, federal and other applicable laws and regulation.
- B. Drawings are intended to be diagrammatic and reflect the Basis of Design manufacturer's equipment. They are not intended to show every item in its exact dimensions, or details of equipment or proposed systems layout. Verify actual dimensions of systems (i.e., conduit) and equipment proposed to assure that systems and equipment will fit in available space. Contractor is responsible for design and construction costs incurred for equipment other than Basis of Design, including, but not limited to, architectural, structural, electrical, HVAC, fire sprinkler, and plumbing systems.
- C. Manufacturer's Instructions: Follow manufacturer's written instructions. If in conflict with Contract Documents, obtain clarification. Notify Engineer/Architect, in writing, before starting work.
- D. Items shown on Drawings are not necessarily included in Specifications or vice versa. Confirm requirements in all Contract Documents.
- E. Provide products that are UL listed.
- F. Contractor Qualifications:
 - 1. Minimum of five years experience in the design, installation, testing and maintenance of communications systems.
 - 2. Must employ at least one full time BICSI certified Registered Communications Distribution Designer (RCDD) who is involved in reviewing work performed by contractor on this project.
 - 3. Maintain a local service facility which stocks spare devices and/or components for servicing systems.
 - 4. Have performed successful installation and maintenance of at least three projects similar in scope and size. Be able to provide project references for these three projects, including scope of Work, project type, Owner/user contact name and telephone number.
 - 5. The contractor selected for this project must be certified by the manufacturer of the approved products and utilize these components for completion of work.

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1.6 WARRANTY

- A. Provide written warranty covering the work for a period of one year from date of Substantial Completion in accordance with Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 27 00 00, Communications Basic Requirements and individual Division 27, Communications Sections.
- B. Sections under this Division can require additional and/or extended warranties that apply beyond basic warranty under Division 01, General Requirements and the General Conditions. Confirm requirements in all Contract Documents.

1.7 COORDINATION DOCUMENTS

- A. Prior to construction, coordinate installation and location of HVAC equipment, ductwork, grilles, diffusers, piping, plumbing equipment/fixtures, fire sprinklers, plumbing, lights, cable trays and electrical services with architectural and structural requirements, and other trades (including ceiling suspension and tile systems), and provide maintenance access requirements. Coordinate with submitted architectural systems (i.e. roofing, ceiling, finishes) and structural systems as submitted, including footings and foundation. Identify zone of influence from footings and ensure systems are not routed within the zone of influence.
- B. Advise Architect in event a conflict occurs in location or connection of equipment. Bear costs resulting from failure to properly coordinate installation or failure to advise Architect of conflict.
- C. Verify in field exact size, location, invert, and clearances regarding existing material, equipment and apparatus, and advise Architect of discrepancies between that indicated on Drawings and that existing in field prior to installation related thereto.
- D. Submit final Coordination Drawings with changes as Record Drawings at completion of project.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Provide like items from one manufacturer, including but not limited to jacks, patch panels, equipment connection cords and wall plates.

2.2 MATERIALS

- A. Base contract upon furnishing materials as specified. Materials, equipment, and fixtures used for construction are to be new, latest products as listed in manufacturer's printed catalog data and are to be UL approved or have adequate approval or be acceptable by State, County, and City authorities. Equipment/fixture supplier is responsible for

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obtaining state, county, and city acceptance on equipment/fixture not UL approved or not listed for installation.

- B. Articles, fixtures, and equipment of a kind to be standard product of one manufacturer.
- C. Names and manufacturer's names denote character and quality of equipment desired and are not to be construed as limiting competition.
- D. Hazardous Materials:
 - 1. Comply with local, State of Oregon, and Federal regulations relating to hazardous materials.
 - 2. Comply with Division 00, Procurement and Contracting Requirements and Division 01, General Requirements for this project relating to hazardous materials.
 - 3. Do not use any materials containing a hazardous substance. If hazardous materials are encountered, do not disturb; immediately notify Owner and Architect. Hazardous materials will be removed by Owner under separate contract.

PART 3 - EXECUTION

3.1 ACCESSIBILITY AND INSTALLATION

- A. Confirm Accessibility and Installation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 27 00 00, Communications Basic Requirements and individual Division 27, Communications Sections.
- B. Install equipment requiring access (i.e., amplifiers, taps, zone controllers, volume controls, and storage devices) so that they may be serviced, reset, replaced or recalibrated by service people with normal service tools and equipment. Do not install equipment in obvious passageways, doorways, scuttles or crawlspaces which would impede or block intended usage.
- C. Install equipment and products complete as directed by manufacturer's installation instructions. Obtain installation instructions from manufacturer prior to rough-in of equipment and examine instructions thoroughly. When requirements of installation instructions conflict with Contract Documents, request clarification from Architect prior to proceeding with installation. This includes proper installation methods, sequencing and coordination with other trades and disciplines.
- D. Firestopping:

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1. Confirm Firestopping requirements in Division 07, Thermal and Moisture Protection. In absence of specific requirements, comply with individual Division 27, Communications Sections and the following:
 - a. Coordinate location and protection level of fire and/or smoke rated walls, ceilings, and floors. When these assemblies are penetrated, seal around piping, ductwork and equipment with approved firestopping material. Install firestopping material complete as directed by manufacturer's installation instructions. Meet requirements of ASTM E814, Standard Test Method for Fire Tests of Through-Penetration Fire Stops.
- E. Plenums: In plenums, provide plenum rated materials that meet the requirements to be installed in plenums. Immediately notify Architect/Engineer of discrepancy.

3.2 SEISMIC CONTROL

- A. Confirm Seismic Control requirements in Division 01, General Requirements, Structural documents, and individual Division 27 Communications Sections.
- B. General:
 1. Earthquake resistant designs for Communications (Division 27) equipment and distribution, i.e. cabinets and racks, ceiling assemblies, raceways, ladder racking, etc. to conform to regulations of jurisdiction having authority.
 2. Restraints which are used to prevent disruption of function of piece of equipment because of application of horizontal force to be such that forces are carried to frame of structure in such a way that frame will not be deflected when apparatus is attached to a mounting base and equipment pad, or to structure in normal way, utilizing attachments provided. Secure equipment and distribution systems to withstand a force in direction equal to value defined by jurisdiction having authority.
 3. Provide stamped Shop Drawings from licensed Structural Engineer of seismic bracing and seismic movement assemblies for cabinets, racks, major equipment and overhead raceways. Engineer to design and provide stamped Shop Drawings cabinets, racks, major equipment and overhead raceway. Submit Shop Drawings along with equipment submittals.
 4. Provide stamped Shop Drawings from licensed Structural Engineer of seismic flexible joints for piping and crossing building expansion or seismic joints. Submit Shop Drawings along with seismic bracing details.
 5. Provide means to prohibit excessive motion of communications equipment during earthquake.

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3.3 REVIEW AND OBSERVATION

- A. Confirm Review and Observation requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 27 00 00, Communications Basic Requirements and individual Division 27, Communications Sections.
- B. Notify Architect, in writing, at following stages of construction so that they may, at their option, visit site for review and construction observation:
 - 1. Underground conduit installation prior to backfilling.
 - 2. Prior to ceiling cover/installation.
 - 3. When main systems, or portions of, are being tested and ready for inspection by AHJ.
- C. Final Punch: Costs incurred by additional trips required due to incomplete systems will be the responsibility of the Contractor.

3.4 CONTINUITY OF SERVICE

- A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Division 27, Communications Sections and the following:
 - 1. During remodeling or addition to existing structures, or addition of a structure to existing structure, while existing structure is occupied, current services to remain intact until new construction, facilities or equipment is installed.
 - 2. Prior to changing over to new service, verify that every item is thoroughly prepared. Install new wiring to point of connection.
 - 3. Coordinate transfer time to new service with Owner. If required, perform transfer during off peak hours. Once changeover is started, pursue to its completion to keep interference to a minimum. If overtime is necessary, there will be no allowance made by Owner for extra expense for such overtime or shift work.
 - 4. Organize work to minimize duration of power interruption.

3.5 CUTTING AND PATCHING

- A. Confirm Cutting and Patching Requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Division 27, Communications Sections and the following:

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1. Proposed floor cutting/core drilling/sleeve locations to be approved by Project Structural Engineer. Submit proposed locations to Architect/Project Structural Engineer. Where slabs are of post tension construction, perform x-ray scan of proposed penetration locations and submit scan results including proposed penetration locations to Project Structural Engineer/Architect for approval. Where slabs are of waffle type construction, show column cap extent and cell locations relative to proposed penetration(s).
2. Cutting, patching and repairing for work specified in this Division including plastering, masonry work, concrete work, carpentry work, and painting included under this Section will be performed by skilled craftsmen of each respective trade in conformance with appropriate Division of Work.
3. Additional openings required in building construction to be made by drilling or cutting. Use of jack hammer is specifically prohibited. Patch openings in and through concrete and masonry with grout.
4. Restore new or existing work that is cut and/or damaged to original condition. Patch and repair specifically where existing items have been removed. This includes repairing and painting walls, ceilings, etc. where existing conduit and devices are removed as part of this project. Where alterations disturb lawns, paving, and walks, surfaces to be repaired, refinished and left in condition matching existing prior to commencement of work.
5. Additional work required by lack of proper coordination will be provided at no additional cost to the Owner.

3.6 EQUIPMENT SELECTION AND SERVICEABILITY

- A. Replace or reposition equipment which is too large or located incorrectly to permit servicing, at no additional cost to Owner.

3.7 DELIVERY, STORAGE AND HANDLING

- A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Division 27, Communications Sections and the following:
 1. Handle materials delivered to project site with care to avoid damage. Store materials on site inside building or protected from weather, dirt and construction dust. Insulation and lining that becomes wet from improper storage and handling to be replaced before installation. Products and/or materials that become damaged due to water, dirt and/or dust as a result of improper storage to be replaced before installation.
 2. Protect all equipment and conduit to avoid damage. Close conduit openings with caps or plugs. Keep motors and bearings in watertight and dustproof covers during entire course of installation.

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3.8 DEMONSTRATION

- A. Confirm Demonstration requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 27 00 00, Communications Basic Requirements and individual Division 27, Communications Sections.
- B. Upon completion of work and adjustment of equipment and test systems, demonstrate to Owner's Authorized Representative, Architect and Engineer that equipment furnished and installed or connected under provisions of these Specifications functions in manner required. Provide field instruction to Owner's Maintenance Staff as specified in Division 01, General Requirements, Section 27 00 00, Communications Basic Requirements and individual Division 27, Communications Sections.
- C. Manufacturer's Field Services: Furnish services of a qualified person at time approved by Owner, to instruct maintenance personnel, correct defects or deficiencies, and demonstrate to satisfaction of Owner that entire system is operating in satisfactory manner and complies with requirements of other trades that may be required to complete work. Complete instruction and demonstration prior to final job site observations.

3.9 CLEANING

- A. Confirm Cleaning requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 27 00 00, Communications Basic Requirements and individual Division 27, Communications Sections.
- B. Upon completion of installation, thoroughly clean exposed portions of equipment, removing temporary labels and traces of foreign substances. Throughout work, remove construction debris and surplus materials accumulated during work.

3.10 INSTALLATION

- A. Confirm Installation requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 27 00 00, Communications Basic Requirements and individual Division 27, Communications Sections.
- B. Install equipment and devices in accordance with manufacturer's installation instructions, plumb and level and firmly secured to mounting surfaces. Maintain manufacturer's recommended clearances.
- C. Start up equipment, in accordance with manufacturer's start-up instructions, and in presence of manufacturer's representative. Test operation and demonstrate compliance with requirements. Replace damaged or malfunctioning equipment.
- D. Provide miscellaneous supports/metals required for installation of equipment.

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3.11 PAINTING

- A. Confirm Painting requirements in Division 01, General Requirements and Division 09, Finishes. In absence of specific requirements, comply with individual Division 27, Communications Sections and the following:
1. Ferrous Metal: After completion of communications work, thoroughly clean and paint exposed supports constructed of ferrous metal surfaces in telecommunications rooms, i.e., hangers, hanger rods, equipment stands, with one coat of black asphalt varnish for exterior or black enamel for interior, suitable for hot surfaces.
 2. In a telecommunications room, on roof or other exposed areas, equipment not painted with enamel to receive two coats of primer and one coat of rustproof enamel, colors as selected by Architect.
 3. See individual equipment Specifications for other painting.
 4. Structural Steel: Repair damage to structural steel finishes or finishes of other materials damaged by cutting, welding or patching to match original.
 5. Conduit: Clean, primer coat and paint interior conduit exposed in finished areas with two coats paint suitable for metallic surfaces. Color selected by Architect.
 6. Covers: Covers such as manholes, vaults and the like will be furnished with finishes which resist corrosion and rust.

3.12 DEMOLITION

- A. Confirm requirements in Division 01, General Requirements and Division 02, Existing Conditions. In absence of specific requirements, comply with individual Division 27, Communications Sections and the following:
1. Scope:
 - a. It is the intent of these documents to provide necessary information and adjustments to communications systems required to meet code and accommodate installation of new work.
 - b. Coordinate with Owner so that work can be scheduled not to interrupt operations, normal activities, building access or access to different areas.
 - c. Existing Conditions: Determine exact location of existing utilities and equipment before commencing work. Compensate Owner for damages caused by failure to exactly locate and preserve underground utilities. Replace damaged items with new material to match existing. Promptly notify Owner if utilities are found which are not shown on Drawings.

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2. Equipment: Unless otherwise directed, equipment, fixtures, or fittings being removed as part of demolition process are Owner's property. Remove other items not scheduled to be reused or relocated from job site as directed by Owner.
3. Unless specifically indicated on Drawings, remove exposed, unused raceways behind finished surfaces (floor, walls, ceilings, etc.). Cap raceways and patch surfaces to match surrounding finish.
4. Unless specifically indicated on Drawings, remove unused equipment, electrical boxes, fittings and connectors. Removal is to be to a point behind finished surfaces (floors, walls, and ceilings).
5. Examination:
 - a. Determine exact location of existing utilities and equipment before commencing work, compensate Owner for damages caused by failure to locate and preserve utilities. Replace damaged items with new material to match existing.
 - b. Verify that abandoned wiring and equipment serve only abandoned facilities.
 - c. Demolition Drawings are based on casual field observation and existing record documents.
 - (1) Verify accuracy of information shown prior to bidding and provide such labor and material as is necessary to accomplish work.
 - (2) Verify location and number of communications outlets, racks, panels, etc. in field.
 - d. Report discrepancies to Architect before disturbing existing installation.
6. Promptly notify Owner if utilities are found which are not shown on Drawings.
7. Execution:
 - a. Remove existing connectors, backboxes, wall plates and other communications equipment and devices and associated wiring from walls, ceilings, floors, and other surfaces scheduled for remodeling, relocation, or demolition unless shown as retained or relocated on Drawings.
 - b. Provide temporary wiring and connections to maintain communications continuity of existing systems during construction. Remove or relocate communications boxes, conduit, wiring, equipment, and the like, as

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encountered in removed or remodeled areas in existing construction affected by this work.

- c. Remove and restore cable which serves usable existing outlets clear of construction or demolition.
- d. If existing junction boxes will be made inaccessible, or if abandoned outlets serve as feed through boxes for other existing communications equipment which is being retained, provide new conduit and cable to bypass abandoned outlets.
- e. If existing conduits pass through partitions or ceiling which are being removed or remodeled, provide new conduit and cable to reroute clear of construction or demolition and maintain service to existing equipment. If these are conduits which require a new cable home run, e.g. telecom cable, request clarification from Architect or Engineer prior to proceeding with demo.
- f. Extend cable slack and devices in existing walls to be furred out.
- g. Remove abandoned cable to originating telecom room.
- h. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.
- i. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets which are not removed.
- j. Disconnect and remove abandoned panelboards and distribution equipment.
- k. Maintain access to existing communications installations which remain active. Modify installation or provide access panel as appropriate.
- l. Existing communications outlets and devices are indicated on technology demolition plans. Verify exact location and number of existing communications outlets and devices in field. Only partial existing communications shown. Locations of items shown on Drawings as existing are partially based on Record and other Drawings which may contain errors. Verify accuracy of information shown prior to bidding and provide such labor and material as is necessary to accomplish intent of Contract Documents.
- m. Remove abandoned cable to leave site clean.

COMMUNICATIONS BASIC REQUIREMENTS

- B. Existing Communication Systems: Maintain existing systems in service until new system is complete and ready for service. Disable system only to make switchovers and connections.
 - 1. Notify Owner at least _____ working days before partially or completely disabling system.
 - 2. Make temporary connections to maintain service in areas adjacent to work area.

3.13 ACCEPTANCE

- A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In absence of specific requirements, comply with individual Division 27, Communications Sections and the following:
 - 1. System cannot be considered for acceptance until work is completed and demonstrated to Architect that installation is in strict compliance with Specifications, Drawings and manufacturer's installation instructions, particularly in reference to following:
 - a. Testing Reports
 - b. Cleaning
 - c. Operation and Maintenance Manuals
 - d. Training of Operating Personnel
 - e. Record Drawings
 - f. Warranty and Guaranty Certificates, including extended manufacturer's warranties.
 - g. Start-up/test Documents and Commissioning Reports

3.14 FIELD QUALITY CONTROL

- A. Confirm Field Quality Control requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 27 00 00, Communications Basic Requirements and individual Division 27, Communications Sections.
- B. Tests:
 - 1. Conduct tests of equipment and systems to demonstrate compliance with requirements specified. Reference individual Specification Sections for required tests. Document tests and include in Operation and Maintenance Manuals.

COMMUNICATIONS BASIC REQUIREMENTS

2. During site evaluations by Architect or Engineer, provide appropriate personnel with tools to remove and replace trims, covers, and devices so that proper evaluation of installation can be performed.

END OF SECTION

PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included:
 - 1. Raceway
 - 2. Rigid Metal Conduit and Fittings
 - 3. Electrical Metallic Tubing and Fittings
 - 4. Conduit Accessories
 - 5. Penetration Sealing Systems
 - 6. Telecommunications Outlet Boxes
 - 7. Pull Boxes
- B. This Section specifies the requirements to provide communications conduit raceways, boxes, cable trays, innerduct and fittings.
- C. Scope of Work: provide continuous sleeving from telecom outlet location to nearest upstream IT room. Assume 290-foot distance from each outlet to IT room for purposes of bidding.

1.2 RELATED SECTIONS

- A. Contents of Division 27, Communications and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

- A. Submittals as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.
- B. Provide plan drawings showing completions and as-built corrections which indicate type, size, placement, routing and/or length for raceway and cable tray components; e.g., manholes, handholes, conduit, boxes, enclosures, etc.

PATHWAYS FOR COMMUNICATIONS SYSTEMS

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

1.7 DEFINITIONS

- A. Cabinet: A freestanding floor-mounted modular enclosure designed to house and protect rack-mounted electronic equipment.
- B. Conduit: Round raceway.
- C. Conduit Body: Separate portion of a conduit or tubing system that provides access through removable cover(s) to the interior of the system at a junction of two or more sections of the system or at a terminal point of the system.
- D. Pull Box Enclosure: Box with a cover installed in one or more runs of raceway to facilitate pulling conductors through the raceway system. There are no openings in the cover.
- E. Raceway: Enclosed channel designed expressly for holding wires or cables. Metal or insulating material and the term includes conduit, tubing, wireways, underfloor raceways and surface raceways; does not include cable tray.
- F. Surface Raceway: Surface-mounted metal channel or plastic duct with snap-in removable covers for housing and protecting electrical wires and cables. Raceway and fittings are designed so sections can be electrically and mechanically coupled together without subjecting cables to abrasion.
- G. Wire Basket Runway Systems: Includes, but are not limited to straight sections of type wire basket runway cable trays, bends, tees, elbows, drop-outs, supports and accessories.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Raceway:
 - 1. Koppers Bitumastic
 - 2. Scotchwrap

PATHWAYS FOR COMMUNICATIONS SYSTEMS

3. Or approved equivalent.
- B. Rigid Metal Conduit and Fittings:
 1. Sealing Fittings:
 - a. Crouse-Hinds
 - b. Or approved equivalent.
- C. Electrical Metallic Tubing and Fittings:
 1. Allied Tube and Conduit
 2. Wheatland Tube
 3. Appleton
 4. Or approved equivalent.
- D. Conduit Accessories:
 1. Duct Spacers:
 - a. Carlon
 - b. Allied Tube and Conduit
 - c. Or approved equivalent.
 2. Expansion/Deflection Fittings:
 - a. Appleton
 - b. Emerson
 - c. Or approved equivalent.
 3. Pulltape:
 - a. George-Ingraham
 - b. Greenlee
 - c. Or approved equivalent.
 4. Duct Plugs:
 - a. Carlon

PATHWAYS FOR COMMUNICATIONS SYSTEMS

- b. Vikimatic
 - c. Or approved equivalent.
- E. Penetration Sealing Systems:
 - 1. SEMCO
 - 2. Or approved equivalent.
- F. Telecommunications Outlet Boxes:
 - 1. Raco
 - 2. Or approved equivalent.
- G. Pull Boxes:
 - 1. Hoffman
 - 2. Oldcastle (concrete)
 - 3. Or approved equivalent.

2.2 RACEWAYS

- A. Raceways: Labeled and/or listed as acceptable to the AHJ as suitable for the use intended.
- B. Table 1: Product Identification:

Product Designation	Product Type
RGS	Rigid Galvanized Steel
CRS	PVC Externally Coated RGS
EMT	Galvanized Steel Tubing
PVC	Polyvinylchloride Conduit
LMC	Liquidtight Metal Conduit
LNC	Liquidtight Nonmetal Conduit

- C. The product identification codes used for the Communications Raceways and Boxes in Part 2, Products, are summarized in Table 1.
- D. Bitumastic material or plastic tape.

PATHWAYS FOR COMMUNICATIONS SYSTEMS

2.3 RIGID METAL CONDUIT AND FITTINGS

- A. Conduit:
 - 1. Type RGS: Rigid galvanized steel.
 - 2. Type CRS: PVC externally coated conduit; rigid steel conduit with external PVC coating and internal galvanized surface.
- B. Fittings and Conduit Bodies: In-line straight-through, threaded, galvanized steel fittings and Type C conduit bodies only; do not use bends or tees, e.g., Lbs.
 - 1. Bonding and Grounding Locknuts and Wedges: Malleable iron with set screws and lug screws.
 - 2. Insulated Bushing: Malleable iron with integral insulated throat, rated for 150C.
 - 3. Bonding and Grounding Bushing: Malleable iron with integral insulated throat, rated for 150C, with solderless lugs or lug screws.
 - 4. Sealing Fittings: Threaded type conduit seal fittings and sealing compound suitable for hazardous location installations in accordance with OESC:
 - a. Crouse-Hind retrofit sealing fitting EYSR.
 - b. Crouse-Hind CHICO A sealing compound.

2.4 ELECTRICAL METALLIC TUBING AND FITTINGS

- A. Type EMT: Electrogalvanized steel tubing.
- B. Fittings and Conduit Bodies:
 - 1. In-line straight-through steel or malleable iron fittings and Type C conduit bodies only; do not use bends or tees, e.g. Lbs.
 - 2. Wet Areas: Steel compression-type couplings and nipples.
 - 3. Dry Areas: Set screw-type couplings and nipples.
 - 4. Bonding Locknuts:
 - a. Malleable iron with set screws and lug screws.
 - b. Insulated Bushing: Malleable iron with integral insulated throat, rated for 150C.

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- c. Bonding and Grounding Bushing: Malleable iron with integral insulated throat, rated for 150C, with solderless lugs or lug screws.

2.5 CONDUIT ACCESSORIES

A. Duct Spacers:

- 1. Nonmetallic base and intermediate duct spacers with locking keyways designed specifically for use with nonmetallic conduit; e.g., Carlon SNAP-LOC duct spacers for 4-inch diameter conduit with 1-1/2-inch separation.
- 2. Base Spacer: S288NHN.
- 3. Intermediate Spacer: S289NHN.

B. Expansion/Deflection Fittings: Similar to Crouse-Hinds XD expansion/deflection coupling or Appleton DF Series deflection and expansion coupling.

C. Pulltape: Measuring and pulling tape constructed of synthetic fiber with plastic jacket, printed with accurate sequential footage marks; e.g., George-Ingraham 1/2-inch tape 9216-JK.

D. Duct Plugs:

- 1. Aboveground Conduit Openings: Tapered PVC plugs with tab for pulltape; e.g., Carlon 4-inch PVC plugs with pull tab, P258NT.
- 2. Underground or Underslab Conduit Openings: Removable screwtight compression type duct plugs with wing-nut and corrosion resistant hardware; e.g., Vikimatic 4-inch, Part Number 40D402U. Use appropriate part number according to duct size.

2.6 PENETRATION SEALING SYSTEMS

A. Firestopping: Provide fire barrier penetration sealing materials as specified in Division 07, Firestopping Section.

B. Duct Water Seal: Products suitable for closing underground and entrance duct openings, where innerduct or cable is installed, to prevent entry of gases, liquids, or rodents into the structure; e.g., SEMCO PR 851.

2.7 TELECOMMUNICATIONS OUTLET BOXES

A. Sheet Metal Outlet Boxes: Minimum 4-inch square by 2-1/8-inch deep, galvanized steel for use with single-gang plaster rings.

B. Plaster Rings: Single-gang as shown on the Drawings.

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2.8 PULL BOXES

- A. Construction: NEMA Standard No. 250. Type 1 galvanized steel enclosures designed for use as junction boxes and pull boxes with flat screw-applied covers, with or without knockouts and gray enamel finish.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Workmanship:
 - 1. Provide, condition, apply, install, connect and test manufactured products, materials, equipment and components in accordance with the manufacturer's specifications and printed instructions.
 - 2. The installation of system components to be carried out under the direction of qualified personnel. Appearance to be considered as important as mechanical and electrical efficiency. Workmanship to meet or exceed industry standards.
 - 3. Place support for raceways, cable trays, backboards, equipment racks and cabinets.
- B. Protection During Construction: Protect products from the effects of moisture, corrosion and physical damage during construction. Except during installation activity in a section, keep openings in conduit, tubing and wireway capped with manufactured seals during construction.
- C. Concrete Sleeves: Conduits routed perpendicular through floors, walls, or other concrete structures to pass through cast-in-place conduit sleeve openings wherever possible, or appropriate size holes to be bored to accommodate the installation of conduit sleeves. The size and location of the holes to not impair the structure's integrity.
 - 1. Concrete Boring: Bore a hole in the concrete with a diameter of 1/2 to 1-inch larger than the conduit sleeve to be installed. Grout around the conduit sleeve and finish to match existing surroundings.
 - 2. Conduits that rise vertically through a slab to be stubbed 6-inches above the floor and capped pending future use.
- D. Drywall/Gypsum Board Sleeves: Install insulating throat bushings on both ends of conduit sleeves placed in fire-rated walls using drywall construction.
- E. Where conduit enters a structure through a concrete roof or membrane waterproofed wall or floor:
 - 1. Provide a watertight seal.

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2. With Concrete Encasement: Install watertight entrance seal device on the accessible side.
 3. Securely anchor malleable iron body of watertight entrance seal device into construction with one or more integral flanges.
 4. Secure membrane waterproofing to watertight entrance seal device in a permanent, watertight manner.
- F. Provide continuous sleeving through walls, floors and ceilings separating each telecom outlet from its respective MER/TR room, using sleeve conduit size as required per Standards. Restore penetrations through rated assemblies to original fire rating per NFPA and local codes.
- G. Locate sleeves as shown on Drawings. Where sleeves are not shown on Drawings, install sleeves above suspended ceilings and locate to minimize length of pathway for future cable from telecom outlet to MER/TR rooms.
- H. Where sleeves are routed between rooms with floating ceilings, extend conduits horizontally 2-feet over edge of floating ceiling to avoid exposed cabling from being seen at floor level.
- I. Make floor penetrations no more than 4-inches from wall. Install conduit stubs to extend 4-inches from floor base. Cap conduits for protection.
- J. Provide removable heat-expanding pillows at fire barrier penetrations as specified in Firestopping section and described as Firestop Material Type 7 (indicated as FSM-7).
- K. Grounding: Provide ground connections and bonding continuity between raceway and wire basket runway sections, boxes, enclosures, cabinets and fittings as required per code and industry standard.
- L. Provide plenum rated products, components and accessories for installation in plenums.

3.2 RACEWAYS

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's written instructions and recommendations.
- C. Raceway Identification Banding:
1. Degrease and clean surfaces to receive tape labels.
 2. Exposed conduits and wireway, including raceways above lay-in or accessible ceilings, together with associated pull boxes to be banded at intervals of not over 10-feet and at direction changes. Two-band identification to be different contrasting colors as follows:

PATHWAYS FOR COMMUNICATIONS SYSTEMS

Raceway Use	Color
Grounding	Green
Telecom/datacom	Yellow
CCTV	White
Building monitoring and security	Grey

3.3 RIGID METAL CONDUIT AND FITTINGS

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's written instructions and recommendations.
- C. Conduit Type:
 - 1. Install the following types of circular communications raceway in the locations listed unless otherwise indicated on the Drawings.
 - a. Exterior, Exposed Including Roof: Rigid steel conduit.
- D. Conduit Bends and Sweeps:
 - 1. Make changes in direction of communications conduit runs with sweeps of the longest possible radius.
 - 2. Make sweeps in parallel or banked runs of conduits, 2-inches and larger in diameter, from the same center or centerline so that sweeps are parallel and of neat appearance.
 - 3. Field-Made Bends and Sweeps:
 - a. Use an acceptable hickey or conduit-bending machine.
 - b. Do not heat metal raceways to facilitate bending.
 - c. Before installing 4-inch field-made sweeps in duct banks, pull a 3-1/2-inch diameter by 12-inch long mandrel through duct sections to verify circularity and sweep radius.
 - 4. The angular sum of the bends between pull points and/or pull boxes to not exceed 180 degrees.
 - 5. Minimum Inside Bend Radius for Communications Conduit Bends, Sweeps, Boxes and Fittings:
 - a. One-inch conduit, 11-inches
 - b. Two-inch conduit, 21-inches

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- c. Three-inch conduit, 36-inches
 - d. Four-inch conduit, 48-inches
 - e. Other sizes, 10 times the inside diameter of the conduit.
- 6. Do not install boxes, bends, elbows, tees, conduit bodies and other conduit fittings, which do not provide for the minimum inside cable bend radius specified in paragraph E above.
 - a. Conduit Bodies: In-line straight-through Type C conduit fittings can be used as pull boxes for conduit up to a maximum of 2-inches ID. Other conduit fittings, which include direction changes such as E, L, LB, LR, LL, LRT, TA, TB and X, are not allowed.
 - b. Refer design or installation conflicts with these requirements to the Architect.
- E. Aboveground Conduit Installation:
 - 1. Support conduit installed in aboveground interior and exterior locations at a maximum of 7-feet on center.
 - 2. Group conduit in parallel runs where practical and use conduit rack constructed of steel channel with conduit straps or clamps.
 - 3. Securely attach aboveground conduit under the provisions of this Section.
 - 4. Only conduit servicing elevator equipment can be installed through elevator shafts or equipment rooms. These conduits may only enter the room and go directly to the equipment being supplied.
 - 5. Keep power wiring independent of communication system wiring.
 - 6. Arrange conduit to maintain headroom and present neat appearance.
 - 7. Do not install conduits on surface of building exterior, across roof, on top of parapet walls, or across floors, unless otherwise noted on drawings.
 - 8. Exposed conduits are permitted only in the following areas:
 - a. Mechanical rooms, electrical rooms or spaces where walls, ceilings and floors will not be covered with finished material.
 - b. Existing walls that are concrete or block construction.
 - c. Where specifically noted on drawings.

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- d. Route exposed conduit parallel and perpendicular to walls, tight to finished surfaces and neatly offset into boxes.
- 9. Do not install conduits or other electrical equipment in obvious passages, doorways, scuttles or crawl spaces which would impede or block area passage's intended usage.
- 10. Keep conduits a minimum of 12-inches away from steam or hot water radiant heating lines (at or above 104 degrees F) or 3-inches away from waste or water lines.
- 11. Run exposed and concealed conduits parallel or perpendicular to walls, structural members, or intersections of vertical planes to provide a neat appearance. Follow surface contours as much as possible.
- 12. No section of conduit located within buildings to exceed 100-feet in length between pull points and/or pull boxes.
- 13. Expansion/Deflection Joints:
 - a. Where indicated on the Drawings, provide specific purpose expansion/deflection fittings for conduit crossing building expansion/deflection joints in structures or concrete slabs. Expansion fittings to have copper bonding jumper.
 - b. For PVC conduit, provide expansion/deflection joints for 25 degrees F maximum temperature variation. Install in accordance with manufacturer's written instructions.
 - c. For rigid steel conduit located in exterior areas, provide expansion/deflection joints for maximum site temperature variation, installed in accordance with manufacturer's written instructions.
- 14. Provide each conduit passing from a nonhazardous or noncorrosive area to a hazardous area and each conduit entering an enclosure within a hazardous area with a sealing fitting in accordance with NEC Article 500. The sealing fitting is to be UL listed and to be filled with approved sealing compound of the same manufacture.
- 15. Hubs, Bushings and Insulating Sleeves:
 - a. Interior Box and Cabinet Connections: Install insulating throat connectors wherever conduit terminates in boxes or cabinets. In addition, install bonding type locknuts at metallic conduit terminations.
 - b. Wet and Hazardous Box and Cabinet Connections: Use watertight threaded conduit sealing hubs with insulated throat and bonding type

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locknuts for fastening rigid steel conduit to cast or sheet metal pull boxes.

- c. Exposed Conduit Terminations: Cap exposed steel communication conduit ends with bushings or smooth collars to protect cable sheath.

F. Pulltape and Duct Plugs:

1. Following conduit installation, install pulltape (muletape) with preprinted foot markers in each empty conduit containing a bend or over 10-feet in length, except sleeves and nipples. Tie the pulltapes securely at each end.
2. Immediately after pulltape installation, install removable manufactured plugs in empty conduit and wireway openings. For underground conduit openings, use screwtight, removable, watertight and dust-tight duct plugs.
3. Verify lengths at the time of installation and provide as-built documentation.

3.4 ELECTRICAL METALLIC TUBING AND FITTINGS

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's written instructions and recommendations.
- C. Minimum Conduit Size: Size recessed conduits to surface raceway serving multiple data outlets as follows. Sizing is based on TIA/EIA 569-B for 28 percent conduit fill, assuming Category 6 cables (nominal outer diameter 0.24-inch) to each data outlet. Provide recessed backbox between surface raceway and recessed conduit sized for conduit.

1 to 6 cables	1-inch conduit
7 to 10 cables	1-1/4-inch conduit
11 to 15 cables	1-1/2-inch conduit
16 to 20 cables	2-inch conduit
Above 20 cables	Use multiple runs of conduit from surface raceway based on above table

- D. Minimum Backbone Conduit Requirements: Install three 4-inch conduits from MER to each TR, unless otherwise noted on Drawings.
- E. Conduit Type:
 1. Install the following types of circular communications raceway in the locations listed unless otherwise indicated on the Drawings.
 - a. Interior Dry Locations, Exposed: EMT with set screw fittings.

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- b. Interior Dry Locations, Concealed (Not Embedded in Concrete): EMT with set screw fittings.
 - c. Interior Wet Locations: EMT with compression fittings.
- F. Conduit Bends and Sweeps:
 - 1. Make changes in direction of communications conduit runs with sweeps of the longest possible radius.
 - 2. Make sweeps in parallel or banked runs of conduits, 2-inches and larger in diameter, from the same center or centerline so that sweeps are parallel and of neat appearance.
 - 3. Field-Made Bends and Sweeps:
 - a. Use an acceptable hickey or conduit-bending machine.
 - b. Do not heat metal raceways to facilitate bending.
 - c. Before installing 4-inch field-made sweeps in duct banks, pull a 3-1/2-inch diameter by 12-inch long mandrel through duct sections to verify circularity and sweep radius.
 - 4. The angular sum of the bends between pull points and/or pull boxes to not exceed 180 degrees.
 - 5. Minimum Inside Bend Radius for Communications Conduit Bends, Sweeps, Boxes and Fittings:
 - a. One-inch conduit, 11-inches
 - b. Two-inch conduit, 21-inches
 - c. Three-inch conduit, 36-inches
 - d. Four-inch conduit, 48-inches
 - e. Other sizes, 10 times the inside diameter of the conduit.
 - 6. Do not install boxes, bends, elbows, tees, conduit bodies and other conduit fittings, which do not provide for the minimum inside cable bend radius specified in paragraph E above.
 - a. Conduit Bodies: In-line straight-through Type C conduit fittings can be used as pull boxes for conduit up to a maximum of 2-inches ID. Other conduit fittings, which include direction changes such as E, L, LB, LR, LL, LRT, TA, TB and X, are not allowed.

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- b. Refer design or installation conflicts with these requirements to the Architect.

3.5 CONDUIT ACCESSORIES

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's written instructions and recommendations.
- C. Duct Spacers: Install per manufacturer's recommendation.
- D. Expansion/Deflection Fittings: Install per manufacturer's recommendation.
- E. Pulltape: Install per manufacturer's recommendation.
- F. Duct Plugs: Install per manufacturer's recommendation.

3.6 PENETRATION SEALING SYSTEMS

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's written instructions and recommendations.
- C. Seal conduit entering structures at the first box or outlet to prevent the entrance of gases, liquids, or rodents into the structure.
 - 1. Empty Conduits: Removable screwtight duct plugs.
 - 2. Innerduct Installed: Suitable duct water seal between conduit and innerduct. Manufactured seals in empty innerduct.
 - 3. Cable Installed: Suitable duct water seal between conduit and cable, or between innerduct and cable.

3.7 TELECOMMUNICATIONS OUTLET BOXES

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's written instructions and recommendations.
- C. Provide 4-inch by 4-inch by 2-1/8-inch deep outlet boxes for mounting telecommunications outlets with single-gang plaster rings as required, or as indicated on the Drawings.
- D. Do not install outlet boxes back to back in walls. Provide minimum 6-inch separation, except provide minimum 24-inch separation in acoustic-rated walls.

PATHWAYS FOR COMMUNICATIONS SYSTEMS

- E. Locate outlet boxes in masonry walls to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat openings for outlet boxes. Use boxes with sufficient depth to permit conduit hubs to be located in masonry void spaces.
- F. Provide knockout closures for unused openings.
- G. Support telecommunications outlet boxes independently of conduit.
- H. Use multiple-gang boxes where more than one device is mounted together; do not use sectional outlet boxes.
- I. Install outlet boxes in walls without damaging wall insulation.
- J. Coordinate mounting heights and locations of outlet boxes mounted above counters, benches and backsplashes.
- K. Provide recessed outlet boxes in finished areas; secure boxes to interior wall and partition studs, accurately positioning to allow for surface finish thickness. Use stamped steel stud bridges for flush outlet boxes in hollow stud wall.
- L. Provide cast outlet boxes in exterior and wet locations.

3.8 PULL BOXES

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's written instructions and recommendations.
- C. In-Ground: Size and install per manufacturer's recommendations.
- D. Aboveground: Size and install per manufacturer's recommendations.

END OF SECTION

COMMUNICATIONS HORIZONTAL CABLING

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included:
 - 1. Station Cabling
 - 2. Modular Jacks
 - 3. Work Area Outlets
 - 4. Patch Cords

1.2 RELATED SECTIONS

- A. Contents of Division 27, Communications and Division 01, General Requirements apply to this Section.
- B. Use this Section in conjunction with other Division 27, Communications specifications and related Contract Documents to establish the total general requirements for the project communications systems and equipment.

1.3 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.
- B. Meet requirements of NFPA 780, Standard for the Installation of Lightning Protection Systems.

1.4 SUBMITTALS

- A. Submittals as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
 - 1. Procedures for cable labeling and identification, long term documentation methods and numbering scheme in accordance with ANSI/TIA/EIA-606A.
 - 2. A copy of certified installer certificates and warranty certificates for products proposed.

1.5 QUALITY ASSURANCE

- A. Quality assurance as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

COMMUNICATIONS HORIZONTAL CABLING

- B. Manufacturers to have a recognized certified installer program in place for system components proposed. Cable will be approved with manufacturer system installed.

1.6 WARRANTY

- A. Warranty of materials and workmanship as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
 - 1. Labor, materials and documentation according to selected manufacturer requirements necessary to ensure that the Owner will be furnished with an Extended Product Warranty and Application Assurance of a minimum of 20 years in length. The Application Assurance Warranty will cover the failure of the wiring system to support current or future applications that are designed for the link/channel specifications of ANSI/TIA/EIA-568-C.1. These applications include, but are not limited to, 10BASE-T, 100BASE-T, 1000BASE-T, 10GBASE-T and 155 Mb/s ATM.
 - 2. A warranty on the physical installation.
 - 3. Necessary documentation required by the manufacturer immediately following 100 percent testing of cables.
- C. Administer the warranty process with the responsible manufacturer's representative. Provide warranty directly to the Owner from the manufacturer. Ensure that the manufacturer provides the Owner with the appropriate warranty certification within 90 calendar days of the final project completion.

1.7 SYSTEM DESCRIPTION

- A. Provide a standards-based cable system to serve horizontal communication systems requirements as specified and as shown on Drawings. Closely follow ANSI/TIA/EIA, IEEE and ISO standards.
- B. The horizontal distribution subsystem refers to intrabuilding twisted-pair communications cabling connecting telecommunications rooms (TRs) to telecommunications outlets (TOs) located at individual work areas and consists of the following:
 - 1. Category 6 100 ohm, 4-pair, unshielded twisted pair cables from the telecom rooms to the outlets.
 - 2. The horizontal system includes cables, jacks, patch panels and patch cords, as well as the necessary support systems, such as cable managers and faceplates.

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3. Cables are routed through conduit, spaces below raised floors, open ceiling areas, non-ventilated spaces above ceiling tile and through plenum air-handling spaces above ceiling tile.
4. Furnish and install materials necessary for a complete and working system.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Station Cabling:

1. ADC
2. Belden
3. CommScope Systimax or Uniprise
4. Corning - fiber optic only
5. Leviton/Berk-Tek
6. Ortronics/Superior Essex
7. Panduit/General
8. Simon/Mohawk
9. Tyco AMP NETCONNECT
10. Or approved equivalent.

B. Modular Jacks:

1. ADC
2. Belden
3. CommScope Systimax or Uniprise
4. Leviton
5. Ortronics/Berk-Tek
6. Panduit/General
7. Simon/Mohawk

COMMUNICATIONS HORIZONTAL CABLING

8. Tyco AMP NETCONNECT

9. Or approved equivalent.

C. Work Area Outlets:

1. ADC

2. Belden

3. CommScope Systimax

4. Corning - fiber optic only

5. Leviton

6. Ortronics

7. Panduit/General

8. Simon/Mohawk

9. Tyco AMP NETCONNECT

10. Or approved equivalent.

D. Patch Cords:

1. ADC

2. Belden

3. CommScope Systimax or Uniprise

4. Corning - fiber optic only

5. Leviton

6. Ortronics

7. Panduit/General

8. Simon/Mohawk

9. Tyco AMP NETCONNECT

10. Or approved equivalent.

COMMUNICATIONS HORIZONTAL CABLING

2.2 STATION CABLING

A. Category 6 Unshielded Twisted Pair:

1. 100 ohm, Category 6, 23 AWG, 4-pair unshielded twisted pair, CMP rated jacket, color blue.

2.3 MODULAR JACKS

A. Category 6 Modular Jacks:

1. Eight-position modular jack, Category 6, IDC terminals, T568A/B wiring scheme
2. Each jack must be stamped or have icons to identify it as CAT 6.
3. Coordinate color with building finishes.

2.4 WORK AREA OUTLETS

A. Flush Mounted Faceplate:

1. Two-port faceplate, constructed from high impact thermo-plastic, with recessed label fields, mounts within a single-gang wall box.
2. Coordinate faceplate color with building finishes. Submit to Architect for approval prior to installation.

B. Surface Mounted Outlet Boxes:

1. Two-port surface mount box, constructed from high impact thermo-plastic, with recessed label fields.

C. Modular Mounting Frames/Covers:

1. Two-port 106-Type duplex frame, mounts within a single gang wall box.

D. Dust Covers: Single port dust cover for modular openings, color to match faceplate.

2.5 PATCH CORDS

A. Category 6 Modular Patch Cords: Factory terminated double ended, eight-position to eight-position, modular, stranded conductors, 4 pair, color grey. 15-feet.

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PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Miscellaneous Hardware: Provide supporting hardware, cable ties, labels, pull rope and other miscellaneous hardware for a complete and operable system.
- B. Provide like items from one manufacturer, such as jacks, patch panels, equipment connection cords and wall plates.
- C. Horizontal cabling includes cables, jacks, patch panels, connecting blocks and patch cords, as well as the necessary support systems, such as cable managers and faceplates.
- D. Furnish and install materials necessary for a complete and working system.
- E. Contractor must be a Certified Installer for selected manufacturer prior to, during and through completion of the system installation and must be able to provide the manufacturer's extended warranty.
- F. Perform work in a neat and workmanlike manner.
- G. Install cable after interior of building has been physically protected from the weather and mechanical work likely to damage cabling has been completed.
- H. Before installing cabling, ensure cable pathways are completely and thoroughly cleaned.
 - 1. Inspect conduit, wireway, cable trays and innerduct systems prior to installation.
 - 2. Swab any additional enclosed raceway and innerduct systems.
- I. Provide protection for exposed cables where subject to damage. Provide abrasion protection for any cable or wire bundles, which pass through holes or across edges of sheet metal.
- J. Install cable ties and other cable management clamps via hand so it fits snugly. Do not over tighten or use mechanical tools which could compress, crimp, or otherwise change the physical characteristics of the cable jacket or distort the placement of twisted-pair components. Replace any cable exhibiting stresses due to over tightening of cable management devices.
- K. Where possible, route cables in overhead cable trays and inside wire management systems attached to the equipment cabinets and racks. Use Velcro ties or ducts to restrain cabling installed outside of wire management systems on racks or in cabinets.
- L. Co-install a pull cord (nylon; 1/8-inch minimum) with cable installed in conduit.

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- M. Limit cable raceway fill to less than the TIA/EIA-569-B maximum fill for the particular raceway type.
- N. If a J-hook or trapeze system is used to support cable bundles, support horizontal cables at a maximum of 48- to 60-inch intervals. Cables are prohibited to rest on acoustic ceiling grids or panels.
- O. Bundle horizontal distribution cables in groups of no more than 50 cables. Cable bundle quantities in excess of 50 cables may cause deformation of the bottom cables within the bundle and degrade cable performance.
- P. Install cable above fire-sprinkler systems and ensure that the cable does not attach to the system or any ancillary equipment or hardware. Install cable system and support hardware such that it does not obscure any valves, fire alarm conduit, boxes, or other control devices.
- Q. Do not attach cables to ceiling grid or lighting fixture wires. Where support for horizontal cable is required, install appropriate carriers to support the cabling.
- R. Any cable damaged or exceeding recommended installation parameters during installation will be replaced by the contractor prior to final acceptance at no cost to the Owner.
- S. Determine requirements for plenum rated cable and devices. When in doubt, seek determination in writing by Authority Having Jurisdiction (AHJ) prior to ordering. Without written confirmation from the AHJ, Contractor to assume that a plenum rating is required.
- T. Unshielded Twisted Pair Cable Installation Practices:
 - 1. Install cable in accordance with manufacturer's recommendations and best industry practices.
 - 2. Install cables in continuous lengths from origin to destination (no splices).
 - 3. Do not exceed the cable's minimum bend radius and maximum pulling tension.
 - 4. Install unshielded twisted pair cable so that there are no bends smaller than four times the cable outside diameter at any point in the run and at the termination field.
 - 5. Do not exceed 25-lbf pulling tension on 4-pair UTP cable.
- U. Provide the following minimum separation distances between pathways for copper communications cables and power wiring of 480 volts or less:
 - 1. Open or Nonmetal Communications Pathways:

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- a. 12-inches from electric motors, fluorescent light fixtures and unshielded power lines carrying up to 3 kVA.
 - b. 36-inches from electrical equipment and unshielded power lines carrying more than 5 kVA.
 - c. 48-inches from large electrical motors or transformers.
 2. Grounded Metal Conduit Communications Pathways:
 - a. 2-1/2-inches from electrical equipment and unshielded power lines carrying up to 2 kVA.
 - b. 6-inches from electrical equipment and unshielded power lines carrying from 2 kVA to 5 kVA.
 - c. 12-inches from electrical equipment and unshielded power lines carrying more than 5 kVA.
 - d. 3-inches from power lines enclosed in a grounded metal conduit (or equivalent shielding) carrying from 2 kVA to 5 kVA.
 - e. 6-inches from power lines enclosed in a grounded metal conduit (or equivalent shielding) carrying more than 5 kVA.
- V. Unshielded Twisted Pair Termination:
1. Coil cables in the in-wall or surface-mount boxes if adequate space is present to house the cable coil without exceeding the manufacturers bend radius. In hollow wall installations where box-eliminators are used, excess wire can be stored in the wall. Do not store more than 12-inches of UTP in an in-wall box, modular furniture raceway, or insulated walls. Loosely coil and store excess slack in accessible ceiling space above each drop location when there is not enough space present in the outlet box to store slack cable.
 2. Dress and terminate cables in accordance with the recommendations made in the ANSI/TIA/EIA-568-C.1 document.
 3. Terminate four pair cables on the jack and patch panels using T568B wiring scheme.
 4. Maintain the cable jacket within 1-inch of the termination point.
 5. Do not exceed 0.5-inch of pair untwist at the termination point.
 6. Do not exceed four times the outside diameter of the cable in the termination area for bend radiance compliance.

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7. Neatly bundle and dress cables to their respective panels or blocks. Feed each panel or block by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.

W. Testing Procedures:

1. Test cables and termination hardware for defects in installation and to verify cabling system performance under installed conditions according to the requirements of ANSI/TIA/EIA-568-C. Verify pairs of each installed cable prior to system acceptance. Repair or replace any defect in the cabling system installation including but not limited to cable, connectors, feed through couplers, patch panels and connector blocks in order to ensure 100 percent useable conductors in cables installed.
2. Test cables in accordance with this document, the ANSI/TIA/EIA standards, the manufacturer's procedures and best industry practice. If any of these are in conflict, bring any discrepancies to the attention of the project team for clarification and resolution.
3. Test Unshielded Twisted Pair Cables as Follows:
 - a. Test twisted-pair copper cable links for continuity, pair reversals, shorts, opens and performance as indicated below. Additional testing is required to verify Category performance. Test horizontal cabling using a Level IV test unit for Category 6 performance compliance as specified in ANSI/TIA/EIA-568 C.
 - b. Continuity: Test each pair of each installed cable using a test unit that shows opens, shorts, polarity and pair-reversals, crossed pairs and split pairs. Test shielded/screened cables with a device that verifies shield continuity in addition to the above stated tests. Record the test as pass/fail as indicated by the test unit in accordance with the manufacturers' recommended procedures and referenced to the appropriate cable identification number and circuit or pair number. Correct or repair any faults in the wiring and retest the cable prior to final acceptance.
 - c. Length: Test each installed cable link for installed length using a TDR type device. Test the cables from patch panel to patch panel, block to block, patch panel to outlet or block to outlet as appropriate. The cable length will conform to the maximum distances set forth in the ANSI/TIA/EIA-568-C Standard. Record cable lengths, referencing the cable identification number and circuit or pair number. For multipair cables, record the shortest pair length as the length for the cable.
4. Follow the Standards requirements established in ANSI/TIA/EIA-568-C.
5. Perform testing with a Level IV tester. The basic tests required are:

COMMUNICATIONS HORIZONTAL CABLING

- a. Wire Map
 - b. Length
 - c. Attenuation
 - d. NEXT (Near-end Crosstalk)
 - e. Return Loss
 - f. ELFEXT Loss
 - g. Propagation Delay
 - h. Delay Skew
 - i. PSNEXT (Power Sum Near-end Crosstalk Loss)
 - j. PSELFEXT (Power Sum Equal Level Far-end Crosstalk Loss)
 6. Provide test results in electronic format, with the following minimum information per cable:
 - a. Circuit ID
 - b. Test Result, "Pass" or "Fail"
 - c. Date and Time of Test
 - d. Project Name
 7. Provide an electronic copy of the test results, in the native tester software format, to the Architect along with the printed test results.
 8. Provide a fully functional version of the tester software for use by the Architect in reviewing the test results.
- X. Labeling:
1. Label horizontal cables using a machine printed label at each end of the cable at approximately 6-inches of the termination point. Do not use handwritten labels.
 2. Label patch panel ports and TO ports with the cable identifier.
 3. Labels to be Telecom Room number, patch panel number and patch panel port number. Provide the final cable ID matrix to the Architect for approval one week prior to cable installation.

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4. Note labeling information at each outlet on the record drawings.

- Y. Coordination of Conditions: Structured cabling for wireless access points of a given description may be used in more than one type of ceiling or wall structure. Coordinate ceiling construction, wall types, recessing depth and other construction details prior to ordering special components indicated in the details for shipment. Where materials supplied do not match ceiling construction replace them at no cost to Owner.

3.2 STATION CABLING

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.

3.3 MODULAR JACKS

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.

3.4 WORK AREA OUTLETS

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.

3.5 PATCH CORDS

- A. Field terminated patch cords and jumpers are not allowed. At a minimum, provide equipment connection cords for one-half the total number of cables installed at each termination point. For example: A telecommunications outlet with four Category 6 cables installed would require two Category 6 equipment connection cords at the work area outlet and two Category 6 equipment connection cords in the telecommunications equipment room for a total of four Category 6 equipment connection cords.

END OF SECTION

CHAIN LINK FENCES AND GATES

PART 1 GENERAL

1.1 SUMMARY

- A. Furnish all labor, material, equipment and services required for the installation of the chain link fencing.
- B. Include all gates, rails, braces, fittings and footings necessary for the complete installation.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM A120, Pipe, Steel, Black and Hot-Dipped, Zinc Coated (Galvanized) Welded and Seamless, for Ordinary Uses.
 - 2. ASTM A123, Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strips.
 - 3. ASTM A153, Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - 4. ASTM A392, Standard specification for Zinc-Coated Steel chain link fence fabric; 2007.

1.3 SUBMITTALS

- A. Submit the following in accordance with Division 1 Section "Submittal Procedures."
- B. Shop drawings indicating plan layout, spacing of components, fence heights, sizes of posts, post foundation dimensions, rails, braces, gates, and accessories.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Fencing Products:
 - 1. Ameristar, 800/321-8724.
 - 2. Boundary Fence and Railing Systems, Co., 800/628-8928..
- B. Other Manufacturers: Submit Substitution Request prior to bid date in accordance with Division 1 Section "Product Requirements."

2.2 MATERIALS

- A. Framework: Line, terminal and pull posts; top, rail or braces; and gates shall be Type I or Type II steel pipe.

CHAIN LINK FENCES AND GATES

1. Type I Schedule 40 pipe with 1.8 oz./s.f. zinc coating conforming to the standard specifications for black and hot-dip zinc coated (galvanized welded and seamless steel pipe for ordinary uses), ASTM F1083.
2. Type II pipe manufactured from steel conforming to ASTM A569, cold-formed, electric welded and triple coated per ASTM F1234, Type B and Type D with 1.0 oz \pm 0.1 oz./s.f. zinc, 30 \pm 15 micrograms chromate, 0.5 \pm 0.2 mils clear cross-linked polyurethane acrylic exterior coating. The internal surface shall be given corrosion protection by zinc-rich based organic coating with a 91% minimum zinc powder coating, capable of providing galvanic protection.
3. All coating to be applied inside and outside after welding.
4. Pipe shall be straight, true to section and conform to the following weights:

<u>Pipe Size</u> <u>Outside Diameter</u>	<u>Type I</u> <u>Weight Lbs./Ft.</u>	<u>Type II</u> <u>Weight Lbs./Ft.</u>
1-5/8 inches	2.27	1.84
2 inches	2.72	2.28
2-1/2 inches	3.65	3.12
3 inches	5.79	4.64

5. Roll-Formed Steel: Hot-rolled steel shape H-section with a minimum yield strength of 45,000 psi conforming to ASTM F669, Group III. Protective coating system according to ASTM F1234, Type A, hot-dip galvanized with a minimum of 2.0 oz./s.f. zinc according to ASTM A123, or 4.0 oz./s.f. zinc according to ASTM A525.

B. Fabric:

1. Zinc coated fabric shall be galvanized after weaving with a minimum 1.2 oz. of zinc per square foot of surface area and conform to ASTM A392, Class 1. Fabric to be 9 gauge wire woven in a 2-inch diamond mesh, 8-feet high. Top selvage twisted and knuckled. Bottom selvage knuckled.

2.3 COMPONENTS

A. Fence Posts:

1. Line Post: 2-1/2-inch o.d.
2. Terminal Post: 3-inch o.d.

B. Gate Posts: 3-inch o.d.

CHAIN LINK FENCES AND GATES

- C. Rails and Braces: 1-5/8 inches o.d.
- D. Gates: Frame assembly of 2-inch o.d. pipe with welded joints. Weld areas repaired with zinc-rich coating applied per manufacturer's directions. Cover gate frame with same fabric as fencing, attaching with stretcher bars at vertical edges and tie wire at top and bottom. Provide diagonal cross-bracing of 3/8-inch diameter adjustable length truss rods where necessary to provide frame rigidity against sag or twist.
- E. Rolling Gate hardware: Provide manufacturer's standard wheel trollies and guide wheels/guide rails as required for rolling gates as detailed.
- F. Fittings:
 - 1. Post Caps: Pressed steel, cast iron, or cast aluminum alloy designed to fit snugly over posts to exclude moisture. Supply cone type caps for terminal posts and loop type for line posts. All fittings to conform to ASTM F626.
 - 2. Rail and Brace Ends: Pressed steel, cast iron or cast aluminum alloy, cup-shaped to receive rail and brace ends.
 - 3. Top Rail Sleeves: Tubular steel, 0.051-inch thickness by 7 inches long, expansion type.
 - 4. Tension Bars: Steel strip, 5/8-inch wide by 3/16-inch thick.
 - 5. Tension Bands: Pressed steel, 14 gauge thickness by 3/4-inch wide.
 - 6. Brace Bands: Pressed steel, 12 gauge thickness by 3/4-inch wide.
 - 7. Truss Rods: Steel rod, 3/8-inch diameter merchant quality with turnbuckle.
- G. Tension Wire: Marcellled 7 gauge steel wire with minimum coating of 0.80 oz. of zinc or 0.40 oz. of aluminum per square foot of wire surface and conforming to ASTM A824.
- H. Tie Wires: Aluminum, 9 gauge, alloy 1100-H4.
- I. Hog Rings: Steel wire, 11 gauge, with a minimum zinc coating of 0.80 oz./s.f. of wire surface.

PART 3 EXECUTION

3.1 ACCEPTABLE INSTALLERS

- A. All installation work performed by experienced, skilled workers approved by the manufacturer, in conformance with the Chain Link Fence Manufacturer's Association and ASTM F567.

3.2 INSTALLATION

- A. Height: 6-feet, 0-inches.

CHAIN LINK FENCES AND GATES

- B. Post Spacing: Space line posts at intervals not exceeding 10 feet.
- C. Post Setting: After final grading is complete, set terminal, gate, and line posts plumb in concrete footings. Top of footing to be 2-inches above grade and sloped to direct water away from posts.
- D. Bracing: Brace gate and terminal posts back to adjacent line posts with horizontal brace rails and diagonal truss rods.
- E. Top Rail: Install through line post loop caps connecting sections with sleeves. One coupling in each five to have expansion spring. Top rail to fasten securely to each gate, corner, pull and end posts and form a continuous brace on each run of fence.
- F. Bottom Tension Wire: Stretch between terminal posts 6 inches above grade and fasten to outside of line posts with tie wires.
- G. Fabric: Pull fabric taut with bottom selvage 2 inches above grade. Fasten to terminal posts with tension bars threaded through mesh and secured with tension bands at maximum 15-inch intervals. Tie to line posts and top rails with tie wires spaced at maximum 12 inches on posts and 24 inches on rails. Attach to bottom tension wire with hog rings at maximum 24-inch intervals.
- H. Gates: Install gates plumb, level, and secure for full opening without interference. Anchor center stops and keepers in concrete.
- I. Fasteners: Install nuts for fittings, bands, and hardware bolts on inside of fence.

3.3 COMPLETION

- A. The area of installation shall be left free of debris caused by the installation of the fence.

END OF SECTION