U.S. FOREST SERVICE
REGION 5

LOS PRIETOS HELITACK H-528 OFFICE TRAILER UTILITY CONNECTIONS

PROJECT SPECIFICATIONS

Los Padres National Forest

SECTION 00 01 10

TABLE OF CONTENTS

Division 0: INTRODUCTORY INFORMATION

00 01 10 Table of Contents

Division 1: GENERAL REQUIREMENTS

01 00 40 Project Coordination

01 06 00 Regulatory Requirements

01 40 10 Quantity Measurement

01 50 00 Temporary Facilities and Controls

01 60 00 Product Requirements

01 70 00 Execution and Closeout Requirements

01 78 00 Closeout Submittals

01 90 00 Mobilization

Division 2: EXISTING CONDITIONS

02 41 16 Removal of Structures and Obstructions

Divisions 3: NOT USED

Divisions 4: NOT USED

Division 5: NOT USED

Division 6: NOT USED

Division 7: NOT USED

Division 8: NOT USED

Division 9: NOT USED

Division 10: NOT USED

Division 11: NOT USED

Division 12: NOT USED

Division 15: NOT USED

Division 22: PLUMBING

22 05 23 Valves and Enclosures

22 08 00 Disinfection of Water Distribution System

22 11 00 Water Distribution System

22 11 14 Liquefied Petroleum Gas System

22 13 13 Gravity Sewer Lines

Division 23: NOT USED

Division 26: ELECTRICAL

26 00 00 Electric Basic Requirements

26 05 09 Equipment Wiring

26 05 19 Low-Voltage Electrical Power Conductors and Cables

26 05 26 Grounding and Bonding for Electrical Systems

26 05 29 Hangers and Supports for Electrical Systems and Equipment

26 05 33 Raceways

26 05 34 Boxes

26 05 53 Identification for Electrical Systems

26 05 73 Electrical Distribution System Studies

26 08 05 Electrical Acceptance Testing

26 24 16 Panelboards

26 28 00 Overcurrent Protective Devices

26 28 16 Enclosed Switches and Circuit Breakers

Division 27: NOT USED

Division 31: EARTHWORK

31 20 00 Earth Moving

31 31 19 Weed and Disease Prevention

31 50 00 Trenching and Backfilling

Division 32: EXTERIOR IMPROVEMENTS

32 11 00 Base Courses

32 12 16 Asphaltic Concrete Paving and Base Material

32 12 17 Pavement Markings and Accessories

END OF SECTION

SECTION 01 00 40

PROJECT COORDINATION

PART 1 – GENERAL

1.1 SCOPE

A. This Section specifies administrative and supervisory requirements necessary for Project coordination including, but not necessarily limited to:

1. Coordination.
2. Contractor's personnel.
3. General installation provisions.
4. Cleaning and protection.

1.2 COORDINATION

A. Coordination: Coordinate construction activities included under various Sections of these Specifications to assure efficient and orderly installation of each part of the Work. Coordinate construction operations included under different Sections of the Specifications that are dependent upon each other for proper installation, connection, and operation.

1. Where installation of one part of the Work is dependent on installation of other components, either before or after its own installation, schedule construction activities in the sequence required to obtain the best results.
2. Where availability of space is limited, coordinate installation of different components to assure maximum accessibility for required maintenance, service and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

B. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.

1.3 SUBMITTALS

A. Coordination Drawings: Prepare and submit coordination Drawings where close and careful coordination is required for installation of products and materials fabricated off-site by separate entities, and where limited space availability necessitates maximum utilization of space for efficient installation of different components.

1. Indicate required installation sequences.

2. Comply with requirements contained in Section "01 30 00 Administrative Requirements."

PART 2 – PRODUCTS

Not Applicable.

PART 3 – EXECUTION

3.1 GENERAL INSTALLATION PROVISIONS

A. Inspection of Conditions: Require the Installer of each major component to inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.

B. Manufacturer's Instructions: Comply with manufacturer's installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in Contract Documents.

C. Inspect materials or equipment immediately upon delivery and again prior to installation. Reject damaged and defective items.

D. Provide attachment and connection devices and methods necessary for securing Work. Secure Work true to line and level. Allow for expansion and building movement.

E. Visual Effects: Provide uniform joint widths in exposed Work. Arrange joints in exposed Work to obtain the best visual effect. Refer questionable choices to the Contracting Officer for final decision.

F. Recheck measurements and dimensions, before starting each installation.

G. Install each component during weather conditions and Project status that will ensure the best possible results. Isolate each part of the completed construction from incompatible material as necessary to prevent deterioration.

H. Coordinate temporary enclosures with required inspections and tests, to minimize the necessity of uncovering completed construction for that purpose.

I. Mounting Heights: Where mounting heights are not indicated, install individual components at standard mounting heights recognized within the industry for the particular application indicated. Refer questionable mounting height decisions to the Contracting Officer for final decision.

3.2 CLEANING AND PROTECTION

A. During handling and installation, clean and protect construction in progress and adjoining materials in place. Apply protective covering where required to ensure protection from damage or deterioration.

B. Clean and maintain completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

END OF SECTION

SECTION 01 06 00

REGULATORY REQUIREMENTS GENERAL

1.1 SCOPE

A. This section describes the codes and standards which apply to the work in this contract. Additional codes and standard may be cited in sections to which they apply.

1.2 CODES AND STANDARDS

A. The following codes and standards shall apply to the work in this contract:

1. The following are the Codes to be used for the project. The Contractor shall use the latest adopted building code. In the case of conflicting codes the most stringent Code shall apply.
   a. National Electric Safety Code.
   b. International Fire Code with County of Los Angeles amendments.
   c. International Building Code.
   d. Uniform Mechanical Code.
   e. ASHRAE/IESNA Standard 90.1, Energy Standard For Buildings Except Low Rise Residential Buildings.
   f. Uniform Plumbing Code.
   g. NFPA 101.
   h. NFPA 13: Standard for the Installation of Sprinkler Systems.
   i. Cal/OSHA Construction and Electrical Safety Orders including updates.
   j. Stormwater Management for Federal Facilities under Section 438 of the Energy Independence and Security Act to obtain a 2009- 0009-DWQ Construction general permit, Effective start July 1, 2010.
   k. American with Disabilities Act and Architectural Barriers Act Accessibility Guidelines, July 3, 2004.
   l. State of California Codes:
      1) California Building Code, Title 24, Part 2 (First Printing) includes Supplements thru Jan 09.
      2) California Existing Building Code, Title 24, Part 10 (First Printing).
      3) California Energy Code, Title 24, Part 6 (First Printing), includes Supplements thru January 10.
      4) California Administrative Code, Title 24, Part 1 (First Printing), includes Supplements thru Januarfy 10.
      5) California Referenced Standards Code, Title 24, Part 12 (First Printing).

6) California Administrative Code, Title 24, (First Printing) including Supplements thru January 10.
7) Construction General Permit, State Water Quality Board.

2. Other Federal Requirements:
   a. National Environmental Policy Act (NEPA).
   b. The Forest Service prepared and submitted NEPA Through compliance with section 106 in prior undertakings, the agency has evaluated the structures within the complex. In consultation with the California Office of Historic Preservation, it has been determined, by consensus, that no historic properties are located in the APE for the current undertaking. The Environmental Assessment Document was issued and a Decision Notice Decision Notice and Finding of No Significant Impact was filed.
   c. EPA's Final Guidance on Environmentally Preferable Purchasing.
   d. EPA's Comprehensive Procurement Guidelines for recovered content.
   e. USDA's BioPreferred Program.
   f. ENERGY STAR® & DOE Federal Energy Management Program (FEMP)
   g. Product Efficiency Recommendations.
   h. Energy Policy Act of 2005 and the Energy Independence and Security Act of 2007, Section 483, Storm water Requirements.

B. Unless otherwise specified in this contract, reference to a specific standard or specification shall mean the latest edition or amendment in affect on the date of the invitation to bid.

1.3 DEFINITIONS

A. Administrative Authority as used in the Uniform Mechanical Code, the Uniform Plumbing Code and the National Electrical Code will be the Contracting Officer.

B. Building Official as used in the Uniform Fire Code, International Building Code Standards will be the Contracting Officer.

PART 2 – PRODUCTS

Not Used

PART 3 – EXECUTION

Not Used

END OF SECTION

SECTION 01 40 10

QUANTITY MEASUREMENT

PART 1 – GENERAL

1.1 SCOPE

A. This work shall consist of providing quality control in conformance with the Inspection of Construction provisions of this contract to ensure compliance with the drawings, specifications, and provisions of the contract, and measuring the quantities of completed work in conformance with the provisions of the applicable specifications. The Contractor shall provide all personnel, equipment, tests, and reports necessary to meet the requirements of this specification.

1.2 RELATED WORK

A. The work shall be in accordance with the following subsidiary specifications. The subsidiary specifications are referred to in the text by the Section designation only.

1. Section 02 40 00 – Demolition.
2. Section 31 23 00 – Excavation and Fill.
3. Section 31 23 17 – Trenching.

1.3 MEASUREMENT AND PAYMENT

A. No payment under this section.

B. Payment will be prorated on the percentage of work accomplished on the related pay item that meets specifications.

PART 2 – PRODUCTS

Not Used.

PART 3 – EXECUTION

3.1 QUALITY CONTROL SYSTEM AND QUANTITY MEASUREMENT

A. The Contractor shall provide and maintain a quality control system that will ensure that all services, supplies, and construction required under this contract

conform to the contract requirements. The Contractor shall perform, or cause to be performed, the sampling, inspection, and testing required to substantiate that all supplies, services, and construction conform to the contract requirements.

B. The Contractor shall also perform, or cause to be performed, all measurement of quantities of materials incorporated into the work or work processes that are to be measured under the provisions of the contract.

C. Quality Control Plan: The Contractor shall submit in writing the following:

1. Authorities and responsibilities of inspection and testing personnel.

2. Experience and qualifications of inspection and testing personnel to be assigned and name and location of any (for hire) testing facility to be used.

D. Approval of Quality Control Plan: The Contractor's proposed quality control plan for all items requiring quality control shall be submitted to the Engineer for review prior to the Contractor commencing work. Within five (5) days of receipt of plan, the Engineer shall notify the Contractor whether the plan adequately covers quality control requirements. Construction work shall not be performed prior to Contractor's receipt of written approval of the proposed plan. The Contractor shall submit to the Engineer, in writing, any proposed changes in the approved quality control plan. Proposed changes shall not be put into effect until approved in writing by the Engineer.

E. Sampling, Testing, Inspection, and Measurement of Quantities: The Contractor shall provide and maintain appropriate measuring and testing devices, equipment, and supplies to accomplish the required measurement, testing, and inspection in a timely manner. Tests, measurements, and certifications shall be made as required by the drawings and specifications. The Contractor shall take samples and perform inspections and tests necessary to achieve the quality of construction required by the contract and make required measurements of work under this contract performed onsite or offsite. Sampling and testing frequency for specific items shall be shown on the Drawings, Specifications or in the table below.

Item	Subsection	Certification or Test Required	Cert. or Test By	Required Test	Frequency
02201	02201,3.06	Compaction	CC	F	3
02201	02201,3.06	Compaction	PE	D	1 per material type
02220	02220,3.03B	Compaction	CC	F	7
02220	02220,3.03B	Compaction	PE	D	1 per material type
02550	02550,3.07	Surface and Thickness	CC		2
02550	02550,3.04	Compaction	PE	F	2

Item	Subsection	Certification or Test Required	Cert. or Test By	Required Test	Frequency
02550	02550,1.01	Job Mix Formula	SC		1 per source
03300	03300,1.04	Cert. of Agg. Gradation and Design Mix	SC		1 per proposed mix design
03300	03300,3.7D	Test Cylinders	CC		3 per truck
03300	03300,3.7F	Slump Test	CC		1 per truck
03300	03300,3.7F	Air Entrainment Test	CC		1 per truck
03300	03300,3.7G	Batch Cert.	SC		1 per truck
07210	07210,3.4A	Quality Insulation Installation	HERS	CA Title 24	Prior to closing-in.

Notes: Key to "Cert. Or Test By:"
SC: Certification by supplier or manufacturer
CC: Certification and/or testing by contractor
PE: Sampling and testing under the direction of and certified by a registered Engineer or certified lab.

Key to "Required Test:"
D: Maximum density and optimum moisture content.
F: Field density and moisture content. If there is no entry under this column, refer to the parent specification to determine the test(s) required. Field density tests shall be performed in the presence of the Contracting Officer and at locations agreed upon with the Contracting Officer.

Where "random sample" is specified in this table, it is to be a statistically random sample.

3.2 RECORDS OF INSPECTION, TESTS, AND MEASUREMENT

A. Inspection and Tests: The Contractor shall maintain current records of all inspections and tests performed.

The following format or one containing the following information will be acceptable to the government:

Project_____Contract No._____

Pay Item No. Test Date Station Standard Results Test By (Initials)

The Contractor shall certify in writing that all inspections and tests were performed in accordance with specifications.

B. As-built Drawings: The Contractor shall maintain a set of the contract drawings depicting as-built conditions. These drawings shall be maintained in a current condition and shall be available for review. All variations from contract drawings shall be indicated in red on the drawings. Upon completion of the contract work, as-built drawings shall be submitted to the Engineer.

3.3 CERTIFICATIONS AND MEASUREMENTS

A. Off-site Produced Materials: The Contractor shall furnish certificates executed by the manufacturer, supplier, or vendor, stipulating that all offsite produced materials incorporated into the work meet the applicable requirements shown on the Drawings or stated in the specifications. Incidental purchases needed to remedy minor shortages of material shall be certified by the Contractor.

B. Quantity Measurements: The Contractor shall make all measurements for computation of quantities for all work items except those specified for payment by Designed Quantity (DQ). The Contractor shall compute the quantities for periodic progress payments; the Engineer will compute the quantities for the final payment based on measurements taken by the contractor. All Contractor measurements are subject to verification. The Contractor shall submit all field notes, calculation sheets, and other data used to determine quantities. The Contractor shall certify in writing as to the accuracy of the measurements and computations submitted.

The following format or one containing the following information will be acceptable to the Government:

Project_____ Contract No._____

Pay Item No.	Date	Quantity or Station Measurement	Measured By (Initials)

END OF SECTION

SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Temporary utilities.

B. Temporary telecommunications services.

C. Temporary telephone service.

D. Temporary sanitary facilities.

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

F. Security requirements.

G. Vehicular access and parking.

H. Waste removal facilities and services.

I. Project identification sign.

J. Field offices.

K. Use of Site/Clean up

1.2 QUALITY ASSURANCE

A. Regulations: Comply with industry standards and applicable laws and regulations of authorities having jurisdiction including, but not limited to:

1. Building code requirements.
2. Health and safety regulations.
3. Utility company regulations.
4. Police and fire department rules.
5. Environmental protection regulations.

B. Standards: Comply with following:

1. NFPA 241 “Standard for Safeguarding Construction, Alterations, and Demolition Operations.”

2. ANSI A10 Series standards for “Safety Requirements for Construction and Demolition.”

3. NECA Electrical Design Library “Temporary Electrical Facilities.”

C. Comply with NEMA, NECA, and UL standards and regulations for temporary electric service. Install service in compliance with NFPA 70 “National Electric Code.”

D. Inspections:

1. Arrange for authorities having jurisdiction to inspect and test each temporary utility before use.

2. Obtain required certifications and permits.

1.3 TEMPORARY UTILITIES

A. Contractor to provide and pay for all electrical power, lighting, water, heating and cooling, and ventilation required for construction purposes.

B. New permanent facilities may not be used until occupied by Government.

C. Heating and Air Conditioning Units: Provide temporary heating and air conditioning units that have been tested and labeled by UL, FM, or another recognized trade association related to type of fuel being consumed.

D. Fire Extinguishers: Provide hand-carried, portable, UL-rated, Class A fire extinguishers for temporary offices and similar spaces. In other locations, provide hand-carried, portable, UL-rated, Class ABC dry-chemical extinguishers or a combination of extinguishers of NFPA recommended classes for exposures.

E. Temporary Fire Protection:

1. Install and maintain temporary fire protection facilities of types needed to protect against reasonably predictable and controllable fire losses until permanent fire protection facilities are operable.

2. Comply with NFPA 10 and NFPA 241.

3. Store combustible materials in containers in fire safe locations.

4. Maintain unobstructed access to fire protection equipment.

5. Provide supervision of welding operation, combustion type temporary heating units, and similar sources of fire ignition.

1.4 TELECOMMUNICATIONS SERVICES

A. Contractor to provide, maintain, and pay for telecommunications services to field office at time of project mobilization.

B. Telecommunications services shall include:

1. Windows-based personal computer dedicated to project telecommunications, with necessary software and laser printer.
2. Telephone Land Lines: One line, minimum; one handset per line.
3. Internet Connections: Minimum of one
4. Email: Account/address reserved for project use.
5. Facsimile Service: One dedicated line fax machine/printer.
6. Videoconferencing Capability for meetings during construction.

C. Provide, maintain and pay for facsimile service and a dedicated telephone line to field office at time of project mobilization.

D. Electronic correspondence: Contractor to set up phone lines and computers to facilitate electronic communications at job site.

1.5 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.

B. Provide self-contained, single-occupant toilet units of chemical, aerated recirculation or combustion type.

C. Provide units properly vented and fully enclosed with a fiber-glass-reinforced polyester shell or similar non-absorbent material.

D. Wash Facilities:

1. Install wash facilities supplied with potable water at convenient locations for personnel involved in handling materials that require wash-up.
2. Dispose of drainage properly. Supply cleaning compounds.
3. Provide safety showers, eyewash fountains and similar facilities for safety and sanitation of personnel.

E. Drinking Water Facilities: Provide containerized tap-dispenser bottled-water type drinking water units.

1.6 LIFT AND HOISTS

A. Temporary Lifts and Hoists:

1. Provide facilities for hoisting materials and employees.

2. Truck cranes and similar devices used for hoisting materials are considered “tools and equipment” and not temporary facilities.

1.7 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

B. Provide barricades required by governing authorities for public rights-of-way. Comply with standards and codes for erection of structurally adequate barricades.

C. Provide appropriate warning signs to inform personnel and public of hazards being protected against.

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

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

1.8 FENCING

A. Construction: Commercial grade chain link fence.

1.9 EXTERIOR ENCLOSURES

A. Provide temporary insulated weather tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

1.10 NEPA REQUIREMENTS

A. The following is a list of mitigation measures required to be performed by the Contractor.

1. Construction Noise and Dust: Watering of ground disturbance areas will be performed to minimize construction-related dust.

2. To minimize or avoid potential impacts associated with the proposed action, the following management recommendations are proposed:

3. Any reseeding or planting plans must first be approved by the Forest Botanist. Any landscaping will utilize native plants appropriate to the site conditions.

4. Any mulch, hay or rice straw brought to the site must be certified weed free.

5. During project implementation and after the project is completed, monitor the site for noxious weeds. Monitoring should be conducted monthly for the first year and then on a bi-monthly basis. District personnel can be trained by the Forest Botanist to conduct this monitoring activity. Any new populations of noxious weeds will be immediately treated as directed by the Forest Botanist.

6. All appropriate Forest Best Management Practices (BMPs) shall be implemented to minimize damage to surface soil structure and to reduce potential for erosion and sediment transport to drainages due to project activities.

7. Equipment refueling must be conducted in a manner that will ensure no contamination of soils or water will occur. Refueling cannot occur within 100 feet of any drainage or riparian area.

8. All excavation must be implemented in a manner that reduces the potential for entrapment of small mammals, reptiles or amphibians. Drift nets or other exclusionary fencing can be placed around excavations to reduce the potential for individuals entering excavated areas. If an excavation is to remain open for more than 12 hours it must include some means for small mammals, reptiles and amphibians to escape. This can be accomplished by placement of a ramp that reasonably allows trapped individuals to crawl or walk out of the excavation. Before an excavation is backfilled, it must be checked to ensure that there are no live individuals inside. Backfilling cannot occur until the excavation is clear of all live individuals.

9. Project generated garbage must be properly stored/disposed of on a daily basis. When operations are complete, any excess materials or debris shall be removed from the work area.

10. All personnel involved in project implementation will receive a briefing from the project biologist to describe sensitive resources that may be encountered in the project area. Wildlife encountered during the course of project implementation should be given the opportunity to evacuate the site. Personnel will be reminded that harassment, handling or removal of wildlife from the site is not permitted.

1.11 SECURITY

A. Provide security and facilities to protect Work, and Government's operations from unauthorized entry, vandalism, or theft.

1.12 VEHICULAR ACCESS AND PARKING

A. Coordinate access and haul routes with governing authorities and the Contractors Officer (CO).

1. Coordinate the use of the site access with the CO.

B. Temporary Paving: Construct and maintain temporary roads and paving to accommodate traffic during construction period. Repair any existing roadways damaged during construction.

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

D. Provide means of removing mud from vehicle wheels before entering streets.

E. Existing on-site roads shall not be used for construction traffic.

F. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.

1.13 WASTE REMOVAL

A. See Section 01 74 19 – Construction Waste Management and Disposal, for additional requirements.

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

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

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

1.14 PROJECT IDENTIFICATION

A. Provide project identification sign of design and construction minimum size 4 feet x 8 feet identifying the Project, Design Build team and major subcontractors. Include ARRA information and logo.

B. No other signs are allowed without Governments permission except those required by law.

1.15 CONTRACTORS FIELD OFFICES

A. Office: Weather-tight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture, drawing rack and drawing display table.

B. Provide space for Project meetings, with table and chairs to accommodate six (6) persons.

C. Locate offices a minimum distance of 30 feet from existing and new structures.

1.16 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities, and materials prior to Substantial Completion inspection.

B. Clean and repair damage caused by installation or use of temporary work.

C. Restore/Repair existing and new permanent facilities used during construction to original condition.

1.17 TERMINATION AND REMOVAL

A. Remove each temporary facility when need has ended, when replaced by authorized use of a permanent facility, or no later than Substantial Completion.

B. Materials and facilities that constitute temporary facilities are Contractor's property, except Project sign.

C. Substantial Completion: Clean and renovate permanent facilities used during construction period.

PART 2 – PRODUCTS

Not Used.

PART 3 – EXECUTION

Not Used.

END OF SECTION

SECTION 01 60 00

PRODUCT REQUIREMENTS

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. General product requirements.

B. Transportation, handling, storage and protection.

C. Product option requirements.

D. Substitution limitations and procedures.

E. Spare parts and maintenance materials.

1.2 RELATED SECTIONS

A. Section 01 40 00 – Quality Requirements: Product quality monitoring.

1.3 REFERENCES

A. GreenSeal GS-36 – Commercial Adhesives; Green Seal, Inc.; 2000.

B. SCAQMD 1168 – South Coast Air Quality Management District Rule No.1168; current edition; www.aqmd.gov.

1.4 DEFINITIONS

A. Products: Items purchased for incorporation in Work.

1. Term “product” includes terms “material,” “equipment,” “system,” and terms of similar intent.

2. “Named Products” are items identified by manufacturer’s product name, including make or model number or other designation, listed in manufacturer’s published product literature.

B. Materials: Products shaped, cut, worked, mixed, finished, refined or otherwise fabricated, processed, or installed to form a part of Work.

C. Equipment: Product with operational parts, whether motorized or manually operated, that requires service connections, such as wiring or piping.

1.5 SUBMITTALS

A. Proposed Products List: Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.

1. Submit with Response to Request for Proposal.

2. For products specified only by reference standards, list applicable reference standards.

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

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

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

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

1.6 QUALITY ASSURANCE

A. Source Limitations: Provide products of same kind from a single source to fullest extent possible.

B. Compatibility of Products: When given option of selecting products, Contractor is responsible for providing products and construction methods that are compatible with previously selected products and construction methods, or products specified to with those selected products to be compatible.

1.7 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products according to manufacturer’s recommendations.

B. Schedule delivery to minimize long-term storage at site.

C. Coordinate delivery with installation time to assure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, or other losses.

D. Deliver products to site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.

E. Inspect products upon delivery to ensure compliance with Contract Documents and to ensure that products are undamaged and properly protected.

F. Store products at site in a manner that will facilitate inspection and measurement of quantity or counting of units.

G. Store products subject to damage by weather above ground, under cover in a weather tight enclosure, and with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer's instructions.

PART 2 – PRODUCTS

2.1 NEW PRODUCTS

A. Product Substitutions: Where products or manufacturers are named and accompanied by term equal, approved, or approved equal, comply with Product Substitution Procedures to obtain approval of an unnamed product.

B. Specified Standards, Codes, and Regulations: Where compliance with an imposed code, standard, or regulation is specified, provide a product that complies with that code, standard, or regulation

C. Visual Matching: Where matching a sample, COR's decision will be final on whether a proposed product matches satisfactorily.

D. Visual Selection: Where product requirements include phrase "...as selected from manufacturer's standard colors, patterns, textures..." or a similar phrase, Design Team will select color, pattern, and texture from product line selected that complies with other specified requirements.

E. Do not use products having any of the following characteristics:

1. Made using or containing CFC's or HCFC's.
2. Made of wood from newly cut old growth timber.

F. Where all other criteria are met, Contractor shall give preference to products that:

1. Are extracted, harvested, and/or manufactured closer to the location of the project.
2. Have longer documented life span under normal use.
3. Result in less construction waste.

4. Are made of vegetable materials that are rapidly renewable.

G. Motors: Refer to Section 22 05 13, NEMA MG 1 Type. Specific motor type is specified in individual specification sections.

H. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Size terminal lugs to NFPA 70, include lugs for terminal box.

I. Cord and Plug: Provide minimum 6 foot cord and plug including grounding connector for connection to electric wiring system. Cord of longer length is specified in individual specification sections.

2.2 PRODUCT OPTIONS

A. Specified Standards, Codes, and Regulations: Where compliance with an imposed code, standard, or regulation is specified, provide a product that complies with that code, standard, or regulation.

B. Inappropriate Product Selections:

1. If Contractor believes specified product, method, or system is inappropriate for use, Contractor to notify CO before performing Work in question.

2. If notice of objection is not received prior to delivery to site, it will be assumed by the Government that Contractor agrees specified products, methods, and systems are appropriate for use in Project.

PART 3 – EXECUTION

3.1 INSTALLATION OF PRODUCTS

A. Comply with manufacturer's instructions and recommendations for installation of products in applications indicated.

1. Anchor each product securely in place, accurately located and aligned with other Work.

2. Clean exposed surfaces and protect as necessary from damage and deterioration.

3.2 SUBSTITUTION PROCEDURES

A. Definitions:

1. Substitutions: Contractor proposals for changes in products, materials, equipment, and methods of construction required by Contract Documents

made after award of Contract are not to be considered to be requests for substitution unless the product is unavailable.

2. Following are not considered to be requests for substitution:
   a. Revisions to Contract Documents requested by CO.
   b. Specified options of products and construction methods included in Contract Documents.
   c. Contractor's determination of and compliance with regulations and orders issued by governing authorities.

B. Contractor's Responsibilities

1. Contractor's responsibilities for substitution requests made after award of Contract are as follows:
   a. Provide same guarantee for accepted substitutions as for products specified.
   b. Make changes in, and coordinate, Work as may be required to incorporate and install accepted substitutions.
   c. Waive claims for additional costs which subsequently become apparent which are related to substitutions.

C. All requests for substitutions shall be submitted 10 working days prior to submittals for the Response to Proposals. Comply with requirements specified in this section.

D. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.

E. Equality of different materials or products shall be determined by methods set forth in this Section.

1. No product or material shall be arbitrarily presumed to be "equal" without having first been so judged by appropriate procedures.

2. Provide comparison chart itemizing specified parts or components of specified and proposed substitutions.

3. Comparative analysis to be evaluated by CO approving substitution. CO will be judge of acceptability of any proposed substitution and decision is final.

4. A request for substitution constitutes a representation that the submitter:
   a. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
   b. Will provide the same warranty as for the specified product.
   c. Will coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to the Government.

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

F. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents. It is intended that substitutions are not permitted.

G. Substitution Submittal Procedure:

1. Submit three copies of request for substitution for consideration. Limit each request to one proposed substitution on CSI Substitution Request Form.

2. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence. Burden of proof is on proposer.

3. The CO will notify Contractor in writing of decision to accept or reject request.

4. CO will be sole judge of acceptability of any proposed substitution.

3.3 SUBSTITUTIONS REQUESTED AFTER AWARD OF CONTRACT

A. CO will receive and consider Contractor's request for substitution after award of Contract when one or more of following conditions are satisfied, as determined by CO. If following conditions are not met, CO will return requests without action except to record noncompliance with these requirements.

1. Specified product cannot be provided within Contract time. CO will not consider request of products that cannot be provided as a result of failure to pursue product promptly or coordinate activities properly.

2. Specified product cannot receive necessary approval by a governing authority, and requested substitution can be approved.

3. Specified product cannot be coordinated with other materials and Contractor certifies that proposed substitution can be coordinated.

4. Specified product cannot provide required warranty and Contractor certifies that proposed substitution provides warranty.

5. Requested substitution offers Government a substantial advantage in cost, time, or other considerations.

B. Contractor's submittal and CO's acceptance of Shop Drawings, Product Data, or Samples for construction activities not complying with Contract Documents do not constitute an acceptable or valid request for substitution, nor do they constitute approval.

3.4 TRANSPORTATION AND HANDLING

A. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials. Transport and handle products in accordance with manufacturer's instructions.

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

C. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products. Maintain temperature and humidity within range required by manufacturer's instructions.

END OF SECTION

SECTION 01 70 00

EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.

B. Pre-installation meetings.

C. Surveying for laying out the work.

D. Cleaning and protection.

E. Starting of systems and equipment.

F. Demonstration and instruction of Government personnel.

G. Closeout procedures, except payment procedures.

1.2 RELATED SECTIONS

A. Section 01 50 00 – Temporary Facilities and Controls.

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

1.3 SUBMITTALS

A. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.

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

2. Identify demolition firm and submit qualifications.

3. Include a summary of safety procedures.

B. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.4 PROJECT CONDITIONS

A. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

B. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere.

C. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation including temporary measures such as berms, dikes, and drains, to prevent water flow.

D. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations during office hours, 7:00 am to 5:00 pm, Monday to Saturday.

E. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations.

1.5 COORDINATION

A. Coordinate scheduling, submittals, and work to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later. All defective work must be repaired and completed prior to final payment.

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

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

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

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

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

PART 2 – PRODUCTS

Not Used.

PART 3 – EXECUTION

3.1 EXAMINATION

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

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

3.2 GENERAL INSTALLATION REQUIREMENTS

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

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

3.3 UTILITY ALTERATIONS

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

1. Verify that utility arrangements are as shown.
2. Report discrepancies to CO before disturbing existing installation.
3. Beginning of alterations work constitutes acceptance of existing conditions.

B. Services (Including but not limited to Fire Protection, Electrical, and Telecommunications): Extend existing systems to accommodate new construction. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.

C. Protect existing work to remain.

1. Perform cutting to accomplish removals neatly and as specified for cutting new work.
2. Repair adjacent construction damaged during removal work.

3.4 PROGRESS CLEANING

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

B. Control dust to remain in building during cleaning. The opening of doors and windows is not permitted.

C. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site.

D. See other Division 1 requirements for closing off ducts during construction and post occupancy flush out.

3.5 PROTECTION OF INSTALLED WORK

A. Protect installed work from damage by construction operations.

3.6 SYSTEMS STARTUP

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

B. Notify CO seven (7) days prior to start-up of each item.

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

D. Verify that wiring and support components for equipment are complete and tested.

E. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.

F. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.

G. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.7 DEMONSTRATION AND INSTRUCTION

A. Demonstrate operation and maintenance of products to CO's personnel two (2) weeks prior to date of Substantial Completion.

B. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled time, at equipment location. Videotape procedures for use by CO.

C. For equipment or systems requiring seasonal operation, perform demonstration for other season within six (6) months.

D. Provide a qualified person who is knowledgeable about the Project to perform demonstration and instruction of owner personnel.

3.8 ADJUSTING

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

3.9 FINAL CLEANING

A. Execute final cleaning prior to final project assessment.

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

3.10 CLOSEOUT PROCEDURES

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

B. Accompany Owner's Representative on preliminary inspection to determine items to be listed for completion or correction in Contractor's Notice of Substantial Completion.

C. 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 CO's review.

D. Correct items of work listed in executed Certificates of Substantial Completion and comply with requirements for access to Owner-occupied areas.

E. Complete items of work determined by CO’s final inspection and provide documentation this work is complete.

3.11 MAINTENANCE SERVICE

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

B. Examine system components at a 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 the manufacturer of the original component.

D. Maintenance service shall not be assigned or transferred to any agent or Subcontractor without prior written consent of the Government.

END OF SECTION

SECTION 01 78 00

CLOSEOUT SUBMITTALS

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Project Record Documents.

B. Operation and Maintenance Data.

C. Warranties and bonds.

D. Inspection procedures

1.2 RELATED SECTIONS

A. Section 01 70 00 – Execution and Closeout Requirements: Contract closeout procedures.

B. Individual Product Sections: Specific requirements for operation and maintenance data and warranties for specific products.

1.3 SUBMITTALS

A. Project Record Documents: Submit documents to CO with claim for final Application for Payment.

B. Operation and Maintenance Data:

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

2. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with CO comments.

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

C. Warranties and Bonds:

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

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

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

PART 2 – PRODUCTS

Not Used.

PART 3 – EXECUTION

3.1 SUBSTANTIAL COMPLETION

A. Prior to requesting inspection for certification of Substantial Completion, complete following.

1. In Application for Payment that coincides with, or first follows, date of Substantial Completion is claimed, show 100 percent completion for portion of Work claimed as substantially complete.
   a. Include supporting documentation for completion as indicated in these Contract Documents.
   b. If 100 percent cannot be shown, include a list of incomplete items, value of incomplete construction, and reasons Work is not complete.

2. Submit warranties, workmanship bonds, maintenance agreements, final certifications, and similar documents.

3. Obtain and submit releases enabling Owner unrestricted use of Work and access to services/utilities.

4. Submit: Record drawings, record specifications, maintenance manuals, final project photographs, damage or settlement surveys, property surveys, and other final record information.

5. Deliver tools, spare parts, extra stock, and similar items.

6. Make final changeover of permanent locks and transmit keys to Government.

7. Complete startup testing of systems and instruction to Government's operation and maintenance personnel as designated in each specification section.

8. Discontinue and remove temporary facilities from site, construction tools, and similar elements.

9. Complete final cleanup requirements.

10. Touch up and otherwise repair and restore marred, exposed finishes, including touchup painting.

B. Inspection Procedures:

1. On receipt from contractor a written request for inspection with certification the project is substantially complete and a punch list, CO will proceed with an inspection or advise Contractor of unfilled requirements.

2. CO will prepare Certificate of Substantial Completion following inspection or advise Contractor of construction that must be completed or corrected before certificate can be issued.
   a. CO will reinspect once when requested with assurance that punch list and Work is substantially complete.
   b. Results of completed inspection will form basis of requirements for Final Acceptance.

3. CO will allow Contractor no longer than 30 calendar days from Date of Substantial Completion to remedy deficiencies.

3.2 FINAL ACCEPTANCE

A. Prior to requesting final inspection for certification of final acceptance and final payment, Contractor to submit following:

1. Final payment request with releases, including insurance certificates for products and systems where applicable.

2. Updated final statement accounting for final additional changes to Contract Sum including a final Change Order summary after final acceptance showing adjustments to Contract Sum which were not made previously by Change Orders.

3. Certified copy of CO's final inspection list of items to be completed or corrected, endorsed and dated showing each item has been completed or corrected or otherwise resolved for acceptance.

4. Consent of Surety to Final Payment.

5. Evidence of final, continuing insurance coverage complying with insurance requirements.

6. List of all defective work corrected and completed including all punchlist items signed off as completed.

B. Reinspection Procedure:

1. CO will reinspect to verify status of completion upon receipt of notice that Work, including list of items from earlier inspection, has been completed. Indicate items for which completion is delayed under circumstances acceptable to CO.

2. If Work is found to be complete following final inspection, CO will issue a Certificate of Final Acceptance.

3. For work is incomplete or defective, CO will promptly notify Contractor, in writing, listing incomplete or defective Work. Contractor shall remedy deficiencies promptly, and notify CO when ready for reinspection.

3.3 3.3 PROJECT RECORD DOCUMENTS

A. Maintain on-site one set of the following record documents, record actual revisions to the Work, and identify as RECORD DRAWINGS – PROJECT SET:

1. Drawings, Specifications, Addenda, Change Orders and other modifications to the Contract.

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

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

B. Mark Drawings to show actual installation and construction which varies substantially from Work as shown.

1. Using an erasable colored pencil (not ink), describe change by graphic line and note.

2. Date entries, and note related Change Order numbers where applicable.

3. Call attention to entries by a "cloud" drawn around areas affected.

C. Conversion of schematic layouts:

1. Design of future modifications of facility may require accurate information as to final physical layout of items which are shown schematically on Drawings.

2. Show on Project set of Record Drawings, by dimension accurate to within 1-inch, centerline of each run of items shown schematically on Drawings. Clearly identify item by accurate note such as "cast iron drain," "galv. water," and like. Show, by symbol or note, vertical location of item ("under slab," "in ceiling plenum," "exposed", and like). Relate by identification descriptive to Specifications

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

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

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

2. Field changes of dimension and detail.

3. Details not on original Contract drawings.

3.4 OPERATION AND MAINTENANCE DATA

A. For Each Product or System: List names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.

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

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

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

3.5 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

A. For Each Product:

1. Product data, with catalog number, size, composition, and color and texture designations.
2. Information for re-ordering custom manufactured products.
3. Care and Maintenance Instruction

B. Moisture protection and weather-exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.

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

3.6 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

A. For Each Item of Equipment and Each System:

1. Description of unit or system, and component parts.
2. Identify function, normal operating characteristics, and limiting conditions.
3. Include performance curves, with engineering data and tests.
4. Complete nomenclature and model number of replaceable parts.

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

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

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

E. Include manufacturer's printed operation and maintenance instructions including sequence of operation by controls manufacturer.

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

END OF SECTION

SECTION 01 90 00

MOBILIZATION

PART 1 – GENERAL

1.1 SCOPE

A. This work consists of preparatory work and operations necessary for the movement of personnel, equipment, supplies, and incidentals to the project site, and for all other work and operations that must be performed or that cause costs to be incurred prior to beginning work on the various items on the project site.

1.2 MEASUREMENT AND PAYMENT

A. The accepted quantities will be paid for at the contract unit price for Item 01, Mobilization.

B. Progress payments will be made as follows:

1. The Government will pay to the Contractor in the first progress payment the total premium paid by the Contractor to obtain bonds. This payment shall not be in addition to the contract price and will be included in Item 01, Mobilization.

2. When 5 percent or more of the original contract amount is earned from other pay items, 50 percent of the amount for mobilization, or 5 percent of the original contract amount, whichever is less, will be paid.

3. When 10 percent or more of the original contract amount is earned from other pay items, 100 percent of the amount for mobilization, or 10 percent of the original contract amount, whichever is less, will be paid.

4. Upon completion of all work on the project, any unpaid amount for Item 01, Mobilization, will be paid.

C. The total of all payments will not exceed the original contract amount for Item 01, Mobilization.

PART 2 – PRODUCTS

Not Used.

PART 3 – EXECUTION

Not Used.

END OF SECTION

SECTION 02 41 16
REMOVAL OF STRUCTURES AND OBSTRUCTIONS

PART 1 – GENERAL

1.1 SCOPE

A. This section includes:
   1. Demolition
   2. Deconstruction
   3. Salvage

B. Work covered under this section include:
   1. Demolition of designated structures and removal of materials from site.
   2. Demolition and removal of foundations and slabs on grade.
   3. Demolition of septic system where designated
   4. Disconnecting and removal of identified utilities.
   5. Demolition and removal of site paving.

1.2 RELATED SECTIONS

1.1 DEFINITIONS

A. Deconstruction: Disassembly of buildings for the purpose of recovering materials

1.2 SUBMITTALS

A. Schedule of items and materials to be salvaged. Identify procedures for disassembly.

   1. Coordinate with Solid Waste Management Plan. Identify materials to be recycled. Identify materials to be salvaged for reuse.

1.3 REGULATORY REQUIREMENTS

A. Conform to applicable codes for demolition of structures, safety of adjacent structures, dust control, runoff control, disposal, etc.

B. Obtain required permits from authorities.

C. Notify affected utility companies before starting work and comply with their requirements.

D. Conform to applicable regulatory procedures when hazardous or contaminated materials are discovered.

PART 2 – PRODUCTS

NOT APPLICABLE

PART 3 – EXECUTION

3.1 DECONSTRUCTION

A. Inspect and evaluate for reuse existing structures on site.

B. Disassemble existing construction scheduled to be removed for recycling or reuse.

C. Demolition will not be permitted unless approved in writing by the Contracting Officer.

D. Salvage materials for recycling and reuse.

3.02 DEMOLITION

A. Apply water or otherwise maintain demolition areas to minimize dust. Provide hoses and water connections, or other equipment necessary for this purpose.

B. Disconnect and cap utilities within demolition areas. Remove disconnected utilities.

C. Disconnect waterlines at a point in the system where no dead lines will be connected to the system.

D. Remove concrete slabs on grade. Remove footings and foundation walls completely.

E. Break up and remove retaining walls at sites indicated, and grade remaining material to match the angle of repose.

F. Break up and remove site paving in areas indicated.

G. Backfill areas excavated caused as a result of demolition in accordance with Section 02 50 00 or Civil Drawings and Geotechnical report if entire parking lot paving option is awarded.

H. Remove demolished materials from site.

I. Leave site in clean condition.

END OF SECTION

SECTION 22 05 23

VALVES AND ENCLOSURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. This work consists of furnishing and installing water valves, fire hydrants and valve boxes as SHOWN ON THE DRAWINGS and specified herein.

1.2 CODES AND STANDARDS: In addition to the Codes and Standards listed under Divisions 1 and 2, Regulatory Requirements, work performed under this section shall meet the requirements of the following:

A. Work performed under this Section shall meet the requirements of the California Plumbing Code, 2013 Edition.

B. The following standards are applicable:

1. American Society for Testing and Materials (ASTM)

2. American Water Works Association (AWWA)

3. Underwriters Laboratory (UL)

1.2 SUBMITTALS:

A. Submittals shall conform to Section 01 30 00.

B. Product Data

1. Submit manufacturer’s technical product data and instructions for valves, fire hydrants and precast concrete boxes.

2. Product literature shall be sufficient to determine compliance with the Drawings and Specifications.

PART 2 - PRODUCTS

2.1 VALVES:

A. Bronze Gate Valves, Class 125 - 1/2 inch through 2 1/2 inch. Valves shall be bronze, screw-in bonnet with solid wedge disk, non-rising stem, with wheeled handle, 200-psi non-shock cold water, oil, or gas.

B. Ball Valves, bronze body with chromium plated ball, reinforced TFE seats and stuffing box ring with blowout proof stem.

C. Iron Gate Valves, below grade, Class 125 ductile iron- 3 inch and larger. Valves shall be non-rising stem, bolted bonnet, bronze mounted, solid wedge disk, 200-psi non-shock cold water, oil, or gas. Valves shall have mechanical joint or flanged ends and hand wheel unless otherwise SHOWN ON THE DRAWINGS.

D. Iron Gate Valves, above grade, Class 125 ductile iron- 3 inch and larger. Valves shall be OS&Y, bolted bonnet, bronze mounted, solid wedge disk, 200-psi non-shock cold water, oil, or gas. Valves shall have mechanical joint or flanged ends and hand wheel unless otherwise SHOWN ON THE DRAWINGS.

2.2.1 PRECAST CONCRETE UTILITY AND VALVE BOX: Boxes shall be precast concrete. Boxes located in traveled ways shall be traffic rated with H20 cast iron frame and cover. Covers shall be marked "WATER". Extension shall be of the same material and manufacturer as the box unless otherwise specified herein. Installation, size, and type of box shall be as SHOWN ON THE DRAWINGS and as designated as follows. Box lids for meters shall have reading lids positioned over the read out of the meters.

PART 3 -EXECUTION

3.1 VALVES:

A. Valves shall be installed as SHOWN ON THE DRAWINGS. Valves shall be installed in such positions that they are readily accessible and can be easily and fully opened and closed without binding. All valves shall be installed with stems pointing up. Where possible all valves shall be installed in the center of the valve box. Where extension handles are required to operate valves, contractor shall provide the Government with two handles.

3.2 VALVE BOXES AND ENCLOSURES:

A. All valves shall be installed in boxes or enclosures as SHOWN ON THE DRAWINGS and specified herein. The box shall be set over the pipes, centered on the valve, and related assemblies. Boxes shall be installed so as not to be in contact with the pipe or apparatus they serve so as not to create any undo stress or strain on the piping system. The area in which the box sets shall be compacted as required for the sub-base for structures. The box, when in final position, shall be 1-inch minimum above surrounding finish grade and there shall be a minimum of 1/2-inch minimum clearance between the box and the pipeline at any point.

B. All boxes shall be provided with a lid marked “WATER”. For areas in traffic areas, the lid shall be rated for H20 loading. Lid in non-traffic areas shall be concrete manufactured for the box it serves.

C. After the box is in final position, the area around the box shall be backfilled and compacted the same as for structures.

3.3 TESTING: Upon completion of water distribution system and testing of the system, Contractor shall coordinate this test and notify the Contracting Officers Representative 24 hour’s prior to test. In the event the do not pass, contractor shall have repairs made at no additional expense and repeat the testing.

3.4 THRUST BLOCK: Thrust blocks shall be installed for all valves 3” and larger and all hydrants. Concrete shall be a dry mix placed and formed by hand. Concrete shall be placed so as not to interfere with bolt attaching flanges.

END OF SECTION

SECTION 22 08 00

DISINFECTION OF WATER DISTRIBUTION SYSTEM

PART 1 -GENERAL

1.1 RELATED DOCUMENTS

A. The work consists of cleaning, flushing, and disinfecting waterlines and appurtenances in compliance with AWWA and as specified herein.

1.2 REFERENCES

A. The following codes and standards will apply to work in this Section.

1. AWWA Manual M20, "Water Chlorination, Principles and Practices".

2. AWWA Standard C-601-68.

PART 2 -PRODUCTS

2.1 DISINFECTING AGENT: Disinfecting agent shall be calcium hypochlorite, sodium hypochlorite or elemental gaseous chlorine to produce a stock solution of known strength.

PART 3 -EXECUTION

3.1 PRELIMINARY FLUSHING: Before disinfection, the main shall be flushed thoroughly with water. Flushing shall be done after the pressure test has been made. Develop a minimum velocity in the main of at least 2.5 feet per second.

3.2 VALVE DAMAGE BY FOREIGN MATERIAL: If it appears that foreign material may be in the main, all valves on the line shall be thoroughly flushed, and carefully inspected after flushing, to see that the entire operating mechanism of each valve is in good condition.

3.3 DISINFECTION METHODS: After flushing is completed, disinfection (using liquid chlorine, sodium hypo chlorite, or calcium hypo chlorite can proceed by one of the following methods or other method approved by the Contracting Officer. Distribution system disinfection shall be done prior to structures systems disinfection.

A. Continuous Feed: In this method, water from the distribution system or other approved source and the chlorine form selected are fed at constant rate into the new main at a concentration of at least 50 milligrams per liter (mg/L). A properly adjusted hypochlorite solution injected into the main through a solution-feed chlorinator and booster pump may be used. The chlorine residual shall be checked in the presence of the Contracting Officer to insure that the proper level is maintained. Chlorine application shall continue until the entire main is filled. The water shall remain in the main for a minimum of 24 hours, during which time all valves, hydrants, and the like, along the main must be operated to insure their proper disinfection. Following the 24-hour period, no less than 25 mg/L chlorine residual shall remain in the main.

B. Slug Method: In this method, a continuous flow of water is fed with a constant dose of chlorine (as in the previous method) but with rates proportioned to give a chlorine concentration of at least 300 mg/L. The chlorine is applied continuously for a period of time to provide a column of chlorinated water that will contact all interior surfaces of the main for a period of at least three hours. As the slug passes tees, crosses, and the like, proper valves shall be operated to insure their disinfection.

3.4 DISINFECTING BROKEN WATERLINES: After determining location and exposure of the break, the area shall be carefully inspected to locate and isolate sewers and other contaminant sources. Following this, the Contractor shall flush the main while standing water in the trench is being pumped away. The affected section shall be isolated, service connections shall be shut off, and the section shall be subjected to disinfection procedures described for new mains. The slug may be increased to 500 mg/L. Bacteriological samples shall be taken by the Contracting Officer following disinfection to test the effectiveness of the process.

3.5 FINAL FLUSHING: Following disinfection, all treated water shall be thoroughly flushed from the newly laid pipelines.

END OF SECTION

SECTION 22 11 00

WATER DISTRIBUTION SYSTEM

PART 1 -GENERAL

1.1 RELATED WORK

A. This work consists of furnishing and installing new waterlines as SHOWN ON THE DRAWINGS and specified in this contract. There shall be a 1-1/2" supply from existing valve box.

1.2 CODES AND STANDARDS: In addition to the Codes and Standards listed in these specifications and the Prospectus and in Section 01 06 00, Regulatory Requirements, work performed under this section shall meet the requirements of the following:

A. National Sanitation Foundation (NSF)

B. International Association of Plumbing and Mechanical Officials (IAPMO)

C. Installation Standards (IAPMO-IS)

D. American Water Works Association (AWWA)

1.3 SUBMITTALS:

A. Submittals shall conform to Section 01 30 00.

B. Product Data

1. Submit manufacturer's technical product data and instructions for all pipes and fittings.

PART 2 PRODUCTS

2.1 PIPE AND FITTINGS: All materials shall be new, of size, material, and type called for in these specifications and SHOWN ON THE DRAWINGS.

A. Below Grade Water Service outside building

1. 3" NPS and smaller, Schedule 40 PVC Plastic Pipe and fittings. ASTM D1785, D2466, with Solvent Cement Joints ASTM D2564.
2. 2" NPS and smaller, Type K Soft Annealed Temper Copper Tube ASTM B88 with Wrought Copper pressure fittings, ANSI B16.22. SIL-FOS - High temperature Brazing Metal Filler.

3. 4" NPS and larger, PVC AWWA C900 Class 100 Plastic Pipe with Dutile-Iron fittings AWWA C110, C111 or Elastomeric Gasket Joints

B. Above Grade (Distribution System inside building)

1. Piping
   a. For soldered, brazed, and mechanical joints, 4" and smaller Copper Water Tube Type L Annealed Temper (Hard Drawn) ASTM B75 or ASTM B88.
2. Fittings
   a. Wrought Copper Pressure Solder Fittings, ASME B16.22 or ASME B16-25, 95-5 Tin-Antimony Filler Metal.
   b. Press Fitting: Copper press fittings shall conform to the material and sizing requirements of ASME B16.18 or ASME B16.22. O-rings for copper press fittings shall be EPDM. Press fittings shall have an inboard bead design.
      1) Copper Press Fittings: Viega/Rigid Tool Company, NIBCO, or approved equal.
   c. All underground water piping within the building boundaries shall be ASTM B88-93a Type "L" annealed (soft) copper tube made up without fittings below the floor level.

C. PVC Solvent Cements and Primer: Solvent cements and primer for use with PVC pipe shall comply with the Uniform Plumbing Code Installation Standard IAPMO IS 8-95, 316.1 and have a type recommended for use by the pipemanufacturer.

D. Pipe Fittings: All change in direction fittings for PVC pipe 3 inches and smaller shall be of the same size and material as the pipe it serves. All pipe 4 inches and larger installed below ground shall make changes in direction with Ductile Iron Flanged fittings of the same size and class as to the pipe it serves. All PVC and Ductile Iron fitting shall be joined together using a Mechanical Joint (MJ).

F. Pipe Thread Sealing Paste: Pipe sealant compound shall be a non-hardening, non-seizing, and non-toxic sealing paste containing TFE-Fluorocarbon approved for use with potable water.

2.2 MARKING TAPE:

A. Marking tape shall be 2 inches wide with imprint "Caution - Buried Waterline Below"; color shall be blue. Tape shall be as manufactured by Calpico Inc., 185 Harbor Way, South San Francisco, CA 94580.

B. Where more than one utility is located in a common trench marking tape shall be 6 inches wide with imprint "Caution - Buried Utility Lines Below".

2.2.1 TRACER WIRE:

A. Tracer wire shall be a Minimum No. 14 AWG blue insulated copper conductor.

2.3 VALVES AND ENCLOSURES: See section 22 05 23

PART 3 -EXECUTION

3.1 GENERAL: All piping shall be installed per manufacturer's recommendations and in accordance with the Uniform Plumbing Code Installation Standards IS 8-95.

3.2 PIPE INSTALLATION: All pipe interiors shall be clean prior to its installation. Pipe that is not clean shall be flushed and swabbed out with water. No pipe shall be installed in the trench until the trench and bedding have been inspected and approved. Valves and other control devices shall be installed in the line where SHOWN ON THE DRAWINGS, and per Section 31 50 00. PVC pipe shall be cut square to insure proper assembly. PVC gasketed pipe shall be beveled with a plastic pipe pilot-beveling tool, hand beveling will not be allowed. Pipe 3” and smaller shall be assembled out of the trench and laid in the trench, dropping piping into trench after assembled will not be allowed. Pipe 4” and larger shall be assembled in the trench with the use of blocks assuring that no dirt or debris enters pipe and fittings. PVC spigot end pipe shall be assembled with its spigot ends pointing in the direction of flow. Solvent welded pipe shall be snaked in the trench.

3.3 CHANGES IN GRADE AND ALIGNMENT: Changes in grade and alignment shall be made with appropriate fittings. All PVC pipe may be deflected as SHOWN ON THE DRAWINGS, mechanically joined pipe shall not exceed 5° deflections at the joint or not exceeding manufactures recommendations. Changes in alignment to PVC solvent welded pipe, which cannot be made with standard fittings, may be accomplished with swing joints installed so the lines drain. All pipes shall be laid with no sags or crests in gradient.

3.4 PIPE TERMINATION: Pipes shall be terminated AS SHOWN ON THE DRAWINGS. Water lines serving buildings shall terminate five feet (5’) from the building footprint connection to be by others.

3.5 PROTECTION OF PIPE: All pipe and fittings shall be protected during storage and installation to prevent contamination. Care shall be taken during laying and joining to prevent dirt and other objectionable material from entering pipe. Cap or plug lines when work is not in progress. Storage and stockpiles of PVC pipe shall be protected from exposure to sunlight. No PVC pipe will be left exposed to sunlight for more than 5 days.

3.6 CONNECTIONS: Lateral connections from PVC gasketed pipe AWWA C900 shall be made with mechanical joint fittings. Other fittings shall be installed as SHOWN ON DRAWINGS or approved by the CONTRACTING OFFICER.

3.7 TRACER WIRE: A continuous No. 14 AWG blue insulated copper wire shall be attached to the underground piping system. Wire shall be attached to the pipe every 10

feet by means of a cable-ty or equal. Splicing of the wire will be done per Div. 16, splicing shall be kept to a minimum. Wire shall terminate on an approved grounding clamp on the riser pipe 6" above grade.

3.8 MARKING TAPE: Marking tape shall be buried in all trenches AS SHOWN ON THE DRAWINGS. Tape shall be continues in the trench, if tape needs to be broken, tape shall be overlapped 6".

3.9 TRENCHING AND BACKFILLING: See section 31 50 00. Bedding material shall be as specified in the section and as SHOWN ON THE DRAWINGS.

3.10 THRUST BLOCKING: Thrust blocking shall be cast in place concrete sized and placed in accordance with the schedules and details AS SHOWN ON THE DRAWINGS with a soil-bearing load of 1500 Lbs/sq. ft. Thrust blocks shall be installed at all vertical and horizontal changes in direction, at tees and bends, changes in size, at stops or dead ends, at valves where thrust may be expected. Concrete shall be a dry mixture so the concrete may be shaped by hand into the desired shape. Concrete shall not interfere with the pipe and fitting connection. Thrust Blocks shall be placed against undisturbed earth.

3.11 DISINFECTION: Disinfection shall be as specified in section 22 08 00 for that work.

3.12 FLUSHING LINES: Water lines shall be flushed with fresh water before and after disinfection in 3.2above, the entire system shall be flushed with treated water until the free residual chlorine concentration at any outlet is less than 1 ppm.

3.13 TESTING:

A. The equipment, material, and labor necessary for testing shall be supplied by the Contractor. Piping systems shall be tested after the lines have been cleaned as hereinbefore specified and where applicable. Piping systems shall be hydrostatically tested using water not to exceed 100 degrees Fahrenheit. In all tests, all apparatus, which may be damaged by the test pressure, shall be isolated form the system. A calibrated test pressure gauge shall be installed in the system to observe pressure. A pressure of 150-psi shall be introduced for a period of 4 hours without the loss of any pressure. All defects, which may develop during the test, shall be rectified, and the piping system shall be retested, until passed.

B. All tests shall be performed in the presence of the Contracting Officer or a Representative.

END OF SECTION

SECTION 22 11 14

LIQUIFIED PETROLEUM GAS SYSTEM

PART 1 - GENERAL

1.1 SCOPE

A. Work to be performed under this Section consists of furnishing and installing a liquefied petroleum gas (LPG) system including, concrete tank pad, trenching, backfill, piping, fittings, valves, first and second stage regulators AS SHOWN ON THE DRAWINGS or specified in this contract. This shall include all work from the tank to inside the building,

1.2 CODES AND STANDARDS

A. In addition to the Codes and Standards listed in these specifications and the Prospectus and in Section 01 06 00, Regulatory Requirements, work performed under this section shall meet the requirements of the following:
   1. Uniform Plumbing Code, latest edition with California Amendments, Installation Standard IS-13-84.
   2. National Fire Protection Association, Standard for the (NFPA 58) Storage and Handling of Liquefied Petroleum Gases, latest Edition.
   3. National Fire Protection Association, National (NFPA 54) Fuel Gas Code, Latest Edition

1.3 SUBMITTALS Submittals shall meet the requirements of Section 01 30 00.

1.4 LICENSED CONTRACTOR

A. All work under this section shall be performed by a California licensed plumbing contractor.

B. In the event that Polyetholene (PE) pipe is used, the installers shall have a current certification card from the manufacturer of the pipe.

PART 2 – PRODUCTS

2.1 GENERAL

All materials shall be new and unused. Any used or damaged materials shall be removed from the job site.

2.2 LPG REGULATORS:

First and Second Stage Regulators shall be AS SHOWN ON THE DRAWINGS. First stage regulator shall convert tank pressure to 10 psi and shall be rated at a sufficient capacity. Second stage regulator shall convert 10 psi to 11 inches water column. Listed regulator capacity shall be sufficient to serve connected appliances.

2.3 GAS VALVE

Building service gas stop valve (high pressure) shall be iron body, brass plug, flat/tee head lockwing pattern, 100 psi rated, and listed for use with Liquefied Petroleum Gas. All appliance gas stop valves shall be A.G.A. certified, bronze or other materials allowed by Code. Size of valve shall be the same as appliance connection to which it attaches.

2.4 CONNECTORS

Connectors shall be flexible stainless steel and shall be have an AGA label. They shall be a maximum length of 36 inches and shall be the same size as appliance connection to which it attaches. Listed capacities shall be adequate for the appliances served. With the exception of cooking equipment, and laundry equipment, in which case they shall be 72 inches. All connectors shall be equipped with an approved gas shut off valve.

2.5 METAL GAS OUTLET BOX

Metal gas outlet box shall a pre-assembled box and valve with recessed construction to be mounted in the wall. Unit shall be pre-finshed. Dimensions of box are approximately 5-3/16 inches x 5-3/16 inches x 2-1/2 inches. Faceplate, 6-13/16 inches x 6-13/16 inches. Units and locations shall be AS SHOWN ON THE DRAWINGS.

2.6 EARTHQUAKE ACTUATED GAS VALVE

Valve shall be sensitive to the means of shutting off the gas system within 5 seconds when subjected to a horizontal sinusoidal oscillation having a peak period of 0.3G and a period of 0.4 seconds. The sensing means of the valve shall not actuate the shut off means when subjected to horizontal sinusoidal oscillation created by vehicular traffic.

2.7 PIPE AND FITTINGS

A. Pipe 6" above ground and inside building shall be threaded schedule 40 wrought black iron. Fitting shall be threaded malleable iron or steel, standard class 150.

B. Pipe from 6" above ground and under ground shall be Schedule 40, Seamless, Black Steel Pipe, 2 1/2" and under ASTM A-120 with Malleable-Iron Threaded fittings ANSI-B16.3, Class 150. Pipe and fittings shall be coated and wrapped per IAPMO IS 13-91 or provide factory applied plastic coated pipe.

C. Pipe shall be marked as required by Uniform Plumbing Code IS-13-84. No Teflon coated pipe shall be used. Fitting shall be threaded malleable iron or steel, standard class 150.

D. Polyethylene (PE) 18" below grade shall have an SDR of 11 and rated at 80 psig. Piping shall be listed and shall meet the requirements of ASTM D2513 and shall be AGA approved. Fitting shall be of the same material and manufacturer and shall be fusion weld type, no mechanical joints will be allowed. Transition service riser shall be a manufatuered steel riser with an approved fusion end. Field manufactureing risers will not be allowed.

E. Galvanized steel pipe, or copper tubing shall not be allowed in any part of the gas system.

2.8 TAPE FOR FIELD APPLICATION

Tape for hand wrapped field application shall meet the requirements of PS 22-84, as published by the International Association of Plumbing and Mechanical Officials (IAPMO), and shall be applied as required in IS-13-84 in the Uniform Plumbing Code. Primer for field application shall be as recommended by the tape manufacturer. Tape shall have a minimum thickness of 10 mils.

2.9 MARKING TAPE

Marking tape shall be 3 inches wide with standard imprint "Buried Gas Line Below" as manufactured by Allen Systems Inc. Color shall be high visibility safety yellow.

2.10 TRACER WIRE

Tracer wire shall be AWG 14 solid copper minimum. Splices for wire shall be a compression type.

2.11 LPG TANK

LPG tank concrete pad, barrier posts, regulator support post, etc., shall be furnished and installed by Contractor AS SHOWN IN THE DRAWINGS. Tank shall be supplied by others.

PART 3 EXECUTION

3.1 PIPE INSTALLATION

A. All pipe, fittings and valve interiors shall be free of all foreign matter at time of installation. All steel pipe shall be aligned in the trench prior to "make up", and shall be installed so as not to be bent or stressed. All exposed pipe and fittings, and

all damaged factory wrapping shall be cleaned, primed, and wrapped in accordance with UPC IS-13 prior to backfilling.

B. All Polyethelene pipe shall be layed out along side of the open trench to make up fusion fitting. Upon completion of installation of fittings, pipe shall be lifted and set into trench. Pipe shall not be dropped or drug into trench. After pipe is set in trench, the #14 AWG copper wire shall be attached to the pipe as approved by the Contracting Officer. Tracer wire shall be continuous and shall be exteneded out of the trench and 12 inches coiled above grade.

C. All open ends of pipe or fittings shall be plugged or capped while work is not in progress. Pipe left open during work, and has dirt or other debris introduced into it, shall be uncovered and removed back to a sufficient length as directed by the Contracting Officer, and cleaned by swabbing or replaced.

D. Piping within the building shall be supported in a substantial and professional manner at intervals as prescribed in the Uniform Plumbing Code, Table 3-2. An approved support shall be used. Wire nails and plumbers tape will not be allowed.

3.2 PIPE AND FITTINGS

All buried pipe, and pipe 6 inches or less above grade shall be protectively coated. Hand wrapped field applied tape shall be required and will be permitted only for buried fittings and damaged factory wrap. The use of bushings, close nipples, and copper tubing will not be permitted.

3.3 TAPPING AND FIELD APPLICATIONS

Installation and material for field application of a pipe coating shall meet the requirements of the International Association of Plumbing and Mechanical Officials (IAPMO) IS 13-84. Field joints and repairs shall be made as follows. Oil, grease, and foreign matter shall be removed with suitable non-oily type solvent such as "Heptane" or "Trichlorethylene". Materials such as kerosene and gasoline shall not be used. For area of pipe to be field wrapped, remove coating approximately three inches from end of pipe or from repair area, and bevel exposed shoulder of coating at area to be wrapped. Apply listed primer, as recommended by manufacturer of the tape being applied, over the unprotected and adjacent 1 inch of the protected area. Tape approved for field hand wrapping shall be spirally wrapped with half overlaps stretched around the unprotected area to provide a minimum 40 mil thickness (double wrap). A maximum of 2 inch wide tape shall be used on all change of direction fittings.

3.4 EARTHQUAKE ACTUATED VALVES

The earthquake actuated shut off valve shall be install level and supported AS SHOWN ON THE DRAWINGS. Install per manufactures requirements.

3.5 MARKING TAPE

Marking tape shall be installed with the standard imprint "Buried Gas Line Below" facing up in the trench. Cover over the marking tape shall be approximately 12 inches.

3.6 TESTING

A. All underground piping shall be tested. Testing shall be performed after the trench has been backfilled and compacted. Piping shall be pressure tested with air at 100 psi for a period of sixty minutes. Testing shall begin after the outdoor air temperature has stabilized for a minimum period of thirty minutes. Test shall include all piping from point of tank regulator to service stop connections but shall not include the regulator or service stop. No leakage will be permitted

B. All building piping shall be tested. Testing shall be performed after all piping has been installed in the building. Piping shall be pressure tested with air at 50 psi for a period of sixty minutes. Testing shall begin after the air temperature has stabilized for a minimum period of thirty minutes. Test shall include all piping from point of service stop connections but shall not include the regulator or service stop to all appliance shut off valve. The appliance shut off shall be closed. No leakage will be permitted

C. The testing of all piping, fittings, valves, and regulators not included above shall be tested with a soap-water solution at working pressure and shall be leak free.

END OF SECTION

SECTION 22 13 13

GRAVITY SEWER LINES

PART 1 GENERAL

1.1 SCOPE: This work consists of the installation of a gravity sewer system from the buildings sewer connection point inside the pipe chase or surveyed stake and to a new septic tank.

1.2 CODES AND STANDARDS: In addition to the Codes and Standards listed in these specificatons and the Prospectus and in Section 01 06 00, Regulatory Requirements, work performed under this section shall meet the requirements of the following:

A. International Association of Plumbing and Mechanical Officials (IAPMO) Uniform Plumbing Code, latest edition and its Installation Standards (UPC-IS)

1.3 SUBMITTALS: Submittals shall conform to Section 01 30 00. When substitution for any item, fixture or equipment is made, manufacturers shop drawings/cut sheets shall be provided. Facsimile copies of these sheets shall not be acceptable. Xeroxed copies will be accepted unless manufactures sheets are printed in color, if this is the case, original sheets shall be submitted. Submittals shall include but not limited to pipe, fitting and boxes.

PART 2 PRODUCTS

2.1 SEWER LINES: Gravity sewer lines shall be of the size DESIGNED OR SHOWN ON THE DRAWINGS. Below Grade-Standard weight, Acrylonitrile,butadiene styrene (ABS) pipe and fittings. Pipe connections shall be bell and spigot solvent weldtype.

A. Fittings: All fittings and accessories shall be from the same manufacturer of the pipe and have bell and/or spigot solvent weld configurations compatible with that of the pipe.

2.2 CLEANOUTS: Cleanouts shall be installed at the locations SHOWN ONTHE DRAWINGS. Cleanouts shall be of the same size and material as the sewer line it serves. Cleanout boxes shall be pre-cast concrete boxes with cover marked "SEWER" or "CO" Brooks No. 1RT, or Christy No. G8, or approved equal.

2.3 MARKING TAPE: Marking tape shall be 6 inches wide with imprint "Caution - Buried Sewer Line Below"; where more than one utility is located in a common trench, marking tape shall be 6 inches wide with imprint "Caution - Utility Lines Buried Below", color shall be red. Warning tape shall be as manufactured by Calpico Inc., 185 Harbor Way, South San Francisco, California, 94580, or approved equal.

PART 3 EXECUTION

3.1 PIPING: Before lowering pipe into the trench, the pipe shall be inspected. Cracked, chipped, broken, or otherwise defective pipe will be rejected and removed from the job site. The ends and interior of the pipe shall be clean. No pipe shall be laid until the trench and foundation have been inspected and approved. All piping, fittings, and accessories shall be assembled per manufacturers recommendations. Pipe deflections shall be kept to a minimum any deflection of piping shall be per manufactures requirements. All pipes shall be graded and sloped as indicated on the drawings.

3.2 BEDDING AND BACKFILL MATERIAL: Lines shall be bedded in material as specified in Sec. 31 23 00, and/or AS DESIGNED OR SHOWN ON THE DRAWINGS. It shall be the responsibility of the contractor to shape the bedding material to conform to the slope required and the pipe is not knocked out of alignment when final backfill in installed. Prior to laying lines, the trench and bedding shall be approved in writing by the Contracting Officer.

3.3 LAYING LINES: Laying of lines shall begin at the lowest point with spigot ends pointing in the direction of flow. Pipe joints shall be made in conformance with the manufacturer's recommendations. Lines shall terminate five feet (5') outside building footprint with a cleanout and box.

3.4 MARKING TAPE: Marking tape, appropriately color coded and marked, shall be placed above the lines 6 to 12 inches below finish ground grade and DESIGNED and/or AS SHOWN ON THE DRAWINGS.

3.5 TESTING: Sewer lines and main shall be tested for leaks between the point of connection to the building cleanouts and the sewer manhole. The main shall be tested between the manhole and point of connection to city main. Plugging the line and introducing air into the system until the pressure reaches 5 psi shall do testing. The pressure shall be maintained for a minimum of 15 minutes. Other drain lines shall be plugged at both ends and at any cleanouts, or manholes and tested in the same manner.

3.6 WATERLINE CROSSING: Where waterlines are crossed, full-length pipelines shall be used with the length centered so as to maximize the distance from the waterline to the nearest sewer or drain line joint. Where water and sewer lines share a common trench, the waterline shall be installed a minimum of 12 inches horizontally and vertically from the sewer line on undisturbed soil.

3.7 CLEANING LINES: All sections of pipe shall be cleaned with an inflatable rubber ball of a size that will inflate to fit snugly into the pipe. The ball may be used without a tag line. The ball shall be placed in the last cleanout, manhole, or entry on the pipe to be cleaned, and water shall be introduced behind it. The ball shall pass through the pipe with only the force of the water impelling it. All debris flushed out ahead of the ball shall be removed at the first location or manhole where its presence is noted. In the event that

wedged debris, or a damaged pipe, shall stop the ball, the contractor shall remove the obstruction, or make suitable repairs.

END OF SECTION

SECTION 26 00 00

ELECTRICAL BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Work included in 26 00 00, Electrical Basic Requirements applies to Division 26, Electrical work to provide materials, labor, tools, permits, incidentals, and other services to provide and make ready for Owner's use of electrical systems for proposed project.

B. Contract Documents include, but are not limited to, Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Drawings, Addenda, Owner/Architect Agreement, and Owner/Contractor Agreement. Confirm requirements before commencement of work.

C. Definitions:
1. Provide: To furnish and install, complete and ready for intended use.
2. Furnish: Supply and deliver to project site, ready for unpacking, assembly and installation.
3. Install: Includes unloading, unpacking, assembling, erecting, installation, applying, finishing, protecting, cleaning and similar operations at project site as required to complete items of work furnished.
4. Approved or Approved Equivalent: To possess the same performance qualities and characteristics and fulfill the utilitarian function without any decrease in quality, durability or longevity. For equipment/products defined by the Contractor as "equivalent", substitution requests must be submitted to Engineer for consideration, in accordance with Division 01, General Requirements, and approved by the Engineer prior to submitting bids for substituted items.
5. Authority Having Jurisdiction (AHJ): Indicates reviewing authorities, including local fire marshal, Owner's insurance underwriter, Owner's representative, and other reviewing entity whose approval is requiredto obtain systems acceptance.

1.2 RELATED SECTIONS:

A. Contents of Section applies to Division 26, Electrical Contract Documents.

B. Related Work:
1. Additional conditions apply to this Division including, but not limited to:
a. Specifications including Division 00, Procurement and Contracting

Requirements and Division 01, General Requirements.

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

1.3 REFERENCES AND STANDARDS

A. References and Standards per Division 01, General Requirements, individual Division 26, Electrical Sections and those listed in this Section.

B. Codes to include latest adopted editions, including current amendments, supplements and local jurisdiction requirements in effect as of the date of the Contract Documents, of/from:
1. State of California:
a. CBC California Building Code
b. NEC National Electrical Code
c. CFC California Fire Code
d. CMC California Mechanical Code
e. CPC California Plumbing Code
f. CSFM California State Fire Marshal

C. General: Reference standards and guidelines include but are not limited to the latest adopted editions from:

1.	ABA	Architectural Barriers Act
2.	ADA	Americans with Disabilities Act
3.	ANSI	American National Standards Institute
4.	APWA	American Public Works Association
5.	ASCE	American Society of Civil Engineers
6.	ASHRAE	Guideline 0, the Commissioning Process
7.	ASTM	ASTM International
8.	CFR	Code of Federal Regulations
9.	EEMAC	Electrical Equipment Manufacturers Association of Canada
10.	EPA	Environmental Protection Agency
11.	ETL	Electrical Testing Laboratories
12.	FCC	Federal Communications Commission
13.	FM	FM Global
14.	IBC	International Building Code
15.	IEC	International Electrotechnical Commission
16.	IEEE	Institute of Electrical and Electronics Engineers
17.	IES	Illuminating Engineering Society
18.	ISO	International Organization for Standardization
19.	MSS	Manufacturers Standardization Society
20.	NEC	National Electric Code
21.	NECA	National Electrical Contractors Association

22. NEMA National Electrical Manufacturers Association
23. NETA National Electrical Testing Association
24. NFPA National Fire Protection Association
25. OSHA Occupational Safety and Health Administration
26. UL Underwriters Laboratories Inc.

D. See Division 26, Electrical individual Sections for additional references.

E. Where code requirements are at variance with Contract Documents, meet code requirements as a minimum requirement and include costs necessary to meet these in Contract. Machinery and equipment are to comply with OSHA requirements, as currently revised and interpreted for equipment manufacturer requirements. Install equipment provided per manufacturer recommendations.

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

1.4 SUBMITTALS

A. See Division 01, General Requirements for Submittal Procedures as well as individual Division 26, Electrical Sections.

B. Provide drawings in format and software release equal to the design documents. Drawings to be the same sheet size and scale as the Contract Documents.

C. In addition:
1. "No Exceptions Taken" constitutes that review is for general conformance with the design concept expressed in the Contract Documents for the limited purpose of checking for conformance with information given. Any action is subject to the requirements of the Contract Documents. Contractor is responsible for the dimensions and quantity and will confirm and correlate at the job site, fabrication processes and techniques of construction, coordination of the work with that of all other trades, and the satisfactory performance of the work.
2. Provide product submittals and shop drawings in electronic format only. Electronic format must be submitted via zip file via e-mail or posted to ftp site. For electronic format, provide one zip file per specification division containing a separate file for each specification Section. Individual submittals sent piecemeal in a per Specification Section method will be returned without review or comment. All transmissions/submissions to be submitted to Architect.
3. Product Data: Provide manufacturer's descriptive literature for products specified in Division 26, Electrical Sections.
4. Identify/mark each submittal in detail. Note what differences, if any, exist between the submitted item and the specified item. Failure to identifythe

differences will be considered cause for disapproval. If differences are not identified and/or not discovered during the submittal review process, Contractor remains responsible for providing equipment and materials that meet the specifications and drawings.

a. Label submittal to match numbering/references as shown in Contract Documents. Highlight and label applicable information to individual equipment or cross out/remove extraneous data not applicable to submitted model. Clearly note options and accessories to be provided, including field installed items. Highlight connections by/to other trades.
b. Include technical data, installation instructions and dimensioned drawings for products, fixtures, equipment and devices installed, furnished or provided. Reference individual Division 26, Electrical specification Sections for specific items required in product data submittal outside of these requirements.
c. See Division 26, Electrical individual Sections for additional submittal requirements outside of these requirements.

5. Maximum of two reviews of complete submittal package. Arrange for additional reviews and/or early review of long-lead items; Bear costs of these additional reviews at Engineer's hourly rates. Incompletesubmittal packages/submittals will be returned to contractor without review.
6. Structural/Seismic: Provide weights, dimensions, mounting requirements and like information required for mounting, seismic bracing, and support. Indicate manufacturer's installation and support requirements to meet ASCE 7-10 requirements for non-structural components Provide engineered seismic drawings and equipment seismic certification. Equipment Importance Factor as specified in Part 3 of this Section.
7. Trade Coordination: Include physical characteristics, electrical characteristics, device layout plans, wiring diagrams, and connections as required per Division 26, Electrical Coordination Documents. For equipment with electrical connections, furnish copy of approved submittal for inclusion in Division 26, Electrical submittals.
8. Make provisions for openings in building for admittance of equipment prior to start of construction or ordering of equipment.
9. Substitutions and Variation from Basis of Design:
   a. The Basis of Design designated product establishes the qualities and characteristics for the evaluation of any comparable products by other listed acceptable manufacturers if included in this Specification or included in an approved Substitution Request as judged by the Design Professional.
   b. If substitutions and/or equivalent equipment/products are being proposed, it is the responsibility of parties concerned, involved in, and furnishing the substitute and/or equivalent equipment to verify and compare the characteristics and requirements of that furnished to that specified and/or shown. If greater capacity and/or more

materials and/or more labor is required for the rough-in, circuitry or connections than for the item specified and provided for, then provide compensation for additional charges required for the proper rough-in, circuitry and connections for the equipmentbeing furnished. No additional charges above the Base Bid, including resulting charges for work performed under other Divisions, will be allowed for such revisions. Coordinate with the requirements of "Submittals". For any product marked "or approved equivalent", a substitution request must be submitted to Engineer for approval prior to purchase, delivery or installation.

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

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

3) Include Warranty per Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.
4) Include product certificates of warranties and guarantees.
5) Include copy of complete parts list for equipment. Include available exploded views of assemblies and sub assemblies.
6) Include commissioning reports.
7) Include copy of startup and test reports specific to each piece of equipment.
8) Engineer will return incomplete documentation without review. Engineer will provide one set of review comments in Submittal Review format. Contractor must arrange for additional reviews; Contractor to bear costs for additional reviews at Engineer's hourly rates.

b. Thoroughly instruct Owner in proper operation of equipment and systems. Where noted in individual Sections, training will include classroom instruction with applicable training aids and systems demonstrations. Field instruction per Section 26 00 00, Electrical Basic Requirements, Demonstration.
c. Copies of certificates of code authority inspections, acceptance, code required acceptance tests, letter of conformance and other special guarantees, certificates of warranties, specified elsewhere or indicated on Drawings.

14. Record Drawings:
a. Maintain at site at least one set of drawings for recording “As-constructed” conditions. Indicate on drawings changes to original documents by referencing revision document, and include buried elements, location of conduit, and location of concealed electrical items. Include items changed by field orders, supplemental instructions, and constructed conditions.
b. Record Drawings are to include equipment and fixture/connection schedules that accurately reflect "as constructed or installed" for project.
c. At completion of project, input changes to original project on CAD Drawings and make one set of black-line drawings created from CAD Files in version/release equal to contract drawings. Submit CAD disk and drawings upon substantial completion.
d. See Division 26, Electrical individual Sections for additional items to include in record drawings.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Work and materials installed to conform with all local, State and Federal codes, and other applicable laws and regulations.

B. Drawings are intended to be diagrammatic and reflect the Basis of Design manufacturer's equipment. They are not intended to show every item in its exact dimensions, or details of equipment or proposed systems layout. Verify actual dimensions of systems (i.e. distribution equipment, duct banks, light fixtures, etc.) and equipment proposed to assure that systems and equipment will fit in available space. Contractor is responsible for design and construction costs incurred for equipment other than Basis of Design, including, but not limited to, architectural, structural, electrical, HVAC, fire sprinkler, and plumbing systems.

C. Manufacturer's Instructions: Follow manufacturer's written instructions. If in conflict with Contract Documents, obtain clarification. Notify Engineer/Architect, in writing, before starting work.

D. Items shown on Drawings are not necessarily included in Specifications orvice versa. Confirm requirements in all Contract Documents.

E. UL Compliance: Provide products which are UL listed.

1.6 WARRANTY

A. Provide written warranty covering the work for a period of one year from date of Substantial Completion in accordance with Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.

B. Sections under this Division can require additional and/or extended warranties that apply beyond basic warranty under Division 01, General Requirements and the General Conditions. Confirm requirements in all Contract Documents.

1.7 COORDINATION DOCUMENTS

A. Prior to construction, coordinate installation and location of HVAC equipment, ductwork, grilles, diffusers, piping, plumbing equipment/fixtures, fire sprinklers, plumbing, lights, cable tray and electrical services with architectural and structural requirements, and other trades (including ceiling suspension and tile systems), and provide maintenance access requirements. Coordinate with submitted architectural systems (i.e. roofing, ceiling, finishes) and structural systems as submitted, including footings and foundation. Identify zone of influence from footings and ensure systems are not routed within the zone of influence.

B. Advise Architect in event a conflict occurs in location or connection of equipment. Bear costs resulting from failure to properly coordinate installation or failure to advise Architect of conflict.

C. Verify in field exact size, location, and clearances regarding existingmaterial, equipment and apparatus, and advise Architect of discrepancies between that indicated on Drawings and that existing in field prior to installation related thereto.

D. Submit final Coordination Drawings with changes as Record Drawings at completion of project.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Provide like items from one manufacturer.

2.2 MATERIALS

A. Base contract upon furnishing materials as specified. Materials, equipment, and fixtures used for construction are to be new, latest products as listed in manufacturer's printed catalog data and are to be UL approved or have adequate approval or be acceptable by state, county, and city authorities. Equipment/fixture supplier is responsible for obtaining State, County, and City acceptance on equipment/fixtures that are not UL approved or are not listed for installation.

B. Articles, fixtures, and equipment of a kind to be standard product of one manufacturer.

C. Names and manufacturer's names denote character and quality ofequipment desired and are not to be construed as limiting competition.

D. Hazardous Materials:
   1. Comply with local, State of California, and Federal regulations relatingto hazardous materials.
   2. Comply with Division 01, General Requirements for this project relating to hazardous materials.
   3. Do not use any materials containing a hazardous substance. If hazardous materials are encountered, do not disturb; immediately notify Owner and Architect. Hazardous materials will be removed by Owner under separate contract.

PART 3 - EXECUTION

3.1 ACCESSIBILITY AND INSTALLATION

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

B. Install equipment requiring access (i.e., junction boxes, light fixtures, power supplies, motors, etc.) so that they may be serviced, reset, replaced or recalibrated by service people with normal service tools and equipment. Do not install equipment in passageways, doorways, scuttles or crawlspaces which would impede or block the intended usage.

C. Install equipment and products complete as directed by manufacturer'sinstallation instructions. Obtain installation instructions from manufacturer prior to rough-in of equipment and examine instructions thoroughly. When requirements of installation instructions conflict with Contract Documents, request clarification from Architect prior to proceeding with installation. This includes proper installation methods, sequencing, and coordination with other trades and disciplines.

D. Earthwork:
   1. Confirm Earthwork requirements in Contract Documents. In the absence of specific requirements, comply with individual Division 26, Electrical Sections and the following:
      a. Perform excavation, dewatering, shoring, bedding, and backfill required for installation of work in this Division in accordance with related earthwork Sections. Contact utilities and locate existing utilities prior to excavation. Repair any work damaged during excavation or backfilling.
      b. Excavation: Do not excavate under footings, foundation bases, or retaining walls.
      c. Provide protection of underground systems. Review the project Geotechnical Report for references to corrosive or deleterious soils which will reduce the performance or service life of underground systems materials.

E. Start-up equipment, in accordance with manufacturer's start-up instructions, and in presence of manufacturer's representative. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.

F. Provide miscellaneous supports/metals required for installation of equipment and conduit.

3.2 SEISMIC CONTROL

A. Confirm Seismic Control requirements in Section 26 00 00, Electrical Basic Requirements and individual Division 26 Electrical Sections.

B. Equipment Importance Factor: 1.0.

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

D. Equipment:
   1. Provide means to prohibit excessive motion of electrical equipment during earthquake.

3.3 REVIEW AND OBSERVATION

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

B. Notify Architect, in writing, at following stages of construction so that they may, at their option, visit site for review and construction observation:
   1. Underground conduit installation prior to backfilling.
   2. Prior to covering walls.
   3. Prior to ceiling cover/installation.
   4. When main systems, or portions of, are being tested and ready for inspection by AHJ.

C. Final Punch:
   1. Costs incurred by additional trips required due to incomplete systems will be the responsibility of the Contractor.

3.4 CONTINUITY OF SERVICE

A. Confirm requirements in Division 01, General Requirements. In the absence of specific requirements in Division 01, General Requirements, comply with individual Division 26, Electrical Sections and the following:
   1. During remodeling or addition to existing structure, while existing structure is occupied, present services to remain intact until new construction, facilities or equipment is installed.
   2. Prior to changing over to new service, verify that every item is thoroughly prepared. Install new wiring, and wiring to point of connection.
   3. Coordinate transfer time to new service with Owner. If required, perform transfer during off-peak hours. Once changeover is started, pursue to its completion to keep interference to a minimum.
      a. If overtime is necessary, there will be no allowance made by Owner for extra expense for such overtime or shift work.
   4. No interruption of services to any part of existing facilities will be permitted without express permission in each instance from Owner. Requests for outages must state specific dates, hours and maximum durations, with outages kept to these specific dates, hours and maximum durations. Obtain written permission from Owner for any interruption of power, lighting or signal circuits and systems.
      a. Organize work to minimize duration of power interruption.

b. Coordinate utility service outages with utility company.

3.5 CUTTING AND PATCHING

A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In the absence of specific requirements in Division 01, General Requirements, comply with individual Division 26, Electrical Sections and the following:

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

3.6 EQUIPMENT SELECTION AND SERVICEABILITY

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

3.7 DELIVERY, STORAGE AND HANDLING

A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In the absence of specific requirements, comply with individual Division 26, Electrical Sections and the following:

1. Handle materials delivered to project site with care to avoid damage. Store materials on site inside building or protected from weather, dirt and

construction dust. Products and/or materials that become damaged due to water, dirt, and/or dust as a result of improper storage and handling to be replaced before installation.

2. Protect equipment to avoid damage. Close conduit openings with caps or plugs. Keep motors and bearings in watertight and dustproof covers during entire course of installation.
3. Protect bus duct and similar items until in service.

3.8 DEMONSTRATION

A. Confirm Demonstration requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 26 08 00, Commissioning of Electrical and individual Division 26, Electrical Sections.

B. Upon completion of work and adjustment of equipment, test systems and demonstrate to Owner's Representative, Architect, and Engineer that equipment furnished and installed or connected under provisions of these Specifications functions in manner required. Provide field instruction to Owner's Maintenance Staff as specified in Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.

C. Manufacturer's Field Services: Furnish services of a qualified person at time approved by Owner, to instruct maintenance personnel, correct defects or deficiencies, and demonstrate to satisfaction of Owner that entire system is operating in satisfactory manner and complies with requirements of other trades that may be required to complete work. Complete instruction and demonstration prior to final job site observations.

3.9 CLEANING

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

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

3.10 INSTALLATION

A. Confirm Installation requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.

B. Install equipment and fixtures in accordance with manufacturer's installation instructions, plumb and level and firmly anchored to vibration isolators. Maintain manufacturer's recommended clearances.

C. Start up equipment, in accordance with manufacturer's start-up instructions, and in presence of manufacturer's representative. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.

D. Provide miscellaneous supports/metals required for installation of equipment.

3.11 PAINTING

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

3.12 ACCEPTANCE

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

3.13 FIELD QUALITY CONTROL

A. Confirm Field Quality Control requirements in Division 01, General Requirements, Section 26 00 00, Electrical Basic Requirements and individual Division 26, Electrical Sections.

B. Tests:
   1. Conduct tests of equipment and systems to demonstrate compliance with requirements specified. Reference individual Specification Sections for required tests. Document tests and include in operation and maintenance manuals.
   2. During site evaluations by Architect or Engineer, provide appropriate personnel with tools to remove and replace trims, covers, and devices so that proper evaluation of installation can be performed.

3.14 LETTER OF CONFORMANCE

A. Provide Letter of Conformance, copies of manufacturers' warranties and extended warranties with a statement that Electrical items were installed in accordance with manufacturer's recommendations, UL listings and FM Global approvals. Include Letter of Conformance, copies of manufacturers' warranties and extended warranties in Operation and Maintenance Manuals.

END OF SECTION

SECTION 26 05 09

EQUIPMENT WIRING

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

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

1.2 RELATED SECTIONS

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

1.3 REFERENCES AND STANDARDS

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

1.4 SUBMITTALS

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

B. In addition:
1. Verify mechanical and utilization equipment electrical characteristics with Drawings and equipment submittals prior to ordering equipment. Submit confirmation of this verification as a part of, or addendum to, the electrical product submittals.

1.5 QUALITY ASSURANCE

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

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 26 0000, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

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

2.2 GENERAL

A. Unless otherwise noted, the following voltage and phase characteristics apply to motors:
   1. 3/4 HP and Under: 120 volt, 1 phase.
   2. 1 HP and Over: 208 volt, 3 phase.

B. Safety Switches: Provide as required by NEC and as specified in Section 26 28 16 - Enclosed Switches and Circuit Breakers.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to submittal of product data for electrical distribution equipment, obtain and examine product data and shop drawings for equipment furnished by the Owner and by other trades on the project. Update the schedule of equipment electrical connections accordingly, noting proper ratings for overcurrent devices, fuses, safety disconnect switches, conduit and wiring, and the like. As a minimum, this requirement applies to equipment furnished by Owner and equipment furnished under the following divisions of work under this contract:
   1. Division 22, Plumbing
   2. Division 27, Communications

3.2 INSTALLATION

A. Do not install unrelated electrical equipment or wiring on mechanical equipment without prior approval of Architect.

B. Provide moisture tight equipment wiring and switches in ducts or plenums used for environmental air.

C. Connect motor and appliance/utilization equipment complete from panel to motor/equipment as required by code.

D. Install motor starters and controllers for equipment furnished by others.

E. Appliance/Utilization Equipment:
   1. Provide appropriate cable and cord cap for final connection unless equipment is provided with same. Provide receptacle configured to receive cord cap.
   2. Verify special purpose outlet NEMA configuration and ampere rating with equipment supplier prior to ordering wiring devices and cover plates.

F. Door Hardware:
   1. Provide dedicated circuit from nearest 208/120V emergency panelboard for door hardware power supplies. Provide complete control connections for door hardware locking mechanisms to building security system.
   2. Provide control connection for door hardware locking mechanisms to building fire alarm system.
   3. Coordinate with Division 08, Openings and Drawing requirements.

G. ADA Automatic Doors:
   1. Provide control wiring in continuous raceway from door controller unit to manual wall control stations. Provide local switch disconnect for door controller as required by Code.
   2. Coordinate with Division 08, Openings and Drawing requirements.

H. Rolldown Doors:
   1. Provide control wiring between door controller, wall switch controller and limit switches for door.
   2. Coordinate with Division 08, Openings and Drawing requirements.

3.3 FIELD QUALITY CONTROL

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

3.4 SYSTEMS STARTUP

A. Provide field representative to prepare and start equipment.
   1. Test and correct for proper rotation of polyphase motors.

B. Adjust for proper operation within manufacturer's published tolerances.

C. Demonstrate proper operation of equipment to Owner's designated representative.

END OF SECTION

SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:
1. Wires and Cables
2. Connectors
3. Lugs and Pads

1.2 RELATED SECTIONS

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

1.3 REFERENCES AND STANDARDS

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

1.4 SUBMITTALS

A. Submittals not required for this Section.

1.5 QUALITY ASSURANCE

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

1.6 WARRANTY

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Wires and Cables:
1. Carol
2. General Cable
3. Okonite
4. Southwire
5. Or approved equivalent.

B. Connectors:
   1. Stranded conductors by Anderson.
   2. Burndy
   3. Ilsco
   4. 3M
   5. Thomas & Betts
   6. Or approved equivalent.

C. Splices:
   1. Branch Circuit Splices:
      a. Ideal
      b. Scotch-Lock
      c. 3M
      d. Or approved equivalent.
   2. Feeder Splices:
      a. Not allowed.

D. Metal Clad Cable - Type MC:
   1. Alflex
   2. AFC
   3. Carol
   4. Southwire
   5. Or approved equivalent.

E. Connectors:
   1. Construction:
      a. T & B Series 60200
      b. Or approved equivalent.
   2. Oxide-Inhibiting Joint Compounds:
      a. PENETROX A-13
      b. Or approved equivalent.

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

2.2 WIRES AND CABLES

A. Copper, 600 volt rated throughout. Conductors 12 AWG and 10 AWG, solid. Conductors 8 AWG and larger, stranded. 12 AWG minimum conductor size.

Minimum insulation rating of 90 degrees C. Insulation Type: THWN-2, XHHW-2 or THHN-2.

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

C. Color Code Conductors as Follows:

PHASE	**208 VOLT WYE**
A	Black
B	Red
C	Blue
Neutral	White
Ground	Green

D. MC Cable: High strength galvanized steel flexible armor. Full length minimum size No. 12 copper ground wire, THHN 90C conductors, full length tapemarker phase/circuit identification on cable armor. Short circuit throat insulators, mechanical compression termination.

E. AC Cable (Armored Cable): Not allowed.

F. Service Entrance Cable: Copper conductor, 600 volt insulation, XHHW, Type SE.

2.3 CONNECTORS

A. Copper Pads: Drilled and tapped for multiple conductor terminals.

B. Lugs: Compression type for use with stranded branch circuit or control conductors; mechanical lugs for use with solid branch and feeder circuit conductors.

C. Split bolt connectors not allowed.

D. Conductor Branch Circuits: Wire nuts with integral spring connectors for conductors 12 AWG through 8 AWG. Push-in type connectors where conductors are not required to be twisted together are not acceptable.

2.4 LUGS AND PADS

A. Ampacity: Cross-Sectional area of pad for multiple conductor terminations to match ampere rating of panelboard bus or equipment line terminals.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Wires and Cables:

1. Conductor Installation:
   a. Install conductors in raceways having adequate, code size cross-Sectional area for wires indicated.
   b. Install conductors with care to avoid damage to insulation.
   c. Do not apply greater tension on conductors than recommended by manufacturer during installation.
   d. Use of pulling compounds is permitted. Clean residue from exposed conductors and raceway entrances after conductor installation. Do not use pulling compounds for installation of conductors connected to GFCI circuit breakers or GFCI receptacles.
2. Conductor Size and Quantity:
   a. Install no conductors smaller than 12 AWG unless otherwise shown.
   b. Provide required conductors for a fully operable system.
3. Provide dedicated neutrals (one neutral conductor for each phase conductor) in all 120V circuits.
   a. Multi-conductor branch circuits fed from single-pole overcurrent protective devices.
   b. Dimmer controlled circuits.
   c. Ground fault protected circuits where a GFCI breaker is used in a panelboard.
   d. Other electronic equipment which produces a high level of harmonic distortion including, but not limited to, computers, printers, plotters, copy machines, and fax machines.
4. Conductors in Cabinets:
   a. Cable and tree wires in panels and cabinets for power and control. Use plastic ties in panels and cabinets.
   b. Tie and bundle feeder conductors in wireways of panelboards.
   c. Hold conductors away from sharp metal edges.
5. Homeruns:
   a. Do not change intent of branch circuit homeruns without approval. Homeruns for 20A branch circuits may be combined to a maximum of six current carrying conductors including neutral conductors in homeruns. Apply derating factors as required per NEC. Increase conductor size as needed.
6. Identify wire and cable under the provisions of Section 26 05 53, Identification for Electrical Systems. Identify each conductor with its panel and circuit number as indicated.

7. Use of MC Cable is limited to the following conditions. Installations that do not comply with the following conditions are to be removed and replaced with no additional expense to the Owner.
   a. 20 and 30 amp branch wiring where following conditions apply:
      1) Where there is a suspended ceiling with accessible space above (example: suspended acoustic ceiling tile).
      2) For drops to ceiling mounted luminaires in areas with accessible ceiling space.
      3) Do not use for homeruns from branch circuit panel to first device or luminaire in circuit.
      4) Do not use in walls in areas where MC cable cannot be fished into the walls after construction is completed. For example: walls with glazing or solid beams overhead, partial height walls, etc.
      5) No single run of MC cable longer than 50-feet.
8. Exposed cable is not allowed.

3.2 FIELD QUALITY CONTROL

A. Test conductor insulation on feeders of 100 amp and greater for conformity with 1000 volt megohmmeter. Use Insulated Cable Engineers Association testing procedures. Minimum insulation resistance acceptable is 1 megohm for systems 600 volts and below. Notify Architect if insulation resistance is less than 1 megohm.

B. Test Report: Prepare a typed tabular report indicating the testing instrument, the feeder tested, amperage rating of the feeder, insulation type, voltage, the approximate length of the feeder, conduit type, and the measured resistance ofthe megohmmeter test. Submit test reports with project closeout documents.

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

D. Perform inspections and tests listed in NETA Standard ATS, Section 7.3.2.

END OF SECTION

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:
1. Grounding Electrodes
2. Connectors and Accessories
3. Grounding Busbar
4. Grounding Conductor
5. Grounding Test Well

1.2 RELATED SECTIONS

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

1.3 REFERENCES AND STANDARDS

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

1.4 SUBMITTALS

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

B. In addition, provide:
1. Test reports of ground resistance for service and separately derived system grounds.

1.5 QUALITY ASSURANCE

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

B. In addition, meet the following:
1. Comply with the requirements of ANSI/NFPA 70.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 26 0000, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Grounding Electrodes:
1. Erico
2. Thomas & Betts
3. Talley
4. Or approved equivalent.

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

C. Grounding Busbar:
1. Chatsworth
2. Erico
3. Square D
4. Panduit
5. Or approved equivalent.

D. Grounding Conductor
1. Carol
2. General Cable
3. Okonite
4. Southwire
5. Or approved equivalent

E. Grounding Test Well
1. Erico
2. Harger
3. Thompson
4. Or approved equivalent

2.2 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel, minimum 3/4-inch diameter, 10-feet long, tapered point, chamfered top.

2.3 CONNECTORS AND ACCESSORIES

A. Grounding Connectors: Hydraulic compression tool applied connectors or exothermic welding process connectors or powder actuated compression tool applied connectors.

B. Pipe Grounding Clamp: Mechanical ground connector with cable parallel or perpendicular to pipe.

2.4 GROUNDING BUSBAR

A. Grounding Busbar: 1/4-inch thick by 4-inch high by 10-inch long copper grounding busbar with insulators that meet ANSI J-STD-607-A specifications. UL 467 listed. Hole patterns in busbar to accommodate two-hole lugs, four-hole configuration.

2.5 GROUNDING CONDUCTOR

A. Grounding Electrode Conductor: Soft-draw bare stranded copper for wire sizes larger than #10 AWG Bare. Solid copper for wire sizes #10 AWG and smaller.

B. Equipment Grounding Conductor: Green insulated, insulation type to match that of associated feeder or branch circuit wiring, size as indicated on drawings.

2.6 GROUNDING TEST WELL

A. Grounding Well:
   1. Well Pipe: 8-inch diameter by 12-inch long concrete pipe with belled end.
   2. Well Cover: Cast iron with legend "GROUND" embossed on cover. Provide lip on bottom of cover, sized to match interior pipe diameter to hold cover in place.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Verify site conditions prior to beginning work.

B. Bond Sections of service equipment enclosure to service ground bus.

C. Separately Derived Systems: Ground each separately derived system per NEC Article 250.

D. Corrosion inhibitors: Apply a corrosion inhibitor to contact surfaces when making grounding and bonding connections. Use corrosion inhibitor appropriate for protecting a connection between metals used.

E. Grounding system resistance to ground not to exceed 25 ohms. Make necessary modifications or additions to grounding electrode system for compliance. Submit final tests to assure that this requirement is met.

F. Resistance of grounding electrode system: measure using afour-terminal fall-of-potential method as defined in IEEE 81. Take ground resistance measurements before electrical distribution system is energized and in normally dry conditions, not less than 48 hours after last rainfall. Take resistance measurements of separate grounding electrode systems before systems are bonded together below grade. Combined resistance of separate systems may be used to meet required resistance, but specified number of electrodes must still be provided.

G. Inspect and test in accordance with NETA Standard ATS, Except Section 4.

H. Perform inspections and tests listed in NETA Standard AB, Section 7.13.

3.2 GROUNDING ELECTRODES INSTALLATION

A. Concrete-Encased Electrode ("Ufer ground"):
   1. From service equipment ground bus provide grounding electrode conductor to footing/foundation rebar.
   2. Bond #4 grounding electrode conductor to one minimum 20-foot long, 0.5-inch diameter independent steel rebar(s).
   3. Protect grounding electrode conductor from footing/foundation to service equipment grounding bus with rigid PVC conduit where grounding electrode conductor passes through concrete floor or other concrete structure. Do not use rigid metal conduit for grounding electrode conductor protection.
   4. Coordinate bonding of rebar in base of building concrete footing with installer prior to placement of concrete.

B. Ground Rod Electrode:
   1. Verify that final backfill and compaction have been completed before driving rod electrodes.
   2. Bond #6 grounding electrode conductor to driven ground rods as indicated on Drawings.
   3. Tap at center ground rod and extend grounding electrode conductor to service grounding bus. Install grounding electrode conductor to service grounding bus in rigid PVC conduit for physical protection where grounding electrode conductor passes through concrete floor or other concrete structure.

C. Metal Underground Water Service: Bond water service pipe to service equipment ground bus or to the grounding electrode system. Connect to water pipe on utility side of isolating fittings or meters, bond across water meters.

D. Other Metal Piping Systems: Bond gas piping system, fire sprinkler piping system and other metal piping systems to service equipment ground bus or tothe grounding electrode system.

E. Bond together metal siding not attached to grounded structure; bond to grounding electrode system.

3.3 CONNECTORS AND ACCESSORIES INSTALLATION

A. Install per manufacturer's instructions.

3.4 GROUNDING BUSBAR INSTALLATION

A. Install per manufacturer's instructions.

3.5 GROUNDING CONDUCTOR INSTALLATION

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

B. Feeders and Branch Circuits:
   1. Provide continuous green insulated copper equipment grounding conductors for feeders and branch circuits.
   2. Where installed in a continuous solid metallic raceway system and larger sizes are not detailed, provide insulated equipment grounding conductors for feeders and branch circuits sized in accordance with the latest adopted edition of NEC Article 250, Table 250-122.

C. Bond boxes, cabinets, enclosures and panelboard equipment grounding conductors to enclosure with specified conductors and lugs. Install lugs only on thoroughly cleaned contact surfaces.

D. Motors, Equipment and Appliances: Install code size equipment grounding conductor to (motor) equipment frame or manufacturer's designated ground terminal.

E. Receptacles: Connect ground terminal of receptacle and associated outlet box to equipment grounding conductor. Self grounding nature of receptacle devices does not eliminate equipment grounding conductor bolted to outlet box.

3.6 GROUNDING TEST WELL INSTALLATION

A. Provide grounding test well with cover at each rod location. Install test wellpipe top flush with finished grade.

B. Install per manufacturer's instructions

END OF SECTION

SECTION 26 05 29

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:
1. Anchors, Threaded Rod and Fasteners
2. Support Channel, Hangers and Supports
3. Rooftop Conduit Supports

1.2 RELATED SECTIONS

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

1.3 REFERENCES AND STANDARDS

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

1.4 SUBMITTALS

A. Submittals not required for this Section.

1.5 QUALITY ASSURANCE

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

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

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 26 0000, Electrical Basic Requirements and Division 01, General Requirements.

1.7 PERFORMANCE REQUIREMENTS

A. General: Provide conduit and equipment hangers and supports in accordance with the following:
   1. When supports, anchorages, and seismic restraints for equipment and supports, anchorages and seismic restraints for conduit, cable tray and equipment are not shown on the Drawings, the Contractor is responsible for their design.
   2. Connections to structural framing shall not introduce twisting, torsion, or lateral bending in the framing members. Provide supplementary steel as required.

B. Engineered Support Systems: The following support systems to be designed, detailed, and bear the seal of a professional engineer registered in the State of California.
   1. Support frames such as conduit racks or stanchions for conduit and equipment which provide support from below.
   2. Equipment and piping support frame anchorage to supporting slab or structure.

C. Provide channel support systems, for conduits to support multiple conduits capable of supporting combined weight of support systems and system contents.

D. Provide heavy-duty steel trapezes for piping to support multiple conduit capable of supporting combined weight of supported systems and system contents.

E. Provide seismic restraint hangers and supports for conduit and equipment.

F. Obtain approval from AHJ for seismic restraint hanger and support system to be installed for piping and equipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Anchors, Threaded Rod and Fasteners:
   1. Anchor It
   2. Epcon System
   3. Hilti-Hit System
   4. Power Fast System
   5. Or approved equivalent.

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

C. Rooftop Conduit Supports:
   1. Cooper B-Line Dura-Block Rooftop Support Base
   2. Or approved equivalent.

2.2 ANCHORS, THREADED ROD AND FASTENERS

A. Anchors, Threaded Rod and Fasteners - General: Corrosion-resistant materials of size and type adequate to carry the loads of equipment and conduit, including weight of wire in conduit.

B. Concrete Inserts: Cast in concrete for support fasteners for loads up to 800 lbs.

C. Anchors and Fasteners:
   1. Do not use powder-actuated anchors.
   2. Obtain permission from Architect before using powder-actuated anchors.
   3. Concrete Structural Elements: Use precast inserts.
   4. Steel Structural Elements: Use beam clamps.
   5. Concrete Surfaces: Use self-drilling anchors.
   6. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts.
   7. Solid Masonry Walls: Use expansion anchors.
   8. Sheet Metal: Use sheet metal screws.
   9. Wood Elements: Use wood screws.

D. Fasteners: Provide fasteners of types as required for assembly and installation of fabricated items; surface-applied fasteners are specified elsewhere.

E. Bolts: Low carbon steel externally and internally threaded fasteners conforming with requirements of ASTM A307; include necessary nuts and plain hardened washers. For structural steel elements supporting mechanical material or equipment from building structural members or connection thereto, use fasteners conforming to ASTM A325.

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

2.3 SUPPORT CHANNEL, HANGERS AND SUPPORTS

A. Hangers and Supports - General: Corrosion-resistant materials of size and type adequate to carry the loads of equipment and conduit, including weight of wirein conduit.
   1. Channel Material: Carbon steel.
   2. Coating: Hot dip galvanized.

B. Pipe Straps: Two-hole galvanized or malleable iron.

C. Luminaire Chain: 90 lb. test with steel hooks.

D. Miscellaneous Metal: Provide miscellaneous metal items specified hereunder, including materials, fabrication, fastenings and accessories required for finished installation, where indicated on Drawings or otherwise not shown on drawings that are necessary for completion of the project. The Contractor is responsiblefor their design.
   1. Fabricate miscellaneous units to size shapes and profiles indicated or, if not indicated, of required dimensions to receive adjacent other work to be retained by framing. Except as otherwise shown, fabricate from structural steel shapes and plates and steel bars, of welded construction using mitered joints for field connection. Cut, drill and tap units to receive hardware and similar items.

E. Structural Shapes: Where miscellaneous metal items are needed to befabricated from structural steel shapes and plates, provide members constructed of steel conforming with requirements of ASTM A36 or approved equivalent.

F. Steel Pipe: Provide seamless steel pipe conforming to requirements of ASTM A53, Type S, Grade A, or Grade B. Weight and size required as specified.

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

2.4 ROOFTOP CONDUIT SUPPORTS

A. Curb base made of 100 percent recycled rubber and polyurethane prepolymer with a uniform load

B. Capacity of 500 pounds per linear foot of support.

C. UV resistant.

D. Steel Frame: Steel, 14 gauge strut galvanized per ASTM A653 or 12 gaugestrut galvanized per ASTM A653 for bridge series.

E. Continuous block channel supports with 1-inch gaps to allow water flow, bridge channel supports, extendable height channel supports and elevated single conduit supports.

F. Attaching Hardware: Zinc-plated threaded rod, nuts and attaching hardware per ASTM B633 fastened directly into rubber material with weather resistant Type 12 lag screws.

G. Provide load distribution plates when required for heavy loads.

H. Finish: Black with safety yellow striping.

I. Provide hot dipped galvanized components for items exposed to weather.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Fabrication - Miscellaneous Metals

1. General: Verify dimensions prior to fabrication. Form metal items to accurate sizes and configurations as indicated on Drawings and otherwise required for proper installation; make with lines straight and angles sharp, clean and true; drill, countersink, tap, and otherwise prepare items for connections with work of other trades, as required. Fabricate to detail of structural shapes, plates and bars; weld joints where practicable; provide bolts and other connection devices required. Include anchorages; clip angles, sleeves, anchor plates, and similar devices. Hot dipped galvanize after fabrication items installed in exterior locations. Set accurately in position as required and anchor securely to building construction. Construct items with joints formed for strength and rigidity, accurately machining for proper fit; where exposed to weather, form to exclude water.
2. Finishes:
   a. Ferrous Metal: After fabrication, but before erection, clean surfaces by mechanical or chemical methods to remove rust, scale, oil, corrosion, or other substances detrimental to bonding of subsequently applied protective coatings. For metal items exposed to weather or moisture, galvanize in manner to obtain G90 zinc coating in accordance with ASTM A123. Provide other non-galvanized ferrous metal with one coat of approved rust-resisting paint primer, in manner to obtain not less than 1.0 mil dry film thickness. Touch-up damaged areas in primer with same material, before installation. Apply zinc coatings and paint primers uniformly and smoothly; leave ready for finish painting as specified elsewhere.

b. Metal in contact with Concrete, Masonry and Other Dissimilar Materials: Where metal items are to be erected in contact with dissimilar materials, provide contact surfaces with coating of an approved zinc-chromate primer in manner to obtain not less than 1.0 mil dry film thickness, in addition to other coatings specified in these specifications.

c. For Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and apply galvanizing repair paint to comply with ASTM A780.

3.2 ANCHORS, THREADED ROD AND FASTENERS INSTALLATION

A. Safety factor of 4 required for every fastening device or support for electrical equipment installed. Supports to withstand four times the weight of equipment it supports.

B. Do not use other trade's fastening devices as supporting means for electrical luminaires, equipment or materials.

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

D. Do not use supports or fastening devices to support other than one particular item.

E. Securely suspend junction boxes, pull boxes or other conduit terminating housings located above suspended ceiling from floor above or roof structure to prevent sagging and swaying.

F. Provide seismic bracing per IBC requirements.

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

H. Use spring lock washers under fastener nuts for strut.

I. Cutting and Drilling
   1. Do not drill or cut structural members without prior permission from Architect.

3.3 SUPPORT CHANNEL, HANGERS AND SUPPORTS INSTALLATION

A. Install hangers and supports as required to adequately and securely support electrical system components, in a neat and workmanlike manner, as specified in NECA 1.

B. Safety factor of 4 required for every fastening device or support for electrical equipment installed. Supports to withstand four times the weight of equipment it supports.

C. Verify mounting height of luminaires prior to installation when heights arenot detailed.

D. Install vertical support members for equipment and luminaires, straight and parallel to building walls.

E. Install horizontal support members straight and parallel to ceilings or finished floor unless otherwise noted.

F. Provide independent supports to structural member for electrical luminaires, materials, or equipment installed in or on ceiling, walls or in void spaces or over suspended ceilings.

G. Do not use other trade's fastening devices as supporting means for electrical luminaires, equipment or materials.

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

I. Do not use supports or fastening devices to support other than one particular item.

J. Support conduits within 18-inches of outlets, boxes, panels, cabinets and deflections unless more stringently required by NEC.

K. Maximum distance between supports not to exceed 8 foot spacing unless otherwise required by NEC.

L. Support flexible conduits and metal clad cable within 12-inches of outlets, boxes, panels, cabinets and deflections unless otherwise required by NEC.

M. Maximum distance between supports for flexible conduits and metal clad cable not to exceed 48-inches spacing unless otherwise required by NEC.

N. Maximum distance between supports for rigid PVC conduits unless otherwise required by NEC is as follows:
   1. 1/2-inch or 3/4-inch and 1-inch conduit, 3-feet apart.
   2. 1-1/4-inch or 1-1/2-inch and 2-inch conduit, 4-feet apart.
   3. 2-1/2-inch and 3-inch conduit, 5-feet apart.

O. Securely suspend junction boxes, pull boxes or other conduit terminating housings located above suspended ceiling from floor above or roof structure to prevent sagging and swaying.

P. Provide seismic bracing per IBC requirements.

Q. Where service disconnects are mounted on building exterior, physicallyattach service disconnect to the building or structure served.

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

S. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.

T. Wet and Damp Locations:
   1. In wet and damp locations use steel channel supports to stand cabinets and panelboards 1-inch off wall.

3.4 ROOFTOP CONDUIT SUPPORTS INSTALLATION

A. Consult roofing manufacturer for roof membrane compression capacities. If necessary, provide a compatible sheet of roofing material (rubber pad)under rooftop support to disperse concentrated loads and add further membrane protection.

B. Do not use supports that will void roof warranty.

C. Install supports per manufacturers instructions and recommendations.

D. Use properly sized clamps to suit conduit sizes.

E. Install supports for rooftop raceways to raise raceways a minimum of 4-inches above the roof structure unless otherwise noted.

END OF SECTION

SECTION 26 05 33

RACEWAYS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Rigid Metal Conduit (RMC)
2. Electrical Metallic Tubing (EMT)
3. Flexible Metal Conduit (FMC)
4. Liquidtight Flexible Metal Conduit (LFMC)
5. Electrical Polyvinyl Chloride (PVC) Conduit
6. Conduit Fittings

B. Provide a complete system of conduit and fittings, with associated couplings, connectors, and fittings, as shown on drawings and described in these specifications.

1.2 RELATED SECTIONS

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

B. In addition, reference the following:
1. Section 26 05 29, Hangers and Supports for Electrical Systems and Equipment
2. Section 26 05 34, Boxes

1.3 REFERENCES AND STANDARDS

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

1.4 SUBMITTALS

A. Submittals not required for this Section.

1.5 QUALITY ASSURANCE

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

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 26 0000, Electrical Basic Requirements and Division 01, General Requirements.

1.7 DEFINITIONS

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Rigid Metal Conduit (RMC):
1. Allied Tube & Conduit
2. Beck Manufacturing Inc.
3. Picoma
4. Wheatland Tube Company
5. Or approved equivalent.

B. Electrical Metallic Tubing (EMT):
1. Allied Tube & Conduit
2. Beck Manufacturing WL
3. Picoma
4. Wheatland Tube Company
5. Or approved equivalent.

C. Flexible Metal Conduit (FMC):
1. AFC Cable Systems Inc.
2. Electri-Flex Company
3. International Metal Hose
4. Or approved equivalent.

D. Liquidtight Flexible Metal Conduit (LFMC):
1. AFC Cable Systems Inc.
2. Electri-Flex Company
3. International Metal Hose
4. Or approved equivalent.

E. Electrical Polyvinyl Chloride (PVC) Conduit:
1. AFC Cable Systems Inc.
2. Electri-Flex Company

3. International Metal Hose
4. JM Eagle
5. Or approved equivalent.

F. Conduit Fittings:
1. Bushings:
a. Insulated type for Threaded Rigid or EMT without Factory Installed Plastic Throat Conductor Protection:
1) Thomas & Betts 1222 Series
2) O-Z Gedney B Series
3) Or approved Equivalent.
2. Raceway Connectors and EMT Couplings:
a. Thomas & Betts Series
b. O-Z Gedney Series
c. Or approved Equivalent.

2.2 RIGID METAL CONDUIT (RMC)

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

2.3 ELECTRICAL METALLIC TUBING (EMT)

A. Description: UL 797, ANSI C80.3; steel galvanized tubing.

B. Fittings: NEMA FB 1; steel, compression type.

2.4 FLEXIBLE METAL CONDUIT (FMC)

A. Description: UL 1, Interlocked steel construction.

B. Fittings: NEMA FB 2.20.

2.5 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

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

B. Fittings: NEMA FB 2.20.

2.6 ELECTRICAL POLYVINYL CHLORIDE (PVC) CONDUIT

A. Description: UL 651, NEMA TC 2; Schedule 40 PVC.

B. Fittings: NEMA TC 3.

2.7 CONDUIT FITTINGS

A. Bushings:
1. Insulated type for threaded rigid conduit without factoryinstalled plastic throat conductor protection.
2. Insulated grounding type for threaded rigid conduit.

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

PART 3 - EXECUTION

3.1 SEQUENCING AND SCHEDULING

A. Finished Surfaces: Schedule raceway installation to avoid conflict withinstalled wall and ceiling surfaces. If unavoidable, coordinate work and repairs with Architect.

3.2 CONDUIT REQUIREMENTS

A. Conduit Size:
1. Minimum Size: 3/4-inch for power and control, unless otherwise noted. 3/4-inch for communication/data, unless otherwise noted. 3/4-inch for signal systems, unless otherwise noted.

B. Underground Installations:
1. More than 5-feet from Foundation Wall: Use PVC.
2. Within 5-feet from Foundation Wall: Use PVC coated RMC.
3. In or Under Slab on Grade: Use PVC.
4. Minimum Size: 1-inch.

C. Outdoor Locations Above Grade: Use RMC.

D. Damp Locations: EMT up to 2-inches in diameter.

E. Dry Locations:
1. Concealed: EMT.
2. Exposed: EMT.

F. Dry, Protected: EMT.

G. In areas exposed to severe mechanical damage: RMC.

H. For security conduits installed exposed and subject to tampering: RMC.

I. Provide two pull strings/tapes in empty conduits. Types:
1. Utility CompanyConduit: Polyester measure/pulling tape, Greenlee 4436 or approved equivalent. Coordinate exact requirements with utility company.
2. Feeders: Polyester measure/pulling tape, Greenlee 4436 or approved.
3. Branch circuits and low voltage: Greenlee Poly Line 431 or approved.
4. If fish tape is used for pulling line or low voltage wiring, fiberglass typeto be used. Metal fish tapes will not be allowed.
5. Secure pull string/tape at each end.
6. Provide caps on ends of empty conduit to be used in future.
7. Label both ends of empty conduits with location of opposite end.

J. Elbows: Fiberglass or PVC coated RMC acceptable for underground installations.

K. Elbow for Low Energy Signal Systems: Use long radius factory ells where linking sections of raceway for installation of signal cable.

L. Use PVC coated RMC 36-inch radius ells for power service conduits and 48-inch radius ells for telephone service conduits.

M. For Dry Areas: Motors, recessed luminaires and equipment connections subjectto movement or vibration, use flexible metallic conduit.

N. Motors and equipment connections subject to movement or vibration and subjected to any of following conditions; exterior location, moist or humid atmosphere, water spray, oil, or grease use PVC coated liquidtight flexible metallic conduit.

3.3 EXAMINATION

A. Verify that field measurements are as shown on drawings.

B. Plan locations of conduit runs in advance of the installation and coordinate with ductwork, plumbing, ceiling and wall construction in the same areas.

C. Locate penetrations and holes in advance where they are proposed in the structural sections such as footings, beams, and walls. Penetrations are acceptable only when the following occurs:
   1. Where shown on the structural drawings.
   2. As approved by the Structural Engineer prior to construction, and after submittal of drawing showing location, size, and position of each penetration.

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

E. Conduit routing is shown on drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

3.4 INSTALLATION

A. Install raceways securely, in neat and workmanlike manner, as specified in NECA 1, Standard Practices for Good Workmanship in Electrical Construction.

B. Install steel conduit as specified in NECA 101, Standard for Installing Steel Conduits.

C. Install nonmetallic conduit in accordance with manufacturer's instructions.

D. Inserts, anchors and sleeves.
   1. Coordinate location of inserts and anchor bolts for electrical systems prior to concrete pour.
   2. Coordinate location of sleeves with consideration for other building systems prior to concrete pour.

E. Conduit Supports:
   1. Arrange supports to prevent misalignment during wiring installation.
   2. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
   3. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.
   4. Do not attach conduit to ceiling support wires.

F. Flexible steel conduit length not-to-exceed 6-feet, 3-feet in concealed walls. Provide sufficient slack to reduce the effect of vibration.

G. Install conduit seals at boundaries where ambient temperatures differ by 10 degrees F or more as shown on the drawings. Install seals on warm side of partition.

H. Seal raceways stubbing up into electrical equipment. Plug raceways with conductors with duct-seal. Cap spare raceways and plug PVC raceway products with plastic plugs as made by Underground Products, or equal, shaped to fit snugly into the stubup.

I. Seal raceways penetrating an exterior building wall to prevent moistureand vermin from entering into the electrical equipment.

J. Use suitable caps on spare and empty conduits to protect installed conduit against entrance of dirt and moisture.

K. Installation of conduit in structural concrete that is less than 3-inches thick is prohibited without the approval of the Structural Engineer. Maintenance pads, and curbs are exempted.

L. Raceways Embedded in Floor Slabs:
1. Do not install raceways in slab without the approval of the Structural Engineer.
2. Do not let raceways interfere with placement of floor slabreinforcement components.
3. Install raceways between the upper and the lower layers ofreinforcing steel.
4. Space raceways not less than 8-inches on centers except wherethey converge at panels or junction boxes.
5. Raceways running parallel to slabs supports, such as beams, columns and structural walls, to be installed not less than 12-inches from such supporting elements.
6. Branch circuit homeruns are not permitted in slab, route branch circuit homeruns above grade exposed in approved areas or above lay-in ceiling spaces.
7. Route conduits in or under slabs point-to-point.
8. Do not cross conduits in slab.

M. Conduit Joints: Assemble conduits continuous and secure to boxes, panels, luminaires and equipment with fittings to maintain continuity. Provide watertight joints where embedded in concrete, below grade or in damp locations. Seal PVC conduit joints with solvent cement and metal conduit with metal thread primer. Rigid conduit connections to be threaded, clean and tight (metal to metal). Threadless connections are not permitted for RMC. Seal conduits where penetrating below raised floor area.

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

O. Arrange conduit to maintain headroom and present neat appearance.

P. Do not install conduits on surface of building exterior, along vapor barrier, across roof, on top of parapet walls, or across floors, unless otherwise noted on drawings.

Q. Exposed conduits are permitted only in following areas:
1. Mechanical rooms, electrical rooms or spaces where walls, ceilings and floors will not be covered with finished material.
2. Existing walls that are concrete or block construction.
3. Where specifically noted on Drawings.
4. Route exposed conduit parallel and perpendicular to walls, tight to finished surfaces and neatly offset into boxes.

R. Do not install conduits or other electrical equipment in obvious passages, doorways, scuttles or crawl spaces which would impede or block area passage's intended usage.

S. Install continuous conduit and raceways for electrical power wiring and signal systems wiring.

T. Below Grade Conduit:
1. Place minimum 3-inch cover of sand or clean earth fill around conduit. Lay conduit on smooth level trench bottom, so that contact is made for its entire length.
2. Remove water from trench before conduit is installed.
3. When three or more conduits are in a single trench, use conduit spacers that will maintain 3-inch spacing between conduits. Provide spacers on 5-foot centers.
4. Provide PVC coated galvanized rigid conduit for elbows larger than 30 degrees or 1-inch diameter.
5. Provide trenching, backfilling, compaction, repaving or other site restoration as required by work done in this division.
6. Slope underground conduits which enter building to drain away from building and to be water sealed to prevent moisture from passing through conduit into building. Joints threaded and taped or glued to prevent entry of water into conduits.
7. Provide watertight conduit sleeves and rubber seals for conduit entering building below grade, Link-Seal system by Thunderline Corporation or approved equivalent.

U. Route conduit installed above accessible ceilings parallel and perpendicularto walls.

V. Maintain adequate clearance between conduit and piping.

W. Keep conduits a minimum of 12-inches away from steam or hot water radiant heating lines (at or above 104 degrees F) or 3-inches away from waste or water lines.

X. Cut conduit square using saw or pipecutter; deburr cut ends.

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

Z. Use conduit hubs to fasten conduit to cast boxes in damp and wet locations.

AA. Install no more than the equivalent of three 90 degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Use hydraulic one shot bender to fabricate factory elbows for bends in metal conduit larger than 2-inch size.

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

AC. Conduit Terminations for Signal Systems: Provide a plastic bushing on the end of conduit used for signal system wiring.

AD. Flexible Conduit: Install 12-inch minimum slack loop on flexible metallic conduit and liquidtight flexible metallic conduit.

AE. Feeders: Do not combine or change feeder runs.

3.5 CONDUIT FITTINGS

A. Use set screw type fittings only in dry locations. When set screw fittings are utilized provide insulated continuous equipment ground conductor in conduit, from overcurrent protection device to outlet.

B. Use compression fittings in dry locations, damp and rain-exposed locations. Maximum size permitted in damp locations and locations exposed to rain is 2-inches in diameter.

C. Use threaded type fittings in wet locations, and damp or rain-exposed locations where conduit size is greater than 2-inches.

D. Use PVC coated RMC 36-inch radius ells for power service conduits and 48-inch radius ells for telephone service conduits.

E. Use insulated type bushings with ground provision at switchboards, panelboards, safety disconnect switches, junction boxes that have feeders 60 amperes and greater.

F. Condulets and Conduit Bodies:
   1. Do not use condulets and conduit bodies in conduits for signal wiring or in feeders 100 amp and larger.

G. Sleeves and Chases - Floor, Ceiling and Wall Penetrations: Provide necessary rigid conduit sleeves, openings and chases where conduits or cables arerequired to pass through floors, ceilings or walls.

H. Provide rigid conduit coupling flush with surface of slab or wall for conduit stubbed in concrete slab or wall to serve electrical equipment or an outlet under table or to supply shop tool, etc. Provide plug where conduit is to be used in future.

3.6 INTERFACE WITH OTHER PRODUCTS

A. Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Division 07, Thermal and Moisture Protection.

B. Route conduit through roof openings for piping and ductwork wherever possible. Where separate roofing penetration is required, coordinate location and installation method with roofing installation and installer.

END OF SECTION

SECTION 26 05 34

BOXES

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:
1. Outlet Boxes
2. Pull and Junction Boxes
3. Box Extension Adapter
4. Conduit Fittings
5. Weatherproof Outlet Boxes

B. Provide electrical boxes and fittings for a complete installation. Include but not limited to outlet boxes, junction boxes, pull boxes, bushings, locknuts and other necessary components.

1.2 RELATED SECTIONS

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

B. In addition, reference the following:
1. Section 26 05 33, Raceways
2. Section 26 05 53, Identification for Electrical Systems

1.3 REFERENCES AND STANDARDS

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

1.4 SUBMITTALS

A. Submittals not required for this Section.

1.5 QUALITY ASSURANCE

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

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 26 00 00,

Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Outlet Boxes:
1. Bowers
2. Hubbell
3. Raco
4. Steel City
5. Thomas & Betts
6. Or approved equivalent.

B. Pull and Junction Boxes:
1. B-Line
2. Hoffman
3. Or approved equivalent.

C. Box Extension Adapter:
1. Bell
2. Carlon
3. Raco
4. Red Dot
5. Steel City
6. Thomas & Betts
7. Or approved equivalent.

D. Conduit Fittings:
1. Killark
2. O-Z Gedney
3. Raco
4. Steel City
5. Thomas & Betts
6. Or approved equivalent.

E. Weatherproof Outlet Boxes:
1. Pass and Seymour
2. Bell
3. Red Dot
4. Carlon
5. Or approved equivalent.

2.2 OUTLET BOXES

A. Luminaire Outlet: 4-inch octagonal box, 1-1/2-inches deep with 3/8-inch luminaire stud if required. Provide raised covers on bracket outlets and on ceiling outlets.

B. Device Outlet: Installation of one or two devices at common location, minimum 4-inches square, minimum 1-1/2-inches deep. Single- or two-gang flush device raised covers.

C. Telecom Outlet: Provide 4-inches square, minimum 2-1/8-inch deep box with two-gang plaster ring.

D. Multiple Devices: Three or more devices at common location. Install one-piece gang boxes with one-piece device cover. Install one device per gang.

E. Masonry Boxes: Outlets in concrete.

F. Construction: For interior locations, provide galvanized steel outlet wiring boxes, of the type, shape and size, including depth of box, to suit each respective location and installation; constructed with stamped knockouts in back and sides, and with threaded holes with screws for securing box covers or wiring devices.

G. Accessories: Provide outlet box accessories for each installation, including mounting brackets, wallboard hangers, extension rings, luminaire studs, cable clamps and metal straps for supporting outlet boxes, compatible with outlet boxes being used and meeting requirements of individual wiring situations.

H. Noise Control: Provide acoustic putty pad to back side of each outlet box installed in acoustic rated walls.

2.3 PULL AND JUNCTION BOXES

A. Construction: Provide ANSI 49 gray enamel painted sheet steel junction andpull boxes, with screw-on covers; of type shape and size, to suit each respective location and installation; with welded seams and equipped with stainless steel nuts, bolts, screws and washers.

B. Location:
   1. Provide junction boxes above accessible ceilings for drops into walls for receptacle outlets from overhead.
   2. Provide junction boxes and pull boxes to facilitate installation of conductors and limiting accumulated angular sum of bends between boxes, cabinets and appliances to 270 degrees.

C. In-Ground Cast Metal Box: NEMA 250, Type 6, outside flanged, recessed cover box for flush mounting:
   1. Construction: Galvanized cast iron.
   2. Cover: Smooth cover with neoprene gasket and stainless steel cover screws.
   3. Cover Legend: ELECTRIC.

2.4 BOX EXTENSION ADAPTER

A. Construction: Diecast aluminum.

B. Location: Install over flush wall outlet boxes to permit flexible racewayextension from flush outlet to fixed or movable equipment. Bell 940 Series, Red Dot IHE4 Series.

2.5 CONDUIT FITTINGS

A. Requirements: Provide corrosion-resistant punched-steel box knockout closures, conduit locknuts and plastic conduit bushings of the type and size to suit each respective use and installation.

2.6 WEATHERPROOF OUTLET BOXES

A. Construction: Provide corrosion-resistant cast metal weatherproof outlet wiring boxes, of the type, shape and size, including depth of box, with threaded conduit ends, cast metal faceplate with spring-hinged waterproof cap suitably configured for each application, including faceplate, gasket, blank plugs and corrosion proof fasteners. Weatherproof boxes to be constructed to have smooth sides, gray finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Coordinate locations of floor boxes and wall mounted wiring device boxes with architectural and structural floor plans prior to rough-in.

3.2 INSTALLATION

A. Install boxes securely, in a neat and workmanlike manner, as specified inNECA 1, Standard Practice of Good Workmanship in Electrical Construction.

B. Secure boxes rigidly to substrate upon which they are being mounted, orsolidly embed boxes in concrete or masonry.

C. Install in locations as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and as required by NFPA 70. Locate boxes and conduit bodies so as to ensure accessibility of electrical wiring.

D. Set wall mounted boxes at elevations to accommodate mounting heights specified in Section.

E. Electrical boxes are shown on Drawings in approximate locations unless dimensioned.
   1. Adjust box locations up to 10-feet if required to accommodate intended purpose.

F. Mount outlet boxes, unless otherwise required by ADA, or noted on drawings, following distances above finished floor:
   1. Control Switches:
      a. 48-inches to the top of outlet box.
      b. 4-inches above top of backsplash at countertops/workstations, not-to-exceed 44-inches above finished floor to the top of outlet box per ADA requirements.
   2. Receptacles: 15-inches to the bottom of outlet box.
   3. Telecom Outlets: 15-inches to the bottom of outlet box.
   4. Other Outlets: As indicated in other Sections of specifications or as detailed on drawings.

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

H. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6-inches from ceiling access panel or from removable recessed luminaire.

I. Flush Outlets in Insulated Spaces: Maintain integrity of insulation and vapor barrier.

J. Install boxes to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Division 07, Thermal and Moisture Protection.

K. Coordinate electrical device locations and elevations (switches and receptacles) with architectural drawings to prevent mounting devices in mirrors, back splashes, and behind cabinets.

L. Locate outlet boxes to allow luminaires positioned as shown on reflected ceiling plan.

M. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices. Adjacent boxes not aligned vertically to be adjusted at no additional cost to Owner.

N. Use flush mounting outlet box in finished areas.

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

P. Do not install flush mounting box back-to-back in walls; provide minimum 6-inches separation. Provide minimum 24-inches in acoustic rated walls.

Q. Apply acoustic putty pad on outlet box prior to installation of acoustical blanket.

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

S. Use stamped steel bridges to fasten flush mounting outlet box between studs.

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

U. Use adjustable steel channel fasteners for hung ceiling outlet box.

V. Do not fasten boxes to ceiling support wires.

W. Support boxes independently of conduit, except cast box that is connected to two rigid metal conduits both supported within 12-inches of box.

X. Use gang box where more than one device is mounted together. Do not use Sectional box.

Y. Use gang box with plaster ring for single device outlets.

Z. Use cast outlet box in exterior locations exposed to the weather and wet locations.

AA. Large Pull Boxes: Use hinged enclosure in interior dry locations, surface-mounted cast metal box in other locations.

AB. Box Color Coding and Marking: Reference Section 26 05 53, Identification for Electrical Systems.

3.3 ADJUSTING

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

B. Adjust boxes to be parallel with building lines. Boxes not plumb to building lines are not acceptable.

C. Install knockout closures in unused box openings.

3.4 CLEANING

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

B. Clean exposed surfaces and restore finish.

END OF SECTION

SECTION 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:
1. Nameplates and Labels
2. Wire Markers
3. Underground Warning Tape

1.2 RELATED SECTIONS

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

1.3 REFERENCES AND STANDARDS

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

1.4 SUBMITTALS

A. Submittals not required for this Section.

1.5 QUALITY ASSURANCE

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

B. In addition, meet the following:
1. Manufacturer's Qualifications: Firms regularly engaged in manufacture of identification devices of types and sizes required.
2. Codes and Standards: Comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices unless otherwise indicated.

1.6 WARRANTY

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. General: Manufacturer's standard products of categories and types required for each application as referenced in other Division 26, Electrical Sections. Where more than a single type is specified for application, provide single selection for each product category.

B. Equipment Nameplates:
1. B & I Nameplates
2. Intellicum
3. JBR Associates
4. Or approved equivalent.

C. Device Labels:
1. Kroy
2. Brady
3. Or approved equivalent.

D. Wire Markers:
1. Brady
2. Panduit
3. Sumitomo
4. Or approved equivalent.

E. Underground Warning Tape:
1. Allen Systems
2. Brady
3. Or approved equivalent.

2.2 NAMEPLATES AND LABELS

A. Nameplates: Engraving stock melamine or lamicoid plastic laminate in the size and thicknesses indicated, engraved with engraver's standard letter style of the sizes and wording indicated, black with white core (letter color), punched for mechanical fastening except where adhesive mounting is necessary because of substrate. Provide 1/8-inch thick material.
1. Letter Color: White.
2. Letter Height: 1/4 inch.
3. Background Color: Black.
4. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.

5. Access Panel Markers: Manufacturer's standard 1/16-inch thick engraved plastic laminate access panel markers, with abbreviations and numbers corresponding to concealed valve or devices/equipment. Include center hole to allow attachment.
6. Locations:
    a. Each electrical distribution and control equipment enclosure.
    b. Disconnect switches and starters.

B. Labels: Adhesive tape, with 3/16-inch black letters on clear background. Use only for identification of individual wall switches and receptacles. Indicate device name, source panel, and source circuits. Panel and circuit designation written in permanent marker on the back of the plate and inside the back-box. Do not provide punch tape style labels.

2.3 WIRE MARKERS

A. Description: Vinyl-cloth self-adhesive type wire markers.

B. Locations: Each conductor at panelboard gutters, pull boxes, outlet boxes, junction boxes, and each load connection.

C. Power and Lighting Circuits: Branch circuit or feeder number as indicatedon drawings and source panel.

D. Control Circuits: control wire number indicated on schematic and interconnection diagrams on drawings or shop drawings.

2.4 UNDERGROUND WARNING TAPE

A. Description: 6-inch wide inert polyethylene plastic tape, 4-mil thick, detectable type, colored per APWA recommendations unless otherwise noted withsuitable warning legend describing buried electrical lines.

PART 3 - EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive nameplates and labels.

B. Coordinate designations used on Drawings with equipment labels.

3.2 INSTALLATION

A. Install nameplates and labels parallel to equipment lines.

B. Secure nameplates to equipment front using self-tapping stainless steel screws.

C. Secure nameplates to inside surface of door on panelboard that is recessed infinished locations.

D. Identify underground raceways using underground warning tape. Install one continuous tape per underground raceway at 6- to 8-inches below finishgrade. Where multiple underground raceways are buried in a common trench and exceeds 16-inch width, install multiple warning tapes not over 10-inches apart (edge to edge) over the entire group of underground raceways.

E. Identify empty conduit and boxes with intended use.

F. Provide wire markers on each conductor for power, control, signalling and communications circuits.

G. On the back of receptacle and switch finish plates and inside the back-box, legibly write with permanent ink marker, the circuit that each device is connected to.

H. On the front of receptacle and switch finish plates, provide label with the circuit that each device is connected to.

I. Verify emergency system distribution equipment nameplate colors with Architect/Owner.

J. Locations:
   1. Switchboards, distribution panels, and branch panels.
   2. Main breakers and distribution breakers in switchboards, and distribution panels.
   3. Equipment including, but not limited to, motor controllers, disconnects, and VFD's.
   4. Low-voltage equipment enclosures including, but not limited to, fire alarm panels and lighting control panels.

K. Switchboards and panels to include name source, voltage, current phase, wire configuration and fault current rating.

L. Provide nameplates for flush mounted branch panelboards identifying name on front door. On inside of door provide nameplate as noted above.

M. Provide a second label at branch panelboards listing the means of identification of branch circuit conductors. This identification legend to consist of the color code used for each voltage system (208Y/120V and 480Y/277V). See specification Section 26 05 19, Low-Voltage Electrical Power Conductors and Cables, for required conductor color code for this project. Include identification of both voltage systems on each label, regardless of the voltage of the panelboard to which the label is affixed. Comply with requirements of NEC 210.5.

N. Provide engraved nameplate similar to distribution panelboards for lighting control panels, contactors, relays, time switches, etc. identifying name, service point and circuit number.

O. For flush mounted panelboards verify label location (inside or outsidepanelboard door) with Architect/Owner.

P. Provide typewritten branch panel schedules with protective cleartransparent covers accounting for every breaker installed. Use actual room designations assigned by name or number near completion of the work, and not the designations shown on drawings.

Q. Provide color coded boxes as follows:
1. Fire Alarm: Red.

R. Provide labeling where switches control remote lighting or power outletsor where multiple switches are located in the same location.

S. Where switches control remote lighting or power outlets, or where switches or outlets in same location serve different purposes, such as light, power, intercom, etc. or different areas, such as corridor and outside, plates with 1/8-inch black letters indicating function of each switch or outlet. Also label function light switches where two or more are mounted in same locations.

T. Provide receptacle device plates with panel and circuit designation labeled on the face, with Dymo-type label, and with circuit written in permanent marker on back of plate and back-box. Provide switch device plates with panel and circuit designation written in permanent marker on back of plate and back-box.

END OF SECTION

SECTION 26 05 73

ELECTRICAL DISTRIBUTION SYSTEM STUDIES

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:
1. Protective Devices
2. Arc Flash Labels
3. Protective Device Study
4. Short Circuit Study
5. Arc Flash Hazard Analysis

1.2 RELATED SECTIONS

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

1.3 REFERENCES AND STANDARDS

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

B. In addition, meet the following:
1. IEEE 242, Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems.
2. IEEE 399, Recommended Practice for Industrial and Commercial Power Systems Analysis.
3. IEEE 1584, Guide for Performing Arc Flash Calculation.

1.4 SUBMITTALS

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

B. In addition provide:
1. Power system studies required under this Section with submittals for electrical equipment, including overcurrent protective devices.
2. Electrical equipment ordered prior to submittal of power system studies are not compliant with these specifications, and are subject to removal and replacement at no cost to Owner where not in compliance with Code and Contract Documents for selective coordination.
a. Provide written verification with Stamp or Seal and signature of preparing Engineer.

3. Provide samples of NFPA 70E compliant arc flash hazard labeling for electrical equipment.

1.5 QUALITY ASSURANCE

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

B. In addition, meet the following:
   1. Study Preparer Qualifications: Qualified engineer of switchgear manufacturer or approved professional engineer.
      a. Experienced in preparation of studies of similar type and magnitude.
      b. Familiar with software analysis products specified.

1.6 WARRANTY

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

PART 2 - PRODUCTS

2.1 GENERAL

A. Analyze specific electrical and utilization equipment (according to NEC definition), actual protective devices to be used, and actual feeder lengths tobe installed.
   1. Scope of Studies: New and existing distribution wiring and equipment, from primary source to buses and branch circuit panelboards.
   2. Primary Source, for Purposes of Studies: Utility companyprimary protective devices.
   3. Study Methodology: Comply with requirements and recommendations of NFPA 70, IEEE 399, and IEEE 242.
   4. Report: State methodology and rationale employed in making each type of calculation; identify computer software package(s) used.

B. One-Line Diagrams: Prepare schematic drawing of electrical distribution system, with electrical equipment and wiring to be protected by protective devices; identify nodes on diagrams for reference on report that includes:
   1. Calculated fault impedance, X/R ratios, utility contribution, and short circuit values (asymmetric and symmetric) at main switchboard busand downstream devices containing protective devices.
   2. Breaker and fuse ratings.
   3. Generator kW and voltage ratings, percent impedance, X/R ratios, and wiring connections.

4. Transformer kVA and voltage ratings, percent impedance, X/R ratios, and wiring connections.
5. Identification of each bus, with voltage.
6. Conduit materials, feeder sizes, actual lengths, and X/R ratios.

2.2 PROTECTIVE DEVICES

A. Provide protective devices of ratings and settings as required so that protective device closest to fault will open first.

B. Replace existing protective devices to achieve specified performance.

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

D. Protective Device Rating and Setting Chart: Summarize in tabular format required characteristics for each protective device based on analysis;include:
1. Device identification.
2. Relay CT ratios, tap, time dial, and instantaneous pickup.
3. Circuit breaker sensor rating, long-time, short-time, and instantaneous settings, and time bands.
4. Fuse rating and type.
5. Ground fault pickup and time delay.

6. Input level and expected response time at two test points that are compatible with commonly available test equipment and ratings of protective device.
7. Highlight devices that as furnished by Contractor will not achieverequired protection.

E. Specified equipment has been designed and selected to achieve specified performance; ensure that equipment actually installed provides thatperformance.

F. In addition to requirements specified elsewhere, provide overcurrent protective devices having ratings and settings in accordance with results of systemstudies.

2.3 ARC FLASH LABELS

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

2.4 PROTECTIVE DEVICE STUDY

A. Analyze and determine ratings and settings of protective devices to minimize damage caused by fault and so that protective device closest to fault will open first.
1. Required Ratings and Settings: Derive required ratings and settings of protective devices in consideration of upstream protective device settings and optimize system to ensure selective coordination.
2. Identify any equipment that is underrated as specified.
3. Identify existing protective devices that will not achieverequired coordination and cannot be field adjusted to do so.
4. Identify specified protective devices that will not achieve required protection or coordination but with minor changes can be made to do so; provide such modified devices at no additional cost to Owner and identify them on submittals as "revised in accordance with Protective Device Coordination Study"; minor changes include different trip sizes in same frame, time curve characteristics of induction relays, CT ranges, etc.
5. Identify specified protective devices that will not achieve required protection or coordination and cannot be field adjusted to do so, and for which adequate devices would involve change to contract sum.
6. In all cases where adequate protection or coordination cannot be achieved at no extra cost to Owner, provide a discussion of alternatives and logical compromises for best achievable coordination.
7. Do not order, furnish, or install protective devices that do not meet performance requirements unless specifically approved byArchitect.

B. Protective Device Rating and Setting Chart: Summarize in tabular format required characteristics for each protective device based on analysis;include:
   1. Device identification.
   2. Relay CT ratios, tap, time dial, and instantaneous pickup.
   3. Circuit breaker sensor rating, long-time, short-time, and instantaneous settings, and time bands.
   4. Fuse rating and type.
   5. Ground fault pickup and time delay.
   6. Input level and expected response time at two test points that are compatible with commonly available test equipment and ratings of protective device.
   7. Highlight devices that as furnished by Contractor will not achieverequired protection.

2.5 SHORT CIRCUIT STUDY

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

2.6 ARC FLASH HAZARD ANALYSIS

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

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. Provide services of qualified field engineer and necessary tools and equipmentto test, calibrate, and adjust installed protective devices to conform to requirements determined by coordination analysis.

B. Adjust installed protective devices having adjustable settings to conform to requirements determined by coordination analysis.

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

3.2 ELECTRICAL POWER SYSTEM STUDIES

A. Short Circuit Analysis Study.
1. Provide complete short circuit study, equipment interrupting and withstand evaluation. Study to include complete electrical distribution system, including simultaneous contributions from normal and alternative sources of power. Include complete low voltage distribution systems as specified in this Section.
2. Study Basis: thoroughly cover normal and alternative operation modes that can produce maximum fault conditions, including simultaneous motor contributions.
3. Perform study in accordance with applicable ANSI/IEEE Standards.
4. Study Input Data: Utility company short circuit single and three phase contribution, and X/R ratio; resistance and reactance components of each feeder, busway and branch impedance; motor and generatorcontributions; applicable circuit parameters and contribute to short circuit duty.
5. Calculate short circuit momentary duties and interrupting duties on basis of maximum available fault current at each switchgear bus, switchboard, motor control center, panelboards, transfer switches, busway plug connection point, dry-type transformer primary and secondary locations, other significant locations throughout system affected by available fault current (including large HVAC units, uninterruptible power supplies, etc.).
6. Perform equipment evaluation study to determine adequacy ofovercurrent protection devices by tabulating and comparing short circuit ratings of these devices with available fault current. Notify Owner in writing where problem areas or inadequacies appear in electrical equipment.
7. Study Report: In bound final report, include sheets listing tabulated information from study, including feeder impedances, motor, utilityand generator impedances and fault contributions, and resulting short circuit current including asymmetrical, symmetrical, three, five and eight cycle fault current levels, and line-to-neutral and three-phase-bolted-fault current levels at each calculated point in electrical distribution system.

B. Protective Device Study:
1. Perform time-current coordination analysis with aid of computersoftware intended for this purpose. Include determination of settings, ratings, or types for overcurrent protective devices supplied.

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

C. Arc Flash Hazard Analysis:
1. Perform arc flash hazard analysis with aid of computer software intended for this purpose.
2. Perform arc flash hazard analysis in conjunction with short-circuit analysis and time-current coordination analysis.
3. Submit results of Analysis in tabular form, and include device or bus name, bolted fault and arcing fault current levels, flash protection boundary distances, personal-protective equipment classes and AFIE levels.
4. Perform analysis under worst-case arc flash conditions, and final report describes, when applicable, how these conditions differ from worst-case bolted fault conditions.

5. Arc flash hazard analysis includes recommendations for reducing AFIE levels and enhancing worker safety.
6. Proposed vendor demonstrates experience with arc Flash hazard analysis bysubmitting names of at least ten actual arc flash hazard analyses it has performed in past year.
7. Proposed vendor demonstrates capabilities in providing equipment, services, and training to reduce arc flash exposure and train workers in accordance with NFPA 70E and other applicable standards.
8. Proposed vendor demonstrates experience in providing equipment labels in compliance with NEC and ANSI Z535.4 to identify AFIE and appropriate Personal Protective Equipment classes.

END OF SECTION

SECTION 26 08 05

ELECTRICAL ACCEPTANCE TESTING

PART 1 - GENERAL

1.1 SUMMARY

A. Work included: Testing, evaluation, and calibration of :
   1. Power Distribution Equipment

B. Test procedures specified in this Section are in addition to those specified in other Sections of Division 26, Electrical.

1.2 RELATED SECTIONS

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

1.3 REFERENCES AND STANDARDS

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

B. In addition, meet the following:
   1. Acceptance Testing Criteria: Latest edition of Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems, published by NETA.

1.4 SUBMITTALS

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

B. In addition, provide:
   1. Test Reports:
      a. Maintain written record of tests.
      b. At completion of project, assemble and certify a final test report. Document testing and performance compliance with NETA recommended forms, parameters, and level of detail. Submit report to Architect prior to final acceptance to include:
         1) Summary of Project
         2) Description of Equipment Tested
         3) Visual Inspection Report
         4) Description of Tests

5) Test Results
6) Conclusions and Recommendations

1.5 QUALITY ASSURANCE

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

B. In addition, meet the following:
   1. Qualifications of Testing Firm:
      a. Corporately independent testing organization which canfunction as an unbiased testing authority, professionally independent of manufacturers, suppliers and installers of equipment or systems evaluated by testing firms.
      b. Independent organization as defined by a NETA Level II ETT certified testing agency in compliance with NETA LevelII ETT certified testing requirements and practices.
      c. Regularly engaged in testing of electrical materials, devices, appliances, electrical installations and systems for purpose of preventing injury to persons or damage to property and other equipment.
      d. Engaged in testing practices for minimum of 2 years.
      e. Use only full-time technicians, regularly employed by firm for testing services. Electrically unskilled employees are not permitted to perform testing or assistance of any kind. Electricians and line workers may assist, but may not perform testing or inspection services.
      f. Submit proof of above qualifications with Bid Documents.
   2. Certifications:
      a. Comply with NETA Level II ETT certified testing agency criteria for accreditation of testing laboratories. Full membership in NETA constitutes proof of such criteria.
      b. Lead, on site, technical person currently certified byNETA in Electrical Power Distribution System Testing.
      c. Instruments used by testing firm to evaluate electricalperformance meet NETA Specifications for Test Instruments.

1.6 PERFORMANCE REQUIREMENTS

A. Retain services of recognized independent testing firm for purpose ofperforming inspections and tests as specified.

B. Independent test firm providing report direct to Architect.

C. Material, equipment, labor and technical supervision to perform tests and inspections provided by testing firm.

D. Intent of these tests to assure that electrical equipment, Contractor or Owner supplied, is operational within industry and manufacturer's tolerances and is installed in accordance with design Specifications.

E. Tests and inspections determine suitability for energization.

F. Supply to independent testing organization complete sets of approved shop drawings, coordination study (provided by Contractor's equipment supplierunder Contractor's direction), setting of adjustable devices and other information requested by testing agency.

1.7 SCOPE OF WORK

A. Provide testing, evaluation, and calibration of the following:
1. Low Voltage Circuit Breakers (greater than 100 amp)
2. Switchboards
3. Panelboards
4. Grounding Systems

B. Test cable, equipment and systems listed above to assure proper installation, setting, connections, and functioning in accordance with the Drawings, Specifications, and the manufacturer's recommendations. It is the intent that field testing be extensive, and complete as specified, to provide positive assurance of totally correct installation and operation of equipment.

C. Furnish necessary test equipment to satisfactorily perform tests specified.

PART 2 - PRODUCTS

2.1 POWER DISTRIBUTION EQUIPMENT

A. The testing agency provides test equipment.

B. Care and Precautions:
1. Contractor responsible for any damage to equipment or material due to improper test procedures or test apparatus handling. Replace or restore to original condition any damaged equipment or material.
2. Provide and use safety devices such as rubber gloves and blankets, protective screen, barriers and danger signs to adequately protect and warn personnel in the vicinity of the tests.
3. Use test equipment that is calibrated and certified traceable to the National Bureau of Standards. Certification Date: No later than 6 months.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. Tests:
   1. Contractor's Responsibilities:
      a. Perform routine insulation resistance, continuity and rotation tests for distribution and utilization equipment prior to and in addition to tests performed by testing firm.
      b. Notify testing firm when equipment becomes available for acceptance tests. Coordinate work to expedite project scheduling.
   2. Testing Firm's Responsibilities:
      a. Notify Architect prior to commencement of any testing.
      b. Report directly to Architect anysystems, material or installation found defective on basis of acceptance tests.
      c. Provide auxiliary portable power supply necessary for conducting tests.

3.2 REPLACEMENT OF DEFECTIVE MATERIAL OR EQUIPMENT

A. Repair or replace any material or equipment found defective or cannot passthe tests specified in this Section at no additional cost to the Owner.

B. Complete correction of defective material or equipment and retesting within the Contract period.

C. If the equipment or material cannot pass the second test, remove the defective equipment and replace it with equivalent equipment that meets the requirements of the Specifications. Such replacement at no additional cost to the Owner.

3.3 ADJUSTING

A. Final Settings: Testing firm responsible for implementing final settings and adjustments on protective devices and tap changes in accordance with Architect's specified values.

END OF SECTION

SECTION 26 24 16

PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Power Distribution Panelboards
2. Panelboards

1.2 RELATED SECTIONS

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

1.3 REFERENCES AND STANDARDS

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

B. In addition, meet the following:
1. UL 67, Standards for Panelboards.

1.4 SUBMITTALS

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

1.5 QUALITY ASSURANCE

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

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 26 0000, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Power Distribution Panelboards:

1. Eaton
2. General Electric
3. Siemens

4. Square D
5. Or approved equivalent.

B. Panelboards:
1. Eaton
2. General Electric
3. Siemens
4. Square D
5. Or approved equivalent.

C. Manufacturers listed above are allowed on condition of meeting specified conditions including available space for equipment, Code required working clearances. Prior to submitting bid, manufacturer to provide documentation to Engineer verifying specific conditions, including those mentioned above, can be met. Remove and replace electrical equipment installed, at no cost to the Owner, that does not meet these conditions.

D. Basis of Design: Square D. Manufacturers listed are allowed on condition of meeting specified conditions including available space for the equipment and Code required working clearances. Remove and replace electrical equipment installed that does not meet these conditions at no cost to Owner.

2.2 POWER DISTRIBUTION PANELBOARDS

A. Description: NEMA PB 1 Type 1, circuit breaker type.

B. Integrated Equipment Rating: Provide fully rated integrated equipment rating greater than the available fault current. Series rated panelboards are not acceptable. Reference drawings for available fault current. If drawings do not have available fault current shown, then coordinate with serving electricalutility. Final rating based on the protective device study completed under the provisions of Division 26, Electrical Distribution System Studies.

C. Panelboard Bus: Non-reduced Copper, ratings as indicated on drawings. Bus bar with suitable electroplating (tin) for corrosion control at connection. Provide copper ground bus in each panelboard.

D. Lugs: Mechanical type for copper conductors.

E. Molded Case Circuit Breakers: With integral thermal and instantaneous magnetic trip in each pole; UL listed. For air conditioning equipment branch circuits provide circuit breakers UL listed as Type HACR.

F. Circuit Breaker Accessories: Trip units and auxiliary switches as indicated.

G. Fully equip unused spaces for future devices, including manufacturerrequired connections and mounting hardware.

H. Cabinet Front: Surface type hinged door with flush lock, metal directory frame, finished in manufacturer's standard gray enamel.

2.3 PANELBOARDS

A. Description: Panelboards 400 amps or less. NEMA PB1, Type 1 as indicated on drawings, circuit breaker type. Maximum enclosure depth: 6-inches for surface mounted, 5 3/4-inches for flush mounted.

B. Maximum Width: 20-inches.

C. Integrated Equipment Rating: Provide fully rated integrated equipment rating greater than the available fault current. Series rated switchboards are not acceptable. Reference drawings for available fault current. If drawings do not have available fault current shown, then coordinate with serving electricalutility. Final rating based on the protective device study completed under the provisions of Division 26, Electrical Distribution System Studies.

D. Panelboard Bus Non-Reduced: Copper, ratings as indicated on drawings. Bus bar with suitable electroplating (tin) for corrosion control at connection. Provide copper ground bus in each panelboard.

E. Lugs: Mechanical type for conductors.

F. Provide double lugs and/or feed-through lugs for feed through feeders.

G. Molded Case Circuit Breakers: Thermal magnetic trip circuit breakers, bolt-on type, with common trip handle for poles; UL listed. Predrill bus for bolt-on breakers.
   1. Type SWD for lighting circuits.
   2. Type HACR for air conditioning equipment circuits.
   3. Class A ground fault interrupter circuit breakers where scheduled.
   4. Class B ground fault equipment protection circuit breakers for heat trace and other circuits as required by Code. Provide shunt trip circuitbreakers where scheduled; provide wiring to remote trip switch/contacts as indicated on Drawings.
   5. Do not use tandem circuit breakers.

H. Accessories: Provide where indicated: shunt trip, Class A ground fault circuit interrupter (GFCI), auxiliary switch and alarm switch.

I. Cabinet Front: Provide flush or surface mounting as shown on the schedules, drawings, or otherwise noted. Cabinet front with concealed hinged front cover door-in-door construction, metal directory frame with heavy clear plastic protector, flush lift latch and lock, two keys per panel all keyed alike.

J. Provide boxes with removable blank end walls and interior mounting studs. Provide interior support bracket for ease of interior installation.

K. Furnish surface mounted cabinet boxes without knockouts.
1. Minimum Integrated Short Circuit Rating:
a. 10,000 amperes symmetrical for 240 V panelboards.
b. Minimum rating as indicated on the Drawings or Panel Schedules.
c. Final rating based on the Protective Device Study completed under the provisions of Section 26 05 73, Electrical Distribution System Studies.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install panelboards in accordance with NEMA PB 1.1, NECA 1 and manufacturers installation instructions.

B. Install panelboards level and plumb. Install recessed panelboards flush with wall finishes.

C. Height: 6-feet 6-inches to top of panelboard; install panelboards taller than 6-feet 6-inches with bottom no more than 4-inches above floor.

D. Provide filler plates for unused spaces in panelboards.

E. Provide typed circuit directory for each branch circuit panelboard. Include all "spaces" and "spares." Revise directory to reflect circuiting changes and as-installed conditions. Use final Owner designated room names and numbers, and not designations shown on drawings.

F. Provide engraved plastic nameplates per Section 26 05 53, Identification for Electrical Systems.

G. Provide arc flash labels per Section 26 05 73, Electrical Distribution System Studies.

H. Provide 3 (qty), 1-inch spare conduits out of each recessed panelboard toan accessible location above ceiling. Identify each as SPARE.

I. Provide permanent identification number in or on panelboard dead-front adjacent to each breaker pole position. Horizontal centerline of numbers to correspond with centerline of circuit breaker pole position.

J. Paint:
1. Standard factory finish unless noted otherwise.

2. Panelboards located in finished interior areas in view of building occupants: paint to match adjacent wall surface. Color and paint preparation as specified by Architect. Covers to be painted off wall, then installed over dried, painted wall surface.

K. Provide handle guards on each circuit supplying obviously constant loads suchas fire alarm, security, lighting controls, refrigerators and freezers, fire protection, etc.

L. Provide handle tie to branch circuit breakers of multiwire branch circuits for simultaneous disconnection of circuits. Handle tie will be identified for use with circuit breakers provided. Reconfigure assigned circuits as necessary so that circuit breakers associate with multiwire branch circuits are physically adjacent, record changes in panelboard schedules and circuiting plans for recorddrawings.

M. Provide interior wiring diagram, neutral wiring diagram, UL label, andshort circuit rating on interior or in booklet format inserted in sleeve inside panel cover.

N. Verify available recessing depth and coordinate wall framing with other divisions.

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

3.2 FIELD QUALITY CONTROL

A. Perform inspections and tests in accordance with manufacturer's requirements.

3.3 ADJUSTING

A. Measure steady state load currents at each panelboard feeder; rearrange circuits in panelboard to balance phase loads to within 20 percent of each other. Maintain proper phasing for multi-wire branch circuits.

3.4 CLEANING

A. Thoroughly clean exterior and interior of each panelboard in accordancewith manufacturer's installation instructions.

B. Vacuum construction dust, dirt, and debris out of each panelboard.

C. Where enclosure finish is damaged, touch up finish with matching paint in accordance with manufacturer's specifications and installation instructions.

3.5 TESTING

A. Reference Section 26 08 05, Electrical Acceptance Testing.

END OF SECTION

SECTION 26 28 00

OVERCURRENT PROTECTIVE DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:
   1. Molded Case Circuit Breakers

1.2 RELATED SECTIONS

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

1.3 REFERENCES AND STANDARDS

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

1.4 SUBMITTALS

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

B. In addition, provide:
   1. Product data and instantaneous let-through current curves and average melting time current curves for fuses supplied to project.
   2. Product data and time/current trip curves for circuit breakers supplied to project.

1.5 QUALITY ASSURANCE

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

1.6 WARRANTY

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Molded Case Circuit Breakers:

1. Eaton Electrical

2. General Electric
3. Siemens
4. Square D
5. Or approved equivalent.

2.2 MOLDED CASE CIRCUIT BREAKERS

A. 1-, 2- or 3-pole bolt-on, single handle common trip, 250VAC as indicated on Drawings.

B. Overcenter toggle-type mechanism, quick-make, quick-break action. Trip indication is by handle position.

C. Calibrate for operation in 40 degrees C ambient temperature.

D. 15 to 150 Amp Breakers: Permanent trip unit containing individual thermal and magnetic trip elements in each pole.

E. 151 to 400 Amp Breakers: Adjustable magnetic trip elements. Provide push-to-trip button on cover of breaker for mechanical tripping.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Coordination:
1. Obtain and review the submitted product data for equipment furnished by the Owner, and furnished under other Divisions of this contract, particularly under Divisions 22 and 23.
2. Confirm the equipment nameplate maximum overcurrent protection (MOCP) and make accommodations and adjustments to overcurrent protective devices as necessary to coordinate with the nameplaterating.

B. Install all items in accordance with manufacturers written instructions.

3.2 MOLDED CASE CIRCUIT BREAKERS

A. Provide testing of ground fault interrupting breakers.

B. Provide circuit breakers, as specified and on Drawings, for installation in panelboards, individual enclosures or combination motor starters.

C. Provide ground fault interrupter circuit breakers for equipment in damp or wet locations.

D. Provide device on handle to lock breaker in "ON" position for breakers feeding time switches, night lights and similar circuits required to be continuously energized.

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

F. Provide multi-pole branch circuit breakers for multiwire branch circuits for simultaneous disconnection of circuits.

END OF SECTION

SECTION 26 28 16

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 RELATED SECTIONS

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

1.3 REFERENCES AND STANDARDS

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

1.4 SUBMITTALS

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

1.5 QUALITY ASSURANCE

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

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 26 0000, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Toggle Type Disconnect Switches:
1. Cooper
2. Hubbell

3. Leviton
4. Pass & Seymour
5. Slater
6. Or approved equivalent.

B. Manual Motor Starters:
1. Eaton Electrical
2. General Electric
3. Siemens
4. Square D
5. Or approved equivalent.

C. Safety Switches:
1. Eaton Electrical
2. GE Industrial
3. Siemens
4. Square D
5. Or approved equivalent.

D. Enclosed Circuit Breakers:
1. Eaton Electrical
2. GE Industrial
3. Siemens
4. Square D
5. Or approved equivalent.

E. Molded Case Switches:
1. Eaton Electrical
2. General Electric
3. Siemens
4. Square D
5. Or approved equivalent.

2.2 TOGGLE TYPE DISCONNECT SWITCHES

A. Rating: 120 volt, 1 or 2 pole, 20 amp, 1 hp maximum.

B. Enclosure:
1. NEMA 1: Dry locations/Indoors.
2. NEMA 3R: Damp or wet locations/Outdoors.

C. Handle lockable in 'off' position.

2.3 MANUAL MOTOR STARTERS

A. Quick-Make, Quick-Break. Thermal overload protection. Device labeled with maximum voltage, current, and horsepower.

B. Enclosure:
   1. NEMA 1: Dry locations/Indoors.
   2. NEMA 3R: Damp or wet locations/Outdoors.

2.4 SAFETY SWITCHES

A. Heavy duty fusible type and non-fusible type (as indicated on drawings), dual rated, quick-make, quick-break with fuse rejection feature for use with Class R fuses only, unless other fuse type is specifically noted.

B. Clearly marked for maximum voltage, current, and horsepower.

C. Operable handle interlocked to prevent opening front cover with switch in 'on' position.

D. Switches rated for maximum available fault current.

E. Handle lockable in 'off' position.

F. Enclosure:
   1. NEMA 1: Dry locations/Indoors.
   2. NEMA 3R: Damp or wet locations/Outdoors.

2.5 ENCLOSED CIRCUIT BREAKERS

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

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

C. Fusible Switch Assemblies: NEMA KS 1, quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle. Provide interlock to prevent opening front cover with switch in ON position. Handle

lockable in OFF position. Fuse clips: Provide fuse rejection feature for Class Ror J fuses up to 600 amp. Remove if circuit breaker type is used. Provide switches of 30 to 200 amp with plug-on line side connections.

2.6 MOLDED CASE SWITCHES

A. Removable cover, galvanized steel enclosure, powder coat painted.

B. Provide cover padlock provision.

C. Provide trip unit with no overcurrent, overload, or low level fault protection. Trip unit to be high instantaneous magnetic fixed trip type with magnetic trip reset at factory to interrupt high fault currents at or above preset level.

D. Enclosure:
1. NEMA 1: Dry locations/Indoors.
2. NEMA 3R: Damp or wet locations/Outdoors.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Obtain and review the submitted product data for equipment furnished by the Owner, and furnished under other Divisions of this contract, particularlyunder Divisions 22 and 23.

B. Confirm the equipment nameplate maximum overcurrent protection (MOCP) and make accommodations and adjustments to switches, fuses and circuit breakers as necessary to coordinate with the nameplate rating

C. Install in accordance with manufacturer's instructions.

D. Provide engraved nameplates per Section 26 05 53, Identification for Electrical Systems.

E. Provide arc flash labels per Section 26 05 73, Electrical Distribution System Studies.

F. Apply neatly typed adhesive tag on inside door of each fusible switch indicating NEMA fuse class and size installed.

3.2 TOGGLE TYPE DISCONNECT SWITCHES

A. Install fuses in fusible disconnect switches. Coordinate fuse ampere rating with installed equipment. Do not provide fuses of lower ampere rating than motor starter thermal units.

B. Install products, systems and equipments in accordance withmanufacturers written instructions and requirements.

C. See General Installation Requirements above.

3.3 MANUAL MOTOR STARTERS

A. Provide disconnecting means within sight of each motor controller and of each motor. Motor controller disconnecting means equipped with lock-out/tag-out padlock provisions do not require a disconnect switch at the controlled motor location. Locate disconnect means in view of and not inside of equipment, such that tools are not needed to remove covers to access the disconnecting means.

B. Install products, systems and equipments in accordance withmanufacturers written instructions and requirements.

C. See General Installation Requirements above.

3.4 SAFETY SWITCHES

A. Install products, systems and equipments in accordance withmanufacturers written instructions and requirements.

B. See General Installation Requirements above.

3.5 ENCLOSED CIRCUIT BREAKERS

A. Install products, systems and equipments in accordance withmanufacturers written instructions and requirements.

B. See General Installation Requirements above.

3.6 MOLDED CASE SWITCHES

A. Install products, systems and equipments in accordance withmanufacturers written instructions and requirements.

B. See General Installation Requirements above.

END OF SECTION

SECTION 31 20 00

EARTH MOVING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Refer to the General Conditions, Supplementary Conditions, and Division 1 General Requirements.

B. Refer to the Project's Geotechnical Investigation prepared by Bengal Engineering for additional requirements and specifications.

1.2 WORK INCLUDED

A. Scarifying, excavation, backfilling, and surfacing AS SHOWN ON THE DRAWINGS and Contained in the Specifications.

B. Excavate and Backfill, complete, as shown and as specified for roads, paved areas, walks, slabs and structures.

1.3 RELATED WORK

A. Related sections can include, but may not be limited to:

1. Section 31 50 00 – Trenching and Backfilling.
2. Section 32 12 16 – Asphaltic Concrete Paving and Base Material.

1.4 REFERENCES

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

B. Standard Specifications for Construction of Roads and Bridges on Federal Projects, FP-03 .

C. Civil Drawings.

D. Geotechnical investigation report as prepared by Bengal Engineering, Inc.

1.5 QUALITY ASSURANCE

A. A Geotechnical Engineer will be retained by Contractor to observe performance of work in connection with excavating, filling and grading.

B. Observations by the Geotechnical Engineer will be made during the earthwork and grading operations to verify that the work was performed in accordance with accepted specifications. The Contractor is required to notify the Geotechnical

Engineer 48 hours prior to performing any work associated with clearing, grubbing, grading, excavation, backfilling, or interruption of utilities.

C. Adjust all work performed that does not meet technical or design requirements, but make no deviations from the Contract Document s without specific and written acceptance by the CO.

1.6 REQUIREMENTS OF REGULATORY AGENCIES

A. Federal, State, and local code requirements shall control all work.

B. Obtain and pay for inspections and certificates of inspection.

C. Comply with OSHA excavation requirements and permits.

1.7 ENGINEERING OBSERVATIONS

A. The Geotechnical Engineer will observe the earthwork construction during preparation of the site, excavation, and the compaction of engineered fill.

B. Geotechnical Engineer will make field observations and tests to determine the adequacy of the site preparation, the acceptability of fill materials, and the extent to which the earthwork construction and the degree of compaction comply with the Specifications requirements.

C. Geotechnical Investigation Report: All earthwork and grading shall be done in accordance with the recommendations presented in the Geotechnical Investigation, prepared for this site by Bengal Engineering, Inc.

D. The presence or absence of the Geotechnical Engineer does not in any way relieve the Contractor of the obligation for full time supervision or for compliance with the Contract Documents. The requirement for guarantee of all work is not affected by the presence of those noted above.

1.8 SITE CONDITIONS

A. General: Clearing work shall not begin until temporary fences, barricades, warning signs and other pedestrian control devices are installed.

B. Existing Subsurface Utilities: Existing facilities are shown on the plans to help the Contractor avoid damage to essential utilities which must remain in service. The Contractor shall contact Underground Service Alert to ascertain location of all underground facilities prior to doing work that may damage such facilities. The Contractor shall retain the services of an underground locating company to determine the location of all private facilities. If the Contractor discovers

underground facilities not indicated on the plans or in a location different from what is indicated on the plans, the Contractor shall protect such facilities from damage and notify the CO immediately.

C. Protection

1. If existing live utilities are encountered, protect same from damage and notify the CO. Do not interrupt service except as directed by the CO. Allow sufficient time for utility company to arrange for continuation of required services. Record locations on As-Built Drawings.

2. Do not allow equipment to pass over existing streets or other public and private property without ample protection. Any such property which is damaged as a result of operations under this Section shall be restored to original condition with duplicate materials.

3. Protect open excavations, trenches, and the like with fences, barricades, covers, and railings as required to maintain safe pedestrian and vehicular traffic passage. Prevent erosion of freshly graded areas during construction and until such time as permanent drainage measures have been installed. Assume liability for all claims related to windblown dust and dirt or downstream siltation of waterways due to on-site erosion due to construction.

4. Every precaution shall be taken to prevent spillage when hauling on or adjacent to any Public Street or highway. If spillage occurs, all such spillage shall be removed and the streets and highways shall be swept, washed, or otherwise cleaned as required by local City and County authorities and/or the State of California.

5. All precautions shall be taken as needed to prevent dust nuisance to adjacent or other public and private properties and to prevent erosion and transportation of soil to downstream properties due to work under this Section. Any damage so caused shall be corrected or repaired as part of the work under this Section at no additional cost to USFS.

6. If precautions, corrections, or repairs required under this Section are not undertaken promptly, the CO may take such steps as it may deem necessary and deduct the cost of same from the monies due under the Contract. Any such action or failure to act on the part of the CO shall in no way alter or relieve the Contractor from complete responsibility for the proper protection of the work and all public and private properties and activities which may be affected thereby.

7. All portions of the Work shall be kept free of standing water at all times. Maintain uniform grades, construct ditches and/or provide and operate pumps to prevent erosion, softening of compacted surfaces and formation of mud in trenches and excavations. Ditches shall be constructed, tamped and maintained in a neat, uniform shape. Do not under any circumstances

conduct or pump water or allow water to be diverted or flow toward other areas of the site which may be damaged thereby. Protect inlets from siltation.

1.9 DEFINITIONS

A. Fill: Soils or soil-rock material placed to raise the existing grade of the site or to backfill excavations.

B. On-Site Material: Material obtained from the site including aggregate base or asphalt. Asphalt shall be no larger than 1 inch.

C. Borrow: Material required for earthwork construction in excess of the quantity of suitable material available from the required grading, cuts and excavations. Borrow may be necessary even though not shown on Drawings.

D. Select Material: Material meeting the requirements as indicated under Part 2 – Products.

E. Embankment: The portion of a fill section situated between the natural ground or exposed excavation surface and the finished surface, excluding any material placed under another Section of these Specifications.

F. Relative Compaction: The ratio of the in-place dry density of constructed fill to the maximum dry density, as expressed as a percentage.

G. The following test procedures will be utilized by the Geotechnical Engineer to determine compliance of materials and placement and compaction methods with these specifications:

1. Test Procedures or Designation Purpose:
    a. ASTM Designation: D422 Grain-Size Analysis ASTM Designation: D2216 Moisture Content ASTM Designation: D4318 Plasticity Index.
    b. ASTM Designation: D1557 Maximum Dry Density ASTM Designation: D1556-64 In-Place Density ASTM Designation: D6938-08 In-Place Density ASTM Designation: D3017-88 In-Place Moisture Content ASTM Designation: D4254-83 Relative Density.

H. Subgrade: The soil prepared and compacted to support a structure or a pavement system.

I. Imported Material: Material hauled in from off-site borrow areas.

J. Engineered Fill: Embankment that has been constructed to specifications requirements, in the opinion of Geotechnical Engineer.

K. Standard Specifications: Standard Specifications of Caltrans, latest edition.

L. Bridging Material is a course, angular material used for stabilizing soft subgrade conditions.

M. Materials Manual is that of the State of California, Department of Public Works, Division of Highways, latest edition.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Requirements for General Fill Materials: All fill material shall be approved by the Geotechnical Engineer. The material shall be a soil or soil-rock mixture which is free from organic matter or other deleterious substances. The fill material shall not contain rocks or lumps over 4 inches in greatest dimension, and with not more than 15 percent larger than 2-1/2 inches.

B. Requirements for Select Material: In addition to the above requirements for general fill material, select non-expansive material shall be a low plasticity soil having a Plasticity Index of 7 (seven) or less, and be approved by the soils engineer.

C. Site Material: Structural fill shall consist of a predominately granular material such as a creek run or pit run clayey sand and gravel, uniform soil classification GM, GC, SM, or SC.

D. Provide inorganic soil materials that have a plastic index less than 7 (seven) and an Expansion Index no greater than 20 (twenty) and that meet the following gradation criteria:

Sieve Opening	Percent Passing by Weight
4-inch square	100
3/4-inch square	70 minimum
U.S. No.4	60 minimum

Native backfill shall consist of native materials excavated at the project site during construction.

All fill materials shall be approved in advance by the CO prior to placement.

E. Imported Materials: Imported materials shall be approved by the Geotechnical Engineer prior to use. The Contractor shall give at least 10 (ten) working days' notice prior to using the imported material to enable the Geotechnical Engineer to sample and test the material. All import mate-rial shall meet the requirements of the Geotechnical Engineer for the specific purpose the mate-rial is to be used for

Earthwork and Site Grading purposes. All fill materials shall be approved in advance by the CO prior to placement.

F. Excess Material: Excess material is material deemed not suitable for use on the site. Excess material shall be disposed of only in lawfully designated areas.

G. Mounding Material: On-site soil containing organic matter considered unsuitable for fill material or topsoil may be used to construct landscape mounds and berms which do not support paving, steps or other structures.

H. Soil materials used on this Project shall not contain asbestos.

PART 3 – EXECUTION

3.1 FAMILIARIZATION

A. Prior to all work, the Contractor shall become thoroughly familiar with the site and subsurface conditions, and all portions of the work.

3.2 LINES AND LEVELS

A. Accurately lay out lines, grades, elevations and drain locations and set all necessary stakes required for the work.

B. Protect and maintain existing bench marks and control monuments and stakes and any new bench marks and control monuments and stakes that may be established.

C. Finished grades shown on Plans are given in feet and decimals of feet and are to be the top of graded or paved surfaces. Slope uniformly between given spot grades (minimum slope is 1 percent) unless otherwise indicated.

D. Transition between slopes and relatively flat areas shall be rounded and gradual.

E. Transition between changes in vertical gradient of walks and paving shall be smooth and gradual with no abrupt or sharp changes.

F. Horizontal curves and radii shall be laid out tangent to adjacent straight lines or adjacent compound curves. Curves shall be smooth and flowing.

3.3 DEWATERING

A. Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area. Do not allow water to be diverted onto adjacent properties.

B. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rainwater and water removed from excavations to

collecting or runoff areas. Do not use trench excavations as temporary drainage ditches.

C. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting of footings, and changes in soil detrimental to stability of sub-grades and foundations. Provide and maintain pumps, well points sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.

D. The Contractor shall employ sediment and erosion control measures, as necessary, so that water which is to be discharged into the street, storm drainage system, stream, channel, etc., shall be predominately free of silt and other objectionable particulate matter.

3.4 SITE PREPARATION AND EXCAVATION

A. Site preparation shall conform to Section 31 00 00 – Site Clearing.

B. Excavation:

1. Excavation is unclassified and shall be done to the lines, grades and dimensions indicated on the Drawings regardless of the character of the materials encountered.
2. When the required excavations have been made, the Geotechnical Engineer shall examine the exposed conditions. If pockets of debris, soft or weak soils are encountered at the required subgrade, carry the excavations deeper to the limits designated in the field by the Geotechnical Engineer.
3. Perform excavating of every type of material encountered within the limits of the work to the lines, grades, and elevations indicated and specified herein.
4. The top 8 inches of subgrade shall be removed and then replaced and compacted as herein specified.
5. Excavated material designated by the CO as satisfactory shall be transported to and placed in landscape embankment areas or stockpiled (for future use on this project) at a site designated by the CO.
6. Excavated material designated by the CO as unsuitable for use on this project shall be removed from Government property.
7. Excavation of rock: Where rocks, boulders, granite, concrete, or similar material is encountered, and where such material cannot be removed or excavated by conventional earth moving or ripping equipment, take required steps to proceed with the general grading operations of the work, and remove or excavate such material by means which will neither cause

additional cost to the Government nor endanger buildings or structures whether on or off the site.

C. Unauthorized Excavation:

1. Unauthorized excavation consists of removal oil materials beyond indicated subgrade elevations or dimensions without specific instruction from the CO.

2. Backfill and compact unauthorized excavations as specified for authorized excavations, unless otherwise directed by the CO.

D. Utility Removal:

1. Any abandoned buried utility pipes encountered on the site shall be capped, sealed and/or grouted closed.

E. Subgrade Compaction:

1. After the excavations have been approved by the Geotechnical Engineer, the exposed native soils shall be scarified, moisture-conditioned, and compacted to a minimum depth of 8 inches.

2. After the subgrade is compacted, fill can be placed to provide the desired finished grades.

F. Soft Subgrades:

1. Any areas where soft or pumping soils are encountered which will not allow proper com-paction should be excavated to firm soil. The areas may then be brought up to planned grade in compacted lifts not exceeding 8 inches in loose thickness. Soft Subgrades shall be prepared as directed by the soils engineer.

G. All excess clean site material not used as part of this project shall be stockpiled as directed by the CO.

3.5 PLACING AND COMPACTING FILL MATERIAL

A. All fill material shall be compacted as specified below or by other methods, if approved by the Geotechnical Engineer. Fill material shall be spread in uniform lifts of not more than 8 inches in un-compacted thickness. All fills shall be compacted to the minimum relative compactions specified in the soils report. The top 8 inches of subgrade shall be compacted to a minimum relative compaction of 95 percent in pavement areas.

B. Before compaction begins, the fill shall be moisture conditioned either by: (1) aerating the material if it is too wet; or (2) spraying the material with water if it is too dry. Each lift shall be thoroughly mixed before compaction to assure a

uniform distribution of water content. It shall be the responsibility of the Grading Contractor to attain the proper moisture content during compaction. No fill shall be placed during the rain or when saturation will hinder proper compaction. Jetting or flooding of the fill will not be permitted.

C. Place landscape embankment along walls and areas shown so as to prevent damage to the structure or drainage system.

D. Backfill excavations as promptly as progress of the work permits, but not until completion of the following:

1. Acceptance of construction below finish grade including, compaction and where applicable, damp proofing and waterproofing.

2. Inspecting, testing, approving and recording locations of underground utilities.

3. Removing trash and debris.

E. Compacting:

1. Control soil compaction during construction to provide the percentage of density specified for each area as determined according to ASTM D1557.

2. Provide not less than the following maximum density of soil material compacted at optimum moisture content for the actual density of each layer of soil material In place, and as approved by the CO.
   a. Structures: 90 percent of maximum density.
   b. Driveways and Parking Areas: 95 percent of maximum density (top 6 inches).

F. Moisture Control:

1. Where subgrade or layer of soil material must be moisture conditioned before compacting, uniformly apply water to surface of subgrade or layer of soil material to prevent free water appearing on surface during or subsequent to compacting operations.

2. Remove and replace, or scarify and air dry, soil material that is too wet to permit compacting to the specified density.

3. Soil material that has been removed because it is too wet to permit compacting may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing, or pulverizing until moisture content Is reduced to a satisfactory value as determined by moisture density relation tests approved by the CO.

3.6 TOLERANCES

A. The surface of the completed fill shall be finished true to line and grade and shall present a smooth, compacted, and unyielding surface. Depressions shall be filled and compacted and loose material shall be removed. The finished building pads shall not vary from a true horizontal plane by more than plus or minus 0.05-foot at any point. This true plane shall be not more than an average of 0.05-foot higher or lower than the elevation indicated on the plans.

B. Elevations for subgrade in streets and parking areas shall not vary from the plans by more than plus or minus 0.05-foot at any point.

C. At the completion of the grading, the CO reserves the right to retain the services of a Registered Civil Engineer or Licensed Land Surveyor to verify that the elevations are within the tolerances specified herein.

3.7 ADJUSTMENT OF EXISTING UTILITY STRUCTURES

A. Adjust tops of existing manholes, vaults, pull boxes, valve boxes, and cleanouts, to conform to new finish grades.

B. Tops of existing structures shall be adjusted to set flush with finished grades and shall conform with slope angles where possible.

C. Lids, covers, etc., shall be put into operable condition equal to the original installation.

3.8 TREATMENT AFTER COMPLETION OF GRADING

A. After grading is completed and the Geotechnical Engineer has finished his observation of the work, no further excavation or filling shall be done except with the approval of and under the observation of the Geotechnical Engineer. It shall be the responsibility of the Contractor to prevent erosion of freshly graded areas during construction and until such time as permanent drainage measures have been installed.

3.9 FIELD QUALITY CONTROL

A. Secure the CO’s inspection and approval of subgrades and fill layers before subsequent construction Is permitted thereon.

B. The following compaction tests can be expected by the Government:

1. At building pad at least four (4) tests per layer and four (4) tests for subgrade.

2. Other areas will be tested at the CO’s option.

C. If, in the CO's opinion based on reports of the testing, subgrade or fills which have been placed are below specified density, provide additional compacting.

3.10 MAINTENANCE

A. Protection of newly graded areas:

1. Protect newly graded areas from traffic and erosion, and keep free from trash and weeds.

2. Repair and reestablish grades in settled, eroded, and rutted areas to the specified tolerances.

B. Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify the surface, reshape and compact to the required density prior to further construction.

END OF SECTION

SECTION 31 31 19

WEED AND DISEASE PREVENTION

PART 1 – GENERAL

1.1 DESCRIPTION

A. This work consists of washing and treating construction equipment to remove dirt, mud, seeds, plants, and plant fragments from the equipment before the equipment is used on National Forest lands.

B. Notify the Contracting Officer in writing at least 5 days before moving any construction equipment onto National Forest System lands. Construction equipment does not include cars, pickup trucks, and other vehicles that regularly travel between the construction site and areas outside of National Forest lands.

PART 2 – PRODUCTS

2.1 HIGH PRESSURE WASHING SYSTEM

A. The Contractor shall use a washing system that utilizes high-pressure water to dislodge dirt, debris, and seeds from the equipment.

PART 3 – EXECUTION

3.1 WASHING

A. Washing shall be performed outside of the National Forest at a location pre-approved by the Contracting Officer. The Contractor shall notify the Contracting Officer 72 hours in advance that he will be washing the equipment, and provide the opportunity to monitor the washing and inspection. If the Contracting Officer is not present at the time the equipment is being washed, the Contractor shall submit written verification that the work was performed and inspected.

B. Wash the sides, tops, and undercarriages of all construction equipment. Remove all soil, mud (wet or dried), seeds, plants, plant fragments, dirt, and debris that could contain seeds from the construction equipment. Light dust that does not contain seeds is not of concern.

C. Do not mix soaps, detergents, or other chemicals with the wash water.

3.2 INSPECTION

A. Contractor shall inspect the washed construction equipment, including the undercarriage, to ensure that the washing removed the dirt, debris, and seeds from the construction equipment. Rewash the construction equipment as necessary or as directed by the Contracting Officer.

3.3 ACCEPTANCE

A. Acceptance is based on visual inspection of the work for compliance with the contract and prevailing industry standards.

END OF SECTION

SECTION 31 50 00

TRENCHING AND BACKFILLING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Refer to the General Conditions, Supplementary Conditions, and Division 1 General Requirements.

1.2 WORK INCLUDED

A. Excavate trenches for utilities and storm sewers.

B. Bedding and fill over utilities and storm sewers to subgrade elevations.

1.3 RELATED WORK

A. Related sections can include, but may not be limited to:

1. Section 31 20 00 – Earth Moving.
2. Section 31 50 00 – Trenching and Backfilling.
3. Section 32 12 16 – Asphaltic Concrete Paving and Base Material.

1.4 REFERENCES

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

B. Standard Specifications for Construction of Roads and Bridges on Federal Projects, FP-03.

1.5 CIVIL DRAWINGS

A. Geotechnical investigation report as prepared by Bengal Engineering, Inc.

1.6 PROTECTION

A. Trenching and shoring plan must be submitted for trenches over 5 feet deep and a permit from the State Division of Industrial Safety will be necessary. Comply with OSHA trenching/excavation requirements and permits.

B. Protect excavations by shoring, bracing, sheet piling, underpinning, or other methods required to prevent cave-in or loose soil from falling into excavation.

C. Notify Geotechnical Engineer of unexpected subsurface conditions and discontinue work in affected area until notification to resume work.

D. Control water in excavations as specified in Section 31 20 00 of these Specifications.

E. Grade top perimeter of excavation to prevent surface water run-off into excavation.

F. All footings located adjacent to utility trenches shall have their bearing surface below an imaginary 1 to 1 (H:V) plane projected from the bottom edge of the footing downward.

PART 2 – PRODUCTS

2.1 SELECT BEDDING AND BACKFILL MATERIALS

A. Bedding: Coarse sands and gravels with maximum particle size of 1.5 inches.

B. Bedding Material:

1. Sand shall be clean free flowing granular material, free of vegetative matter with a Sand Equivalent value of at least 30.

2. Clean naturally rounded aggregate with a mix of particle sizes not less than 1/8-inch or greater than 1/2-inch. This material is commonly called pea gravel.

C. The remaining trench backfill material shall be on -site or imported materials meeting the requirements for "general fill" or "select fill" specified in Section 31 20 00.

PART 3 – EXECUTION

3.1 GENERAL

A. Trenching shall be performed to the lines, grades, and dimensions shown on the drawings to provide the minimum required cover and separation between lines. Excavation shall be considered unclassified regardless of material encountered.

B. Existing Utilities: Prior to beginning trenching, the Contractor shall locate all existing underground utilities intersecting or parallel to the trench. Existing utilities shall be located by means of an electronic pipe and cable locator and the location identified by spray painting the ground surface.

C. Responsibility for Utilities: Any existing underground utilities identified on the plans or identified by the Contractor, as required above, shall be repaired or replaced at no additional cost to the Government if damaged.

D. Saw Cutting: Before trenching through concrete, asphalt concrete, chip sealed or oiled areas, the edges of all trenches shall be saw cut to sharp clean vertical edges.

E. Excavated Material: Trench excavation shall be placed in a neat pile adjacent to the trench a sufficient distance to prevent cave ins. Spoils pile shall not obstruct traffic. Excess excavation or excavation not suitable for backfill shall be hauled off Government land.

F. Bedding: All pipes shall be bedded in sand as shown on the drawings.

G. Backfill: Native material may be used as backfill as shown on the drawings provided it contains no rocks larger than 6 inches in greatest dimension. Native backfill shall be compacted in 12-inch loose measure lifts to 85 percent (ASTM D-1557), except in paved areas where backfill shall be compacted to 90 percent and 95 percent at the top 6 inches (ASTM D-1557) and placed in 6-inch lifts.

H. Concrete (if applicable): Concrete shall be replaced when trenching through concrete walkways. Concrete shall conform to the requirements of Section 03 30 00.

I. Asphalt Concrete (if applicable): Asphalt concrete shall be replaced when trenching through asphalt concrete. Asphalt concrete shall conform to the requirements of Section 31 12 16 – Asphaltic Concrete Paving and Base Material.

3.2 INSPECTION

A. Verify that stockpiled materials to be reused are acceptable.

B. Verify that areas to be backfilled are free of debris or water.

C. Contractor shall submit samples of proposed backfill materials for testing and approval. Submit samples to the Geotechnical Engineer at least one (1) week prior to intended placement.

3.3 PREPARATION

A. Identify required lines, levels, contours, and datum.

B. When necessary, compact subgrade surfaces to density requirements for backfill material.

3.4 EXCAVATION

A. Cut trenches sufficiently wide to enable installation of utilities and allow inspection.

B. Hand trim excavation and leave free of loose matter.

C. Excavate subsoil required for underground pipe.

D. Remove lumpy subsoil, boulders and rocks not meeting the gradation requirements for general fill defined in Section 31 20 00 of these Specifications.

E. Fill over-excavated areas under pipe-bearing surfaces with materials meeting the requirements for general fill as defined in Section 31 20 00 of these Specifications.

F. If excess excavated material from trenches is suitable for embankment construction, incorpo-rate it into embankments. Dispose of unsuitable earth material off-site.

G. Correct unauthorized excavation as directed by the Geotechnical Engineer.

3.5 BACKFILLING

A. Support pipe during placement and compaction of bedding.

B. Backfill trenches to the contours and elevations on the Drawings. Do not backfill over wet or spongy subgrade surfaces. Maintain ground water levels at least 2 feet below base of trench until bedding and backfilling have been completed.

C. Place and compact trench bedding and backfill material in uniform, horizontal layers not exceeding 8 inches in uncompacted thickness.

D. Placement and compaction of trench backfill shall be performed only during the presence of the Geotechnical Engineer or, if absent, only with his approval. All utility trenches shall be back-filled with compacted structural fill. If on -site soil is used (and approved by the Geotechnical Engineer), the material shall be placed in lifts not exceeding 8 inches in uncompacted thickness by mechanical means only. Due to the varying soil conditions, compaction requirements should be set forth based on the Compaction Recommendations in the geotechnical report prepare d by Bengal Engineering Inc. Water jetting to attain the minimum required degree of compaction will not be allowed. Trench cut-off plugs shall be of impermeable material.

E. Where granular backfill is used in trenches and/or the perimeter of the building footprint, a cut-off plug 2 feet wide of impermeable material shall be placed where trenches enter the pavement areas.

F. Leave stockpile areas completely free of excess fill materials at completion of contract.

END OF SECTION

SECTION 32 11 00

BASE COURSES

PART 1 – GENERAL

1.1 1.1 SUMMARY

A. Furnish all labor, materials, equipment, facilities, transportation and services to complete all base course preparation, installation and related work as shown on the Drawings and/or specified herein.

B. Scope of Work: The general extent of the base course work is shown on the Drawings and may include, but is not necessarily limited to, the following:

1. Grading and compaction of subgrade soil for areas to receive pavement, structures, base material, etc.

2. Furnishing and placing of aggregate base material.

C. Related sections can include, but may not be limited to:

1. Section 31 20 00 – Earthwork.

2. Section 32 12 16 – Asphalt Concrete Paving and Base Material.

1.2 REFERENCES AND REGULATORY REQUIREMENTS

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

B. Standard Specifications for Construction of Roads and Bridges on Federal Projects, FP-03.

C. Civil Drawings.

D. Geotechnical investigation report as prepared by Bengal Engineering, Inc.

1.3 SUBMITTALS

A. Conform to the requirements of Section 01 30 00 and/or applicable Division 1 and Division 2 Specifications, General Conditions, and Special Provisions.

B. Submit material certificates of compliance and/or sieve analyses for all products and materials proposed to be used in work covered by this Section.

1.4 QUALITY ASSURANCE

A. A Geotechnical Engineer will be retained by Contractor to observe performance of work in connection with excavating, filling and grading.

B. Observations by the Geotechnical Engineer will be made during the earthwork and grading operations to verify that the work was performed in accordance with accepted specifications. The Contractor is required to notify the Geotechnical Engineer 48 hours prior to performing any work associated with clearing, grubbing, grading, excavation, backfilling, or interruption of utilities.

C. Adjust all work performed that does not meet technical or design requirements, but make no deviations from the Contract Document s without specific and written acceptance by the CO.

1.5 1.5 PROJECT/SITE CONDITIONS

A. Wet Conditions: No subgrade preparation or base material placement shall occur when excessively wet conditions exist in the opinion of the CO.

B. Dry Conditions: Contractor shall provide dust control shall provide water to subgrades and base courses as necessary to achieve compaction goals.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Materials shall be stockpiled on site in locations that, in the opinion of the contractor, cause least interference with construction operations and as acceptable to the CO.

B. Materials shall not be stockpiled in proposed planting areas.

C. Protect materials from segregation, contamination and wind and water erosion.

1.7 SEQUENCING AND SCHEDULING

A. Work of this section shall not proceed until all underground utilities and irrigation sleeving has been installed and accepted.

B. Contractor shall schedule work so that installation of paving/surfacing occurs no later than five (5) working days after placement and proper compaction of base materials. Base materials left un-paved longer than this time period shall be subject to testing and re-compaction at the contractor’s expense.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Where Class 2 Aggregate Base (R=78) is indicated on the Plans, aggregate base shall conform to Class 2 aggregate base 1-1/2-inch maximum size, as specified in Section 26 of the Caltrans Standard Specifications.

PART 3 – EXECUTION

3.1 SUBGRADE PREPARATION

A. Preparation of subgrade shall conform to Section 6 of the Standard Specifications and as described in Section 31 20 00 – Earth Moving.

B. Remove unsuitable subgrade material as necessary and replace with suitable material or aggregate base per the discretion of the CO.

3.2 BASE MATERIAL PLACEMENT

A. Conform to Section 31 50 00 – Trenching and Backfilling.

B. Obtain acceptance of subgrade preparation work prior to placing base material thereon.

C. Place and compact base material in 6-inch maximum lifts unless otherwise noted. Compaction shall be at least 95 percent relative compaction.

D. Base material shall be moisture conditioned to between optimum and 3 percent above optimum prior to placement and compaction.

3.3 TOLERANCES

A. Conform to Section 31 50 00 – Trenching and Backfilling and the CIVIL DRAWINGS, unless more stringent requirements in these Contract Documents are provided, in which place the more stringent tol-erances shall govern.

3.4 CLEAN-UP OF WORK AREA

A. The contractor shall remove and legally dispose of excess materials/spoils and debris from the job site on a daily basis.

3.5 PROTECTION OF FINISHED PRODUCT

A. The contractor shall provide lighted barricades, signs and other devices as necessary to prevent damage to finished base courses.

END OF SECTION

SECTION 32 12 16

ASPHALTIC CONCRETE PAVING & BASE MATERIAL

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Refer to the General Conditions, Supplementary Conditions, and Division 1 General Requirements.

1.2 WORK INCLUDED

A. Prepare sub-grade to receive base course.

B. Place stabilizing base courses, work and compact.

C. Prime base course, place asphalt pavement, apply seal coat.

1.3 RELATED WORK

A. Related sections can include, but may not be limited to:

1. Section 31 20 00 – Earth Moving.
2. Section 31 50 00 – Trenching and Backfilling.

1.4 REFERENCES

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

B. Standard Specifications for Construction of Roads and Bridges on Federal Projects, FP-03.

1.5 CIVIL DRAWINGS

A. Geotechnical investigation report as prepared by Bengal Engineering, Inc.

1.6 SUBMITTALS

A. The CO shall be provided with two (2) copies of material certificates signed by the material producer and the Contractor, certifying that each material item complies with, or exceeds specified requirements.

B. The Contractor shall furnish the Owner a certified weight or load slip for each load of material used in the construction of the asphaltic concrete pavement.

1.7 TESTING AND INSPECTION

A. Testing and inspection of asphaltic pavement mix and testing of the in-place, stabilizing base course and asphaltic pavement will be performed by an independent Testing Laboratory. Testing and inspection will be performed in a manner to minimize disruption to work.

B. Allow agents of the Testing Laboratory access to the mixing plant for verification of weights or proportions, character of materials used and determination of temperatures used in the preparation of asphaltic concrete mix.

C. When and if required, the Testing Laboratory will perform laboratory tests on proposed asphalt pavement mixes to determine conformity with requirements.

D. The Testing Laboratory will perform one series of compaction tests for the stabilizing base course and for asphalt pavement. Payment for costs of additional testing required due to improper performance of work will be borne by the Contractor.

E. When the stabilizing base course or a portion thereof has been placed and compacted in accordance with requirements, notify the Testing Laboratory to perform density tests. Do not place asphalt pavement until results have been verified and base course installation approved.

F. If compaction tests indicate that the stabilizing base course or asphalt paving do not meet Specifications, remove defective work, replace and retest at Contractor's expense.

1.8 PROJECT CONDITIONS

A. Asphaltic Concrete Paving: Asphaltic concrete surfaces shall be constructed only when ambient temperature is above 40 deg and when base is dry.

PART 2 – PRODUCTS

2.1 PAVING MATERIALS

A. Where Class 2 Aggregate Base (R=78) is indicated on the Plans, aggregate base shall conform to Class 2 aggregate base 1-1/2-inch maximum size, as specified in Section 26 of the Caltrans Standard Specifications.

B. Asphaltic Concrete Paving:

1. Paving asphalt to be mixed with aggregate shall be steam refined asphalt, AR-4000, conforming to Section 92 of the Caltrans Standard Specifications.

2. Aggregate shall be Type B aggregate as specified in Section 39 of the Caltrans Standard Specifications.

3. Maximum aggregate size shall be as follows: The aggregate for the surface course shall conform to the grading for 1/2-inch Maximum, Medium;" "Contract Compliance" column as shown in Section 39 of Caltrans Standard Specifications. The structural section AC surface course shall be placed in 1-1/2 inches thick lifts.

4. Liquid asphalt for prime coat shall be Grade SC-70 in conformance with Section 93 of the Caltrans Standard Specifications.

5. Asphaltic emulsion for paint binder and fog seal coat shall be emulsified asphalt, Type SS-1h, conforming to Section 94 of the Caltrans Standard Specifications.

PART 3 – EXECUTION

3.1 PREPARATION

A. The top 12 inches of subgrade shall be scarified and compacted to 95% relative compaction.

B. Aggregate base shall be compacted to 95 percent as determined by ASTM D1557. Comply with Sections 26-1.04B and 26-1.05 of the Caltrans Standard Specifications. Redwood Header is required wherever asphalt is set adjacent to or through unpaved areas.

3.2 ASPHALTIC CONCRETE PAVING

A. General:

1. Asphaltic concrete shall be proportioned, mixed, placed, spread and compacted in conformance with Section 39 of Caltrans Standard Specifications.

2. Before placing asphaltic concrete on an untreated base, a liquid asphalt prime coat shall be applied to the base course in conformance with Section 39 of Caltrans Standard Specifications. Prime coat shall be applied at the rate of 0.25 gallons per square yard.

3. Before placing asphaltic concrete, an asphaltic emulsion tack coat (paint binder) shall be applied to all vertical surfaces of existing pavement, curbs, gutters, construction joints and all existing pavement to be surfaced, in conformance with Section 39 of Caltrans Standard Specifications.

4. Spreading and compacting asphaltic concrete shall be performed in accordance with Section 39 of the Caltrans Standard Specifications.

5. Fog seal shall be applied to all finished surface of asphaltic concrete pavement in accordance with Section 37 Caltrans Standard Specifications, at a rate of 0.05 gallons per square yard.

6. After the fog seal has been applied, ample time shall be allowed for drying before traffic is allowed on the pavement or paint striping is applied.

7. Compaction equipment shall meet the requirements of FP-03.

3.3 PAVEMENT MARKING

A. As specified in Section 32 12 17.

3.4 FIELD QUALITY CONTROL

A. Aggregate Base: The surface of finished aggregate base shall vary by no more than an average of 0.05 feet above or below the grade shown on the drawings.

B. Asphaltic Concrete Paving:

1. The finished asphalt pavement, where not controlled by adjacent structures or features, shall not vary more than 0.05 feet above or below the planned grade; it shall be uniform and free of sharp breaks.

2. The cross section of the finished pavement shall be free of ridges and valleys and shall not vary more than 0.03 feet above or below the theoretical section at any point on the cross section.

3. The specified thickness of the finished pavement shall be the minimum acceptable.

4. Conforms shall form a smooth, pond-free transition between existing and new pavement.

C. Acceptance testing of the compacted bituminous mixture for surface and thickness tolerance will be as follows:

1. Surface: Acceptance testing will be performed on the top surface. The surface will be tested by the CO with a 10-foot straightedge. The variation of the surface from the testing edge of the straightedge shall not deviate at any point more than 1/8-inch.

2. Thickness: The total compacted thickness of the mixture shall not vary more than 1/4-inch less than or 1/2-inch greater than the specified thickness. The compacted thickness shall not be consistently below nor consistently above the specified thickness.

3. The CO reserves the right to test areas that appear defective and require immediate correction.

3.5 FRAMES, COVERS, GRATES, AND VALVE BOXES

A. Frames, covers, grates and valve boxes of existing manholes, inlets, or other facilities shall be adjusted to grade in conformance with Section 15 of the Caltrans Standard Specifications.

B. All structures located in the pavement area shall not be constructed to final grade until the adjacent pavement or surfacing has been compacted.

3.6 CLEANUP

A. Surplus material remaining upon completion of fog sealing operations shall become the property of the Contractor and be removed from the Work site and disposed of in a lawful manner.

B. All sealed surfaces shall be left in a clean, neat, and workman like condition, and all construction waste, rubbish, and debris shall be removed from the Work site and disposed of in a lawful manner.

END OF SECTION

SECTION 32 12 17

PAVEMENT MARKING AND ACCESSORIES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Refer to the Civil Drawings and Division 1 General Requirements and refer to the Project's Geotechnical Investigation prepared by Bengal Engineering, Inc. for additional requirements and specifications.

1.2 DESCRIPTION

A. Work Included:

1. All labor, materials, tools, equipment, transportation and temporary construction of any nature necessary for a complete operational installation of all pavement markings and accessories work shown on the Drawings and specified herein.

B. Related Work Specified Elsewhere:

1. Section 32 12 16 – Asphaltic Concrete Paving and Base Material.

1.3 REFERENCES

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

B. Standard Specifications for Construction of Roads and Bridges on Federal Projects, FP-24.

1.4 CIVIL DRAWINGS

1.5 PROJECT CONDITIONS

A. Specifications, standards, tests and recommended methods cited in the above referenced specifications shall determine quantity and quality of materials and methods unless specifically designated otherwise.

B. Reference to makers, brands, models, etc. is to establish type and quality desired; substitution of equals will be permitted upon approval by the CO.

PART 2 – PRODUCTS

2.1 TRAFFIC PAINT

A. Traffic paint shall conform to or exceed the standards set forth by the State of California Materials and Research Department. Common brands are: Kelly Moore No. 2130, Crown Products, DeSoto and Bauer.

B. All paint shall be thoroughly mixed prior to placing in painting equipment.

2.2 WHEELSTOPS

A. Wheel stops shall be precast concrete, shop-fabricated 3 feet 0 inches long, where shown on the drawings.

PART 3 – EXECUTION

A. Types of Traffic Paint:

1. White:
   a. Solid 4-inch line: edge lines, parking stalls.
2. Blue:
   a. Solid 4-inch line: accessible parking stalls.
   b. Blue curb: accessible parking stalls.
   c. Pavement Markings: international symbol of accessibility.
3. Red:
   a. Red curb: no parking lanes for fire access.

B. Rates of Application:

1. All new surfaces shall have the traffic paint applied in two applications. The first or priming coat of paint is the wearing surface and the rates of application are shown in Table 1.
2. Restriping where indicated on the drawings, shall coincide with the original painting and shall be applied in one application at the rates indicated in Table 1.
3. All surfaces to be painted shall be clean and dry prior to painting. Ample time shall be allowed between the asphalt pavement seal coat and the initial painting application. Usual-ly the drying time of the seal coat is approximately three to four (3 to 4) days, depending upon weather conditions. There shall be a minimum drying time between paint applications of approximately 20 minutes.
4. Rates of Application:
   a. Solid Stripe (4 inches wide):

1) New surface (first coat) 12 to 14 gallons per mile, 1 gallon per 125 to 150 square feet of line.
2) Second coat or restriping 16 to 18 gallons per mile, 1 gallon per 100 to 110 square feet of line.

b. Pavement Markings:
1) New surface (first coat): 1 gallon per 100 square feet of area.
2) Second coat or restriping: 1 gallon per 100 square feet of area.

5. The Contractor shall provide sufficient evidence to the CO that the quantity of paint specified has been applied to the job. Such evidence can be invoice tickets made out to the specific job, counting empty paint cans, or a method acceptable to the CO.

6. Striping shall not be applied at temperatures below 40 degrees F or if pavement surfaces are wet.

7. The alignment of all striping shall be accurately laid out. Lines which do not conform to the alignment as set forth in the Drawings, or which have a wavy appearance, shall be removed and replaced by the Contractor at his expense.

3.1 REMOVAL OF STRIPES

A. All stripes and pavement markings not in conformance with the proposed striping plan shall be removed by sandblasting. Painting-out black paint will not be allowed unless specifically indicated on the Drawings. In slurry seal and asphalt concrete overlay areas, painted stripes and markings need not be removed prior to sealing or overlay operations; all thermoplastic material and raised pavement markers shall be removed prior to slurry seal or overlay application.

B. After removal of paint, apply fog seal coat of SS-lh emulsified asphalt per Section 94 of the CDT Standard Specifications to all asphalt surfaces affected by the removal operations. The fog seal coat must be given ample time to dry prior to the initial painting application.

END OF SECTION