Project Manual

BEAVERTON SCHOOL DISTRICT
PHASE 4 AUDITORIUM UPGRADES

BID / PERMIT DOCUMENTS

JANUARY 13, 2020

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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. At Southridge High School, new work lighting will replace the existing fixtures at the grid. Retrofit lamps will replace the existing aisle light fixtures.

2. At Westview High School, the production lighting system will be upgraded and new emergency lighting at the Black Box will be added. Existing step light fixture and working lighting will be replaced.

3. At Beaverton High School, new manual and motorized line-sets will be added. New ladders with cages and a platform will be added to access the walking grid from the mezzanine. The existing ladder to be removed.

4. 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.

SUMMARY

1.2 CONTRACTS

A. Standard Contract Form: Provided by Owner.

1.3 SITE INVESTIGATION AND REPRESENTATION

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.

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.

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

ALTERNATES

PART 1 GENERAL

1.1 SUMMARY

A. Owner Selected Adjustments:

1. The Work required and Lump Sum Contract price shall be modified by the Alternates selected by the Owner and incorporated into the Agreement Form.

B. Related Documents:

1. Bid Form: Comply with successful Bidder's lump sum price for each Alternate.

2. Agreement Form: Refer to Owner-selected Alternates as listed in the signed Agreement Form.

1.2 CONTRACT ADJUSTMENTS

A. Work Adjustments:

1. Adjust Work required by the Contract for each Alternate accepted by Owner.

2. Include changes in material, equipment, and fabrication.

3. Include changes in erection, installation, and finishing.

4. Adjust work to achieve the desired result as indicated on Drawings and specified in the related technical Sections for each Alternate selected by the Owner.

B. Contract Sum Adjustments: Owner will adjust the Contract Lump Sum as indicated in the successful bidder's Bid Form, which the Owner incorporates into the signed Agreement Form.

C. Bidder's Requirements:

1. Review Contract Documents for the Scope of Work required by each Alternate.

2. State in the Bid Form in the space provided the addition to or deduction from the Basic Bid for each Alternate listed in this Section.

D. Contractor's Requirements:

1. Alternate Work is outlined in this Section and is specified in detail in the technical Sections referenced in this Section.

2. Minor adjustments to exposed finish surfaces, or concealed Work by the incorporation of the selected Alternates may or may not be indicated on Drawings or be specified in the referenced Specifications.

3. Include adjustments in Work as required to achieve the intended result, consistent with requirements in the Contract Documents.

4. Coordinate Work modified by the incorporation of the Alternates.

ALTERNATES

E. Owner's Rights:

1. The Owner reserves the right to accept or reject any one or all of the Alternates.

2. The Owner reserves the right to reinstate Alternate Bids at any time within 30 days after Contract Award.

1.3 DESCRIPTION OF ALTERNATES

A. Work related to the Alternates shall include but is not necessarily limited to the Work shown on the referenced Drawings.

B. Alternate No. 1 – Aisle Luminaires

1. Provide cost to perform work of removing and replacing existing aisle seat luminaires and associated hardware for aisle outhridge High School and Westview High School.

Referenced Sections: 26 00 00 Electrical

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.

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.

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.

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 notorized original copies of each Application for Payment to Architect through Owner’s web-based progam (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).

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.

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 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.

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®:

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 electornic format as approved by the Architect.

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:

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.

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

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:

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

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 of 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

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	(215) 697-6257
	Available from General Services Administration www.gsa.gov	(202) 619-8925
	Available from National Institute of Building Sciences	(202) 289-7800

	www.nibs.org	
FTMS	Federal Test Method Standard (See FS)	
UFAS	Uniform Federal Accessibility Standards Available from Access Board www.access-board.gov	(800) 872-2253 (202) 272-0080

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

	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)	

ICBO ES	ICBO Evaluation Service, Inc. (See ICC-ES)	
ICC	International Code Council www.iccsafe.org	(888) 422-7233 (703) 931-4533
ICC-ES	ICC Evaluation Service, Inc. www.icc-es.org	(800) 423-6587 (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 www.cpsc.gov	(800) 638-2772 (301) 504-7923
DOE	Department of Energy www.energy.gov	(202) 586-9220
EPA	Environmental Protection Agency www.epa.gov	(202) 272-0167
NIST	National Institute of Standards and Technology www.nist.gov	(301) 975-6478
OSHA	Occupational Safety & Health Administration www.osha.gov	(800) 321-6742 (202) 693-1999
PBS	Public Building Service (See GSA)	
PHS	Office of Public Health and Science www.osophs.dhhs.gov/ophs	(202) 690-7694
SD	State Department www.state.gov	(202) 647-4000

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, compentent 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:

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.

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.

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

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.

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."

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.

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.

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.

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 ____ Approved as Noted
____ Not Approved ____ 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.

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.

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.

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.

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.

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.

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.

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.

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 electornic 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.

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 submitted via eBuilder for permanent reference. Submit through eBuilder for review and approval, and shall include the following information:

a. Name, address, and phone number of the firm/person who installed the equipment or system.

b. Name, address, and phone number of the nearest service facility authorized by the manufacturer.

c. Complete technical information, such as electrical and mechanical schematics, diagrams, parts lists, data sheets, connection details, and similar data.

d. Operating instructions such as start up procedures, inspection and maintenance routines.

e. 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.

f. 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 mauals for systems that were commissioned. The manuals are reviewed for 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.

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.

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

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.

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 AWPA 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: WWPA 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:

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.

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.

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.

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.

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.

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.

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.

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.

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.

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.

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:

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.

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.

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.

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

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.

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

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.

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.

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.

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

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.

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.

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

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

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. Division 5 “Metal Fabrications” for painting of caged vertical ladders and platform.

2. Divisions 26 through 27 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.

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 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:

(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

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.

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.

1.2 RELATED SECTIONS

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

1. Division 01 – General Conditions

2. Section 26 05 36 – Production Systems Electrical Installation

3. Division 26 – Electrical

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

1.5 SYSTEM DESCRIPTION

A. The stage will include single purchase, T-bar guided counterweighted rigging pipe battens in quantities and configurations as shown on the Drawings.

B. The Cyc batten shall be motorized package hoist.

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.

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 DEMOLITION

A. Remove grating in rigging zone at gallery level where it obstructs arbor travel.

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 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

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:

   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. Motor Hoists – General

1. All winches shall be supported by a sturdy steel base, holding the elements of the winch in proper alignment.

K. Gearmotors and Primary Brakes:

1. Motors, primary brakes, and gearboxes shall be an integrated unit, with the first stage pinion gear mounted directly on the motor's armature shaft. No couplings will be permitted between the motor, primary brake and gear reducer. Exceptions will be permitted only when special gearing or torque requirements cannot be met with an integrated unit.

2. Motors shall be totally enclosed fan cooled (TEFC). The motor shall have a minimum AGMA service factor of 1.0 for constant operation.

3. The gear reducer shall be a combination Helical/Worm reducer. The gear case shall be cast iron for protection against shock damage. The output shaft(s) shall have double lip oil seals to prevent leaks. The gearing service factor shall be a minimum of 1.0 with a mechanical strength service factor of 1.25.

4. Primary Brake:

a. For motors of 20 HP or less the primary brake shall be an integral part of the motor, mounted directly on the motor's armature shaft. No couplings will be permitted between the motor and primary brake.

b. Brakes shall fail to a safe condition ("fail safe") in case of power failure. Brakes shall be spring applied, direct acting, electrically released by energizing the coil simultaneously with the motor winding, and equipped with a manual release. The brake shall an AC / DC electro-magnetic unit with a minimum retarding torque equal to 200% of motor full load torque.

L. Shafts, Keys, and Couplings:

1. Shafts shall be designed to accommodate the applied loads (including shock and bending loads) in accordance with ANSI B 106.1M, "Design of Transmission Shafting,"

2. All connections shall be keyed, using keys designed to accommodate the applied loads. Keys shall be in accordance with ANSI B 17.1, "Keys and Keyseats".

3. Couplings shall be chosen to accommodate the applied loads, including shock and bending loads. Couplings shall accommodate the possible parallel and angular misalignments caused during manufacturing, assembly, and installation, as well as by structural tolerances and structural or equipment deflections.

4. In the case of line shaft hoists, the couplings in the shafts between the drums shall be universal joints in order to compensate for misalignment and deflections.

5. Only couplings made of steel and with steel to steel contact surfaces shall be used.

M. Bearings:

1. Bearings shall be selected to accommodate the applied loads and speeds.

2. The use of self-aligning flange bearings is preferred. The use of other bearing types shall be in accordance with good engineering practice. Pillow blocks may be used only where they are subject to compressive forces only.

N. Helical Drums:

1. Provide cast iron or steel drums designed to properly support the required loads.

2. Each helical drum shall be supported by a rigid steel base, holding the elements of the drum assembly in proper alignment.

3. Where directly adjacent to a motor, drum shall be directly connected to the output shaft of the integrated motor - brake - gear reducer unit and the outboard end of the drum shall be supported by a self-aligning flange bearing.

4. Where connected to shafting, both ends of each drum shall be supported by a self-aligning flange bearing mounted in a steel plate that fully captures the drum shaft.

5. Side plates shall hold a minimum of three keepers designed to prevent cross winding of the lift lines on the drums.

6. Drums shall be helically grooved to accept a single layer of cable accommodating the entire travel distance PLUS three dead wraps PLUS two contingency wraps.

7. The drum diameter shall meet or exceed the wire rope manufacturer's minimum recommended D/d ratio, assumed herein to be 32x the lift line diameter.

8. Cables shall enter the drum at a 45 degree angle and shall be retained by a Nicopress stop sleeve.

O. Direct Struck Limit Switches

1. Direct struck limit switches shall be heavy duty, lever operated rotary head units, and shall have positive opening contacts.

2. Direct struck limit switches shall be Telmecanique ZCKJ series or Allen Bradley Bulletin 802T.

3. Mount limit switch strike plate assembly to a Unistrut assembly to allow for 2' minimum of vertical adjustment.

P. Fabrication:

1. The mechanical fabrication and workmanship shall incorporate best practices for good fit and finish. There shall be no burrs or sharp edges to cause a hazard nor shall there be any sharp corners accessible to personnel.

2. All moving parts shall have specified tolerances.

3. All equipment shall be built and installed to facilitate future maintenance and replacement.

Q. Finishes:

1. Paint shall be the manufacturer's standard finish and color except as noted.

2. All turnbuckles, clips, tracks, chains and other items of incidental hardware shall be furnished plated or painted black.

R. Recommended Working Load: This specification calls for minimum recommended working loads for hardware. The manufacturer's recommended working load is the maximum load which the manufacturer recommends be applied to properly installed, maintained, and operated new equipment. Manufacturer's recommended working loads shall be determined by calculations by a Licensed Professional Engineer and destructive testing by an independent testing laboratory. These calculations and reports shall be available for review.

2.2 COUNTERWEIGHT SETS

A. It shall be under the work in this section to mount and rig the multicable and install and hang the receptacle boxes on existing battens. Production Lighting Control shall supply the

multicable and receptacles. Production Rigging shall coordinate the length of multicable required for the linesets and inform Production Lighting contractor of the required length to make a functional lineset. The multicable shall not pull the lineset out of alignment with the other linesets.

B. Guide System:

1. The complete guide system shall consist of vertical flanges, located to receive sets on centers as shown on drawings. The T-bar guides shall be 2" deep x 2" wide x 3/16" black painted steel members.

2. Guides shall be held in place by clips on each leg of the guide. The clips are bolted to horizontal angles. The clips and guide shall be formed so that they lock together in accurate alignment.

3. Horizontal wall battens shall be located per drawings, Wall battens shall be unistrut anchored to the wall.

4. Wall battens shall be held in place by wall knees, formed from 24” x1/4” steel, with factory punched slots to aid in alignment made necessary by irregularities in the wall. Wall knees shall be bolted to wall batten with ½” bolts as shown on the drawings. Wall knees shall be welded to the wall batten after final commissioning and approvals have been given. Wall knees shall be welded to the backing girts provided under structural steel contract.

5. There shall be a top stop batten, a bottom stop batten and a floor batten, all of which shall be made of 2" x 2" x 1/4" steel angle bolted to each T-guide with 3/8” bolts. The top and bottom stop battens shall each have a 2" x 2" hardwood and 3/8” thick rubber bump stop securely bolted to the stop battens by 3/8" bolts every three sets. Rubber shall be continuously attached to the hardwood with mastic and screws. Bump stops shall be placed to maximize travel.

   a. Single set bump stops shall be installed where required to prevent orchestra shell ceiling panels from hitting the floor.

6. All other members of the guide system shall be assembled using 5/16" hex head bolts, lock nuts and washers.

7. All components of the guide system shall be finished flat black. No exceptions.

8. Guides shall be installed precisely and plumb, and splices shall align. Minor inconsistencies in the guide flanges shall be ground smooth.

9. Acceptable Alternate: A-Bar guide tracks by JR-Clancy or equal by Thern.

C. 10” Tension Floor Block:

1. The cast iron sheave shall have a 10” outside diameter, and shall be an ASTM A48 Class 30 grey iron casting or steel, with a machined groove for a ¾” rope.

2. The sheave shall be equipped with a 17 mm diameter machined steel shaft and two sealed, precision ball bearings.

3. Side plates shall be a minimum of 3/16” steel plate.

4. The block shall have a minimum weight of 40 lbs. to properly tension the hand line.

5. A toe kick plate shall be provided to permit adjustment of the rope tension.

6. The floor block shall be held in place and guided in the T-bar guides by two guide shoe assemblies, each consisting of two UHMW guides, one UHMW spacer, and 5/16" thick steel plates. Each guide shall be secured to the housing by means of two 3/8" hex head bolts and nuts.

D. Counterweight Arbors:

1. Arbor shall be lengths required to achieve batten loading capacity of 25 pounds per linear foot of batten.

2. The arbor shall be a front-loading type. Side loading arbors are not acceptable.

   a. The arbor shall enclose the counterweight bricks on three sides. Arbors that do not enclose the counterweight bricks are not acceptable.

   b. The arbor shall have a spring activated self-closing lock bar to prevent bricks from sliding out the front of the arbor. The lock bar shall engage and lock in the slot or indentation at the front of the counterweight bricks in the event the bricks slide forward in the arbor.

   c. Counterweight arbors shall be designed to hold weights for balancing loads in a manner that permits safe handling and easy access while retaining the counterweights within the arbor, even in the case of unexpected impact. Arbor frames and fittings shall be of materials having ductile properties that deform plastically without fracturing.

   d. The arbor shall be sized to a width which can readily accept the counterweight as described below without excessive free space.

3. The arbor shall have shelves welded in place no more than 24 inches apart. Arbors requiring spreader plates are not acceptable. Arbors without shelves are not acceptable.

   a. The arbor shelves shall impose an angle on the counterweight bricks causing them to be slanted toward the back of the arbor.

   b. The inside of the counterweight arbor bottom frame shall be configured so that the counterweights rest without rocking. Counterweights shall not be permitted to rest on any bolt, nut, fastener, or other mounting hardware.

4. The arbor shall be delivered at pipe weight. Pipe weight may be achieved by the delivering an arbor that is pipe weight and/or by the addition of counterweights.

5. The arbor shall be single purchase and shall have tie off points for up to 10 loft lines and for one 3/4 inch purchase line.

a. All counterweight arbor tops shall be equipped with attachment points for the lift lines and purchase lines, and the attachment points shall be sized so that terminations do not rest on, pinch, or otherwise bind adjacent terminations.

6. The arbor frame shall contain guide assemblies for engaging guide rail systems. Guide assemblies shall run freely, and engage the rail assembly in a manner that prevents arbors from disengaging under normal usage. The guide assemblies shall be designed to minimize noise and friction.

7. Arbors shall be:

a. Brickhouse by Thern Stage Equiment

b. Or equal front loading arbor by JR Clancy,

c. Or equal front loading arbor as provided by H&H specialties

E. Counterweight:

1. Counterweights shall be steel plate 1” thick x 13-3/4" long and width 2” narrower than the set centers. Counterweights shall be flame or laser cut steel. Each piece shall be free from slag and sharp edges. The thickness of counterweights shall not vary more than 1/8" from nominal dimension.

2. Weight shall be primed grey with rust inhibitor.

a. Dead load weight shall be painted yellow on the edges once installed.

3. Opposite corners shall be notched for ease of handling. Pipe weight dead load shall be stacked with weights alternating to provide finger holds when loading arbors.

4. The counterweights shall have an oblong shaped hole to be used as a handle cut toward one end. The same end shall have a slight notch cut. This notch accommodates the locking gate.

5. Provide 6,000 lbs. of live load counterweight PLUS the dead load of pipe weight of all installed sets.

6. Load all sets for balance at the midpoint of travel and band pipe weight dead load stack to arbor with 2 mechanically locked steel straps.

7. Deliver and distribute live load counterweight in safe and neat stacks at the loading gallery floor level.

F. Operating Line:

1. Operating line shall employ a 3-strand composite construction combining filament and staple/spun polyester wrapped around fibrillated polyolefin.

2. The rope shall hold knots well, be easily spliced, and be dense enough to allow it to be clamped in a rope lock without damage. Rope shall not be subject to rotting, mildew, or moisture damage nor shall its length be affected by changes in humidity.

3. Tape ends before cutting. Attach to arbor around rope thimble with two half hitches or bowline and tape end to standing line with rigging tape.

4. Adjust length so tension block is at mid travel at time of checkout.

5. Operating lines shall be Multiline II rope or SureGrip rope as provided by J. R. Clancy, standard white.

G. Locking Rails:

1. Reuse existing locking rails and extend as required to fit new linesets.

H. Rope Locks:

1. Provide rope locks which prevent any movement of the operating line and arbors while rope lock is closed. The rope lock shall consist of an ASTM A536 ductile iron housing, cams and handle. The body of the rope lock shall accommodate a padlock, securing the handle in the closed position.

2. There shall be a rubber bumper in the housing to silence the handle when it is opened. Replace standard bumper with larger bumper to keep the handle from hitting the steel tube of the lock rail.

3. Rope lock shall be configured so it will not open if the set is out of balance by 50 lbs. in either direction, and the balance or out of balance condition shall be clearly identifiable.

4. Adjustment for rope shall be from 5/8" to 1" by means of a 1/2" nylon tipped, socket head adjustment screw with lock nut at the rear of the housing.

5. The handle shall be 9" long with a vinyl dip coating. The handle shall be installed so that it passes two degrees past vertical to lock the hand line. The cam at the lower end of the handle shall be equipped with a steel roller to eliminate sliding friction and promote ease of use.

6. A vinyl dip coated, oval, welded steel ring shall be provided as a safety lock.

7. The rope lock shall mount to the locking rail with four 3/8" hex bolts and lock nuts.

8. Provide rope locks for the complete quantity of T-bar centers as shown on drawings, U.O.N.

9. Rope locks shall be SureLock as provided by J. R. Clancy.

a. Acceptable Alternate: Standard rope locks by JR Clancy or Thern or equal by other manufacturers listed above are acceptable if the headblocks are provided with safety brakes.

I. Head Blocks:

1. The sheave shall be an ASTM A48 Class 30 grey iron casting or steel with an outer diameter as shown on drawings. The machined rope and cable grooves shall have equal pitch diameters. The sheave shall be equipped with a 1" (for 12" diameter sheaves) or 1-1/2" (for 16" diameter sheaves) diameter machined steel shaft and two tapered roller bearings.

2. Base angles shall be a minimum 2" x 1-½" x 1/4" angle with the short leg turned in. The turned in leg shall be notched to allow clear passage of all cables.

3. Side plates shall be a minimum of 10-gauge (for 12" diameter sheaves) or 7-gauge (for 16" diameter sheaves) steel, and shall fully enclose the sheave. Side plates shall be bolted and welded to the base angles for extra strength. Side plates shall be shaped to overlap the flanges of the head block beams. There shall be a minimum of six 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 3,000 lbs. (for 12" diameter sheaves) or 3,600 lbs. (for 16" diameter sheaves).

5. Block mounting clip per standard specification listed in Section 11 61 33.2.02.I.

6. Head blocks may be equipped with safety brakes as a voluntary alternate, or are required when providing rope locks per 2.04.J.9.a.

    a. Safety brake shall sense speed mechanically and engage a brake when an overspeed condition is sensed. Brake shall stop all movement, and prevent both the batten and the arbor from falling.

    b. Safety brake shall control the speed reduction so as not to cause damage to equipment.

    c. Once the out of balance situation is rectified, brake shall release automatically.

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: short line loft block shall be multi-grooved to carry all lines.

2. Base angles shall be a minimum 1-½" x 1-½" 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 ¼" 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.

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 ½" 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.

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. Pipe Battens:

1. Battens shall be pipe battens as shown in the PR drawings at lengths to match existing battens.

2. All battens shall be 1-1/2" nominal diameter, schedule 40 black pipes in lengths to match existing batten lengths.

3. All edges shall be de-burred.

4. All joints shall be spliced with tight fitting mech tube sleeves held by two 3/8" hex bolts and lock nuts on each side of the joint. Hex bolts shall all be parallel and installed vertically.

5. Battens shall be finished with a suitable rust resistant finish, black.

6. The center of each counterweight pipe batten shall be marked with a 1” wide white stripe enamel painted around the full circumference.

7. Safety yellow end caps at each end, all battens.

P. System Signage:

1. Provide signage indicating system load data and warnings on downstage wall for each of the following locations:

a. Rigged side stage level.

b. Rigged side fly gallery level.

2. System data shall include:

a. Overall live load capacity of general purpose battens.

b. Concentrated live load capacity midway between pickups on general purpose battens.

c. Weight per each counterweight.

d. Weight per foot of counterweight.

e. System operation safety advisory.

f. Rigging Contractor contact information.

3. Signs shall meet ANSI Z535 standard for warning signs.

4. Mount on wall in plain view.

2.3 CYC BATTEN HOIST

A. The cyc batten hoist shall be designed to properly support the required loads with factors of safety as specified herein.

B. The hoist shall be a fully integrated unit including Power head, compression tube with beam clamps, loftblocks, lift lines and lift line terminations, right angle cable adjuster and pipe batten, mounting beams, gearmotor with integral brake, drive shaft and winding drums, a batten for attachment of lighting fixtures, wireway, and cable management system.

C. Hoist shall incorporate a build in load cell, and slack line sensor.

D. Absolute position encoder is required.

E. Each hoist unit shall have the capacity to raise and lower the specified load at a speed of at least 30 fpm.

F. Characteristics: The winch shall have the following characteristics:

1. Lifting Capacity: 1300lbs live load on the batten

2. Hoist operating voltage: 208 VAC 60 Hz

3. Travel distance to match existing battens travel.

G. Lift Lines: 3/16" diameter, 7X19 galvanized utility cable.

H. Construction: The gearmotor, shafting, drums, and steel backbone shall be factory assembled in complete modules. Modules shall be designed for simple field assembly and installation.

I. Limit Switches

1. All winches shall have positively driven mechanical limit switches for normal end of travel indication. These switches shall signal control circuits in the reversing contactors.

2. Positively driven mechanical limit switches shall be provided for overtravel indication. Overtravel levels shall be set according to the final installation of related lighting fixtures and obstructions to movement such as seating, railings, HVAC ducts, sprinklers, architectural elements, etc.

3. Actuation of an overtravel limit switch shall use a separate, redundant circuit to positively disconnect power from the winch, per NFPA 79, using a UL580E Type 2, non-welding, positive break contactor.

J. Motor Controllers:

1. For fire and electrical safety, motor controllers shall conform to the NEC (NFPA 70), be built in accordance with UL Standard 508, and be “touch safe” per IEC 204-1 “Protection against direct contact” rules.

2. Controllers shall be wired so that operation of the normal end of travel limit switches shall only allow movement away from the limit switch.

3. The controller shall be sized to match the winch motor horsepower. Overload and overcurrent protection shall conform to UL and NEC requirements.

4. A spring return toggle switch shall be housed inside the starter cabinet to allow override of the overtravel limits for resetting purposes.

K. Control Station:

1. One control station shall be provided in surface mounted enclosure, and shall contain a key operated On / Off switch with green LED indicating “Power On”, hold to operate (dead man) Up and Down pushbuttons, a mushroom head emergency stop pushbutton.

   a. Emergency stop pushbutton shall disconnect power to the winch through a circuit meeting NFPA-79 (Electrical Standards for Industrial Machinery) requirements and directly remove power by means of electromechanical components, using a UL580E Type 2, non-welding, positive break contactors.

   b. The emergency stop circuit shall be a normally closed circuit or a supervised circuit that provides the same or greater level of reliability and security. Its operations shall not depend on software or semiconductors.

   c. Resetting the emergency stop circuit shall not initiate motion.

2. This panel shall also include LED’s indicating full travel positions (green) and “primary limit failure” (red). The “primary limit failure” indicators shall illuminate when the ultimate limits are reached on the rotary or hard limit switches. This station shall also contain a speed dial selector.

3. A “Service” indicator shall be provided to alert the user when regular system service is required, and the manufacturer’s contact information.

4. Panel components including pushbuttons, key switches, switches, E-stop switches, and the like shall be industrial grade, heavy-duty components with 7/8" (22 mm) operators. Indicators shall be 5/16" (8 mm) minimum diameter.

5. Position Control:

   a. The Contractor shall set two primary stop positions and two ultimate positions. The winch will stop at each primary limit position. When the primary limits are reached an “UP” or “DOWN” green indicator will illuminate. If the primary limit is reached and engaged, the unit shall not continue in that direction. If an ultimate limit is reached, a red “PRIMARY LIMIT FAILURE” indicator will illuminate.

L. Provide ETC Exo or equal

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 1.5-degrees.

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.

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 6 hours of training. Training shall be in two sessions a minimum of 1 week apart.

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, and adjustment of lower tension block.

3. Proper and safe operation of motorized cyc batten.

4. Care and maintenance of rigging systems.

5. Basic system visual inspections to be performed by the owner.

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. Division 26 – Electrical

3. 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.

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

B. Remove wiring to existing production lighting receptacles that are being abandoned. Cover back box with blank plate. See locations on PL plans.

C. Remove existing main stage dimmer racks and stands. Salvage working dimmer modules for use in the black box dimmer rack.

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 school district maintenance department 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

C. District has a brand name specification. 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 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

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 EXISTING BLACK BOX DIMMER RACK

A. It is under the work in this section to evaluate the condition of the existing black box dimmer rack. Repair the rack using parts from the demolished main stage racks and provide any required upgrade or refurbishments kits to make the existing rack fully functional.

2.5 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.

7. Products shall be

a. ETC Paradigm

2.6 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.

2.7 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.

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.

11. Provide 16 portable nodes.

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.

2.8 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

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.

2.9 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

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.

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.

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.

2.10 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:

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.

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

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 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.

a. Exception: provide standard length monitor data cables.

9. Dust covers for console and all monitors.

2.13 FIXTURES AND ACCESSORIES

A. General

1. Provide all stage lighting fixtures, cables and accessories in quantities as listed in appendix 116183-A.

2. Models shall be as listed on the appendix.

B. Lighting Fixtures

1. General

a. All fixtures shall be provided in a “ready to hang” state. Fixtures shall have the connector (where required) and C-clamp installed and shall provide any required

initial programing or fixture set up.

b. Each fixture shall be provided with the following:

1) 5’-0” connector cable to Powercon input adapter, as applicable, plus 10% spares.

2) Safety Cable, Black, 1 per yoke, plus 50% spares

3) C-clamp, finished black, 1 per yoke/trunnion, plus 50% spares

4) Gel-frame, 1 per fixture, as applicable, plus 50% spares

c. Fixtures shall be either installed as required for the lighting plot or shall be mounted to the upper catwalk railings for storage on the stage side galleries or rear side of the catwalk.

2. Provide the following LED stage lighting fixtures

a. ETC Colorsource Spot CSSPOTS

b. ETC Colorsource PAR Model SCPAR

c. ETC Colorsource CYC

d. Lenses: Provide High Definition Lens tubes for spot fixtures and 7.5” plastic lenses for PAR fixtures.

3. Follow spots.

a. Follow spots shall be on rolling bases.

b. Follow spots shall have the following characteristics:

1) LED light source

2) Douser Iris

3) Iris

4) 5 color boomerang with pre-installed gel

5) Gobo slot with holder

6) 8 to 24 degree zoom

7) Internal ballast

8) 120v-240v operation with pre-terminated 15amp power cord.

9) Ball bearing yoke

c. Follow spots shall be Canto Astro 500 LED followspot.

C. Stage extension cable

1. 10A and 20A rated stage extension Cable

a. All connectors of the same manufacturer as those on the fixtures. Connectors shall provide clamping strain relief that tightly engages the cable jacket. Visible leads shall not be acceptable. Connectors shall have a Clear Cover.

b. Strain relief mechanism shall be fully engaged.

c. Cable 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.

d. Two-fers and adapters

1) Provide molded Y adapters 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.

2. Control cabling

a. Cable assemblies shall be heavy touring grade TMB ProPlex cable or similar.

D. Accessories

1. Barndoors shall be six leaf type and shall be finished black.

2. Top hats and half hats shall be “stackers” by City Theatrical, or similar.

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. Production Lighting Control System

a. Safety precautions.

b. Identification of all elements provided under this section.

c. Configuring and connecting portable nodes.

d. Maintenance, diagnostics and trouble shooting.

e. Control operation training of the console, dimming and control electronics.

f. Altering the architectural controls on the LCD screen.

2. Production Lighting Fixtures

a. Identification of all the fixture types, parts and what they are used for

b. Hanging and focusing the fixtures

c. Configuring DMX addresses on the fixtures

3. General:

a. Basics of using the control console

b. Lighting design basics including how to create a rep plot, what to consider when customizing a plot for a show, creating cues for a show, and working offline.

c. Operations and maintenance manual orientation.

E. Provide 8 hours of training minimum, over 2 days.

3.3 APPENDICES

A. 116183-A Lighting Fixture and Accessories list

B. This specification is incomplete without this appendix.

END OF SECTION

Beaverton High School District - Westview High School

Production Lighting Fixtures

Notes: "A/R" = As Required

REF	DESCRIPTION	MFR	MODEL	QTY	NOTES
	Production Lighting Fixtures				
1CF	LED Cyclorama light	ETC	CSCYC	8	Top row cyc Light
2CF	LED Ellipsoidal spotlight - Multi color	ETC	CSSPOTS	56	Color source Spot LED Engine with shutter barrel assembly
3CF	LED Par Fixture - Multi-color	ETC	CSPAR	30	LED PAR fixture with RGB color control
4CF	Follow spot	Canto	Astro 500	2	Complete with rolling base
	Production Lighting Fixture Lenses				
1L	Ellipsoidal spotlight lens - 10 degree	ETC	410LT	2	Lens Tube for Source 4 series fixtures
2L	Ellipsoidal spotlight lens - 19 degree	ETC	419-EDLT	24	Enhanced Definition Lens Tube for Source 4 series fixtures
3L	Ellipsoidal spotlight lens - 26 degree	ETC	426-EDLT	30	Enhanced Definition Lens Tube for Source 4 series fixtures
4L	Ellipsoidal spotlight lens - 36 degree	ETC	436-EDLT	24	Enhanced Definition Lens Tube for Source 4 series fixtures
5L	Ellipsoidal spotlight lens - 50 degree	ETC	450-EDLT	8	Enhanced Definition Lens Tube for Source 4 series fixtures
6L	Ellipsoidal spotlight lens - Zoom 15-30 Degree	ETC	41530LT	4	Zoom Lens adapter for Source4 Series Fixtures
7L	PAR lenses - Narrow - Round	ETC	SELRN-7.5	10	
8L	PAR lenses - Medium - oblong	ETC	SELOM-7.5	30	
9L	PAR lenses - Wide Oblong	ETC	SELOW-7.5	30	
10L	PAR lenses - Wide - Round	ETC	SELRW-7.5	10	
	Spares & Fixture Add-ons				
1SP	Connector			A/R	1.1 x number of fixtures
2SP	C-Clamp	Contractor		A/R	1.1 x number of fixtures
3SP	Safety Cable, Black	Contractor		A/R	1.5 x number of fixtures
4SP	Gel Frames, Source 4 ERS	ETC		A/R	1.5 x number of fixtures
5SP	Gel Frames, Fresnel/Par	ETC		A/R	1.5 x number of fixtures
	Accessories				
1ACC	Top hat, Source 4 ERS	City Theatrical	Contractor	5	Stackable
2ACC	Half Hats, Source 4 ERS	City Theatrical	Contractor	5	Stackable
3ACC	Pattern Holders, A size, Source 4 ERS	City Theatrical	Contractor	20	For Standard Patterns
4ACC	Pattern Holders, Glass, Source 4 ERS	City Theatrical	Contractor	5	For Effects patterns
5ACC	Iris, Source 4	City Theatrical	Contractor	2	Drop In
6ACC	Donuts, Source 4	City Theatrical	Contractor	5	
7ACC	Barn Door, PAR	City Theatrical	Contractor	10	6 leaf barn door
	Cables				

Beaverton High School District - Westview High School

Production Lighting Fixtures

Notes: "A/R" = As Required

REF	DESCRIPTION	MFR	MODEL	QTY	NOTES
1C	Power Extension Cable, 5'	TMB	Contractor	10	Cable for Lighting Fixtures
2C	Power Extension Cable, 10'	TMB	Contractor	15	Cable for Lighting Fixtures
3C	Power Extension Cable, 25'	TMB	Contractor	15	Cable for Lighting Fixtures
4C	Power Extension Cable, 50'	TMB	Contractor	2	Cable for Lighting Fixtures
5C	Power Extension Two-Fer, Molded	TMB	Contractor	10	Cable for Lighting Fixtures
6C	Powercon to Powercon Cable, 5'	TMB	Contractor	30	Cable for Lighting Fixtures
7C	Powercon to Powercon Cable, 10'	TMB	Contractor	40	Cable for Lighting Fixtures
8C	Powercon to Powercon Cable, 25'	TMB	Contractor	10	Cable for Lighting Fixtures
9C	Powercon to Powercon Cable, 50'	TMB	Contractor	5	Cable for Lighting Fixtures
10C	5-pin DMX Cable, 5'	TMB	ProPlex	30	Cable for DMX Nodes
11C	5-pin DMX Cable, 10'	TMB	ProPlex	40	Cable for DMX Nodes
12C	5-pin DMX Cable, 25'	TMB	ProPlex	10	Cable for DMX Nodes
13C	Orchestra Light Stringer, 50'	LEX	20A E-String	4	(6) NEMA 5-15 Receptacles
14C	Ethernet Control Cable, 10'	TMB	Contractor	16	Cable for Portable Nodes
15C	Ethernet Control Cable, 25'	TMB	Contractor	10	Cable for Portable Nodes
	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

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

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.

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,

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

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

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

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

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.

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:

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.

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.

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.

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.

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.

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.

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.

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 transport to location as designated by Owner:

1. Luminaires

2. Panelboards

3. Breakers

4. Coordinate with Owner prior to start of partial demolition.

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.

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.

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:

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:

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

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.

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, great or paint.

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.

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:

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 used 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.

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.

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.

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:

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.

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

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

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

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.

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~~ **5** 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.

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.

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.

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

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

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.

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.

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.

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.

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.

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.

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.

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.

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.

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.

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.

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.

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.

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.

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.

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.

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.

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.

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

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.

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.

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.

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.

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.

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.

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

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.

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.

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: Gray. Type 302 stainless steel, satin finish, beveled edge.

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. Gray. Type 302 stainless steel, satin finish, beveled edge.

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.

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.

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:

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.

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.

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.

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:

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.

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:

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.

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

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

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:

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.

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.

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.

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.

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.

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.

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.

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.

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.

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