SECTION 01700

EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1: GENERAL

1.1 SECTION INCLUDES

A. Closeout procedures.

B. Final cleaning.

C. Starting of systems.

D. Demonstration and instructions.

E. Testing, adjusting and balancing.

F. Protecting installed construction.

G. Project record documents.

H. Operation and maintenance data.

I. Manual for materials and finishes.

J. Manual for equipment and systems.

K. Spare parts and maintenance products.

L. Product warranties and product bonds.

M. Maintenance service.

1.2 CLOSEOUT PROCEDURES

A. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Engineer's review.

B. Provide warranties, bonds, service agreements, certifications, record documents, maintenance and operation manuals, and similar documents to Engineer.

C. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due.

D. Submit:

1. Affidavit of payment of debts and claims, AIA Document G706.

2. Affidavit of release of liens, AIA Document G706A.

3. Consent of Contractors surety to final payment, AIA Document G707.

E. Deliver all spare parts and keys to Owner.

1.3 FINAL CLEANING

A. Leave project clean and ready for occupancy by Owner.

B. Execute final cleaning prior to final project assessment by Engineer. Final cleaning shall be by experienced professional cleaners.

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

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

E. Replace filters of operating mechanical equipment. Clean exposed surfaces of grilles, registers, and diffusers.

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

G. Remove waste and surplus materials, rubbish, and construction facilities from site.

H. Clean all new and existing fixtures or devices.

1.4 STARTING OF SYSTEMS

A. Coordinate schedule for start-up of various equipment and systems.

B. Notify Project Manager 7 calendar days prior to start-up of each item.

C. Verify each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions which may cause damage.

D. Verify tests, meter readings, and specified electrical characteristics agree with those required by equipment or system manufacturer.

E. Verify wiring and support components for equipment are complete and tested.

F. Execute start-up under supervision of applicable Contractors' personnel in accordance with manufacturers' instructions.

G. Submit a written report in accordance with Section 01330 - Submittal Procedures that equipment or system has been properly installed and is functioning correctly.

1.5 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate operation and maintenance of products, systems and equipment to Owner's personnel ten calendar days prior to date of final inspection. Demonstration shall be by a manufacturer's representative or other agreed on qualified person.

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

C. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at agreed time, at and Owner designated location.

D. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

E. Required instruction time for each item of equipment and system is specified in individual sections.

1.6 TESTING, ADJUSTING AND BALANCING

A. Contractor will appoint, employ, and pay for services of independent firm to perform testing, adjusting, and balancing.

B. Reports will be submitted by independent firm to Engineer indicating observations and results of tests and indicating compliance or non-compliance with requirements of Contract Documents.

1.7 PROTECTING INSTALLED CONSTRUCTION

A. Protect installed Work and provide special protection where specified in individual specification sections.

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

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

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

1.8 PROJECT RECORD DOCUMENTS

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

1. Contract Drawings.

2. Specifications.

3. Addenda.

4. Change Orders and other modifications to the Contract.

5. Reviewed Shop Drawings, Product Data, and Samples.

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

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

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

D. Record information concurrent with construction progress, not less than weekly.

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

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

2. Product substitutions or alternates utilized.

3. Changes made by Addenda and modifications.

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

1. Measured depths of foundations in relation to finish floor datum.

2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.

3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.

4. Field changes of dimension and detail.

5. Details not on original Contract drawings.

6. Changes to electrical circuits and device/equipment locations.

G. Submit documents to Engineer with claim for final Application for Payment.

1.9 OPERATION AND MAINTENANCE DATA

A. Submit data bound in 8-1/2 x 11 inch text pages, three D side ring binders with durable vinyl covers.

B. Prepare binder cover with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS", title of project, and subject matter of binder when multiple binders are required.

C. Internally subdivide binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.

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

E. Contents: Prepare Table of Contents for each volume, with each product or system description identified, typed on white paper, in three parts as follows:

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

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

   a. Significant design criteria.

   b. List of equipment.

   c. Parts list for each component.

   d. Operating instructions, including start-up and shutdown procedures.

   e. Maintenance instructions for equipment and systems.

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

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

   a. Shop drawings and product data.

   b. Air and water balance reports.

   c. Certificates.

   d. Photocopies of warranties.

1.10 SPARE PARTS AND MAINTENANCE PRODUCTS

A. Furnish spare parts, maintenance, and extra products in quantities specified in individual specification sections.

B. Deliver to Project site and place in location as directed by Owner; obtain receipt prior to final payment.

1.11 PRODUCT WARRANTIES AND PRODUCT BONDS

A. Obtain warranties and bonds executed in duplicate by responsible subcontractors, suppliers, and manufacturers, within ten days after acceptance by Owner.

B. Execute and assemble transferable warranty documents and bonds from subcontractors, suppliers, and manufacturers.

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

D. Co-execute submittals when required.

E. Include Table of Contents and assemble in binder with durable vinyl cover.

F. Submit prior to final Application for Payment.

1.12 MAINTENANCE SERVICE

A. Furnish service and maintenance of components as indicated in specification sections during warranty period.

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

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

D. Do not assign or transfer maintenance service to agent or Subcontractor without prior written consent of Owner.

PART 2: PRODUCTS - NOT USED

PART 3: EXECUTION - NOT USED

END OF SECTION

SECTION 01 78 23

OPERATION AND MAINTENANCE DATA

PART 1: GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Emergency manuals.

2. Operation manuals for systems, subsystems, and equipment.

3. Maintenance manuals for the care and maintenance of products, materials, finishes, systems and equipment.

B. See Section 26 24 16 – Panelboards, and Section 23 54 00 – Electronic Unit Heater for specific operation and maintenance manual requirements for the Work in those Sections.

1.2 SUBMITTALS

A. Manual: Submit one copy of each manual in final form at least 5 working days before final inspection. Engineer will return copy with comments within 5 working days after final inspection.

1. Correct or modify each manual to comply with Engineer's comments. Submit 2 copies of each corrected manual within 10 working days of receipt of Engineer's comments.

PART 2: PRODUCTS

2.1 MANUALS, GENERAL

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain a title page, table of contents, and manual contents.

B. Title Page: Enclose title page in transparent plastic sleeve. Include the following information:

1. Subject matter included in manual.

2. Name and address of Project.

3. Name and address of Owner.

4. Date of submittal.

5. Name, address, and telephone number of Contractor.

6. Name and address of Engineer.

7. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

1. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

   a. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.

3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.

4. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

   a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.

   b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.2 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for type of emergency, emergency instructions, and emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component for power failure and equipment failure.

C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

D. Emergency Procedures: Include instructions on stopping, shutdown instructions for each type of emergency, operating instructions for conditions outside normal operating limits, and required sequences for electric or electronic systems.

2.3 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and equipment descriptions, operating standards, operating procedures, operating logs, wiring and control diagrams, and license requirements.

B. Descriptions: Include the following:

1. Product name and model number.

2. Manufacturer's name.

3. Equipment identification with serial number of each component.

4. Equipment function.

5. Operating characteristics.

6. Limiting conditions.

7. Engineering data and tests.

8. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include start-up, break-in, and control procedures; stopping and normal shutdown instructions; routine, normal, seasonal, and weekend operating instructions; and required sequences for electric or electronic systems.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.4 PRODUCT MAINTENANCE MANUAL

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance proce-

dures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Product Information: Include the following, as applicable:

1. Product name and model number.

2. Manufacturer's name.

3. Color, pattern, and texture.

4. Material and chemical composition.

5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and inspection procedures, types of cleaning agents, methods of cleaning, schedule for cleaning and maintenance, and repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

2.5 SYSTEMS AND EQUIPMENT MAINTENANCE MANUAL

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including maintenance instructions, drawings and diagrams for maintenance, nomenclature of parts and components, and recommended spare parts for each component part or piece of equipment.

D. Maintenance Procedures: Include test and inspection instructions, troubleshooting guide, disassembly instructions, and adjusting instructions, and demonstra-

tion and training videotape if available, that detail essential maintenance procedures:

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

PART 3: EXECUTION

3.1 MANUAL PREPARATION

A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

B. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

C. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

D. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

E. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in Record Drawings to ensure correct illustration of completed installation.

1. Do not use original Project Record Documents as part of operation and maintenance manuals.

END OF SECTION

SECTION 01 78 39

PROJECT RECORD DOCUMENTS

PART 1: GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for Project Record Documents, including the following:

1. Record Drawings.

2. Record Specifications.

3. Record Product Data.

B. See Section 01 78 23 - Operation and Maintenance Data for operation and maintenance manual requirements.

C. See other Sections for specific requirements for Project Record Documents of the Work in those Sections.

1.2 SUBMITTALS

A. Record Drawings: Comply with the following:

B. Number of Copies: Submit one set of marked-up Record Prints.

C. Record Specifications: Submit one copy of Project's Specifications, including addenda and contract modifications.

D. Record Product Data: Submit one copy of each Product Data submittal.

PART 2: PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of blue- or black-line white prints of the Contract Drawings and Shop Drawings.

1. Preparation: Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.

a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.

b. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.

2. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.

3. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.

4. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Record Prints: Organize Record Prints and newly prepared Record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.

2. Identification: As follows:

a. Project name.

b. Date.

c. Designation "PROJECT RECORD DRAWINGS."

d. Name of Contractor.

2.2 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.

2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.

3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.

4. Note related Change Orders, Record Product Data, and Record Drawings where applicable.

2.3 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.

2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.

3. Note related Change Orders, Record Specifications, and Record Drawings where applicable.

2.4 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

PART 3: EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur; do not wait until the end of Project.

B. Maintenance of Record Documents and Samples: Store Record Documents and Samples in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.

END OF SECTION

SECTION 01 79 00

DEMONSTRATION AND TRAINING

PART 1: GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:

1. Demonstration of operation of systems, subsystems, and equipment.

2. Training in operation and maintenance of systems, subsystems, and equipment.

3. Demonstration and training videotapes.

B. See other Divisions for specific requirements for demonstration and training for products in those Sections.

1.2 SUBMITTALS

A. Instruction Program: Submit two copies of outline of instructional program for demonstration and training, including a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

B. Demonstration and Training Videos: Submit two copies within seven days of end of each training module.

1.3 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

B. Instructor Qualifications: A factory-authorized service representative experienced in operation and maintenance procedures and training.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Engineer.

PART 2: PRODUCTS

2.1 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections:

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following:

1. Basis of System Design, Operational Requirements, and Criteria: Include system and equipment descriptions, operating standards, regulatory requirements, equipment function, operating characteristics, limiting conditions, and performance curves.

2. Documentation: Review emergency, operations, and maintenance manuals; Project Record Documents; identification systems; warranties and bonds; and maintenance service agreements.

3. Emergencies: Include instructions on stopping; shutdown instructions; operating instructions for conditions outside normal operating limits; instructions on meaning of warnings, trouble indications, and error messages; and required sequences for electric or electronic systems.

4. Operations: Include startup, break-in, control, and safety procedures; stopping and normal shutdown instructions; routine, normal, seasonal, and weekend operating instructions; operating procedures for emergencies and equipment failure; and required sequences for electric or electronic systems.

5. Adjustments: Include alignments and checking, noise, vibration, economy, and efficiency adjustments.

6. Troubleshooting: Include diagnostic instructions and test and inspection procedures.

7. Maintenance: Include inspection procedures, types of cleaning agents, methods of cleaning, procedures for preventive and routine maintenance, and instruction on use of special tools.

8. Repairs: Include diagnosis, repair, and disassembly instructions; instructions for identifying parts; and review of spare parts needed for operation and maintenance.

PART 3: EXECUTION

3.1 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule training with Owner with at least 15 days' advance notice.

D. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a written performance-based test.

3.2 DEMONSTRATION AND TRAINING VIDEOS

A. General: Engage a qualified commercial photographer to record demonstration and training videos. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.

B. At beginning of each training module, record each chart containing learning objective and lesson outline.

C. Video Format: Provide high-quality color video on DVD discs.

D. Narration: Describe scenes on video by audio narration by microphone while or dubbing audio narration off-site after videotape is recorded. Include description of items being viewed. Describe vantage point, indicating location, direction (by compass point), and elevation or story of construction.

END OF SECTION

SECTION 02 41 26

SELECTIVE ELECTRICAL DEMOLITION

PART 1: GENERAL

1.1 SUMMARY

A. Section Includes:

1. Removal of existing electrical equipment, wiring, and conduit in areas to be remodeled; removal of designated construction; dismantling, cutting and alterations for completion of the Work.

2. Disposal of materials.

3. Storage of removed materials.

4. Identification of utilities.

5. Salvaged items.

6. Protection of items to remain as indicated on Drawings.

7. Relocate existing equipment to accommodate construction.

1.2 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings: Indicate demolition and removal sequence and location of salvageable items; location and construction of temporary work. Describe demolition removal procedures and schedule.

1.3 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of capped conduits and equipment abandoned in place.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with State of California and County of Riverside standards.

1.5 PRE-INSTALLATION MEETINGS

A. Convene minimum one week prior to commencing work of this section.

1.6 SEQUENCING

A. Section 01 10 00 - Summary: Requirements for sequencing.

B. Sequence work in the following order as indicated on drawings.

1.7 SCHEDULING

A. Perform noisy, malodorous, or dusty work:

1. Between hours of 6:00 p.m. and 3:00 a.m.

B. Cease operations immediately when structure appears to be in danger and notify Engineer. Do not resume operations until directed.

1.8 COORDINATION

A. Conduct demolition to minimize interference with adjacent and occupied building areas.

B. Coordinate demolition work with the Riverside County representative.

C. Coordinate and sequence demolition so as not to cause shutdown of operation of surrounding areas.

D. Shut-down Periods:

1. Arrange timing of shut-down periods of in service panels with Owner and Fire Marshal. Do not shut down any utility without prior written approval.

2. Keep shut-down period to minimum or use intermittent period as directed by Owner.

3. Maintain life-safety systems in full operation in occupied facilities, or provide notice minimum 3 days in advance.

E. Identify salvage items in cooperation with Owner.

PART 2: PRODUCTS

Not Used

PART 3: EXECUTION

3.1 EXAMINATION

A. Verify wiring and equipment indicated to be demolished serve only abandoned facilities.

B. Verify termination points for demolished services.

3.2 PREPARATION

A. Erect, and maintain temporary safeguards, including warning signs and lights, barricades, and similar measures, for protection of the public, Owner, Contractor's employees, and existing improvements to remain.

B. Temporary egress signage and emergency lighting

3.3 DEMOLITION

A. Demolition Drawings are based on casual field observation and existing record documents. Report discrepancies to Owner and Engineer before disturbing existing installation.

B. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors and patch surfaces.

C. Remove conduit, wire, boxes, and fastening devices to avoid any interference with new installation.

D. Disconnect electrical systems in walls, floors, and ceilings scheduled for removal.

E. Reconnect equipment being disturbed by renovation work and required for continue service to nearest available panel.

F. Disconnect or shut off service to areas where electrical work is to be removed. Remove electrical fixtures, equipment, and related switches, outlets, conduit and wiring which are not part of final project.

G. Install temporary wiring and connections to maintain existing systems in service during construction.

H. Perform work on energized equipment or circuits with experienced and trained personnel.

I. Remove, relocate, and extend existing installations to accommodate new construction.

J. Repair adjacent construction and finishes damaged during demolition and extension work.

K. Remove exposed abandoned grounding and bonding components, fasteners and supports, and electrical identification components, including abandoned components above accessible ceiling finishes. Cut embedded support elements flush with walls and floors.

L. Clean and repair existing equipment to remain or to be reinstalled.

M. Protect and retain power to existing active equipment remaining.

N. Cap abandoned empty conduit at both ends.

3.4 EXISTING PANELBOARDS

A. Ring out circuits in existing panel affected by the Work. Where additional circuits are needed, reuse circuits available for reuse. Install new breakers.

B. Tag unused circuits as spare.

C. Where existing circuits are indicated to be reused, use sensing measuring devices to verify circuits feeding Project area or are not in use.

D. Remove existing wire no longer in use from panel to equipment.

E. Provide new updated directories where more than three circuits have been modified or rewired.

3.5 SALVAGE ITEMS

A. Remove and protect items indicated on Drawings to be salvaged and turn over to Owner.

B. Items of salvageable value may be removed as work progresses. Transport salvaged items from site as they are removed.

3.6 REUSABLE ELECTRICAL EQUIPMENT

A. Carefully remove equipment, materials, or fixtures which are to be reused.

B. Disconnect, remove, or relocate existing electrical material and equipment interfering with new installation.

C. Relocate existing fire alarm panel as required. Clean and re-program. Test equipment to see if it is in good working condition before installation at new location.

3.7 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for cleaning.

B. Remove demolished materials as work progresses. Legally dispose.

C. Keep workplace neat.

3.8 PROTECTION OF FINISHED WORK

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Do not permit traffic over unprotected floor surface.

END OF SECTION

SECTION 26 05 00

COMMON WORK RESULTS ON ELECTRICAL

PART 1: GENERAL

1.1 SCOPE

A. This section supplements all sections of this division and shall apply to all phases of work hereinafter specified, shown on the drawings, or required to provide a complete installation of electrical systems for the Project. Which may designate Work to be accomplished. The intent of the Specifications is to provide a complete electrical system which include all documents which are a part of the Contract.

1. Work included: Furnish all labor, material, tools, equipment, facilities, transportation, skilled supervision necessary for, and incidental to, performing operations in connection with furnishing, delivery, and installation of the work in this section complete as shown or noted on the Drawings and specified herein.

B. Related Work Specified Elsewhere: Refer to all sections in Division 0, Contract Requirements and Division 1, General Requirements.

C. Work Installed but Furnished by Others: The electrical work includes the installation or connection of certain materials and equipment furnished by others. Verify installation details. Foundations for apparatus and equipment will be furnished by others unless otherwise noted or detailed.

1.2 GENERAL REQUIREMENTS

A. Guaranty See General Conditions and Section 01 70 00 – Execution and Closeout Requirements:

1. Except as may be specified under other Sections in the specification, guarantee equipment furnished under the specifications for a period of one year, except for equipment required to have a longer guaranty period, from date of Substantial Completion against defective workmanship and material, and improper installation. Upon notification of failure, correct deficiency immediately and without cost to the Owner.

2. Standard warranty of manufacturer shall apply for replacement of parts after expiration of the above period. Manufacturer shall furnish replacement parts to the Owner or his service agency as approved. Furnish to the Owner, through the Architect, printed manufacturer's warranties complete with material included and expiration dates, upon completion of project. Conform to Section 01 70 00 – Execution and Closeout Requirements.

B. Equipment Safety: All electrical materials and equipment shall be new and shall be listed by Underwriter's Laboratories and bear their label, or listed and certified by a nationally recognized testing authority where UL does not have an approval. Custom made equipment must have complete test data submitted by the manufacturer attesting to its safety. Provide signage at all electrical rooms and on each exterior electrical enclosure access door or gate. Sign shall read "DANGER-HIGH VOLTAGE". Provide signage on each door or removable access panel on electrical equipment rated 600 volts and over. Sign shall read "DANGER-HIGH VOLTAGE".

C. Codes and Regulations:

1. Design, manufacture, testing and method of installation of all apparatus and materials furnished under the requirements of these specifications shall conform to the latest publications or standard rules of the following:

Institute of Electrical and Electronic Engineers - IEEE
National Electrical Manufacturers' Association - NEMA
Underwriters' Laboratories, Inc. - UL
National Fire Protection Association - NFPA
American Society for Testing and Materials - ASTM
American National Standards Institute - ANSI
California Electrical Code - CEC
California Code of Regulations, Title 8, Subchapter 5
California Building Code
State & Municipal Codes in Force in the Specific Project Area
Occupational Safety & Health Administration - OSHA
California State Fire Marshal - CSFM
The term "Code", when used within the specifications, shall refer to the Publications, Standards, ordinances and codes, listed above. In the case where the codes have different levels of requirements the most stringent rules shall apply.

D. Requirements of Regulatory Agencies:

1. Codes, Permits, and Fees: Where the Contract Documents exceed minimum requirements, the Contract Documents take precedence. Where code conflicts occur, the most stringent shall apply unless variance is approved.

a. Comply with all requirements for permits, licenses, fees and Code. Permits, licenses, fees, inspections and arrangements required for the work shall be obtained by the Contractor at his expense, unless otherwise specified.

E. Shop Drawings:

1. See Section 01 33 00 – Submittal Procedures for additional requirements.

2. Time Schedules for Submission and Ordering: The Contractor shall prepare, review and coordinate his schedule of submissions carefully,

determining the necessary lead time for preparing, submitting, checking, ordering and delivery of materials and equipment for timely arrival. The Contractor shall be responsible for conformance with the overall construction schedule.

3. Submittals will be checked for general compliance with specifications only. The Contractor shall be responsible for deviations from the drawings or specifications and for errors or omissions of any sort in submittals.

4. Submit a complete list of materials and equipment proposed for the job, including manufacturer's names and catalog numbers.

5. Shop drawings shall be submitted in completed groups of materials (i.e., lighting fixtures or switchgear). The Contractor shall add and sign the following paragraph on equipment and materials submitted for review. "It is hereby certified that the equipment and material shown and marked in this submittal is that proposed to be incorporated into the project; is in compliance with the Contract Drawings and specifications and can be installed in the allocated spaces". Failure to add the above written statement for compliance will result in return of submittals to be reviewed.

   a. Bind catalog cuts, plate numbers, descriptive bulletins and drawings, 11" x 17" or smaller, in sets with covers neatly showing titles.

   b. The Contractor shall verify dimensions of equipment and be satisfied as to Code compliance for fit prior to submitting shop drawings for approval.

   c. Where current limiting devices are specified, submit technical data to substantiate adequate protection of equipment cascaded downstream. Submittals shall not be reviewed unless supporting calculations and data are submitted therewith.

   d. Include complete catalog information such as construction, ratings and insulation systems, as applicable.

   e. For any material specified to meet UL or trade standards, furnish the manufacturer or vendor's certification that the material furnished for the work does in fact equal or exceed such specifications.

   f. Reference listings to the specifications' Sections and Article to which each is applicable.

   g. Equipment Floor Plans: After approval of material is secured, prepare a floor plan of each electrical communication, and voice/data equipment room, drawn to scale at 1/2 inch equals 1 foot and submit for approval prior to rough-in in the same manner as for shop drawings. The layout drawings shall be exact scale.

Equipment dimensions shall not exceed those indicated on the drawings. If proposed equipment exceeds these dimensions, it shall be the responsibility of the contractor to coordinate all equipment arrangement within the room with all affected trades to provide all code clearances and proper arrangements prior to rough-in. Equipment that grossly exceeds the space allocated and would require an increase in room size is not acceptable.

6. Contractor shall prepare coordinated drawings when required by Section 01 33 00 – Submittal Procedures.

F. Interpretations: Requests for interpretations of drawings and specifications must be made by the Contractor through the Engineer. Any such requests made by equipment manufacturers or suppliers will be referred to the Contractor.

G. Substitutions: Refer to General Conditions.

H. Submit comprehensive material list, shop drawings and complete technical data for the following equipment and materials:

1. General Requirements:

a. Conduits.

b. Conductors, include selected insulation type.

c. Standard and special receptacles, and finish device plates.

d. Cabinets for signal system, special terminals and cabinets.

e. Fire alarm system.

I. Record Drawings: Refer to Section 01 70 00 – Execution and Closeout Requirements.

J. Work Responsibilities:

1. The drawings indicate diagrammatically the desired locations or arrangement of conduit runs, outlets and equipment and are to be followed. Execute the work so as to secure the best possible installation in the available space and to overcome local difficulties due to space limitations. The Contractor is responsible for the correct placing of his work.

2. Locations shown on plan or on wall elevations shall take precedence over electrical plan locations, but where a major conflict is evident, notify the Engineer before installing any rough-in conduit underground or above ground.

3. In the event changes in the indicated locations or arrangement are necessary due to developed conditions in the building construction or

rearrangement of furnishings or equipment, such changes shall be made without extra cost.

4. Verify dimensions and the correct location of Owner-Furnished equipment before proceeding with the roughing-in of connections.

5. All scaled and figured dimensions are approximate of typical equipment of the class indicated. Before proceeding with work carefully check and verify dimensions and sizes with the drawings to see that the equipment will fit into the spaces provided without violation of applicable Codes.

6. Should any changes to the work indicated on the drawings or described in the specifications be necessary in order to comply with the above requirements, notify the Engineer.

7. Be responsible for coordination of coordinated drawings.

8. Replace or repair, without additional compensation, any work which does not comply with these requirements.

K. Installation General: For special requirements, refer to specific equipment under these requirements.

1. Unless otherwise specified elsewhere in the specifications, do all excavating necessary for the proper installation of the electrical work.

2. Locations of Openings: Locate chases, shafts and openings required for the installation of the electrical work during framing of the structure. Do any additional cutting and patching required. Cutting or drilling in any structural member is prohibited without approval of the Engineer. Furnish access panels as required.

3. Location of Sleeves: Where conduits pass through concrete walls, suspended slabs or metal deck floors, install sleeves of adequate size to permit installation of conduit. Sleeves shall be installed prior to pouring of concrete and shall have ends flush with the wall or extend 2 inches above floor surfaces. Verify locations.

4. Type of Sleeves: Sleeves shall be steel pipe or galvanized sheet steel.

5. Finish Around Sleeves: Rough edges shall be finished smooth. Space between conduit and sleeves where conduit passes through exterior walls shall be sealed to permit movement of conduit, but prevent entrance of water. Space between conduit and sleeves where conduit passes through fire rated interior walls and slabs shall be sealed with approved materials to provide a fire barrier conforming to the requirements of the governing authorities having jurisdiction, using UL Approved Firestopping Systems.

6. Wherever conduit extends through roof, install flashings in accordance with drawings and details.

7. Be responsible for cutting and patching which may be required for the proper installation of the electrical work.

8. Protect work, materials and equipment cause whatever and provide adequate and proper storage facilities during the progress of the work.

9. Storage outdoors shall be weather protected and shall include space heaters to prevent condensation. Provide for the safety and good condition of all work until final acceptance of the work. Replace all damaged or defective work, materials and equipment before requesting final acceptance.

10. Conduit and Equipment to be Installed: Clean thoroughly to remove plaster, spattered paint, cement and dirt on both exterior and interior

11. Conduit and Equipment to be Painted: Clean conduit exposed to view in completed structure by removing plaster and dirt. Remove grease, oil and similar material from conduit and equipment by wiping with clean rags and suitable solvents in preparation for paint.

12. Items with Factory Finish: Remove cement, plaster, grease and oil, and leave surfaces, including cracks and corners, clean and polished. Touch up scratched or bare spots to match finish.

13. Site Cleaning: Remove from site all packing cartons, scrap materials and other rubbish.

14. Electrical equipment and materials exposed to public and in finished areas shall be finish-painted after installation in accordance with the Painting Section. All exposed screw-type fasteners, exterior, or interior in restrooms, shall be vandal-resistant spanner type; include tool.

L. Tests:

1. Equipment and systems for which the National Electrical Testing Association (NETA) has an approved or recommended procedure, shall be tested in accordance with that procedure. Test values shall equal values recommended by NETA. Copies of test reports shall be submitted as required under shop drawing submittals.

2. Resistance to ground tests shall be accomplished by a qualified independent testing firm to measure resistance to ground at grounding electrodes. Make tests before slabs or affected areas are poured in order that corrective measures, if required, may be taken. Submit a report showing the results of these measurements. If the resistances exceed values specified elsewhere or NETA test procedure recommendations, perform corrective measures required to reduce resistance to acceptable values.

3. Prior to energizing any motor, measure the service voltage for phase balance and report if unbalance exceeds 1% from mean.

4. Upon completion of the work and adjustment of all equipment, conduct an operating test. Conduct the test in the presence of an authorized representative of the Engineer. Demonstrate system and equipment to operate in accordance with requirements of the Contract Documents and to be free from electrical and mechanical defects. Provide systems free from short circuits and grounds and show an insulation resistance between phase conductors and ground not less than the requirements of the governing electric code. Test circuits for proper neutral connection.

5. Complete tests prior to final inspection of project, including corrective work based on the results of the tests.

6. Perform special tests on systems and equipment as specified herein using personnel qualified to perform such tests.

7. Submit a report showing test voltage of line to neutral on the secondaries of transformers.

8. Measure voltage on secondary side of transformers with full load connected and adjust taps to provide rated secondary voltage.

9. Refer to Section 01 40 00 – Quality Requirements for other testing requirements.

M. Protection: Protect finish parts of the materials and equipment against damage during the progress of the work and until final completion and acceptance. Cover materials and equipment in storage and during construction in such a manner that no finished surfaces will be damaged or marred. Keep moving parts clean, dry and lubricated.

N. Cleaning Up:

1. Upon completion of the work and at various time during the progress of the work, remove from the building all surplus materials, rubbish and debris resulting from the work of this Division.

2. Thoroughly clean switchgear including busses, apparatus, exposed conduit, metal work including the exterior and interior, and accessories for the work of this Division, of cement, plaster and other deleterious materials; remove grease and oil spots with cleaning solvent; carefully wipe surfaces and scrape cracks and corners clean.

3. Thoroughly polish chromium or plated work. Remove dirt and stains from lighting fixtures.

4. Leave the entire installation in a clean condition.

O. Completion:

1. The work will not be reviewed for final acceptance until operating and maintenance data, manufacturer's literature, panel directories and nameplates specified herein have been approved and properly posted or installed and final cleaning of equipment and premises has been completed.

2. When the installation is complete and adjustments have been made, operate the system for a period of one week, during which time demonstrate that systems are completed and operating in conformance with the specifications.

3. Refer to Section 01 70 00 – Execution and Closeout Requirements for other system starting requirements.

P. Operating and Maintenance Data: Submit complete and at one time, prior to acceptance of the installation, 4 copies of manufacturer's instructions for operation and maintenance of electrical equipment, including replacement parts lists. As specified in Section 01 70 00 – Execution and Closeout Requirements.

Q. Inspection and Acceptance Procedures: The Architect will submit observation reports periodically during the construction phase detailing Contract deficiencies. The Contractor is responsible for making corrections immediately. Notice of Completion of the project will not be made until all items have been corrected.

R. Substantial Completion of Electrical Systems:

1. Prior to Substantial Completion of operating electrical systems, the Contractor shall:

   a. Provide materials of the type and quality specified and as necessary for proper operation, tested and ready for use.

   b. Deliver to the Engineer, the Record Drawings.

   c. Furnish the required Operating and Maintenance Data/Manuals.

   d. Clean up of the project pertaining to this Division of the work.

   e. After installation has been completed and adjustments made, operate the system for a period of one week, during which time, demonstrate to the Engineer that systems are complete and operating in conformance with Contract Documents.

   f. Conduct tests required and as specified in this Division and submit test reports and corrective actions taken.

   g. Submission of warranties and guarantees.

2. Substantial Completion of Work Shall be Contingent On:

   a. Contractor replacing defective materials and workmanship.

b. Upon completion of work and adjustments made, Contractor shall conduct an operating test for each system for approval at such time as Engineer directs. Conduct test in presence of authorized representative of Architect and demonstrate that systems and equipment do operate in accordance with requirements of the Contract Documents and are free from electrical and mechanical defects.

c. Contractor shall provide the necessary training programs and instructions to the Owner's representative. Number of hours or days as required under separate Sections of these Specifications.

d. Submit copies of manufacturer's instructions and maintenance of electrical equipment including replacement parts lists. Each set shall include one set of shop drawings of equipment installed.

S. Submittals for Change Orders: When changes are made during the construction phase, deletions and additions shall be presented in a manner that will indicate the cost of each item of material and corresponding labor. Markup shall be then added in accordance with the requirements of the General Conditions as modified by the Supplementary Conditions.

1. Unit pricing shall apply in event of changes, additions and deletions to the base Contract, as follows:

a. Submit a unit cost, covering one hour of labor, including all applicable supervision, nonproductive labor, burdens, benefits, insurance's, taxes, direct and indirect job expenses including drawings, engineering temporary power, warehouse, tools, equipment, clean-up, bonds, overhead and profit, charged for labor. Unit cost of labor shall be applicable for duration through completion of the project.

b. Material unit costs shall be based on the latest edition of "Electrical Trade Book," published by Trade Service Publications, Inc., Unit cost shall be taken from extreme right-hand column.

2. Labor unit quantities, for specific items as required by unit pricing and for equipment not covered by unit pricing shall be those listed in the third column from the National Electrical Contractors' Association, Inc., "NECA Manual of Labor Units."

3. For material not covered by the Unit Pricing, use the latest edition of "Electrical Trade Book, extreme right hand column. This materials cost shall remain for the duration of the contract and shall apply to all phases of construction.

T. The Contractor at a time convenient to the Owner shall provide instruction to the Owner's operating personnel in the proper operation and maintenance of the equipment and systems. The instructors shall have received factory training and shall be thoroughly familiar with the equipment installed. The operating

personnel shall receive the number of days instruction as indicated in other sections.

U. General Commissioning Requirements:

1. Attend Commissioning pre-construction meeting and other required meetings to facilitate coordination and execution of the commissioning scope.

2. Provide the services of specialized technicians when required for certain tests and/or validation efforts. These services may come from the vendors of the equipment to be tested or from qualified independent testing services.

3. Systems that will be commissioned are:

a. Fire detection and alarm system.

V. Commissioning Work in Cooperation with Other Trades:

1. Coordinate with the various vendors of products provided to obtain the extra descriptive data, submittal data, O&M manuals, documentation and other information required for submittal for commissioning purposes. Provide this information timely to the commissioning schedule outlined and/or as required by the commissioning provider.

2. Arrange and pay for focused training materials and services provided by the various equipment vendors of products provided and installed for this project.

3. For each of the systems categories outlined above, inform the vendors and subcontractors of the commissioning responsibilities incumbent on them to provide so they can offer their assistance and experience related to their products.

4. Cooperate with and assist the Owner for functional testing of HVAC, fire protection/suppression systems, iron door systems upon testing of fire detection and alarm system.

PART 2: PRODUCTS – NOT USED

PART 3: EXECUTION – NOT USED

END OF SECTION

SECTION 26 05 03

EQUIPMENT WIRING CONNECTIONS

PART 1: GENERAL

1.1 SUMMARY

A. Section includes electrical connections to equipment.

B. Related Sections:

1. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.

2. Section 26 05 33 - Raceway and Boxes for Electrical Systems.

1.2 REFERENCES

A. National Electrical Manufacturers Association:

1. NEMA WD 1 - General Requirements for Wiring Devices.

2. NEMA WD 6 - Wiring Devices-Dimensional Requirements.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit wiring device manufacturer's catalog information showing dimensions, configurations, and construction.

C. Manufacturer's installation instructions.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Submittal procedures.

B. Project Record Documents: Record actual locations, sizes, and configurations of equipment connections.

1.5 COORDINATION

A. Section 01 31 00 – Project Management and Coordination.

B. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.

C. Determine connection locations and requirements.

D. Sequence rough-in of electrical connections to coordinate with installation of equipment.

E. Sequence electrical connections to coordinate with start-up of equipment.

PART 2: PRODUCTS

2.1 CORD AND PLUGS

A. Manufacturers:

1. Hubbell.

2. Pass & Seymour.

3. Arrow-Hart.

4. Substitutions: Section 01 25 00 – Substitution procedures.

B. Attachment Plug Construction: Conform to NEMA WD 1.

C. Configuration: NEMA WD 6; match receptacle configuration at outlet furnished for equipment.

D. Cord Construction: Type SO multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.

E. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.

PART 3: EXECUTION

3.1 EXAMINATION

A. Section 01 31 00 – Project Management and Coordination.

B. Verify equipment is ready for electrical connection, for wiring, and to be energized.

3.2 INSTALLATION

A. Make electrical connections.

B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.

C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.

D. Install receptacle outlet to accommodate connection with attachment plug.

E. Install cord and cap for field-supplied attachment plug.

F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.

H. Install terminal block jumpers to complete equipment wiring requirements.

I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

J. Coolers and Freezers: Cut and seal conduit openings in freezer and cooler walls, floor, and ceilings.

3.3 ADJUSTING

A. Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting, and balancing.

B. Cooperate with utilization equipment installers and field service personnel during checkout and starting of equipment to allow testing and balancing and other startup operations. Provide personnel to operate electrical system and checkout wiring connection components and configurations.

END OF SECTION

SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1: GENERAL

1.1 SUMMARY

A. Section includes building wire and cable; nonmetallic-sheathed cable; direct burial cable; service entrance cable; armored cable; metal clad cable; and wiring connectors and connections.

B. Related Sections:

1. Section 26 05 53 - Identification for Electrical Systems: Product requirements for wire identification.

1.2 REFERENCES

A. International Electrical Testing Association:

1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

B. National Fire Protection Association:

1. NFPA 70 - National Electrical Code.

2. NFPA 262 - Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.

C. Underwriters Laboratories, Inc.:

1. UL 1277 - Standard for Safety for Electrical Power and Control Tray Cables with Optional Optical-Fiber Members.

1.3 SYSTEM DESCRIPTION

A. Product Requirements: Provide products as follows:

1. Solid conductor for feeders and branch circuits 10 AWG and smaller.

2. Stranded conductors for feeders and branch circuits 8 AWG and larger.

3. Stranded conductors for control circuits.

4. Conductor not smaller than 12 AWG for power and lighting circuits.

5. Conductor not smaller than 16 AWG for control circuits.

6. 10 AWG conductors for 20 ampere, 120 volt branch circuits larger than 75 feet.

7. 10 AWG conductors for 20 ampere, 277 volt branch circuits larger than 200 feet.

B. Wiring Methods: Provide the following wiring methods:

1. Concealed Dry Interior Locations: Use only building wire, Type THHN/THWN insulation, in raceway.

2. Exposed Dry Interior Locations: Use only building wire, Type THHN/THWN insulation, in raceway.

3. Above Accessible Ceilings: Use only building wire , Type THHN/THWN insulation, in raceway.

4. Wet or Damp Interior Locations: Use only building wire, Type THHN/THWN insulation, in raceway.

5. Exterior Locations: Use only building wire, Type THHN/THWN insulation, in raceway.

6. Underground Locations: Use only building wire, Type THHN/THWN insulation, in raceway.

1.4 DESIGN REQUIREMENTS

A. Conductor sizes are based on copper type THHN/THWN 600V insulation rated 75 degrees C.

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit for building wire and each cable assembly type.

C. Test Reports: Indicate procedures and values obtained.

1.6 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

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

1.7 QUALITY ASSURANCE

A. Provide wiring materials located in plenums with peak optical density not greater than 0.5, average optical density not greater than 0.15, and flame spread not greater than 5 feet (1.5 m) when tested in accordance with NFPA 262.

B. Perform Work in accordance with State of California Public Work's standard.

C. Maintain two copies of each document on site.

1.8 QUALIFICATIONS

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

1.9 FIELD MEASUREMENTS

A. Verify field measurements are as indicated on Drawings.

1.10 COORDINATION

A. Section 01 31 00 – Project Management and Coordination.

B. Where wire and cable destination is indicated and routing is not shown, determine routing and lengths required.

PART 2: PRODUCTS

2.1 BUILDING WIRE

A. Manufacturers:

1. General Cable Co.
2. Rome Cable.
3. Southwire.
4. Superior Essex.
5. Substitutions: Section 01 25 00 – Substitution procedure.

B. Product Description: Single conductor insulated wire.

C. Conductor: Copper.

2.2 ARMORED CABLE

A. Manufacturers:

1. Diamond Wire & Cable Co.
2. Essex Group Inc.
3. General Cable Co.
4. Substitutions: Section 01 25 00 – Substitution procedure.

B. Conductor: Copper.

C. Insulation Voltage Rating: 600 volts.

D. Insulation Temperature Rating: 60 degrees C.

E. Insulation Material: Thermoplastic.

F. Armor Material: Steel

G. Armor Design: Interlocked metal tape.

2.3 METAL CLAD CABLE

A. Manufacturers:

1. Diamond Wire & Cable Co.

2. Essex Group Inc.

3. General Cable Co.

4. Substitutions: Section 01 25 00 – Substitution procedure.

B. Conductor: Copper.

C. Insulation Voltage Rating: 600 volts.

D. Insulation Temperature Rating: 60 degrees C.

E. Insulation Material: Thermoplastic.

F. Armor Material: Steel.

G. Armor Design: Interlocked metal tape.

H. Jacket: PVC.

2.4 WIRING CONNECTORS

A. Split Bolt Connectors:

1. ILSCO, Model SK.

2. Blackburn, Model HPS.

3. Burndy, Model KSU.

4. Substitutions: Section 01 25 00 – Substitution procedure.

B. Solderless Pressure Connectors:

1. ILSCO, Model SLUH.

2. Burndy, Model KA-U.

3. Panduit, Model LAM.

4. Substitutions: Section 01 25 00 – Substitution procedure.

C. Compression Connectors:

1. ILSCO, Model CRL.

2. Blackburn, Model ATL.

3. Burndy, Model HYLUG/HYLINK.

4. Substitutions: Section 01 25 00 – Substitution procedure.

2.5 TERMINATIONS

A. Terminal Lugs for Wires 6 AWG and Smaller: Solderless, compression type copper.

B. Lugs for Wires 4 AWG and Larger: Color keyed, compression type copper, with insulating sealing collars.

PART 3: EXECUTION

3.1 EXAMINATION

A. Section 01 31 00 – Project Management and Coordination.

B. Verify interior of building has been protected from weather.

C. Verify mechanical work likely to damage wire and cable has been completed.

D. Verify raceway installation is complete and supported.

3.2 PREPARATION

A. Completely and thoroughly swab raceway before installing wire.

3.3 INSTALLATION

A. Route wire and cable to meet Project conditions.

B. Neatly train and lace wiring inside boxes, equipment, and panelboards.

C. Identify wire and cable under provisions of Section 26 05 53. Identify each conductor with its circuit number or other designation indicated.

D. Special Techniques--Building Wire in Raceway:

1. Pull conductors into raceway at same time.

2. Install building wire 4 AWG and larger with pulling equipment.

E. Special Techniques - Cable:

1. Protect exposed cable from damage.

2. Support cables above accessible ceiling, using spring metal clips or plastic cable ties to support cables from structure. Do not rest cable on ceiling panels.

3. Use suitable cable fittings and connectors.

F. Special Techniques - Wiring Connections:

1. Clean conductor surfaces before installing lugs and connectors.

2. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.

3. Tape uninsulated conductors and connectors with electrical tape to 150 percent of insulation rating of conductor.

4. Install split bolt connectors for copper conductor splices and taps, 6 AWG and larger.

5. Install solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.

G. Install stranded conductors for branch circuits 10 AWG and smaller. When stranded conductors are used in lieu of solid, then install crimp on fork terminals for device terminations. Do not place bare stranded conductors directly under screws.

H. Size lugs in accordance with manufacturer's recommendations terminating wire sizes. Install 2-hole type lugs to connect wires 4 AWG and larger to copper bus bars.

I. For terminal lugs fastened together such as on motors, transformers, and other apparatus, or when space between studs is small enough that lugs can turn and touch each other, insulate for dielectric strength of 2-1/2 times normal potential of circuit.

3.4 WIRE COLOR

A. General:

1. For wire sizes 10 AWG and smaller, install wire colors in accordance with the following:

a. Black and red for single phase circuits at 120/240 volts.

b. Black, red, and blue for circuits at 120/208 volts single or three phase.

c. Orange, brown, and yellow for circuits at 277/480 volts single or three phase.

2. For wire sizes 8 AWG and larger, identify wire with colored tape at terminals, splices and boxes. Colors are as follows:

a. Black and red for single phase circuits at 120/240 volts.

b. Black, red, and blue for circuits at 120/208 volts single or three phase.

c. Orange, brown, and yellow for circuits at 277/480 volts single or three phase.

B. Neutral Conductors: White. When two or more neutrals are located in one conduit, individually identify each with proper circuit number.

C. Branch Circuit Conductors: Install three or four wire home runs with each phase uniquely color coded.

D. Feeder Circuit Conductors: Uniquely color code each phase.

E. Ground Conductors:

1. For 6 AWG and smaller: Green.

2. For 4 AWG and larger: Identify with green tape at both ends and visible points including junction boxes.

3.5 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements, 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.3.1.

END OF SECTION

SECTION 26 05 29

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1: GENERAL

1.1 SUMMARY

A. Section Includes:

1. Conduit supports.
2. Formed steel channel.
3. Spring steel clips.
4. Sleeves.
5. Firestopping relating to electrical work.
6. Firestopping accessories.
7. Equipment bases and supports.

B. Related Sections:

1. Section 03 30 00 - Cast-In-Place Concrete: Product requirements for concrete for placement by this section.
2. Section 28 05 29 - Hangers and Supports for Electronic Safety and Security.

1.2 REFERENCES

A. ASTM International:

1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
2. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
3. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops.
4. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.

B. FM Global:

1. FM - Approval Guide, A Guide to Equipment, Materials & Services Approved By Factory Mutual Research For Property Conservation.

C. California Electrical Code

1. CEC – California Electrical Code.

D. Underwriters Laboratories Inc.:

1. UL 263 - Fire Tests of Building Construction and Materials.

2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

3. UL 1479 - Fire Tests of Through-Penetration Firestops.

4. UL 2079 - Tests for Fire Resistance of Building Joint Systems.

5. UL - Fire Resistance Directory.

1.3 DEFINITIONS

A. Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

1.4 SYSTEM DESCRIPTION

A. Firestopping Materials: ASTM E119, UL 1479 to achieve fire ratings as noted on Drawings for adjacent construction, but not less than 1 hour fire rating.

B. Firestopping Materials ASTM E119, UL 1479 to achieve fire ratings of adjacent construction in accordance with UL Design Numbers noted on Drawings.

C. Firestop interruptions to fire rated assemblies, materials, and components.

1.5 PERFORMANCE REQUIREMENTS

A. Firestopping: Conform to CSFM and UL for fire resistance ratings and surface burning characteristics.

B. Firestopping: Provide certificate of compliance from authority having jurisdiction indicating approval of materials used.

1.6 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings: Indicate system layout with location and detail of trapeze hangers.

C. Product Data:

1. Hangers and Supports: Submit manufacturers catalog data including load capacity.

2. Firestopping: Submit data on product characteristics, performance and limitation criteria.

D. Firestopping Schedule: Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance rating of adjacent assembly.

E. Design Data: Indicate load carrying capacity of trapeze hangers and hangers and supports.

F. Manufacturer's Installation Instructions:

1. Hangers and Supports: Submit special procedures and assembly of components.

2. Firestopping: Submit preparation and installation instructions.

G. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

H. Engineering Judgements: For conditions not covered by UL listed designs, submit judgements by licensed professional engineer suitable for presentation to authority having jurisdiction for acceptance as meeting code fire protection requirements.

1.7 QUALITY ASSURANCE

A. Through Penetration Firestopping of Fire Rated Assemblies: ASTM E814 with 0.10 inch water gage minimum positive pressure differential to achieve fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.

1. Wall Penetrations: Fire F-Ratings as indicated on Drawings, but not less than 1-hour.

2. Floor Penetrations: Fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.

a. Floor Penetrations Within Wall Cavities: T-Rating is not required.

B. Through Penetration Firestopping of Non-Fire Rated Floor Assemblies: Materials to resist free passage of flame and products of combustion.

1. Noncombustible Penetrating Items: Noncombustible materials for penetrating items connecting maximum of three stories.

2. Penetrating Items: Materials approved by authorities having jurisdiction for penetrating items connecting maximum of two stories.

C. Fire Resistant Joints in Fire Rated Floor, Roof, and Wall Assemblies: UL 2079 to achieve fire resistant rating as indicated on Drawings for assembly in which joint is installed.

D. Fire Resistant Joints Between Floor Slabs and Exterior Walls: ASTM E119 with 0.10 inch water gage minimum positive pressure differential to achieve fire resistant rating as indicated on Drawings for floor assembly.

E. Surface Burning Characteristics: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

F. Perform Work in accordance with State of California Public Work's standard.

G. Maintain two copies of each document on site.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum three years documented experience.

1.9 PRE-INSTALLATION MEETINGS

A. Section 01 31 00 – Project Management and Coordination.

B. Convene minimum one week prior to commencing work of this section.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

B. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

1.11 ENVIRONMENTAL REQUIREMENTS

A. Do not apply firestopping materials when temperature of substrate material and ambient air is below 60 degrees F.

B. Maintain this minimum temperature before, during, and for minimum 3 days after installation of firestopping materials.

PART 2: PRODUCTS

2.1 CONDUIT SUPPORTS

A. Manufacturers:

1. Cooper B-Line Systems
2. Panduit Corp.
3. Unistrut Corp.
4. Substitutions: Section 01 25 00 – Substitution procedure.

B. Hanger Rods: Threaded high tensile strength galvanized carbon steel with free running threads.

C. Beam Clamps: Malleable Iron, with tapered hole in base and back to accept either bolt or hanger rod. Set screw: hardened steel.

D. Conduit clamps for trapeze hangers: Galvanized steel, notched to fit trapeze with single bolt to tighten.

E. Conduit clamps - general purpose: One hole malleable iron for surface mounted conduits.

F. Cable Ties: High strength nylon temperature rated to 185 degrees F. Self locking.

2.2 FORMED STEEL CHANNEL

A. Manufacturers:

1. Cooper B-Line Systems.
2. Panduit Corp.
3. Unistrut Corp.
4. Substitutions: Section 01 25 00 – Substitution procedure.

B. Product Description: Galvanized (12 gage) thick steel. With holes 1-1/2 inches on center.

2.3 SPRING STEEL CLIPS

A. Manufacturers:

1. Cooper B-Line Systems
2. Substitutions: Section 01 25 00 – Substitution procedure.

B. Product Description: Mounting hole and screw closure.

2.4 SLEEVES

A. Furnish materials in accordance State of California Public Work's standard.

B. Sleeves for Through Non-fire Rated Floors: 18 gage thick galvanized steel.

C. Sleeves for Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.

D. Sleeves for Through Fire Rated and Fire Resistive Floors and Walls, and Fire Proofing: Prefabricated fire rated sleeves including seals, UL listed.

2.5 FIRESTOPPING

A. Manufacturers:

1. Dow Corning Corp.

2. Fire Trak Corp.

3. Hilti Corp.

4. International Protective Coating Corp.

5. 3M Fire Protection Products.

6. Specified Technology, Inc.

7. Substitutions: Section 01 25 00 – Substitution procedure.

B. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.

1. Silicone Firestopping Elastomeric Firestopping: Silicone elastomeric compound and compatible silicone sealant.

2. Foam Firestopping Compounds: Foam compound.

3. Fiber Stuffing and Sealant Firestopping: Composite of mineral or ceramic fiber stuffing insulation with silicone elastomer for smoke stopping.

4. Intumescent Firestopping: Intumescent putty compound which expands on exposure to surface heat gain.

5. Firestop Pillows: Formed mineral fiber pillows.

C. Color: As selected from manufacturer's full range of colors.

2.6 FIRESTOPPING ACCESSORIES

A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.

B. Dam Material: Permanent:

1. Mineral fiberboard.

2. Sheet metal.

C. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

D. General:

1. Furnish UL listed products or products tested by nationally recognized independent testing laboratory.

2. Select products with rating not less than rating of wall or floor being penetrated.

E. Non-Rated Surfaces:

1. Stamped steel, chrome plated, hinged, split ring escutcheons or floor plates or ceiling plates for covering openings in occupied areas where conduit is exposed.

2. For exterior wall openings below grade, furnish modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill annular space between conduit and cored opening or water-stop type wall sleeve.

PART 3: EXECUTION

3.1 EXAMINATION

A. Section 01 31 00 – Project Management and Coordination: Verification of existing conditions before starting work.

B. Verify openings are ready to receive sleeves.

C. Verify openings are ready to receive firestopping.

3.2 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.

B. Remove incompatible materials affecting bond.

C. Install backing or damming materials to arrest liquid material leakage.

D. Obtain permission from Architect/Engineer before using powder-actuated anchors.

E. Obtain permission from Architect/Engineer before drilling or cutting structural members.

3.3 INSTALLATION - HANGERS AND SUPPORTS

A. Anchors and Fasteners:

1. Concrete Structural Elements: Provide expansion anchors.

2. Steel Structural Elements: Provide beam clamps.

3. Concrete Surfaces: Provide expansion anchors.

4. Hollow Masonry, Plaster, and Gypsum Board Partitions: Provide toggle bolts and hollow wall fasteners.

5. Solid Masonry Walls: Provide expansion anchors and preset inserts.

6. Sheet Metal: Provide sheet metal screws.

7. Wood Elements: Provide wood screws.

B. Inserts:

1. Install inserts for placement in concrete forms.

2. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.

4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

C. Install conduit and raceway support and spacing in accordance with CEC.

D. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.

E. Install multiple conduit runs on common hangers.

F. Supports:

1. Fabricate supports from structural steel or formed steel channel. Install hexagon head bolts to present neat appearance with adequate strength and rigidity. Install spring lock washers under nuts.

2. Install surface mounted cabinets and panelboards with minimum of four anchors.

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

4. Support vertical conduit at every floor.

3.4 INSTALLATION - FIRESTOPPING

A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, conduit and other items, requiring firestopping.

B. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.

C. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating.

D. Dam material to remain.

E. Fire Rated Surface:

1. Seal opening at wall, ceiling, and roof as follows:

a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.

b. Size sleeve allowing minimum of 1 inch void between sleeve and building element.

c. Pack void with backing material.

d. Seal ends of sleeve with UL listed fire resistive silicone compound to meet fire rating of structure penetrated.

2. Where cable tray, conduit, or wireway penetrates fire rated surface, install firestopping product in accordance with manufacturer's instructions.

F. Non-Rated Surfaces:

1. Seal opening through non-fire rated wall, floor, ceiling, and roof opening as follows:

a. Install sleeve through opening and extending beyond minimum of 1 inch on both sides of building element.

b. Size sleeve allowing minimum of 1 inch void between sleeve and building element.

c. Install type of firestopping material recommended by manufacturer.

2. Install escutcheons, floor plates or ceiling plates where conduit, penetrates non-fire rated surfaces in occupied spaces. Occupied spaces include rooms with finished ceilings and where penetration occurs below finished ceiling.

3. Exterior wall openings below grade: Assemble rubber links of mechanical seal to size of conduit and tighten in place, in accordance with manufacturer's instructions.

4. Interior partitions: Seal pipe penetrations at telecommunication rooms. Apply sealant to both sides of penetration to completely fill annular space between sleeve and conduit.

3.5 INSTALLATION - SLEEVES

A. Exterior entries: Seal with adjustable interlocking rubber links.

B. Set sleeves in position in forms. Provide reinforcing around sleeves.

C. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

D. Extend sleeves through floors 2 inches above finished floor level. Caulk sleeves.

E. Where conduit or raceway penetrates floor, ceiling, or wall, close off space between conduit or raceway and adjacent work with fire stopping insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

F. Install stainless steel escutcheons at finished surfaces.

3.6 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements and 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspect installed firestopping for compliance with specifications and submitted schedule.

3.7 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for cleaning.

B. Clean adjacent surfaces of firestopping materials.

3.8 PROTECTION OF FINISHED WORK

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Protect adjacent surfaces from damage by material installation.

END OF SECTION

SECTION 26 05 33

RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1: GENERAL

1.1 SUMMARY

A. Section includes conduit and tubing, surface raceways, wireways, outlet boxes, pull and junction boxes, and handholes.

B. Related Sections:

1. Section 26 05 03 - Equipment Wiring Connections.
2. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
3. Section 26 05 29 - Hangers and Supports for Electrical Systems.
4. Section 26 05 53 - Identification for Electrical Systems.
5. Section 26 27 16 - Electrical Cabinets and Enclosures.
6. Section 26 27 26 - Wiring Devices.
7. Section 28 05 33 - Conduits and Backboxes for Electronic Safety and Security.
8. Section 28 05 36 - Cable Trays for Electronic Safety and Security.

1.2 REFERENCES

A. American National Standards Institute:

1. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.
2. ANSI C80.3 - Specification for Electrical Metallic Tubing, Zinc Coated.
3. ANSI C80.5 - Aluminum Rigid Conduit - (ARC).

B. National Electrical Manufacturers Association:

1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
2. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
3. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.

4. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers, and Box Supports.

5. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.

6. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.

7. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.

1.3 SYSTEM DESCRIPTION

A. Raceway and boxes located as indicated on Drawings, and at other locations required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements. Raceway and boxes are shown in approximate locations unless dimensioned. Provide raceway to complete wiring system.

B. Underground More than 5 feet outside Foundation Wall: Provide thickwall nonmetallic conduit. Provide cast metal boxes.

C. Under Slab on Grade: Provide rigid steel conduit. Provide cast metal boxes.

D. Outdoor Locations, Above Grade: Provide PVC coated rigid steel conduit. Provide cast metal or nonmetallic outlet, pull, and junction boxes.

E. Wet and Damp Locations: Provide rigid steel conduit. Provide cast metal outlet, junction, and pull boxes. Provide flush mounting outlet box in finished areas.

F. Concealed Dry Locations: Provide electrical metallic tubing. Provide sheet-metal boxes. Provide flush mounting outlet box in finished areas. Provide hinged enclosure for large pull boxes.

G. Exposed Dry Locations: Provide electrical metallic tubing. Provide sheet-metal boxes. Provide flush mounting outlet box in finished areas. Provide hinged enclosure for large pull boxes.

1.4 DESIGN REQUIREMENTS

A. Minimum Raceway Size: 3/4 inch above grade and once unless otherwise specified.

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit for the following:

1. Flexible metal conduit.

2. Liquidtight flexible metal conduit.

3. Nonmetallic conduit.

4. Flexible nonmetallic conduit.

5. Nonmetallic tubing.

6. Raceway fittings.

7. Conduit bodies.

8. Surface raceway.

9. Wireway.

10. Pull and junction boxes.

C. Manufacturer's Installation Instructions: Submit application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

1.6 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents:

1. Record actual routing of conduits larger than 2 inches.

2. Record actual locations and mounting heights of outlet, pull, and junction boxes.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

B. Protect PVC conduit from sunlight.

1.8 COORDINATION

A. Section 01 31 00 – Project Management and Coordination.

B. Coordinate installation of outlet boxes for equipment connected under Section 26 05 03.

C. Coordinate mounting heights, orientation and locations of outlets mounted above counters, benches, and backsplashes.

PART 2: PRODUCTS

2.1 METAL CONDUIT

A. Manufacturers:

1. Allied Tube.
2. Hubbell Wiring Devices .
3. Thomas & Betts Corp.
4. Walker Systems Inc.
5. The Wiremold Co..
6. Substitutions: Section 01 25 00 – Substitution procedure.

B. Rigid Steel Conduit: ANSI C80.1.

C. Intermediate Metal Conduit (IMC): Rigid steel.

D. Fittings and Conduit Bodies: NEMA FB 1.

2.2 PVC COATED METAL CONDUIT

A. Manufacturers:

1. Allied Tube.
2. Hubbell Wiring Devices .
3. Thomas & Betts Corp.
4. Walker Systems Inc.
5. The Wiremold Co..
6. Substitutions: Section 01 25 00 – Substitution procedure.

B. Product Description: NEMA RN 1; rigid steel conduit with external PVC coating, 20 mil thick.

C. Fittings and Conduit Bodies: NEMA FB 1; steel fittings with external PVC coating to match conduit.

2.3 FLEXIBLE METAL CONDUIT

A. Manufacturers:

1. Allied Tube.
2. Hubbell Wiring Devices .
3. Thomas & Betts Corp.
4. Walker Systems Inc.

5. The Wiremold Co..

6. Substitutions: Section 01 25 00 – Substitution procedure.

B. Product Description: Interlocked steel construction.

C. Fittings: NEMA FB 1.

2.4 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

A. Manufacturers:

1. Allied Tube.

2. Hubbell Wiring Devices .

3. Thomas & Betts Corp.

4. Walker Systems Inc.

5. The Wiremold Co..

6. Substitutions: Section 01 25 00 – Substitution procedure.

B. Product Description: Interlocked steel construction with PVC jacket.

C. Fittings: NEMA FB 1.

2.5 ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:

1. Allied Tube.

2. Hubbell Wiring Devices .

3. Thomas & Betts Corp.

4. Walker Systems Inc.

5. The Wiremold Co..

6. Substitutions: Section 01 25 00 – Substitution procedure.

B. Product Description: ANSI C80.3; galvanized tubing.

C. Fittings and Conduit Bodies: NEMA FB 1; steel , compression type.

2.6 NONMETALLIC CONDUIT

A. Manufacturers:

1. Allied Tube.
2. Hubbell Wiring Devices .
3. Thomas & Betts Corp.
4. Walker Systems Inc.
5. The Wiremold Co..
6. Substitutions: Section 01 25 00 – Substitution procedure.

B. Product Description: NEMA TC 2; Schedule 40 PVC.

C. Fittings and Conduit Bodies: NEMA TC 3.

2.7 SURFACE METAL RACEWAY

A. Manufacturers:

1. Hubbell Wiring Devices .
2. Panduit Corp.
3. Walker Systems Inc.
4. The Wiremold Co..
5. Substitutions: Section 01 25 00 – Substitution procedure.

B. Product Description: Sheet metal channel with fitted cover, suitable for use as surface metal raceway.

C. Size: As noted on drawings.

D. Finish: As noted on drawings.

E. Fittings, Boxes, and Extension Rings: Furnish manufacturer's standard accessories; match finish on raceway.

2.8 SURFACE NONMETAL RACEWAY

A. Manufacturers:

1. Carlon Electrical Products.
2. Hubbell Wiring Devices .
3. Thomas & Betts Corp.
4. Walker Systems Inc.

5. The Wiremold Co..

6. Substitutions: Section 01 25 00 – Substitution procedure.

B. Product Description: Plastic channel with fitted cover, suitable for use as surface raceway.

C. Size: As noted on drawings.

D. Finish: As noted on drawings.

E. Fittings, Boxes, and Extension Rings: Furnish manufacturer's standard accessories, finish to match raceway.

2.9 WIREWAY

A. Manufacturers:

1. Carlon Electrical Products.

2. Hubbell Wiring Devices .

3. Thomas & Betts Corp.

4. Walker Systems Inc.

5. The Wiremold Co..

6. Substitutions: Section 01 25 00 – Substitution procedure.

B. Product Description: General purpose type wireway.

C. Knockouts: Manufacturer's standard.

D. Size: As indicated on Drawings.

E. Cover: Screw cover.

F. Connector: Slip-in.

G. Fittings: Lay-in type with removable top, bottom, and side; captive screws.

H. Finish: Rust inhibiting primer coating with gray enamel finish.

2.10 OUTLET BOXES

A. Manufacturers:

1. Carlon Electrical Products.

2. Hubbell Wiring Devices .

3. Thomas & Betts Corp.

4. Walker Systems Inc.

5. The Wiremold Co..

6. Substitutions: Section 01 25 00 – Substitution procedure.

B. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.

1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; furnish 1/2 inch male fixture studs where required.

2. Concrete Ceiling Boxes: Concrete type.

C. Nonmetallic Outlet Boxes: NEMA OS 2.

D. Cast Boxes: NEMA FB 1, Type FD, cast feralloy. Furnish gasketed cover by box manufacturer. Furnish threaded hubs.

E. Wall Plates for Finished Areas: As specified in Section 26 27 26.

F. Wall Plates for Unfinished Areas: Furnish gasketed cover.

2.11 PULL AND JUNCTION BOXES

A. Manufacturers:

1. Carlon Electrical Products.

2. Hubbell Wiring Devices .

3. Thomas & Betts Corp.

4. Walker Systems Inc.

5. The Wiremold Co..

6. Substitutions: Section 01 25 00 – Substitution procedure.

B. Sheet Metal Boxes: NEMA OS 1, galvanized steel.

C. Hinged Enclosures: As specified in Section 26 27 16.

D. Surface Mounted Cast Metal Box: NEMA 250, Type 4; flat-flanged, surface mounted junction box:

1. Material: Cast aluminum.

2. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.

PART 3: EXECUTION

3.1 EXAMINATION

A. Section 01 31 00 – Project Management and Coordination.

B. Verify outlet locations and routing and termination locations of raceway prior to rough-in.

3.2 INSTALLATION

A. Ground and bond raceway and boxes in accordance with Section 26 05 26.

B. Fasten raceway and box supports to structure and finishes in accordance with Section 26 05 29.

C. Identify raceway and boxes in accordance with Section 26 05 53.

D. Arrange raceway and boxes to maintain headroom and present neat appearance.

3.3 INSTALLATION - RACEWAY

A. Raceway routing is shown in approximate locations unless dimensioned. Route to complete wiring system.

B. Arrange raceway supports to prevent misalignment during wiring installation.

C. Support raceway using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.

D. Group related raceway; support using conduit rack. Construct rack using steel channel specified in Section 26 05 29; provide space on each for 25 percent additional raceways.

E. Do not support raceway with wire or perforated pipe straps. Remove wire used for temporary supports

F. Do not attach raceway to ceiling support wires or other piping systems.

G. Construct wireway supports from steel channel specified in Section 26 05 29.

H. Route exposed raceway parallel and perpendicular to walls.

I. Route raceway installed above accessible ceilings parallel and perpendicular to walls.

J. Route conduit under slab from point-to-point.

K. Maintain clearance between raceway and piping for maintenance purposes.

L. Maintain 12 inch clearance between raceway and surfaces with temperatures exceeding 104 degrees F.

M. Cut conduit square using saw or pipe cutter; de-burr cut ends.

N. Bring conduit to shoulder of fittings; fasten securely.

O. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for minimum 20 minutes.

P. Install conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.

Q. Install no more than equivalent of three 90 degree bends between boxes. Install conduit bodies to make sharp changes in direction, as around beams. Install factory elbows for bends in metal conduit larger than 2 inch size.

R. Avoid moisture traps; install junction box with drain fitting at low points in conduit system.

S. Install fittings to accommodate expansion and deflection where raceway crosses seismic and expansion joints.

T. Install suitable pull string or cord in each empty raceway except sleeves and nipples.

U. Install suitable caps to protect installed conduit against entrance of dirt and moisture.

V. Surface Raceway: Install flat-head screws, clips, and straps to fasten raceway channel to surfaces; mount plumb and level. Install insulating bushings and inserts at connections to outlets and corner fittings.

W. Close ends and unused openings in wireway.

3.4 INSTALLATION - BOXES

A. Install wall mounted boxes at elevations to accommodate mounting heights as indicated on Drawings.

B. Adjust box location up to 10 feet prior to rough-in to accommodate intended purpose.

C. Orient boxes to accommodate wiring devices oriented as specified in Section 26 27 26.

D. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

E. In Accessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.

F. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.

G. Do not install flush mounting box back-to-back in walls; install with minimum 6 inches separation. Install with minimum 24 inches separation in acoustic rated walls.

H. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.

I. Install stamped steel bridges to fasten flush mounting outlet box between studs.

J. Install flush mounting box without damaging wall insulation or reducing its effectiveness.

K. Install adjustable steel channel fasteners for hung ceiling outlet box.

L. Do not fasten boxes to ceiling support wires or other piping systems.

M. Support boxes independently of conduit.

N. Install gang box where more than one device is mounted together. Do not use sectional box.

O. Install gang box with plaster ring for single device outlets.

3.5 INTERFACE WITH OTHER PRODUCTS

A. Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods described in other sections.

B. Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket.

C. Locate outlet boxes to allow luminaires positioned as indicated on Drawings.

D. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.

3.6 ADJUSTING

A. Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting, and balancing.

B. Adjust flush-mounting outlets to make front flush with finished wall material.

C. Install knockout closures in unused openings in boxes.

3.7 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Clean interior of boxes to remove dust, debris, and other material.

C. Clean exposed surfaces and restore finish.

END OF SECTION

SECTION 26 05 48

SEISMIC CONTROLS FOR ELECTRICAL WORK

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 seismic restraints and other earthquake-damage-reduction measures for electrical components. It complements optional seismic construction requirements in the various electrical component Sections.

1.3 DEFINITIONS

A. BOCA: BOCA National Building Code.

B. SBC: Standard Building Code.

C. UBC: Uniform Building Code.

D. Seismic Restraint: A fixed device (a seismic brace, an anchor bolt or stud, or a fastening assembly) used to prevent vertical or horizontal movement, or both vertical and horizontal movement, of an electrical system component during an earthquake.

E. Mobile Structural Element: A part of the building structure such as a slab, floor structure, or wall that may move independent of other mobile structural elements during an earthquake

1.4 SUBMITTALS

A. Product Data: Illustrate and indicate types, styles, materials, strength, fastening provisions, and finish for each type and size of seismic restraint component used.

1. Anchor Bolts and Studs: Tabulate types and sizes, complete with report numbers and rated strength in tension and shear as evaluated by ICBO Evaluation Service.

B. Shop Drawings: For anchorage and bracing not defined by details and charts n Drawings. Indicate materials, and show designs and calculations signed and sealed by a professional engineer.

1. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.

2. Details: Detail fabrication and arrangement. Detail attachment of restraints to both structural and restrained items. Show attachment locations, methods, and spacings, identifying components and listing their strengths. Indicate direction and value of forces transmitted to the structure during seismic events.

3. Preapproval and Evaluation Documentation: By ICBO Evaluation Service, showing maximum ratings of restraints and the basis for approval (tests or calculations).

4. Coordination Drawings: Plans and sections drawn to scale and coordinating seismic bracing for electrical components with other systems and equipment, including other seismic restraints, in the vicinity.

C. Product Certificates: Signed by manufacturers of seismic restraints certifying that products furnished comply with requirements.

D. Qualification Data: For firms and persons specified in "Quality Assurance" Article.

E. Material Test Reports: From a qualified testing agency indicating and interpreting test results of seismic control devices for compliance with requirements indicated.

1.5 QUALITY ASSURANCE

A. Comply with seismic restraint requirements in California Building Code, unless requirements in this Section are more stringent.

B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing seismic engineering services, including the design of seismic restraints, that are similar to those indicated for this Project.

C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, with the experience and capability to conduct the testing indicated.

1.6 PROJECT CONDITIONS

A. Project Seismic Zone and Zone Factor as Defined in UBC: Zone 4, Zone Factor 0.40.

B. Occupancy Category as Defined in UBC: IV.

1.7 PROJECT CONDITIONS

A. Project Seismic Hazard Exposure Group as Defined in BOCA or SBC: III.

1.8 COORDINATION

A. Coordinate layout and installation of seismic bracing with building structural system and architectural features, and with mechanical, fire-protection, electrical, and other building features in the vicinity.

B. Coordinate concrete bases with building structural system.

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:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Amber/Booth Company, Inc.
2. B-Line Systems, Inc.
3. Erico, Inc.
4. GS Metals Corp.
5. Loos & Company, Inc.
6. Mason Industries, Inc,
7. Powerstrut.
8. Thomas & Betts Corp.
9. Unistrut Corporation.

2.2 MATERIALS

A. Use the following materials for restraints:

1. Indoor Dry Locations: Steel, zinc plated.
2. Outdoors and Damp Locations: Galvanized steel.
3. Corrosive Locations: Stainless steel.

2.3 ANCHORAGE AND STRUCTURAL ATTACHMENT COMPONENTS

A. Strength: Defined in reports by ICBO Evaluation Service or another agency acceptable to authorities having jurisdiction.

1. Structural Safety Factor: Strength in tension and shear of components used shall be at least two times the maximum seismic forces to which they will be subjected.

B. Concrete and Masonry Anchor Bolts and Studs: Steel-expansion wedge type.

1. Concrete Inserts: Steel-channel type.

C. Through Bolts: Structural type, hex head, high strength. Comply with ASTM A 325.

D. Welding Lugs: Comply with MSS SP-69, Type 57.

E. Beam Clamps for Steel Beams and Joists: Double sided. Single-sided type is not acceptable.

F. Bushings for Floor-Mounted Equipment Anchors: Neoprene units designed for seismically rated rigid equipment mountings, and matched to the type and size of anchor bolts and studs used.

G. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for seismically rated rigid equipment mountings, and matched to the type and size of attachment devices used.

2.4 SEISMIC BRACING COMPONENTS

A. Slotted Steel Channel: 1-5/8-by-1-5/8-inch cross section, formed from 0.1046-inch thick steel, with 9/16-by-7/8-inch slots at a maximum of 2 inches o.c. in webs, and flange edges turned toward web.

1. Materials for Channel: ASTM A 570, GR 33.

2. Materials for Fittings and Accessories: ASTM A 575, ASTM A 576, or ASTM A 36.

3. Fittings and Accessories: Products of the same manufacturer as channels and designed for use with that product.

4. Finish: Baked, rust-inhibiting, acrylic-enamel paint applied after cleaning and phosphate treatment, unless otherwise indicated.

B. Channel-Type Bracing Assemblies: Slotted steel channel, with adjustable hinged steel brackets and bolts.

C. Cable-Type Bracing Assemblies: Zinc-coated, high-strength steel wire rope cable attached to steel thimbles, brackets, and bolts designed for cable service.

1. Arrange units for attachment to the braced component at one end and to the structure at the other end.

2. Wire Rope Cable: Comply with ASTM 603. Use 49- or 133-strand cable with a minimum strength of 2 times the calculated maximum seismic force to be resisted.

D. Hanger Rod Stiffeners: Slotted steel channels with internally bolted connections to hanger rod.

PART 3: EXECUTION

3.1 APPLICATION

A. Generator Sets: Comply with Division 15 Section "Mechanical Vibration Controls and Seismic Restraints."

3.2 INSTALLATION

A. Install seismic restraints according to applicable codes and regulations and as approved by authorities having jurisdiction, unless more stringent requirements are indicated.

3.3 STRUCTURAL ATTACHMENTS

A. Use bolted connections with steel brackets, slotted channel, and slotted-channel fittings to spread structural loads and reduce stresses.

B. Attachments to New Concrete: Bolt to channel-type concrete inserts or use expansion anchors.

C. Holes for Expansion Anchors in Concrete: Drill at locations and to depths that avoid reinforcing bars.

D. Attachments to Solid Concrete Masonry Unit Walls: Use expansion anchors.

E. Attachments to Hollow Walls: Bolt to slotted steel channels fastened to wall with expansion anchors.

F. Attachments to Wood Structural Members: Install bolts through members.

G. Attachments to Steel: Bolt to clamps on flanges of beams or on upper truss chords of bar joists.

3.4 ELECTRICAL EQUIPMENT ANCHORAGE

A. Anchor rigidly to a single mobile structural element or to a concrete base that is structurally tied to a single mobile structural element.

B. Anchor panelboards, motor-control centers, motor controls, switchboards, switchgear, transformers, unit substations, fused power-circuit devices, transfer switches, busways, battery racks, static uninterruptible power units, power conditioners, capacitor units, communication system components, and electronic signal processing, control, and distribution units as follows:

1. Size concrete bases so expansion anchors will be a minimum of 10 bolt diameters from the edge of the concrete base.

2. Concrete Bases for Floor-Mounted Equipment: Use female expansion anchors and install studs and nuts after equipment is positioned.

3. Bushings for Floor-Mounted Equipment Anchors: Install to allow for resilient media between anchor bolt or stud and mounting hole in concrete.

4. Anchor Bolt Bushing Assemblies for Wall-Mounted Equipment: Install to allow for resilient media where equipment or equipment-mounting channels are attached to wall.

5. Torque bolts and nuts on studs to values recommended by equipment manufacturer.

3.5 SEISMIC BRACING INSTALLATION

A. Install bracing according to spacings and strengths indicated by approved analysis.

B. Expansion and Contraction: Install to allow for thermal movement of braced components.

C. Cable Braces: Install with maximum cable slack recommended by manufacturer.

D. Attachment to Structure: If specific attachment is not indicated, anchor bracing to the structure at flanges of beams, upper truss chords of bar joists, or at concrete members.

3.6 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Make flexible connections in raceways, cables, wireways, cable trays, and busways where they cross expansion and seismic control joints, where adjacent sections or branches are supported by different structural elements, and where they terminate at electrical equipment anchored to a different mobile structural element from the one supporting them.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform the following field quality-control testing:

B. Testing Agency: Engage a qualified testing agency to perform the following field quality-control testing:

C. Testing: Test pull-out resistance of seismic anchorage devices.

1. Provide necessary test equipment required for reliable testing.

2. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.

3. Schedule test with Owner, through Engineer, before connecting anchorage device to restrained component (unless post-connection testing has been approved), and with at least seven days' advance notice.

4. Obtain Architect's approval before transmitting test loads to the structure. Provide temporary load-spreading members.

5. Test at least four of each type and size of installed anchors and fasteners selected by Architect.

6. Test to 90 percent of rated proof load of device.

7. If a device fails the test, modify all installations of same type and retest until satisfactory results are achieved.

8. Record test results.

END OF SECTION

SECTION 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1: GENERAL

1.1 SUMMARY

A. Section Includes:

1. Nameplates.
2. Labels.
3. Wire markers.
4. Conduit markers.
5. Stencils.
6. Lockout Devices.

B. Related Sections:

1. Section 27 05 53 - Identification for Communications Systems.
2. Section 28 05 53 - Identification for Electronic Safety and Security.

1.2 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data:

1. Submit manufacturer's catalog literature for each product required.
2. Submit electrical identification schedule including list of wording, symbols, letter size, color coding, tag number, location, and function.

C. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.

1.3 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of tagged devices; include tag numbers.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Accept identification products on site in original containers. Inspect for damage.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

C. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Install products only when ambient temperature and humidity conditions for adhesive are within range recommended by manufacturer.

1.7 EXTRA MATERIALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for extra materials.

PART 2: PRODUCTS

2.1 NAMEPLATES

A. Furnish materials in accordance with County standards.

B. Product Description: Laminated three-layer plastic with engraved black letters on white background color.

C. Letter Size:

1. 1/8 inch high letters for identifying individual equipment and loads.

2. 1/4 inch high letters for identifying grouped equipment and loads.

D. Minimum nameplate thickness: 1/8 inch.

2.2 LABELS

A. Furnish materials in accordance with County standards.

B. Labels: Embossed adhesive tape, with 3/16 inch white letters on black background.

2.3 WIRE MARKERS

A. Furnish materials in accordance with County standards.

B. Description: Split sleeve type wire markers.

C. Legend:

1. Power and Lighting Circuits: Branch circuit or feeder number as indicated on Drawings.

2. Low voltage and Control Circuits: Wire number as indicated on shop drawings.

2.4 CONDUIT AND RACEWAY MARKERS

A. Furnish materials in accordance County standards.

B. Description: Labels fastened with adhesive black lettering on white background.

C. Legend:

1. 480 Volt System: 480 VOLTS.

2. 208 Volt System: 208 VOLTS.

2.5 STENCILS

A. Furnish materials in accordance with County standards.

B. Stencils: With clean cut symbols and letters of following size:

1. Up to 2 inches Outside Diameter of Raceway: 1/2 inch high letters.

2. 2-1/2 to 6 inches Outside Diameter of Raceway: 1 inch high letters.

2.6 LOCKOUT DEVICES

A. Lockout Hasps:

1. Anodized aluminum hasp with erasable label surface; size minimum 7-1/4 x 3 inches.

PART 3: EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

B. Prepare surfaces in accordance for stencil painting.

3.2 INSTALLATION

A. Install identifying devices after completion of painting.

B. Nameplate Installation:

1. Install nameplate parallel to equipment lines.

2. Install nameplate for each electrical distribution and control equipment enclosure with corrosive-resistant mechanical fasteners, or adhesive.

3. Install nameplates for each control panel and major control components located outside panel with corrosive-resistant mechanical fasteners, or adhesive.

4. Secure nameplate to equipment front using adhesive.

5. Secure nameplate to inside surface of door on recessed panelboard in finished locations.

6. Install nameplates for the following:

a. Switchboards.

b. Panelboards.

c. Transformers.

d. Service Disconnects.

C. Label Installation:

1. Install label parallel to equipment lines.

2. Install label for identification of individual control device stations.

3. Install labels for permanent adhesion and seal with clear lacquer.

D. Wire Marker Installation:

1. Install wire marker for each conductor at panelboard gutters, pull boxes, outlet and junction boxes and each load connection.

E. Stencil Installation:

1. Apply stencil painting in accordance with Industry standards.

F. Underground Warning Tape Installation:

1. Install underground warning tape along length of each underground conduit, raceway, or cable 6 to 8 inches below finished grade, directly above buried conduit, raceway, or cable.

END OF SECTION

SECTION 26 05 72

ACCEPTANCE TESTING

PART 1: GENERAL

1.1 SCOPE OF WORK

It is the intent of these acceptance tests to assure that all Contractor supplied equipment is operational and within industry and manufacturer's tolerances and is installed in accordance with designed specifications.

A. The acceptance tests and inspections shall determine suitability for energization of switchgear and cables.

B. Items that shall be checked, inspected, and tested include, but are not limited to, the following:

1. Relays.
2. Power/Lighting panel boards.
3. 600V rated cable.
4. Fire alarm system.

1.2 APPLICABLE CODES

A. All inspections and tests shall be in accordance with the following applicable codes and standards except as provided otherwise herein.

1. California Electrical Code - CEC 2010 Edition.
2. National Electrical Manufacturer's Association - NEMA.
3. American Society for Testing and Materials - ASTM.
4. Institute of Electrical and Electronic Engineers - IEEE.
5. National Electrical Testing Association - NET A.
6. American National Standards Institute - ANSI:
    a. C2, National Electrical Safety Code
    b. Z244-1, American National Standard for Personnel Protection
7. State Codes and Ordinances.
8. Insulated Cable Engineers Association - ICEA.
9. Association of Edison Illuminating Companies - AEIC.

10. Occupational Safety and Health Administration:

    a. Part 1910, Subpart S, 1910.30S

    b. Part 1926, Subpart V, 1926.950 through 1926.960

11. National Fire Protection Association - NFPA:

    a. ANSI/CECB, Electrical Equipment Maintenance

    b. CECE, Electrical Safety Requirements for Employee Workplaces

    c. ANSI/CEC, National Electrical Code 2002 Edition

    d. ANSI/NFPA 7S, Lightning Protection Code

    e. ANSI/NFPA 101, Life Safety Code

12. All inspections and tests shall utilize the following references:

    a. Project Design Specification.

    b. Project Design Drawings.

    c. Manufacturer's instruction manuals applicable to each particular apparatus.

1.3 QUALIFICATIONS OF TESTING AGENCY

A. The testing firm shall be an independent testing organization, which can function as an unbiased testing authority, professionally independent of the manufacturers, suppliers, and installers of equipment or systems evaluated by the testing firm.

B. The testing firm shall be regularly engaged in the testing of electrical equipment devices, installations, and systems.

C. The testing firm and all the testing personnel shall have been engaged in such practices for a minimum of ten years.

D. The testing firm shall meet federal OSHA criteria for accreditation of testing laboratories, Title 29, Parts 1907, 1910, and 1936. Full membership in the National Electrical Testing Association constitutes proof of such criteria.

E. The lead, on site, technical person shall be currently certified by the National Electrical Testing Associate (NETA) in Electrical Power Distribution System Testing.

F. Testing firm shall utilize only full-time technicians who are regularly employed by the firm for testing services. Electrically unskilled employees are not permitted to perform testing or assistance of any kind. Electricians may assist, but may not perform testing and/or inspection services.

G. The testing firm shall submit proof of the above qualifications.

H. The testing firm shall be an independent organization as defined by OSHA Title 29, Part 1936 and the National Electrical Testing Association.

I. All instruments used by the testing firm to evaluate electrical performance shall meet NETA's Specifications for Test Instruments. (See Section 1.7 of this specification).

J. The terms used herewith such as Test Agency, Testing Laboratory, or Contractor Test Company, shall be construed to mean testing firm.

1.4 RESPONSIBILITIES

A. The Contractor shall notify the Owners Representative prior to commencement of any testing.

B. Any system, material or workmanship, which is found defective on the basis of acceptance tests, shall be reported.

C. The testing firm shall maintain a written record of all tests and upon completion of project, assemble and certify a final test report.

D. A stable source of 60 hertz power shall be provided for testing purposes by the Contractor. Owners Representative shall witness all tests and a minimum of 14 days notice shall be provided.

1.5 TEST EQUIPMENT

A. Test Instrument Calibration

1. The testing firm shall have a calibration program that assures that all applicable test instrumentation is maintained within rated accuracy.

2. The accuracy shall be directly traceable to the National Bureau of Standards.

3. Instruments shall be calibrated in accordance with the following frequency schedule:

a. Field instruments: Analog - 6 months maximum
Digital - 12 months maximum

b. Laboratory Instruments - 2 months

c. Leased specialty equipment - 12 months (where accuracy is guaranteed by lessor)

4. Dated calibration labels shall be visible on all test equipment.

5. Records must be kept up-to-date which show date and results of instruments calibrated or tested.

6. An up-to-date instrument calibration instruction and procedure will be maintained for each test instrument.

7. Calibrating standard shall be of higher accuracy than that of the instrument tested.

1.6 TEST REPORTS

A. The test report shall include the following:

1. Summary of project.

2. Description of equipment/device tested.

3. Description of test, including date, time, and duration of test.

4. Test results.

5. Conclusions and recommendations.

6. Appendix, including appropriate test forms.

7. Identification' of test equipment used.

8. Signature of responsible test organization authority.

9. Signature of the person witnessing the tests.

10. Furnish five copies of the complete report to the Owners Representative no later than thirty (30) days after completion of project unless otherwise directed.

1.7 SAFETY AND PRECAUTIONS

A. Safety practices shall include, but are not limited to, the following requirements:

1. Occupational Safety and Health Act of 1970 - OSHA.

2. Accident Prevention Manual for Industrial Operations, National Safety Council, Chapter 4.

3. Applicable State safety operating procedures.

4. NETA Safety/Accident Prevention Program.

5. District's safety practices.

6. National Fire Protection Association - CECE.

7. ANSI Z244.1 American National Standards for Personnel Protection.

B. All tests shall be performed with apparatus de-energized except where otherwise specifically required.

C. The testing firm shall have a designated safety representative on the project to supervise operations with respect to safety.

PART 2: PRODUCTS – NOT USED

PART 3: EXECUTION

3.1 EQUIPMENT VERIFICATIONS, TESTS AND CALIBRATIONS GENERAL

A. As part of the contract, the Contractor shall perform tests of installed work as herein specified and specified in other Sections of these Specifications.

B. The Contractor shall provide all materials, equipment, labor and technical supervision to perform such tests and inspections.

C. All tests shall be performed in compliance with the recommendations and requirements of the National Electrical Testing Association, Inc. (NETA), and applicable codes and standards.

D. Upon completion of the tests and inspections noted in these Specifications, a label shall be attached to all serviced devices. These labels shall indicate date serviced and the service company responsible.

E. The test and inspections shall determine suitability for continued reliable operation.

F. All tests shall be conducted in the presence of the Owners Representative. Provide a minimum of two weeks notice to the Owners Representative.

G. Furnish the necessary equipment and personnel to perform all required tests of all wiring and connections for continuity, short circuit, and improper grounds. Included, but not limited to, the following systems: substations, air interrupting switches, low voltage main and feeder circuit breakers, interlocking controls, panelboards, distribution transformers, branch circuits.

3.2 BATTERY SYSTEM

A. Visual and mechanical inspection:

1. Inspect for physical damage, anchorage, electrolyte leakage and level.

2. Check intercell bus link and cable connection integrity for tightness and corrosion.

B. Electrical tests:

1. Measure system charging voltage and each individual cell voltage.

2. Measure electrolyte specific gravity.

3. Perform infrared scan of the intracell links cable connections under current discharge conditions.

3.3 LOW VOLTAGE CIRCUIT BREAKERS

A. Visual and mechanical inspection:

1. Inspect for physical condition.

2. Inspect alignment and grounding.

3. Perform mechanical operator and contact alignment tests on the breaker and its operating mechanism in accordance with manufacturer's instructions.

4. Perform insulation resistance test on control wiring.

5. Clean mechanism, insulating surfaces and contacts.

B. Electrical tests:

1. Measure contact resistance.

2. Trip overcurrent protective device by operation of each protective device.

3. Perform an insulation resistance test phase-to-ground, phase-to-phase and across open contacts.

4. Perform insulation resistance test in accordance with Doble procedure.

5. Perform timing test with Travel Analyzer to insure proper contact overtravel and pressure.

3.4 CABLES, LOW VOLTAGE (600 VOLTS AND LESS)

A. Visual and mechanical inspections:

1. Inspect cables for physical damage and proper connection.

2. Torque test cable connection. Tighten connections in accordance with industry standards.

3. Perform infrared scan of all connections under loaded conditions.

B. Electrical tests: Perform insulation resistance test of each cable with respect to ground and adjacent cables.

3.5 GROUNDING SYSTEMS

A. Visual and mechanical inspection: Inspect ground system connections for completeness and adequacy.

B. Electrical tests: Perform fall-of-the-potential test per IEEE No. 81, Section 9.03 to determine the ground resistance between the main grounding system and all major electrical equipment frames, system neutral and/or *derived* neutral points.

3.6 FIRE ALARM SYSTEM

A. Refer to Section 28 31 00 for systems testing and certification requirements.

END OF SECTION

SECTION 26 27 16

ELECTRICAL CABINETS AND ENCLOSURES

PART 1: GENERAL

1.1 SUMMARY

A. Section Includes:

1. Hinged cover enclosures.
2. Cabinets.
3. Terminal blocks.
4. Accessories.

B. Related Requirements:

1. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
2. Section 26 05 29 - Hangers and Supports for Electrical Systems.
3. Section 26 05 33 - Raceway and Boxes for Electrical Systems.
4. Section 27 05 33 - Conduits and Backboxes for Communications Systems.
5. Section 28 05 33 - Conduits and Backboxes for Electronic Safety and Security.

1.2 REFERENCE STANDARDS

A. National Electrical Manufacturers Association:

1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
2. NEMA ICS 4 - Industrial Control and Systems: Terminal Blocks.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit manufacturer's standard data for enclosures, cabinets, and terminal blocks.

C. Manufacturer's Instructions: Submit application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for maintenance materials.

B. Extra Stock Materials:

1. Furnish two of each key.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

PART 2: PRODUCTS

2.1 HINGED COVER ENCLOSURES

A. Manufacturers:

1. Cooper B-Line.
2. Hammond Stahlin.
3. Hoffman Engineering Company
4. Hubbell Wiring Devices
5. Reliance Electric
6. Substitutions: Section 01 25 00 – Substitution procedure.

B. Description: NEMA 250, Type 1 or 3R galvanized steel enclosure.

1. Covers: Continuous hinge, held closed by flush latch operable by key.
2. Furnish interior plywood panel for mounting terminal blocks and electrical components; finish with white enamel.
3. Enclosure Finish: Manufacturer's standard enamel.

2.2 CABINETS

A. Manufacturers:

1. Cooper B-Line.
2. Hammond Stahlin.
3. Hoffman Engineering Company
4. Hubbell Wiring Devices

5. Reliance Electric

6. Substitutions: Section 01 25 00 – Substitution procedure.

B. Description:

1. Boxes: Galvanized steel.

2. Box Size: 24 inches wide x 30 inches high x 6 inches deep.

3. Backboard: Furnish 3/4 inch thick plywood backboard for mounting terminal blocks. Paint matte white.

4. Fronts: Steel, flush or surface type with door with concealed hinge, and flush lock.

5. Knockouts: None.

C. Fabrication

1. Furnish metal barriers to form separate compartments wiring of different systems and voltages.

2. Furnish accessory feet for free-standing equipment.

D. Finishes:

1. Finish with gray baked enamel.

2.3 TERMINAL BLOCKS

A. Manufacturer List:

1. Entrelec Inc.

2. Phoenix Contact.

3. Weidmuller.

4. Substitutions: Section 01 25 00 – Substitution procedure.

B. Description:

1. Terminal Blocks: NEMA ICS 4.

2. Power Terminals: Unit construction type with closed back and tubular pressure screw connectors, rated 600 volts.

3. Signal and Control Terminals: Modular construction type, suitable for channel mounting, with tubular pressure screw connectors, rated 300 volts.

4. Furnish ground bus terminal block, with each connector bonded to enclosure.

PART 3: EXECUTION

3.1 INSTALLATION

A. Install enclosures and boxes plumb. Anchor securely to wall and structural supports at each corner in accordance with Section 26 05 29.

B. Install cabinet fronts plumb.

3.2 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Clean electrical parts to remove conductive and harmful materials.

C. Remove dirt and debris from enclosure.

D. Clean finishes and touch up damage.

END OF SECTION

SECTION 26 27 26

WIRING DEVICES

PART 1: GENERAL

1.1 SUMMARY

A. Section includes wall receptacles; and device plates and decorative box covers.

B. Related Sections:

1. Section 26 05 33 - Raceway and Boxes for Electrical Systems: Outlet boxes for wiring devices.

1.2 REFERENCES

A. National Electrical Manufacturers Association:

1. NEMA WD 1 - General Requirements for Wiring Devices.

2. NEMA WD 6 - Wiring Devices-Dimensional Requirements.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit manufacturer's catalog information showing dimensions, colors, and configurations.

C. Samples: Submit two samples of each wiring device and wall plate illustrating materials, construction, color, and finish.

1.4 QUALIFICATIONS

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

1.5 EXTRA MATERIALS

A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish 20 of each style, size, and finish wall plate.

PART 2: PRODUCTS

2.1 RECEPTACLES

A. Manufacturers:

1. Cooper Wiring Devices.

2. Hubbell, Inc.

3. Leviton Manufacturing Company.

4. Pass and Seymour.

5. Substitutions: Section 01 60 00 - Product Requirements.

B. Product Description: NEMA WD 1, Heavy-duty general use receptacle.

C. Device Body: Ivory plastic.

D. Configuration: NEMA WD 6, type as indicated on Drawings.

E. Convenience Receptacle: Type 5-20.

F. GFCI Receptacle: Convenience receptacle with integral ground fault circuit interrupter to meet regulatory requirements.

2.2 WALL PLATES

A. Manufacturers:

1. Cooper Wiring Devices.

2. Hubbell, Inc.

3. Leviton Manufacturing Company.

4. Pass and Seymour.

5. Substitutions: Section 01 60 00 - Product Requirements.

B. Cover Plate: 0.035 inch thick satin-finished.

C. Jumbo Cover Plate: 0.035 inch thick satin-finished.

D. Weatherproof Cover Plate: Gasketed cast galvanized metal plate with threaded and gasketed device cover.

PART 3: EXECUTION

3.1 EXAMINATION

A. Section 01 31 00 – Project Management and Coordination.

B. Verify outlet boxes are installed at proper height.

C. Verify wall openings are neatly cut and completely covered by wall plates.

D. Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.2 PREPARATION

A. Clean debris from outlet boxes.

3.3 EXISTING WORK

A. Disconnect and remove abandoned wiring devices.

B. Modify installation to maintain access to existing wiring devices to remain active.

C. Clean and repair existing wiring devices to remain or to be reinstalled.

3.4 INSTALLATION

A. Install devices plumb and level.

B. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.

C. Do not share neutral conductor on load side of dimmers.

D. Install receptacles with grounding pole on top.

E. Connect wiring device grounding terminal to outlet box with bonding jumper and branch circuit equipment grounding conductor.

F. Install wall plates on flush mounted switches, receptacles, and blank outlets.

G. Install decorative plates on switch, receptacle, and blank outlets in finished areas.

H. Connect wiring devices by wrapping solid conductor around screw terminal. Install stranded conductor for branch circuits 10 AWG and smaller. When stranded conductors are used in lieu of solid, use crimp on fork terminals for device terminations. Do not place bare stranded conductors directly under device screws.

I. Use jumbo size plates for outlets installed in masonry walls.

J. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.

3.5 INTERFACE WITH OTHER PRODUCTS

A. Coordinate locations of outlet boxes provided under Section 26 05 33 to obtain mounting heights as specified or as indicated on drawings.

B. Install wall switch 48 inches above finished floor.

C. Install convenience receptacle 18 inches above finished floor.

D. Install convenience receptacle 6 inches above counter or centered in back splash of counter.

E. Install top of dimmer 48 inches above finished floor.

3.6 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements, 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspect each wiring device for defects.

C. Operate each wall switch with circuit energized and verify proper operation.

D. Verify each receptacle device is energized.

E. Test each receptacle device for proper polarity.

3.7 ADJUSTING

A. Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting, and balancing.

B. Adjust devices and wall plates to be flush and level.

3.8 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Clean exposed surfaces to remove splatters and restore finish.

END OF SECTION

SECTION 27 13 43

COMMUNICATIONS SERVICES CABLING

PART 1: GENERAL

1.1 SUMMARY

A. Section includes termination devices, outlets, and premises wiring.

B. Related Sections:

1. Section 26 27 26 - Wiring Devices: Wall plates.

1.2 REFERENCES

A. International Electrical Testing Association:

1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

B. National Fire Protection Association:

1. NFPA 262 - Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.

C. Telecommunications Industry Association/Electronic Industries Alliance:

1. TIA/EIA 568 - Commercial Building Telecommunications Cabling Standard.

2. TIA/EIA 569 - Commercial Building Standard for Telecommunications Pathways and Spaces.

D. Underwriters Laboratories, Inc.:

1. UL 2043 - Fire Test for Heat and Visible Smoke Release for Discrete Products and their Accessories Installed in Air-Handling Spaces.

1.3 SYSTEM DESCRIPTION

A. Horizontal Pathway: Conform to TIA/EIA 569, using raceway, backboards, and cabinets as indicated on Drawings.

B. Horizontal Wiring: By Owner. Complete from telecommunications closet to each outlet using shielded horizontal cables.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit catalog data for each termination device, cable, and outlet device.

C. Test Reports: Indicate procedures and results for specified field testing and inspection.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations and sizes of pathways and outlets.

1.6 QUALITY ASSURANCE

A. Provide wiring materials located in plenums with peak optical density not greater than 0.5, average optical density not greater than 0.15, and flame spread not greater than 5 feet (1.5 m) when tested in accordance with NFPA 262.

B. Provide combustible electrical equipment exposed within plenums with peak rate of heat release not greater than 100 kW, peak optical density not greater than 0.5, and average optical density not greater than 0.15 when tested in accordance with UL 2043.

C. Perform Work in accordance with County standard.

D. Maintain one copy of each document on site.

1.7 QUALIFICATIONS

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

B. Installer: Company specializing in installing products specified in this section with minimum three years documented experience, and with service facilities within 100 miles of project.

C. Testing Agency: Company member of International Electrical Testing Association and specializing in testing products specified in this section with minimum three years documented experience.

1.8 PRE-INSTALLATION MEETINGS

A. Section 01 31 00 – Project Management and Coordination.

B. Convene minimum one week prior to commencing work of this section.

1.9 EXTRA MATERIALS

A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish two telephone outlet jacks.

1.10 COORDINATION

A. Coordination with Utility and Owner for additional dedicated telephone lines required for the fire alarm system.

B. Utility charges for service installation paid by Owner and are not part of this contract.

PART 2: PRODUCTS

2.1 TELEPHONE OUTLET JACKS

A. Product Description: Conform to TIA/EIA 568 requirements for cable connectors for specific cable types.

2.2 SHIELDED HORIZONTAL CABLE

A. Product Description: TIA/EIA 568, 100-ohm, unshielded twisted pair CAT 6 plenum rated noncombustible cable with 24 AWG copper conductor.

PART 3: EXECUTION

3.1 EXISTING WORK

A. Remove exposed abandoned telecommunications cables and pathways, including abandoned cables and pathways above accessible ceiling finishes. Cut flush with walls and floors, and patch surfaces.

B. Maintain access to existing telecommunications equipment, cabling, and terminations and other installations remaining active and requiring access. Modify installation or provide access panel.

C. Extend existing telecommunications installations using materials and methods compatible with existing installations, or as specified.

D. Clean and repair existing telecommunications equipment remaining or is to be reinstalled.

3.2 INSTALLATION

A. Install pathways in accordance with TIA/EIA 569.

B. Install wire and cable in accordance with TIA/EIA 568.

C. Install termination cabinets plumb, and attach securely to building wall at each corner. Install cabinet trim plumb.

D. Install pull wire in each empty telephone conduit over 10 feet in length or containing bends.

E. Ground and bond pathways, cable shields, and equipment.

3.3 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspect and test optical fiber cables in accordance with NETA ATS, except Section 4. Perform inspections and tests listed in NETA ATS, Section 7.25.

C. Inspect and test copper cables and terminations in accordance with TIA/EIA 568.

END OF SECTION

SECTION 28 05 29

HANGERS AND SUPPORTS FOR ELECTRONIC SAFETY AND SECURITY

PART 1: GENERAL

1.1 SUMMARY

A. Section Includes:

1. Conduit supports.
2. Formed steel channel.
3. Spring steel clips.
4. Sleeves.
5. Mechanical sleeve seals.
6. Firestopping relating to electrical work.
7. Firestopping accessories.
8. Equipment bases and supports.

B. Related Sections:

1. Section 03 30 00 - Cast-In-Place Concrete: Product requirements for concrete for placement by this section.
2. Section 26 05 29 - Hangers and Supports for Electrical Systems.

1.2 REFERENCES

A. ASTM International:

1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
2. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
3. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops.
4. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.

B. FM Global:

1. FM - Approval Guide, A Guide to Equipment, Materials & Services Approved By Factory Mutual Research For Property Conservation.

C. National Fire Protection Association:

1. NFPA 70 - National Electrical Code.

D. Underwriters Laboratories Inc.:

1. UL 263 - Fire Tests of Building Construction and Materials.

2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

3. UL 1479 - Fire Tests of Through-Penetration Firestops.

4. UL 2079 - Tests for Fire Resistance of Building Joint Systems.

5. UL - Fire Resistance Directory.

E. Intertek Testing Services (Warnock Hersey Listed):

1. WH - Certification Listings.

1.3 DEFINITIONS

A. Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

1.4 SYSTEM DESCRIPTION

A. Firestopping Materials: ASTM E814 UL 263 UL 1479 to achieve fire ratings as noted on Drawings for adjacent construction, but not less than 1 hour fire rating.

1. Ratings may be 3-hours for firestopping in through-penetrations of 4-hour fire rated assemblies unless otherwise required by applicable codes.

B. Firestop interruptions to fire rated assemblies, materials, and components.

1.5 PERFORMANCE REQUIREMENTS

A. Firestopping: Conform to applicable code FM UL WH for fire resistance ratings and surface burning characteristics.

B. Firestopping: Provide certificate of compliance from authority having jurisdiction indicating approval of materials used.

1.6 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings: Indicate system layout with location and detail of trapeze hangers.

C. Product Data:

1. Hangers and Supports: Submit manufacturers catalog data including load capacity.

2. Firestopping: Submit data on product characteristics, performance and limitation criteria.

D. Firestopping Schedule: Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance rating of adjacent assembly.

E. Design Data: Indicate load carrying capacity of trapeze hangers and hangers and supports.

F. Manufacturer's Installation Instructions:

1. Hangers and Supports: Submit special procedures and assembly of components.

2. Firestopping: Submit preparation and installation instructions.

G. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

H. Engineering Judgements: For conditions not covered by UL or WH listed designs, submit judgements by licensed professional engineer suitable for presentation to authority having jurisdiction for acceptance as meeting code fire protection requirements.

1.7 QUALITY ASSURANCE

A. Through Penetration Firestopping of Fire Rated Assemblies: UL 1479 or ASTM E814 with 0.10 inch water gage minimum positive pressure differential to achieve fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.

1. Wall Penetrations: Fire F-Ratings as indicated on Drawings, but not less than 1-hour.

2. Floor [and Roof] Penetrations: Fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.

a. Floor Penetrations Within Wall Cavities: T-Rating is not required.

B. Through Penetration Firestopping of Non-Fire Rated Floor [and Roof] Assemblies: Materials to resist free passage of flame and products of combustion.

1. Noncombustible Penetrating Items: Noncombustible materials for penetrating items connecting maximum of three stories.

2. Penetrating Items: Materials approved by authorities having jurisdiction for penetrating items connecting maximum of two stories.

C. Fire Resistant Joints in Fire Rated Floor, Roof, and Wall Assemblies: ASTM E1966 or UL 2079 to achieve fire resistant rating as indicated on Drawings for assembly in which joint is installed.

D. Fire Resistant Joints Between Floor Slabs and Exterior Walls: ASTM E119 with 0.10 inch water gage minimum positive pressure differential to achieve fire resistant rating as indicated on Drawings for floor assembly.

E. Surface Burning Characteristics: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

F. Perform Work in accordance with County standard.

G. Maintain one copy copies of each document on site.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum years documented experience approved by manufacturer.

1.9 PRE-INSTALLATION MEETINGS

A. Convene minimum one week prior to commencing work of this section.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

B. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

1.11 ENVIRONMENTAL REQUIREMENTS

A. Do not apply firestopping materials when temperature of substrate material and ambient air is below 60 degrees F.

B. Maintain this minimum temperature before, during, and for minimum 3 days after installation of firestopping materials.

C. Provide ventilation in areas to receive solvent cured materials.

PART 2: PRODUCTS

2.1 CONDUIT SUPPORTS

A. Manufacturers:

1. Allied Tube & Conduit Corp.

2. Electroline Manufacturing Company.

3. O-Z Gedney Co.

4. Substitutions: Section 01 25 00 – Substitution Procedures.

B. Furnish materials in accordance with County standards.

C. Hanger Rods: Threaded high tensile strength galvanized carbon steel with free running threads.

D. Beam Clamps: Malleable Iron, with tapered hole in base and back to accept either bolt or hanger rod. Set screw: hardened steel.

E. Conduit clamps for trapeze hangers: Galvanized steel, notched to fit trapeze with single bolt to tighten.

F. Conduit clamps - general purpose: One hole malleable iron for surface mounted conduits.

G. Cable Ties: High strength nylon temperature rated to 185 degrees F. Self locking.

2.2 FORMED STEEL CHANNEL

A. Manufacturers:

1. Allied Tube & Conduit Corp.

2. B-Line Systems.

3. Midland Ross Corporation, Electrical Products Division.

4. Unistrut Corp.

5. Substitutions: Section 01 25 00 – Substitution Procedures.

B. Furnish materials in accordance with County standards.