PROJECT MANUAL

DELAWARE STATE UNIVERSITY

OBSERVATORY RENOVATIONS

1200 North DuPont Highway

Dover, Delaware 19901

COMMISSION NO. 1302.01

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Issued for Bid : April 2, 2013

DELAWARE STATE UNIVERSITY
OBSERVATORY DOME RENOVATIONS
SCIENCE CENTER – NORTH
DOVER, DELAWARE

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DRAWINGS

SECTION 01010 - SUMMARY OF WORK

PART 1 - GENERAL

1.01 WORK COVERED BY CONTRACT DOCUMENTS:

A. Work included in these contract documents includes, but is not limited to, the following items of work:

1. Demolition and removal of existing Observatory plywood subflooring, existing entry platform and steps along with a portion of existing wood support framing.
2. Construction of new wood framed entrance and observation platform.
3. Construction of new wood framed platform access steps.
4. Installation of new all-weather carpet tiles.
5. Replacement of metal railings and gratings at one exterior access stairway.
6. Installation of new metal observatory dome.
7. Installation of new electrical service to observatory, including new service sub-panel.

B. The Contractor shall visit the site to verify existing conditions. Contractor shall take into consideration any and all site conditions, which may affect price.

C. Contractor's Responsibilities:

1. Except as specifically noted, provide and pay for:

a. Labor, materials and equipment.
b. Tools, construction equipment and machinery.
c. Other facilities and services necessary for proper execution and completion of the work.

2. Secure and pay for, as necessary for proper execution and completion of work and as applicable at time of receipt of bids:

a. Permits
b. Fees
c. Licenses

3. Comply with codes, ordinances, rules, regulations, orders and other legal requirements of public authorities which bear on performance of work.

4. Promptly submit written notices to the Architect of observed variance of contract documents from legal requirements.

5. Enforce strict discipline and order among employees. Do not employ on work, persons not skilled in the assigned task.

6. The Contractor is solely responsible for confirming and correlating all quantities and dimensions, selecting fabrication processes and techniques of construction, coordinating all portions of work under the contract, and performing his work in a safe and satisfactory manner.

1.02 CONTRACTS:

The work will be constructed under a single lump sum contract for awarded work items.

1.03 SUBSTITUTIONS:

Alternate manufacturer's products may be substitutes for consideration as substitutes only wen the specified manufacturer(s) product(s) are followed by the phrase "or approved substitute". In order to be considered, the Contractor must deliver a written request to the Architect no later than ten (10) days prior to the date of receipt of bids accompanied by the manufacturer's supporting data, testing laboratory reports where applicable, samples where appropriate, and any other information required by the specification section. All bidders will be notified by addendum of all approved substitutes.

1.04 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES:

A. The Contractor shall review, approve and submit all shop drawings, product data, and samples required by the contract documents. By approving and submitting them, the Contractor represents that he has verified all field measurements and related field conditions, and that he has coordinated and submitted information with the requirements of the contract documents.

B. The Architect's review is for general conformance with the design concept and contract documents. Corrections or comments made on the submittals do not relieve the Contractor from complying with the requirements of the contract documents, unless the Contractor has specifically informed the Architect in writing of any specific deviations and has received written approval for the specific deviation from the Architect.

1.05 CONSTRUCTION SCHEDULE:

Immediately following contract award, an organizational meeting shall be held at the project site, and shall be attended by the Contractor, the Architect and other Owner's representative(s), for the purpose of scheduling the various portions of the work and establishing project procedures.

1.06 NOTICE TO PROCEED:

The Contractor shall execute no work under the contract until a written notice to proceed is issued by the Owner, and also not until all contract requirements are met, such as list of materials manufacturers, schedule of values, construction schedule, etc.

1.07 COMMENCEMENT, PROSECUTION AND COMPLETION OF WORK:

The Contractor shall be required to commence work under this contract after receipt by him of notice to proceed, to prosecute said work diligently, and to complete the entire work ready for use including clean-up of the premises not later than the time specified in the form of proposal.

1.08 TIME OF COMPLETION - DELAY:

A. The computation of the number of consecutive calendar days required for the completion of the contract shall be reckoned from the date of the notice to proceed.

B. The length of time during which the work, or any part thereof, has been delayed in consequence of the conditions of the weather, or by acts or omission of the Owner or unforeseen and unavoidable delay in delivery of material, where such delay is not chargeable to neglect on the part of the Contractor, shall be modified so that such legitimate and excusable delay(s) shall be excluded from said computation. All foregoing shall be determined by the Architect and such determination shall be binding and conclusive upon the Contractor.

1.09 OWNER OCCUPANCY:

The Owner will continue occupancy of the existing building throughout construction operations. Contractors shall plan accordingly for work in these areas, and shall make allowance for any out-of-phase scheduling of that portion of work in order to accommodate the Owner's occupancy. All work shall be conducted in a careful and orderly manner, with due consideration of the Owner's operations in the above areas.

1.10 ALTERATIONS AND ADDITIONS:

New work in extension of existing work shall match such work, unless otherwise specified. Old work, which is cut, altered or temporarily removed and replaced, and all work remaining in place, but damaged or defaced by reason of work done, shall be restored to its original condition.

1.11 CONTRACTOR USE OF PREMISES:

A. Confine operations at site to areas permitted. Do not unreasonably encumber site with materials or equipment.

B. Assume full responsibility for protection and safekeeping of materials and products under this project and stored at the site.

C. Contractor shall exhibit good housekeeping practices by containing all waste in proper receptacles and storing materials in an organized manner.

D. Provide storage for all materials at each site. No storage space will be available in School Facilities.

1.12 JOB SUPERVISION:

The Contractor shall have present at the jobsite at all times supervisory personnel who are completely familiar with the plans and specifications. Such personnel shall be satisfactory to the Owner and Architect.

1.13 WORK-SITE INSPECTION:

The Owner, Architect and other authorized Owner representatives shall have free access to all portions of the work site at all times for the purpose of inspecting the work.

1.14 CLEANING:

The Contractor shall execute daily cleaning to keep the site free from debris resulting from construction operations. The Contractor shall provide on-site containers for the collection of debris, and shall periodically remove accumulated debris from the site and dispose of it at legal disposal areas. For final cleaning, remove all foreign substances from sight-exposed interior and exterior surfaces and rake clean other exterior surfaces of the ground.

1.15 CONTRACT CLOSEOUT:

When the Contractor considers the work complete, he shall submit written certification that the contract documents have been reviewed, the work has been inspected, and the work is complete in accordance with the contract documents. The following close-out documents must be submitted with the certification to the Architect:

1. All required inspection certificates.
2. Consent of surety to final payment.
3. Release of Liens.
4. All warranties and maintenance data required by the construction documents.

END OF SECTION

SECTION 01200 – PROJECT MEETINGS

PART l - GENERAL

1.01 RELATED DOCUMENTS:

Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division One specification Sections, apply to this Section.

1.02 SUMMARY:

A. This Section specifies administrative and procedural requirement for project meetings including, but not limited to:

Pre-Construction Conference
Progress Meetings

1.02 PRE-CONSTRUCTION CONFERENCE:

A. The Architect will schedule a pre-construction conference and organizational meeting at the Project site or other convenient location no later than five (5) days after execution of the Agreement and prior to commencement of construction activities. The meeting will be for the purpose of reviewing responsibilities and personnel assignments.

B. Attendees: The Owner, Architect and their consultants, the Contractor(s) and its superintendent, major subcontractors, manufacturers, suppliers and other concerned parties shall each be represented at the conference by persons familiar with and authorized to conclude matters relating to the Work.

C. Agenda: Discuss items of significance that could affect progress, including such topics as:

Construction schedule
Critical work sequencing
Designation of responsible personnel
Procedures for processing field decisions and Change Orders
Procedures for processing Applications for Payment
Distribution of Contract Documents
Submittal of Shop Drawings, Product Data and Samples
Preparation of record documents
Use of the premises
Office, work and storage areas

Equipment deliveries and priorities
Safety procedures
First aid
Security
Housekeeping
Working hours

1.03 PROGRESS MEETINGS:

A. The Architect will conduct progress meetings at the Project site at regularly scheduled intervals.

B. Attendees: In addition to representatives of the Owner and Architect, each subcontractor, supplier or other entity concerned with current progress or involved in planning, coordination or performance of future activities shall be represented at these meetings by persons familiar with the project and authorized to conclude matters relating to progress.

C. Agenda: Review and correct or approve minutes of the previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to the current status of the Project.

Contractors Construction Schedule: Review progress since the last meeting. Determine where each activity is in relation to the Contractor's Construction Schedule; whether on time or ahead or behind schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

Review the present and future needs of each entity present, including such items as:

Interface requirements
Time
Sequences
Deliveries
Off-site fabrication problems
Access
Site utilization
Temporary facilities and services
Hours of work
Hazards and risks
Housekeeping
Quality and work standards
Change Orders
Documentation of information for payment requests

B. Reporting: The Architect will distribute copies of minutes of the meeting to each party present and to other parties who should have been present.

C. Schedule Updating: The construction schedule will be revised after each progress meeting where revisions to the schedule have been made or recognized. The revised schedule will be issued concurrently with the report of each meeting.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

SECTION 01201 – SAFETY PROGRAM

PART l - GENERAL

1.01 RELATED DOCUMENTS:

Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division One specification Sections, apply to this Section.

1.02 GENERAL:

A. The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the work.

B. Each Contractor shall be responsible for the safety of his personnel.

1.03 SAFETY PROGRAM:

A. Prior to commencing the work, the Contractor shall submit a detailed safety program for the approval of the Owner.

B. The safety program shall outline those hazards peculiar to the Contractor's work, and the steps to be taken to eliminate or reduce the risk of injury or loss due to these hazards.

C. Each Contactor shall designate a safety supervisor to implement the safety program. Unless otherwise approved by the Owner, the safety supervisor shall be the Contractor's field superintendent.

1.04 EXECUTION:

A. The Contractor shall provide and enforce the use at all times of the personal protective equipment specified in the U.S. Department of Labor Occupational Safety and Health Regulations for Construction and any applicable State and Local laws.

B. The Contractor shall take immediate action to correct unsafe practices or conditions when discovered.

C. The Contractor's superintendent or safety supervisor hall report to the Owner any unsafe conditions or practices that are observed, or violations of job safety, which are not within the Contractor's jurisdiction.

D. Subcontractors shall immediately report to the contractor any unsafe practices or conditions that are observed that are not under the subcontractor's jurisdiction.

E. The Contractor's superintendent or safety supervisor shall insure that adequate first aid supplies are available, and that personnel are qualified to administer first aid as required by State and/or Federal regulations.

F. The Contractor's superintendent or safety supervisor shall insure that all accidents or injuries are reported on a timely basis and in accordance with State regulations.

G. The Contractor shall continue to educate his Job Foremen of their responsibilities, which shall include:

1. Instructing workers under his supervision in safe work practices and work methods at the time that they are given work assignments.

2. Seeing that his workers have and use the proper protective equipment and suitable tools for the job.

3. Continuously checking to see that no unsafe practices or conditions are allowed to exist on any part of his job.

4. Acquainting his workers with all applicable safety requirements and seeing that they are enforced.

5. Setting a good example for his workers.

6. Making a complete investigation of accidents to determine facts necessary to take corrective action.

7. Promptly completing a "Supervisor's Investigation Form" with his supervisor's assistance and distributing as required. This form will be provided by the Project Manager.

8. Holding weekly "Tool Box" safety meetings with his men to:

   Discuss observed unsafe work practices or conditions.

   Review the accident experience of his crew and discuss correction of accident causes.

   Encourage safety suggestions from his men.

9. Seeing that prompt first aid is administered to an injured employee.

10. Correcting or reporting immediately to job superintendent any observed unsafe conditions, practices or violations of job safety.

1.05 SAFETY MEETINGS:

The Contractor's Superintendent shall attend bi-weekly supervisory personnel safety meetings to be scheduled by the Owner. The Contractor shall designate a job-site employee other than the Superintendent to represent the employees at the meeting.

1.06 TOOL BOX SAFETY MEETINGS:

A. The Contractor shall schedule weekly "Tool Box" safety sessions to be held by his job foreman for all of his employees.

B. A member of the Contractor's management staff shall periodically attend "Tool Box" safety sessions to evaluate their effectiveness and offer any appropriate suggestion for improvement.

1.07 REPORTS:

A. Contractor shall report all accidents or injuries on a timely basis in accordance with all applicable State regulations.

B. Contractors shall promptly complete an accident investigation report on all accidents.

C. A record of all "Tool Box" safety sessions shall be made and submitted to the Project Manager on forms to be provided.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

SECTION 01340 - SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

PART l - GENERAL

1.01 RELATED DOCUMENTS:

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division One Specification sections, apply to the work of this section.

1.02 SUMMARY:

This section contains administrative and procedural requirements for submittal of Shop Drawings, Product Data and Samples to verify that products, materials and systems proposed for use comply with applicable provisions of the Contract Documents.

1.03 SUBMITTAL SCHEDULE:

After development and acceptance of the Contractor's construction schedule, prepare a complete schedule of submittals. Submit the schedule within seven days of the date required for establishment of the Contractor's construction schedule.

1.04 SHOP DRAWINGS:

A. Drawings shall be presented in a clear and thorough manner.

1. Details shall be identified by reference to sheet, detail and/or schedule as shown on Contract Drawings.

1.05 PRODUCT DATA:

A. Preparation

1. Clearly mark each copy to identify pertinent products or models.
2. Show performance characteristics and capacities.
3. Show dimensions and clearances required.

B. Manufacturer's standard schematic drawings and diagrams:

1. Modify drawings and diagrams to delete information, which is not applicable to the Work.
2. Supplement standard information to provide information specifically applicable to the Work.

C. Material and/or equipment percent of pre-consumer and post-consumer recycled content.

D. Location of material and/or equipment point of extraction, harvest, recovery and/or manufacture.

1.06 SAMPLES:

Office samples shall be of sufficient size and quantity to clearly illustrate:

1. Functional characteristics of the product, with integrally related parts and attachment devices.
2. Full range of color, texture and pattern.

1.06 CONTRACTOR RESPONSIBILITIES:

A. Review Shop Drawings, Product Data and Samples prior to submission.

B. Determine and verify:

1. Field measurements.
2. Field construction criteria.
3. Catalog numbers and similar data.
4. Conformance with specifications.

C. Coordinate each submittal with requirements of the Work and of the Contract Documents.

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

E. Begin no fabrication or work, which requires submittals until return of submittals with Architect/Engineer approval.

1.07 SUBMISSION REQUIREMENTS:

A. Make submittals promptly in accordance with approved schedule, and in such sequence as to cause no delay in the Work or in the work of any other contractor.

B. Number of submittals required:

1. Shop Drawings: Submit the number of opaque reproductions, which the Contractor requires, plus three copies, which will be retained by the Architect.

2. Product Data: Submit the number of copies, which the Contractor requires, plus three copies which will be retained by the Architect.

3. Samples: Submit the number stated in each specification section.

C. Submittals shall contain:

1. The date of submission and the dates of any previous submissions.
2. The Project title and number.
3. Contract identification.
4. The names of:
   a. Contractor.
   b. Supplier.
   c. Manufacturer.
5. Identification of the product, with the specification section number.
6. Field dimensions, clearly identified as such.
7. Relation to adjacent or critical features of the Work or materials.
8. Applicable standards, such as ASTM or Federal Specification numbers.
9. Identification of deviations from Contract Documents.
10. Identification of revisions on resubmittals.
11. An 8 in. x 3 in. blank space for Contractor and Architect/Engineer stamps.
12. Contractor's stamp, initialed or signed, certifying to review of submittal, verification of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the Work and of Contract Documents.

1.08 RESUBMISSION REQUIREMENTS:

A. Make any corrections or changes in the submittals required by the Architect/Engineer and resubmit until approved.

B. Shop Drawings and Product Data:

1. Revise initial drawings or data, and resubmit as specified for the initial submittal.
2. Indicate any changes, which have been made other than those requested by the Architect/Engineer.

C. Samples: Submit new samples as required for initial submittal.

1.09 ARCHITECT/ENGINEER DUTIES:

A. Review submittals with reasonable promptness and in accord with schedule.

B. Affix stamp and initials or signature, and indicate requirements for resubmittal, or approval of submittal.

C. Return submittals to Contractor for distribution, or for resubmission.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

SECTION 01600 - MATERIAL AND EQUIPMENT

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED:

A. Material and equipment incorporated into the Work:

1. Conform to applicable specifications and standards.

2. Comply with size, make, type and quality specified, or as specifically approved in writing by the Architect/Engineer.

3. Manufactured and Fabricated Products:

a. Design, fabricate and assemble in accord with the best engineering and shop practices.

b. Manufacture like parts of duplicate units to standard sizes and gages, to be interchangeable.

c. Two or more items of the same kind shall be identical, by the same manufacturer.

d. Products shall be suitable for service conditions.

e. Equipment capacities, sizes and dimensions shown or specified shall be adhered to unless variations are specifically approved in writing.

4. Do not use material or equipment for any purpose other than that for which it is designed or is specified.

1.02 RELATED REQUIREMENTS:

A. Conditions of the Contract.

B. Section 01010: Summary of Work.

C. Section 01340: Shop Drawings, Product Data & Samples.

D. Section 01700: Contract Closeout.

1.03 MANUFACTURER'S INSTRUCTIONS:

A. When Contract Documents require that installation of work shall comply with manufacturer's printed instructions, obtain and distribute copies of such instructions to parties involved in the installation, including two copies to Architect/Engineer.

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

B. Handle, install, connect, clean, condition and adjust products in strict accord with such instructions and in conformity with specified requirements.

1. Should job conditions or specified requirements conflict with manufacturer's instructions, consult with the Architect for further instructions.

2. Do not proceed with work without clear instructions.

C. Perform work in accordance with manufacturer's instructions. Do not omit any preparatory step or installation procedure unless specifically modified or exempted by Contract Document.

1.04 TRANSPORTATION AND HANDLING:

A. Arrange deliveries of Products in accord with construction the schedule, coordinate to avoid conflict with work and conditions at the site.

1. Deliver Products in undamaged condition, in manufacturer's original containers or packaging, with identifying labels intact and legible.

2. Immediately on delivery, inspect shipments to assure compliance with requirements of Contract Documents and approved submittals, and that Products are properly protected and undamaged.

B. Provide equipment and personnel to handle Products by methods to prevent soiling or damage to Products or packaging.

1.05 STORAGE AND PROTECTION:

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

1. Store products subject to damage by the elements in weathertight enclosures.

2. Maintain temperature and humidity within the ranges required by manufacturer's instructions.

B. Exterior Storage:

1. Store fabricated products above the ground, on blocking or skids, to prevent soiling or staining. Cover products which are subject to deterioration with impervious sheet coverings, provide adequate ventilation to avoid condensation.

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

C. Arrange storage in a manner to provide easy access for inspection. Make periodic inspections of stored Products to assure that Products are maintained under specified conditions, and free from damage or deterioration.

D. Protection After Installation:

Provide substantial coverings as necessary to protect installed Products from damage from traffic and subsequent construction operations. Remove when no longer needed.

1.06 SUBSTITUTIONS AND PRODUCT OPTIONS:

A. Products List:

Within 30 days after Contract Date, submit to the Architect a complete list of major products proposed to be used, with the name of the manufacturer and the installing subcontractor.

B. Contractor's Options.

1. For Products specified only be reference standard, select any product meeting that standard.

2. For Products specified by naming several products or manufacturers, select any one of the products or manufacturers named, which complies with the specifications.

3. For Products specified by naming one or more Products or manufacturers and "or equal", Contractor must submit a request as for substitutions for any Product or manufacturer not specifically named.

4. For Products specified by naming only one Product and manufacturer, there is no option.

C. Substitutions

1. Up to 10 days prior to receipt of bids. Architect/Engineer will consider written requests from Contractor for substitution of Products.

2. Submit a separate request for each Product, supported with complete data, with drawings and samples as appropriate, including:

    a. Comparison of the qualities of the proposed substitution with that specified.

    b. Changes required in other elements of the work because of the substitution.

    c. Effect on the construction schedule.

    d. Cost data comparing the proposed substitution with the Product specified.

    e. Any required license fees or royalties.

    f. Availability of maintenance service, and source of replacement materials.

3. Architect/Engineer shall be the judge of the acceptability of the proposed substitution.

D. Contractor's Representation:

1. A request for a substitution constitutes a representation that Contractor:

    a. Has investigated the proposed Product and determined that it is equal to or superior in all respects to that specified.

    b. Will provide the same warranties or bonds for the substitution as for the Product specified.

    c. Will coordinate the installation of an accepted substitution into the Work, and make such other changes as may be required to make the Work complete in all respects.

    d. Waives all claims for additional costs, under his responsibility, which may subsequently become apparent.

E. Architect/Engineer will review requests for substitutions with reasonable promptness, and notify Contractor, in the form of an addendum, of the decision to accept or reject the requested substitution.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION

SECTION 01700 - CONTRACT CLOSEOUT

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED:

A. Comply with requirements stated in Conditions of the Contract and in Specifications for administrative procedures in closing out the Work.

B. Work included as part of this specification includes, but is not limited to the following:

1. Cleaning.

2. Record Documents.

3. Maintenance Data.

4. Warranties and Bonds.

1.03 SUBSTANTIAL COMPLETION:

A. When Contractor considers the Work is substantially complete, he shall submit to the Architect:

1. A written notice that the Work, or designated portion thereof, is substantially complete.

2. A list of items to be completed or corrected.

B. Within a reasonable time after receipt of such notice, the Architect/Engineer will make an inspection to determine the status of completion.

C. When the Architect/Engineer concurs that the Work is substantially complete, he will:

1. Prepare a Certificate of Substantial Completion on AIA Form G704, accompanied be Contractor's list of items to be completed or corrected, as verified and amended by the Architect/Engineer.

2. Submit the Certificate to Owner and Contractor for their written acceptance of the responsibilities assigned to them in the Certificate.

1.04 FINAL INSPECTION:

A. When Contractor considers the Work is complete, he shall submit written certification that:

1. Contract Documents have been reviewed.

2. Work has been completed and inspected for compliance with Contract Documents.

3. Work is completed and ready for final inspection.

B. The Architect/Engineer will make an inspection to verify the status of completion with reasonable promptness after receipt of such certification.

C. When the Architect/Engineer find that the Work is acceptable under the Contract Documents, he shall request the Contractor to make closeout submittals.

1.05 CONTRACTOR'S CLOSEOUT SUBMITTALS:

A. Evidence of compliance with requirements of governing authorities:

Middle Department Inspection Certificate.

B. Instruction of Owner's Personnel:

1. Prior to final inspection or acceptance, fully instruct Owner's designated operating and maintenance personnel in operation, adjustment and maintenance of products, equipment and systems.

2. Operating and maintenance manual shall constitute the basis of instruction.

3. Review contents of manual with personnel in full detail to explain all aspects of operations and maintenance.

a. Product Data: Include only those sheets, which are pertinent to the specific product. Annotate each sheet to:

1) Clearly identify specific product or part installed.

2) Clearly identify data applicable to installation.

3) Delete references to inapplicable information.

b. Drawings: Supplement product data with drawings as necessary to clearly illustrate:

Relations of component parts of equipment and systems.

D. Warranties, Bonds and Maintenance Manuals:

1. Assemble warranties, bonds and maintenance contracts executed by each of the respective manufacturer, suppliers and subcontractors.

2. Number of original signed copies required: 2 each.

3. Table of Contents: Neatly typed, in orderly sequence. Provide complete information for each item.

a. Product or work item.

b. Firm, with name of principal, address and telephone number.

c. Date of beginning of warranty, service and maintenance contract.

d. Provide information for Owner's personnel:

1) Proper procedure in case of failure.

2) Instances which might affect the validity of warranty or bond.

e. Contractor, name of responsible principal, address and telephone number.

4. Make submittals within ten days after Date of Substantial Completion, prior to final request for payment.

E. Project Documents and Samples:

1. Store Documents and samples in the Contractor's field office apart from document used for construction.

2. Maintain documents in a clean, dry, legible condition and in good order. Do not use record documents for construction purposes.

3. Make documents and samples available at all times for inspection by the Architect.

4. Drawings: Legibly mark to record actual construction:

a. Location of internal utilities and appurtenances concealed in the construction, referenced to visible and accessible features of the structure.

b. Field changes of dimension and detail.

c. Changes made by Field Order or by Change Order.

d. Details not on original contract drawings.

END OF SECTION

SECTION 01710 - CLEANING

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED:

Execute cleaning, during progress of the Work, and at completion of the Work, as required by General Conditions.

1.02 RELATED REQUIREMENTS:

A. Conditions of the Contract.

B. Each Specification Section: Cleaning for specific Products or work.

1.03 DISPOSAL REQUIREMENTS:

Conduct cleaning and disposal operations to comply with codes, ordinances, regulations, and anti-pollution laws.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Use only those cleaning materials which will not create hazards to health or property and which will not damage surfaces.

B. Use only those cleaning materials and methods recommended by manufacturer of the surface material to be cleaned.

C. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.

PART 3 - EXECUTION

3.01 DURING CONSTRUCTION:

A. Execute periodic cleaning to keep the Work, the site and adjacent properties free from accumulations of waste materials, rubbish and windblown debris, resulting from

construction operations.

B. Provide on-site containers for the collection of waste materials, debris and rubbish.

C. Remove waste materials, debris and rubbish from the site periodically and dispose of at legal disposal areas away from the site.

3.02 DUST CONTROL:

A. Clean interior spaces prior to the start of finish painting and continue cleaning on an as-needed basis until painting is finished.

B. Schedule operations so that dust and other contaminants resulting from cleaning process will not fall on wet or newly-coated surfaces.

3.03 FINAL CLEANING:

A. Employ skilled workmen for final cleaning.

B. Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels, and other foreign materials from sight-exposed interior and exterior surfaces.

C. Polish glossy surfaces to a clear shine.

D. Prior to final completion, or Owner occupancy, Contractor shall conduct an inspection of sight-exposed interior and exterior surfaces, and all work areas, to verify that the entire Work is clean.

END OF SECTION

SECTION 02060 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division One Specification sections, apply to work specified in this section.

1.02 DESCRIPTION OF WORK:

A. Extent of building demolition work is shown on the drawings.

B. Schedule of Demolition Work: Demolition requires removal and disposal, off site existing carpet tiles, plywood floor, wood storage bins and floor framing and exterior metal stair railings, platform and treads as shown on the drawings and as required to complete the work as shown.

C. Related Work Specified Elsewhere: Cutting and removal of mechanical/electrical work is specified under mechanical/electrical specifications.

1.03 JOB CONDITIONS:

A. Occupancy: The existing buildings shall remain accessible to the Owner during the course of demolition. Provision shall be made by the Contractor for safe passage to this area during the Contractor’s course of operations.

B. Condition of Structures: The Owner assumes no responsibility for actual condition of structures to be demolished.

Conditions existing at the time of bidding will be maintained by the Owner in so far as practicable. How ever, variations within structure may occur by Owner's removal and salvage operations prior to start of demolition work.

C. Traffic: Conduct demolition operations and removal of debris to ensure minimum interference with adjacent occupied or used facilities.

D. Protections: Provide construction barriers at adjacent Owner occupied areas to keep dust, noise, air and moisture infiltration to a minimum, and as required to provide safety and security of Owner's possessions, personnel and the public.

E. Utility Services: Maintain existing utilities indicated to remain, keep in service and protect against damage during demolition operations. Do not interrupt existing utilities serving occupied or used facilities, except when authorized in writing by authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to the Owner.

PART 2 - PRODUCTS

Not Applicable.

PART 3 - EXECUTION

3.01 DEMOLITION:

A. Pollution Controls: Use temporary enclosures or other suitable methods to limit dust and dirt rising and scattering in air to lowest practical level. Comply with governing regulations pertaining to environmental protection.

Clean adjacent portions of structure of dust, dirt and debris caused by demolition operations, as directed by Architect or governing authorities. Return adjacent areas to condition existing prior to start of work.

B. Building Demolition: Demolish existing buildings as shown and remove from site. Use such methods as required to complete work within limitations of governing regulations.

3.02 DISPOSAL OF DEMOLISHED MATERIALS:

A. General: Remove from site debris, rubbish and other materials resulting from demolition operations.

B. Removal: Transport materials removed form demolished structures and dispose of off site.

3.03 CLEAN UP:

Maintain cleanliness of Contract limits on a daily basis and as directed by the Architect. Clean adjacent areas of dust, dirt and debris caused by demolition operations as directed by the Architect or governing authorities. Return adjacent areas to condition existing prior to start of the work.

END OF SECTION

SECTION 05500 - METAL FABRICATIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division One Specification sections apply to the work of this section.

1.02 DESCRIPTION OF WORK:

A. Definition: Metal fabrications include items made from iron and steel shapes, plates, bars, tubes and/or pipes which are not a part of structural steel or other metal systems specified elsewhere.

B. Extent of metal fabrications is indicated on the drawings.

C. Extent of work in this section include metal fabrications for:

Steel pipe railings
Galvanized steel platform and stair grating
Observatory ring anchor plates

1.03 QUALITY ASSURANCE:

A. Field measurements: Take field measurements prior to preparation of shop drawings and fabrication, where possible. Do not delay job progress; allow for trimming and fitting where taking field measurements before fabrication might delay work.

B. Shop Assembly: Pre-assemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for re-assembly and coordinated installation.

1.04 SUBMITTALS:

A. Product Data: Submit manufacturer's specifications, anchor details and installation instructions for products used in miscellaneous metal fabrications, including paint products and grout.

B. Shop Drawings: Submit shop drawings for fabrication and erection of miscellaneous metal fabrications. Include plans, elevations and details of sections and connections. Show anchorage and accessory items. Provide templates for anchor and bolt installation by others.

PART 2 -PRODUCTS

2.01 MATERIALS:

A. Metals:

1. Metal Surfaces, General: For fabrication of miscellaneous metal work which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names and roughness.

2. Steel Pipe: ASTM A 53; Type and grade (if applicable) as selected by fabricator and as required for design loading; black finish unless galvanizing is indicated; standard weight (schedule 40), unless otherwise indicated.

B. Galvanizing:

Provide zinc coating for those items shown or specified to be galvanized, as follows:

1. ASTM A 153 for galvanizing iron and steel hardware.

2. ASTM A 123 for galvanizing rolled, pressed and forged steel shapes, plates, bars and strip 1/8" thick and heavier.

3. ASTM A 386 for galvanizing assembled steel products.

Fabricate joints which will be exposed to weather in a manner to exclude water or provide weep holes where water may accumulate.

C. Paint:

Galvanizing Repair Paint: High zinc dust content paint for regalvanizing welds in galvanized steel, complying with the Military Specifications MIL-P-21035 (Ships) or SSPC-Paint-20.

2.02 FABRICATION, GENERAL:

A. Workmanship:

1. Use materials of size and thickness indicated or, if not indicated, as required to produce strength and durability in finished product for use intended. Work to dimensions indicated or accepted on shop drawings, using proven details of fabrication and support. Use type of materials indicated or specified for various components of work.

2. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges. Ease exposed edges to a radius of approximately 1/32" unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

3. Weld corners and seams continuously, complying with AWS recommendations. At exposed connections, grind exposed welds smooth and flush to match and blend with adjoining surfaces.

4. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts.

B. STEEL PIPE RAILINGS AND HANDRAILS:

1. Fabricate steel pipe railings and handrails to design, dimensions and details indicated. Provide railings and handrail members formed of pipe of sizes and wall thickness indicated, but not less than that required to support design loading. Railing to support 150% of design load required by local building code or OSHA, whichever is greater.

2. Interconnect railing and handrail members by butt-welding or welding with integral connectors, at fabricator's option, unless otherwise indicated.

   At tee and cross intersections provide coped joints.

   At bends interconnect pipe by means of prefabricated elbow fittings or flush radius bends, as applicable, of radiuses indicated.

3. Form simple and compound curves by bending pipe in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross-section of pipe throughout entire bend without buckling, twisting or otherwise deforming exposed surfaces of pipe.

4. Close exposed ends of pipe by welding 3/16" thick steel plate in place or by use of prefabricated fittings.

5. Ramp Railings and Handrails: Comply with applicable requirements specified elsewhere in this specification section for steel pipe railings and handrails, and as follows:

   Railings may be bent at corners, rail returns and wall returns, instead of using prefabricated fittings.

C. GALVANIZED BAR GRATING PLATFORM AND TREADS:

1. Galvanized bar grating PLATFORM PANELS shall be 1-1/2" x 3/16" galvanized welded steel (McNichols Series GW-150 or equal).

2. Bar grating stair treads shall be 1" bar grating with cast abrasive nosing (McNichols Type C or equal).

PART 3 - EXECUTION

3.01 PREPARATION:

Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication, where possible, do not delay job progress; allow for trimming and fitting where taking field measurements before fabrication might delay work.

3.02 INSTALLATION:

A. General:

1. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction.

2. Cutting, Fitting and Placement: Perform cutting, drilling and fitting required for installation of miscellaneous metal fabrications. Set work accurately in location, alignment and elevation, plumb, true and free of rack, measured from established lines and levels.

3. Fit exposed connections accurately together to form tight hairline joints. Weld connections which are not to be left as exposed joints, but cannot be shop welded because of shipping size limitations. Grind exposed joints smooth and touch-up shop paint coat. Do not weld, cut or abrade the surfaces of exterior units which have been hot-dip galvanized after fabrication, and are intended for bolted or screwed field connections.

4. Field Welding: Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, and methods used in correcting welding work.

B. Steel Pipe Railings and Handrails:

Adjust railings prior to anchoring to ensure matching alignment of abutting joints.

Space posts at spacing indicated, or if not indicated, as required by design loadings. Plumb posts in each direction.

3.03 ADJUST AND CLEAN:

A. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting.

Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. For galvanized surfaces: Clean field welds, bolted connections and abraded areas and apply galvanizing repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 06100 - CARPENTRY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division One Specification sections, apply to the work of this section.

1.02 DESCRIPTION OF WORK:

Definition: Carpentry includes carpentry work not specified as part of other sections and which is generally not exposed, except as otherwise indicated. Types of work in this section include rough carpentry for:

Platform and Observatory Floor framing
Plywood subflooring
Plywood wall sheathing
Stair Framing

A. REFERENCES:

B. Lumber Standards: Comply with PS 20 and with applicable rules of the respective grading and inspecting agencies for species and products indicated.

C. Plywood Product Standards: Comply with PS l (ANSI A l99.l) or, for products not manufactured under PS l provisions, with applicable APA Performance Standard for type of panel indicated.

D. PRODUCT HANDLING:

Delivery and Storage: Keep materials dry at all times. Protect against exposure to weather and contact with damp or wet surfaces. Stack lumber and plywood, and provide air circulation within stacks.

E. JOB CONDITIONS:

Coordination: Fit carpentry work to other work; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds and similar supports to allow proper attachment of other work.

PART 2 – PRODUCTS

2.01 MATERIALS:

A. Lumber, General:

B. Factory-mark each piece of lumber with type, grade, mill and grading agency, except omit marking from surfaces to be exposed with transparent finish or without finish.

C. Nominal sizes are indicated, except as shown be detail dimensions. Provide actual sizes as required by PS 20, for moisture content specified for each use.

D. Provide dressed lumber, S4S, unless otherwise indicated.

E. Provide seasoned lumber with l9% maximum moisture content at time of dressing.

F. Miscellaneous Lumber:

Provide wood for support or attachment of other work including bucks, nails, blocking, furring, grounds, stripping and similar members. Provide lumber of sizes indicated, worked into shapes shown, and as follows:

Moisture Content: l5% maximum for lumber items not specified to receive wood preservative treatment.

C. Fasteners and Anchorages: Provide size, type, material and finish as indicated and/or as recommended by applicable Federal Specifications for nails, staples, screws, bolts, nuts, washers and anchoring devices.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. General:

1. Discard units of material with defects which might impair quality of work, and units which are too small to use in fabricating work with minimum joints or optimum joint arrangement.

2. Set carpentry work accurately to required levels and lines, with members plumb and true and accurately cut and fitted.

3. Securely attach carpentry work to substrate by anchoring and fastening as shown and as required by recognized standards. Use common wire nails, except as otherwise indicated. Select fasteners of size that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting of wood; pre-drill as required.

4. Install supplementary framing, blocking and bracing at terminations in the work and for support of fixtures, equipment, services, heavy trim, and similar work to comply with applicable published recommendations.

B. Wood Grounds, Nailers and Blocking:

Provide wherever shown and where required for screeding or attachment of other work. Form to shapes as shown and cut as required for true line and level of work to be attached. Coordinate locations with other work involved.

END OF SECTION

SECTION 09680 – CARPET TILES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division One Specification sections, apply to work of this section.

1.02 DESCRIPTION OF WORK:

The extent of required carpet tiles is indicated on the drawings, and by specifications, and is defined to include carpet tiles and accessories.

1.03 QUALITY ASSURANCE:

A. Installer: Firm with not less than two years experience, similar to work of this section.

B. Manufacturer: Firm (carpet mill) with not less than five years of production experience with carpet similar to type specified in this section.

1.04 SUBMITTALS:

A. Samples: Submit 12” x 12" samples of carpet tile to be provided.

B. Product Data: In addition to complete data on each carpet and carpeting material and maintenance instruction, provide manufacturer's certification or certified test laboratory reports for required compliance with specified tests, and provide written instructions for each type of installation required.

1.05 PRODUCT DELIVERY AND STORAGE:

Deliver carpet tiles in protective wrapping, and store inside, protected from weather, moisture and soiling.

1.06 WARRANTY:

Provide special project warranty, signed by Contractor, Installer and Manufacturer (Carpet Mill), agreeing to repair or replace defective materials and workmanship of carpeting work during 5-year surface wear warranty period following substantial completion. Attach copies of product warranties.

PART 2 - PRODUCTS

2.01 CARPET TILES:

A. Carpet Tiles shall be Tire-Tex or approved substitute.

B. Carpet tiles shall be made from recycled truck tires with a reinforced rubber backing. Each 12” x 12” carpet tile shall be 3/8” thick. Color shall be grey

2.02 CARPET ACCESSORIES:

A. Adhesive to install carpet tiles shall be as manufactured or recommended by the carpet tile manufacturer.

PART 3 - EXECUTION

3.01 INSTALLATION REQUIREMENTS:

A. Installer must examine substrates for moisture content and other conditions under which carpet tiles are to be installed, and notify Contractor in writing of conditions detrimental to proper completion of the work. Do not proceed until unsatisfactory conditions have been corrected.

B. Clear away debris and scrape up cementitious deposits from surfaces to receive carpeting; vacuum clean immediately before installation.

C. Carpet tiles are to be direct adhesive applied to plywood subfloor in accordance with the manufacturer’s printed instructions.

D. Sequence carpeting with other work so as to minimize possibility of damage and soiling of carpet tiles during remainder of construction period.

3.02 CLEANING AND PROTECTION:

A. Remove debris, sorting pieces to be saved from scraps to be disposed of.

B. Advise Contractor of protection methods and materials needed to ensure that carpeting will be without deterioration or damage at time of substantial completion.

END OF SECTION

SECTION 09900 - PAINTING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division One Specification sections, apply to work of this section.

1.02 DESCRIPTION OF WORK:

A. Extent of painting work is indicated on drawings and schedules, and as herein specified.

B. Work includes painting and finishing of interior items and surfaces throughout project, including, but not limited to the following:

Interior plywood walls
Interior concrete masonry units
Interior and exterior metal stair framing and railings

C. "Paint" as used herein means all coating systems materials including primers, emulsions, enamels, sealers and fillers and other applied materials whether used as prime, intermediate or finish coats.

1.03 QUALITY ASSURANCE:

Single Source Responsibility: Provide primers and other undercoat paint produced by same manufacturer as finish coats. Use only thinners approved by paint manufacturer, and use only within recommended limits.

1.04 SUBMITTALS:

A. Product Data: Submit manufacturer's technical information including paint label analysis and application instructions for each material proposed for use.

B. Samples: Prior to beginning of work, furnish color chips to the Owner for color selection for surfaces to be painted. Owner's review of sample will be for color and texture only.

1.05 DELIVERY, STORAGE AND HANDLING:

A. Deliver paint materials in sealed original labeled containers, bearing manufacturer's

name, type of paint, brand name, color designation and instructions for mixing and/or reducing.

B. Provide adequate storage facilities. Store paint materials at minimum ambient temperature of 45°F (7°C) in well-ventilated area.

C. Take precautionary measures to prevent fire hazards and spontaneous combustion.

1.06 ENVIRONMENTAL CONDITIONS:

Ensure surface temperatures or the surrounding air temperature is above 40º (5ºC) before applying finishes.

1.07 PROTECTION:

A. Adequately protect other surfaces from paint and damage. Repair any damage as a result of inadequate or unsuitable protection. Any materials that cannot be repaired to the satisfaction of the Owner shall be replaced in kind.

B. Furnish sufficient drop cloths, shields and protective equipment to prevent spray or droppings from fouling surfaces not being painted and in particular, surfaces within preparation and storage area.

C. Place cotton waste, cloths and material which may constitute a fire hazard in closed metal containers and remove daily from site.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Paint, Enamel and Fillers: Types as listed herein.

B. Paints: Ready-mixed, pigments fully ground maintaining a soft paste consistency, capable of ready and uniform dispersion in a complete homogeneous mixture.

C. Paints shall have good flowing and brushing properties and shall be capable of drying or curing free of streaks or sags.

D. Proprietary names of Pratt and Lambert, Benjamin Moore used to designate colors or materials are not intended to imply that products of the named manufacturers are required to the exclusion of equivalent products of other manufacturers. Alternate paint systems (manufacturer brands) may be submitted for consideration as equal to those specified.

PART 3 - EXECUTION

3.01 INSPECTION:

A. Applicator must examine areas and conditions under which painting work is to be applied and notify the Contractor in writing of conditions detrimental to proper and timely completion of the work. Do not proceed until unsatisfactory conditions have been corrected in manner acceptable to the Applicator.

B. Starting of painting work will be construed as Applicator's acceptance of surfaces and conditions within any particular area.

C. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.

3.02 SURFACE PREPARATION:

A. General: Perform preparation and cleaning procedures in accordance with paint manufacturer's instructions and as herein specified, for each particular substrate condition.

B. Clean surfaces to be painted before applying paint or surface treatments. Remove oil or grease prior to mechanical cleaning. Program cleaning and painting so that contaminants from cleaning process will not fall onto wet, newly painted surfaces.

3.03 MATERIALS PREPARATION:

A. Mix and prepare painting materials in accordance with manufacturer's directions.

B. Maintain containers used in mixing and application of paint in a clean condition, free of foreign materials and residue.

C. Stir materials before application to produce a mixture of uniform density, and stir as required during application. Do not stir surface film into material. Remove film and, if necessary, strain material before using.

3.04 APPLICATIONS - GENERAL:

A. Apply each coat at proper consistency.

B. Do not apply finishes on surfaces that are not sufficiently dry.

C. Allow each coat of finish to dry before following coat is applied, unless directed otherwise by the manufacturer.

D. Apply additional coats when undercoats, stains or other conditions show through final coat of paint, until paint film is of uniform finish, color and appearance.

3.05 CLEANING:

A. As work proceeds and upon completion, promptly remove paint where spilled, splashed or spattered.

B. During progress of work keep premises free from any unnecessary accumulation of tools, equipment, surplus materials and debris.

C. Upon completion of work leave premises neat and clean, to the satisfaction of the Owner.

3.06 SCHEDULE OF PAINTING:

A. Interior Wood (Painted Finish):

1st Coat:	Pratt & Lambert Interior Trim Paint
2nd Coat:	Pratt & Lambert Cellutone Satin
3rd Coat:	Pratt & Lambert Cellutone Satin

1st Coat:	Moore's Alkyd Underbody
2nd Coat:	Moore's Satin Impervo
3rd Coat:	Moore's Satin Impervo

B. Interior Ferrous Metal:

1st Coat:	Pratt & Lambert Noxide Pro-Hide Primer
2nd Coat:	Pratt & Lambert Cellutone Satin
3rd Coat:	Pratt & Lambert Cellutone Satin

1st Coat:	Moore's Alkyd Enamel Underbody
2nd Coat:	Moore's Satin Impervo
3rd Coat:	Moore's Satin Impervo

C. Interior Concrete Block Masonry:

1st Coat:	Pratt & Lambert Primafil 200
2nd Coat:	Pratt & Lambert Cellutone Satin
3rd Coat:	Pratt & Lambert Cellutone Satin

1st Coat:	Moore's Fill-Coat Block Filler
2nd Coat:	Moore's Aquavelvet Latex Eggshell Enamel
3rd Coat:	Moore’s Aquavelvet Latex Eggshell Enamel

D. Exterior Ferrous Metal:

1st Coat:	Pratt & Lambert Effecto Rust Inhibiting Primer
2nd Coat:	Pratt & Lambert Aqua Latex House and Trim Paint
3rd Coat:	Pratt & Lambert Aqua Latex House and Trim Paint

1st Coat:	Moore's Iron Clad Retardo Red
2nd Coat:	Moore's Iron Clad Retardo Finish
3rd Coat:	Moore's Iron Clad Retardo Finish

END OF SECTION

SECTION 13550 – OBSERVATORY DOME

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division One Specification sections, apply to work of this section.

1.02 DESCRIPTION OF WORK:

Provide and install one (1) 14'-6" metal observatory dome at the Science Center (North) at Delaware State University, Dover, Delaware. An optional 54" wide aperture opening shall be provided.

1.03 SUBMITTALS:

A. Product Data: Brochure, manufacturer's standard Model REB showing all dimensions, accessory details and method of installation shall be submitted to the Architect for review and approval.

B. Operating Instructions, Electrical Data and General Maintenance Information shall be mailed in advance of the unit's shipment.

C. Setting Drawings: Provide setting drawings, templates, instructions, and directions for installation of anchorage devices in other work.

1.04 DELIVERY AND HANDLING:

Delivery: The disassembled observatory dome unit shall be shipped in such a way as to insure all materials will arrive in a satisfactory condition. The shipment must be kept above ground and dry, free from concrete dust and other abrasive materials.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

Metal Observatory Dome shall be Model "REB" as manufactured by Ash Dome Inc. of Plainfield, Illinois (Contact Richard Olson, President - (815) 436-9403) or an approved substitute.

2.02 MATERIALS, GENERAL:

A. Standard Dome Wall Plate Assembly: Minimum 1-1/2” thick x 5-1/2” wide, solid core MDO plywood, sealed with exterior grade paint and encircled with a 14GA (.0747) galvanized steel low carbon commercial quality, galvanized G 90, Minimum Spangle, Extra Smooth, steel ring. This plate is made up of interlocking segments.

B. MDO Plywood shall be manufactured with a high quality paper saturated with phenolic resin solids and overlaid on exterior grade plywood panels. It shall be a selected hardwood veneer overlay, free of patches, providing a smooth surface. MDO plywood shall be manufactured with waterproof resins that meet or exceed all veneer-grade, adhesion and construction requirements of PS1-83.

C. Anchor Bolts: Anchor bolts shall be provided and installed by the Contractor as shown on the project drawings and details. Anchor bolt placement shall be as shown on the manufacturer’s standard drawings.

D. Dome Rollers Model 'R': Heavy Duty, self-aligning, grease lubricated ball bearing type, galvanized, 3" diameter rollers. Rollers shall be mounted on stamped wheel clips equally spaced at a maximum of 20" around the circumference of the wall plate assembly. Rollers shall distribute the load around the circumference of the support wall.

E. Roller Mount Model 'R': 14 GA (.0747) Galvanized Steel, low carbon, commercial quality, galvanized G 90 or equal, Minimum Spangle, Extra Smooth, oiled, die formed - conforming- to ASTM Specification A-569.

F. Roller Isolation: Fixtures shall be isolated from the wall plate assembly by Isomode Pads, 60 +/- 5 Durometer, Black Color, nominal static deflection, minimizing vibration to the roof structure and adjacent areas.

G. Shutter Rollers Model 'R': Heavy Duty self-aligning, grease lubricated ball bearing type, galvanized, 1-1/2” diameter rollers shall be spaced so the weight of the shutter is distributed over the length of tile shutter section. Bearings shall be rated for 5 years.

H. Dome Track Model 'R': 10 GA (.1345) Galvanized Steel, low carbon, commercial quality, galvanized G-90, Grade B or equal, roll formed track, Minimum Spangle, Extra Smooth Surface, oiled - conforms to ASTM Specification A-569, all exterior welds are undercoated with a cold zinc primer and coated with a rust inhibitor (Rust Oleum).

I. Dome Skirt: 14 GA (.0747) flat, Galvanized Steel, low carbon, commercial quality, galvanized G-90, Grade B or equal, Minimum Spangle, Extra Smoot Surface, oiled – conforming to ASTM Specification A-569.

J. Roof Sheets: 26 GA (.022-.026) Galvalume, Chem-treated, oil lite, minimum spangle. Segments shall be 16" wide at the base, taping toward top, a stiffening flange shall be roll formed on each edge, forming a weatherproof roof structure.

Roof sheets shall be a Galvalume corrosion resistant sheet, continuously hot dipped coated with an aluminum zinc alloy, offering a substantial increase in corrosion resistance over G 90 galvanized sheet. It can be readily formed, welded or soldered. Conforms to ASTM A-792 A-792 AZ 50 coating.

K. Rib Sections: Stiffening ribs, 26 GA (.022-.026) Galvalume, chem treated, oil lite, minimum spangle, ASTM A-792 AZ. 90 coating (Two segments shall be roll formed, fastened into a completed unit, riveted every 12" forming an interlocking type cross section.)

Note: Roof Panels & Rib Sections shall be secured on the outside of the dome skirt to prevent water from entering the Dome Roof Structure, as all interlocking joints are on the outside on the dome skirt.

L. Fasteners: Typically all fasteners on the dome shall be 18 - 8 Series - stainless steel; satisfying all requirements of ASAB 182 -1960; MS 35308 or MS 35311.

M. Framing: 14 GA (.0747) galvanized steel, G-90, Commercial Quality, Grade B or equal, roll formed, additional reinforcing shall be provided in areas where extra wind or snow loading may occur.

N. Caulking Compound: Perm-E-Lastic Glazing Compound shall be used along the viewing aperture framing.

O. Shutter Track: 12 GA (.1046) galvanized steel, G-90, Commercial Quality, Grade B, Minimum Spangle, Extra Smooth, 10" formed, Conforms to ASTM A 569.

P. Shutter Sections: Shall be the optional Type '8' is a two-section Etyle with the lower short door section designed to hinge forward level with the Horizon. Providing the observer an unobstructed clear viewing aperture from the Horizon to approx. 105 degrees at any one time. The lower dropout door section shall be electrically operated on Model 'R' observatory dome units.

Q. Contactor Bars: A set of electrical contactors shall be fitted into the observatory dome skirt. A set of brush contacts shall then provide power to the shutter drive system, allowing operation of the shutter drive system without the need to connect and disconnect electrical power when turning the dome in azimuth.

R. Shutter Motor: Shall be a standard single speed in line gear motor with reversing capability, 1/4hp, 115 V, 60 cycles, 1 phase, CSA Certified: 42492. Limit switches shutoff the shutter drive motor when the shutter reaches the

extreme open or closed positions. All upper shutter sections are driven with an electric motor with a positive rack and gear device. A disconnect between the motor switch and power shall be furnished on the standard.

S. Azimuth Drive: One speed, capacitor start, end mounted motor with reversing capability. 1/4 hp, 115V, 60 cycle, 1 phase, NEMA 56 C face. The motor shall be mounted to a C-56 face right angle speed reducer 6:1 reduction (standard). The drive shall be a positive drive rack and gear system. The furnished motor and gear reduction mount shall be suitable for any adjustment and alignment. An electric motor having a C-56 face can be adapted.

Note: All electrical motor and gearbox data shall be furnished with the observatory dome unit. The motors shall be guaranteed for a period of one year after the completion of the observatory dome on the job site.

T. Weather Seals: Weather stripping, black color (contact adhesive is used to secure weather seal along viewing aperture). All necessary clearances shall be sealed with a sponge type neoprene weather seal to effectively keep out severe amounts of rain, dust and snow.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Install observatory dome in accordance with approved shop drawings and the manufacturer's printed instructions. The Electrical Contractor shall provide positive lightening ground for observatory dome. (See electrical specifications and drawings)

B. It is the Contractor's option to install the observatory dome under the direct supervision of the manufacturer's qualified representatives.

C. The wall plate must be set and secured level plain. Cedar leveling shims provided with observatory shall be used for this purpose.

D. Finish electrical shall be by Electrical Contractor. Electrical equipment shall be thoroughly tested in accordance with manufacturer's instructions during and after assembly of the observatory dome unit. The electrical subcontractors must complete any local codes or 'finish' electrical requirements.

E. Motor Control: Unless otherwise specified, all electric motors shall be controlled with UL listed NEMA switches.

F. Thoroughly Testing: The finished observatory dome unit shall be completely fabricated and tested in accordance with the manufacturer's printed testing procedures.

END OF SECTION

SECTION 260501 – BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections apply to this section.

1.2 SUMMARY

A. This Section includes the following:

1. Sleeves, seals, and plates.
2. Cutting and patching for electrical construction.
3. Touchup painting.
4. Provisions for Access.
5. Quality Control.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction and marked for intended use.

B. Comply with NFPA 70.

PART 2 PRODUCTS

2.1 TOUCHUP PAINT

A. For Equipment: Equipment manufacturer's paint selected to match installed equipment finish.

B. Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

2.3 SLEEVES/SEALS/PLATES

A. Sleeve Inside diameters: Before ordering, fabricating, or installing these sleeves, the Contractor shall determine the required inside diameter of each individual sleeve, and shall provide each sleeve accordingly. The actual inside diameter of each sleeve shall be as required to accommodate the conduit entering or passing through the sleeve, and to assure the watertight installation of the seal specified below. Sleeves shall be flush 22 gauge galvanized steel.

B. Seals: For conduit sleeves, seals shall be *Link-Seal,* as manufactured by Cooper/Crouse-Hinds, Thunderline Corporation, or an approved equal. Seals shall be modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the conduit and the sleeve, with zinc phosphate plated carbon steel bolts, nuts, and pressure plates. Links shall be loosely assembled with bolts to form a continuous rubber belt around the conduit, with a pressure plate under each bolt head and each nut. After the seal assembly is properly positioned in the sleeve, tightening of the bolts shall cause the rubber sealing elements to expand and provide a strictly watertight seal between the pipe and the sleeve. Each seal assembly shall be sized as recommended by the manufacturer to fit the conduit and sleeve involved.

C. Sleeves shall be provided for the installation of conduit, etc. The sleeves shall be carefully located in advance of the construction of walls and floors where new construction is involved. Provide all cutting and patching necessary to set sleeves which are not placed prior to construction.

D. Sleeves shall be provided for all conduit, etc. passing through concrete, masonry, construction. Caulk the annular space of sleeves with an elastic fire-resistant caulking compound to make the installation fire, air and water-tight. Provide raceway penetration system equivalent to ProSet Systems System "A" for steel pipe to provide vertical and horizontal support through rated floors and walls in addition to a nominal 2-hour fire rating.

E. Fasten sleeves securely in the construction so that they will not become displaced when concrete is poured or when other construction is built around them. Take precautions to prevent concrete, plaster, or other materials being forced into space between conduit, etc., and sleeve during construction.

F. Sleeves required in existing concrete or masonry walls shall be set and secured with mortar grout and fast drying bitumastic sealant.

G. Seal all the openings between conduit, etc., and corresponding sleeves to prevent sound transmission and to maintain fire rating at all sleeves where objectionable noise can be transmitted: at all smoke barriers: at all walls above ceilings that extend to underside of the structure of floor above, or at fire-rated separations. Use UL approved resilient sealant for penetration seals. Submit method of sealing for approval. Where watertight sleeves are indicated or required to suit the installation, provide *Link-Seal* rubber seals, as manufactured by Thunderline Corporation, or approved equal, between pipe and sleeves.

H. Where conduit motion due to expansion and contraction will occur, make sleeves of sufficient diameter to permit free movement of conduit. Check construction to determine proper length for various locations; make actual lengths.

I. All raceways passing through walls, ceilings, floor and partitions exposed to view shall be provided with approved escutcheons. Sleeves penetrating through rated walls and floors shall be caulked with a fire-proof caulking material so as to not compromise the fire rating.

PART 3 EXECUTION

3.1 CUTTING AND PATCHING

A. Accomplish cutting and patching necessary for the installation of work under Division

26. Damage resulting from this work to other work already in place shall be repaired at the Contractor's expense. Where cutting is required, perform the work in a neat and workmanlike manner. Restore disturbed work to match and blend with existing, using materials compatible with the original. Use mechanics skilled in the particular trades required.

B. Do not cut structural members.

C. All cutting of walls, floors, roofs, ceilings and/or partitions, handholes for the passage of conduits. etc., and closing up of superfluous openings around them in connection with the work under this Contract, including the removal of all debris caused thereby, shall be performed.

D. All cutting, patching, and finishing shall be performed by the trade responsible for the type to work to be done in accordance with the requirements of the respective division of the Specifications and shall conform to adjacent work, subject to the approval of the Engineer.

E. Where fireproofing and waterproofing has been removed or damaged in the execution of the work, the Contractor shall have such damage repaired by the respective trades working in the building.

F. Any work already in place that has been disturbed in the execution of the work shall be repaired and restored in harmony with the surrounding work.

G. Provide responsibility for selecting and making all penetrations.

H. All cutting and patching shall conform to the General Conditions. Cutting of walls or floor shall not be done without the written approval of the Owner's Representative.

I. All holes for raceways shall be drilled one-inch larger than the size of the pipe. Space between raceway and hole shall be sealed with grout for masonry work and caulked for dry wall work. Fire ratings shall not be compromised.

3.2 PROVISIONS FOR ACCESS:

A. Provide access panels and doors for all concealed equipment, splice boxes, junction boxes, remote ballasts, disconnects, motor starters, control devices, and other devices requiring maintenance, service, adjustment, manual operation, or as otherwise required by Code.

B. Where access doors are necessary, furnish and install manufactured steel door assemblies consisting of hinged door, key locks (keyed alike), and frame designed for the particular wall or ceiling construction. Access doors shall be set in frames with countersunk screws and shall have cylinder locks. All locks shall have one Master Key. Properly locate each door. Door size shall be a minimum of 24-inch x 24-inch. Provide UL approved and labeled access doors where installed in fire rated walls or ceilings. Doors shall be Milcor Metal Access Doors as manufactured by Inland-Ryerson, or approved equal.

1. Acoustical or Cement Plaster: Style B

2. Hard Finish Plaster: Style K or L

3. Masonry, Ceramic Tile, or Dry Wall: Style M (Stainless Steel).

4. Fire-rated where occurring in fire-rated walls.

C Where access is by means of lift-out ceiling tiles or panels, mark each panel using small color-coded or numbered tabs. Provide a chart or index for identification. Provide chart in O&M Manual. Screw markers on ceiling grid.

D. Access panels, doors, etc. described herein shall be furnished under the section of specifications providing the particular service to be turned over to the pertinent trade for installation. Coordinate installation with all trades.

E. Electrical equipment shall be installed so that working clearances in front of the electrical equipment which is likely to require examination, adjustment, servicing, or maintenance while energized, shall be as required by the NEC.

F. In occupied spaces, provide finished access units of the maximum concealment type, including locks where appropriate, and matching other access units provided in the same expanse of finish (for non-electrical access, if any).

G. Scope: The scope of access units to be furnished or provided as electrical work includes those units indicated on the electrical drawings or specified in Division 26 sections, and those additional units required for adequate access to electrical work and not shown or specified individually.

H. Access Doors: Standard welded steel Construction, 16 gauge frames and 14 gauge door panels, 175-degree concealed spring hinges, rust-inhibitive prime coat, flush cam lock (for screw-driver operation where keyed lock is not required), recessed to receive applied finish where applicable, 5-pin/disk tumbler lock where indicated.

I. Removable Access Plates: Where only hand access is sufficient, provide removable plate-type access unit, of minimum size which will facilitate the required access. Provide units of the type, style, design, material and finish appropriate for the location and exposure in each instance. In exposed surfaces of occupied spaces, provide round plate units, flush floor units, and frameless low-profile wall units, primed for paint where installed in painted surfaces and polished chrome or stainless steel finish in other surfaces.

J. Provide access doors in walls and inaccessible ceilings for concealed electrical equipment and all other concealed electrical specialties and appliances that require manual operation or maintenance.

K. Submit shop drawings indicating the proposed location of all access panels/doors. Access doors in finished spaces shall be coordinated with air devices, lighting and sprinklers to provide a neat and symmetrical appearance.

3.6 FIELD QUALITY CONTROL

A. Inspect installed components for damage and faulty work, including the following:

1. Raceways.

2. Building wire and connectors.

3. Supporting devices for electrical components.

4. Electrical identification.

5. Concrete bases.

6. Electrical demolition.

7. Cutting and patching for electrical construction.

8. Touchup painting.

3.7 REFINISHING AND TOUCHUP PAINTING

A. Provide protective finishes on all materials and equipment. Use coated or corrosion-resistant materials, hardware and fittings throughout the work. Paint bare, untreated ferrous surfaces with rust-inhibiting paint. All exterior components including supports, hangers, nuts, bolts, washers, vibration isolators, etc., shall be galvanized or stainless steel.

B. Clean surfaces prior to application of coatings, paint, or other finishes.

C. Provide factory-applied finishes where specified. Unless otherwise indicated factory-applied paints shall be baked enamel with proper pre-treatment.

D. Protect all finishes and restore any finishes damaged as a result of work under Division 26 to their original condition.

E. The preceding requirements apply to all work, whether exposed or concealed.

F. Remove all construction marking and writing from exposed equipment, conduit, and building surfaces. Do not paint manufacturer's labels or tags.

G. All exposed conduit, etc. in public spaces shall be painted. Colors shall be selected by the Architect and conform to ANSI Standards.

3.8 CLEANING AND PROTECTION

A. On completion of installation, including outlets, fittings, and devices, inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.

B. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

C. Replace all damaged ceiling tiles.

D. Clean all ceiling tiles soiled during construction. Marks, fingerprints, and other soiling of the ceiling tiles shall be cleaned.

END OF SECTION 260501

SECTION 260519 - CONDUCTORS AND CABLES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections apply to this Section.

1.2 SUMMARY

A. This Section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

1.3 SUBMITTALS

A. Field Test Reports: Indicate and interpret test results for compliance with performance requirements. Indicate procedures and values obtained.

B. Submit Product Data: Provide for each cable assembly type, wire, cables, conductors, and connectors.

C. Submit factory test reports. Indicate procedures and values obtained.

D. Submit manufacturer's installation instructions. Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements.

E. Project Record Documents: Record actual locations of components and circuits.

1.4 QUALITY ASSURANCE

A. Listing and Labeling: Provide wires and cables specified in this Section that are listed and labeled.

1. The Terms *Listed and Labeled:* As defined in NFPA 70, Article 100.

2. Listing and Labeling Agency Qualifications: A *Nationally Recognized Testing Laboratory* as defined in OSHA Regulation 1910.7.

B. Comply with NEMA/Insulated Cable Engineers Association (ICEA) Standards.

C. Comply with NECA Standard of Installation.

D. Comply with NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

E. American Society for Testing and Materials (ASTM): Comply with requirements of the following:

1. Bl: Standard Specification for Hard-Drawn Copper Wire

2. B2: Standard Specification for Medium-Hard-Drawn Copper Wire

3. B3: Standard Specification for Soft or Annealed Copper Wire

4. D753: Standard Specification for General Purpose Polychloroprene Jacket for Wire and Cable

5. [B230 Standard Specification for Aluminum Wire, 1350-h19 for Electrical Purposes.]

6. [B498 Standard Specification for Zinc-Coated Steel Core Wire for Aluminum Conductors, Steel Reinforced.]

7. B800 Standard Specification for 8000 Series Aluminum Alloy Wire for Electrical Purposes.

8. B836 Standard Specification for Compact Round Stranded Aluminum Conductors Using Single Input Wire Construction.

F. Electrical Testing Laboratories (ETL): Provide wiring, cabling and connector products which are ETL listed and labeled.

G. Institute of Electrical and Electronics Engineers (IEEE): Comply with the following standards which apply to wiring systems:

1. 82: Test procedure for Impulse Voltage Tests on Insulated Conductors

2. 241: Recommended Practice for Electric Power Systems in Commercial Buildings

H. NFPA: Comply with NFPA 70 requirements for construction, installation and color coding of electrical wire, cable and connections.

I. National Electrical Manufacturer's Association (NEMA): Comply with requirements of the following:

1. WC3: Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy

2. WC5: Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy

J. UL: Provide material conforming to the following standards:

1. UL 83 - Thermoplastic-Insulated Wires and Cables.

2. UL 486A - Wire Connectors and Soldering Lugs for Use with Copper Conductors.

K. UL Labels: Provide wiring, cabling and connector products which are UL listed and labeled.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver wires and cables according to NEMA WC 26, *Wire and Cable Packaging.*

B. Storage: Store wire and cable in a clean dry space in original containers. Protect products from weather, damaging fumes, construction debris and traffic.

C. Handling: Handle wire and cable carefully to avoid abrading, puncturing and tearing wire and cable insulation and sheathing. Ensure that dielectric resistance integrity of wires/cables is maintained.

1.6 COORDINATION

A. Contractor to furnish and install all labor and material for the installation of the conduits, raceways, outlet boxes, backboxes, and sleeves for the communication systems.

B. Coordinate conduit raceways, outlet boxes, backboxes, and sleeves with the Communication Contractor.

C. Install direct burial fiber cable, telephone cable and outside plant cable in conduit/ductbanks.

These cables will be supplied by and installation supervised by the Communication Contractor.

D. Coordinate layout and installation of cables with other installations.

E. Revise locations and elevations from those indicated, as required to suit field conditions and as approved by Engineer.

F. Determine required separation between cables and other work.

G. Determine cable routing to avoid interference with other work.

1.7 PROJECT CONDITIONS

A. Verify that field measurements are as shown on the Drawings.

B. Conductor sizes are based on copper.

C. Wire and cable routing shown on Drawings is approximate unless dimensioned. Route wire and cable as required to meet Project Conditions.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Wires and Cables:

a. American Insulated Wire Corp.; Leviton Manufacturing Co.

b. BICC Brand-Rex Company.

c. Carol Cable Co., Inc.

d. Senator Wire & Cable Company.

e. Southwire Company.

f. Colonial Wire Company

2. Connectors and Accessories for Wires and Cables:

a. AMP Incorporated.

b. Buchanan.

c. General Signal; O-Z/Gedney Unit.

d. Monogram Company; AFC.

e. NSI Industries, Inc.

f. Square D Company; Anderson.

g. 3M Company; Electrical Products Division.

2.2 BUILDING WIRES AND CABLES

A. UL-listed building wires and cables with conductor material, insulation type, cable construction, and rating as specified in Part 3 Article *"Wire and Insulation Applications"*.

B. Rubber Insulation Material: Comply with NEMA WC 3.

C. Thermoplastic Insulation Material: Comply with NEMA WC 5.

D. Cross-Linked Polyethylene Insulation Material: Comply with NEMA WC 7.

E. Ethylene Propylene Rubber Insulation Material: Comply with NEMA WC 8.

F. Conductor Material: Copper.

G. Stranding: Solid conductor for No. 10 AWG and smaller; stranded conductor for larger than No. 10 AWG.

H. Conductor: Single conductor annealed copper type.

I. Insulation Voltage Rating: 600 Volts.

J. Conductivity: Minimum of 98 percent at 20 degrees C (68 degrees F) or maximum resistivity of 1.7 micro-ohms per centimeter.

2.3 CONNECTORS AND SPLICES

A. UL-listed, factory-fabricated wiring connectors of size, ampacity rating, material, type, and class for application and service indicated. Comply with Project's installation requirements and as specified in Part 3 Article, *"Wire and Insulation Applications"*.

B. Split Bolt Connectors: [Not acceptable.] [Blackburn Type H Model] [Blackburn Type HPS Model].

C. Push-in wire connectors: Not acceptable.

D. Spring Wire Connectors: Solderless spring type pressure connector with insulating covers for copper wire splices and taps. Use for conductor sizes 10 AWG and smaller.

E. Wire Nut Connectors:

1. Wire nuts installed in wet locations, exterior, etc., shall be self-contained, waterproof and corrosion-proof units incorporating prefilled silicone grease to block out moisture and air.

2. Connectors shall be UL listed and appropriately sized according to manufacturer's recommendation for the suitable wire sizes and voltage rating (600 volt minimum).

3. Connector body shall have a color-coded outer shell.

4. Connectors shall be as manufactured by Ideal, 3M, or approved equal.

2.4 INSULATING TAPE, PUTTY, RESIN AND SUPPORTS

A. Tape: Provide plastic electrical insulating tape which is flame-retardant, cold and weather-resistant. Tape for use in areas subject to temperatures 30 degrees C to 105 degrees C, or where the tape will be subjected to an oil splash, tape shall have a minimum thickness of 8.5 mils, and shall consist of an oil-resistant acrylic adhesive.

B. Materials: Provide all insulating materials for splices and connections such as glass and synthetic tapes, putties, resins, splice cases, or compositions of the type approved for the particular use, location, voltage and temperature and apply and install in an approved

manner, all in accordance with the manufacturer's recommendations.

C. Supports: Provide cable supports of the wedge type which firmly clamp each individual cable and tighten due to the cable weight.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine raceways and building finishes to receive wires and cables for compliance with requirements for installation tolerances and other conditions affecting performance of wires and cables. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. By beginning work, the Contractor has accepted conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the Owner.

3.2 PREPARATION

Completely and thoroughly swab raceway before installing wire.

3.3 WIRE AND INSULATION APPLICATIONS

A. Building wire, unless otherwise indicated shall be 600 volt, Type THWN **For THHN]** for #8 AWG wire and smaller, and Type THWN or THW for #6 AWG wire and larger for interior use, and Type THWN or THW insulation for underground or exterior installations outside building installation. Conductors shall be sized and run as indicated. Conductors shall be soft drawn copper of not less than 98 percent conductivity.

B. No branch circuit wires smaller than #12 AWG shall be used unless otherwise indicated. Conductors shall be continuous from outlet to outlet and from terminal board to point of final connection, and no splice shall be made except within outlet or junction boxes. All conductors shall be of the size indicated. All wires #8 AWG and larger shall be stranded.

C. A color coding system, as listed below, shall be used throughout the building's network of feeders and circuits and used as a basis of balancing the load. The following color coding shall be used unless an existing system has used a different color code. If this situation occurs obtain approvals prior to installation. Selection shall be based on applicable work covered by this Contract.

System	Color				
	Phase A	Phase B	Phase C	Neutral	Ground
208Y/120V	Black	Red	Blue	White	Green
[4801]/277V	Brown	Orange	Yellow	Gray	Green

1. Wiring in sizes up to #8 AWG shall have colored insulation. Wiring in sizes #6 AWG and larger shall be coded by colored tape for 6 inches of insulation on both ends of conductor. The wiring shall be tagged at terminations, in pull boxes, junction boxes, outlet boxes, panelboards,

handholes, etc...

2. Switch leg wire shall be labeled with *"S"* tag.

D. All control wiring shall be color coded with wires of colors different from those used to designate phase wires.

E. Wiring for general 15 and 20 amp 120 volt branch circuit work shall be as follows unless otherwise indicated.

HOME RUN LENGTH AND WIRE SIZE			CIRCUIT LENGTH AND WIRE SIZE		
120 Volt			120 Volt		
0 — 60 '	-	#12	0-100'	-	#12
60 — 100 '	-	#10	100 &Up	-	#10
100' & Up	-	#8			

G. Circuit length as given above shall be the wire length between the first and last outlet on the circuit. Home run length as given above shall be the wire length between the first outlet and the panelboard. In accordance with the above, where the size of branch circuit conductors is increased by the minimum required by the NEC for the branch circuit rating, ensure that the termination provisions of all equipment connected to such circuits are listed as suitable for the conductor sizes involved.

H. Joints of #10 AWG and smaller shall be made with properly insulated solderless type pressure connectors. Where stranded conductors or multiple solid conductors are connected to terminals, solderless lugs manufactured by Thomas and Betts Company or equivalent shall be used.

I. Branch circuits for lighting and power concealed in ceilings and drywall partitions may be accomplished by utilizing type MC (metal clad) cable. Cables shall be supported with appropriate hangers. Tie wire will not be accepted.

3.4 INSTALLATION

A. Install wires and cables as indicated, according to manufacturer's written instructions and NECA's *Standard of Installation.*

B. Remove existing wires from raceway before pulling in new wires and cables.

C. Pull Conductors: Use a UL-listed and manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway. Completely and thoroughly swab conduit system before installing conductors.

E. Install exposed cables, parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

F. Support cables according to Division 26 Section, *Common Work Results for Electrical* and Division 26, Section, *Hangers and Supports.*

G. Seal around cables penetrating fire-rated elements according to Division 7, Section, *Penetration Firestopping* and Division 26 Section, *Electrical Firestopping.*

H. Identify wires and cables according to Division 26 Section, *Electrical Identification.*

I. Conductors installed in parallel shall be of equal lengths.

J. Wiring at Outlets: Install with at least 12 inches (300 mm) of slack conductor at each outlet.

K. Connect outlets and components to wiring and to ground as indicated and instructed by manufacturer. Tighten connectors and terminals, including screws and bolts, according to equipment manufacturer's published torque-tightening values for equipment connectors. Where manufacturer's requirements are not indicated, tighten connectors and terminals according to tightening torques specified in UL Standard 486A.

L. The Contractor shall provide suitable installation equipment to prevent cutting and abrasion of conductor insulation. The Contractor shall use suitable cable guides, pulleys, and protective sleeving to prevent damage to cable during installation. Ropes used for pulling of wire and cable shall be made of polyethylene or other suitable non-metallic material. Pulling lines shall be attached to cable by means of either woven basket grips or pulling types attached directly to the conductors. Wire pulling lubricants, if used, shall conform to UL requirements applicable to the various insulations and raceway materials. The lubricants shall be certified by the manufacturer to be non-injurious to such insulation and materials.

M. Each feeder cable shall be labeled at terminals and at all accessible points in equipment and in pull boxes. Each control wire shall be labeled at both ends. Labels shall be self-sticking wire markers.

N. Riser cables shall have cable supports as required by Code.

0. For rubber and plastic-covered wire and cable, pulling compound Ideal Yellow 77 may be used.

R. Each circuit serving dedicated receptacle(s) identified on the drawings as isolated ground type shall have a separate green equipment grounding conductor which shall be connected to backboxes, metal raceway, etc., and a separate green and yellow striped isolated ground conductor connected to the panel isolated ground bus and to the receptacle's separate isolation grounding terminal.

S. Install electrical cables, wires, and connectors as indicated in compliance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation", and in accordance with recognized industry practices.

T. Coordinate cable and wire installation work with electrical raceway and equipment installation work, as necessary for proper interface.

U. Conductors installed in runs within 6 inches of heating pipes or equipment shall be type AVA. No conductors shall be drawn into conduit until all work, which may cause cable damage, is completed.

V. During installation, do not deform cable by improper bending, stretching, twisting, kinking, or pinching, nor do any other abusive handling. Any failure to observe these instructions will be detected and corrected during the demonstrations following completion of the installation. All cable runs shall contain *S* loops or other means to accommodate expansion or contraction as required. Cable bends will have a radius not less than the value recommended by the cable manufacturer. Cable connected to electronic equipment in the system shall be tagged to show its function and the location of its other end. All labels shall be of durable material and securely fastened to the cable.

W. Wiring of different system voltages shall not be mixed at pull boxes enclosures, surface metal raceway, wiretrough, etc., unless a barrier (separator) is provided between the differing systems.

3.5 CONNECTIONS

A. Conductor Splices: Keep to minimum.

B. Install splices and taps that possess equivalent or better mechanical strength and insulation ratings than conductors being spliced.

C. Use splice and taps connectors compatible with conductor material.

D. Use oxide inhibitor in each splice and tap connector for aluminum conductors.

E. Connect outlets and components to wiring and to ground as indicated and instructed by manufacturer.

F. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

G. Wire splices and taps shall be adequate to carry full current rating of wire.

H. Splices and taps in wires up to #8 AWG shall be made with *Scotch-lok* or T&B PT Series or Ideal Wing Nut insulated electrical connectors. Wire nuts installed in wet location boxes shall be silicon gel-filled. For wires #8 AWG and larger, use copper solderless connectors covered with insulating molded body and then wrapped with electrical tape. Use twist-on wire connectors for connecting lighting fixtures and small motor leads up to #8 AWG wire.

I. Conductors shall be continuous from outlet to outlet, and no splices shall be made except within outlet or junction boxes. Junction boxes may be utilized where required. Wire connectors of insulating material or solderless pressure connections, properly taped, shall be utilized for all splices in wiring.

J. Splices in branch circuits and feeders shall be made where indicated or as required for the installation. All splices shall be accessible and made in enclosure approved for that purpose.

K. For splices in branch circuits and feeders, provide connectors as follows;

1. Wire Sizes #14 AWG to #10 AWG: Provide Ideal Model 74B or 76B or equivalent by T&B.
2. Wire Sizes #8 AWG and Larger: Provide Ideal Model Series AGP-/[Size]/and GT-/[Size]/ or equivalent by Burndy, O-Z, or T&B.
3. All splices shall be enclosed in insulating molded thermoplastic, rubber, or rubberlike covers or shall be wrapped with Bishop No. 111 or equivalent insulating tape in accordance with the Manufacturer's directions.

L. Thoroughly clean wiring prior to installing lugs or connectors.

3.6 IDENTIFICATION

A. Interface with Other Work:

1. Identify wire and cable using Thomas and Betts Type WM vinyl markers.

2. Identify each phase and neutral conductor with its circuit number or other designation indicated on the Drawings in all junction, pull, terminal boxes, and cabinets.

B. Provide identification tags on each conductor entering panel, switch, junction box, and pull box to identify conductor.

C. Comply with the requirements of Division 16 Section, *Electrical Identification.*

D. Feeder Identification: Securely fasten nonferrous identifying tags or pressure-sensitive labels to all cables, feeders, and power circuits in pull boxes, handholes, panelboards, and at termination of cables.

1. Tags or labels shall be stamped or printed to correspond with markings on Contract Drawings or marked so that feeder or cable may be readily identified.

2. If suspended type tags are provided, they shall be attached by approximately 55-pound test monofilament line or slip-free plastic cable lacing units.

3.7 FIELD QUALITY CONTROL

A. Testing: On installation of wires and cables and before electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

1. Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.3.1. Certify compliance with test parameters.

B. Correct malfunctioning conductors and cables at Project site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.

C. Measure tightness of bolted connections and compare torque measurements with manufacturer's recommended values.

D. Verify continuity of each branch circuit conductor.

E. Tests: All wire and cable feeders and Branch Circuit insulation shall be tested after installation, and before connection to fixtures and appliance.

1. Tests shall be performed with a 500-volt megger, and conductors shall test free from short-circuits and grounds.

2. Conductors shall be tested phase-to-phase and phase-to-ground.

3. Furnish the instruments, materials, and labor required. Perform the tests in the presence of the Contracting Officer.

4. Actual test readings shall be recorded.

5. Submit all test reports to the Engineer for approval.

F. Demonstration: Subsequent to wire and cable hook-ups, energize circuit and demonstrate functioning in accordance with requirements. Where necessary, correct malfunctioning units, and then retest to demonstrate compliance.

END OF SECTION 260519

SECTION 260526 - GROUNDING AND BONDING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes grounding of electrical systems and equipment and basic requirements for grounding for protection of life, equipment, circuits, and systems. Grounding requirements specified in this Section may be supplemented in other Sections of these Specifications.

B. Bond together system neutrals; service equipment enclosures; exposed non-current carrying metal parts of electrical equipment; metal raceway systems; grounding conductor in raceways; receptacle ground connectors; and plumbing systems.

1.3 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data for grounding rods, conductors, connectors and connection materials, and grounding fittings. Submit ground system manufacturer's recommended installation procedure for review.

C. Qualification data for firms and persons specified in *Quality Assurance* Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.4 QUALITY ASSURANCE

A. Comply with NFPA 70 - National Electrical Code.

B. Comply with UL 467 - UL Standard for Safety Grounding and Bonding Equipment.

C. Comply with ANSI/EEE C2 - National Electrical Safety Code.

D. Comply with ANSI/IEEE 32 - Requirements, terms and test procedures for neutral grounding devices.

E. Comply with IEEE Standard 142 - Recommended Practice for Grounding of Industrial and Commercial Power Systems.

F. Comply with ANSI C33.8.

G. Listing and Labeling: Provide products specified in this Section that are listed and labeled.

1. The Terms *Listed* and *Labeled:* As defined in the National Electrical Code, Article 100.

2. Listing and Labeling Agency Qualifications: A *Nationally Recognized Testing Laboratory* (NRTL) as defined in OSHA Regulation 1910.7.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Erico Inc.; Electrical Products Group.

2. Heary Brothers Lightning Protection Co.

3. Ideal Industries, Inc.

4. ILSCO.

5. O-Z/Gedney Co.

6. Raco, Inc.

7. Thomas & Betts, Electrical.

2.2 GROUNDING AND BONDING PRODUCTS

A. Governing Requirements: Where types, sizes, ratings, and quantities indicated are in excess of National Electrical Code (NEC) requirements, the more stringent requirements and the greater size, rating, and quantity indications govern.

2.3 WIRE AND CABLE GROUNDING CONDUCTORS

A. Comply with Division 26 Section, *Conductors and Cables.* Conform to NEC Table 8, except as otherwise indicated, for conductor properties, including stranding.

B. Equipment Grounding Conductors: Insulated with green color insulation, size as indicated on the Drawings, or as required by 2008 National Electrical Code (NEC) Table 250-122, whichever is larger.

C. Grounding-Electrode Conductors: Stranded cable. Size as indicated on the Drawings, in the Specifications, or as required by 2008 National Electrical Code (NEC) Table 250-66, whichever is larger.

D. Underground Conductors: Bare, tinned, stranded, #4/0 AWG size minimum, except as otherwise indicated.

E. Bare Copper Conductors: Conform to the following:

1. Solid Conductors: ASTM B 3.

2. Assembly of Stranded Conductors: ASTM B 8.

3. Tinned Conductors: ASTM B 33.

2.4 MISCELLANEOUS CONDUCTORS

A. Grounding Bus: Bare, annealed-copper bars of rectangular cross section, minimum size 1/4-inch x 2-inch.

B. Braided Bonding Jumpers: Copper tape, braided No. 30 AWG bare copper wire, terminated with copper ferrules.

C. Bonding Straps: Soft copper, 0.05 inch (1 mm) thick and 2 inches (50 mm) wide, unless otherwise indicated.

2.5 CONNECTOR PRODUCTS

A. Mechanical Connectors

1. The mechanical connector bodies shall be manufactured from high strength, high conductivity cast copper alloy material. Bolts, nuts, washers and lockwashers shall be made of silicon bronze and supplied as a part of the connector body and shall be of the two-bolt type.

2. Split bolt connector types are NOT allowed unless indicated on the Drawings.

3. The connectors shall meet or exceed UL 467 and be clearly marked with the catalog number, conductor size and manufacturer.

B. Compression Connectors

1. The compression connectors shall be manufactured from pure wrought copper. The conductivity of this material shall be no less than 99 percent by IACS Standards.

2. The connectors shall meet or exceed the performance requirements of IEEE 837, latest revision.

3. The installation of the connectors shall be made with a compression, tool and die system, as recommended by the manufacturer of the connectors.

4. The connectors shall be clearly marked with the manufacturer, catalog number, conductor size and the required compression tool settings.

5. Each connector shall be factory filled with an oxide-inhibiting compound.

C. Exothermic Connections: Provide exothermic-weld kit selected per manufacturer's written instructions for specific types, sizes, and combinations of conductors and connected items.

PART 3 EXECUTION

3.1 APPLICATION

A. Equipment Grounding Conductors: Comply with NEC Article 250 for types, sizes, and quantities of equipment grounding conductors, except where specific types, larger sizes, or more conductors than required by NEC are indicated.

1. Install Equipment Grounding Conductor (EGC) with circuit conductors for the items below in addition to those required by Code:

a. Lighting circuits.

b. Receptacle circuits.

c. Single-phase motor or appliance branch circuits.

3.2 INSTALLATION

A. General: Ground electrical systems and equipment according to NEC requirements, except where Drawings or Specifications exceed NEC requirements.

B. Grounding Conductors: Route along the shortest and straightest paths possible, except as otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

C. Grounding shall satisfy requirements of the applicable publications. All exposed noncurrent-carrying metallic parts of electrical equipment, metallic raceway systems, grounding conductor in nonmetallic raceways, and grounded conductors of the wiring system shall be grounded.

D. Equipment grounding conductors shall be extended from the ground bus in the distribution equipment to the receptacle, fixture or device lugs where they are provided. When not provided, they shall be connected to equipment enclosures. The connections shall be arranged such that removal of receptacle, the equipment ground conductors, or ground jumpers from ground busing, shall not affect the system ground.

E Raceways shall not be considered as a grounding conductor. Each power, lighting, or control raceway shall have a separate equipment grounding conductor installed. Receptacles shall have a separate grounding pole. All switchgear and bus duct shall be equipped with a grounding bus separate from the neutral bus.

3.3 CONNECTIONS

A. General: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to assure high conductivity and to make contact points closer in order of galvanic series.

2. Make connections with clean, bare metal at points of contact.

3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.

4. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.

5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

B. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections. Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.

C. Equipment Grounding-Wire Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.

D. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. Where these requirements are not available, use those specified in UL 486A and UL 486B.

E. Moisture Protection: Where insulated grounding conductors are connected to grounding rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

3.4 FIELD QUALITY CONTROL

A. Tests: Subject the completed grounding system to a megger test at each location where a maximum ground-resistance level is specified and at service disconnect enclosure grounding terminal, and at ground test wells. Measure ground resistance not less than 2 full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests by the 2-point method according to IEEE 81.

B. Maximum grounding to resistance values are as follows:

1. Equipment Rated 500 kVA and Less: 10 ohms.

2. Equipment Rated 500 to 1000 kVA: 5 ohms.

3. Equipment Rated More than 1000 kVA: 3 ohms.

4. Unfenced Substations and Pad-Mounted Equipment: 5 ohms.

5. Manhole Grounds: 10 ohms.

C. Excessive Ground Resistance: Where resistance to ground exceeds specified values, notify Owner promptly and include recommendations to reduce ground resistance and to accomplish recommended work.

D. Report: Prepare test reports, certified by the testing organization, of ground resistance at each test location. Include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results. Submit all tests to the Engineer for approval.

3.5 ADJUSTING AND CLEANING

A. Restore surface features, including vegetation, at areas disturbed by work of this Section. Reestablish original grades, except as otherwise indicated. Where sod has been removed, replace it as soon as possible after backfilling is completed. Restore areas disturbed by trenching, storing of dirt, cable laying, and other activities to their original condition. Include top soiling, fertilizing, liming, seeding, sodding, sprigging, and mulching. Maintain restored surfaces. Restore disturbed paving as indicated.

3.6 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations of grounding electrodes and all primary grounding locations (i.e., water piping connection, building steel, test wells, etc.).

END OF SECTION 260526

SECTION 260529 - HANGERS AND SUPPORTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Requirements of the following Division 26 Sections apply to this Section:

Division 26 Section, "Common Work Results for Electrical".

1.2 SUMMARY

A. This Section includes secure support from the building structure for electrical items by means of hangers, supports, anchors, sleeves, inserts, seals, and associated fastenings.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 5 Section, "Metal Fabrications" - for requirements for miscellaneous metal items involved in supports and fastenings.

2. Division 7 Section, "Penetration Firestopping" - for requirements for firestopping at sleeves through walls and floors that are fire barriers.

3. Refer to other Division 26 Sections for additional specific support requirements that may be applicable to specific items.

C. Provide equipment supports consisting of platforms, curbs, concrete pads, gratings, cradles, structural members, hangers, rods, racks, and incidental materials.

D. Provide all labor, supervision, and fabrication. Design and construct supporting structures of strength to safely withstand stresses to which they may be subjected and to properly distribute the load and impact over building areas. Provide all engineering and fabrication as required for installation of support system.

E. Provide hangers, clamps, anchors, inserts, supports, supplementary steel framing, and hardware of the proper size and load capacity to support electrical equipment and raceways, whether indicated on the drawings or not.

1.3 SUBMITTALS

A. General: Submit the following in accordance with conditions of Contract and Division I Specification Sections.

B. Product data for each type of product specified.

C. Submit for review, shop/assembly drawings and layout drawings of curbs and equipment supports for major items of equipment.

D. Submit structural calculations for approval. Calculations include stress and deflection analysis. Submit design criteria and selection calculation.

E. Supporting devices and fastening methods shall be subject to the review and approval of the Structural Engineer.

1.4 QUALITY ASSURANCE

A. Electrical Component Standard: Components and installation shall comply with NFPA 70 *National Electrical Code.*

B. Electrical components shall be listed and labeled by UL, ETL, CSA, or other approved, nationally recognized testing and listing agency that provides third-party Certification follow-up services.

C. Installation Standard: Installation shall meet or exceed the National Electrical Contractors Association (NECA) Standard of Installation.

D. Manufacturer's Qualifications:

1. The Manufacturer shall not have had less than ten years' experience in manufacturing Strut Support Systems.

2. The Manufacturer must certify in writing all components supplied have been produced in accordance with an established quality assurance program.

E. Installer's Qualifications:

1. Installer must be a factory-trained manufacturer's authorized representative/installer with not less than five year’s experience in the installation of Strut Support Systems of this size and conformation.

2. All Strut Support System components must be supplied by a single manufacturer.

F. Standards:

1. Work shall meet the requirements of the following standards:

a. Federal, State and Local Codes.

b. American Iron and Steel Institute (AISI) Specification for the Design of Cold-Formed Steel Structural Members - August 19, 1986 Edition, December 1, 1989 Addendum.

c. American Society for Testing and Materials (ASTM).

d. Underwriters Laboratories (UL).

e. National Electrical Code (NEC).

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. All material is to be delivered to the work site in original factory packaging to avoid damage to the finish.

B. Upon delivery to the work site, all components shall be protected from the elements by a shelter or other covering.

1.6 GUARANTEE

A. Separate guarantees shall be issued from the erector and manufacturer, valid for a period of one year against any defects that may arise from the installation or manufacture of the Strut Support System components.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

1. Slotted Metal Angle and U-Channel Systems:

a. American Electric, Kindorf

b. Alstrut

c. Unistrut Diversified Products

d. Power-Strut

e. Thomas & Betts

2. Conduit Sealing Bushings and Accessories:

a. Bridgeport Fittings, Inc.

b. GS Metals Corporation

c. O-Z/Gedney

d. Raco, Inc.

2.2 COATINGS

A. Coating: Supports, support hardware, and fasteners shall be protected with zinc coating or with treatment of equivalent corrosion-resistance using approved alternative treatment, finish, or inherent material characteristic. All products shall be hot-dip galvanized.

2.3 MANUFACTURED SUPPORTING DEVICES

A. Raceway Supports: Clevis hangers, riser clamps, conduit straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring steel clamps.

B. Fasteners: Types, materials, and construction features, as follows:

1. Expansion Anchors - Carbon steel wedge or sleeve type.

2. Toggle Bolts - All steel springhead type.

3. Power-Driven Threaded Studs - Heat-treated steel, designed specifically for the intended application.

C. Conduit Sealing Bushings: Factory-fabricated watertight conduit sealing bushing assemblies suitable for sealing around conduit, or tubing passing through concrete floors and walls. Construct seals with steel sleeve, malleable iron body, neoprene sealing grommets or rings, metal pressure rings, pressure clamps, and cap screws.

D. Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for non-armored electrical cables in riser conduits. Provide plugs with number and size of conductor gripping holes as required to suit individual risers. Construct body of malleable-iron casting with hot-dip galvanized finish.

E. U-Channel Systems: Sixteen-gauge channels with 9/16-inch-diameter holes at a minimum of eight inches on center in top surface. Provide fittings and accessories that mate and match with U-channel and are of the same manufacturer.

F. Floor-Mounted Stands: Construct with structural steel members or steel pipe and fasten with flanges bolted to the floor.

G. Ceiling Suspended Platforms: Construct with steel hangers. Brace and fasten to building structure.

H. Wall-Mounted Platforms: Construct with steel brackets.

2.4 ANCHOR METHODS

A. Hollow Masonry: Toggle bolts or plastic conical type expansion anchors.

B. Solid Masonry: Lead expansion anchors or preset inserts.

C. Metal Surfaces: Machine screws, bolts, or welded studs.

D. Wood Surfaces: Wood screws.

E. Concrete Surfaces: Self-drilling anchors or power-driven studs (non-seismic zones) (Female wedge, stud wedge, or undercut drill-in bolt anchors seismic zones).

PART 3 EXECUTION

3.1 EXAMINATION

A. The installer shall inspect the work area prior to installation. If work area conditions are unsatisfactory, installation shall not proceed until satisfactory corrections are completed.

3.2 INSTALLATION

A. Installation shall be accomplished by a fully trained manufacturer-authorized installer.

B. Set Strut System components into final position true to line, level and plumb, in accordance with approved Shop Drawings.

C. Anchor material firmly in place. Tighten all connections to their recommended torques.

D. Install supporting devices to fasten electrical components securely and permanently in accordance with NEC requirements.

E. Coordinate with the building structural system and with other electrical installation.

F. Raceway Supports: Comply with the NEC and the following requirements:

1. Conform to manufacturer's recommendations for selection and installation of supports.

2. Strength of each support shall be adequate to carry present and future load multiplied by a safety factor of at least four. Where this determination results in a safety allowance of less than 200 pounds, provide additional strength until there is a minimum of 200 pounds safety allowance in the strength of each support.

3. Install individual and multiple (trapeze) raceway hangers and riser clamps as necessary to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assembly and for securing hanger rods and conduits.

4. Support parallel runs of horizontal raceways together on trapeze-type hangers.

5. Support individual horizontal raceways by separate pipe hangers. Spring steel fasteners may be used in lieu of hangers only for 1-1/2-inch and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings only. For hanger rods with spring steel fasteners, use 1/4-inch-diameter or larger threaded steel. Use spring steel fasteners that are specifically designed for supporting single conduits or tubing.

6. Space supports for raceways in accordance with NFPA-70.

7. Support exposed and concealed raceway within one foot of an unsupported box and access fittings. In horizontal runs, support at the box and access fittings may be omitted where box or access fittings are independently supported and raceway terminations are not made with chase nipples or threadless box connectors.

8. In vertical runs, arrange support so the load produced by the weight of the raceway and the enclosed conductors is carried entirely by the conduit supports with no weight load on raceway terminations.

G. Miscellaneous Supports: Support miscellaneous electrical components as required to produce the same structural safety factors as specified for raceway supports. Install metal channel racks for mounting disconnects, light fixtures, and other devices.

H. In open overhead spaces, cast boxes threaded to raceways need not be supported separately except where used for fixture support; support sheet metal boxes directly from the building structure or by bar hangers. Where bar hangers are used, attach the bar to the raceways on opposite sides of the box and support the raceway with an approved type of fastener not more than 24 inches from the box.

I. Sleeves: Install in concrete slabs and walls and all other fire-rated walls for raceways and cable installations. For sleeves through fire rated-wall construction, apply UL-listed firestopping sealant in gaps between sleeves and enclosed conduits and cables in accordance with "Fire Resistant Joint Sealers" requirement of Division 7 Section, "Joint Sealers".

J. Conduit Seals: Install water tight seals for conduit penetrations of slabs on grade and exterior walls below grade and where indicated. Tighten sleeve seal screws until sealing grommets have expanded to form watertight seal.

K. Fastening: Unless otherwise indicated, fasten electrical items and their supporting hardware securely to the building structure, including, but not limited to conduits, raceways, boxes, disconnect switches, and control components in accordance with the following:

1. Fasten by means of toggle bolts on hollow masonry units, concrete inserts or expansion bolts on concrete or solid masonry, and machine screws, welded threaded studs, or spring-tension clamps on steel. Threaded studs driven by a powder charge and provided with lock washers and nuts may be used instead of expansion bolts and machine screws. Do not weld conduit, pipe straps, or items other than threaded studs to steel structures.

2. Holes cut to depth of more than 1-1/2 inches in reinforced concrete beams or to depth of more than 3/4-inch in concrete shall not cut the main reinforcing bars. Fill holes that are not used.

3. Ensure that the load applied to any fastener does not exceed 25 percent of the proof test load. Use vibration-and shock-resistant fasteners for attachments to concrete slabs.

4. Concrete (Existing): Double-plated expander type anchors. Phillips, Hilti, or approved equivalent. Loads shall not exceed 1/4 of tested pullout (or shear) strength.

L. Tests: Test pull-out resistance of one of each type, size, and anchorage material for the following fastener types:

1. Expansion anchors.

2. Toggle bolts.

3. Power-driven threaded studs.

M. Provide all jacks, jigs, fixtures, and calibrated indicating scales required for reliable testing. Obtain the structural Engineer's approval before transmitting loads to the structure. Test to 90 percent of rated proof load for fastener. If fastening fails test, revise all similar fastener installations and retest until satisfactory results are achieved.

N. General Supporting Installations:

1. Provide appropriate concrete anchors for hanger rods. Rods shall be screwed into or extended through frame construction (with washer and nut). Supports shall secure conduit in place, and shall prevent vibration, provide for expansion and contraction and shall make neat appearance. Strap hangers or chains are not permitted.

2. Electrical raceways (conduit and EMT) 1-1/2-inches and smaller shall be secured with 1-hole malleable iron straps or brackets to walls. Trapeze supports shall be used for groups or parallel raceways with raceways secured to trapeze with approved clamps. Individual runs of raceways 2-inches and larger shall be supported by Clevis type hangers.

3. Provide all steel supports including roof curbs for all equipment provided under this Section.

4. Electrical raceway supports to be spaced on the following maximum centers:

a. [Y2-inch] [3/4-inch] to 1-inch conduit - 8 feet

b. [1-1/4-inch and larger - 10 feet]

5. Provide additional hangers or steel members to distribute the load among two or more structural members when required or directed.

6. Drilling of new concrete slabs will not be permitted. Anchors and inserts shall be cast in the concrete slabs.

0. Locations:

1. Anchor bolts, sleeves, inserts, hangers, and supports required for the electrical

work shall be furnished and installed under Division 26.

2. Coordinate with other trades the location of anchors, sleeves, inserts, and supports and insure that they are properly installed.

3. Openings and sleeves shall be set true to line, level, plumb, and position and shall be so maintained during construction. Where sleeves and openings are provided in poured concrete, inspect same during and after concrete is poured to insure proper position and correct any deviation.

P. Hangers and Supports:

1. Provide hangers, angles, channels, and other supports required by field conditions to install items of electrical equipment. Design of supports and methods of fastening to building structure shall be acceptable to the Owner.

2. Use of power-actuated fasteners and devices is permitted in the vertical surfaces of the building only with the following requirements.

   a. For fastening conduits 1-1/2-inch and smaller and lighting fixtures 50 lbs or less.

   b. Load capacity per manufacturer’s recommendations.

   c. Fasteners shall be located in the thickest part of the slab.

   d. Devices shall comply with OSHA requirements.

3. Use of lead shield expansion anchors is not permitted.

4. No electrical items shall rest on, or depend for support on suspended ceiling media (tiles, lath, plaster, splines, etc.).

5. In suspended ceilings, support conduits directly from structural slabs, decks (or framing members). Do not support conduits on ceiling suspension members.

6. Support surface or pendant lighting fixtures:

   a. From an outlet box by means of an interposed metal strap, where weight is less than 5 lbs.

   b. From an outlet box by means of a hickey or other direct threaded connection, where weight is from 5 to 50 lbs.

   c. Directly from structural slab, deck or framing member, where weight exceeds 50 lbs.

7. In addition to the above, provide cushioned, swivel type hangers with appropriate outlet boxes for pendant fixtures in mechanical areas. Such hangers shall have a support rating at least twice that of the load supported.

8. Provide weight-distribution facilities, where required so as not to exceed the load bearing capabilities of floor or walls that bear the weight of, or support, electrical items.

9. For point-of-attachment weight of 100 lbs. or less, fasten items as follows:

   a. On wood, use wood screws.

   b. On concrete and solid masonry that is already in place, use self-drilling concrete anchors or expansion bolt and couplings.

   c. On hollow construction, use toggle bolts.

   d. On structural steel, use beam clamps.

10. For point-of-attachment weights from 100 lbs. to 300 lbs., provide supports as follows:

    a. At cast-in-place concrete slabs, use concrete inserts in bottom of slab, with 8" slip-through steel rods set transverse to the reinforcing steel.

    b. At concrete slab already in place, uses 16-inches x 8-inches x $^{1}/_{2}$-inch steel plates at the top of the slab, with through-bolts welded in place. The plates shall be chased in and grouted flush, where no fill is to be applied.

11. For point-of-attachment weights over 300 lbs., provide supports as follows: At cast-in-place concrete slabs, uses 16-inch x 8-inch x$^{1}/_{2}$-inch steel plate, with through bolts welded in place. Top of the plate shall be 1-1/2-inches below the top of the slab, or on top of the slab where a fill slab is to be installed.

12. Hangers and supports shall be hot dipped galvanized, unless noted otherwise.

13. Equipment shall not be held in place by its own dead weight. Provide base anchor fasteners in each case.

14. Trapeze type hangers may be used where several conduits are to be installed at the same elevation. The spacing of such trapeze hangers shall be in accordance with the NEC for the smallest conduit in the run.

15. Vertical conduits shall be supported by heavy wrought iron clamps or collars anchored to construction at each floor.

Q. Inserts:

1. Inserts for suspended items in poured concrete construction shall be malleable-iron concrete inserts, adjustable type with insert nut.

2. Items manufactured by Barrett, Crawford, Elcen, or Grinnell shall be used where applicable.

3. Inserts for surface-mounted items shall be suitable for the composition of the slab, wall, or structure on which installation is to be made.

TABLE 1: SPACING FOR RACEWAY SUPPORTS			
Raceway Size (Inches)	No. of Conductors in Run	Location	EMT (Ft.)
		HORIZONTAL RUNS	
1/2, ¾	1 or 2	Flat ceiling or wall.	5
1/2, ¾	1 or 2	Where it is difficult to provide supports except at intervals fixed by the building construction.	7
1/2, ¾	3 or more	Any location.	7
1/2 – 1	3 or more	Any location.	
1 & larger	1 or 2	Flat ceiling or wall.	6
1 & larger	1 or more	Where it is difficult to provide supports except at intervals fixed by the building construction.	10
1 & larger	3 or more	Any location.	10
Any	---	Concealed.	10
		VERTICAL RUNS	
1/2, ¾	---	Exposed.	7
1, 1-1/4	---	Exposed.	8
1-1/2 & larger	---	Exposed.	10
Up to 2	---	Shaftway.	10
2-1/2	---	Shaftway.	10
3 & larger	---	Shaftway.	10
Any	---	Concealed.	10
Abbreviations:	EMT	Electrical Metallic Tubing	

3.3 CLEANUP

A. Upon completion of this section of work, remove all protective wraps and debris. Repair any damage due to installation of this section of work.

3.4 PROTECTION

A. During installation, protect this work from damage.

B. Upon completion of this scope of work, it shall become the responsibility of the General Contractor to protect this work from damage during the remainder of construction on the project and until substantial completion.

END OF SECTION 260529

SECTION 260533 - RACEWAY AND BOXES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections apply to this Section.

1.2 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1. Raceways include the following:

a. EMT.

b. ENT.

c. FMC.

d. IMC.

e. LFMC.

f. LFNC.

g. PVC.

h. PVC externally coated, IMC.

i. PVC externally coated, rigid steel conduits.

j. RGS.

k. RMC.

1. Surface raceways.

m. Wireways.

2. Boxes, enclosures, and cabinets include the following:

a. Device boxes.

b. Floor boxes.

c. Outlet boxes.

d. Pull and junction boxes.

e. Cabinets and hinged-cover enclosures.

3. Miscellaneous Products include the following:

a. Expansion/Deflection fittings.

b. Bushings.

B. Related Sections include the following:

1. Division 26 Section, "Electrical Firestopping"

2. Division 26 Section, "Hangers and Supports" for raceways and box supports.

3. Division 26 Section, "Wiring Devices" for devices installed in boxes and for floor-box service fittings.

1.3 DEFINITIONS

A. EMT: Electrical Metallic Tubing.

B. ENT: Electrical Nonmetallic Tubing.

C. FMC: Flexible Metal Conduit.

D. IMC: Intermediate Metal Conduit.

E. LFMC: Liquidtight Flexible Metal Conduit.

F. LFNC: Liquidtight Flexible Nonmetallic Conduit.

G. PVC: Rigid Polyvinyl Chloride Conduit.

H. RGS: Rigid Galvanized Steel Conduit.

I. RMC: Rigid Metal Conduit.

J. RNC: Rigid Nonmetallic Conduit.

1.4 SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: Include layout drawings showing components and wiring for nonstandard boxes, enclosures, and cabinets.

1.5 QUALITY ASSURANCE

A. Listing and Labeling: Provide raceways and boxes specified in this Section that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100

2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.

B. Comply with NECA's "Standard of Installation" and NECA 101 "Recommended Practice for Installing Steel Conduits".

C. Comply with NFPA 70.

1.6 COORDINATION

A. Contractor to furnish and install all labor and material for the installation of the conduits, raceways, outlet boxes, backboxes, and sleeves for the communication systems.

B. Coordinate conduit raceways, outlet boxes, backboxes, and sleeves with the Communication Contractor.

C. Coordinate layout and installation of raceways and boxes with other construction elements to ensure adequate headroom, working clearance, and access.

D. Verify routing and termination locations of conduits and boxes prior to rough-in.

E. Conduit routing shown on Drawings is only approximate and diagrammatic. Route conduits as required for a complete conduit and wiring system.

F. Coordinate installation of outlet boxes, mounting heights, orientation, and locations of outlets.

G. It is the Electrical Contractor's responsibility to provide the following:

1. All labor and material for the installation of conduits, raceways, sleeves, etc., with pull cords at locations indicated on the drawings.

2. Coordinate with Technology Contractor for locations of all conduits, penetrations and sleeves for all systems within that section.

3. Installation of the Communication System cables by the Electrical Contractor is not and will not be acceptable (except: direct burial fibers and telephone cabling and outside plant cable in conduit/ductbank). These cables to be supplied by and the installation supervised by the Technology Contractor.

1.7 PROJECT RECORD DOCUMENTS:

Accurately record routing of all concealed conduits and cables. Record actual routing of all exposed conduits/larger than 1 inch. Indicate actual locations and mounting heights of outlet boxes, pull and junction boxes, branch circuits, arrangements, etc.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Metal Conduit and Tubing:

a. Allied Tube & Conduit Corporation.

b. Anamet, Inc.; Anaconda Metal Hose.

c. AFC/Monogram Company.

d. Carol Cable Co., Inc.

e. Cole-Flex Corp.

f. Electri-Flex Co.

g. Flexcon, Inc.; Coleman Cable Systems, Inc.

h. Grinnell Co.; Allied Tube and Conduit Div.

i. Monogram Co.; AFC.

j Spiraduct, Inc.

k. Triangle PWC, Inc.

1. Wheatland Tube Co.

2. Nonmetallic Conduit and Tubing:

a. Anamet, Inc.; Anaconda Metal Hose.

b. Arnco Corp.

c. Breeze-Illinois, Inc.

d. Cantex Industries; Harsco Corp.

e. Certainteed Corp.; Pipe & Plastics Group.

f. Cole-Flex Corp.

g. Condux International; Electrical Products.

h. Electri-Flex Co.

i. George-Ingraham Corp.

j. Hubbell, Inc.; Raco, Inc.

k. Lamson & Sessions; Carlon Electrical Products.

l. R&G Sloan Manufacturing Co., Inc.

m. Spiraduct, Inc.

n. Thomas & Betts Corp. I

3. Conduit Bodies and Fittings:

a. American Electric; Construction Materials Group.

b. Crouse-Hinds; Div. of Cooper Industries.

c. Emerson Electric Co.; Appleton Electric Co.

d. Hubbell, Inc.; Killark Electric Manufacturing Co.

e. Lamson & Sessions; Carlon Electrical Products.

f. O-ZlGedney; Unit of General Signal.

g. Scott Fetzer Co.; Adalet-PLM.

h. Spring City Electrical Manufacturing Co.

i. Thomas & Betts Corporation.

4. Metal Wireways:

a. Hoffman Engineering Co.

b. Keystone/Rees, Inc.

c. Square D Co.

5. Surface Nonmetallic Raceways:

   a. Anixter Brothers, Inc.

   b. Butler Manufacturing Co.; Walker Division.

   c. Hubbell, Inc.; Wiring Device Division.

   d. JBC Enterprises, Inc.; Enduro Fiberglass Systems.

   e. Lamson & Sessions; Carlon Electrical Products.

   f. Panduit Corp.

   g. Thermotools Co.

   h. United Telecom; Premier Telecom Products, Inc.

   i. Wiremold Co.

6. Boxes, Enclosures, and Cabinets:

   a. American Electric; FL Industries.

   b. Butler Manufacturing Co.; Walker Division.

   c. Crouse-Hinds; Div. of Cooper Industries.

   d. Electric Panelboard Co., Inc.

   e. Erickson Electrical Equipment Co.

   f. Hoffman Engineering Co.; Federal-Hoffman, Inc.

   g. Hubbell Inc.; Killark Electric Manufacturing Co.

   h. Hubbell Inc.; Raco, Inc.

   i. Lamson & Sessions; Carlon Electrical Products.

   j. O-Z/Gedney; Unit of General Signal.

   k. Parker Electrical Manufacturing Co.

   1. Robroy Industries, Inc.; Electrical Division.

   m. Scott Fetzer Co.; Adalet-PLM.

   n. Spring City Electrical Manufacturing Co.

o. Thomas & Betts Corp.

p. Woodhead Industries, Inc.; Daniel Woodhead Co.

2.2 METAL CONDUIT AND TUBING

A. Rigid Galvanized Steel Conduit: ANSI C80.1 and UL 6.

B. IMC: ANSI C80.6.

C. Plastic-Coated Steel Conduit and Fittings: NEMA RN 1.

D. Plastic-Coated IMC and Fittings: NEMA RN 1.

E. EMT and Fittings: ANSI C80.3, galvanized tubing.

1. Fittings: Compression type, NEMA FB1.

F. FMC: Zinc-coated steel.

G. LFMC: Flexible steel conduit with PVC jacket.

H. Fittings: NEMA FB 1; compatible with conduit/tubing materials.

2.3 SURFACE RACEWAYS

A. Surface Metal Raceways: Galvanized steel with snap-on covers. Finish with manufacturer's standard prime coating.

B. Types, sizes, and channels as indicated and required for each application, with fittings that match and mate with raceways.]

2.4 OUTLET AND DEVICE BOXES

A. Sheet Metal Boxes: NEMA OS I, galvanized flat-rolled sheet steel.

B. Cast-Metal Boxes: NEMA FB I. Type FD, cast box, deep type, with gasketed cover, and threaded hubs.

C. Outlet Box Accessories: Provide outlet box accessories as required for each installation, including corrosion-resistant screws, mounting brackets, wallboard hangers, extension rings, fixture studs, cable clamps, and metal straps for supporting outlet boxes which are compatible with outlet boxes being used and fulfilling requirements of individual wiring situations.

D. Nonmetallic: NEMA 0S2.

2.5 PULL AND JUNCTION BOXES

A. Small Sheet Metal Boxes: NEMA OS 1.

B. Sheet metal boxes over 12" in any dimension shall comply with the requirements of this Section, Article "Enclosures and Cabinets", of this Section.

C. Boxes for Outdoor and Wet Locations: Flat flanged, surface-mounted, UL listed as raintight, galvanized cast iron box and cover with neoprene gasket and stainless steel cover screws.

2.6 EXPANSION / DEFLECTION FITTINGS

A. Provide an expansion/deflection fitting in each concealed or exposed electrical run crossing a building expansion joint. Fittings shall be complete with bronze end couplings, neoprene sleeves, tinned copper braid integral bonding jumper and stainless steel bands. Expansion/deflection fittings shall be suitable for the size and type of conduit run they connect. Bonding jumper shall comply with NEC and UL requirements.

B. Expansion/deflection fitting shall accommodate the following movements without collapsing or fracturing the conduit and damaging the wires it contains:

1. Axial expansion or contraction up to 3/4-inch.

2. Angular misalignment of the axes of the conduits up to 30 degrees in all directions.

3. Parallel misalignment of the axes of the conduits up to 3/4-inch in all directions.

C. Expansion/Deflection fitting shall be OZ/Gedney Type "DX" or approved equal by Crouse Hinds (Type XD).

2.7 BUSHINGS

A. Bushings for 1-inch conduit and smaller shall be self-extinguishing thermoplastic type - 150°C temperature rating.

B. Bushings for 1-1/4" conduit and larger shall be malleable iron body with 150 degrees C insulating ring. Insulating material shall be locked in place and non-removable.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine surfaces to receive raceways, boxes, enclosures, and cabinets for compliance with installation tolerances and other conditions affecting performance of raceway installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 RACEWAY REQUIREMENTS

A. Conduit:

Application	Conduit Type	Remarks
In or under concrete slab	RGS	
Exposed exterior locations.	RGS	Use threaded or rain-tight fittings.
Wet interior locations.	RGS	Use threaded or rain-tight fittings.
Exposed dry interior locations up to 7'-0" AFF.	RGS	
Exposed dry interior locations above 7'-0" AFF.	EMT	
Exterior Underground	RNC (Sched. 40 PVC)	RGS Elbows/Sweeps
Equipment connections in dry interior locations.	FMC (e.g. Greenfield)	Short lengths only (maximum 6 feet).
Equipment connections in wet interior locations.	LFMC (e.g. Sealtite)	Short lengths only (maximum 6 feet). Use threaded or rain-tight
Equipment connections in exterior locations.	LFMC (e.g Sealtite)	Short lengths only (maximum 6 feet). Use threaded or rain-tight
Concealed in dry wall construction.	EMT, IMC, RGS [, **MC**	
Concealed above suspended ceilings.	EMT, IMC, RGS [, **MC**	
Concealed in masonry walls.	EMT	

1. Provide hot-dip Rigid Galvanized Steel Conduit (RGS), galvanized intermediate Metal Conduit (IMC) or galvanized Electrical Metallic Tubing (EMT) for concealed work above suspended ceilings and within interior partitions and for exposed interior work above 7'-0". Maximum EMT size permitted is two inches.

2. Provide Liquidtight Flexible Metal Conduit (LFMC), e.g. Sealtite, in short length (maximum 6 feet) for the connection of exterior equipment, motors and equipment in damp or wet locations as defined in Division 26 Section "Common Work Results for Electrical".

7. Aluminum conduit is prohibited.

8. Where indicated on the drawings, Rigid Non-metallic Conduit may be used as permitted in Article 347 of the NEC, with or without concrete encasement. Where rigid non-metallic conduit is exposed, it shall be Schedule 40 PVC, with all provisions for thermal expansion/contraction as recommended by the Manufacturer.

9. All steel conduits from outside terminations to service entrance equipment shall be painted with two heavy coats of asphaltum.

10. Conduits shall slope from entrance equipment toward outside of building.

B. Fittings:

1. All fittings to match conduit material and to be suitable for the purpose intended. Join conduit with fittings designed and approved for the purpose and make joints tight.

2. Provide UL listed compound filled sealing fittings for NEC-required locations, for conduits passing from interior to exterior, and at the interface of widely different space temperatures such as refrigeration or cold storage rooms where conduits pass from warm locations to cool locations, such as the boundaries of air conditioned spaces and non-conditioned air spaces. For concealed conduits, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces.

3. Provide expansion fittings with bonding jumpers where conduits cross expansion joints or where otherwise required to compensate for thermal expansion and contraction. Provide expansion fittings in each straight uninterrupted run of surface-mounted conduit, both horizontal and vertical, in excess of 200 feet. Distance between fittings shall not exceed 200 linear feet. The Contractor shall refer to the Architectural Drawings for expansion joint locations.

4. Fasten rigid steel conduit with threaded galvanized steel fittings, double locknuts. and insulated bushings. Insulated bushings shall be OZ/Gedney type "B", or equal.

5. Fasten EMT conduit with "Concretight" or "Raintight" compression fittings made from galvanized steel or malleable iron. Fittings using set screw or indentations as a means of attachment or made from cast "white metal" are prohibited. All connectors shall have insulated throats.

6. Fasten liquid-tight conduit with fittings incorporating a threaded ferrule, nylon sealing ring, and steel or malleable iron compression nut and body. Furnish Crouse Hinds metallic liquid-tight fittings, or equal.

7. Fasten Flexible Metallic Conduit (FMC) with Thomas & Betts (T&B) "Tite-Bite" insulated connectors, or equal.

8. Watertight fittings shall use a copper base anti-corrosive conductive compound. Provide watertight fittings in conduits exposed to weather, in wet locations, in underground locations, and in slabs.

C. Box Locations:

1. Electrical boxes shall accommodate wire pulling, splices, taps, equipment connections and Code compliance.

2. Coordinate access doors as required to provide access to boxes in hard ceilings and similar inaccessible areas.

D. Outlet Boxes:

1. Outlet boxes for concealed work shall be zinc-coated or cadmium-plated sheet steel boxes suitable for the service and type outlet. Boxes and conduit fittings for outdoor and exposed work shall be NEMA 4 cast-aluminum, cast steel or cast iron type with threaded hubs for conduit entrance. Boxes and conduit fittings for outdoor work shall have gasketed cover plates. Extra large boxes shall be provided in accordance with the National Electrical Code where necessary to prevent crowding of wire in the box. Plastic boxes and cast "white metal" boxes classified as NEMA 4 will not be acceptable shall be used only in areas designated on the drawings.

2. Outlet boxes in unplastered brick or block walls shall be provided with deep square-cut device covers. They shall be set so that the brick or block can be cut and fitted closely to the cover opening and so that the standard wall plate will cover the joint between the brick or block and the box.

3. All boxes, whether outlet, junction, pull, or equipment, shall be furnished with appropriate covers.

4. No sectionalized boxes shall be used.

5. Back-to-back outlet boxes are not permitted. Separate boxes a minimum of 6" in standard walls and a minimum of 2 feet in acoustical walls.

6. Provide knockout closures for unused openings.

7. Provide blank coverplates on all unused boxes.

8. For multiple device installations, provide multi-gang boxes. Sectional boxes are not permitted. Provide barrier separation of different voltage conductors in the same box.

9. Thoroughly coordinate mounting heights of boxes.

10. Provide recessed outlet boxes in finished areas, supported from interior partition studs. Supports are to be stamped steel stud bridges for hollow stud walls and

adjustable steel channel fasteners for flush ceiling outlet boxes.

11. Provide back supports for boxes in metal stud walls.

E. Junction and Pull Boxes:

1. Junction and pull boxes shall be furnished and installed as shown or where required to facilitate pulling of wires or cables. Such boxes shall be installed in accessible locations. All boxes for concealed work shall be constructed of 12 gauge USS galvanized sheet steel minimum, unless otherwise specified or indicated and provided with mounting brackets and flat screw covers secured in position by round head brass or stainless steel 300 grade machine screws. Boxes for exterior work shall be cast aluminum or galvanized cast iron type with threaded hubs unless otherwise directed. Gasketed cover plates shall be furnished for outdoor installation. Provide barrier (separators) where different system voltages share the same box.

2. Wherever possible, locate pull and junction boxes above accessible ceilings in finished areas.

3. Pull or junction boxes shall be supported independently of conduit.

4. In flush grade outdoor applications, unit shall be adequately supported against settling or tipping. Where heavy traffic or poor soil compaction exists, cast box in a concrete base which provides 6" of cover around and under the box.

3.3 INSTALLATION

A. Install raceways. boxes, enclosures, and cabinets as indicated, according to manufacturer's written instructions.

B. Furnish and install a separate and independent raceway system as shown on the Drawings for each of the various wiring systems including, but not limited to, the following:

Lighting
Power 120/208 volt

1. All raceway systems shall be completely wired as specified herein, shown on drawings and/or required for satisfactory operation of the various systems.

2. Raceways, generally, shall be concealed conduit as specified herein. Where wiring troughs are required or used to facilitate the wiring installation, they shall be equal to Square D Company's Square-Duct and fittings, with hinged cover arranged for total removal, all finished in baked enamel and all components U/L listed. The gutters shall be of ample size to accommodate conductors therein and as required by the NEC.

3. Support all conduit not embedded in concrete or masonry such that strain is not transmitted to outlet boxes and pull/junction boxes, etc. Supports to be sufficiently rigid to prevent distortion of conduits during wire pulling.

C. Minimum Raceway Size: 3/4-inch trade size (DN21).

D. Conceal conduit and EMT, unless otherwise indicated, within finished walls, ceilings, and floors.

E. Electrical Metallic Tubing (EMT) shall be used for the following unless otherwise indicated:

1. Branch circuits for lighting, receptacles, and power concealed in:

a. Dry wall construction.

b. Suspended ceilings.

c. Masonry walls.

2. Exposed in equipment room areas above 7'-0" above finished floors and as needed to serve fixed equipment.

3. Circuits for communication and signaling concealed in:

a. Dry wall construction.

b. Suspended ceilings.

F. Electric Non-metallic Tubing (ENT) may be used for circuits for communication and fire alarm in dry wall construction.

G. Rigid Galvanized Steel Conduit (RGS) shall be used for the following, unless otherwise indicated:

1. Branch circuits and feeders for lighting, receptacle and power, installed exposed up to 7'-0" above finished floor in areas subject to physical damage.

H. Conduit shall be run concealed wherever possible, within walls, ceilings, or floors, unless otherwise indicated or specified. Where exposed conduits runs are shown or required, they shall be run parallel to building construction and shall be suitably supported at required intervals.

I. Conduit may be run exposed in Mechanical Equipment rooms, Electrical rooms, and where necessary in Storage rooms and unfinished areas. Where conduit is run exposed, it shall be run as close as possible to walls and ceilings and shall not interfere with equipment, ductwork and piping.

J. Keep raceways at least 12 inches (300 mm) away from parallel runs of flues, steam or hot-water pipes and other hot surfaces above 77 degrees F. Install horizontal raceway runs above water and steam piping.

K. Install raceways level and square and at proper elevations. Provide adequate headroom.

L. Complete raceway installation before starting conductor installation.

M. Support raceways as specified in Division 16 Section, *Hangers and Supports.* Arrange supports to prevent misalignment during wiring installation.

N. Use capped bushings or "push-penny" plugs to prevent foreign matter from entering the conduit system during construction. Clean and plug or cap all conduits left empty for future use.

O. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portion of bends is not visible above the finished slab. Conduit stub-ups and stub-downs shall be arranged in a neat and orderly manner and shall emerge at right angles to floors or ceilings.

P. Make bends and offsets so the inside diameter is not reduced. Keep legs of bends in the same plane and straight legs of offsets parallel, unless otherwise indicated.

Q. Use raceway fittings compatible with raceways and suitable for use and location. For intermediate steel conduit, use threaded rigid steel conduit fittings, unless otherwise indicated.

R. Run concealed raceways, with a minimum of bends, in the shortest practical distance considering the type of building construction and obstructions, unless otherwise indicated.

S. Conduits larger than 1-1/4" may be installed in concrete floor slabs only with the specific permission of the Engineer, or as specifically indicated on the drawings, all in accordance with the above limitation.

T. Conduits in close proximity to each other at panelboards, etc., shall be located and wrapped with wire mesh to prevent cracking of slab.

U. Transition non-metallic tubing to rigid steel conduit before rising above the floor.

V. Install exposed raceways parallel to or at right angles to nearby surfaces or structural members, and follow the surface contours as much as practical.

X. Run parallel or banked raceways together, on common supports where practical.

Y. Make bends in parallel or banked runs from same centerline to make bends parallel. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.

Z. Join raceways with fittings designed and approved for the purpose and make joints tight.

1. Make raceway terminations tight. Use bonding bushings or wedges at connections subject to vibration. Use bonding jumpers where joints cannot be

made tight.

2. Use insulating bushings to protect conductors.

AA. Tighten set screws of threadless fittings with suitable tools.

BB. Install pull wires in empty raceways. Use No. 14 AWG zinc-coated steel or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of the pull wire.

CC. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with the finished floor. Extend conductors to equipment with rigid steel conduit; FMC may be used 6 inches (150 mm) above the floor. Install screwdriver-operated, threaded flush plugs flush with floor for future equipment connections.

DD. Lubricants for pulling wires shall be approved for use with the types of wire and conduit installed.

EE. Use conduit hubs or sealing lock nuts to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.

FF. Install no more than equivalent of three 90° bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Use factory elbows for bends in metal conduit larger than 2 inches (50 mm) in size.

GG. Avoid moisture traps; provide junction box with drain fittings at low points in conduit system.

HH. Die-cast fittings of pot metal will not be accepted.

II. Do not install aluminum conduit embedded in or in contact with concrete.

JJ. Conduits shall be free of any burrs, foreign objects, and water prior to conduit installation.

KK. Conduit placed against concrete or masonry above ground shall be fastened to the concrete or masonry with pipe straps or one screw clamp attached to the concrete by means of expansion screw anchors and screws. "Caddy Clip" type hangers or straps will be permitted only in non-exposed areas and restricted to $^{1}/2$ " to 3/4" conduit.

LL. Where conduits turn up out of concrete slabs and are not concealed by wall construction, bends shall be carefully made so that no portion of the radius is above the floor.

MM. Rigid conduit or electrical metallic tubing shall not be strapped or fastened to equipment subject to vibration or mounted on shock-absorbing bases.

NN. Conduit shall be installed in such manner as to insure against the collection of trapped condensation, and runs of conduit shall be without traps wherever possible. Drill 1/8" diameter weep hole where necessary.

OO. Conduits run to and from cabinets shall be run neatly, in accurate manner and shall emerge from the floors and ceilings at right angles thereto.

PP. Conduit risers shall be rigidly supported on the building structure, using appropriate supports only.

QQ. In equipment spaces, such as fan rooms, plenums, attics etc., conduits and outlets may be exposed, but shall avoid interference with ventilating ducts, piping, etc.

RR. Exposed conduit installed adjacent to ventilating ducts shall be installed after the ducts are in place, and shall be run from ceiling or wall junction boxes in such manner as to retain accessibility to junction box covers and to permit future removal or replacement of ducts.

SS. Conduits and other electrical items shall not be fastened to or supported from ventilating ducts but shall be separately supported. The method of supporting and details of the supporting members shall be reviewed by the Owner's Representative. In no case shall screws penetrate the sheet metal of the ducts.

TT. Exposed conduit run on surface shall be supported according to Code and within three feet of each outlet, junction box, or cabinet, by galvanized malleable conduit clamps and clamp backs. Suspended conduits shall be supported every five feet by conduit hangers and round rods, or where two or more conduits are run parallel, by trapeze hangers suitably braced to prevent swaying.

UU. Screws for all exposed work shall be stainless steel, unless otherwise noted.

VV. Cadmium-plated steel screws may be used for interior dry locations only.

WW. No running threads shall be cut or used.

XX. Conduits which are installed at this time and left empty for future use and which are five feet or more in length, including all telephone and communication conduits shall have a nonferrous, 600 lb. tensile strength drag line left in place for future use. All empty conduits including conduit stubs shall be tagged at all exposed ends with tags identifying the location of the end of the conduit.

3.4 FLEXIBLE CONNECTIONS

A. Use maximum of six (6) feet (1830 mm) of UL Listed Flexible Metal Conduit (FMC) for recessed and semi-recessed lighting fluorescent fixtures; for equipment subject to vibration, noise transmission, or movement; for all motors. Use Liquidtight Flexible Metal Conduit (LFMC) in wet or damp locations, as defined per NEC. Flexible conduits shall not be used for indoor HID lighting fixture connections.

B. Grounding conductors with green colored insulation shall be extended through all flexible connections including fixture "whips", and fastened to terminals within the first junction boxes on either side of the flexible length.

C. Flexible connections shall be sized per the Contract Drawings, or as required in accordance with Code; the more stringent requirement shall apply.

3.5 INSTALLATION OF TERMINATIONS

A. Where raceways are terminated with lock nuts and bushings, align the raceway to enter squarely, and install the lock nuts with dished part against the box. Where terminations cannot be made, secure with one lock nut, use two lock nuts, one inside and one outside of the box.

B. Where terminating in threaded hubs, screw the raceway or fitting tight into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align the raceway so the coupling is square to the box, and tighten the chase nipple so no threads are exposed.

C. Open ends shall be capped with approved manufactured conduit seals as soon as installed and kept capped until ready to pull in conductors.

D. Double lock nuts shall be used at termination of rigid conduit in knock-out openings.

E. Ends of conduits shall be equipped with insulating bushings for 1" and smaller, and insulated metallic bushings for 1-1/4" and larger. Ends of conduit shall be temporarily capped prior to installation and during construction to exclude foreign material.

3.6 INSTALLATION OF BOXES

A. Provide grounding connections for raceway, boxes, and components as indicated and instructed by manufacturer. Tighten connectors and terminals, including screws and bolts, according to equipment manufacturer's published torque-tightening values for equipment connectors.

B. Provide junction boxes, pull boxes, cable support boxes, and wireways as required for proper installation of the electrical work. Covers shall be accessible. Small junction boxes shall be similar to outlet boxes.

C. Pull boxes, cable support boxes, and large junction boxes for indoor use shall be made of code gauge steel or no less than 12 gauge. Covers shall be held in place with stainless steel screws. Paint interior and exterior surfaces with rust-inhibitive paint. (Pull boxes and covers shall be hot-dipped galvanized.)

D. Boxes located outdoors and in damp or wet locations shall be cast metal or alloy, fitted with screw-fastened covers and gaskets, and with threaded conduit connections. Fasteners shall be stainless steel or brass.

E. Pull boxes shall be installed at all necessary points to prevent injury to the insulation or other damage that might result from pulling resistance or for other reasons necessary for proper installation. Pull box locations shall be approved by the Owner's representative prior to installation.

F. Where boxes are used in connection with exposed conduit, plain covers attached to the box with a suitable number of countersunk flat head machine screws shall be used.

G. Exposed pull boxes will not be permitted in finished spaces.

H. Location of pull boxes shall be coordinated with piping, ductwork, and other equipment so as to permit sufficient clearance for maintenance and access.

I. Pull boxes recessed in walls or partitions shall be provided with flanged type covers.

J. Outlet boxes and covers shall be sheet steel knockout type, zinc-coated, or cadmium-plated and shall be of proper Code size for the number of wires or conduits passing through or terminating therein, but in no case shall any box be less than 4" square. Covers for flush outlets shall finish flush with plaster or other finished surface. Approved factory-made knockout seals shall be used in all boxes where knockouts are not intact. Boxes in concrete shall be a type which will allow the placing of conduit without displacing the reinforcing bars. Additional pull boxes shall be installed as required to facilitate pulling of wires.

K. Outlet boxes for switches shall be of the gang type.

L. Outlet boxes for exterior use shall be of the weatherproof cast metal type, with threaded hubs.

M. Each circuit in each pull box shall be marked with a tag guide denoting panelboard to which they connect.

N. Boxes shall be separated to prevent sound transmission. Back-to-back boxes shall not be used.

O. Outlet boxes shall include suitable plaster rings and covers or plates.

P. Unused knockout holes shall remain closed and those opened by error shall be closed with snap-in blanks.

Q. Outlet boxes shall not be smaller than required by Code for the number and size of wires to be installed.

R. Outlet boxes installed in plenum ceilings shall be in accordance with applicable Codes.

S. Outlet boxes for exposed interior work and all exterior work shall be cast metal or alloy with screw-fastened covers and gaskets, and with threaded conduit connections. Fasteners shall be stainless steel or brass.

Y. Outlet boxes shall be installed true and plumb so that the covers or plates will be level and at uniform elevations for the types of outlets contained.

Z. Outlet boxes for toggle switches and pilot lights at doorways shall be located at the strike side of the door as finally hung.

AA. Outlet box locations as indicated shall be considered to be approximate only. Determine exact locations from architectural details or from field instructions and coordinate outlet box locations with the work of other trades.

BB. Install junction and pullboxes to be accessible. Boxes in plenum ceilings shall comply with Code requirements.

CC. Locations of junction and pullboxes requiring access panels shall be reviewed by the Owner's Representative.

3.7 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to Manufacturer and Installer that ensure coatings, finishes, and cabinets are without damage or deterioration at the time of Substantial Completion.

B. Repair damage to galvanized finishes with zinc-rich paint recommended by Manufacturer.

C. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

D. Steel conduit: Conduit that shows corrosion within the guarantee period shall be replaced.

3.8 CLEANING

A. On completion of installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.

B. After conduits (ducts) and accessories have been installed, and concreting operations completed, conduit runs shall be satisfactorily cleared of obstructions and foreign matter. Defects which might damage cable upon installation shall be corrected**.** Where conduits (ducts) installed are connected to conduits (ducts) installed by others and where new conduits installed are connected to existing conduits] the entire run to the nearest box or other termination point shall be cleaned.

END OF SECTION 260533

SECTION 260534 – CONDUIT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

B. Specifications throughout all Divisions of the Project Manual are directly applicable to this Section, and this Section is directly applicable to them.

1.02 SUMMARY

C. This Section specifies the requirements for raceways, conduits and boxes.

1.03 REFERENCE STANDARDS

D. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.

E. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.

F. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the following references:

1. ANSI C80.1 - Rigid Steel Conduit, Zinc-Coated.
2. ANSI C80.3 - Electrical Metallic Tubing, Zinc Coated.
3. ANSI/NEMA FB 1 - Fittings and Supports for Conduit and Cable Assemblies.
4. ANSI/NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers and Box Supports.
5. ANSI/UL 1 - Flexible Metal Conduit.
6. ANSI/UL 5 - Surface Metal Raceways and Fittings.
7. ANSI/UL 360 - Liquid-tight Flexible Steel Conduit.
8. ANSI/UL 467 - Electrical Grounding and Bonding Equipment.
9. ANSI/UL 797 - Electrical Metallic Tubing.
10. ANSI/UL 870 - Wireways, Auxiliary Gutters and Associated Fittings.
11. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
12. UL6 - Standard for Safety, Rigid Metal Conduit.

13. UL514B - Standard for Safety, Fittings for Conduit and Outlet Boxes

14. ANSI/UL 651 - Schedule 40 and 80 Rigid PVC Conduit.

1.04 QUALITY ASSURANCE

G. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

H. Comply with NFPA 70.

1.05 SUBMITTALS

I. Product Data:

1. Submit manufacturer's product data for raceways, conduits, outlet boxes, and wireways.

J. Shop Drawings:

2. Submit Shop Drawings of the complete metal surface raceway system.

3. Shop Drawings shall include sizes and lengths of raceways as verified with laboratory furniture Shop Drawings, inside corners, outside corners, end caps, raceway cover spacing, grounding, branch circuiting and wiring including locations of service entrances, receptacle types and manufacturers, receptacle spacing, and receptacle labeling with proper voltage, phase, circuit and panelboard designations as indicated on the Drawings.

4. Submit firestopping installation Shop Drawings to cover the following scope, but not limited to. The Contractor shall obtain Owner’s approval prior to installation.

a. Product data sheet from a manufacturer that is specified by Section 07 84 13 Penetration Firestopping.

b. Dimensioned installation Shop Drawing detail(s) with UL listed firestopping assembly number that is associated to the same material manufacturer.

PART 2 - PRODUCTS

1.06 GENERAL

K. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

1.07 WIREWAYS AND TERMINAL BOXES

L. Wireways and terminal boxes shall be of steel construction, oil-tight with knockouts.

M. Size shall be minimum 4 x 4 inches or as indicated on the Drawings.

N. Cover shall be hinged.

O. Fittings shall be so constructed to continue the ”lay in" feature throughout the entire installation.

P. Provide all sheet metal parts with a rust-inhibiting phosphatizing primer coating and finished in gray enamel. All hardware shall be cadmium plated to prevent corrosion.

Q. Inside Terminal Boxes: Provide 25-ampere, 300-volt industrial rated terminal blocks with marking strip. Mark strip with black ink identifying circuit connection. Provide nameplate on exterior of each terminal box indicating panelboard served.

1.08 CONDUIT AND FITTINGS

R. Manufacturers:

1. Conduit and Electrical Metallic Tubing: Allied Tube & Conduit or equal.

2. Fittings: Appleton Electric, Midwest Electric Products or O-Z/Gedney.

3. Expansion Fittings: O-Z/Gedney Type DX, Crouse-Hinds Type XC, or equal by Midwest Electric Products or Appleton Electric.

4. Flexible Metal Conduit and Fittings: Anaconda Sealtite, Type UA.

S. Application:

5. Conduit and fittings for all electrical systems on this Project shall include the following:

a. Electrical power and lighting feeders.

b. Electrical power and lighting circuits.

c. Fire alarm and signaling systems.

d. Other electrical systems, as identified on the Drawings.

T. For each electrical wireway system indicated, provide a complete assembly of conduit, tubing or duct with fittings including, but not necessarily limited to, connectors, nipples, couplings, locknuts, bushings, expansion fittings, and other components and accessories as needed to form a complete system of the type indicated.

U. Conduit fittings shall be designed and approved for the specific use intended. Conduit fittings, including flexible, shall have insulated throats or bushings. Rigid conduits shall have insulated bushings, unless grounding bushings are required by NEC Article 250-28. Grounding bushings shall have insulated throats.

V. Rigid metal conduit shall be hot-dipped galvanized. Fittings shall be threaded type.

W. Electrical metallic tubing shall be galvanized. Fittings shall be all steel set screw deep socket UL marked and approved for the application. Compression fittings uses shall be in, not limited to, wet damp and environmental areas type.

X. Flexible metal conduit and fittings shall be zinc-coated steel.

Y. Crimp type fittings are not acceptable.

Z. Raceways such as electrical nonmetallic tubing (ENT) and liquid-tight flexible nonmetallic conduit (LFNC) are not acceptable for use on any Project.

1.09 WALL AND CEILING OUTLET BOXES

AA. Manufacturers: Appleton Electric, RACO-Hubbell, Thomas & Betts - Steel City, Cooper Crouse-Hinds.

BB. Galvanized steel interior 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. Minimum switchbox depth shall be 2 inches. Outlet boxes for electrical power shall be 2-1/8 inches deep. Outlet boxes for communication (voice and data) shall be minimum 3-1/2 inches deep.

1. Provide outlet box accessories as required for each installation, including mounting brackets, wallboard hangers, extension rings, fixture studs, cable clamps and metal straps for supporting outlet boxes.

2. Accessories shall be compatible with outlet boxes being used and shall meet requirements of individual situations.

CC. Corrosion-resistant cast-metal weatherproof exterior outlet wiring boxes of the type, shape and size, including depth of box, with threaded conduit ends, cast metal faceplate with spring-hinged waterproof cap and corrosion-proof fasteners.

DD. Outlet boxes in poured concrete shall be plenum type without holes and with reset knockouts. Where extension rings are used to offset conduit between wall reinforcing steel, joint between extension ring and box shall be sealed to prevent concrete from entering box during pour.

1.10 PULL AND JUNCTION BOXES

EE. Boxes shall be galvanized sheet metal with screw-on cover and welded seams, stainless steel nuts, bolts, screws and washers.

FF. Boxes larger than 12 inches in any dimension shall be panelboard code gauge galvanized steel with hinged cover.

GG. Boxes shall be sized In accordance with NEC.

1.11 SURFACE METAL RACEWAYS

HH. Furnish with all entrance fittings, elbows, end caps, covers, and device brackets and plates as indicated on the Drawings for a complete system.

1. Fittings shall be finished in enamel to match the raceway.

2. Fittings shall be supplied with a base where applicable to eliminate mitering.

II. Provide couplings, elbows, connectors, boxes, extension rings and outlet covers specifically designed for use with surface raceway system.

JJ. Provide factory fittings for vertical raceway riser connection to horizontal raceway runs. Such directional change fittings must accommodate required radius flex for Category 6a communication cable under both load and no load conditions.

KK. All internal exposed surfaces within the raceway, including joints and covers shall be free of nicks, cuts, sharp edges, and other imperfections.

LL. Grommets shall be used to accommodate building automation system cabling to critical equipment or as noted on Drawings.

MM. Multiple raceways shall be provided for normal power, emergency power, and communication / critical alarm as noted on the Drawings.

3. Raceway lengths shall be as shown on the Drawings.

PART 3 - EXECUTION

3.02 INSTALLATION - GENERAL

A. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.

B. All installation shall be in accordance with manufacturer's published recommendations.

C. Concrete metal hit anchor and fastener is an unacceptable fastening system for concrete, brick and block.

D. Where raceways penetrate fire-rated floors or roofs, sleeve and seal opening around raceways with UL listed firestop assemblies equal to fire rating of floors or roofs. Seal penetrations through all floors or roofs to provide and maintain a watertight installation. Conduit sleeves, where required, shall be two (2) trade sizes larger for proper sealing and extend 2 inches above the surface. Refer to Section 07 84 13 Penetration Firestopping and Section 09 29 00 Gypsum Drywall for sealing and firestopping requirements where raceways penetrate smoke, fire, and sound rated walls. The installation shall be in compliance with UL listed firestopping assembly.

E. Support all conduits and J-boxes above ceilings from the building structure. All J-boxes being installed above suspended ceilings must have a minimum of 12-inch clearance from the top of the ceiling grid except where approved by the Owner in writing prior to installation.

F. No raceways, metallic or non-metallic, flexible or rigid, shall be installed in any floor slab elevated above slab on grade. The only exception may be for the lighting grid in the parking deck areas of a parking garage.

G. Bushings and throats shall be installed for fittings, raceways, boxes or other enclosures prior to installing cables and wiring systems. Provide raceway support in intervals not exceeding the maximum spacing per NEC.

3.03 INSTALLATION - CONDUIT

A. Install raceway and conduit system from point of origin in outlets shown, complete with offsets, pull boxes, junction boxes and fittings.

B. Installation of all new conduits must be minimum 12 inches from ceiling grid except where approved by Owner.

C. No raceway shall be run horizontally inside of walls or partitions. Exceptions: building perimeter walls under windows, clerestory panel walls, and where structural conditions do not allow vertical access to tops of walls. The contractor shall obtain written approval from the Owner for exceptions prior to installation.

D. Install rigid wall hot-dipped galvanized steel conduit. Minimum size shall be ½-inch unless noted otherwise on the Drawings. Minimum size for communication shall be 1-inch. The following exceptions are permitted:

E. Electrical Metallic Tubing (EMT): In sizes ½-inch up to and including 4 inches, may be used inside dry locations where not subject to mechanical damage. ½-inch EMT may only be used for connections between distribution J-boxes in the ceiling and J-boxes in the walls within the same room, serving 15-20 Amp single phase receptacles, lighting occupancy sensors, switches, dimmers, and fire alarm respectively. In such application the length of ½-inch EMT shall not exceed 25 feet. EMT shall be used in air-conditioned spaces, such as accessible ceilings, and dry wall partitions. EMT shall not be used outside, in concrete, underground, in underfloor spaces, in masonry walls and in locations likely to be damp. EMT shall not be used for circuits with system voltage over 480 volts.

F. Single Conduit Installation:

G. Install single conduits parallel to or at 90 degrees to the structure and suspended from the structure on all thread rods (1/4-inch minimum) or clamped and/or clipped to the structure with manufactured clamps/clips. When single conduits are suspended from all thread rods, conduit clamps with bolts and nuts shall be used. Through partition wall penetration shall not be construed as a means of conduit support. Wire ties and hanger wires are not permitted. No powder actuated, compressed air, propane or similar powered “shot” anchor systems shall be installed under any circumstance. Wire ties and hanger wires are not permitted. Single conduits may be secured as follows:

a. Wood screws on wood.

b. Toggle bolts on hollow masonry.

c. Bolts and expansion anchors in concrete or brick.

d. Machine screws, threaded rods and clamps on steel.

e. Conduit clips on steel joists.

f. Plastic anchors are not allowed.

g. Conduit hangers from drop rod (like Caddy B18 Series) are acceptable only upon prior written approval from the Owner.

H. Fittings shall be approved for grounding purposes or shall be jumpered with a copper grounding conductor of appropriate ampacity. Leave termination of such jumpers exposed. Conduit and wireway systems shall not serve as branch circuit grounding conductors.

I. Install expansion fittings in metal conduit as follows:

J. Conduit Crossing Building Expansion Joints:

a. EMT all sizes.

b. Rigid Galvanized Steel (RGS) all sizes.

K. Conduits entering environmental rooms and other locations subject to thermal expansion and as required by NEC.

L. Provide conduit expansion fitting with an integral bonding braid, as in Crouse-Hinds Type XC.

M. Expansion fittings are not required where offsets, expansion loops, or flexible conduit are placed in conduit runs.

N. Install conduit concealed in walls, partitions and above ceilings. Install exposed in overhead conduit (at structure) of mechanical rooms and in other similar rooms where ceilings are not provided.

O. Avoid moisture traps where possible; where unavoidable, provide junction box with drain fitting at conduit low point.

P. Use suitable conduit caps to protect installed conduit against entrance of dirt and moisture.

Q. Install pull wires in empty conduits. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Jetline 232 or equal by Greenlee. Leave at least 12 inches of slack at each end of pull wire.

R. Cap ends of spare conduits and extend into space above accessible ceiling a minimum of 18 inches. Label conduit as spare.

S. Do not daisy chain conduit installations in or on walls, provide a single conduit wall drop per device.

T. The support means for conduit installation, whether threaded rods, trapeze or other system, shall not be shared with non-electrical system. Any deviation from this standard due to space constrain shall be submitted to the Owner. Owner’s review does not necessarily guarantee an approval; therefore the Contractor is advised not to start installation prior to final approval.

3.04 INSTALLATION - WIREWAYS AND TERMINAL BOXES

A. Bolt wireways and terminal boxes to steel channels fastened to the wall or in self-supporting structure. Install level.

B. Gasket each joint in oil-tight wireway.

C. Mount rain-tight wireway in horizontal position only.

3.05 INSTALLATION - BOXES

A. Provide electrical boxes as shown on Drawings, and as required for wire pulling, equipment connection, and code compliance. Electrical box locations shown on Drawings are approximate unless dimensioned. Verify location of outlets prior to rough in. Locate and install boxes to allow access and clearances per NEC.

B. J-boxes shall be provided for branch circuits in excess of 100 feet.

C. Provide outlet box accessories as required for each installation, including mounting brackets, wallboard hangers, extension rings, fixture studs, cable clamps, and metal strap for supporting outlet boxes. Accessories shall be compatible with outlet boxes being used and shall meet requirements of individual situations.

D. Do not install boxes back-to-back in walls. Provide minimum 6-inch separation in non-fire-rated walls. Provide minimum 24-inch horizontal separation in acoustic-rated walls.

E. Membrane penetration of minimum 1-hour, up to maximum 2-hour fire rating walls and partitions by recessed steel electrical boxes that do not exceed 16 square inches in area are permitted, provided the aggregate area of the openings does not exceed 100 square inches in any 100 square feet of wall area. The annular space between the wall membrane and the box shall not exceed 1/8 inch. Such boxes on opposite sides of the wall or partition shall be either separated by a horizontal distance of not less than 24 inches or separated by protecting both boxes by listed putty pads or other listed materials and methods.

F. Secure boxes rigidly to the substrate upon which they are being mounted, or solidly imbed boxes in concrete or masonry. Boxes shall not be permitted to move laterally. Boxes shall be secured between two studs. Boxes connected to one stud are not permitted.

G. Provide knockout plugs for unused openings.

H. Use multiple-gang boxes where more than one device is mounted together; do not use sectional boxes. Provide barriers to separate wiring of different voltage systems.

I. Install boxes in walls without damaging wall insulation.

J. Outlet boxes in plaster partitions shall be “shallow-type” set flush in wall so there is at least 5/8-inch plaster covering back of box.

K. Switch boxes shall not be used as junction boxes.

L. In inaccessible ceiling areas, position outlets and junction boxes within 6 inches of recessed luminaires, to be accessible through luminaire ceiling opening.

M. Outlet boxes supporting fixtures shall be securely anchored in place in an approved manner. Support outlet boxes and fixtures in acoustic ceiling areas from building structures with separate supports, not from acoustic ceiling or ceiling tile wire. Lighting fixture outlets shall be coordinated with mechanical and architectural equipment and elements to eliminate conflicts and to provide a workable neat installation.

N. Locate pull boxes and junction boxes above accessible ceilings or in unfinished areas.

O. Support pull and junction boxes independent of conduit. Combination box/conduit hangers from drop rod (like Caddy B18 Series) are acceptable only upon prior written approval from the Owner.

END OF SECTION 260534