National Aeronautics and
Space Administration

George C. Marshall Space Flight Center
Marshall Space Flight Center, Alabama 35812

FAC-M5054

CONSTRUCTION SPECIFICATIONS

FOR

REVITALIZE ELECTRICAL SYSTEM AT BUILDING 4619

GEORGE C. MARSHALL SPACE FLIGHT CENTER

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

MARSHALL SPACE FLIGHT CENTER, AL

Approval: _____ **Date:** 10/24/13
Lead, Facilities Engineering Office

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SECTION 01 00 10 — SCOPE AND DESCRIPTION

PART 1 - GENERAL

1.1 SCOPE

A. The work to be performed under this project consists of providing the labor, equipment, and materials to perform the upgrade, replacement or removal of most of the electrical distribution equipment for building 4619 at Marshall Space Flight Center in Huntsville, Alabama. This effort shall include:

1. Upgrade and replacement of all secondary cabling, switchboards, panel boards, transformers, motor control centers, switchgear, and disconnect switches as shown on construction drawings FAC-GO-4619.

2. New panel boards will be installed at existing panel board locations to facilitate connections to existing branch circuits. New switchboards will be installed as close to the existing system as possible to facilitate easy switch over from the old system to the new system. The transition will be completed during off-peak hours.

3. Existing services 2, 3, 4 and 5 and are to be replaced; existing service 1 will be removed. Service 7 will have the feeder replaced and service 6 has no work to be done at this time.

4. Feeders to the new services and panels fed from new services shall have a parallel feed run to each location to provide a seamless and off-peak hour change over. After the new services is in proper working order the existing feed and equipment shall be removed.

1.2 DESCRIPTION

A. This request for proposal (RFP) is a bid-build (BB), full and open competition contract for construction.

B. The following are identified as an Additive Alternate for the Project:

#1 – Replace bus duct, bus plugs and reconnect existing wire in the West Bay.

#2 – Replace bus duct, bus plugs and reconnect existing wire in the East Bay.

#3 – Replace bus duct, bus plugs and reconnect existing wire in the LTA.

#4 – Replace indoor dry-type transformers as shown on drawings and schedules.

1.3 APPLICABLE DOCUMENTS

A. The publications of the issues of referenced documents in effect on the date of issuance of invitation for bids form a part of this specification and, where referred to herein by basic designation only, are applicable to the extent indicated by the references thereto. In the event of difference between this specification or its accompanying drawings and the referenced document, this specification and its accompanying drawings shall govern to the extent of such difference.

1.4 CONTRACT DRAWINGS

A. The following drawings accompany this specification and are a part thereof. The Contractor shall check all drawings and specifications for construction interferences, detail misdescriptions, dimensional errors, and other conflicts and shall promptly notify the Contracting Officer of any discrepancies utilizing a "Request for Information." The Contracting Officer shall make a written interpretation.

REF. NO.	SHEET TITLE	DRAWING NO.	REV.
G001	COVER SHEET & INDEX OF DRAWINGS	FAC-GO-4619-G001	
E001	GENERAL NOTES, ABBREVIATIONS, & LEGEND	FAC-GO-4619-E001	
E002	PHASING PLAN - BASEMENT & 1ST FLOOR	FAC-GO-4619-E002	
E003	UNDERGROUND UTILITY SITE PLAN	FAC-GO-4619-E003	
E004	SECTIONS AND SITE CONDITIONS	FAC-GO-4619-E004	
E101	PANELS & SWBDS SUB FLOOR PART A	FAC-GO-4619-E101	
E102	PANELS & SWBDS SUB FLOOR PART B	FAC-GO-4619-E102	
E103	PANELS & SWBDS SUB FLOOR PART C	FAC-GO-4619-E103	
E104	PANELS & SWBDS 1ST FLOOR PART A	FAC-GO-4619-E104	
E105	PANELS & SWBDS 1ST FLOOR PART B	FAC-GO-4619-E105	
E106	PANELS & SWBDS 1ST FLOOR PART C	FAC-GO-4619-E106	
E107	PANELS & SWBDS 1ST FLOOR PART D	FAC-GO-4619-E107	
E108	PANELS & SWBDS 1ST FLOOR PART E	FAC-GO-4619-E108	
E109	PANELS & SWBDS 1ST FLOOR PART F	FAC-GO-4619-E109	
E110	PANELS & SWBDS 2ND FLOOR PART A & B	FAC-GO-4619-E110	
E111	PANELS & SWBDS 2ND FLOOR PART C	FAC-GO-4619-E111	
E112	PANELS 3RD FLOOR	FAC-GO-4619-E112	
E113	PANELS 4TH FLOOR	FAC-GO-4619-E113	
E114	PANELS 5TH FLOOR	FAC-GO-4619-E114	
E115	PANELS 6TH FLOOR	FAC-GO-4619-E115	
E116	CROSSHEAD PANELS	FAC-GO-4619-E116	
E201	DISC SUB FLOOR PART A	FAC-GO-4619-E201	
E202	DISC SUB FLOOR PART B	FAC-GO-4619-E202	
E203	DISC & BUS DUCT 1ST FLOOR PART A (ADD ALT #2)	FAC-GO-4619-E203	
E204	DISC & BUS DUCT 1ST FLOOR PART B (ADD ALT #2)	FAC-GO-4619-E204	
E205	DISC & BUS DUCT 1ST FLOOR PART C (ADD ALT #1 & #3)	FAC-GO-4619-E205	

REF. NO.	SHEET TITLE	DRAWING NO.	REV.
E206	DISC & BUS DUCT 1ST FLOOR PART D (ADD ALT #1)	FAC-GO-4619-E206	
E207	DISC & BUS DUCT 1ST FLOOR PART E (ADD ALT #1)	FAC-GO-4619-E207	
E208	DISC 2ND FLOOR PART A & B	FAC-GO-4619-E208	
E209	DISC 2ND FLOOR PART C	FAC-GO-4619-E209	
E210	DISC 6TH FLOOR	FAC-GO-4619-E210	
E211	DISC 8TH FLOOR	FAC-GO-4619-E211	
E301	ONE LINE BUS DUCT EAST BAY DEMO (ADD ALT #2)	FAC-GO-4619-E301	
E302	ONE LINE BUS DUCT EAST BAY NEW WORK (ADD ALT #2)	FAC-GO-4619-E302	
E303	ONE LINE BUS DUCT LTA AREA DEMO (ADD ALT #3)	FAC-GO-4619-E303	
E304	ONE LINE BUS DUCT LTA AREA NEW WORK (ADD ALT #3)	FAC-GO-4619-E304	
E305	ONE LINE BUS DUCT WEST BAY PART A DEMO (ADD ALT #1)	FAC-GO-4619-E305	
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E408	ONE LINE SERVICE #5 DEMO	FAC-GO-4619-E408	
E409	ONE LINE SERVICE #5 NEW WORK	FAC-GO-4619-E409	
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E411	ONE LINE SERVICE #7 EXISTING TO REMAIN	FAC-GO-4619-E411	
E501	SERVICE #2, #3 & #4 RISER DIAGRAMS	FAC-GO-4619-E501	
E502	SERVICE #5, #6 & #7 RISER DIAGRAMS	FAC-GO-4619-E502	
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E705	PANEL SCHEDULES	FAC-GO-4619-E705	
E706	PANEL SCHEDULES	FAC-GO-4619-E706	
E707	PANEL SCHEDULES	FAC-GO-4619-E707	

REF. NO.	SHEET TITLE	DRAWING NO.	REV.
E708	PANEL SCHEDULES	FAC-GO-4619-E708	
E709	PANEL SCHEDULES	FAC-GO-4619-E709	
E710	PANEL SCHEDULES	FAC-GO-4619-E710	
E711	PANEL SCHEDULES	FAC-GO-4619-E711	
E712	PANEL SCHEDULES	FAC-GO-4619-E712	
E713	PANEL SCHEDULES	FAC-GO-4619-E713	
E714	PANEL SCHEDULES	FAC-GO-4619-E714	
E715	PANEL SCHEDULES	FAC-GO-4619-E715	
E716	PANEL SCHEDULES	FAC-GO-4619-E716	
E717	PANEL SCHEDULES	FAC-GO-4619-E717	
E801	SWITCHBOARD SCHEDULES	FAC-GO-4619-E801	
E802	PANLES & MCC SCHEDULES	FAC-GO-4619-E802	
E803	DISCONNECT SCHEDULES	FAC-GO-4619-E803	
E804	DISCONNECT SCHEDULES AND TRANSFORMER SCHEDULES	FAC-GO-4619-E804	
E805	TRANSFORMER SCHEDULES (ADD ALT #4)	FAC-GO-4619-E805	
UCS1	BASEMENT - UCS FLOOR PLAN, COMM TRUNK LAYOUT AND NOTES	FAC-GO-4619-EUCS1	
UCS2	1ST FLOOR UCS FLOOR PLAN. AND TRUNK LAYOUT	FAC-GO-4619-EUCS2	

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 00 10

SECTION 01 05 90 — SPECIAL CONDITIONS

PART 1 - GENERAL

1.1 SUBMITTALS

The following shall be submitted in accordance with Section 013300, "Submittal Procedures," in sufficient detail to show full compliance with the specification.

A. Plan for maintaining roof watertight integrity.

B. List of Government-furnished property or equipment identifying the condition of and quantities as received.

C. Contractor’s e-mail address and emergency contact information, including cell phone numbers, home phone number and pager numbers for all key personnel and the business owner.

D. Traffic control plans.

E. Photographs of temporary structures to be brought on Center by the Contractor.

F. Notices for work above Federal Aviation Administration height limits.

G. UXO/CWM work/safety plan and certifications of UXO/CWM personnel.

1.2 CONTRACTOR’S WORKING DRAWINGS

A. It shall be the Contractor's responsibility to develop all necessary working drawings for installation of piping, ductwork, conduit, fixtures, and equipment. Design drawings are not intended to eliminate all dimensional conflicts in routing or location of piping, ductwork, conduit, fixtures, equipment, etc. but shall show only the general arrangement. Use of design drawings for working drawings will be at the Contractor's risk, and changes required in installed work due to failure of Contractor to develop working drawings shall be accomplished at no additional cost to the Government. Prefabricated items shall have working dimensions to accommodate the actual field dimension of earlier-installed items. The Contractor shall carefully investigate all structural, mechanical, electrical, architectural, and finish conditions affecting all his work and shall coordinate and resolve all dimensional conflicts.

1.3 COOPERATION WITH OTHERS

A. During the life of this contract it is anticipated that other contractors will be performing operations in the general area where work under this contract is being performed. The Contractor shall cooperate in all respects wherever necessary for the better prosecution of the work.

1.4 EXPLOSIVE AND DISPOSAL AREA PRECAUTION

A. The possibility exists that materials of unexploded ordnance (UXO) could be encountered on NASA/MSFC property. In most areas, the potential for these occurrences is small. However, if materials resembling and suspected to be UXO are discovered in a work area immediately stop all work, cordon off or barricade suspect area, withdraw from the area, contact the Fire Department at 911, the Contracting Officer, and the Facilities Maintenance Organization (FMO) COTR and inform them of the findings. Then, post temporary barriers to prevent personnel entry into the area and remain near the site at a safe distance from the suspected UXO until the Contracting Officer or COTR takes charge of this activity. The Contracting Officer or COTR will then arrange for investigation and safe disposal of suspect material. Upon clearance from the Contracting Officer or COTR, work may then be resumed in the area.

B. Some areas are known to have formerly been utilized for ordnance related manufacturing, delivery, storage, and/or disposal activities. These areas are identified on the "Army and NASA Site Access Control Boundaries" map. When work is to be accomplished in the areas designated on the map as "Facilities Precautionary UXO Area" or as "UXO/CWM Probability 'Occasional', 'Remote', or 'Seldom'", prior to beginning construction, contractor shall procure the services of a UXO services provider (qualified for the project-specific requirements as shown on the drawings) for initial investigation and characterization, and then a remediation recommendation, required when suspect material is detected. Upon receipt of a report that states potential UXO was detected during investigation, the Contracting Officer or COTR will then arrange for disposition of suspect material. UXO services provider shall employ personnel with skills that meet applicable minimum qualification requirements contained in the U.S. Army Corps of Engineers document, "Attachment to Chapter 20, EP 1110-1-18, Ordnance and Explosives Response, UXO Personnel Training and Experience Hierarchy", at the end of this Section. UXO services provider shall submit for approval documentation that includes the number and names of employees to be utilized for the effort and their corresponding levels of training and experience, including copies of certifications and/or other qualifying paperwork. Additionally, UXO services provider shall have a work plan and a safety plan approved by NASA MSFC prior to initiating job activities. Alternately, when working under a prime contractor, UXO investigation work and safety plan requirements may be included in the prime contractor's work and safety plans. Questions concerning UXO operations and work plans may be addressed to the Contracting Officer or the COTR. Prior to commencing UXO investigation that requires disturbing the soil, obtain a digging permit from the Contracting Officer or the COTR.

C. The Contractor shall be responsible for alerting personnel under his authority, including subcontractor personnel, when the site of work is located on a site known to have had former ordnance activity.

D. The "Army and NASA Site Access Control Boundaries" map, showing the areas at MSFC which have the potential to contain UXO, is available for reference. Contact the Contracting Officer or COTR to obtain this information.

1.5 CHEMICAL WARFARE MATERIAL PRECAUTION

A. The possibility exists that chemical warfare material (CWM) could be encountered on NASA/MSFC property. In most areas, the potential for these occurrences is small. However, if such materials are suspected in a work area, immediately stop all work, cordon off or barricade suspect area, withdraw from the area, contact the Fire Department at 911, the Contracting Officer, and the FMO COTR, and inform them of the findings. Then, remain near the site at a

safe distance from the suspected CWM, and post temporary barriers to prevent personnel entry into the area until the Contracting Officer or COTR takes charge of this activity. The Contracting Officer or COTR will then arrange for investigation and safe disposal of suspect material. Upon clearance from the Contracting Officer or COTR, work may then be resumed in the area.

B. Some areas are known to have formerly been utilized for chemical warfare related manufacturing, delivery, storage, and/or disposal activities. These areas are identified on the "Army and NASA Site Access Control Boundaries" map. When work is to be accomplished in the areas designated on the map as "UXO/CWM Probability 'Occasional', 'Remote', or 'Seldom'", prior to beginning construction, contractor shall procure the services of a CWM services provider (qualified for the project-specific requirements as shown on the drawings) for initial investigation and characterization, and then a remediation recommendation, required when suspect material is detected. Upon receipt of a report that states potential CWM was detected during investigation, the Contracting Officer or COTR will then arrange for disposition of suspect material. CWM services provider shall meet applicable minimum qualification requirements for the work to be performed. CWM services provider shall submit for approval documentation that includes the number and names of employees to be utilized for the effort and their corresponding levels of training and experience, including copies of certifications and/or other qualifying paperwork. Additionally, CWM provider shall have a work plan and a safety plan approved by NASA MSFC prior to initiating job activities. Alternately, when working under a prime contractor, CWM work and safety plan requirements may be included in the prime contractor's work and safety plans. Questions concerning CWM operations and work plans may be addressed to the Contracting Officer or COTR. Prior to commencing CWM investigation that requires disturbing the soil, obtain a digging permit from the Contracting Officer or COTR.

C. The Contractor shall be responsible for alerting personnel, including subcontractor personnel, when the site of work is located on a site known to have had former CWM activity.

D. The "Army and NASA Site Access Control Boundaries" map, showing the areas at MSFC which have the potential to contain CWM, is available for reference. Contact the Contracting Officer or COTR to obtain this information.

1.6 SECURITY

A. The Contractor shall conform to security procedures as directed by the Contracting Officer. Additional information will be provided at the preconstruction meeting and as changes occur during the contract period. Status of Center access is available by calling (256)544-HELP.

B. Center Entry and Vehicles: Entry security at the Center is critical to effect a safe environment. All personnel, vehicles, equipment, and materials are subject to search, investigation, and authorization at each entry and while on Center. Construction vehicles and trucks delivering large equipment and materials, including concrete trucks, shall enter the Center via Gate 1 or 10 or as directed by the Contracting Officer. Significant entry delays should be expected, particularly at higher security levels, so the Contractor is responsible for keeping himself apprised of security conditions and entry requirements at the Center and notifying his contract personnel of changes in order to prosecute contract work in a timely manner without delay. All vehicles must have proof of valid registration and insurance residing in the vehicle at all times

and shall show such proof to security personnel on demand and in order to obtain a vehicle pass.

C. Personnel Identification and Badging: All personnel shall be able to show proof of United States citizenship and have on their person, valid Government-issued picture identification such as a driver's license. All Contractor personnel, including subcontractor and visitor personnel, shall have and display on their person a badge issued by Center security at all times. Center security has the right to not issue, confiscate, or change any badge. The Contractor is responsible for assuring each individual working under this contract is immediately badged in the first instance, continually wears and displays a valid badge, has only the necessary access permissions, and returns the badge to Center security upon completion of their work just prior to leaving the Center. All personnel requiring access to the Center by the Contractor shall possess either a visitor's badge or picture badge issued by Center security at Building 4312. All Contractor personnel requiring access to the east or west test areas must receive test area access training provided by MSFC.

D. Any person on Center failing to have in their possession a valid badge or operating a vehicle without a valid pass is ultimately subject to arrest and further legal action.

1.7 SPECIAL CONSIDERATIONS FOR SPECIAL HOURS OF WORK

A. Reference contract Section H attached to Standard Form 1442 – "Solicitation, Offer, and Award" – regarding "Hours of Work" therein. The following are clarifications and additional requirements necessary to perform work at the Marshall Space Flight Center (MSFC).

1. "Duty Hours" shall be considered to be 7:00 a.m. to 5:00 p.m., Monday through Friday, excluding Government holidays. All other times shall be considered "Non-Duty Hours."

2. The Contractor shall only schedule and plan contract performance during "Duty Hours,", unless specific allowances are made elsewhere herein for specific activities that may be required to be performed during "Non-Duty Hours."

3. The Contractor shall make all requests to work during "Non-Duty Hours" by 9 AM of the day before the requested work period begins. The Contracting Officer must approve any work activities during "Non-Duty Hours" prior to the start of work for the period requested." These requests will typically be denied unless justifiable by outages, road crossings, hazardous operations, coordination with Government operations, and/or facility or subsystem need date.

4. All items above as well as all other Special Conditions of Section 010590 shall be factored into the Contractor's scheduling of work to meet the contract's performance period at no additional cost to the Government after contract award.

5. The Contractor may be prohibited from working in the east and west test areas approximately two days per week during hazardous testing operations. The Government typically issues a tentative weekly schedule on the Friday preceding a week which has scheduled testing. The Contractor is responsible for monitoring this schedule, making regular contact with the test point of contact, closely coordinating their specific activities, and adjusting/delaying construction activities to accommodate testing operations without additional cost to the Government after contract award.

1.8 TEMPORARY UTILITIES

A. Contractor shall provide temporary utilities required for construction. Materials may be new or used, shall be adequate for the required usage, shall not create unsafe conditions, and shall not violate applicable codes and standards.

B. Water: All reasonably required amounts of water will be available to the Contractor by the Government from such existing water systems, outlets, and supplies, without cost to the Contractor for the water he consumes. The Contractor shall be responsible for approved disposal of wastewater. The Contractor shall install and maintain at his own expense any necessary supply connections, safety measures, and facilities in a workmanlike manner as approved by the Contracting Officer. All water shall be carefully conserved. Before final acceptance, temporary connections and piping installed by the Contractor shall be removed in a manner satisfactory to the Contracting Officer.

C. Electricity: Electric power will be made available to the Contractor by the Government in the form of single phase 208V/120V or 240V/120V, depending on availability, 60 Hz, 100A service without cost to the Contractor for temporary power purposes. Other electrical service may be provided, if available and accessible to the construction site, upon request by the Contractor and approved by the Contracting Officer. The Contractor shall install and maintain at his own expense any necessary supply connections, safety measures as required by 29 CFR 1926 Subpart K, 1926-402-408 or NEC ANSI/NFPA 70 plus formal interpretations and tentative interim amendments, and facilities in a workmanlike manner as approved by the Contracting Officer. All electricity shall be carefully conserved. When Government-provided temporary power is not available, is not of sufficient capacity, or is not of sufficient power quality, the Contractor is responsible for providing his own temporary power at his own expense. The Contractor is responsible for protecting his own electrical equipment and devices as necessary at his own expense from damage due to electrical events such as lightning, loss of power, power surges and sags, single phasing, and poor power quality.

D. Compressed Air: The Contractor is responsible for providing compressed air as needed at his own expense.

E. Breathing Air: The Contractor is responsible for providing breathing air as needed at his own expense.

F. Telephone Service: Contractor shall provide his own telephone service at his own expense.

G. Sanitary Facilities: Contractor shall provide temporary sanitary facilities in accordance with 29 CFR 1926.51 and shall service, clean, and maintain these facilities and enclosures at least once per week. Temporary facilities shall be removed from the site at the completion of the work. Sanitary facilities in existing facilities are unavailable for Contractor use.

H. Removal of Temporary Utilities: Before final project acceptance, temporary connections and facilities installed by the Contractor shall be removed and all removal locations painted, graded, etc. as necessary to match surrounding conditions in a workmanlike manner and hazard-free condition to the satisfaction of the Contracting Officer.

1.9 TRAFFIC PROVISIONS

A. Maintenance of Traffic: Contractor shall conduct his operations in a manner that will not close any thoroughfare or interfere in any way with traffic on roadways except with written permission of the Contracting Officer. Contractor may move oversized and slow-moving vehicles to the worksite provided requirements of the highway authority have been met. Work shall be conducted so as to minimize obstruction of traffic, and traffic shall be maintained on at least half of the roadway width at all times. If the entire roadway width requires blocking, the Contractor shall submit a traffic control plan to the Contracting Officer's Technical Representative for approval prior to blocking the roadway. Approval shall be obtained from the Contracting Officer prior to starting any activity that will obstruct traffic in any manner (one half of the roadway or the entire width of the roadway). Contractor shall provide, erect, and maintain, at his own expense, lights, barriers, signals, passageways, detours, etc., that may be required.

B. Rush Hour Restrictions: Contractor shall not interfere with the peak traffic flows preceding and during normal operations without notification to and approval by the Contracting Officer.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PROTECTION OF FACILITIES, MATERIAL, AND WORK

A. The Contractor shall at all times protect and preserve all facilities, materials, supplies, and equipment of every description (including property which may be Government-furnished or owned) and all work performed. All reasonable requests of the Contracting Officer to enclose or especially protect such property shall be complied with. If, as determined by the Contracting Officer, material, equipment, supplies and work performed are not adequately protected by the Contractor such property may be protected by the Government and the cost thereof may be charged to the Contractor or deducted from any payments due him.

3.2 PROTECTION OF UNDERGROUND UTILITIES/DIGGING PERMITS

A. Prior to performing any excavation work or any surface penetrations 6 inches or deeper (such as driving stakes more than 6 inches in the ground) on any ground surface, this includes both outside and inside of buildings, structures, tents, or gazebos, etc., the Contractor shall obtain from the Facilities Office a digging permit and the current subsurface utility drawing of the particular area to be worked on. Subsurface excavations include the penetration of ground below slabs on grade or interior building slabs that are in contact with the ground. Requests for dig permits shall be made a minimum of two working days prior to conducting any planned digging or excavation activities. Contractor shall stake out subsurface high voltage cables, communication cables, and pipelines indicated within the scope of the work contemplated. After exposure, the Contractor shall obtain agreement from the Contracting Officer on how much closer to cable or pipe the excavations can be permitted. Contractor shall notify the Contracting Officer, 48 hours prior to the start of excavation work or surface penetration, to enable the Contracting Officer to review measures being taken to prevent hazard to employees and possible damage to subsurface utilities. Where emergency conditions preclude the 48 hours advance notification, the Contractor shall immediately inform

the Contracting Officer. After obtaining clearance from the Contracting Officer, the Contractor shall proceed with excavating work, or other surface penetration work. Contractor, however, shall temporarily halt any machine excavation work or other surface penetration when approaching within 3 feet of the staked-out cable or pipeline until the Contractor has exposed the cable or pipe by hand excavation to fix its location.

B. Trenching machines and augers shall not be used unless approved in advance by the Contracting Officer.

C. Prior to commencing any operations which include digging, excavations, or soil borings, etc. where there is considerable doubt of the location of concealed utilities, the Contractor shall de-energize or turn off all hazardous utilities to the building and surrounding areas.

D. When de-energizing is not possible, a waiver shall be required to allow work to continue. The waiver shall provide rationale detailing how the safety of the workers will be maintained. The waiver shall be approved by the Facilities Management Office project manager and the MSFC Industrial Safety Office.

3.3 LAYOUT OF WORK

A. The Contractor shall lay out his work from the Government-established base lines and bench marks and shall be responsible for all measurements in connection therewith. The Contractor shall furnish, at his own expense, all stakes, templates, equipment, range markers, and labor as may be required in laying out any part of the work from the base lines and bench marks established by the Government. The Contractor will be held responsible for the execution of the work to such lines and grades as may be established or indicated by the Contracting Officer until authorized to remove them. If such marks are destroyed by the Contractor or through his negligence prior to their authorized removal, they may be replaced by the Contracting Officer at his discretion. The expense of replacement will be deducted from any amount due, or to become due, the Contractor.

3.4 TEMPORARY STRUCTURES AND LAYDOWN AREA

A. All temporary structures and equipment such as construction office trailers, storage trailers, boom trucks, dump trucks, backhoes, etc. are to be in good and fully operable condition, with no broken windows, rusted areas, boarded-up openings, loose insulation, bent doors, paint in poor condition, leaks, exposed wiring, code or safety violations, or other similar defects when brought on site and are to be maintained in good and fully operable condition while they are on site. Contractor shall submit photographs of all trailers, storage units, or other temporary structures and equipment for review and initial approval prior to bringing them on Center. Regardless, trailers and equipment are to be inspected for final approval for lay down by the Government when they are brought on site prior to detaching them from the truck that delivers them so they can be immediately removed if they are found to be in unacceptable condition.

B. At least 7 days prior to arrival, the Contractor shall request the need for and extent of an all-inclusive lay down area for temporary structures, equipment, material, vehicle parking, fencing, fence gates, hazardous material storage, and the like for the duration of the work. The lay down area shall be marked up in detail on the site plan drawing and submitted for approval by the Government. Once approved, all office trailers shall be installed per the International

Building Code, the Alabama Manufactured Housing Commission, and NASA safety requirements, whichever is most stringent. Any type of structure used in whole or part as office space or otherwise occupied on a regular basis shall be tied down. Utility connections shall be installed according to applicable codes/standards and in a neat and acceptable manner.

C. Housekeeping in the structures and about the lay down area shall be very well kept on a daily basis and the grass, weeds, and the like shall be kept below 6 inches in height at all times; all other areas within the construction site boundaries shall be kept below 12 inches in height. Open storage of material both singularly and collectively shall be kept and in a manner continuously acceptable to the Government.

D. Only equipment and material necessary for the work shall be kept on site, and equipment shall not be repaired on site without prior approval from the Government for more than very minor repairs.

E. All structures and equipment requiring certification, licensure, etc. shall be kept current at all times or immediately removed from the Center. Any changes to the lay down area use, arrangement, boundaries, or egress must be pre-approved by the Government.

3.5 NASA MISSION NON-INTERFERENCE

A. The Center conducts special tests and experiments, as well as unique operations that cannot be interrupted. Certain operations such as Space Shuttle flights have predetermined periods of non-interference where the Contractor can plan ahead with little or no impact to the project Schedule. During such flights, a Dig Moratorium will be issued where the Contractor cannot dig more than 6 inches below the surface.

B. Other non-interferences are utility related and require extensive coordination and precise planning and timing.

C. Non-interference periods shall be shown on the project Schedule to the extent they potentially impact the project Schedule.

3.6 INTERRUPTION OF UTILITIES

A. Interruption to utility services, such as (but not limited to) water, sanitary sewer, steam, electricity, communications, air, high-pressure systems, heating, and air conditioning systems, shall occur at such times as permitted by the Contracting Officer so that interruption of such services will not interfere with the operation of the Center. Generally, such outages to utility services shall be scheduled in advance and caused by the Contractor on Saturdays, Sundays, or other nonworking days or periods at no additional cost to the Government. The existing steam distribution system shall not be altered nor service to existing buildings be interrupted without prior written approval of the Contracting Officer. Such interruption to the steam distribution system insofar as is practicable shall be accomplished in the summer season. All interruptions shall be held to the minimum practicable. Interruption to high-pressure systems must be pre-planned 90 days in advance, with date certain and duration certain.

B. Notice of Interruptions: The Contractor shall submit each and every request for each individual utility outage in writing seven calendar days in advance of the actual need date for

approval by the Contracting Officer. Each required interruption anticipated by the Contractor shall be indicated on the project Schedule for pre-planning purposes by the Government to support the work; lack of such indication, or lack of date accuracy where the date changes from the previously approved project Schedule may result in delays and any such delay will be at the sole expense of the Contractor.

3.7 LEAKAGE PREVENTION

A. Capping of Piping Systems: All piping installed by the Contractor that is connected to a pressurized piping system, and not connected immediately to equipment, shall be terminated with a properly rated cap, blind flange, or capped valve and not left open-ended when Contractor personnel are not at the jobsite.

B. Construction Surveillance: At such time when new or modified piping systems are activated, the Contractor shall provide adequate personnel to monitor the initial start-up and operation of that system to insure that no damaging leak occurs. A monitor shall be present at each separate site of piping installation or modification at the instant of system activation. These Contractor personnel shall be authorized to immediately deactivate the system and qualified to make emergency repairs in the event of system failures. The Contractor shall notify Contracting Officer's Technical Representative a minimum of 2 days prior to activation.

3.8 GOVERNMENT FURNISHED PROPERTY

A. - The design drawings will indicate the government furnished property to be incorporated or installed in the work or used in its performance. Salvage property to be removed and reused that is in the general work area shall be handled as a Contractor Service and not listed here.

B. Property shall be furnished on the ground at a location within the MSFC boundaries as designated by the Contracting Officer. The Contractor shall be responsible for paying any demurrage or detention charges incurred loading, unloading, and transporting the property to the job site at his own expense.

C. All such property shall be installed or incorporated into the work at the expense of the Contractor, unless otherwise indicated herein.

D. The Contractor in conjunction with an authorized Government representative shall verify the quantity and condition of such Government-furnished property when delivered to him, acknowledge receipt thereof in writing to the Contracting Officer, and in case of damage to or shortage/overage of such property, he shall within 24 hours report in writing such damage or shortage/overage to the Contracting Officer.

E. It is the intention of the Government to furnish all of these items required to complete the work as specified and the various quantities will be adjusted when necessary. These quantities are not to be considered as indications or warranties that the amounts stated will either be sufficient or insufficient. The Contractor shall be required to furnish any additional quantities required.

3.9 SALVAGE MATERIALS AND EQUIPMENT

A. The Contractor shall maintain adequate property control records for all materials or equipment specified to be salvaged. These records may be in accordance with the Contractor's system of property control, if approved by the Contracting Officer. The Contractor shall be responsible for the adequate storage and protection of all salvaged materials and equipment and shall replace, at no cost to the Government, all salvage materials and equipment broken or damaged during salvage operations as the result of his negligence, or while in his care. Any salvaged materials and equipment that are excess upon the completion of the work shall remain the property of the Government. All such excess material and equipment shall be loaded, transported, and unloaded by the Contractor in a location specified by the Contracting Officer within the boundaries of the Marshall Space Flight Center.

3.10 CONSTRUCTION PROCEDURES

A. The Contractor shall use the following procedures and methods. Only the most current Government approved forms shall be used.

B. Request for Information (RFI) S.O.P. 7321.6: The purpose of this procedure establishes the system for initiating, dispositioning the clarification of technical or quality assurance requirements specified in the contract documents, and engineering direction to the Contractor for no-cost changes to the specifications or drawings.

C. Design Change Requests (DCR's) S.O.P. 7321.1: The purpose of this procedure establishes the system for documenting and approving changes to the contract documents if on-site work must be performed prior to the contract modifications.

D. Construction Deficiency Reports (CDR's) S.O.P. 7321.3: The purpose of this procedure establishes the system for initiating, processing, distributing, and controlling any item, condition, or material which deviates from engineering drawings, specifications, or procedures which require a disposition from NASA Engineering to resolve.

E. Quality Verification System (QVS) S.O.P. 7321.2: The purpose of this procedure is to plan and perform inspections, tests, and reviews to determine compliance with engineering and quality requirements or procedural methods for data gathering. It provides for planning of activities, establishment of hold points, and documentation of the performance and results of the verification.

F. Preparation, Review, Approval & Control of Submittals S.O.P. 7321.8: The purpose of this procedure establishes the system for initiating, approving, and controlling submittal documents.

G. Field Drawing Changes (FDC) S.O.P. 7321.5: The purpose of this procedure is to establish a method of resolving and documenting same-day, no-cost field adjustments by the COTR.

3.11 ELECTRONIC CAPABILITY

A. The Contractor shall have in-house computer capability to perform daily electronic mail, word processing, Internet connectivity, virus protection, and project scheduling.

B. Contractor management and administration personnel shall be competent in the electronic capability and able to create, print, save, and electronically transfer documents, files, and messages.

C. The Contractor's site superintendent shall have an active cell phone in his possession at all times for emergency and Government representative communication.

D. The Contractor shall submit his e-mail address and emergency contact information, including cell phone numbers, home phone numbers, and pager numbers, for all key personnel as well as the business owner.

3.12 COMMUNICATION RADIOS

A. To insure safety to Government personnel on nearby test stands and to prevent dangerous radio interference from damaging space vehicle test programs underway near site, the Contractor shall not use any radio communication on or near site without coordinating same with Contracting Officer. Radio use is also restricted in certain laboratories, operation centers, and communication and computer rooms as directed by signage and the Contracting Officer. All frequencies used must be submitted for approval by the Contracting Officer prior to use.

3.13 HOUSEKEEPING

A. The Contractor shall comply with the requirements of 29 CFR 1926.25 and assure cleanliness of facilities, equipment, and protection against damage before, during, and after installation. Generally, all working and storage areas will be cleaned regularly. The Contractor shall maintain such conditions insofar as good working practices will permit. It is essential to the proper conduct of the work and to the safety of workers and others that good housekeeping be practiced at all times. Equipment shall be kept clean and shall be protected against damage before, during, and after installation. All working and storage areas shall be cleaned regularly and all scrap materials and refuse properly and promptly disposed of. Accumulations of such materials and, in particular, accumulations of flammable crates, packing, plastic coverings, and other scrap materials in working or storage areas will not be tolerated. All areas shall be left neat, clean, and free from obstructions and hazards at the end of each working day or shift.

3.14 WEATHERTIGHT INTEGRITY OF BUILDING DURING CONSTRUCTION PERIOD

A. Contractor shall not remove or penetrate any portion of the roof that he cannot replace with the specified roofing system by the end of the workday or protect by other approved methods in the event of rain or other inclement weather that might occur during the workday. The connection of the installed specified roofing system to an existing roofing system shall be made watertight at the end of each workday and/or in the event of inclement weather that might occur during the workday. The details for said connection and the manner that the Contractor plans to maintain a watertight roof throughout the entire period of performance shall be submitted for review and approval by the Contracting Officer's Technical Representative; this shall be approved before work can commence. For 24 hours a day, 7 days per week, throughout the period of the contract, the Contractor will be responsible for keeping moisture outside of the building interior.

B. In the event that there is water penetration, the Contractor shall take immediate action to provide all materials, equipment, and labor to capture the moisture, dispose of the moisture, and protect all contents of the building.

C. The Contractor shall make repairs to stop any water penetration in a timely manner. The Contracting Officer reserves the right to stop the work when he determines the Contractor is not executing the work in a responsible manner and is causing any water penetration of the building. Work will resume once the Contractor has shown evidence that he has prepared an adequate plan for the remainder of the work; said plan shall include preventive measures to assure watertight conditions throughout the remainder of the contract.

D. When the Contractor fails to respond in time to prevent damage from occurring, MSFC maintenance personnel will respond to clean up and protect as best possible until Contractor personnel arrive. Costs incurred by the Government and maintenance operations associated with such response shall be deducted from any of the Contractor's pay requests and the contract value reduced accordingly by the Contracting Officer.

E. When the Contractor fails to adequately protect equipment and materials, the Contractor shall pay all expenses to replace or repair any and all damages and in a manner acceptable to the Contracting Officer. Such payments shall be made within 30 days of invoice date, and proof of such payments shall be submitted to the Contracting Officer within 15 days of payment date.

3.15 CONSTRUCTION SITE DUST AND MUD CONTROL

A. The Contractor is responsible for establishing effective and mandatory controls to prevent dust and mud from leaving the construction site boundary. These controls shall be communicated to all personnel and enforced at all times. All resulting additional environmental controls required shall be in place, functional, and inspected daily.

B. The Contractor is responsible for preventing wind-blown dust from going outside the construction site boundary including civil works during normal business hours and during other hours the Contractor is present on the site.

C. The Contractor is responsible for preventing vehicles from tracking and depositing mud and other similar debris and materials outside the construction site boundary. Any such tracking or depositing on roadways, parking lots, sidewalks, equipment, building walls, and any other man-made surface shall be cleaned up immediately without delays to the satisfaction of the Contracting Officer. Rainfall is not an acceptable method.

D. The Contractor shall provide at his expense all the necessary labor, equipment, and material.

3.16 CONSERVATION

A. All energy consumption and resources shall be conserved to the greatest extent possible by the Contractor. The Contractor is responsible for communicating this requirement to all on-site personnel and for compliance. Energy and resource utilization shall be proactively managed and conservation measures and methods developed and promoted by the Contractor's management and supervision.

B. Temporary lighting shall be divided into switchable areas of relatively small size to promote and achieve energy conservation to the satisfaction of the Government. Lighting shall be off unless absolutely necessary to accomplish the work at hand. Lighting for security purposes only shall be minimized and other non-energy consuming methods employed to the greatest extent.

C. Recyclable materials (e.g. aluminum cans, white paper, cardboard, metals, etc.) shall be diverted from the waste stream and delivered to the appropriate off-site, off-Center recycle center by the Contractor as indicated. For Leadership in Energy and Environmental Design (LEED) projects, see other specification sections for more stringent requirements.

D. All cardboard materials shall be flattened, consolidated, and recycled. Cardboard may be delivered to the Center's cardboard recycling location.

3.17 FEDERAL AVIATION ADMINISTRATION (FAA) REQUIREMENTS

A. The Contractor shall comply with all applicable FAA regulations, particularly FAA AC 70/7460-1.

B. The Contractor shall provide all notices to the COTR in writing in order for the Government to assist the Contractor in meeting the applicable FAA regulations. The FAA requires multiple notifications and submission of forms then approval for any work including cranes above the ground over a certain height from ground level at the construction site (height limit). The Contractor shall know the current regulations and provide the notifications to meet these regulations using the 100 to 1 slope from the Redstone Army Airfield. The Contractor shall determine the requirements and any potential project impacts (both schedule and cost) prior to bidding. The Contractor shall assist the Government in completing all required forms and provide all the necessary information for accurate form completion.

C. The Contractor shall notify the COTR in writing as follows to facilitate timely form completion and submission:

1. 35 calendar days prior to anticipated breach of height limit;
2. 72 hours prior to actual breach of height limit;
3. The same day when the construction or alteration of the structure reaches its greatest height;
4. Any supplemental notices required by the FAA or the Contracting Officer.

D. Aviation lighting shall be provided by the Contractor at his own expense as indicated on the approved FAA forms but will be as typically defined under the TEMPORARY UTILITIES paragraph herein. Contractor shall typically provide a minimum of 2 aviation lights of red or high intensity white obstruction lights on temporary structures (including cranes) over the "height limit" determined by the FAA Requirements. Lights shall be operational during periods of reduced visibility, darkness, and as directed by the Contracting Officer or FAA

3.18 TRENCHING/EXCAVATIONS

A. Prior to beginning any excavations, this includes both outside and inside of buildings, structures, tents, or gazebos, etc., an excavation permit shall be obtained from the FMO.

Trenching machines and augers shall not be used unless approved in advance by the COTR and it shall be so annotated on the issued excavation permit. Before starting any earth work, the location of underground utilities shall be carefully verified. Utilities to be left in place shall be protected from damage. Trench excavations over 5 feet in depth shall be shored braced or sloped to the angle of repose of the material. Excavated or other materials shall be shored and retained at least 2 feet from the edge of the excavation to prevent it from falling or sliding back into the excavated area and to prevent excessive pressure upon the side of the excavation.

B. Excavations, trenching and shoring requirements for the protection of employees in OSHA Regulation, CFR 29 part 1926.650 shall be employed and enforced. Side and slopes of excavations shall be maintained in a safe condition by scaling, benching or barricading. Where employees are required to be in trenches, a ladder extending from the floor of trench/excavation to at least 3 feet above top of excavation, located as to provide means of exit without more than 25 feet of lateral travel. Excavations will be barricaded and posted with warning signs for the safety of personnel. Warning lights will be provided during hours of darkness.

C. The Contractor shall ensure employees working in or around excavation projects are trained and familiar with the safety requirements in 29 CFR 1926. 650 – 652 (Subpart P).

D. Prior to commencing any operations which include digging, excavations, or soil borings, etc. where there is considerable doubt of the location of concealed utilities, the Contractor shall de-energize or turn off all hazardous utilities to the building and surrounding areas.

E. When de-energizing is not possible, a waiver shall be required to allow work to continue. The waiver shall provide rationale detailing how the safety of the workers will be maintained. The waiver shall be approved by the Facilities Management Office project manager and the MSFC Industrial Safety Office.

3.19 EXPLOSIVES

A. Explosives shall not be permitted on Government Property. This prohibition does not include the explosive cartridges/devices required to operate powder actuated tools.

3.20 SIGNS

A. Construction Identification Sign: Within 30 days after Notice to Proceed, the Contractor shall install the Government-furnished construction identification sign at the location designated by the Contracting Officer. This sign shall be securely installed in an acceptable manner approved by the Contracting Officer and shall be maintained in good condition and returned to the Government at project completion.

B. Other Signs and Advertisements: Only signs necessary to expedite deliveries, maintain traffic flow, promote safety (e.g. caution, danger, blasting, hardhat area), and prevent interference with Government operations shall be erected.

3.21 JOBSITE TRAILER (FOR GOVERNMENT)

A. Contractor shall provide an approximately 500 square foot trailer at the jobsite for use solely by the Government and government representatives. Contractor shall provide the original and four copies of the keys to the trailer; no one else shall have a key to this trailer. Trailer shall be heated and cooled and custodial services shall be provided at least once per week. Trailer is to be located adjacent to the superintendent's trailer. A refrigerator with at least 14 cubic feet and -potable water shall be provided for sole use by the Government. Trailer shall be divided into four (4) rooms: an office at each end, a restroom equipped with sanitary sewer services including running water, and a common area in the middle for drawings, files, and small meetings. Submit layout drawing for COTR's review and approval.

Attachment to Chapter 20, EP 1110-1-18, Ordnance and Explosives Response
UXO Personnel Training and Experience Hierarchy

Position Description	Training Required (Notes 1, 2, & 3)	Minimum Years of EOD/UXO Experience (Note 4)	Special Requirements
UXO Safety Officer	1, 2, or 3	10 years	Experience in all phases of UXO remediation and applicable safety standards
UXO Quality Control Specialist	1, 2, or 3	10 years	Experience in all phases of UXO remediation and the transportation, handling, and storage of ordnance and explosives materials
Senior UXO Supervisor	1, 2, or 3	15 years	Significant experience in all aspects of UXO remediation. Five years' experience in supervisory positions
UXO Technician III	1, 2, or 3	10 years	Prior military EOD and/or commercial UXO experience
UXO Technician II	1, 2 --- Or 3	N/A --- 5 years	Prior military EOD experience --- Experience in UXO remediation/range clearance operations. Plus specific project/ordnance training
UXO Technician I	1, 2, or 3	0	Successfully completed DOD certified course of instruction appropriate to this skill level
UXO Sweep Personnel	Equipment and site specific training	N/A	Equipment and site specific training. (Experience at this position is not required for UXO Technician I certification.)

Notes:

1. Graduate of the Army Bomb Disposal School at Aberdeen, MD.
2. Graduate of the Naval EOD School.
3. Graduate of a Department of Defense certified UXO Training Program.
4. This is the minimum experience requirement for designation. This is not an automatic designation, but reserved for those who have demonstrated the requisite knowledge, maturity, judgment, and are recommended by the contractor for recognition at the specified skill level.

END OF SECTION

SECTION 01 06 10 — GENERAL SAFETY AND ENVIRONMENTAL HEALTH REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. The requirements of this Section apply to, and are a component part of, each section of the specifications.

1.2 REFERENCES

A. The publications listed below form a part of this contract as required by law or as referenced:

B. Code Of Federal Regulations (CFR)

1. Executive Order 13423 Strengthening Federal Environmental, Energy, and Transportation
2. 29 CFR Part 1910 Occupational Safety and Health Standards
3. 29 CFR Part 1926 Safety and Health Regulations for Construction
4. 40 CFR Parts 1- 1068 Protection of Environment

C. NASA/MSFC Publications

1. NPR 3792.1 Plan for a Drug-Free Workplace
2. NPR 8715.1 NASA Occupational Safety and Health Programs
3. NPR 8715.3 NASA General Safety Program Requirements
4. NPR 8820.2 Facility Project Requirements
5. NASA-STD-8719.11 Safety Standard for Fire Protection
6. MPR 1800.3 MSFC Sanitation Program
7. MPR 1840.4 MSFC Asbestos Program
8. MPR 1860.1 MSFC Radiation Safety Procedural Requirements
9. MPR 1860.2 Nonionizing Radiation Safety
10. MPD 1860.2 Radiation Safety Program
11. MPD 8500.1 MSFC Environmental Management Policy
12. MPR 8500.1 MSFC Environmental Engineering and Occupational Health Program
13. MPR 8500.2 MSFC Environmental Management System (EMS)
14. MWI 1810.1 Automated External Defibrillator (AED) Program
15. MWI 3410.1 Personnel Certification Program
16. MWI 8540.2 Green Purchasing Program
17. MWI 8550.1 Waste Management
18. MWI 8550.2 Storm Water Management
19. MWI 8550.3 Wastewater Compliance
20. MWI 8550.4 Air Emissions Compliance
21. MWI 8550.5 Hazardous Material Management
22. MWI 8621.1 Mishap and Close Call Reporting and Investigation Program
23. MPR 8715.1 Marshall Safety, Health, and Environmental (SHE) Program
24. MWI 8715.1 Electrical Safety Program

25. MWI 8715.2 Control of Hazardous Energy (Lockout/Tagout) Program
26. MWI 8715.10 Explosives, Propellant, and Pyrotechnics Program
27. MWI 8715.11 Fire Safety Program
28. MWI 8715.12 Safety, Health & Environmental Finding Tracking System (SHEtrak)
29. MWI 8715.13 Safety Concerns Reporting System (SCRS)
30. MWI 8715.15 Ground Operations Safety Assessment Program
31. MWI 8715.17 Hazardous Operations Readiness Review Program

D. Fire Protection

1. National Fire Protection Association (NFPA) codes
2. NFPA 241 "Standard for Safeguarding Construction, Alteration, and Demolition Operations"
3. NASA FAR Supplement 1852.223-73 Safety and Health Plan

E. NOTE: These documents can be accessed through the Marshall Integrated Document Library (MIDL) located on MSFC "Inside Marshall" Webpage or by contacting the Facilities Management Office (FMO) Contracting Officer Representative (COR).

1.3 SUBMITTALS

A. The following shall be submitted in accordance with Section 01 33 00 "Submittals," in sufficient detail to shown full compliance with the contract documents.

B. Safety, Health and Environmental (SHE) Plan. The Contractor shall submit a Contractor SHE Plan that establishes the contractor's approach for implementing an industrial safety, occupational health, and environmental program that provides a workplace that is incident and injury free by (1) preventing employee fatalities, (2) reducing the number and severity of employee injuries and illnesses, and (3) protecting the environment through the ongoing planning, implementation, and management control of these programs in accordance with MPR 8715.1.

C. The Contractor's SHE Plan shall be written specifically for the work to be performed at MSFC and provide a clear description of the Contractor's approach for implementing their SHE Program at MSFC over the duration of this contracted effort.

D. The Contractor shall submit their SHE Plan to the FMO as directed in this TRSC section for review and approval prior to the contractor being notified to start work in accordance with NPR 8820.2, MPR 8715.1 and NASA FAR Supplement 1852.223-73.

E. The Contractor's SHE Plan shall address in sufficient detail their methods for implementing each of the following five (5) MSFC SHE Core Program Requirements (CPR) described in MRP 8715.1 while performing work at MSFC under this contracted effort.

F. NOTE: At MSFC, the topics listed below each CPR are considered as minimum fundamentals necessary to fulfill the CPR.

1. CPR 1 - Management Leadership and Employee Involvement

a. Policy to provide a safe and healthful work environment free from recognized hazardous conditions.
b. Accountability and responsibility for employees to perform work in a safe and healthful manner without endangering other employees or damaging property.
c. Authorization and necessary resources to reduce hazardous conditions in the work area to a safe working level.
d. Safety meetings and awareness training provided regularly to employees.

2. CPR 2- Worksite Analysis

a. Safety/risk assessments or hazard analysis of worksites, jobs and operations are performed to identify hazardous conditions and reduce these hazardous conditions to a safe working level.
b. Worksites, jobs and operations considered as hazardous are identified and communicated to employee.
c. Worksite inspections are performed regularly to identify hazardous conditions.
d. Employees are allowed to report safety-related concerns to management without fear of reprisal.
e. Safety, health and environmental services are provided at the worksite as needed.
f. Mishaps and close calls are reported and investigated to the extent necessary to determine the cause.
g. Drug tests are initiated for employees involved in mishaps and close calls as needed.

3. CPR 3 - Hazard Prevention and Control

a. Control methods adequate to reduce hazardous conditions to a safe working level are provided and implemented.
b. Hazardous operating procedures/instructions are provided for jobs/operations considered hazardous, as needed.
c. Emergency medical services are provided as needed.
d. Disciplinary program is implemented.
e. Emergency preparedness program is provided at the worksite as needed.

4. CPR 4 - Safety, Health and Environmental Training

a. Hazard awareness training is provided to employees.
b. Jobs/operations are evaluated to identify specific training needed for employees.
c. Training is provided to employees, so they are qualified and competent to perform their jobs/operations in a safe and healthful manner.

5. CPR 5 - Environmental Management System

a. Work activities are performed in compliance with all applicable environmental-related Federal, State, local regulations, NASA and Center requirements and environmental-related Executive Orders.

6. Contractor format is acceptable, but it is recommended that the Contractor's SHE Plan follow the order of the MSFC SHE CPR elements shown in MPR 8715.1 or provide a matrix that clearly identifies where each MSFC SHE CPR is addressed in the Contractor's SHE Plan.

7. The COR can require the Contractor to review and sign the MSFC Alternate SHE Plan for Construction prior to being allowed to start work at MSFC. When required the Contractor shall abide by all requirements identified in the MSFC Alternate SHE Plan for Construction. See "Attachment" at the end of this section for an example of the MSFC Alternate SHE Plan for Construction.

G. Reports. In addition to documentation and reports required elsewhere in this section, the following reports shall also be submitted:

1. Safety Statics Report: The Contractor shall complete MSFC Form 4371, MSFC Contractor Accident and Safety Statistics, and submit to the COR at the end of the project with the final payroll or at the frequency specified by the COR. If the contract is for a long duration, the COR in coordination with the ISB can determine the frequency that the Form 4371 is submitted. The Contractor shall ensure the form is complete and accurate in every detail and identify any information required by the form that is not applicable to the Contractor and/or scope of work.

1.4 GENERAL SAFETY PROVISIONS

A. Contractor shall:

1. Be subject to applicable Federal, State, local laws, NASA and Center regulations, ordinances, codes, and orders relating to safety, health and environmental in effect on the date of this Contract.

2. Be responsible for the control and safety of persons working on and visiting the project site during the performance of work under this contracted effort.

3. Be responsible for ensuring their employees and all subcontractor employees supporting them comply with all applicable federal, state, and local laws, regulations, ordinances, codes, and orders relating to safety, health and environmental and MSFC SHE requirements while working at MSFC.

4. Advise the FMO COR or FMO Project Manager (PM) of any special safety restriction he has established so that Government personnel can be notified of these restrictions.

5. Identify a "competent person" when required by 29 CFR 1910 or 29 CFR 1926. Post the name of this person(s) at the project site or designated meeting area where the workers gather prior to commencing work, and they shall be on the project site during any operation for which they have been identified as the "competent person." (NOTE: Use the "MSFC Emergency Telephone List" provided by FMO or ISB, or a similar format to post these names at the project site or designated meeting area.)

6. Use locks with a red case and tags with red diagonal strips containing the word "lockout" when controlling hazardous energy during construction, maintenance and servicing

activities in accordance with MWI 8715.2. Contractor employees that are expected to place a lock and/or tag or perform activities where the control of hazardous energy is needed are required to attend and complete the MSFC Lockout/Tagout Training. Contact the FMO or the MSFC Industrial Safety Branch (ISB) for more information on obtaining this training. Contractors are responsible for maintaining records of the completion of this training. (NOTE: Work on energized equipment shall only be allowed under special situation in accordance with MWI 8715.1.)

7. Conduct safety meetings/awareness training/toolbox meetings weekly at a minimum and retain documentation of these meetings at the construction site. Safety meeting sign-in sheets and a general description of the items covered shall be submitted to the COR or FMO PM.

8. Develop or use a job hazard analyses (JHA's), safety or risk assessment or Hazard Identification Safety Checklists (HIC) for jobs/operations identified as hazardous. These documents shall be retained at the construction site. (Hazard Identification Safety Checklists are located on the SHE web page under the "News and Information" pull down menu.

9. Provide MSFC SHE 101C, "MSFC SHE Program Construction Awareness Training" to employees. A copy of this training will be provided to the contractor by the ISB during the Pre-construction Conference. The contractor shall provide this training to all Contractor employees within 30 days of the Authority to Proceed (ATP) or their arrival at the worksite unless a different time limit is specified in the contract. It is recommended that this training be provided during a weekly safety meeting. Document the completion of this training by including the title of the training course, the names of the employees with their signatures and the date the training was provided. Notify the COR or FMO PM that this training has been completed. Maintain documentation of this training completion and provide to the Government upon their request.

10. Maintain in an orderly fashion, make readily available and provide all safety, health, and environmental related documentation (e.g., plans, forms, reports, supervisor safety visits, inspections, correspondence, JHA's, risk assessments, checklists, SDS, logs, and evidence of employee training/certifications) to the Government, upon request.

11. Ensure employee(s) are properly trained to perform their jobs/operations and when required to wear Personal Protective Equipment (PPE) has been trained in proper PPE usage in accordance with 29 CFR 1910.132(f) and MWI 8715.15. Documentation of this training shall be provided to the Government upon request.

12. NOTE: If training certificates are unavailable the Contractor may elect to provide a written document that provides rationale and clearly states why the Contractor considers the employee(s) as fully trained, knowledgeable, experienced, and qualified to perform the job/operation. The written document will only be accepted in lieu of a training certificate when it is written on a document that contains the company letterhead and is signed and dated by a company official or superintend. In either case the Contractor is assuming the responsibility that the employee is trained, knowledgeable, experienced, and qualified to perform the job/operation in a safe and healthful manner.

13. Provide a worksite that is easily identified, clearly separated from other ongoing activities in the same general area and effectively barricaded to prevent accidental entry into the worksite by unauthorized employees.

14. Provide protection against damage for structures, utilities, sidewalks, pavements, and other facilities that are immediately adjacent to excavations.

B. Hazard Communication (29 CFR 1910.1200). During the Pre-Construction Conference, to be arranged by the FMO, ISB and/or the Environmental Engineering and Occupational Health (EEOH) may discuss common safety and health requirements at MSFC and distribute handouts addressing these requirements.

1.5 ACCIDENT TREATMENT AND RECORDS

A. Contractor shall post emergency first aid, ambulance information, and a list of key personnel to be contacted in times of emergency at the project site. (NOTE: Use the "MSFC Emergency Telephone List" provided by FMO or ISB, or a similar format to post these names at the project site or designated meeting area.)

B. Contractor employees may utilize government dispensary facilities located in building 4249 for injury and emergency medical treatment. Contact occupational medicine services (telephone 256-544-2390).

C. Contractor shall report all accidents and incidents that occur at their work site that can result in injury or illness serious to Contractor employee or employees to the FMO Project Manager, FMO Construction Inspector and MSFC ISB.

1. Notify by the quickest means possible the Medical Ambulance Service and Medical Team (Telephone 911 and instruct the operator you are located at Marshall Space Flight Center and provide the building number and name of road or phone 256-544-4357 and select the appropriate option. For non-emergency call 256-544-2390.

2. Notify ISB at 256-544-0046.

a. Initial reporting for Type A, Type B, High-Visibility Mishaps and Close Calls – The initial reporting for these types of mishaps/close call shall be made as soon as possible after initiating emergency response, but no later than one hour of occurrence or awareness.

b. Initial reporting for Type C, Type D, Low-Visibility Mishaps and Close Calls– The initial reporting for these types of mishaps/close calls shall be reported as soon as possible after initiating emergency response, but no later than four hours of occurrence or awareness.

3. Notify the FMO COR, Project Manager or Government Construction Inspector.

D. The Contractor shall provide preform investigations and provide follow-up actions for reported accidents and incidents in accordance with MWI 8621.1, "Mishap and Close call Reporting and Investigation Program."

1.6 FIRE PREVENTION AND PROTECTION

A. Contractor shall comply with all fire prevention measures described in MWI 8715.11, "Fire Safety Program."

B. The Contractor shall obtain permission from the MSFC Authority Having Jurisdiction (AHJ) for fire protection, ISB or Fire Chief for the use of open flame devices, such as blowtorches, portable furnaces, tar kettles, or gas and electric welding and cutting equipment, in, on or within 25 feet of buildings.

C. Open-flame heating devices are not permitted except by approval of a hot work permit by ISB in accordance with MWI 8715.11, Fire Safety Program. Approval for the use of open-flame heating devices or open-fires does not relieve the Contractor from the responsibility for any damage incurred as a result of a fire.

D. Hot Work Permits are issued by ISB in accordance with MWI 8715.11, Fire Safety Program. Details for requesting a hot work permit will be provided by the ISB representative during the Pre-Construction Conference.

E. Burning trash, brush, or wood on the project site shall not be permitted.

F. Employees shall not be permitted to smoke inside any building located at MSFC (temporary, permanent or under construction).

G. Contractor shall be liable for any fire loss to Government property attributable to negligence on the part of the Contractor, including failure to comply with fire prevention measures prescribed in NASA STD 8719.11 and MWI 8715.11.

1.7 ELECTRICAL

A. Contractor shall appoint an employee to serve as the "competent employee" for electrical safety. This employee shall have received training in the hazards of electricity and familiar with the safety requirements in 29 CFR 1926. 400 – 449 (Subpart K) to be responsible for the electrical safety of the contracted effort and to restrict entry to dangerous locations to only those authorized by him and the FMO.

1.8 CONFINED SPACE ENTRY

A. The contractor shall obtain a permit prior to entering and accomplishing work in a designated confined space. At least 10 days prior to commencing activities, the contractor or sub-contractor shall submit to EEOH and ISB the following for review:

1. Training records showing personnel that have been trained in confined space entry in accordance with OSHA standard 29 CFR 1910.146.

2. Communication on company letterhead and signed by an officer or supervisor of the company stating that all personnel who are to work in the confined space entry have had appropriate training, physicals and are fit to safely perform the role they are assigned. The letter shall call out who are to act as entrants, attendants and entry

supervisors. At no time shall the person performing the job of Entry Supervisor also be an entrant unless another designated Entry Supervisor is present and duties are transferred.

3. A copy of the company's written confined space entry program.

4. Submission of this information earlier than 10 days is encouraged since failing to comply with this section can lead to delays and completion penalties.

B. Contractor shall be responsible for removing water and debris before commencement and during execution of work in manholes.

C. Contractor shall furnish their own atmospheric testing equipment and have one or more employees properly trained in operation of the testing equipment and formally qualified as Confined Space Entry Supervisors who shall be on duty during times workers are in confined spaces in accordance with 29 CFR 1910.146(g) &(j). Their primary functions shall be to perform the duties of Confined Space Entry Supervisor and to test for atmospheric hazards and operate testing equipment. Unless equipment of constant supervisory type with automatic alarm is employed, atmospheric tests shall be made at least every 30 minutes or more often when character of ground or experience indicates gas may be encountered. An atmospheric test shall be made before workers are permitted to enter the space after an idle period exceeding one-half hour, or more frequently at the discretion of the Contractor's Entry Supervisor or by direction of EEOH or ISB. A duly designated Confined Space Entry Supervisor may borrow atmospheric testing equipment from NASA's EEOH office, if the equipment is available.

D. Special requirements, coordination, and precautions will apply to areas that contain a hazardous atmosphere or, by virtue of their use or physical character, may be oxygen deficient. Consultation with and approval by EEOH and ISB is required prior to entering these types of confined spaces.

E. All manholes associated with water, sewer, steam, electrical, communication or any other utility are considered permit-required confined spaces and must be treated as such for entry.

1.9 RADIATION SAFETY REQUIREMENTS

A. The Contractor shall comply with 29 CFR1926.53, MPR 1860.1 and MPD 1860.2 for use of all radioactive material. The Contractor shall notify the MSFC Radiation Safety Officer (RSO) at least 48 hours in advance of any planned radiography. However, if planned during a weekend, notice shall be provided by Thursday. The Contractor shall report to the RSO once on-site and prior to starting work.

B. Loss of radioactive material shall be reported immediately to the COR and RSO.

C. Actual exposure of the radiographic film or unshielding the source shall not be initiated until after 5 p.m. on weekdays, unless prior approval is obtained from the COR and RSO to accomplish such activities prior to 5:00 p.m.

D. In instances where radiography is scheduled near or adjacent to buildings or areas having limited access or one-way doors, no assumptions shall be made as to building occupancy. Where necessary the COR will direct the Contractor to conduct an actual building entry, search,

and alert. Where removal of personnel from such a building cannot be accomplished and it is otherwise safe to proceed with the radiography, a fully instructed employee shall be positioned inside such building or area to prevent exiting while external radiographic operations are in process.

E. Contractor shall perform a hazard analysis (HA) when lasers are used or are in the work area. The HA shall be reviewed and approved by the RSO and ISB, and communicated to all personnel and all necessary protective measures taken.

1.10 ROOFING AND COATING

A. At the beginning of each work day the Contractor shall check with the Government Inspector before proceeding to work on the roof to ensure safe work conditions. Roofing and coating work shall adhere to NFPA-241.

B. Barricades or covers shall be provided for all roof openings which present a hazard.

C. Any employees designated to serve as a “Fire Watch” during roofing and coating operations where a tar kettle or similar fired equipment is used shall be trained in the use of fire-extinguishing equipment, familiar with the procedures for sounding an alarm in the event of a fire, and monitor the area where the hot work operation was conducted for at least 30 minutes after completion of the hot work operation to detect and extinguish any smoldering fires. Documentation of this training shall be provided to the Government, upon request.

1.11 TEMPORARY HANDRAILS AND GUARDRAILS (29 CFR 1910.23 and 29 CFR 1926 Subpart M – Fall Protection).

A. Temporary hand rails shall be provided on all stairwells until permanent hand rails are installed. All floor and wall openings from which there is a drop of more than 4' or there is a potential for employees to fall to a lower level shall be guarded by rail. Where there is exposure below of falling materials, a removable toe board or equivalent shall also be provided. In places where people are required to access an area close to or underneath walkways, handrails, and toe boards; approved netting shall be used.

B. Personal Fall Arrest Systems (PFAS) shall be provided to employees when they work on elevated surfaces where another fall protection system does not provide adequate fall protection. Employees shall be trained in the proper use and care of PFAS. Documentation of this training shall be provided to the Government, upon request.

1.12 TOOLS, HAND AND POWER (29 CFR 1910.241-244 (Subpart P), 29 CFR1926.300-307 (Subpart I).

A. Hand and power tools shall be in a safe operating condition and operators shall be familiar with their safe operations.

B. All portable electrically-powered tools used on this work shall be grounded by means of a 3-wire polarity type grounding system via ground fault interrupter unless the tool is UL-listed as

double-insulated. Operators of Power-operated tools shall be familiar with their safe operation in accordance with 29 CFR 1910.241 -244 (Subpart P) and 29 CFR 1926.300 – 307 (Subpart I).

C. Operators of explosive activated tools shall be trained to operate such tools in accordance with 29 CFR 1926.302(e) and provide documentation of this training to the Government, upon request.

1.13 WELDING, FLAME CUTTING, AND MELTING (MWI 8715.11, NFPA 241, 29 CFR 1926.350-354 (Subpart J)).

A. Contractor shall inform ISB of any welding and cutting operations and obtain a hot work permit before beginning the operations in accordance with MWI 8715.11.

B. Contractor shall ensure welding and cutting operators are familiar with the safe operation of welding and cutting equipment requirements in 29 CFR 1926.350 -354 (Subpart J).

C. Contractor shall discontinue burning, welding, or cutting operations 1 hour prior to the end of the normal work day. A workman shall remain at the site for 1 hour, or as required by the Hot Work Permit (MSFC Form 1155), after discontinuing these operations to make a thorough inspection of the area for possible sources of latent combustion. He shall be equipped with two full 15-pound (6.8 kilogram) carbon dioxide fire extinguishers. Details for reporting fires will be provided by the ISB representative during the Pre-Construction Conference.

D. During operations involving possible fire hazard, the Contractor shall notify the COR and/or Government Inspector and not proceed until clearance is obtained in writing. COR and/or Government Inspector may request a standby from the Fire Station. This requirement does not relieve the Contractor of his responsibility for welding and cutting safety.

E. Roofing/Tar Melting/Handling Devices shall comply with the requirements of NFPA 241. Tar melting kettles and handling devices shall be used in a safe manner to eliminate any chance of an employee being burned or starting a fire. Melting kettles shall be placed on a level, firm foundation and protected against traffic, accidental tipping or similar hazard. An approved type of fire extinguishers shall be available at all locations where melting kettles or heating devices are in use. Melting kettles or heating devices, when in use, shall be provided with a lid and thermometer.

F. Any employees designated to serve as a “Fire Watch” during welding, flame cutting and melting shall be trained in the use of fire-extinguishing equipment, familiar with the procedures for sounding an alarm in the event of a fire, and monitor the area where the hot work operation was conducted for at least 30 minutes after completion of the hot work operation to detect and extinguish any smoldering fires. Documentation of this training shall be provided to the Government upon request.

1.14 HIGH NOISE LEVEL PROTECTION (29 CFR 1910.132(f))

A. Contractor shall ensure employees wear appropriate hearing protection when performing operations that involve the use of equipment with output of high noise levels (jackhammers, air compressors, etc.) shall be scheduled for weekends or after duty working hours as directed at

the pre-construction conference. Use of any such equipment shall be approved in writing by the COR prior to commencement of work.

B. When the sound pressure level in any working area exceeds 85 dBA, personnel shall be required to wear hearing protective devices in accordance with 29 CFR 1926.101.

C. When the sound pressure level in any work area exceeds 120 dBA, hearing protection equivalent to the combination of ear plugs and ear muffs shall be required.

1.15 SEVERE STORM EVACUATION PLAN

A. In the event of a severe storm warning, the Contractor shall:

1. Secure outside equipment and materials and place materials possible to damage in protected locations.
2. Check surrounding area, including roof, for loose material, equipment, debris, and other objects that could be blown away or against existing facilities.
3. Ensure that temporary erosion controls are adequate.
4. Vacate temporary construction trailers
5. Go to the nearest protective area identified by the FMO PM.

1.16 SCAFFOLDS AND LADDERS (29 CFR 1926 Subpart L, 29 CFR 1926.454, 29 CFR 1910.66, 29 CFR 1910.28-29 and 29 CFR 1910.24-27)

A. The Contractor shall comply with the requirements of 29 CFR 1926 Subpart L and 29 CFR 1910.66 for use of scaffolds. All scaffolds, ladders, platforms, and runways shall be erected, inspected and maintained in accordance with the applicable sections listed above.

B. An adequate number of ladders shall be furnished at all times. Job constructed ladders shall be of select materials. All fixed ladders above 20 feet in height shall be staggered or caged. All ladders placed on concrete floors or slippery surfaces shall be equipped with an approved type no-skid shoe or otherwise adequately made to prevent slipping.

1.17 ROPES/SLINGS/CHAINS

A. No loads shall pass over workmen and other personnel at any time. Slings, their fittings and fastenings, when in use, shall be inspected daily by a qualified craft person for evidence of overloading, excessive wear or damage. Defective slings shall be removed from service. Proper storage shall be provided for qualified slings when not in use. Wire rope shall be inspected by a competent person at the time of installation and at scheduled intervals thereafter. Drums, sheaves, or pulleys having eccentric bores or cracked hubs, spokes, or flanges shall be removed from service. To eliminate rope damage: drums, sheaves, and pulleys shall be smooth and free of surface defects.

B. Connections, fittings, fasteners, parts, etc., used in connection with ropes shall be of good quality and of proper size and strength, and shall be installed in accordance with recommendations of the manufacturer. Chains used for lifting loads shall be inspected before each use. After the initial inspection, the chains shall be inspected each week. Chains shall be

removed from service when showing evidence of cracks, nicks, or other damage. All hooks, used to support human loads (on approved lifting devices) or any loads, shall be closed or equipped with a safety latch.

C. Hooks, shackles, rings, pad eyes, and other fittings that show excessive wear or that have been bent, twisted or otherwise damaged shall be removed from service. Frozen fiber rope shall not be used. Fiber rope that has been subjected to acids or excessive heat shall not be used. Fiber rope shall be protected from abrasion by padding where it is fastened. The same protection applies for fiber rope drawn over square corners, sharp or rough surfaces.

D. The Contractor shall ensure employees performing rigging and hoisting operations are trained and familiar with the safety requirements in 1926.753 and 761. Documentation of this training shall be provided to the Government upon request.

1.18 OPERATIONS ADJACENT TO POWER LINES

A. Equipment or any part thereof shall not have the capability of coming within the following minimum clearances from energized power lines. Positioning and blocking of equipment to assure that no part thereof, including cables, can come within the following minimum clearances will be considered an acceptable alternate.

Power Lines Nominal System KV	Minimum Required Clearance (Feet)
5	3
15	8
44	10
69	12
115-161	15

B. A notice of the minimum required clearance shall be posted at the operator's position.

C. The Contractor shall ensure employees performing operations adjacent to power lines are trained and familiar with the safety requirements in 29 CFR 1926. 950 – 960 (Subpart V). Documentation of this training shall be provided to the Government upon request.

1.19 CONSTRUCTION EQUIPMENT

A. All construction equipment and machinery, including required guards, brakes, cable, etc., shall be inspected by qualified personnel before use for safe and serviceable mechanical condition. All inspections shall be done daily before each shift and will be properly maintained by qualified personnel. A warning device or service of a Signal-man shall be provided where there is danger to personnel from moving equipment, swinging loads, buckets, booms, etc. All equipment capable of hauling 5 tons of material is considered to be heavy duty and shall be equipped with an emergency brake system. The State Commercial Drivers License, (CDL) requirement and regulation applies on Redstone Arsenal. Documentation of this training shall be provided to the Government upon request.

B. Before any machinery or mechanized equipment is placed in use, it shall be inspected and tested by a competent mechanic and certified to be in safe operating condition. Records of tests and inspections will be maintained at the site and will be available to the Government upon request. All machinery or equipment found to be unsafe shall be tagged out and its use prohibited until unsafe conditions have been corrected. Machinery or equipment requiring an operator shall not be permitted to run unattended. Equipment shall be locked or secured to prevent operation by unauthorized personnel. All guards and devices shall be replaced immediately after completion of repairs and adjustments.

C. The Contractor shall ensure employees working with construction equipment are trained in its safe operation and are familiar with the safety requirements in 29 CFR 1926. 600 – 606 (Subpart O). Documentation of this training shall be provided to the Government upon request.

D. Self-propelled construction equipment (except light service vehicles), crawler-type equipment, such as cranes, power shovels and draglines, whether moving alone or in combination shall be equipped with a reverse signal alarm in accordance with 29 CFR 1926.601.

1. The alarm shall be mounted on the rear of the equipment and shall withstand severe wear and tear, adverse weather, and unfavorable environmental working conditions and shall be certified by the manufacturer as fully meeting the following performance standards.
2. The alarm shall produce a relatively pure tone which shall peak within the United Standard Association standard octave passband of 600 to 2,400 cycles per second and shall produce a 0.2 to 0.5 second audible warning within the initial 3 feet of backward movement of the vehicle on which it is mounted and at regular intervals, not to exceed 3 seconds, throughout the backward movement. The alarm shall automatically cut out when the backward movement ceases. The sound intensity of the alarm shall range from and not exceed 100 dB at a horizontal distance of 5 feet from the alarm.
3. Actuation of the alarm shall be automatic by direct connection to any part of the equipment that moves or acts in a manner distinctive only to the rearward movement of the vehicle with no manual controls of any kind between the source of actuation and the alarm. Where application of this requirement to specific types of equipment has impractical application, other means of actuation may be used upon written approval of the CO.

1.20 TEMPORARY ELECTRICITY AND LIGHTING

A. All temporary wiring shall be in accordance with the National Electric Codes, OSHA standards, and installed by competent personnel. Adequate, safe lighting shall be provided in advance for any work requiring artificial light. Grounding of all electrical portable equipment and hand tools shall be accomplished by installing three-wire plug systems. All 120 volt, single-phase, 15 and 20 ampere receptacle outlets on construction sites which are not part of the permanent wiring of the building or structure and which are in use by employees shall have approved ground fault circuit interrupters (GFCI) for personnel protection.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

ATTACHMENT

September 12, 2013

Alternate Safety, Health and Environmental (SHE) Plan for Construction

Company Name:	
Contract Number:	**Date:**
MSFC Organization supported:	
MSFC Contracting Officer:	
MSFC Contracting Officer Representative:	
Contract begin date:	**Contract End date:**

Marshall Space Flight Center (MSFC) is committed to providing a workplace that is incident and injury free by (1) preventing employee fatalities, (2) reducing the number and severity of employee injuries and illnesses, and (3) protecting the MSFC environment and property by implementing the five (5) MSFC SHE Program Core Program Requirements (CPRs). During (or for the duration of) the construction, alteration, demolition and/or repair of this contracted effort shall:

_____

(company name)

CPR 1 – Management Leadership and Employee Involvement

1. Provide a visible management commitment, policy, and culture that value the safety and health of employees and provides a safe and healthful workplace free from incidents and injuries.

2. Protect MSFC property and the environment over the duration of this contracted effort.

3. Perform work activities and operations in compliance with EPA, OSHA, NASA, MPR 8715.1 and all MSFC SHE documents listed in 1.02B that contain requirements applicable to this contracted effort.

4. Hold supervisors and employees accountable to perform their work activities in a safe and healthful manner and also understand their roles and responsibilities in the SHE Program.

5. Authorize and provide the necessary resources for the elimination, reduction or for controlling identified hazardous conditions to a safe working level.

6. Evaluate the safety performance of subcontractors or teammates prior to their selection to perform any work in support of this contracted effort, where applicable.

7. Flow down responsibilities and requirements contained in this contracted effort to subcontractors and teammates over the duration of this contracted effort, when applicable.

8. Provide SHE meetings/toolbox meeting/safety awareness training to employees at least weekly and document. (**NOTE**: Contractors shall maintain documentation of these meetings and provide to the Government, upon request).

9. Maintain the SHE Plan current with contract, NASA and MSFC requirements, review and update as necessary. Provide the frequency of this review.

10. Provide the identification, by title, of the individual assigned by the contractor to be responsible to implement the contractor's SHE program elements and designated to serve as the day-to-day SHE Point of Contact (POC) for

this contracted effort. [**NOTE:** The names of these employees shall be posted on the attached Emergency Phone listing.]

CPR 2 – Worksite Analysis

11. Evaluate work areas, jobs and operations by the use of job hazard analysis, safety or risk assessments, or hazard identification safety checklists to identify hazardous conditions and implement the appropriate control measures to eliminate, reduce or control hazardous conditions to an acceptable safe working level.

12. Reevaluate work areas, jobs and operations when significant changes are made to verify that existing control measures are still effective in controlling the hazardous conditions. (**NOTE 1**: This also includes evaluating health conditions to identify and prevent an occupational disease.) (**NOTE 2**: Contractors shall maintain documentation of these evaluations and provide to the Government, upon request).

13. Perform worksite safety inspections of the worksite at least weekly and document. (**NOTE**: Contractors shall maintain documentation of these inspections and provide to the Government, upon request).

14. Encourage employees to report any condition that they feel is hazardous or unsafe without the fear of reprisal from management.

15. Report all contractor mishaps and close calls that occur in support of this contracted effort and investigate to the extent necessary to determine the proximate or root cause(s), develop and implement corrective actions, and track to closure in accordance with MWI 8621.1. Contact the COR, FMO Project Manager or MSFC Industrial Safety Branch for assistance if needed.

16. Perform post-mishap drug and alcohol testing when the initial mishap investigation provides reason to believe an employee's actions or failure to perform a required action is reasonably suspected of having caused or contributed to causing the mishap in accordance with NPR 3792.1, "Plan for Drug-Free Workplace."

CPR 3 – Hazard Prevention and Control

17. Perform a supervisor level review for work activities identified as hazardous or safety critical prior to them being started.

18. Perform work at MSFC in full compliance with the MSFC SHE documented programs listed in 1.02B that contain requirements that are applicable to this contracted effort while working onsite at MSFC (e.g., Personal Protective Equipment (PPE), Respiratory Protection, Hazard Communication, Confined Space Entry, Lockout/Tagout, Bloodborne Pathogens).

19. Provide an emergency management program at the worksite for all types of emergencies that can occur during this contracted effort (e.g., fire, chemical spill, accidents, natural disasters). (**NOTE 1**: Contractors located at the Center, when applicable, should contact their Contracting Officer or Contracting Officer Representative for additional instructions.) (**NOTE 2**: A list of emergency phone numbers and points-of-contacts is recommended to be posted at the worksite for employee reference.)

20. Provide the necessary safety, health, and environmental services at the worksite (i.e., hazardous waste disposal, industrial hygiene monitoring, emergency medical support, hearing conservation program, respiratory protection, and hazard communication, etc.). Provide a list of environmental and health services that will not be provided by MSFC.

21. Provide a worksite that is easily identified, clearly separated from other ongoing activities in the same general area and effectively barricaded to prevent accidental entry into the worksite by unauthorized employees.

22. Provide protection against damage for structures, utilities, sidewalks, pavements, and other facilities that are immediately adjacent to excavations.

23. Provide fall protection to employees that will be walking/working surfaces with unprotected sides or edges where the potential exists for them to fall to the next lower level in accordance with 29 CFR 1926.501, 29 CFR 1926.502, 29 CFR 1910.23 and MPR 8715.1.

24. Develop a "site specific (building) fall protection plan" when a conventional fall protection system cannot be used to provide fall protection at the worksite and submit for approval to the COR and MSFC Industrial Safety Branch (ISB) in accordance with 29 CFR 1926.501(k) and MPR 8715.1.

25. Develop operating procedures/instructions for operations identified as hazardous or safety critical, or when directed by MSFC ISB, EEOH or FMO.
[**NOTE**: The operating procedures/instructions shall be documented, clearly identify the potentially hazardous situations, the mitigation techniques necessary to control the concern/hazard, and made available to the Government upon request.]

CPR 4 – Safety, Health and Environmental Training

[NOTE: The preferred method documenting an employee's training is to provide a certificate of training that contains (1) the name of the training, (2) date the training was provided, (3) name of the company that provided the training, and (4) the employee's name that indicates the employee attended the training and met all training requirements. In cases where a certificate of training is unavailable for an employee the Contractor can elect to provide an alternate documentation of employee training. The alternation documentation shall (1) be written on a document that contains the company letterhead, (2) rationale that clearly states why the employee is considered as trained, knowledgeable, experienced, and qualified to perform the job/operation, and (3) signed and dated by an a company official or supervisor. In either case the Contractor is assuming the responsibility that the employee is trained, knowledgeable, experienced, and qualified to perform the job/operation in a safe and healthful manner.

26. Provide training to employees so they are informed, knowledgeable and are able to recognize hazardous conditions in the workplace and the signs and symptoms of workplace-related illnesses, understand the safe work practices and procedures to be used in the workplace, and are empowered and authorized to "stop or halt" any activity when they have reason to suspect the activity is being performed in an unsafe or unhealthy manner in accordance with 29 CFR Part 1926.21(b)(2). [**NOTE**: This training can be accomplished during a safety (toolbox) meeting and evidence of this training made available to the Government upon request.]

27. Clearly communicate to all employees the contractor's disciplinary policy/program, so that each employee fully understands the actions that can be taken by the contractor when an employee is discovered not following safety, health, and environmental policies, procedures and rules, and the disciplinary actions are warranted.

28. Evaluate each job/operation performed by contractor employees to identify the specific training required by the applicable parts of 29 CFR 1910 and 29 CFR 1926, and provide the specific training to employees prior to them performing the job/operation.

a. Operate Contractor owned equipment and machinery in accordance with 29 CFR 1926.20(a)(4)
b. Handle or use poisons, caustics, and other harmful substances in accordance with 29 CFR 1926.21(b)(3).
c. Enter into confined or enclosed spaces in accordance with 29 CFR 1926.21(b)(6). [**NOTE**: At MSFC all manholes associated with water, sewer, steam, electrical, communication or any other utility are considered permit-required confined spaces and must be treated as such for entry. This includes provisions such as, but not limited to, written confined space program, documentation of appropriate training, atmospheric testing and retrieval equipment.]
d. Operate any MSFC owned lifting equipment (forklift, crane, etc.) in accordance with MWI 3410.1.
e. Perform rigging and hoisting operations in accordance with 29 CFR 1926.753-761 and 29 CFR 1910.178(l)6).
f. Perform operations adjacent to power lines in accordance with 29 CFR 1926.950-960.
g. Operate or use construction equipment considered as heavy equipment or machinery in accordance with 29 CFR 1926.600-606.
h. Wear personal fall arrest system in accordance with 29 CFR 1926.503.
i. Wear Personal Protective Equipment in accordance with 29 CFR 1910.132.
j. Designated as "qualified" to operate equipment and machinery, and perform the work activities that they have been assigned in accordance with the applicable parts of 29 CFR 1910 and 29 CFR 1926.
k. Designated as "competent person" for any operation identified in 29 CFR 1910 or 29 CFR 1926 that require a "competent person."
(**NOTE**: Contractors shall maintain documentation of this training and provide to the Government.)

29. Provide MSFC SHE Program Awareness Training to all employees within 30 days of the Authority to Proceed (ATP) or their arrival at the worksite. [**NOTE** 1: Contact Facilities Management Office (FMO) Project Manager or Industrial Safety Branch (ISB) to receive a copy of this training. **NOTE** 2: Contractors shall maintain a record of this training and made available to the Government, upon request.]

30. Provide MSFC Safety Certification to employees when required by the ISB or Environmental Engineering and Occupational Health (EEOH) Office. (**NOTE**: At the present time if the Contractor is expected to operate MSFC owned lifting equipment in accordance with MWI 3410.1 a MSFC Safety Certification is required.)

31. Inform all employees on the methods of how to report an emergency or accident while working at MSFC. [**NOTE**: Call 4-HELP (4357) and select the appropriate option. If using a cell phone call 911 and tell the operator you are located at Marshall Space Flight Center, provide building number and road name.]

CPR 5 – Environmental Management System

32. Comply with the MSFC Environmental Management System (EMS). The EMS provides the necessary training and procedures to ensure NASA's compliance with all environmental laws and regulations. Environmental procedures are as follows:

a. MPD 8500.1 "MSFC Environmental Management Policy"
b. MPR 8500.1 "MSFC Environmental Engineering & Occupational Health (EEOH) Program"
c. MPR 8500.2 "MSFC Environmental Management System"
d. MWI 8540.2 "Green Purchasing Program"
e. MWI 8550.1 "Waste Management"
f. MWI 8550.2 "Storm Water Management"
g. MWI 8550.3 "Wastewater Compliance"
h. MWI 8550.4 "Air Emissions Compliance"
i. MWI 8550.5 "Hazardous Material Management"

[**NOTE**: Coordination with EEOH is required.]

ADDITIONAL REQUIREMENTS

Pre-work Inspections

33. Erect and inspect scaffolds prior to use each day in accordance with 29 CFR Subpart L and 29 CFR Part 1910.66 and 29 CFR 1926.451(f)(3).

34. Dig, form and inspect excavations/trenches prior to entry and as needed throughout the day in accordance with 29 CFR 1926.651, 29 CFR 1926.652 and 29 CFR 1926.651(k).

[**NOTE**: Evidence of these inspections shall be documented and made available to the Government upon request.]

Equipment and Tools

35. Provide Contractor owned or rented hoisting equipment (cranes and forklifts) that have their rated load capacities conspicuously posted on the equipment in accordance with 29 CFR 1926.550(a)(2) if brought on MSFC.

36. Provide Contractor owned or rented motorized vehicles and lifting equipment that comply with the applicable requirements in 29 CFR 1910.178 – 184, 29 CFR 1926.606, 1000-1003, and 1501 if brought on MSFC. [**NOTE**: Documentation of equipment inspections shall be made available to the Government upon request.]

37. Provide a documented annual inspection for Contractor owned or rented hoisting equipment (cranes and forklifts) in accordance with 29 CFR 1926.550(a)(6) if brought on MSFC. [**NOTE**: Documentation of the annual inspection shall be made available to the Government upon request.]

38. Perform a visual inspection of each hoisting equipment (cranes or forklifts) prior to use in accordance with 29 CFR 1926.753(c)(1).

39. Remove any equipment, machinery or tools if it is discovered to be in an unsafe operating condition in accordance with 29 CFR 1926.20 (a)(3).
[**NOTE**: Equipment, machinery or tools discovered in an unsafe operating condition shall be removed from the worksite or identified (tagged) as unsafe, or rendered inoperable by the use of a lock.]

40. Provide a reverse signal alarm on all self-propelled construction equipment in accordance with 29 CFR 1926.601. [**NOTE**: This is not required for light service vehicles.]

41. Locate and store equipment and materials outdoors so to not cause possible damage to other buildings or structures during severe weather.

Electrical Equipment

42. Provide power portable tools that are double-insulated or grounded by means of a 3-wire polarity type grounding system via a ground fault interrupter in accordance with 29 CR 1926.302.

43. Provide ground-fault circuit interrupters (GFCI) on all single-phase 15 and 20 ampere receptacle outlets used by employees at the worksite during the construction in accordance with 29 CFR 1926.404(b)(1).

44. Provide cord sets and receptacles that are equipped with a grounding plug and are grounded in accordance with 29 CFR 1926.404(b)(1). [**NOTE**: This applies to cord sets and receptacles that are not part of the permanent building structure.]

45. Apply lockout devices to equipment and systems when required in accordance with 29 CFR 1910.147, 29 CFR 1926.417 and MWI 8715.2. [**NOTE** 1: At MSFC all locks used for locking out equipment/system while an employee is working on the equipment/system shall be identified by a “red” colored case. These lockout devices shall also be identified with tags containing “red diagonal stripe”. Reference MWI 8715.2 for more information.]
[**NOTE** 2: Work on energized equipment is strictly prohibited at MSFC, but occasionally a situation will arise where this is not possible. In these situations an Energized Electrical Work Permit shall be required. Contact FMO for more information.]

Lighting

46. Provide adequate lighting (permanent or temporary) in the work area that enables employees to safely perform their jobs/operations in accordance with 29 CFR 1926.26.

Fire Protection

47. Provide fire protection equipment that is appropriate for the work being performed at the worksite in accordance with 29 CFR 1926.24. [**NOTE** 1: Portable fire extinguishers are to be located at the worksite and accessible to employees.] [**NOTE** 2: Any employee that might use a portable fire extinguisher are to receive training in the general principles of fire extinguisher use and the hazards involved with incipient stage firefighting in accordance with 29 CFR 1910.157.]

Barricades

48. Erect barricade fencing that is effective in preventing unauthorized entry around the worksite and hazardous conditions such as excavations, trenches, etc. in accordance with 29 CFR 1926.200 -203, Subpart G.

[**NOTE**: Orange mesh barricade fencing is the preferred method for construction at MSFC, but other means (signs, signals, tags) of warning employees are also acceptable. The FMO inspector or ISB can provide more information.]

49. Provide protection against damage for structures, utilities, sidewalks, pavements, and other facilities immediately adjacent to excavations.

Personal Protective Equipment

50. Communicate Personal Protective Equipment (PPE) requirements to employee whose jobs/operations can expose them to hazardous conditions in accordance with 29 CFR 1926.28 and MWI 8715.15. [**NOTE**: The communication can be by the use of signs posted at the worksite that clearly identify the type PPE and when it is required to be worn.]

Personal Fall Arrest System (PFAS)

51. Provide a system that ensure PFAS and associated positioning device systems are inspected prior to each use in accordance with 29 CFR 1926.502(d)(21) and 29 CFR 1926.502(e)(9).

52. Provide a system that ensures PFAS are inspected at least on a semi-annual basis by a Competent or Qualified person in accordance with ANSI A10.32 (2004) section 6.3).
[**NOTE**: Documentation of equipment inspections shall be made available to the Government upon request.]

Housekeeping

53. Remove all scrap lumber and debris from work areas, passageways and stairs in accordance with 29 CFR 1926.25(a).

54. Remove combustible scrap and debris from the worksite at regular intervals in accordance with 29 CFR 1926.25(b).

55. Provide waste/trash containers at the worksite empty them at regular intervals in accordance with 29 CFR 1926.25(c). [**NOTE**: Containers for garbage and other oily, flammable, or hazardous wastes, such as caustics, acids, harmful dusts, etc. shall be equipped with covers and the covers kept closed.]

Permits/Plans

56. Obtain the following abatements/impairment plans when needed for:

Lead removal – 29 CFR 1926.62
Asbestos removal - 29 CFR 1926.1101
Fire Protection system outages – 29 CFR 1926.150 and MWI 8715.11

57. Obtain the following permits when needed:

Hot Work Permits (MSFC Form 1155) shall be required for activities that are not performed in a MSFC Designated Hot Work Area and use an “open flame”, welding, cutting, grinding, Tar Kettles. etc.
[**NOTE**: All hot work shall end 1 hour prior to the end of the normal work day.]

- Digging Permit (MSFC Form 4392) shall be required for all excavations and trenching
- Confined Space Entry Permit (MSFC Form 2519) shall be required for all entries in MSFC spaces identified as a confined space in accordance with MWI 1840.1.
- Energized Electrical Work Permit (MSFC Form 4462) shall be required if the equipment or system cannot be de-energized to perform work.
  [**NOTE**: No work shall be performed on energized equipment without concurrence from FMO and approval from ISB.]

- Air Emissions Permit (coordinate with EEOH 256-544-4246) shall be required if the equipment or process emits fumes, smoke, particles, dust, chemicals, or other emissions into the air. If the following equipment is installed on site, it shall be evaluated for air emissions permit requirements before installation:
  - Fuel burning equipment (examples: boilers, incinerators, generators, engines, etc)
  - Paint booths
  - Sand/Grit blasters
  - Surface coating equipment
  - Machine shops
  - Woodworking shops
  - Chemical baths, vapor degreasers, solvent cleaning equipment/operations
  - Air strippers/water purification
  - Tanks containing Volatile Organic Chemicals (VOC's) (examples: gasoline tanks, diesel tanks, etc.)
  - Liquid rocket engine, solid motor, or component testing
  - Vapor degreasing
  - Laboratory equipment
  - Equipment for melting or applying wax
  - Hydraulic or hydrostatic test equipment
  - Brazing, soldering, or welding
  - Non-digital photography
  - Exhaust/fume hoods
  - Parts Washers
- Storm Water Permit

General

58. Instruct all employees on the methods to receive emergency medical attention at MSFC in accordance with 29 CFR 1926.23 & 50. [**NOTE**: First aid is available to all employees at the MSFC Medical Center, building 4249 for job related illnesses and injuries.]

59. Identified employee(s) to serve in the role of a "Competent person" for pre-job inspections/verifications/activities (scaffolding, trenches, etc.) as required by the applicable subparts of 29 CFR 1910 and 29 CFR 1926 for this contracted effort. [**NOTE** 1: A "competent person" is identified in 29 CFR 1926.32 and 29 CFR 1910 as "capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who have authorization to take prompt corrective measures to eliminate them."] [**NOTE** 2: Justification/rational of selecting these employees shall be documented (employee's training, work experience and knowledge of the job/operation) and made available to the Government upon request. The name(s) of the "Competent person(s) and the corresponding job/operation for which that are designated to serve as the "Competent person" shall be listed on the attached Emergency Phone listing, Appendix C and posted at the project site or designated meeting area where the worker gather prior to commencing work.]

60. Appoint an employee to be "in charge and responsible" and is physically located onsite while work is being performed. [**NOTE**: This is normally a job superintendent or foreman.]

61. Provide a list of company employee(s) to be contacted in the event of an emergency while work is performed onsite under this contracted effort.

62. Post the "Emergency Phone List" Appendix C at the project site, or a designated meeting area where workers gather prior to commencing work, or for other activities. The "Emergency Phone List" can also be located in company vehicles if the Contractor does not have a designated meeting area.

63. Provide additional requirements not previously listed, if required, specific to the work performed under this contracted effort in Appendix A.

64. Instruct employees to adhere to the MSFC emergency procedures when there is a probability of exposure to Unexploded Ordnance (UXO), hazardous or radiological material.

65. If Unexploded Ordnances (UXO) are suspected of being in the worksite notify the FMO Construction Management Inspector to contact the UXO services organization to perform an assessment/investigation of the worksite in accordance with the MSFC Technical Specifications for Repair and Construction (TSRC) section 01 05 90.

REPORTS/DOCUMENTATION SUBMITTAL

Reports/documentation listed below shall be made available to the Government upon request.

1. Safety (toolbox) meeting and/or safety awareness training documentation
2. Safety Assessments: Hazard Analysis (HA) or Job Hazard Analysis (JHA), Hazardous Inventory Checklists (HIC) for the work being performed
3. Worksite inspections conducted by the contractor documentation
4. Employee training/qualification/certification records
5. Equipment inspections conducted by the contractor documentation
6. Safety Data Sheets (SDS) for chemical and hazardous materials
7. Storm water inspection reports
8. Green purchasing reports
9. Construction Best Management Practices Plan (CBMPP)
10. Waste Management plan

SUBMISSIONS FREQUENCY

1. Submit MSFC Contractor Accident and Safety Statistics (MSFC Form 4371) or an equivalent method to the Contracting Officer Representative (COR) or FMO representative designated by the COR. This information shall be provided to the COR in accordance to the reporting requirements and frequency determined by the COR. At a minimum the following information shall be provided:
   - Contract number
   - North American Industry Classification System (NAICS)
   - Number of employees and supervisors
   - Number of hours worked
   - Lost work day cases, days away from work, and restricted work days
   - Number of safety meeting and worksite inspection

2. Initial reporting for Type A, Type B, High-Visibility Mishaps and Close Calls – The initial reporting for these types of mishaps/close call **shall be made as soon as possible after initiating emergency response, but no later than one hour of occurrence or awareness.**

2.1 Initial reporting for Type C, Type D, Low-Visibility Mishaps and Close Calls– The initial reporting for these types of mishaps/close calls **shall be reported as soon as possible after initiating emergency response, but no later than four hours of occurrence or awareness.**

2.2 Initial report shall be made to the MSFC ISB by one of the following: 1) Call the Safety Hotline at (256)-544-0046 or 4-HELP (4-4357), select the appropriate option, or 2) Submit a "SHE Report" located on "Inside Marshall," or 3) Direct input to the NASA Incident Reporting Information System (IRIS) Quick Incident Report located at https://nasa.ex3host.com/irisquickincident/safety_default.asp., or an equivalent electronic notification method to notify the MSFC ISB, and 4) Notify the FMO Construction Inspector.

The link to the "SHE Report" is located at the bottom of the "Inside Marshall" web page under the "MSFC Safety Reporting System" link. Open "SHE Reporting," select "Continue to SHE Report Form," select "Category," select "Incident or Mishap" and enter all the required information,

2.3 The initial reporting for all mishaps/close calls shall include 1) location and time of incident, 2) number of fatalities and/or hospitalized employees (if known), 3) Company or MSFC organization contact person and phone number, 4) a brief description of the mishap/close call including damage to equipment and/or facilities.

3. Follow-up reporting and documentation of a mishap/close call shall be within 24 hours of initial notification to the FMO Incident Reporting Information System (IRIS) administrator or ISB in accordance with MWI 8621.1.

The extent of investigation to determine the root cause of the mishap or close shall be conducted in accordance with MWI 8621.1.

Approval Signatures

By signing this Alternate SHE Plan the Contactor confirms their agreement and commitment to (1) provide a workplace that is incident and injury free, and (2) to adhere to and comply with all of the requirements contained in MPR 8715.1, MWI 8621.1 and other MSFC SHE documents identified above as applicable to the jobs/operations associated with this contracted effort while working on MSFC.

Contract Number: _____

Company Name: _____

Company Onsite Superintendent/Foreman

(print):_____

(signature):_____Date:_____

Company Onsite SHE representative

(print):_____

(signature):_____Date:_____

APPENDIX A
Additional Information

List of jobs/operations identified as hazardous or safety critical.
List of hazardous operating procedures/instructions
List of JHA, Risk Assessments, or Hazard Identification Safety Checklists
List additional requirements that are specific to the work performed under this contracted effort, if necessary.

1.

2.

Appendix B
Applicable Documents

"Check the box" of the following MSFC SHE Program documents that are **NOT** applicable to the work being performed under this contracted effort.

No.		**Federal Directives and Standards**
1		29 CFR Part 1910, Department of Labor, Occupational Safety and Health Administration Standards for General Industry
2		29 CFR Part 1925, Safety and Health Standards for Federal Service Contracts
3		29 CFR Part 1926, Department of Labor, Occupational Safety and Health Administration Standards for Construction
4		CFR Title 40 Parts 1-1068, Protection of the Environment
5		ANSI Stds., American National Standards Institute, applicable to the scope of this contract (ANSI 10.32)
6		ASME, American Society of Mechanical Engineers, applicable to the scope of this contract
7		NFPA, National Fire Protection Association
8		CGA, Compressed Gas Association, applicable to the scope of this contract
		NASA Directives
9		NPR 3792.1, Plan for a Drug-Free Workplace
10		NPR 8715.1, NASA Occupational Safety and Health Programs
11		NPR 8715.3, NASA General Safety Program Requirements
		MSFC Directives
12		MPR 1840.4, MSFC Asbestos Program
13		MPR 1860.1, MSFC Radiation Safety Procedural Requirements
14		MPD 1860.2, Nonionizing Radiation Safety Program
15		MPD 8500.1, MSFC Environmental Management Policy
16		MPR 8500.1, MSFC Environmental Engineering and Occupational Health Program
17		MPR 8500.2, MSFC Environmental Management System (EMS)
18		MWI 1810.1, Automated External Defibrillator (AED) Program
19		MWI 3410.1, Personnel Certification Program
20		MWI 8540.2, Green Purchasing Program
21		MWI 8550.1, Waste Management
22		MWI 8550.2, Storm Water Management
23		MWI 8550.3, Wastewater Compliance
24		MWI 8550.4, Air Emissions Compliance
25		MWI 8550.5, Hazardous Material Management
26		MWI 8621.1, Mishap and Close Call Reporting and Investigation Program
27		MPR 8715.1, Marshall Safety, Health, and Environmental (SHE) Program
28		MWI 8715.1, Electrical Safety Program
29		MWI 8715.2, Control of Hazardous Energy (Lockout/Tagout) Program
30		MWI 8715.10, Explosives, Propellant, and Pyrotechnics Program
31		MWI 8715.11, Fire Safety Program
32		MWI 8715.12, Safety, Health and Environmental-Finding Tracking System (SHEtrak)

33		MWI 8715.13, Safety Concerns Reporting System (SCRS)
34		MWI 8715.15, Ground Operations Safety Assessment Program
35		MWI 8715.17, Hazardous Operations Readiness Review Program
36		For Construction - Indefinite Delivery Indefinite Quantity (IDIQ) and Blanket Purchase Agreement (BPA) – MSFC Technical Specifications for Repairs and Construction (TSRC)
37		For Construction – Construction of Facilities (CoF) – MSFC Master Specs

APPENDIX C
MSFC EMERGENCY TELEPHONE LIST

[Post at worksite or a designated meeting area where workers gather prior to commencing work or for other activities. The "Emergency Phone List" can also be located in company vehicles if the Contractor does not have a designated meeting area.]

MSFC NETWORK TELEPHONE		OTHER TELEPHONE
AMBULANCE	911	911- Specify at MSFC or 544-4357, Option (Security)
CHEMICAL SPILLS	911	544-4357, Option (Security)
Environmental Engineering Office		544-4246
FIRE	911	876-2117
SECURITY	911	544-4357, Option (Security)
MEDICAL CENTER (bldg 4249)		544-2390

[Identify that you are on MSFC property if using a cell phone and give location, building number, road, intersection, etc. if known.]

TO REPORT UNSAFE, UNHEALTHFUL OR ENVIRONMENTAL CONCERNS

OCCUPATIONAL HEALTH SERVICES	544-2390
ENVIRONMENTAL ENGINEERING OFFICE	544-4246
INDUSTRIAL SAFETY BRANCH	544-0046

TO REQUEST A PERMIT

Welding/Burning/Cutting Permits	544-0046
Inside Test Area	544-7374, 961-1178
CONFINED SPACE PERMITS (call all numbers listed below)	
Occupational Health Services	544-2390
Industrial Safety Branch	544-0046
Inside Test Area	544-7374, 961-1178
Fire Department	876-3437
Digging Permit	544-6759

Company Name:	
Company Emergency Contact:	Phone:
Company Emergency Contact:	Phone:
Company Emergency Contact:	Phone:
Company SHE POC:	Phone:
Competent SHE POC (Alt)	Phone:
Competent Person – Lifting Equip:	Phone:
Competent Person – Excavation/Trench:	Phone:
Competent Person - Scaffold:	Phone:
Competent Person - Rigging:	Phone:
Competent Person:	Phone:
Competent Person:	Phone:

END OF SECTION

SECTION 010650 — ENVIRONMENTAL COMPLIANCE

PART 1 - GENERAL

1.1 SUMMARY

A. This section deals with hazardous waste, stormwater, and green purchasing. Refer to section 01 74 19 for construction waste and demolition.

1.2 REFERENCE

A. The publications listed below form a part of this section to the extent referenced:

1. MPR 1840.4, MSFC Asbestos Program
2. MWI 8540.2 Green Purchasing Program
3. Executive Order 13423 Strengthening Federal Environmental Energy, and Transportation
4. Executive Order 13514 Federal Leadership in Environmental, Energy, and Economic Performance
5. MPD 8500.1, MSFC Environmental Management Policy
6. MPR 8500.1, MSFC Environmental Management Program
7. MPR 8500.2, MSFC Environmental Management System
8. Steel Structures Painting Council (SSPC):

    a. SSPC Technology Guide No. 6 (2004) Guide for Containing Surface Preparation Debris Generated During Paint Removal Operations

1.3 SUBMITTALS

A. Submit one copy of Material Safety Data Sheets (MSDS) and Chemical Inventory Worksheet for all hazardous materials brought on site. The contractor shall use MSFC Form 4582 provided by the Government.

B. Inspection Reports: Monthly Submittals (by the 10th for the previous month):

C. Construction Best Management Practices Plan (CBMPP)

1. For construction disturbances less than 1 acre, submit a Site Specific CBMPP using attachment A.
2. For construction disturbances of one acre or greater, the contractor shall obtain a Construction Storm Water Notice of Registration (NOR) on Alabama Department of Environmental Management (ADEM) Form 498. (http://www.adem.state.al (ADEM Forms). The contractor shall prepare and submit the NOR along with a CBMPP to ADEM, and have an approval from MSFC AS10 prior to starting work. Submit within 10 days of receipt a copy of any and all appropriate permits and notices received or granted.

D. Closeout Submittals

1. Submit Stormwater Inspection Records (monthly and daily inspections) at the end of the project.
2. Green Purchasing Report: The contractor shall submit a report listing purchases of items containing recycled or biobased materials on MSFC Form 4510 (MSFC Construction Green Purchasing Reporting Form). The contractor shall include the amount spent on items containing recycled materials or biobased products and amount spent on items that do not contain recycled materials or are not biobased. The accounting shall include the amount spent on all products that meet the EPA (http://www.epa.gov/epaoswer/non-hw/procure/products.htm) guidelines or the USDA guidelines (http://www.biopreferred.gov/ProposedAndFinalItemDesignations.aspx) whether specified or not.

1.4 DEFINITIONS

A. Construction disturbance: Defined in ADEM Regulation 335-6-12-.02 (e).

B. Environmental Policy: "Enabling NASA's mission by providing environmental compliance and stewardship and a safe and healthful workplace."

C. Inspection: Examining satellite accumulation points to ensure compliance with the State of Alabama Regulations. Examining site conditions, records, and plans for compliance.

D. Postconsumer content: A material or finished product that has served its intended use and has been diverted or recovered from waste destined for disposal, having completed its life as a consumer item. Postconsumer materials are part of the broader category of recovered materials.

E. Qualified Credentialed Inspector (QCI) is an operator, operator employee, or operator designated qualified person who has successfully completed initial training and annual refresher Qualified Credentialed Inspection Program (QCIP) training and holds a valid certification from an ADEM approved cooperating training entity.

F. Qualified Credential Professional (QCP) is any staff member of ADEM designated by the Director, a Professional Engineer, an Alabama Natural Resources Conservation Service professional designated by the State Conservationist, or a Certified Professional in Erosion and Sediment Control (CPESC). A QCP includes a registered landscape architect, a registered land surveyor, a Professional Geologist, a registered forester, a Registered Environmental Manager as determined by the National Registry of Environmental Professionals (NREP), and a Certified Professional Soil Scientist (CPSSc) and other ADEM accepted professional designations, certifications, and/or accredited university programs that can document requirements regarding proven training, relevant experience, and continuing education that enable recognized individuals to prepare Construction Best Management Practice Plans (CBMPPs), to make sound professional judgments regarding Alabama National Pollutant Discharge Elimination System (NPDES) rules, planning, design, implementation, maintenance, and inspection of construction sites, receiving waters, Best Management Practices (BMPs), remediation/cleanup of accumulated offsite pollutants from the regulated site, and reclamation or effective storm water quality remediation of construction associated land disturbances, that meet or exceed recognized technical standard and guidelines, and effective industry standard practice. The QCP shall be in good standing with the authority granting the registration or designation.

G. Waste Stream: A generation of a spent/waste hazardous or recyclable material that requires either recovery or disposal in accordance with appropriate environmental, NASA, Federal, State and local laws and regulations.

1.5 EXPLOSIVE ORDNANCE AND CHEMICAL WARFARE MATERIAL PRECAUTION

A. See Section 01 05 90, 1.4.

PART 2 - PRODUCTS

2.1 ACCUMULATION CONTAINERS

A. Hazardous and controlled waste accumulation containers will be provided by the Government. The containers shall be requested by the Contractor three days in advance of the initial need date.

B. The containers will be labeled by the Government.

C. Ensure that the accumulation containers are secured such that the containers shall not be exposed to vehicular traffic.

D. Turn in the containers when ninety percent (90%) of the rated volume of each container is used for liquid waste. Containers of solid waste may be filled to hundred percent (100%).

E. At the time of turn-in, identify if a replacement container is required.

F. Ensure that hazardous and controlled waste are segregated and labeled by type in different accumulation containers.

PART 3 - EXECUTION

3.1 HAZARDOUS WASTE GENERATOR NOTIFICATION AND TRAINING.

A. The Contractor shall designate a person as point of contact (POC) and as many as two alternate people for each hazardous and controlled waste accumulation site.

B. The POCs shall be responsible for maintaining the Contractor's accumulation site in compliance with all applicable Federal, state and local laws and regulations.

C. The Contractor shall attend the first available SHE 101C, "Safety, Health, and Environmental (SHE) Program Construction Awareness" training after initiation of the contract. The training is conducted on site by the Government at no cost to the Contractor.

D. Government personnel will inspect the accumulation site(s) to ensure compliance.

3.2 HAZARDOUS MATERIAL NOTIFICATION AND TRAINING

A. As required in Federal Standard 313, the Contractor shall submit to the Government a Chemical Inventory Worksheet listing the product names and quantities of all hazardous materials brought on site. The Contractor shall maintain a copy of this list at the job site for inspection by the Government. Copies of the MSDSs shall be readily accessible to all Contractor employees at the job site either hard copy or electronic. Contractor shall provide a copy on MSFC Form 4582.

B. The Contractor shall attend the first available SHE 101C, "Safety, Health, and Environmental (SHE) Program Construction Awareness" training after initiation of the contract. The training is conducted on site by the Government at no cost to the Contractor.

C. The Contractor shall ensure that all personnel working in the area are made aware of the chemical hazards associated with chemicals located at the jobsite.

3.3 HAZARDOUS AND CONTROLLED WASTE COLLECTION

A. The Contractor shall notify the Government of wastes being generated. The Government will determine the correct method of disposal.

B. The following types of hazardous and controlled waste are commonly associated with construction projects; however, it is not necessarily an all inclusive list. All wastes shall be collected and placed into accumulation containers for disposal.

1. All fluorescent light ballasts and lamps.
2. High Intensity Discharge (HID) lamps.
3. Free oil liquids and oil filters. Oil rags that are not saturated (no free liquids dripping) shall be disposed as solid waste.
4. Paint, paint thinners, adhesives, etc.
5. Sandblast material from tanks, equipment, and piping.
6. Materials used for cleaning and degreasing of equipment, tanks, and piping.
7. Paint chips from water blasting operation, scraping, sandblasting, grinding, etc. Shall be collected on a daily basis. Materials to be recycled shall be free of loose lead paint chips prior to recycling.
8. Aerosol cans.
9. Process piping system cleaning operations fluids shall be collected and disposed as directed.

C. The Contractor shall adhere to Government guidelines for inspections, collection, and turn-in of waste materials.

D. Asbestos-containing material (ACM) shall be bagged, labeled and handled in accordance with OSHA and EPA regulations and MSFC procedures per MPR 1840.4, "MSFC Asbestos Program". The Contractor shall transport and dispose of ACM at the Redstone Arsenal Landfill (RSAL), unless otherwise approved by the Government. See Section 02 82 00 for additional information.

3.4 EMPTY CONTAINER MANAGEMENT

A. Empty hazardous material containers (5 gallons and larger) shall be turned in to the Government. The Contractor shall ensure the containers are empty using practices commonly employed to remove materials from that type of container such as pouring, pumping, and aspirating.

B. Clean and purge/triple rinse all empty containers as required by the Government.

C. Ensure bungs and/or tops are secured prior to storage/turn-in.

D. Empty containers shall not be stacked more than two high for any size container on pallets.

E. Empty containers that are damaged and will not seal shall be taped over the damaged area or turned upside down to prevent rainwater collection.

F. Empty containers shall be turned in frequently, as determined by the Government.

3.5 CONSTRUCTION BEST MANAGEMENT PRACTICES PLAN (CBMPP)

A. Construction Best Management Practices Plan (**Site disturbing greater than 1 acre**): The Contractor shall prepare, submit, and have approved a site specific CBMPP, prior to work commencing on site. The Contractor will implement the CBMPP throughout the duration of the construction. This CBMPP must be prepared in accordance with ADEM Administrative Code 335-6-12-.21 by a QCP. If a Construction Storm Water Notice of Registration (NOR) from ADEM is required, the prime construction Contractor shall apply for the permit and advertise for a period of seven days by placing the permit application in the legal section of the local newspaper 15 days prior to starting any work at the selected site..

B. Construction Best Management Practices Plan (Site disturbing less than 1 acre): The Contractor shall prepare a Site Specific Construction Best Management Practices Plan (CBMPP) (Attachment A). The Contractor will implement the CBMPP throughout the duration of the contract.

C. Daily Stormwater Inspection Record: The Contractor shall perform daily inspections of hazardous waste containers, hazardous materials containers, empty containers, vehicles and equipment, and erosion and sediment controls. The daily inspection will be documented in a similar format as shown on MSFC Form 4524, Stormwater Inspection Record (available from the Government), or other format acceptable to the Contracting Officer. The inspection documentation will be maintained and available at the site for periodic verification of compliance by the Government and will be submitted to the Government upon completion of construction.

1. Inspections: When no work is being conducted (e.g., weekends, holidays, etc.), no inspection is necessary. The Contractor shall ensure that the site is in compliance with the CBMPP. If the project construction site is greater than 1 acre, inspections shall be performed by a contractor representative that meets the requirements outlined in ADEM Administrative Codes 335-6-12-.02(p) and (q), which states that inspections must be conducted by a QCI or QCP or a person under the direct supervision of a QCP (QCP designee).

2. Daily Stormwater Prevention Inspection. The Contractor shall inspect daily, unless otherwise noted, hazardous waste containers, hazardous material containers, empty containers, vehicles and equipment, and erosion and sediment controls for:

    a. Containers protected from traffic
    b. Containers labeled
    c. Storage area neat and orderly
    d. Spillage from material handling
    e. Containers sealed, during inactivity
    f. Damaged pallets
    g. Damaged containers
    h. Spill cleanup materials available
    i. Containment system in good condition
    j. Containment valves closed
    k. Containment system water managed appropriately
    l. Fluids leaking from vehicles and equipment

D. Monthly Stormwater Inspection Record

1. The Contractor shall perform monthly inspection of erosion and sediment controls for the construction site. The inspection shall be documented in a format acceptable to the Contracting Officer. The inspection documentation shall be maintained and available at the site for periodic verification of compliance by the Government and shall be submitted to the Government upon completion of construction.

2. The Contractor shall inspect erosion and sediment controls for:

    a. No signs of excessive erosion
    b. Erosion controls are effective and in good condition
    c. No sediment buildup in storm water structures (inlets, ditches)

E. Deficiencies and Inspections: Contractor shall take immediate action to correct any environmental findings or non-compliances. Failure to come into compliance or correct a finding to the satisfaction of the contracting officer within 48 hours, from the time when the non-compliance was discovered by the contractor or from the time when the contractor was notified, shall result in the contractor stopping all on-site work at the contractor's sole expense until compliance is achieved as determined by the government and the contracting officer has approved continuation of work. The contractor may submit to the Contracting Officer's Technical Representative (COTR) for approval within the 48 hours an Environmental Recovery Plan detailing day-by-day activities including intermediate protective measures that will be taken in order to come into compliance within a specified recovery period and to forego the stop of work until completion of the approved recovery period.

F. Stockpiles of dirt must be stabilized with temporary or permanent vegetative cover if material is not actively disturbed more than thirteen (13) days per ADEM Admin R. Code 335-6-12-.21(2)5.

3.6 SPILLS OF HAZARDOUS MATERIALS

A. The Contractor shall activate the MSFC Emergency Plan for emergency spills by dialing 911. The contractor may dial 256-544-4357 for non-emergency hazardous material spills that cannot be cleaned up with contractor cleanup material. The Contractor is responsible for costs incurred in cleaning up spills.

B. The Government will determine the correct disposal method for spilled materials.

C. The Contractor shall maintain spill cleanup material for the type of hazardous materials used at the construction site.

3.7 HANDLING, DUST CONTROL, AND DISPOSITION OF LEAD COATINGS

A. Lead-containing material shall be bagged, labeled, and handled in accordance with OSHA and EPA regulations and MSFC procedures per MWI 1840.1, “MSFC Industrial Hygiene Programs”. The Contractor shall transport and dispose of lead-containing material. See Section 02 83 00 for additional information.

3.8 REQUIREMENTS FOR REMOVING LEAD COATINGS - SMALL SCALE / SHORT DURATION

A. Lead-containing material shall be bagged, labeled, and handled in accordance with OSHA and EPA regulations and MSFC procedures per MWI 1840.1, “MSFC Industrial Hygiene Programs”. The Contractor shall transport and dispose of lead-containing material. See Section 02 83 00 for additional information.

3.9 GREEN PURCHASING

A. The Resource Conservation and Recovery Act (RCRA) requires that use of recovered/recycled (recycled) materials in the products to the greatest extent practicable. Additionally, Executive Order 13423 requires (1) the reduced use of chemicals and toxic materials and purchase of lower risk chemicals and toxic materials as well as (2) the expanded purchasing of environmentally sound goods and services, including biobased products. Furthermore, Executive Order 13514 requires that 95% of new contract actions are energy-efficient, biobased, environmentally preferable, non-ozone depleting, contain recycled content, or are non-toxic or less toxic. The Farm Security and Rural Investment Act of 2002 (Farm Bill) requires the purchase and use of biobased products.

B. The Contractor shall determine from the technical specifications what products require recycled biobased content and purchase accordingly.

C. Whenever a product is required to contain recycled material or be biobased by the technical specification but cannot be produced as specified, the Contractor shall notify the COTR, by submitting a product substitution request per the Section 016000 entitled “Product Requirements” with a Contractor-signed letter explaining in detail what suppliers and manufactures were contacted and why the product cannot be produced as specified.

D. Green Purchasing Report: See Section 1.3 D for requirements

E. GREEN PURCHASING WAIVER: The Contractor purchase from the list of products (see Section 1.3 D) if one of the following exceptions applies: 1) Inadequate competition; 2) Unreasonable price; 3) Lack of quality/performance specifications or standards; or 4) Unavailable within a reasonable timeframe.

1. The Contractor shall prepare a request for waiver using MSFC Form 4412, "Green Purchasing Request for Waiver". Include any necessary accompanying documentation, and forward the document to the Government for concurrence and approval (follow instructions on the form). If the waiver is approved, the excepted item is available for purchase. The Government shall keep the original signed waiver. If the waiver is disapproved, the Contractor shall revise the purchase request to include the environmentally preferable product. If a disapproved waiver is disputed, the Contractor shall consult the Office of Center Operations management for resolution. If necessary, the Agency Environmental Executive shall be consulted (per NPR 8530.1) to resolve the waiver dispute.

3.10 ENVIRONMENTAL MANAGEMENT SYSTEM REQUIREMENTS

A. The Contractor shall comply with the MSFC Environmental Management Policy in MPD 8500.1 and procedures and requirements including, but not limited to, MPR 8500.1, "MSFC Environmental Management Program" and MPR 8500.2, "MSFC Environmental Management System."

B. The Contractor shall ensure that their offsite employees and subcontractors (through subcontract requirements or other means) with onsite access are aware of any environmental responsibilities associated with their activities onsite. Failure to comply with environmental policies and procedures may result in damage to the environment and could potentially result in regulatory penalties against NASA and/or the Contractor, and Contractor loss of access to NASA/Marshall facilities.

ATTACHMENT A

CONSTRUCTION BEST MANAGEMENT PRACTICES PLAN (CBMPP)
(For sites disturbing less than 1 acre)

Contract Information

Contractor: _____

Address: _____

Phone: _____

Construction Site Contact Name: _____

Construction Contract Number: NNM_____

General Information: Describe the planned construction project. Include a description of amount of disturbed land, expected duration, and location. Provide a site map or use the site map included on the design drawings detailing the construction site including general drainage areas and gradients, nearby landmarks (buildings, paved areas, etc.), erosion control measures, topography.

_____

_____

_____

_____

_____

Construction Materials: Provide a general list of the types of chemicals, substances that will be used at the construction site.

_____

_____

_____

Erosion and Sediment Controls: Describe any erosion and sediment controls necessary. These controls shall be implemented during the construction period to prevent or control the loss of soil from the construction site. The methods could incorporate structural practices and/or vegetative stabilization. Examples are mulching, checkdams, temporary downdrain structures, sediment barriers, etc.

_____

_____

_____

_____

END OF SECTION

SECTION 01 07 00 — CONTRACTOR QUALITY ASSURANCE/QUALITY CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. This specification sets forth quality assurance/quality control requirements for the provision of materials, equipment, systems, inspections, tests, services, and construction of facilities and site improvements. The quality of work-in-progress and finished work is the responsibility of Contractor line management. These requirements provide for an effective system to ensure that contractual quality requirements and technical criteria are satisfactorily met.

1.2 RELATION TO OTHER CONTRACT DOCUMENTS

A. The requirements of this specification shall be fully complied with in close concert with the detail requirements of the technical specifications and all other contract documents. Overlapping and interfacing contractual requirements shall not result in duplication of Contractor efforts. The quality program shall effectively complement and support functions required by the technical specifications and other contract documents.

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 013300, "Submittal Procedures," in sufficient detail to show full compliance with the specification:

A. Preconstruction Submittals: The Contractor shall submit a detailed written statement describing procedures that will be implemented to achieve quality on the project according to the paragraph entitled, "Contractor's Quality Assurance/Quality Control Plan." The plan shall be submitted and approved by the Government prior to Notice to Proceed.

B. Contractor's Quality Assurance/Quality Control Plan: Describe how the quality requirements of the specifications will be met using a detailed written statement and address each of the following:

1. Delegation of Contractor's authorized representative responsible for quality assurance/control of contract work.
2. The Contractor's quality assurance/control plan and procedure for accomplishing and reviewing construction methods and controls, fabrication controls, certifications, documentation of quality control operations, inspections, and test records including those required for suppliers and subcontractors. Describe methods to be effected during the procurement cycle (order to deliver) for the selection of construction materials, suppliers, subcontractors, on-site and off-site fabrication and assembly of Contractor- furnished materials and equipment, work procedures, workmanship, and testing to ensure full compliance with plans, specifications, codes, regulatory requirements, and other contract documents.

3. The Contractor's program shall provide for a functional system to document that quality provisions of contract schedules, specifications, and drawings have been performed.
4. Training, certification(s), and re-certification(s) of personnel as required by the specifications.
5. Certification of materials, processes, or equipment as required by the specifications.
6. Qualification of procedures as required by the specifications.
7. Nondestructive testing requirements as required by the specifications.
8. Identification of independent certifying and testing laboratories to be used.

C. Records: Records shall include all quality control data; factory test plans/results, manufacturer's certifications, receiving inspections, deficiency correction reports; construction deficiency reports (CDR); training/certifications; letter of authority or delegation; and routine technical test plans/results, i.e., hydrostatic, electrical continuity, grounding, welding, line cleaning, etc. Quality records shall be available for examination upon request by the designated Government representatives. Quality control records shall be maintained in a central on-site location. Maintenance of quality control records shall not relieve the Contractor from submitting samples, test data, detail drawings, material certificates, or other information required by each section in the specification. All quality records shall be turned over to the Government's designated representatives as a file of record at contract completion.

1.4 QUALITY ASSURANCE

A. Qualifications: When approval or certification of special processes, operating personnel, and special equipment or procedures is required by the specifications, the Contractor shall obtain necessary approvals or certifications prior to starting the work.

B. Management and Organization: Contractor shall ensure effective execution of quality assurance/quality control functions and provide competent personnel with experience in quality assurance/quality control functions to provide supervision, inspection, and testing. Contractor shall be responsible for each of his suppliers and subcontractors. Contractor shall provide quality assurance oversight of suppliers and subcontractors and ensure that each provides effective quality control in the execution of their work. The program shall encompass management and supervisory actions that affect quality of all work-in-progress and finished construction work. The individual designated to direct the program shall report to the Contractor's management and shall have the necessary authority to discharge his responsibilities.

C. Identification and Data Retrieval: The Contractor shall have an identification and data retrieval system. Records, drawings, submittals, and equipment shall be identified to reference the following:

1. Contract Number
2. Contract Specification Number
3. Contract Drawing Number
4. Submittal Document Number
5. Contract Change Number
6. Contractor's Drawing Number System

D. Procurement: The Contractor shall be responsible for controlling procurement sources and those of his subcontractors to ensure that each purchase meets quality requirements. The Contractor shall ensure that his purchase documents include:

1. The basic quality requirements, standards, drawings, and specifications called out in the contract specifications.
2. Inspection and Test Characteristics.
3. Inspection and Test Records.
4. Operational and Maintenance (O&M) manuals, Instructions, Certifications of Compliance, and such other data as may be required by the specification.
5. Preservation, packaging, shipping directions.

E. When Government source inspection is required on a Contractor's purchase, the purchase document shall include the following statement: “All work on this order is subject to inspection and testing by the Government at any time and place. The Contracting Officer shall be notified immediately upon receipt of this order. The Contracting Officer shall be notified 72 hours in advance of the time articles or processes are ready for inspection or test."

F. Procurements that do not require Government source inspection shall include the following statement: "The Government reserves the right to inspect any or all of the materials included on this order at the Contractor's plant."

G. Required Government source inspections will be determined by the Contracting Officer. Government source inspections shall not replace Contractor inspections or relieve the Contractor of his responsibility for ensuring quality procurements and records verifying quality control activities.

H. Receiving Inspection System: Contractor shall maintain a receiving inspection system that ensures procured materials and equipment are inspected and tested as required by specifications, drawings, and approved submittal documents. Shipping/receiving inspection records will accompany each procurement delivery to the construction site. Maintain records of receiving inspections at the construction site by the Contractor. Records shall show defects, discrepancies, dispositions, and waivers, including evidence of Government source inspection.

I. Nonconforming Articles and Material Control: The Contractor shall control nonconformances discovered by the Contractor, subcontractors, suppliers or Government quality representatives to prevent their use and to correct deficient operations.

1. Contractor shall prepare a construction deficiency report for each instance comprising:
   a. A unique and traceable number.
   b. Identification of the nonconforming article or material.
   c. A description of the nonconformance and the applicable requirement.
   d. Cause or reason for the nonconformance.
   e. Remedial actions taken or recommended.
   f. Disposition of the nonconforming article or material.
2. The Contractor shall identify, mark, and segregate each nonconforming article for removal from the work area to prevent inadvertent use.
3. The Contractor shall monitor and correct deficient operations.

J. Fabrication, Process, and Work Control: The Contractor's procedures and controls shall be derived from stated requirements in contract specifications and drawings. The Contractor shall establish in-process inspections and ensure compliance with quality requirements that are not

readily detectable or measurable by inspection and test of finished elements. Special processes may include, but are not limited to, concrete placement, piping system cleaning, plating, anodizing, nondestructive testing, welding, and soldering.

K. Drawings and Change Control: Drawing-control system shall be maintained to provide revised drawings and change distribution and removal of obsolete drawings from work areas. Changes involving interface with other work areas, or affecting articles or materials controlled by others shall be controlled by the Contractor. This system shall be integrated with the document requirements of the contract. Drawing changes shall be clearly specified. Accomplished changes shall be clearly identified and associated drawings shall be revised. Drawings that have been approved, or approved as noted, by the Contracting Officer shall be used for fabrication and inspection.

L. Quality Inspections: Government Inspections: Work performed under the general direction of the Contracting Officer will be subject to inspection by authorized representatives. No representative is permitted to change specifications or drawings without written authorization of the Contracting Officer. Government in-process and end-item inspections may, at the Government's discretion, be performed on site and/or at the Contractor's or subcontractor's facility by Government representatives. Government shall be notified with sufficient advance notice of Contractor work plans which will cover up or make inaccessible previously installed work which may require Government inspection, i.e., backfilling or encasing of any underground utility, concrete placement, etc. Failure to provide such notification may require the work be uncovered to inspect the work. Uncovering and restoration of the work shall be at the Contractor's expense. The Contractor's quality assurance/control program is subject to continuous evaluation, review, and verification by the Contracting Officer. The Contractor will be notified in writing of any noncompliance area and will be given 5 days to correct identified deficiencies.

M. Contractor's Quality Inspections: Contractor shall implement an inspection system. Documentation shall indicate quality control through records of inspections and tests. Contractor shall ensure that nonconforming products are discovered, documented, and controlled. Procedures eliminating future deficiencies shall be implemented. Contractor's quality assurance system shall include the following:

1. Single Contractor's representative responsible for on-site/off-site communication and operation of the inspection program.
2. Purchasing control system documenting project procurement to drawings, specifications, and approved submittals.
3. Receiving inspection system documenting inspections for each procurement verifying material and equipment is compliant with plans and specifications.
4. Documentation for handling and disposing of nonconforming components and materials.
5. Inspection records as required for each specific section of the specification and drawings.
6. Identification of test(s) to be performed, test procedures, test plans/reports, records, and independent organizations used.
7. Documenting and maintaining certification or re-certification of procedures, personnel, and equipment.
8. Management of Government-furnished equipment, components, and materials.
9. Calibration of gages, tools, measuring instruments, and independent laboratories used and all associated documentation.

N. The Contractor shall establish his own system of scheduled or random sample inspections and audits to ensure objectives are met.

O. Manufacturer's Field Services: Responsibility for Inspection and Testing: Contractor is responsible for the performance of inspections and tests. Each shall be recorded. The Contractor shall utilize independent inspection and testing laboratories or services that are acceptable to the Government. Tests of construction materials shall be accomplished by the Contractor utilizing the services of an acceptable independent testing laboratory.

P. Inspection and Test Records: The Contractor shall provide on-site records of each inspection and test performed throughout the life of the contract. Records shall include, but not be limited to, factual evidence that the required inspections or tests have been performed, including type and number of inspections or tests involved, identification of operators and inspectors, test plans/reports, result of inspections or tests, nature of defects, causes for rejection, proposed remedial action, and corrective actions taken.

Q. Records of in-process inspections and controls away from the job site may be used as evidence of quality of materials/work and, at the discretion of the Government, may reduce further inspection or testing after delivery to the job site.

R. The Contractor shall ensure each record is identified and traceable to specific requirements in the specifications and drawings.

1.5 HANDLING AND STORAGE

A. The Contractor shall provide controls and procedures which meet requirements of each section of the specifications. The Contractor shall include documentation with each shipment. The data shall consist of documentation required by the contract along with specifications required to identify, store, preserve, operate, and maintain the items shipped.

1.6 SEQUENCING AND SCHEDULING

A. Contractor shall notify the Government a minimum of 48 hours prior to scheduled inspections and tests. Contractor shall provide 24-hour notice to the Government of the date when the contract work will begin at the site. When Contractor suspends work for 5 days or longer prior to completion, he shall notify the Contracting Officer. Work shall not suspend nor resume without notification of the Contracting Officer.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 07 00

SECTION 01 24 04 - PRECONSTRUCTION SUBMITTALS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section identifies the documents required to be submitted and approved prior to the Pre-Construction Conference.

1. Safety and Health Plan shall be submitted in accordance with Section 013300 “Submittals” and Section 010610 in sufficient detail to shown full compliance with the contract documents.
2. Quality Control Plan shall be submitted in accordance with Section 013300 “Submittals” and Section 014000 in sufficient detail to shown full compliance with the contract documents.

B. This Section identifies the documents required to be submitted at the Pre-Construction Conference.

1. Subcontractor List shall be submitted and shall conform to the requirements in Part 2 below.
2. Waste Management Plan shall be submitted in accordance with Section 017419 “Construction Waste management and Disposal”.

1.2 SUBMITTALS

A. Subcontract List: Submit three copies and a CD containing an electronic copy of the subcontract list at the Preconstruction Conference

PART 2 - PRODUCTS

2.1 SUBCONTRACTOR LIST

A. Submit a list of subcontractors identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Use CSI Form 1.5A or similar form and include the following information in tabular form:

1. Company name, address, telephone number, point of contact and email of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 32 00 — PROJECT SCHEDULES

PART 1 - GENERAL

1.1 SUMMARY

1.2 This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work. Upon contract award, the Contractor shall begin preparation of the Contractor's construction schedule, and critical path submittals necessary to meet the Contractor's construction schedule.

1.3 DEFINITIONS

A. Critical Path: The longest continuous chain of activities through the network schedule that establishes the minimum overall Project duration and contains the least float.

B. Float: The measure of leeway in starting and completing an activity.

1.4 SUBMITTALS

A. Contractor's Baseline Construction Schedule: The Contractor's construction schedule consists of a bar chart identifying the start and finish for all tasks shown in the schedule. When NTP is given, the Contractor shall submit within 30 calendar days of the NTP, a "baseline schedule" changing only the projected NTP date to the actual NTP date on the initial schedule. Subsequent construction schedules shall be submitted every 30 calendar days thereafter, and be chronologically labeled starting with the letter "A". Submit three (3) paper copies and a CD containing the electronic file compatible with "Microsoft Project".

B. Monthly Schedule Updates. The Contractor shall update the previously approved schedule monthly and submit three (3) paper copies and a CD containing the electronic file compatible with "Microsoft Project". Each update shall include a complete revision of all activities and milestones and other and data as needed. Redlined updates will only be acceptable at the weekly meetings. As a minimum, each update shall include revised dates for the following:

1. All tasks started or completed.
2. All tasks with missed start or finish dates.
3. Milestones completed, or missed.
4. Revised percent complete for all active tasks.
5. Revised submittal dates for all submittals
6. Approved changes.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. The Contractor's construction schedule consists of a bar chart identifying the various tasks to be accomplished. Task relationships with predecessors and successors shall be included in the bar chart. Prepare the schedule to ensure consistency of the tasks with each other, the submittals schedule, payment requests, and other required schedules and reports. The schedule shall reflect construction site activities and supporting activities, such as submittal reviews, major material orders and delivery, fabrication, user activities and key milestones, etc., as well as activities at the request of the Contracting Officer.

B. Bar Chart: The Contractor shall:

1. Use a recognized computer software program to prepare the schedule.
2. Prepare the schedule in the form of a bar chart utilizing a format acceptable to the Contracting Officer.
3. Prepare a schedule with sufficient detail to facilitate the Contractor's control of the job and to allow the Contracting Officer to readily follow progress of all portions of the work.
4. Depict and display the order and interdependence of activities and the sequence in which the work is to be accomplished.
5. Indicate project activities beginning with contract award through actual project close out date, in an organized, logical, and consistent order.
6. Show activities by major headings for primary work activities. Each major heading shall show all activities. All activities shall be shown in sufficient detail to track the progress of the task. Typically, activities shall have durations of 30 work days or less. All activities and milestones shall have at least one predecessor and/or one successor activity and/or milestone.
7. The critical path shall be clearly delineated on the display. When milestone dates are included in the Contract they shall be clearly indicated on the display.
8. As a minimum, the following detailed activities and milestones shall be included:

    a. Milestones: Contract Award, NTP, field work, phased work start and finish, final inspection, project planned completion, contract completion date.
    b. Specific activities: Bonding. Mobilization, Demobilization, Punch-list, Cleanup, and Final close out submittals.
    c. Specific project on-site construction tasks of all activities.
    d. Specific off-site tasks necessary to achieve specific project site activities.
    e. All utility outages and road crossings/closures.
    f. Submittal review activity by the Government, as specified herein and its subparagraphs, for each submittal required. Furthermore, each of these activities shall be linked as a predecessor to all affected tasks.
    g. Major equipment and material procurement including delivery (submittal handling shall be separate per above).
    h. Contract required notices to the Government which affect any task/activity (show as a one-day duration) and shall be entitled "Notice," followed by a brief description.

9. Each line item will show the scheduled percentage complete for that given contract performance period.
10. The estimated cost for each activity on the chart.

PART 3 - EXECUTION

3.1 SCHEDULING AND DETERMINATION OF PROGRESS

A. Independent of partial payments made pursuant to Standard Form 1422, Section I (Payments Under Fixed-Price Construction Contracts), Provision No. 52.232-5, there shall be no payment to exceed 90 percent of the actual cost of materials or equipment that is not installed and no partial payments will be made for materials or equipment not on site. The effort shown toward installation of this equipment will be considered by the Contracting Officer in determining the amount of partial payment.

B. As-Built Drawings: In order to minimize the time for final payment at the completion of the project, the Contractor shall update the as-built drawings every month with the Contracting Officer's authorized representative. This update will be a part of "the monthly request for payment" and payment -- or a portion of the payment, including final payment -- may be withheld until the as-built drawings have been updated, and accepted by the Contracting Officer.

3.2 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Bar Chart: The bar chart will be utilized for progress payments.

B. Construction Schedule Approval: Government approval of the construction schedule is in general terms of overall compliance. The Government may question and seek clarification of certain details of the schedule to ensure contract compliance. The Contractor shall make such clarifications within 5 working days. The Contractor retains full responsibility for creation and maintenance of the schedule as well as its contents, logic, and use to fulfill all contract obligations.

C. Requests for Time Extensions: In the event the Contractor requests an extension of the contract completion date, he shall furnish a justification for delay, a revised project completion date, and supporting evidence as the Contracting Officer may deem necessary for a determination as to whether or not the Contractor is entitled to an extension of time under the provisions of the contract. Submission of proof of delay, based on revised activity logic, duration, and costs (updated to the specific date that the delay occurred) is obligatory to any approvals.

1. Justification for Delay: The Contractor shall submit a justification for each request for a change in the contract completion date, based upon the most recent approved schedule at the time of the Notice to Proceed or constructive direction issued for the change. The project schedule shall clearly display that the Contractor has used, in full, all the float time available for the work involved with this request. The request shall be in accordance with the requirements of other appropriate Contract Clauses and shall include, as a minimum:

    a. A list of affected activities, with their associated project schedule activity number.
    b. A brief explanation of the causes of the change.
    c. An analysis of the overall impact of the changes proposed.
    d. A sub-network of the affected area.
    e. Activities impacted in each justification for change shall be identified by a unique activity code contained in the required data file.

The Contracting Officer's determination as to the number of allowable days of contract extension shall be based upon the project schedule updates in effect for the time period in question, and other factual information. Actual delays that are found to be caused by the Contractor's own actions, which result in the extension of the schedule, will not be a cause for a time extension to the contract completion date.

D. Directed Changes: If Notice to Proceed (NTP) is issued for changes prior to settlement of price and/or time, the Contractor shall submit proposed schedule revisions to the Contracting Officer within 2 weeks of the NTP being issued. The proposed revisions to the schedule will be approved by the Contracting Officer prior to inclusion of those changes within the project schedule. If the Contractor fails to submit the proposed revisions, the Contracting Officer may furnish the Contractor suggested revisions to the project schedule. The Contractor shall include these revisions in the project schedule until revisions are submitted and final changes and impacts have been negotiated. If the Contractor has any objections to the revisions furnished by the Contracting Officer, the Contractor shall advise the Contracting Officer within 2 weeks of receipt of the revisions. Regardless of the objections, the Contractor shall continue to update the schedule with the Contracting Officer's revisions until a mutual agreement in the revisions is reached. If the Contractor fails to submit alternative revisions within 2 weeks of receipt of the Contracting Officer's proposed revisions, the Contractor will be deemed to have concurred with the Contracting Officer's proposed revisions. The proposed revisions will then be the basis for an equitable adjustment for performance of the work. All logic changes pertaining to notice to proceed on change orders, change orders to be incorporated into the schedule, Contractor proposed changes in work reference, correction to schedule logic for out-of-sequence progress, lag duration, and other changes that have been made pursuant to contract provisions shall be specifically identified and discussed.

E. Float off the critical path may be used at the Contractor’s discretion. However, use of float on the critical path shall be coordinated with the Government at each weekly project meeting. The Government reserves the right to utilize at its discretion use of float created by the Government acceleration of activities or milestones such as early GFE delivery, use of facilities or space, and early submittal review.

END OF SECTION 01 32 00

SECTION 01 33 00 — SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

This Section includes administrative and procedural requirements for all project submittals required by the individual Specification Sections.

PART 2 - PRODUCTS

2.1 SUBMITTALS

A. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents.

1. Drawing Preparation: Include the following information, as applicable:

   a. The job name, which shall be the general title of the contract drawings.
   b. The date of the drawings and revisions.
   c. Name of Contractor.
   d. Name of Subcontractor.
   e. The name of the item, material, or equipment detailed thereon.
   f. Dimensions.
   g. Identification of products.
   h. Fabrication and installation drawings.
   i. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.
   j. Shopwork manufacturing instructions.
   k. Templates and patterns.
   l. Schedules.
   m. Design calculations.
   n. Compliance with specified standards.
   o. Notation of coordination requirements.
   p. Notation of dimensions established by field measurement.

2. Drawing Format: Drawing submittals shall be prepared using computer interactive graphics and presented on sheets, not less than 11 by 17 inches nor larger than 30 by 42 inches in size, except for full size patterns or templates. Drawings shall be prepared to accurate size, with scale indicated, unless other form is required. Drawings shall have dark lines on a white background. Drawings shall be numbered in logical sequence. The Contractor may use his own number system. Each drawing set shall contain identification of the transmittal number, specification section or contract number or title. A blank space, no smaller than 4 inches by 4 inches, shall be reserved on the right hand side of each sheet for the Government disposition stamp.

3. Drawings Submittals: Five prints of each drawing shall be submitted. Three prints, marked with review notations will be returned to the Contractor.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.

1. Product Data Preparation: Include the following information, as applicable:

a. Manufacturer's product specifications.
b. Standard color charts.
c. Manufacturer's catalog cuts.
d. Wiring diagrams showing factory-installed wiring.
e. Printed performance curves.
f. Operational range diagrams.
g. Mill reports.
h. Standard product operating and maintenance manuals.
i. Compliance with recognized trade association standards.
j. Compliance with recognized testing agency standards.
k. Application of testing agency labels and seals.
l. Notation of coordination requirements.
m. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:

1) Preparation of substrates.
2) Required substrate tolerances.
3) Sequence of installation or erection.
4) Required installation tolerances.
5) Required adjustments.
6) Periodic maintenance requirements
7) Recommendations for cleaning and protection.

2. Product Data Format: Required data submittals for each specific material, product, unit of work, or system shall be collected on an individual submittal and marked for choices, options, and portions applicable to the submittal. Mark each copy of each submittal to show which products and options are applicable. All options not marked out shall be considered as included. Marking of each copy of product data submitted shall be identical. Partial submittals will not be accepted.

3. Each Product Data Submittal: Five complete sets of indexed and bound data shall be submitted. Three sets marked with review notations will be returned to the Contractor.

C. Samples: Prepare physical units of materials or products, including the following:

1. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

2. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from the same material to be used for the Work, cured and finished in manner specified, and physically identical with the product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

3. Sample Preparation: Mount, display, or package Samples in manner specified to facilitate review of qualities indicated. Prepare Samples to match Government's sample where so indicated. Attach label on unexposed side that includes the following:

    a. Name of project
    b. Name of Contractor
    c. Material or equipment
    d. Place of origin
    e. Name of producer and brand
    f. Specification Section to which sample applies
    g. Samples of furnished material shall have additional markings that will identify them under the finished schedules.

4. Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, provide the following:

    a. Size limitations.
    b. Compliance with recognized standards.
    c. Availability.
    d. Delivery time.

5. Samples Format: Samples shall be physically identical with the proposed material or product to be incorporated in the work, fully fabricated and finished in the specified manner, and full scale. Where variations in color, finish, pattern, or texture are inherent in the material or product represented by the sample, multiple units of the sample, showing the near-limits of the variations and the "average" of the whole range (not less than 3 units), shall be submitted. Each unit shall be marked to describe its relation to the range of the variation. Where samples are specified for selection of color, finish, pattern, or texture, the full set of available choices shall be submitted for the material or product specified. Sizes and quantities of samples shall represent their respective standard unit.

6. Sample Submittals: One set of identified samples shall be submitted. Shipping charges shall be paid by the Contractor. Materials or equipment requiring sample approval shall not be delivered to the site or used in the work until approved in writing by the Contracting Officer. A copy of the transmittal form, marked with review notations including selections by the Contracting Officer, will be returned to the Contractor. Samples that are intended or permitted to be returned and actually incorporated in the work are so indicated in the individual technical sections. These samples will be returned to the Contractor, at his expense, to be clearly labeled, with installation location recorded. Samples shall be in undamaged condition at the time of installation. Where mockups and similar large samples are required by individual technical sections, it is recognized that these are a special type of sample which cannot be readily "transmitted" as specified for

submittal of samples. Otherwise, and except as indicated in the individual technical sections, the requirements for samples shall be complied with and a transmittal form shall be processed for each mockup, to provide a record of the activity.

D. Coordination Drawings: Contractor to submit to COTR for approval coordination drawings of all ductwork, including equipment rooms, shafts, hallways, and especially congested areas and areas with possible conflicts. No installation shall proceed without COTR stamped approval of coordination drawings. Submittal to reflect space requirements coordinated with other trades such as Electrical, Plumbing, Mechanical and Structural. Prior to submission to COTR, coordination drawings to have signatory approval of all major trades which occupy ceiling space (HVAC, plumbing, piping, sprinkler, and electrical), to substantiate adequate coordination as to space, accessibility and to ensure no conflict exists between contractors..

1. Indicate relationship of components shown on separate Shop Drawings.
2. Indicate required installation sequences.
3. The General Contractor shall be responsible for coordination between trades and shall stamp and sign the duct drawings to substantiate that the coordination has been accomplished. Water piping and conduit shall give way to ducts.

E. Product Schedule or List: Prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:

1. Type of product. Include unique identifier for each product.
2. Number and name of room or space.
3. Location within room or space.

F. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Prepare written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

G. Contractor’s Construction Schedule: Comply with requirements in Section 013200 "Project Schedules."

H. Submittals Schedule: Comply with requirements in Specification Section "012404."

I. Subcontract List: Comply with requirements Specification Section "012404"

J. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

K. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements.

L. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.

M. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements and, where required, is authorized for this specific Project.

N. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements. Include evidence of manufacturing experience where required.

O. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements.

P. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements. Reports must be signed by authorized representative of the testing agency.

Q. Preconstruction Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements. Reports must be signed by authorized representative of the testing agency.

R. Compatibility Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion. Reports must be signed by authorized representative of the testing agency.

S. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements. Reports must be signed by authorized representative of the testing agency.

T. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency. Reports must be signed by authorized representative of the testing agency.

U. Factory Test Reports: Prepare written reports of tests performed by the manufacturer as indicated in individual Specification Sections

V. Operations and Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements in Division 1 Section "Closeout Procedures” and “Operation and Maintenance Data."

W. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:

1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

X. Warranties: Provide Manufacturers' warranty as indicated in individual Specification Sections

Y. Product Closeout Submittals Comply with requirements in Division 1 Section "Closeout Procedures"

PART 3 - EXECUTION

3.1 CONTRACTOR

A. All submittals shall be verified for compliance with the Contract Documents and signed by the contractor.

B. No work may begin or materials be ordered for any item, until a submittal is approved and returned to the contractor.

3.2 SUBMITTAL REQUIREMENTS

A. Each submittal shall reference drawing number, Specification Section and paragraph pertaining to the submittal and fully describe the submittal item.

B. The numbering system used (on the transmittal form) for transmission and tracking of submittals shall be provided by the Government and used by the Contractor. The submittal number is composed of the Specification Section number followed by a hyphen, and the numerical order of each submission beginning with 001. Revisions and resubmittals will be numbered chronologically thereafter.

C. Transmittal Form: All transmittals submitted to the Government shall be submitted using MSFC Form 4233. All data fields on the form shall be completed and the form signed by the Contractor. Incomplete submittals will be returned to the Contractor without Government review. Each transmittal form shall transmit items relative to one Specification Section. Data pertaining to that Specification Section may be transmitted together, unless required to be submitted as an individual "item." An item is an individual piece recognized by the type of data being submitted. Examples in general of acceptable individual submittal transmittals include:

1. Groups of valves of different sizes. A submittal would allow that all of the information pertaining to those valves could be listed and submitted on one submittal transmittal.
2. Structural drawings and calculations for individual structures.

3. Electrical lighting troffers, ballast, bulbs, and lenses along with installation instructions and certificates of compliance.
4. Air handlers of the same type.
5. Submittals can list one individual piece pertaining to specific data, such as one valve on one submittal and one instruction manual on another, etc.

D. Product Selection: Highlight, circle, or otherwise identify the specific item selected for use on the project. Include manufacturer, model, size (where applicable) and options.

E. Deviations: Deviations from the specific product options in the Contract Documents shall be highlighted, circled, or otherwise identified on submittals. Failure to point out deviations may result in the Government rejection and requiring removal of such work at no additional cost to the Government.

F. Substitutions: Indicate if product is a substitution and comply with Specification Section 01 60 00. Failure to point out substitutions may result in the Government rejection and requiring removal of such work at no additional cost to the Government

G. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. The Government reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.

2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

H. Submittal Quantities: Submit five copies of all submittals unless directed otherwise by the COTR.

3.3 GOVERNMENT'S REVIEW

A. General: The Government will not review submittals that do not bear Contractor's signature and will return them without action. The Government will review submittals and provide pertinent notation within 28 calendar days. The 28-day review clock shall start the day after submittals are received by the Government.

1. Approved Submittals: Approval of the submittals by the Contracting Officer shall not be construed as a complete check but will indicate only that the general method of construction and detailing is satisfactory. The Contractor shall be responsible for the dimensions and design of connection details and construction of work. If changes are necessary to approved submittals, the Contractor shall make such revisions and submission of the submittals in accordance with the procedures above. No item of work requiring a submittal change shall be accomplished until the changed submittals are approved

2. Resubmittals: For submittals requiring resubmittal, the Contractor shall make corrections required by the Contracting Officer and resubmit within 14 calendar days of receipt. If

the Contractor considers any correction or notation on the returned submittals to constitute a change to the contract drawings or Specifications, notice as required under the clause entitled "Changes" shall be given to the Contracting Officer.

B. Review Notations: Submittals will be returned to the Contractor with the following notations:

1. Submittals marked "Approved (APR)" authorize the Contractor to proceed with the work covered.
2. Submittals marked "Approved as Noted (AAN)" authorize the Contractor to proceed with the work covered provided he takes no exception to the corrections.
3. Submittals marked "Approved Except as Noted (AEN)" require the Contractor to make a resubmittal for those items that are noted to NOT be in compliance with the contract requirements. Contractor shall obtain an approval for all aspects of the submittal before the depicted work can begin.
4. Submittals marked "Rejected (REJ)" indicate noncompliance with the contract requirements and shall be resubmitted with appropriate changes prior to proceeding with any work. .

C. Sample Approval: The Contractor shall furnish, for the approval of the Contracting Officer, samples required by the Specifications or by the Contracting Officer.

1. Approval of a sample shall be only for the characteristics or use named in such approval and shall not be construed to change or modify any contract requirements. Before submitting samples, the Contractor shall assure that the materials or equipment will be available in quantities required in the project. No change or substitution will be permitted after a sample has been approved.

2. Materials and equipment incorporated in the work shall match the approved samples. If requested, approved samples, including those which may be damaged in testing, will be returned to the Contractor, at his expense, upon completion of the contract. Samples not approved will also be returned to the Contractor at its expense, if so requested.

3. Failure of any materials to pass the specified tests will be sufficient cause for refusal to consider, under this contract, any further samples of the same brand or make of that material. The Government reserves the right to disapprove any material or equipment which previously has proved unsatisfactory in service.

4. Samples of various materials or equipment delivered on the site or in place may be taken by the Contracting Officer for testing. Samples failing to meet contract requirements will automatically void previous approvals. The Contractor shall replace such materials or equipment to meet contract requirements.

5. Approval of the Contractor's samples by the Contracting Officer shall not relieve the Contractor of his responsibilities under the contract.

END OF SECTION 01 33 00

MASTERWORKS SUBMITTAL LOG

PROJECT: REVITALIZE ELECTRICAL SYSTEM AT BUILDING 4619

OWNER:

PROJECT NO: NAS8-NNM12AA49A/GMC-01: FAC-M5054

CONTRACTOR:

DATE REC'D.	SPECIFICATION SECTION NO.	SUBMITTAL ITEM	Review and Approval Required by NASA	NO. RECEIVED	OTHER REVIEWER					ACTION				DATE RETURNED	COPIES TO			
					DATE SENT	FIRM	NO. COPIES	DUE DATE	DATE REC'D.	APPROVED	APPROVED AS NOTED	REVISE AND RESUBMIT	NOT APPROVED		CONTRACTOR	OWNER	FIELD	FILE
	010590	**SPECIAL CONDITIONS**																
		Contractor's E-mail Address and Emergency Contact Information																
		Photographs of Temporary Structures																
	010610	**GENERAL SAFETY AND ENVIRONMENTAL HEALTH REQUIREMENTS**																
		Safety Plan																
		Reports MSFC Form 4371																
	010650	**ENVIRONMENTAL COMPLIANCE**																
		Material Safety Data Sheets																
		MSFC Form 4582 – Chemical Inventory Worksheet																
		MSFC Form 4510 – Green Purchasing Report																
	010700	**CONTRACTOR QUALITY ASSURANCE/QUALITY CONTROL**																
		Preconstruction Submittals																
		Contractor's Quality Assurance/Quality Control Plan																
		Records																
	012404	**PRECONSTRUCTION SUBMITTALS**																
		Submittals Schedule																
		Subcontract List																
	01 32 00	**PROJECT SCHEDULES**																
		Baseline Construction Schedule																
		Monthly Schedule Updates																
	017310	**CUTTING AND PATCHING**																
		Cutting & Patching Proposal																
	017419	**CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL**																
		Qualification Statements																
		Waste Management Plan																
		Waste Reduction Progress Reports																
		Waste Reduction Final Report																
		Records of Donations																
		Records of Sales																
		Recycling & Processing Facility Records																
		Landfill and Incinerator Disposal Records																
		Qualification Data (Waste Management Coordinator)																
	017700	**CLOSEOUT PROCEDURES**																
		As-Built Drawings																
		Operations and Maintenance Data																
		Warranty																
	017820	**OPERATION AND MAINTENANCE DATA**																
		Operations and Maintenance Manuals																

MASTERWORKS SUBMITTAL LOG

PROJECT: REVITALIZE ELECTRICAL SYSTEM AT BUILDING 4619

OWNER:

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					DATE SENT	FIRM	NO. COPIES	DUE DATE	DATE REC'D.	APPROVED	APPROVED AS NOTED	REVISE AND RESUBMIT	NOT APPROVED		CONTRACTOR	OWNER	FIELD	FILE
	018200	**DEMONSTRATION AND TRAINING**																
		Instruction Program																
		Qualification Statements																
		Demonstration and Training DVD																
	022200	**SELECTIVE DEMOLITION**																
		Proposed Sequence of Operations																
	260501	**ELECTRICAL TESTING**																
		Qualifications																
		Short Circuit Analysis and Coordination Study																
	260519	**LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES**																
		Product Data																
	260526	**GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS**																
		Product Data																
		Field Quality-Control Reports																
	260529	**HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS**																
		Product Data																
	260533	**RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS**																
		Product Data																
		Shop Drawings																
		Coordination Drawings																
		Source Quality-Control Reports																
	260544	**SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING**																
		Product Data																
	260572	**OVERCURRENT PROTECTIVE DEVICE SHORT-CIRCUIT STUDY**																
		Product Data																
		Product Certificates																
	260573	**OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY**																
		Product Data																
		Qualification Statements																
	260574	**ARC FLASH**																
		Analysis Report																
	262200	**LOW-VOLTAGE TRANSFORMERS**																
		Shop Drawings																
		Operation and Maintenance Data																
	262413	**SWITCHBOARDS**																

MASTERWORKS SUBMITTAL LOG

PROJECT: REVITALIZE ELECTRICAL SYSTEM AT BUILDING 4619
OWNER:

PROJECT NO: NAS8-NNM12AA49A/GMC-01: FAC-M5054
CONTRACTOR:

DATE REC'D.	SPECIFICATION SECTION NO.	SUBMITTAL ITEM	Review and Approval Required by NASA	NO. RECEIVED	OTHER REVIEWER					ACTION				DATE RETURNED	COPIES TO			
					DATE SENT	FIRM	NO. COPIES	DUE DATE	DATE REC'D.	APPROVED	APPROVED AS NOTED	REVISE AND RESUBMIT	NOT APPROVED		CONTRACTOR	OWNER	FIELD	FILE
		Product Data																
		Shop Drawings																
		Samples																
		Field Quality-Control Reports																
		Operation and Maintenance Data																
	262416	**PANELBOARDS**																
		Shop Drawings																
		Field Quality-Control Reports																
		Panelboard Schedules																
	262500	**ENCLOSED BUS ASSEMBLIES**																
		Shop Drawings																
		Coordination Drawings																
		Product Certificates																
		Field Quality-Control Test Reports																
		Operation and Maintenance Data																
	262713	**ELECTRICITY METERING**																
		Product Data																
		Shop Drawings																
		Field Quality-Control Reports																
	262726	**WIRING DEVICES**																
		Product Data																
		Shop Drawings																
		Field Quality-Control Reports																
		Operation and Maintenance Data																
	262813	**FUSES**																
		Product Data																
		Operation and Maintenance Data																
	262816	**ENCLOSED SWITCHES AND CIRCUIT BREAKERS**																
		Product Data																
		Shop Drawings																
		Field Quality-Control Reports																
		Field Service Reports																
	264313	**SURGE PROTECTION FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS**																
		Product Data																
		Field Quality-Control Reports																
		Warranty																
		Maintenance Data																

SECTION 01 40 00 — CONTRACTOR QUALITY ASSURANCE/QUALITY CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. This specification sets forth quality assurance/quality control requirements for the provision of materials, equipment, systems, inspections, tests, services, and construction of facilities and site improvements. The quality of work-in-progress and finished work is the responsibility of Contractor line management. These requirements provide for an effective system to ensure that contractual quality requirements and technical criteria are satisfactorily met.

1.2 RELATION TO OTHER CONTRACT DOCUMENTS

A. The requirements of this specification shall be fully complied with in close concert with the detail requirements of the technical specifications and all other contract documents. Overlapping and interfacing contractual requirements shall not result in duplication of Contractor efforts. The quality program shall effectively complement and support functions required by the technical specifications and other contract documents.

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 013300, "Submittal Procedures," in sufficient detail to show full compliance with the specification:

A. Preconstruction Submittals: The Contractor shall submit a detailed written statement describing procedures that will be implemented to achieve quality on the project according to the paragraph entitled, "Contractor's Quality Assurance/Quality Control Plan." The plan shall be submitted and approved by the Government prior to Notice to Proceed and describe how the quality requirements of the specifications will be met and address each of the following:

1. Delegation of Contractor's authorized representative responsible for quality assurance/control of contract work.
2. The Contractor's quality assurance/control plan and procedure for accomplishing and reviewing construction methods and controls, fabrication controls, certifications, documentation of quality control operations, inspections, and test records including those required for suppliers and subcontractors. Describe methods to be effected during the procurement cycle (order to deliver) for the selection of construction materials, suppliers, subcontractors, on-site and off-site fabrication and assembly of Contractor- furnished materials and equipment, work procedures, workmanship, and testing to ensure full compliance with plans, specifications, codes, regulatory requirements, and other contract documents.
3. The Contractor's program shall provide for a functional system to document that quality provisions of contract schedules, specifications, and drawings have been performed.
4. Training, certification(s), and re-certification(s) of personnel as required by the specifications.
5. Certification of materials, processes, or equipment as required by the specifications.

6. Qualification of procedures as required by the specifications.
7. Nondestructive testing requirements as required by the specifications.
8. Identification of independent certifying and testing laboratories to be used.

B. Records: Records shall include all quality control data; factory test plans/results, manufacturer's certifications, receiving inspections, deficiency correction reports; construction deficiency reports (CDR); training/certifications; letter of authority or delegation; and routine technical test plans/results, i.e., hydrostatic, electrical continuity, grounding, welding, line cleaning, etc. Quality records shall be available for examination upon request by the designated Government representatives. Quality control records shall be maintained in a central on-site location. Maintenance of quality control records shall not relieve the Contractor from submitting samples, test data, detail drawings, material certificates, or other information required by each section in the specification. All quality records shall be turned over to the Government's designated representatives as a file of record at contract completion.

1.4 QUALITY ASSURANCE

A. Qualifications: When approval or certification of special processes, operating personnel, and special equipment or procedures is required by the specifications, the Contractor shall obtain necessary approvals or certifications prior to starting the work.

B. Management and Organization: Contractor shall ensure effective execution of quality assurance/quality control functions and provide competent personnel with experience in quality assurance/quality control functions to provide supervision, inspection, and testing. Contractor shall be responsible for each of his suppliers and subcontractors. Contractor shall provide quality assurance oversight of suppliers and subcontractors and ensure that each provides effective quality control in the execution of their work. The program shall encompass management and supervisory actions that affect quality of all work-in-progress and finished construction work. The individual designated to direct the program shall report to the Contractor's management and shall have the necessary authority to discharge his responsibilities.

C. Identification and Data Retrieval: The Contractor shall have an identification and data retrieval system. Records, drawings, submittals, and equipment shall be identified to reference the following:

1. Contract Number
2. Contract Specification Number
3. Contract Drawing Number
4. Submittal Document Number
5. Contract Change Number
6. Contractor's Drawing Number System

D. Procurement: The Contractor shall be responsible for controlling procurement sources and those of his subcontractors to ensure that each purchase meets quality requirements. The Contractor shall ensure that his purchase documents include:

1. The basic quality requirements, standards, drawings, and specifications called out in the contract specifications.
2. Inspection and Test Characteristics.

3. Inspection and Test Records.
4. Operational and Maintenance (O&M) manuals, Instructions, Certifications of Compliance, and such other data as may be required by the specification.
5. Preservation, packaging, shipping directions.

E. When Government source inspection is required on a Contractor's purchase, the purchase document shall include the following statement: “All work on this order is subject to inspection and testing by the Government at any time and place. The Contracting Officer shall be notified immediately upon receipt of this order. The Contracting Officer shall be notified 72 hours in advance of the time articles or processes are ready for inspection or test."

F. Procurements that do not require Government source inspection shall include the following statement: "The Government reserves the right to inspect any or all of the materials included on this order at the Contractor's plant."

G. Required Government source inspections will be determined by the Contracting Officer. Government source inspections shall not replace Contractor inspections or relieve the Contractor of his responsibility for ensuring quality procurements and records verifying quality control activities.

H. Receiving Inspection System: Contractor shall maintain a receiving inspection system that ensures procured materials and equipment are inspected and tested as required by specifications, drawings, and approved submittal documents. Shipping/receiving inspection records will accompany each procurement delivery to the construction site. Maintain records of receiving inspections at the construction site by the Contractor. Records shall show defects, discrepancies, dispositions, and waivers, including evidence of Government source inspection.

I. Nonconforming Articles and Material Control: The Contractor shall control nonconformances discovered by the Contractor, subcontractors, suppliers or Government quality representatives to prevent their use and to correct deficient operations.

1. Contractor shall prepare a construction deficiency report for each instance comprising:
   a. A unique and traceable number.
   b. Identification of the nonconforming article or material.
   c. A description of the nonconformance and the applicable requirement.
   d. Cause or reason for the nonconformance.
   e. Remedial actions taken or recommended.
   f. Disposition of the nonconforming article or material.
2. The Contractor shall identify, mark, and segregate each nonconforming article for removal from the work area to prevent inadvertent use.
3. The Contractor shall monitor and correct deficient operations.

J. Fabrication, Process, and Work Control: The Contractor's procedures and controls shall be derived from stated requirements in contract specifications and drawings. The Contractor shall establish in-process inspections and ensure compliance with quality requirements that are not readily detectable or measurable by inspection and test of finished elements. Special processes may include, but are not limited to, concrete placement, piping system cleaning, plating, anodizing, nondestructive testing, welding, and soldering.

K. Drawings and Change Control: Drawing-control system shall be maintained to provide revised drawings and change distribution and removal of obsolete drawings from work areas. Changes

involving interface with other work areas, or affecting articles or materials controlled by others shall be controlled by the Contractor. This system shall be integrated with the document requirements of the contract. Drawing changes shall be clearly specified. Accomplished changes shall be clearly identified and associated drawings shall be revised. Drawings that have been approved, or approved as noted, by the Contracting Officer shall be used for fabrication and inspection.

L. Quality Inspections: Government Inspections: Work performed under the general direction of the Contracting Officer will be subject to inspection by authorized representatives. No representative is permitted to change specifications or drawings without written authorization of the Contracting Officer. Government in-process and end-item inspections may, at the Government's discretion, be performed on site and/or at the Contractor's or subcontractor's facility by Government representatives. Government shall be notified with sufficient advance notice of Contractor work plans which will cover up or make inaccessible previously installed work which may require Government inspection, i.e., backfilling or encasing of any underground utility, concrete placement, etc. Failure to provide such notification may require the work be uncovered to inspect the work. Uncovering and restoration of the work shall be at the Contractor's expense. The Contractor's quality assurance/control program is subject to continuous evaluation, review, and verification by the Contracting Officer. The Contractor will be notified in writing of any noncompliance area and will be given 5 days to correct identified deficiencies.

M. Contractor's Quality Inspections: Contractor shall implement an inspection system. Documentation shall indicate quality control through records of inspections and tests. Contractor shall ensure that nonconforming products are discovered, documented, and controlled. Procedures eliminating future deficiencies shall be implemented. Contractor's quality assurance system shall include the following:

1. Single Contractor's representative responsible for on-site/off-site communication and operation of the inspection program.
2. Purchasing control system documenting project procurement to drawings, specifications, and approved submittals.
3. Receiving inspection system documenting inspections for each procurement verifying material and equipment is compliant with plans and specifications.
4. Documentation for handling and disposing of nonconforming components and materials.
5. Inspection records as required for each specific section of the specification and drawings.
6. Identification of test(s) to be performed, test procedures, test plans/reports, records, and independent organizations used.
7. Documenting and maintaining certification or re-certification of procedures, personnel, and equipment.
8. Management of Government-furnished equipment, components, and materials.
9. Calibration of gages, tools, measuring instruments, and independent laboratories used and all associated documentation.

N. The Contractor shall establish his own system of scheduled or random sample inspections and audits to ensure objectives are met.

O. Manufacturer's Field Services: Responsibility for Inspection and Testing: Contractor is responsible for the performance of inspections and tests. Each shall be recorded. The Contractor shall utilize independent inspection and testing laboratories or services that are

acceptable to the Government. Tests of construction materials shall be accomplished by the Contractor utilizing the services of an acceptable independent testing laboratory.

P. Inspection and Test Records: The Contractor shall provide on-site records of each inspection and test performed throughout the life of the contract. Records shall include, but not be limited to, factual evidence that the required inspections or tests have been performed, including type and number of inspections or tests involved, identification of operators and inspectors, test plans/reports, result of inspections or tests, nature of defects, causes for rejection, proposed remedial action, and corrective actions taken.

Q. Records of in-process inspections and controls away from the job site may be used as evidence of quality of materials/work and, at the discretion of the Government, may reduce further inspection or testing after delivery to the job site.

R. The Contractor shall ensure each record is identified and traceable to specific requirements in the specifications and drawings.

1.5 HANDLING AND STORAGE

A. The Contractor shall provide controls and procedures which meet requirements of each section of the specifications. The Contractor shall include documentation with each shipment. The data shall consist of documentation required by the contract along with specifications required to identify, store, preserve, operate, and maintain the items shipped.

1.6 SEQUENCING AND SCHEDULING

A. Contractor shall notify the Government a minimum of 48 hours prior to scheduled inspections and tests. Contractor shall provide 24-hour notice to the Government of the date when the contract work will begin at the site. When Contractor suspends work for 5 days or longer prior to completion, he shall notify the Contracting Officer. Work shall not suspend nor resume without notification of the Contracting Officer.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 014200 - REFERENCES

PART 1 - GENERAL

1.1 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents, unless otherwise indicated.

C. Conflicting Requirements: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to the Contracting Officer for a decision before proceeding.

1. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to the Contracting Officer for a decision before proceeding.

D. Copies of Standards: Each entity engaged in construction on Project must be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source and make them available on request.

ADAAG	Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities Available from Access Board,	(800) 872-2253
	www.access-board.gov	(202) 272-5434
CFR	Code of Federal Regulations	(888) 293-6498
	www.access.gpo.gov/nara/cfr	(202) 512-1530
CRD	Handbook for Concrete and Cement Available from Army Corps of Engineers Waterways Experiment Station	(601) 634-2355
	www.wes.army.mil	

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

DOD	Department of Defense Specifications and Standards Available from Defense Automated Printing Service //astimage.daps.dla.mil/online	(215) 697-6257
FES-STD	Federal Standard (See FS)	
FS	Federal Specification Available from Defense Automated Printing Service //astimage.daps.dla.mil/online	(215) 697-6257
	Available from General Services Administration www.fss.gsa.gov/pub/fed-specs.cfm	(202) 619-8925
	Available from National Institute of Building Sciences www.nibs.org	(202) 289-7800
FTMS	Federal Test Method Standard (See FS)	
MILSPEC	Military Specification and Standards Available from Defense Automated Printing Service //astimage.daps.dla.mil/online	(215) 697-6257
NSS	NASA Safety Standards www.hq.nasa.gov/office/codeq/codeg/doctree/1740-9.pdf	
UFAS	Uniform Federal Accessibility Standards Available from Access Board www.access-board.gov	(800) 872-2253 (202) 272-5434

1.2 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale Research's "Encyclopedia of Associations" or in Columbia Books' "National Trade & Professional Associations of the U.S."

B. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web site addresses are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

AA	Aluminum Association, Inc. (The) www.aluminum.org	(202) 862-5100

AAMA	American Architectural Manufacturers Association www.aamanet.org	(847) 303-5664
ABMA	American Bearing Manufacturers Association www.abma-dc.org	(202) 367-1155
ACI	American Concrete Institute/ACI International www.aci-int.org	(248) 848-3700
ACPA	American Concrete Pipe Association www.concrete-pipe.org	(972) 506-7216
AGC	Associated General Contractors of America (The) www.agc.org	(703) 548-3118
AGMA	American Gear Manufacturer's Association www.agma.org	(703) 684-0211
AI	Asphalt Institute www.asphaltinstitute.org	(859) 288-4960
AIA	American Institute of Architects (The) www.e-architect.com	(202) 626-7300
AISC	American Institute of Steel Construction www.aisc.org	(800) 644-2400 (312) 670-2400
AISI	American Iron and Steel Institute www.steel.org	(202) 452-7100
ANSI	American National Standards Institute www.ansi.org	(202) 293-8020
API	American Petroleum Institute www.api.org	(202) 682-8000
ASCA	Architectural Spray Coaters Association www.ascassoc.com	(609) 848-6120
ASCE	American Society of Civil Engineers www.asce.org	(800) 548-2723 (703) 295-6300
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers www.ashrae.org	(800) 527-4723 (404) 636-8400
ASME	ASME International (The American Society of Mechanical Engineers International) www.asme.org	(800) 843-2763 (212) 591-7722
ASTM	American Society for Testing and Materials www.astm.org	(610) 832-9585

AWS	American Welding Society www.aws.org	(800) 443-9353 (305) 443-9353
AWWA	American Water Works Association www.awwa.org	(800) 926-7337 (303) 794-7711
BHMA	Builders Hardware Manufacturers Association www.buildershardware.com	(212) 297-2122
CCFSS	Center for Cold-Formed Steel Structures www.umr.edu/~ccfss	(573) 341-4471
CDA	Copper Development Association Inc. www.copper.org	(800) 232-3282 (212) 251-7200
CFFA	Chemical Fabrics & Film Association, Inc. www.chemicalfabricsandfilm.com	(216) 241-7333
CGA	Compressed Gas Association www.cganet.com	(703) 412-0900
CMAA	Crane Manufacturer's Association of America, Inc. www.mhia.org	(704) 676-1190
CRSI	Concrete Reinforcing Steel Institute www.crsi.org	(847) 517-1200
CSA	CSA International (Formerly: IAS - International Approval Services) www.csa-international.org	(800) 463-6727 (416) 747-4000
CSI	Construction Specifications Institute (The) www.csinet.org	(800) 689-2900 (703) 684-0300
DHI	Door and Hardware Institute www.dhi.org	(703) 222-2010
EIA/TIA	Electronic Industries Alliance/Telecommunications Industry Association www.eia.org	(703) 907-7500
FM	Factory Mutual System (See FMG)	
FMG	FM Global (Formerly: FM - Factory Mutual System) www.fmglobal.com	(401) 275-3000
HMMA	Hollow Metal Manufacturers Association (See NAAMM)	
HPW	H. P. White Laboratory, Inc. www.hpwhite.com	(410) 838-6550
IAS	International Approval Services (See CSA International)	

ICEA	Insulated Cable Engineers Association, Inc. www.icea.net	(508) 394-4424
ICRI	International Concrete Repair Institute (The) www.icri.org	(703) 450-0116
IEEE	Institute of Electrical and Electronics Engineers, Inc. (The) www.ieee.org	(212) 419-7900
IESNA	Illuminating Engineering Society of North America www.iesna.org	(212) 248-5000
IRI	Industrial Risk Insurers www.industrialrisk.com	(800) 243-8308 (860) 520-7300
ITS	Intertek Testing Services www.itsglobal.com	(800) 345-3851 (607) 753-6711
LGSI	Light Gage Structural Institute www.loseke.com	(972) 370-0967
LPI	Lightning Protection Institute www.lightning.org	(800) 488-6864 (847) 577-7200
MBMA	Metal Building Manufacturers Association www.mbma.com	(216) 241-7333
MCA	Metal Construction Association www.metalconstruction.org	(312) 201-0193
MFMA	Metal Framing Manufacturers Association	(312) 644-6610
MHIA	Material Handling Industry of America www.mhia.org	(800) 345-1815 (704) 676-1190
ML/SFA	Metal Lath/Steel Framing Association	
MSS	(See SSMA)	
	Manufacturers Standardization Society of The Valve and Fittings Industry Inc. www.mss-hq.com	(703) 281-6613
NAAMM	National Association of Architectural Metal Manufacturers www.naamm.org	(312) 332-0405
NACE	NACE International (National Association of Corrosion Engineers International) www.nace.org	(281) 228-6200
NAIMA	North American Insulation Manufacturers Association	(703) 684-0084

	(The) www.naima.org	
NAMI	National Accreditation and Management Institute, Inc.	(304) 258-5100
NAPM	National Association of Photographic Manufacturers (See PIMA)	
NEBB	National Environmental Balancing Bureau www.nebb.org	(301) 977-3698
NEC	National Electrical Code	
NECA	National Electrical Contractors Association www.necanet.org	(301) 657-3110
NEMA	National Electrical Manufacturers Association www.nema.org	(703) 841-3200
NETA	InterNational Electrical Testing Association www.netaworld.org	(303) 697-8441
NFPA	National Fire Protection Association www.nfpa.org	(800) 344-3555 (617) 770-3000
NIST	National Institute of Standards and Technology	
NRMCA	National Ready Mixed Concrete Association www.nrmca.org	(888) 846-7622 (301) 587-1400
NSF	NSF International (National Sanitation Foundation International) www.nsf.org	(800) 673-6275 (734) 769-8010
PCI	Precast/Prestressed Concrete Institute www.pci.org	(312) 786-0300
PDCA	Painting and Decorating Contractors of America www.pdca.com	(800) 332-7322 (703) 359-0826
PDI	Plumbing & Drainage Institute www.pdionline.org	(800) 589-8956 (508) 230-3516
PGI	PVC Geomembrane Institute //pgi-tp.ce.uiuc.edu	(217) 333-3929
PIMA	Photographic & Imaging Manufacturers Association (Formerly: NAPM - National Association of Photographic Manufacturers) www.pima.net	(914) 698-7603
RCSC	Research Council on Structural Connections www.boltcouncil.org	(800) 644-2400 (312) 670-2400

RMA	Rubber Manufacturers Association www.rma.org	(800) 220-7620 (202) 682-4800
SAE	SAE International www.sae.org	(724) 776-4841
SDI	Steel Deck Institute www.sdi.org	(847) 462-1930
SDI	Steel Door Institute www.steeldoor.org	(440) 899-0010
SGCC	Safety Glazing Certification Council www.sgcc.org	(315) 646-2234
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association www.smacna.org	(703) 803-2980
SSINA	Specialty Steel Industry of North America www.ssina.com	(800) 982-0355 (202) 342-8630
SSMA	Steel Stud Manufacturers Association (Formerly: ML/SFA - Metal Lath/Steel Framing Association) www.ssma.com	(312) 456-5590
SSPC	SSPC: The Society for Protective Coatings www.sspc.org	(800) 837-8303 (412) 281-2331
STI	Steel Tank Institute www.steeltank.com	(847) 438-8265
SWRI	Sealant, Waterproofing, and Restoration Institute www.swrionline.org	(816) 472-7974
TIA/EIA	Telecommunications Industry Association/Electronic Alliance www.tiaonline.org	(703) 907-7700
TPI	Truss Plate Institute	(608) 833-5900
UL	Underwriters Laboratories Inc. www.ul.com	(800) 704-4050 (847) 272-8800
UNI	Uni-Bell PVC Pipe Association www.uni-bell.org	(972) 243-3902

C. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.

Names, telephone numbers, and Web site addresses are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

CABO	Council of American Building Officials (See ICC)	
IAPMO	International Association of Plumbing and Mechanical Officials (The) www.iapmo.org	(909) 595-8449

ICBO	International Conference of Building Officials www.icbo.org	(800) 284-4406 (562) 699-0541
ICC	International Code Council (Formerly: CABO - Council of American Building Officials) www.intlcode.org	(703) 931-4533

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

CE	Army Corps of Engineers www.usace.army.mil	
CPSC	Consumer Product Safety Commission www.cpsc.gov	(800) 638-2772 (301) 504-0990
DOC	Department of Commerce www.doc.gov	(202) 482-2000
EPA	Environmental Protection Agency www.epa.gov	(202) 260-2090
FAA	Federal Aviation Administration www.faa.gov	(202) 366-4000
FCC	Federal Communications Commission www.fcc.gov	(202) 418-0190
GSA	General Services Administration www.gsa.gov	(202) 708-5082
NIST	National Institute of Standards and Technology www.nist.gov	(301) 975-6478
OSHA	Occupational Safety & Health Administration www.osha.gov	(202) 693-1999
USPS	Postal Service www.usps.com	(202) 268-2000

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

SECTION 01 60 00 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following administrative and procedural requirements, selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products.

B. Related Sections include the following:

1. Division 1 Section "References" for applicable industry standards for products specified.
2. Division 1 Section "Closeout Procedures" for submitting warranties for contract closeout.
3. Remaining Division Sections for specific requirements for warranties on products and installations specified to be warranted.

1.2 DEFINITIONS

A. Products: Items purchased for incorporating into the Work. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation, shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents. Named products or manufacturers are not pre-approved by the Government and are provided for information only. Manufacturers or products named as “Basis of Design” identify type, function, dimension, in-service performance, physical properties, appearance, and other characteristics desired by the Government.
2. Comparable or Equal Product: A product or product substitution that is demonstrated through the submittal process, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that are equal or exceed those of named product. .

B. Substitutions: Contractor proposed use of manufacturer’s products, materials, or equipment different from those identified in the Contract Documents. .

C. Product Specification: Product qualities and features related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for evaluating product compliance with project requirements.

1.3 SUBSTITUTIONS:

A. Substitution Requests: A substitution request form must be completed for all products submitted other than the “Basis of Design” products. Complete the form at the end of this section, and attach to each copy of the submittal of the product. Identify product or fabrication

or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
   a. Statement indicating why specified material or product cannot be provided.
   b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the Government and separate contractors that will be necessary to accommodate proposed substitution.
   c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
   d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
   e. Samples, where applicable or requested.
   f. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
   g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
   h. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.
   i. Cost information, including a proposal of change, if any, in the Contract Sum.
   j. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.

1.4 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.

1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
2. If a dispute arises between contractors over concurrently selectable but incompatible products, the Contracting Officer will determine which products shall be used.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.

2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project 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.
4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
5. Store products to allow for inspection and measurement of quantity or counting of units.
6. Store materials in a manner that will not endanger Project structure.
7. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
8. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
9. Protect stored products from damage.
10. Product shall be stored and handled in a safe manner and housekeeping conducted daily to the satisfaction of the Contracting Officer.

PART 2 - PRODUCTS

2.1 PRODUCT OPTIONS

A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged, and unless otherwise indicated, that are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
4. Or Equal: Where products are specified by name and accompanied by the term "or equal" or "or approved equal" or "or approved," comply with provisions in "Comparable Products" Article to obtain approval for use of an unnamed product.

2.2 PRODUCT SUBSTITUTIONS

A. Timing: The Contracting Officer will consider requests for substitution if received within 90 days after the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of the Contracting Officer.

B. Conditions: The Contracting Officer will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, the Contracting Officer will return requests without action, except to record noncompliance with these requirements:

1. Requested substitution offers the Government a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities the Government must assume.
2. Requested substitution does not require extensive revisions to the Contract Documents.
3. Requested substitution is consistent with the Contract Documents and will produce indicated results.
4. Substitution request is fully documented and properly submitted.
5. Requested substitution will not adversely affect Contractor's Construction Schedule.
6. Requested substitution is compatible with other portions of the Work.
7. Requested substitution has been coordinated with other portions of the Work.
8. Requested substitution provides specified warranty.
9. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 60 00

Advancement of Construction Technology

SUBSTITUTION REQUEST
(After the Bidding Phase)

Project: _____ Substitution Request Number: _____

_____ From: _____

To: _____ Date: _____

_____ Project Number: _____

Re: _____

Specification Title: _____ Description: _____

Section: _____ Page: _____ Article/Paragraph: _____

Proposed Substitution: _____

Manufacturer: _____ Address: _____ Phone: _____

Trade Name: _____ Model No.: _____

Installer: _____ Address: _____ Phone: _____

History: ☐ New product ☐ 2-5 years old ☐ 5-10 yrs old ☐ More than 10 years old

Differences between proposed substitution and specified product: _____

_____

_____

☐ Point-by-point comparative data attached

Reason for not providing specified item: _____

_____

Similar Installation:

Project: _____ Architect: _____

Address: _____ Owner: _____

_____ Date Installed: _____

Proposed substitution affects other parts of Work: ☐ No ☐ Yes; explain _____

_____

Savings to Government for accepting substitution: _____ ($ _____).

Proposed substitution changes Contract Time: ☐ No ☐ Yes [Add] [Deduct] _____days.

Supporting Data Attached: ☐ Drawings ☐ Product Data ☐ Samples ☐ Tests ☐ Reports ☐ _____

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SUBSTITUTION REQUEST
(Continued)

The Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Cost data as stated above is complete. Claims for additional costs related to accepted substitution which may subsequently become apparent are to be waived.
- Proposed substitution does not affect dimensions and functional clearances.
- Coordination, installation, and changes in the Work as necessary for accepted substitution will be complete in all respects.

Submitted by: _____

Signed by: _____

Firm: _____

Address: _____

_____

Telephone: _____

Attachments: _____

_____

_____

_____

GOVERNMENT'S REVIEW AND ACTION

☐ Substitution approved - Make submittals in accordance with Specification Section 01330.
☐ Substitution approved as noted - Make submittals in accordance with Specification Section 01330.
☐ Substitution rejected - Use specified materials.
☐ Substitution Request received too late - Use specified materials.

Signed by: Date:

Additional Comments: ☐ Contractor ☐ Subcontractor ☐ Supplier ☐ Manufacturer ☐ A/E ☐ COTR

_____

_____

_____

_____

_____

_____

_____

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SECTION 01 70 00 — PROJECT MEETINGS

PART 1 - GENERAL

1.1 PRECONSTRUCTION CONFERENCE

A. The Contractor shall attend a preconstruction conference scheduled by the Contracting Officer. Work shall not commence prior to the conference. Subcontractor representatives shall attend.

1.2 PROJECT MEETINGS

A. The Contractor shall attend project meetings scheduled by the Government to discuss safety, the project submittals status, the project construction schedule, and construction issues. The Contractor shall provide a representative from his organization with expertise and knowledge in matters related to the project Schedule. The representative shall have the responsibility of updating and coordinating the Schedule with actual job conditions. During this meeting, the Contractor shall describe, on an activity-by-activity basis, all proposed revisions and adjustments to the project Schedule required to reflect the current status of the project. The Contracting Officer shall approve activity progress, proposed revisions and adjustments as appropriate. Only Contracting Officer approved revisions and adjustments shall be incorporated into the schedule. The representative shall also present current information on the status of purchase orders, shop drawings, off-site fabrication, material deliveries, Subcontractor activities, anticipated needs for any Government-Furnished Equipment (GFE), and any problem which may impact the contract performance period. Subcontractor representatives shall attend as appropriate and as requested.

1.3 PREPARATORY MEETINGS

A. The contractor shall conduct preparatory meetings prior to the start of all new elements of work. The meeting shall include as a minimum representatives of the contractor performing the work, the GC site superintendent or foreman, and Government Inspector. Two days advance notice of preparatory meetings shall be given.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 70 00

SECTION 017310 - CUTTING AND PATCHING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes procedural requirements for cutting and patching.

B. Related Sections include the following:

1. All Division Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work. Refer to Division 2 and electrical Sections for other requirements and limitations applicable to cutting and patching electrical installations

1.2 DEFINITIONS

A. Cutting: Removal of existing construction necessary to permit installation or performance of other Work.

B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

1.3 SUBMITTALS

A. Cutting and Patching Proposal: Unless otherwise determined by the COTR, the contractor shall submit, at least 10 days before the time of cutting and patching, a proposal describing procedures that will be performed, and request approval to proceed. Include the following information:

1. Extent: Describe cutting and patching, show how they will be performed, and indicate why they cannot be avoided.
2. Changes to Existing Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building's appearance and other significant visual elements.
3. Products: List products to be used and firms or entities that will perform the Work.
4. Dates: Indicate when cutting and patching will be performed.
5. Utilities: List utilities that cutting and patching procedures will disturb or affect. List utilities that will be relocated and those that will be temporarily out of service. Indicate how long service will be disrupted.
6. Structural Elements: Where cutting and patching involve modification of any structural element, submit details showing the proposed modification and integration with original structure.

1.4 QUALITY ASSURANCE

A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.

B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.

1. Primary operational systems and equipment.
2. Air or smoke barriers.
3. Fire-protection systems.
4. Control systems.
5. Communication systems.
6. Conveying systems.
7. Electrical wiring systems.

C. Miscellaneous Elements: Do not cut and patch the following elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.

1. Water, moisture, or vapor barriers.
2. Membranes and flashings.
3. Exterior curtain-wall construction.
4. Equipment supports.
5. Piping, ductwork, vessels, and equipment.
6. Noise- and vibration-control elements and systems.

D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

1. Retain recognized, experienced, and specialized firm to cut and patch exposed Work listed below.

a. Processed concrete finishes.
b. Stonework and stone masonry.
c. Ornamental metal.
d. Preformed metal panels.
e. Roofing.
f. Firestopping.
g. Window wall system.
h. Fluid-applied flooring.
i. Aggregate wall coating.
j. Wall covering.
k. HVAC enclosures, cabinets, or covers.

E. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential

interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.5 WARRANTY

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

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections of these Specifications.

B. Existing Materials: Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of existing materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.

1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

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

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

C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

D. Existing Services: Where existing services are required to be removed, relocated, or abandoned, bypass such services before cutting to avoid interruption of services to occupied areas.

3.3 PERFORMANCE

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut existing construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Cutting: Cut existing construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Existing Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
6. Proceed with patching after construction operations requiring cutting are complete.

C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

   a. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface

containing the patch. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.

END OF SECTION 017310

FORM CWM-1: CONSTRUCTION WASTE IDENTIFICATION

MATERIAL CATEGORY	GENERATION POINT	EST. QUANTITY OF MATERIALS RECEIVED* (A)	EST. WASTE - % (B)	TOTAL EST. QUANTITY OF WASTE* (C = A x B)	EST. VOLUME CY (CM)	EST. WEIGHT TONS (TONNES)	REMARKS AND ASSUMPTIONS
Packaging: Cardboard							
Packaging: Boxes							
Packaging: Plastic Sheet or Film							
Packaging: Polystyrene							
Packaging: Pallets or Skids							
Packaging: Crates							
Packaging: Paint Cans							
Packaging: Plastic Pails							
Site-Clearing Waste							
Masonry or CMU							
Lumber: Cut-Offs							
Lumber: Warped Pieces							
Plywood or OSB (scraps)							
Wood Forms							
Wood Waste Chutes							
Wood Trim (cut-offs)							
Metals							
Insulation							
Roofing							
Joint Sealant Tubes							
Gypsum Board (scraps)							
Carpet and Pad (scraps)							
Piping							
Electrical Conduit							
Other:							

* Insert units of measure.

FORM CWM-2: DEMOLITION WASTE IDENTIFICATION

MATERIAL DESCRIPTION	EST. QUANTITY	EST. VOLUME CY (CM)	EST. WEIGHT TONS (TONNES)	REMARKS AND ASSUMPTIONS
Asphaltic Concrete Paving				
Concrete				
Brick				
CMU				
Lumber				
Plywood and OSB				
Wood Paneling				
Wood Trim				
Miscellaneous Metals				
Structural Steel				
Rough Hardware				
Insulation				
Roofing				
Doors and Frames				
Door Hardware				
Windows				
Glazing				
Acoustical Tile				
Carpet				
Carpet Pad				
Demountable Partitions				
Equipment				
Cabinets				
Plumbing Fixtures				
Piping				
Piping Supports and Hangers				
Valves				
Sprinklers				
Mechanical Equipment				
Electrical Conduit				
Copper Wiring				
Light Fixtures				
Lamps				
Lighting Ballasts				
Electrical Devices				
Switchgear and Panelboards				
Transformers				
Other:				

FORM CWM-3: CONSTRUCTION WASTE REDUCTION WORK PLAN

MATERIAL CATEGORY	GENERATION POINT	TOTAL EST. QUANTITY OF WASTE TONS (TONNES)	DISPOSAL METHOD AND QUANTITY			HANDLING AND TRANSPORTION PROCEDURES
			EST. AMOUNT SALVAGED TONS (TONNES)	EST. AMOUNT RECYCLED TONS (TONNES)	EST. AMOUNT DISPOSED TO LANDFILL TONS (TONNES)	
Packaging: Cardboard						
Packaging: Boxes						
Packaging: Plastic Sheet or Film						
Packaging: Polystyrene						
Packaging: Pallets or Skids						
Packaging: Crates						
Packaging: Paint Cans						
Packaging: Plastic Pails						
Site-Clearing Waste						
Masonry or CMU						
Lumber: Cut-Offs						
Lumber: Warped Pieces						
Plywood or OSB (scraps)						
Wood Forms						
Wood Waste Chutes						
Wood Trim (cut-offs)						
Metals						
Insulation						
Roofing						
Joint Sealant Tubes						
Gypsum Board (scraps)						
Carpet and Pad (scraps)						
Piping						
Electrical Conduit						
Other:						

FORM CWM-4: DEMOLITION WASTE REDUCTION WORK PLAN

MATERIAL CATEGORY	GENERATION POINT	TOTAL EST. QUANTITY OF WASTE TONS (TONNES)	DISPOSAL METHOD AND QUANTITY			HANDLING AND TRANSPORTION PROCEDURES
			EST. AMOUNT SALVAGED TONS (TONNES)	EST. AMOUNT RECYCLED TONS (TONNES)	EST. AMOUNT DISPOSED TO LANDFILL TONS (TONNES)	
Asphaltic Concrete Paving						
Concrete						
Brick						
CMU						
Lumber						
Plywood and OSB						
Wood Paneling						
Wood Trim						
Miscellaneous Metals						
Structural Steel						
Rough Hardware						
Insulation						
Roofing						
Doors and Frames						
Door Hardware						
Windows						
Glazing						
Acoustical Tile						
Carpet						
Carpet Pad						
Demountable Partitions						
Equipment						
Cabinets						
Plumbing Fixtures						
Piping						
Supports and Hangers						
Valves						
Sprinklers						
Mechanical Equipment						
Electrical Conduit						
Copper Wiring						
Light Fixtures						
Lamps						
Lighting Ballasts						
Electrical Devices						
Switchgear and Panelboards						
Transformers						
Other:						

FORM CWM-5: COST/REVENUE ANALYSIS OF CONSTRUCTION WASTE REDUCTION WORK PLAN

MATERIALS	TOTAL QUANTITY OF MATERIALS (VOL. OR WEIGHT) (A)	EST. COST OF DISPOSAL (B)	TOTAL EST. COST OF DISPOSAL (C = A x B)	REVENUE FROM SALVAGED MATERIALS (D)	REVENUE FROM RECYCLED MATERIALS (E)	LANDFILL TIPPING FEES AVOIDED (F)	HANDLING AND TRANSPORTATION COSTS AVOIDED (G)	NET COST SAVINGS OF WORK PLAN (H = D+E+F+G)
Packaging: Cardboard								
Packaging: Boxes								
Packaging: Plastic Sheet or Film								
Packaging: Polystyrene								
Packaging: Pallets or Skids								
Packaging: Crates								
Packaging: Paint Cans								
Packaging: Plastic Pails								
Site-Clearing Waste								
Masonry or CMU								
Lumber: Cut-Offs								
Lumber: Warped Pieces								
Plywood or OSB (scraps)								
Wood Forms								
Wood Waste Chutes								
Wood Trim (cut-offs)								
Metals								
Insulation								
Roofing								
Joint Sealant Tubes								
Gypsum Board (scraps)								
Carpet and Pad (scraps)								
Piping								
Electrical Conduit								
Other:								

FORM CWM-6: COST/REVENUE ANALYSIS OF DEMOLITION WASTE REDUCTION WORK PLAN

MATERIALS	TOTAL QUANTITY OF MATERIALS (VOL. OR WEIGHT) (A)	EST. COST OF DISPOSAL (B)	TOTAL EST. COST OF DISPOSAL (C = A x B)	REVENUE FROM SALVAGED MATERIALS (D)	REVENUE FROM RECYCLED MATERIALS (E)	LANDFILL TIPPING FEES AVOIDED (F)	HANDLING AND TRANSPORTATION COSTS AVOIDED (G)	NET COST SAVINGS OF WORK PLAN (H = D+E+F+G)
Asphaltic Concrete Paving								
Concrete								
Brick								
CMU								
Lumber								
Plywood and OSB								
Wood Paneling								
Wood Trim								
Miscellaneous Metals								
Structural Steel								
Rough Hardware								
Insulation								
Roofing								
Doors and Frames								
Door Hardware								
Windows								
Glazing								
Acoustical Tile								
Carpet								
Carpet Pad								
Demountable Partitions								
Equipment								
Cabinets								
Plumbing Fixtures								
Piping								
Supports and Hangers								
Valves								
Sprinklers								
Mech. Equipment								
Electrical Conduit								
Copper Wiring								
Light Fixtures								
Lamps								
Lighting Ballasts								
Electrical Devices								
Switchgear and Panelboards								
Transformers								
Other:								

FORM CWM-7: CONSTRUCTION WASTE REDUCTION PROGRESS REPORT

MATERIAL CATEGORY	GENERATION POINT	TOTAL QUANTITY OF WASTE TONS (TONNES) (A)	QUANTITY OF WASTE SALVAGED		QUANTITY OF WASTE RECYCLED		TOTAL QUANTITY OF WASTE RECOVERED TONS (TONNES) (D = B + C)	TOTAL QUANTITY OF WASTE RECOVERED % (D / A x 100)
			ESTIMATED TONS (TONNES)	ACTUAL TONS (TONNES) (B)	ESTIMATED TONS (TONNES)	ACTUAL TONS (TONNES) (C)		
Packaging: Cardboard								
Packaging: Boxes								
Packaging: Plastic Sheet or Film								
Packaging: Polystyrene								
Packaging: Pallets or Skids								
Packaging: Crates								
Packaging: Paint Cans								
Packaging: Plastic Pails								
Site-Clearing Waste								
Masonry or CMU								
Lumber: Cut-Offs								
Lumber: Warped Pieces								
Plywood or OSB (scraps)								
Wood Forms								
Wood Waste Chutes								
Wood Trim (cut-offs)								
Metals								
Insulation								
Roofing								
Joint Sealant Tubes								
Gypsum Board (scraps)								
Carpet and Pad (scraps)								
Piping								
Electrical Conduit								
Other:								

FORM CWM-8: DEMOLITION WASTE REDUCTION PROGRESS REPORT

MATERIAL CATEGORY	GENERATION POINT	TOTAL QUANTITY OF WASTE TONS (TONNES) (A)	QUANTITY OF WASTE SALVAGED		QUANTITY OF WASTE RECYCLED		TOTAL QUANTITY OF WASTE RECOVERED TONS (TONNES) (D = B + C)	TOTAL QUANTITY OF WASTE RECOVERED % (D / A x 100)
			ESTIMATED TONS (TONNES)	ACTUAL TONS (TONNES) (B)	ESTIMATED TONS (TONNES)	ACTUAL TONS (TONNES) (C)		
Asphaltic Concrete Paving								
Concrete								
Brick								
CMU								
Lumber								
Plywood and OSB								
Wood Paneling								
Wood Trim								
Miscellaneous Metals								
Structural Steel								
Rough Hardware								
Insulation								
Roofing								
Doors and Frames								
Door Hardware								
Windows								
Glazing								
Acoustical Tile								
Carpet								
Carpet Pad								
Demountable Partitions								
Equipment								
Cabinets								
Plumbing Fixtures								
Piping								
Supports and Hangers								
Valves								
Sprinklers								
Mechanical Equipment								
Electrical Conduit								
Copper Wiring								
Light Fixtures								
Lamps								
Lighting Ballasts								
Electrical Devices								
Switchgear and Panelboards								
Transformers								
Other:								

SECTION 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Salvaging nonhazardous demolition and construction waste.
2. Recycling nonhazardous demolition and construction waste.
3. Disposing of nonhazardous demolition and construction waste.

B. Related Requirements:

1. Section 010650 “Environmental Compliance” for MSFC specific waste management procedures

1.3 DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.

C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

G. Total Recovered Material: Waste materials and byproducts that have been recovered or diverted from solid waste, but does not include materials and byproducts generated from, and commonly reused within, an original manufacturing process.

1.4 PERFORMANCE REQUIREMENTS

A. General: Achieve end-of-Project rates for salvage/recycling of 75 percent by weight of total non-hazardous solid waste generated by the Work. Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials, including the following:

1. Demolition Waste:
   a. Asphalt paving.
   b. Concrete.
   c. Concrete reinforcing steel.
   d. Structural and miscellaneous steel.
   e. Acoustical tile and panels.
   f. Piping.
   g. Valves.
   h. Mechanical equipment.
   i. Refrigerants.
   j. Electrical conduit.
   k. Copper wiring.
   l. Lighting fixtures.
   m. Lamps.
   n. Ballasts.
   o. Electrical devices.
   p. Switchgear and panelboards.
   q. Transformers.

2. Construction Waste:
   a. Masonry and CMU.
   b. Lumber.
   c. Wood sheet materials.
   d. Wood trim.
   e. Metals.
   f. Roofing.
   g. Insulation.
   h. Carpet and pad.
   i. Gypsum board.
   j. Piping.
   k. Electrical conduit.
   l. Packaging: Regardless of salvage/recycle goal indicated in "General" Paragraph above, salvage or recycle 100 percent of the following uncontaminated packaging materials:
      1) Paper.
      2) Cardboard.
      3) Boxes.
      4) Plastic sheet and film.
      5) Polystyrene packaging.
      6) Wood crates.
      7) Plastic pails.

1.5 SUBMITTALS

A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Use Form CWM-1 for construction waste and Form CWM-2 for demolition waste.

B. Waste Reduction Final Report: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work. Use Form CWM-1 for construction waste and Form CWM-2 for demolition waste.

C. Landfill and Incinerator Disposal Records or Recycling and Processing Facility Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities or of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

1.6 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 WASTE REDUCTION PROGRESS REPORTS:

A. Concurrent with each Application for Payment, submit report. Use Form CWM- 1 for construction waste and Form CWM-2 for demolition waste. Include the following information:

1. Material category.
2. Generation point of waste.
3. Total quantity of waste in tons.
4. Quantity of waste salvaged, both estimated and actual in tons.
5. Quantity of waste recycled, both estimated and actual in tons.
6. Total quantity of waste recovered (salvaged plus recycled) in tons.
7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.

PART 3 - EXECUTION

3.1 IMPLEMENTATION

A. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.

B. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, and reused
2. Comply with Division 01 Sections for controlling dust and dirt, environmental protection, and noise control.

3.2 SALVAGING DEMOLITION ITEMS

A. Salvage items for reuse and handle as follows:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
3. Store items in a secure area until installation.
4. Protect items from damage during transport and storage.
5. Turn over to the COTR or install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.

B. Lighting Fixtures: Separate lamps by type and protect from breakage.

C. Electrical Devices: Separate switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.

3.3 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

A. NOTE: The policies, procedures and restrictions of the landfill and recycling organizations above are not governed by NASA and are subject to change. All contractors should contact these agencies directly to familiarize themselves with the policies, procedures and restrictions prior to bidding and prepare their bids accordingly.

B. General: Recycle paper and beverage containers used by on-site workers.

C. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor.

D. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.

E. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical.

1. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
2. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
3. Store components off the ground and protect from the weather.

4. Remove recyclable waste from Government's property.

3.4 RECYCLING DEMOLITION WASTE

A. Metals: Separate metals by type.

1. Structural Steel and Siding: Stack members according to size, type of member, and length.
2. Piping: Separate and store by type. Separate supports, hangers, valves, sprinklers, and other components by type.
3. Conduit: Separate and store by type.

B. Concrete and Masonry: Segregate block and concrete.

3.5 RECYCLING CONSTRUCTION WASTE

A. Packaging:

1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
2. Polystyrene Packaging: Separate and bag materials.
3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site.
4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

B. Wood Materials:

1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.

C. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.

3.6 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a manner acceptable to the Government.

1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

C. Disposal: Transport waste materials and dispose at the Redstone Arsenal Landfill, if permissible, or legally dispose off the Government's property. Review Division 01 Section "Environmental Compliance" for further disposal information.

3.7 REDSTONE ARSENAL LANDFILL (RSAL) (Phone # 256-876-4199)

A. The following restrictions concerning use of the Government's Redstone Arsenal Landfill (RSAL) are provided for general use as an example of some of the policies and restrictions that historically have been associated with the RSAL. They are not to be considered complete or necessarily correct. The policies, procedures, and restrictions of the landfill and recycling organizations above are not governed by NASA and are subject to change. All contractors should contact these agencies directly to familiarize themselves with the policies, procedures, and restrictions prior to bidding and prepare their bids accordingly.

1. No garbage shall be mixed in with the construction rubble for disposal at the Redstone Arsenal Landfill (RSAL).
2. No liquids of any kind shall be disposed of at the RSA
3. No ammunition or explosive type material (including training devices) shall be disposed of at the RSAL.
4. No batteries shall be disposed of at the RSAL.
5. No hazardous wastes shall be disposed of at the RSAL, except asbestos as noted herein.
6. Large pieces of heave metal, copper, metal shavings, etc. shall not be disposed of at the RSAL.
7. Asbestos shall be segregated and disposed of in a designated area of the RSAL.
8. Cans of 1 gallon or larger that contain paint, solvent, or any other liquid shall not be disposed of in the RSAL.
9. Empty drums in good condition from 5-gallon containers and up shall not be disposed of in the RSAL.
10. Empty drums in poor condition shall be flattened prior to delivery for disposal to the RSAL.
11. There will be no loitering or scrounging at the RSAL.

B. For all demolition and construction waste to be disposed of at the RSAL, the Contractor shall submit documentation ensuring compliance with ADEM Permit No. 45-3 issued for the RSAL. The MSFC Environmental Engineering and Occupational Health Office (AS10) will provide to the Contractor the Certification Number to be used for the project. The Contractor shall complete all applicable portions of the form's "Material Certification" page except as described below. Upon completion, the Facility Management Office Construction Support Contractor shall submit the "Material Certification" to AS10. MSFC AS10 will complete the "Waste Certification" and "Material Certification" sections of the Form 2435-R and forward it to the RSAL. The Contractor shall complete a Form 4235-R, "Delivery Ticket" for each load using the specific project's Certification Number.

C. The Government will refuse any material or not allow dumping of any material at the site if it does not meet the above requirements. If this occurs, the Contractor is responsible to dispose of the waste material offsite at approved landfills at his own expense.

3.8 ATTACHMENTS

A. Form CWM-1 for construction waste

B. Form CWM-2 for demolition waste.

END OF SECTION 01 74 19

SECTION 01 77 00 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes, but is not limited to, administrative and procedural requirements for contract closeout.

B. Related Sections include the following:

1. Specification Section 017820 "Operation and Maintenance Data" for operation and maintenance manual requirements.
2. Division 1 Section "Demonstration and Training" for requirements for instruction of the Government's personnel.
3. Refer to applicable sections for specific closeout and special cleaning requirements for products of those Sections.

1.2 FINAL INSPECTION

A. Before requesting final inspection, complete the following:

1. All salient parts of the work are substantially complete.
2. All systems and subsystems are substantially complete.
3. Startup testing of systems is complete.
4. Test and Balance is complete and final report is approved.
5. The commissioning is complete to the following level:
   a. Completed and signed start-up and prefunctional checklist documentation.
   b. Requested trend log data provided.
   c. Building UCS system is functioning as designed.
   d. Completion of all functional testing.
   e. Required training of Owner personnel completed.
   f. All identified deficiencies have been corrected or are approved by the Owner to be excepted from this milestone
6. Submission and approval of Operation and Maintenance Manuals.

B. The Owner's Project Manager will determine the date of Functional Completion after reviewing the Commissioning Agent's recommendation for Functional Completion

C. Instruct Government's personnel in operation, adjustment, and maintenance of products, equipment, and systems. The Owner's Project Manager will determine the date of Functional Completion after reviewing the Commissioning Agent's recommendation for Functional Completion.

D. Inspection: Request a final inspection for acceptance. On receipt of request, the Government will either schedule a day for the inspection or reject the Contractor's request for due cause. Requests for "partial" final inspections will only be considered when multiple and functionally

separate buildings are involved or when the project is phased or when systems or occupancies are required by the Government. The Government reserves the right to reject all “partial” requests.

E. After final inspection, the Government shall issue a punch list to be completed by the Contractor.

1.3 PROJECT CLOSEOUT SUBMITTALS

A. As-built Drawings: Submit the redlined as-built drawing set maintained by the Contractor and verified by the Government as defined in Part 2.

B. Operation And Maintenance Data Manuals: Submit O&M manual in accordance with Specification Section 017820

C. Warranties: Organize warranty documents into an orderly sequence.

1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch (115-by-280-mm) paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
4. Provide additional copies of each warranty and include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 AS-BUILT DRAWINGS

A. As-built Drawings: Maintain one set of prints of the Contract Drawings and Shop Drawings at the project site.

1. Preparation: Mark As-built Prints completely and accurately to show the actual installation. The construction contractor shall include on the as-built drawings all variances from that shown on original drawings and all utilities that are field routed in and/or under concrete slabs, walls or masonry walls and/or concealed or buried in the ground. The as-built drawings shall be prepared in reference to the building column lines and include all concealed utilities, depths, and locations from building column lines.
   a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
   b. Accurately record information in an understandable drawing technique.
   c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.

d. For DCR's, RFI's, CDR's, and Change Items, cloud the area on the drawing affected by the change, note the changing document number, and attach the approved changing document to the affected drawing.

2. Content: Types of items requiring marking include, but are not limited to, the following:
   a. Dimensional changes to Drawings.
   b. Revisions to details shown on Drawings.
   c. Depths of foundations below first floor.
   d. Locations and depths of underground utilities. Prior to utilities burial or concrete placement, record horizontal location of utilities with respect to distances from column lines or other permanent features and record depth of underground utilities with respect to grade level or top of concrete slab.
   e. Revisions to identified routing of piping and conduits.
   f. Revisions to electrical circuitry.
   g. Actual equipment locations.
   h. Duct size and routing.
   i. Locations of concealed internal utilities.
   j. Changes made by Change Order.
   k. Changes made following the Contracting Officer's written orders.
   l. Details not on the original Contract Drawings.
   m. Field records for variable and concealed conditions.
   n. Record information on the Work that is shown only schematically.
   o. Note and dimension all underground utilities and structures (including existing) on the drawings.
3. Mark as-built set with red-colored pen.
4. Mark important additional information that was either shown schematically or omitted from original Drawings.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

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

B. Maintenance of Record Documents and Samples: Store Record Documents and Samples in the field office apart from the Contract Documents used for construction. Provide access to Project Record Documents at the project site during normal working hours.

3.2 PROJECT CLOSEOUT

A. General: The final pay application shall not be accepted by the Government until all contract requirements are met and the following is performed.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations:

a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
d. Remove tools, construction equipment, machinery, and surplus material from Project site.
e. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
f. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
g. Sweep concrete floors broom clean in unoccupied spaces.
h. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
i. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
j. Remove labels that are not permanent.
k. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
    1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
l. Wipe surfaces of mechanical and electrical equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
m. Replace parts subject to unusual operating conditions.
n. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
o. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
p. Clean ducts, blowers, and coils if units were operated without filters during construction.
q. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
r. Leave Project clean and ready for occupancy.

C. Complete all punch list items.

D. Demobilize and remove all temporary utilities.

E. Complete all submittal requirements.

F. All permits shall be closed out, notifications made, and hazardous wastes removed.

G. All DCR's signed and closed out.

H. Turn in excess and salvage materials and spare parts as required.

I. Security: Turn in badges, decals, passes, keys, and all other security items.

J. Final Reports: Contractor accident and safety statistics.

K. Release all liens.

L. All permits shall be closed out, notifications made, and hazardous waste removed.

M. Operation and Maintenance Manuals: Submit operation and maintenance data in accordance with Section 017820.

3.3 PUNCHLIST

A. The Contractor shall complete all punch list items as quickly as possible but within 30 days after final inspection.

END OF SECTION 017700

SECTION 01 78 20 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

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

1. Operation and maintenance documentation directory.
2. Operation and Emergency manuals for systems, subsystems, and equipment.
3. Maintenance manuals for the care and maintenance of products, materials, and systems and equipment.

B. Related Sections include the following:

1. Division1 Section 013300 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
2. Division1 Section 017700 "Closeout Procedures" for submitting operation and maintenance manuals.
3. Refer to applicable sections for specific operation and maintenance manual requirements for products in those Sections.

1.2 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.3 SUBMITTALS

A. O & M Manual(s) Submittal: Submit 2 hard copies of each manual in final form at least 30 days before final inspection. In addition to hard copies of each manual, provide CD ROM of operation and maintenance data using PDF format from Adobe Acrobat.

1.4 COORDINATION

A. Where operation and maintenance documentation includes information on installations by more than one factory-authorized service representative, assemble and coordinate information furnished by representatives and prepare manuals.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Organization: Include a section in the directory for each of the following:

1. List of documents.
2. List of systems.
3. List of equipment.
4. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include a list of equipment for each system.

C. List of Equipment: List equipment organized alphabetically that is not already listed as a part of a system or subsystem.

D. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with the same designation used in the Contract Documents. If no designation exists, consult with the COTR.

2.2 MANUALS, GENERAL

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

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

1. Subject matter included in manual.
2. Name and address of Project.
3. Date of submittal.
4. Name, address, and telephone number of Contractor.

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

1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

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

1. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch (115-by-280-mm) paper; with

clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets by stating Volume ___ of ___, where the first blank is the subject volume and the second blank is the total number of volumes.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.
4. Supplementary Text: Prepared on 8-1/2-by-11-inch (115-by-280-mm), 20-lb/sq. ft. (75-g/sq. m) white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

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

2.3 OPERATION AND EMERGENCY MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions.
2. Performance and design criteria if Contractor is delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.
11. Type of Emergency
12. Emergency instructions
13. Emergency procedures

B. Descriptions: Include the following:

1. Product name and model number.
2. Manufacturer's name.
3. Equipment identification by MAXIMO number with corresponding serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special/Emergency operating instructions and procedures.

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

1. Fire.
2. Flood.
3. Gas leak.
4. Water leak.
5. Power failure.
6. Water outage.
7. System, subsystem, or equipment failure.
8. Chemical release or spill.

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

F. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

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

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

2.4 PRODUCT MAINTENANCE MANUAL

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

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

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

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

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

F. Warranties: Provide separate booklet of warranties and lists of circumstances and conditions that would affect validity of warranties.

1. Include procedures to follow and required notifications for warranty claims.

2.5 SYSTEMS AND EQUIPMENT MAINTENANCE MANUAL

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

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

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:

1. Standard printed maintenance instructions and bulletins.
2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training videotape, if available.

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

1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

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

G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

H. Warranties: Provide separate booklet of warranties and lists of circumstances and conditions that would affect validity of warranties.

1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

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

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

C. Emergency, Operation and Maintenance Manuals: Assemble a complete set of emergency, operation and maintenance data and procedures indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system. Manuals may be used by emergency personnel and by Owner’s operating personnel for types of emergencies indicated.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

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

1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

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

F. Comply with Division 1 Section 017700 "Closeout Procedures" for the schedule for submitting operation and maintenance documentation.

END OF SECTION 017820

SECTION 01 82 00 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for training Government's personnel in the operation and maintenance of systems, subsystems, and equipment.

1.2 SUBMITTALS

A. Instruction Program: Submit two copies of outline of instructional program for demonstration and training, and instructors' names for each training module. Include learning objective and outline for each training module.

1. At completion of training, submit one complete training manual(s) for the Government's use in CD .pdf format.

B. Qualification Data: For firms and instructors identified in "Quality Assurance" demonstrate their capabilities and experience to conduct training for the system and equipment specified. Include lists of previous training on completed projects with project names and addresses, and other information specified.

C. Demonstration and Training DVD: Submit two copies at end of each training module.

1.3 QUALITY ASSURANCE

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

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

1.4 COORDINATION

A. Coordinate instruction schedule with the Government's operations. Adjust schedule as required to minimize disrupting the Government's operations.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

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

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

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

1. Motorized doors, including overhead coiling doors, overhead coiling grilles, and automatic entrance doors.
2. Fire-protection systems, including fire alarm, fire pumps, and fire-extinguishing systems.
3. Intrusion detection systems.
4. Conveying systems, including elevators, wheelchair lifts, escalators, and cranes.
5. Laboratory equipment, including laboratory air, and vacuum equipment and piping.
6. Heat generation, including boilers; feed water equipment, pumps, steam distribution piping, and water distribution piping.
7. Refrigeration systems, including chillers, cooling towers, condensers, pumps, and distribution piping.
8. HVAC systems, including air-handling equipment, air distribution systems, and terminal equipment and devices.
9. HVAC instrumentation and controls.
10. Electrical service and distribution, including transformers, switchboards, panel boards, uninterruptible power supplies, and motor controls.
11. Packaged engine generators, including transfer switches.
12. Lighting equipment and controls.

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

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
   a. System, subsystem, and equipment descriptions.
   b. Performance and design criteria if Contractor is delegated design responsibility.
   c. Operating standards.
   d. Regulatory requirements.
   e. Equipment function.
   f. Operating characteristics.
   g. Limiting conditions.
   h. Performance curves.

2. Documentation: Review the following items in detail:
   a. Emergency manuals.
   b. Operations manuals.
   c. Maintenance manuals.
   d. Identification systems.
   e. Warranties.

3. Emergencies: Include the following, as applicable:
   a. Instructions on meaning of warnings, trouble indications, and error messages.
   b. Instructions on stopping.

c. Shutdown instructions for each type of emergency.
d. Operating instructions for conditions outside of normal operating limits.
e. Sequences for electric or electronic systems.
f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:
   a. Startup procedures.
   b. Equipment or system break-in procedures.
   c. Routine and normal operating instructions.
   d. Regulation and control procedures.
   e. Control sequences.
   f. Safety procedures.
   g. Instructions on stopping.
   h. Normal shutdown instructions.
   i. Operating procedures for emergencies.
   j. Operating procedures for system, subsystem, or equipment failure.
   k. Seasonal and weekend operating instructions.
   l. Required sequences for electric or electronic systems.
   m. Special operating instructions and procedures.

5. Adjustments: Include the following:
   a. Alignments.
   b. Checking adjustments.
   c. Noise and vibration adjustments.
   d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:
   a. Diagnostic instructions.
   b. Test and inspection procedures.

7. Maintenance: Include the following:
   a. Inspection procedures.
   b. Types of cleaning agents to be used and methods of cleaning.
   c. List of cleaning agents and methods of cleaning detrimental to product.
   d. Procedures for routine cleaning
   e. Procedures for preventive maintenance.
   f. Procedures for routine maintenance.
   g. Instruction on use of special tools.

8. Repairs: Include the following:
   a. Diagnosis instructions.
   b. Repair instructions.
   c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
   d. Instructions for identifying parts and components.
   e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a combined training manual.

3.2 INSTRUCTION

A. Trainer: Engage a qualified trainer to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and the Government for number of participants, instruction times, and location.

B. Provide instructors to instruct the Government's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

C. Schedule training with the Government at least fourteen calendar days' advance notice.

D. Demonstration and Training Session: Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice. For each training module, submit list of participants and length of instruction time.

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

E. Cleanup: Collect used and leftover educational materials and give to the Government. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

END OF SECTION 01 82 00

SECTION 022200 - SELECTIVE DEMOLITION

PART 1 – GENERAL

1.1 SUMMARY:

A. This Section requires the selective removal and subsequent offsite disposal of the following:

1. Portions of existing interior construction indicated on drawings and as required to accommodate new construction.
2. Removal of walls and interior partitions if indicated on Drawings.
3. Removal of doors and frames indicated “remove”, or similar indication.
4. Removal and protection of existing fixtures, materials, and equipment items indicated “salvage,” or otherwise to be re-used.

1.2 RELATED DOCUMENTS:

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

B. Section 0101590 - Special Conditions.

C. Section 017310 Cutting and Patching.

D. Related work specified elsewhere:

1. Remodeling, construction work, and patching are included within the respective sections of specifications, including removal of materials for reuse and incorporation into remodeling or new construction, and/or delivery of salvage items to Government at on site or off site location as directed by the Contracting Officer’s Representative (COR).
2. Relocation of pipes, conduits, ducts, and other mechanical and electrical work if specified in other Divisions, and/or indicated on the Drawings.

1.3 SUBMITTALS:

General: Submit the following in accordance with conditions of Contract and Division 1 Specification Sections.

A. Schedule indicating proposed sequence of operations for selective demolition work to Contracting Officer’s Representative (COR) for review prior to start of work. Include coordination for shutoff, capping, and continuation of utility services as required, together with details for dust and noise control protection.

1. Provide detailed sequence of demolition and removal work to ensure

uninterrupted progress of Government's on-site operations (i.e.: Work by others on behalf of the Government, normal work of Government's personnel and other building occupants, etc.).

1.4 JOB CONDITIONS:

A. Occupancy: Government will occupy portions of the building or site immediately adjacent to areas of selective demolition. Conduct selective demolition work in manner that will minimize need for disruption of Government's operations. Provide minimum of 72 hours advance notice to COR of demolition activities that will affect Government's operations.

B. Condition of Structures: Government assumes no responsibility for actual condition of items or structures to be demolished.

1. Conditions existing at time of inspection for bidding purposes will be maintained by Government insofar as practicable. However, minor variations within structure may occur by Government’s removal and salvage operations prior to start of selective demolition work.

C. Partial Demolition and Removal: Items indicated to be removed but of salvageable value to Contractor may be removed from structure as work progresses. Transport salvaged items from site as they are removed.

1. Storage or sale of removed items on site will not be permitted.

D. Protections: Provide temporary barricades and other forms of protection to protect Contractor's and Government’s personnel and general public from injury due to selective demolition work.

1. Provide protective measures as required to provide free and safe passage of Government’s personnel and representatives to portions of building and/or site, as required.
2. Erect temporary covered passageways if required by authorities having jurisdiction.
3. Provide interior bracing or support to prevent movement, settlement, or collapse of structure or element to be demolished and adjacent facilities or work to remain.
4. Protect from damage existing finish work that is to remain in place and which becomes exposed during demolition operations.
5. Protect floors with suitable coverings when necessary.
6. Construct temporary insulated dustproof partitions where required to separate areas where noisy or extensive dirt or dust operations are performed. Equip partitions with dustproof doors and security locks.
7. Remove protections at completion of work, unless otherwise indicated on the drawings.

E. Damages: Promptly repair damages caused to adjacent facilities by demolition

work.

F. Traffic: Conduct selective demolition operations and debris removal to ensure minimum interference with roads, streets, walks, building egress, and other adjacent occupied or used facilities.

1. Do not close, block, or otherwise obstruct streets, walks, exit egress from building, or other occupied or used facilities without written permission from authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

G. Flame Cutting: Do not use cutting torches for removal until work area is cleared of flammable materials. At concealed spaces, such as interior of ducts and pipe spaces, verify condition of hidden space before starting flame-cutting operations. Maintain portable fire suppression devices during flame-cutting operations.

H. Utility Services: Maintain existing utilities indicated to remain in service and protect them against damage during demolition operations.

1. Do not interrupt utilities serving occupied or used facilities, except when authorized in writing by authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to governing authorities.
2. Maintain fire protection services during selective demolition operations.

I. Environmental Controls: Use temporary enclosures and other methods to limit dust and dirt migration. Comply with governing regulations pertaining to environmental protection.

PART 2 - PRODUCTS

2.1 Not applicable.

PART 3 – EXECUTION

3.1 PREPARATION:

A. General: Provide interior bracing, or support to prevent movement, settlement, or collapse of areas to be demolished and adjacent facilities to remain.

1. Cease operations and notify COR immediately if safety of structure appears to be endangered. Take precautions to support structure until determination is made for continuing operations.

B. Cover and protect furniture, equipment, and fixtures from soilage or damage when demolition work is performed in areas where such items have not been removed.

C. Erect and maintain dust-proof partitions and closures, as required to prevent spread of dust or fumes to occupied portions of the building.

D. Locate, identify, stub off, and disconnect utility services that are not indicated to remain.

1. Provide bypass connections as necessary to maintain continuity of service to occupied areas of building. Provide minimum of 72 hours advance notice to Owner if shutdown of service is necessary during changeover.

3.2 DEMOLITION:

A. General: Perform selective demolition work in a systematic manner. Use such methods as required to complete work indicated on Drawings in accordance with demolition schedule and governing regulations.

1. Cut concrete and masonry at junctures with construction to remain using power-driven masonry saw or hand tools; do not use power-driven impact tools.
2. Locate demolition equipment throughout structure and promptly remove debris to avoid imposing excessive loads on supporting walls, floors, or framing.
3. Provide services for effective air and water pollution controls as required by local authorities having jurisdiction.

B. If unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure both nature and extent of the conflict. Submit report to COR in written, accurate detail. Pending receipt of directive from COR, rearrange selective demolition schedule as necessary to continue overall job progress without undue delay.

3.3 SALVAGED MATERIALS:

A. Salvaged Items: Where indicated on Drawings as “Salvage - Deliver to Government,” or similar indication, carefully remove indicated items, clean, store, and turn over to Government and obtain receipt.

1. Historic artifacts, including cornerstones and their contents, commemorative plaques and tablets, antiques, and other articles of historic significance, remain property of Government. Notify COR if such items are encountered and obtain acceptance regarding method of removal and salvage for Government.

3.4 DISPOSAL OF DEMOLISHED MATERIALS:

A. Remove from building site debris, rubbish, and other materials resulting from demolition operations. Transport and legally dispose of off site.

1. If hazardous materials are encountered during demolition operations, comply with applicable regulations, laws, and ordinances concerning removal, handling, and protection against exposure or environmental pollution.
2. Burning of removed materials is not permitted on project site.

3.5 CLEANUP AND REPAIR:

A. General: Upon completion of demolition work, remove tools, equipment, and demolished materials from site. Remove protections and leave interior areas broom

clean; vacuum carpets.

1. Repair demolition performed in excess of that required. Return elements of construction and surfaces to remain to condition existing prior to start operations. Repair adjacent construction or surfaces soiled or damaged by selective demolition work.
2. Any protections to remain as noted on the plans shall be left in a clean and functional condition.

END OF SECTION 022200

SECTION 02 82 00 – ASBESTOS PROCEDURES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Procedure to be taken if Asbestos Containing Materials (ACM) identified on the drawings may be disturbed in the course of construction operations.

B. Procedure to be taken if material suspected of being ACM is encountered in the course of construction operations.

C. Procedure to be taken if work is required above ceilings where ACM is known or suspected to be present.

D. Procedure to be taken if ACM products are proposed for installation in new construction.

1.2 REFERENCES

A. 29 CFR 1910.1001 - OSHA Asbestos Standard for General Industry

B. B.29 CFR 1926.1101 - OSHA Asbestos Standard for the Construction Industry

C. C.40 CFR 61 Subpart M - NESHAP

D. 49 CFR 171, 172 & 173 - Department of Transportation (DOT)

1.3 RELATED SECTIONS

A. Section 01 06 50 “ENVIRONMENTAL COMPLIANCE”.

1.4 DEFINITIONS

A. Air Monitoring: The process of measuring the fiber content in a specific volume of air in a stated period of time.

B. Asbestos: Chrysotile, amosite, crocidolite, tremolite, anthophyllite and actinolite.

C. ACM: Asbestos Containing Material(s)

D. EEOH: Environmental Engineering and Occupational Health mission service contractor at MSFC.

E. Friable: Capable of being crumpled or reduced to powder by hand pressure.

F. ADEM: Alabama Department of Environmental Management

G. EPA: The Environmental Protection Agency

H. NESHAP: National Emission Standards for Hazardous Air Pollutants

I. OSHA: The Occupational Safety and Health Administration

J. Personal air monitoring: The process of monitoring the fiber content of air in the breathing zone of a worker performing asbestos related work.

1.5 SUBMITTALS

A. The contractor shall submit the following for all asbestos abatement work.

1. Asbestos Removal Plan

a. A detailed asbestos removal plan within 10 days after receipt of Notice of Award. The plan shall include location of asbestos control areas, location and layout of worker decontamination unit, interface of trades involved in the construction, sequencing of asbestos related work, disposal plan, type of wetting agent and encapsulant to be used. The plan shall be approved by the Contracting Officer prior to the start of any asbestos work.

2. Drawings showing Asbestos Abatement

a. Upon Completion of the project a marked up drawing or a floor plan showing where all asbestos was abated shall be submitted.

3. ADEM Notification

a. The contractor shall complete ADEM Form 496 and submit to ADEM 10 days prior to beginning any asbestos removal operations. In addition the contractor shall provide a copy of the ADEM Form 496 and some type of receipt showing ADEM received the form.

4. Copies of all Delivery Tickets

a. A copy of all delivery ticket(s), signed the by the RSAL operator, indicating that all RACM was appropriately disposed in accordance with above procedures including a Regulated Asbestos Material Waste Shipment Record (MSFC Form 4587) that was obtained from the MSFC Site Asbestos Coordinator.

B. The contractor shall also submit the following for all asbestos abatement work if he has never worked at MSFC or has not worked at MSFC in the last 2 years:

1. Training Records

a. Training records showing that all employees exposed to asbestos in excess of the permissible exposure limit have been trained in accordance with the requirements of 29 CFR 1926.1101 have obtained EPA accreditation in accordance with their duties. Contractor/Supervisor shall obtain Contractor/Supervisor accreditation and workers shall obtain worker accreditation.

2. Medical Examinations

a. A list of all employees that have received medical examinations as required by OSHA regulations (see 1010.134(b) (10) and 1926.1101). This list shall be updated if new employees are hired after work begins. Do not submit medical records.

3. Contractor Licenses/Certifications

a. A copy of the contractor's license to perform asbestos abatement

1.6 QUALITY ASSURANCE

A. Contractors performing work in areas containing ACM shall be qualified and accredited in accordance with OSHA, EPA, ADEM and other governing regulations.

B. Perform all work in accordance with OSHA, EPA, NESHAP, ADEM, MSFC Procedures, and other governing regulations.

C. Provide evidence acceptable to the COTR that workers in areas containing ACM or suspect ACM have been properly fitted with respirators and have been properly trained in accordance with 40 CFR part 61 (NESHAP), OSHA, EPA and other governing regulations.

D. The contractor shall be responsible for all personal, area and clearance monitoring. Monitoring shall be in accordance with EPA and OSHA guidance.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 MATERIALS IDENTIFIED AS ACM

A. If ACM is identified on the drawings as a product in a known location and the ACM must be removed to accomplish the contract, the removal and disposal shall be a part of this contract unless otherwise specifically stated in the contract documents. Examples are: 1) Asbestos containing pipe insulation where the contract requires removal or reworking of the pipe; 2) Asbestos containing siding or roof deck which must be removed or penetrated as part of the contract.

B. If ACM is identified on the drawings as a product in the vicinity of construction operations and which may accidentally be disturbed during construction, the contractor shall provide protective measures approved by the COTR to prevent its disturbance.

1. Example: Asbestos containing pipe insulation on pipes which are not to be removed or reworked as part of this contract.

C. If friable ACM is identified on the drawings as being present above ceilings, proper procedures (specified herein) shall be used before removal of any portion of the ceiling.

1. Example: Sprayed ACM insulation or fireproofing on structure above a ceiling.

3.2 MATERIAL SUSPECTED OF BEING ACM

A. If an unidentified material is suspected of being ACM:

1. Do not disturb the suspect material.

2. Notify the COTR at once and await instructions. The COTR will arrange for sampling and testing by the EEOH and will provide instructions concerning barricades and warning signs, etc.

3.3 WORK ABOVE CEILINGS

A. If the contract requires any work above a ceiling or removal of a ceiling or portion of a ceiling where friable ACM is known to be or suspected to be present above or on the ceiling, the following procedures shall be followed:

1. Notify the CMI of impending operations as soon as practicable (but at least one week) before operations are to begin including a complete schedule for the work.

2. The CMI will arrange for HVAC and other utility outages and other coordination with the Government.

3. Separate the work area from occupied areas by installing "asbestos" warning barricade tape and posting "asbestos" warning signs at entrances to the work area.

4. Wear proper respiratory protection and protective clothing at all times while working in areas where asbestos may be disturbed.

5. Seal the work area as required by OSHA, NESHAP, EPA and other requirements. Seals shall remain until area is cleared and approved by the CMI.

6. Place 6 mil polyethylene over furniture and floor to collect debris that may fall from above the ceiling. Upon completion of each activity, remove the polyethylene and dispose of it as controlled waste. Ensure that no debris or dust will remain within the room. Remove dust and debris that may fall on furniture or floors using a vacuum equipped with a HEPA filter and properly dispose of the dust as controlled waste. No sweeping or dusting will be allowed. Use wet methods only.

3.4 REMOVAL / REPLACEMENT OF CEILINGS

A. In areas where asbestos-containing insulation or fireproofing is installed on the structure or deck above ceilings, asbestos-containing debris has been found on top of the existing ceilings.

B. Removal and disposal of ceiling tiles or ceiling systems in these areas is classified by OSHA as Class II abatement work and shall be performed by workers trained to perform OSHA Class II abatement work.

C. Where the project is limited to removal of a small quantity of ceiling tiles that can be placed in one glove bag or disposal bag, the work is classified by OSHA as Class III work and shall be performed by workers trained in OSHA Class III work.

3.5 REMOVAL OF ASBESTOS-CONTAINING FLOOR TILE

A. Asbestos-containing floor tile, sheet flooring, and mastic shall be removed in accordance with 29 CFR 1926.1101 (g)(8)(i) and other applicable regulations.

B. A utility outage shall be obtained prior to performing this work and the work shall be done after hours unless approval has been obtained from the CMI for work to be done during normal hours.

3.6 REMOVAL OF CARPET THAT IS INSTALLED OVER ASBESTOS-CONTAINING FLOORING

A. If carpet is required to be removed and the asbestos-containing flooring is not required to be removed, the following work practices shall be employed, as a minimum, to prevent excessive breakage of the flooring below:

1. Wet methods shall be used.

2. Carpet shall be cut into small strips and carefully removed so as to prevent breaking or pulling up the flooring.

3. Vacuums equipped with a HEPA filter and a disposable dust bag shall be used to collect dust from broken flooring as the carpet is removed.

4. All broken tile shall be placed in a disposable glove bag or waste bag for disposal. The area shall be thoroughly vacuumed of all dust and waste after removal of carpet prior to the completion of the job.

5. Areas where broken flooring is removed shall be filled with an approved floor filler prior to installing new carpet.

6. When the flooring under the carpet is intended to be used as the finished floor, clean the flooring using accepted methods. No sanding or use of a floor polisher with greater than 300 RPM shall be used. Remove all broken tiles and replace with approved tiles.

B. A utility outage shall be obtained prior to performing this work and the work shall be done after hours unless approval has been obtained from the CMI for work to be done during normal hours.

C. The Facilities Management Office has designated the removal of carpet installed over asbestos-containing flooring to be done in accordance with OSHA Class III requirements and procedures. The work shall be done by personnel trained and accredited for OSHA Class III work.

3.7 DISPOSAL OF REGULATED ASBESTOS CONTAINING MATERIAL (RACM)

A. Disposal of RACM shall be at the Redstone Army Landfill in accordance with their regulations. Packaging, labeling, delivery and unloading shall be in accordance with OSHA and RSAL regulations.

B. No RACM will be accepted at the RSAL without a Material Certification form, a delivery ticket, a copy of the ADEM Form 496, and a Regulated Asbestos Material Waste Shipment Record (MSFC Form 4587) obtained from the MSFC Site Asbestos Coordinator. All RACM will be clearly marked “FRIABLE ASBESTOS” on the delivery ticket.

C. No non-friable ACM will be accepted at the RSAL without a Material Certification form, a delivery ticket, and a copy of the ADEM Form 496. All non-friable ACM will be marked “NON-FRIABLE ASBESTOS” on the delivery ticket.

3.8 ASBESTOS AND NEW CONSTRUCTION.

A. Products containing asbestos shall not be used on projects governed by this specification without the approval of the Government. If the contractor elects to submit a product which contains asbestos for use on a project, the contractor shall identify the product as an “Asbestos Containing Material” (ACM), submit the MSDS sheet for the product which exhibits the asbestos content, and provide a justification for the use of the ACM product. The construction contractor shall provide an “Asbestos Free Statement” for new construction or documentation of where asbestos is located as a result of new construction.

END OF SECTION 028200

SECTION 02 83 00 - LEAD REMEDIATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Surface preparation of steel which is painted with lead-containing paint.

1.2 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

1. American National Standards Institute (ANSI)
2. ANSI Z88.2 - Respiratory Protection
3. Code Of Federal Regulations (CFR)

   a. 29 CFR 1910.134 - Respiratory Protection
   b. 29 CFR 1910.1200 - Hazard Communication
   c. 29 CFR 1926. 62 - Lead - Construction Industry
   d. 29 CFR 1926.57 - Ventilation
   e. 29 CFR 1910.95 - Occupational Noise Exposure

B. Underwriters Laboratories Inc. (UL)

C. UL 586 High - Efficiency Particulate Air Filter Units

D. SSPC - The Society for Protective Coatings, 40 24th Street, 6th Floor, Pittsburgh, PA 15222

E. SSPC Technical “Guide for Containing Surface Preparation Debris” Technical Guide No.6 Generated During Paint Removal Operations”

1.3 DEFINITIONS

A. Action Level

1. Employee exposure, without regard to use of respirators, to an airborne concentration of lead of 30 micrograms per cubic meter of air averaged over an 8 - hour period.

B. Lead Control Area

1. An enclosed area or structure with full containment to prevent the spread of lead dust, paint chips, or debris of lead-containing paint removal operations. The lead control area shall be isolated by physical boundaries to prevent unauthorized entry of personnel.

C. Area Monitoring

1. Sampling of air to determine lead concentrations within the lead control area.

D. Physical Boundary

1. Area physically roped or partitioned off around an enclosed lead control area to limit unauthorized entry of personnel.

E. Certified Industrial Hygienist (CIH)

1. As used in this section, refers to an Industrial Hygienist who is employed by the Contractor and is certified by the American Board of Industrial Hygiene in comprehensive practice.

F. Change Rooms And Shower Facilities

1. Rooms within the designated physical boundary around the lead control area equipped with separate storage facilities for clean protective work clothing and equipment and for street clothes to prevent cross-contamination.

G. Competent Person

1. Person employed by the Contractor who is trained in the recognition and control of lead hazards in accordance with current federal, state, and local regulations and has the authority to take prompt corrective actions to control the lead hazard. A Certified Industrial Hygienist (CIH) certified by the American Board of Industrial Hygiene or a Certified Safety professional (CSP) certified by the Board of Certified Safety Professionals is the best choice.

H. Decontamination Room

1. Room for removal of contaminated personal protective equipment (PPE).

I. Eight - Hour Time Weighted Average (TWA)

1. Airborne concentration of lead averaged over an 8 - hour period.

J. High Efficiency Particulate Air (Hepa) Filter Equipment

1. HEPA filtered vacuuming or exhaust ventilation equipment with a UL 586 filter system capable of collecting and retaining lead-contaminated paint dust. A high efficiency particulate filter means 99.97 percent efficient against 0.3 micron size particles.

K. Lead

1. Metallic lead, inorganic lead compounds, and organic lead soaps. Excluded from this definition are other organic lead compounds.

L. Lead Control Area

1. A system of control methods to prevent the spread of lead dust, paint chips or debris to adjacent areas that may include temporary containment, floor or ground cover protection, physical boundaries, and warning signs to prevent unauthorized entry of personnel. HEPA filtered local exhaust equipment may be used as engineering controls to further reduce personnel exposures or building/outdoor environmental contamination.

M. lead permissible exposure limit (PEL)

1. Fifty micrograms per cubic meter of air as an 8 - hour time weighted average as determined by 29 CFR 1926.62. If an employee is exposed for more than 8 hours in a work day, the PEL shall be determined by the following formula:

   PEL (micrograms/cubic meter of air) = 400/No. hrs. worked per day.

N. Material Containing Lead/Paint With Lead

1. Any material, including paint, which contains lead as determined by the testing laboratory using a valid test method. The requirements of this section does not apply if no detectable levels of lead are found using a quantitative method for analyzing paint or MCL using laboratory instruments with specific limits of detection (usually 0.01%). An X-Ray Fluorescence (XRF) instrument used under the direction of the MSFC Environmental Engineering and Occupational Health Office is an acceptable method for testing for the presence of lead.

O. Personal Monitoring

1. Sampling of lead concentrations within the breathing zone of an employee to determine the 8 - hour time weighted average concentration in accordance with 29 CFR 1926.62. Samples shall be representative of the employee's work tasks. Breathing zone shall be considered an area within a hemisphere, forward of the shoulders, with a radius of 6 to 9 inches and the center at the nose or mouth of an employee.

1.4 QUALITY ASSURANCE

A. In addition to the detailed requirements of this specification, comply with laws, ordinances, rules, and regulations of federal, state, and local authorities regarding removing, handling and storing of lead waste materials. Comply with the applicable requirements of the current issue of 29 CFR 1926.62. Submit matters regarding interpretation of standards to the Contracting Officer for resolution before starting work. Where specification requirements and the referenced documents vary, the most stringent requirement shall apply.

B. Medical Examinations

1. Before exposure to lead-contaminate dust, provide workers with a comprehensive medical examination as required by 29 CFR 1926.62 and 29 CFR 1910.1200.

C. Medical Records

1. Maintain complete and accurate medical records of employees for a period of at least 40 years or for the duration of employment plus 20 years, whichever is longer.

D. Training

1. Train each employee performing paint removal, disposal, and air sampling operations prior to the time of initial job assignment, in accordance with 29 CFR 1910.1200.

2. Submit certifications signed and dated by the Contractor and by each employee stating that the employee has received training. Certify that the training course meets EPA requirements for the category of work assigned to the employee.

E. Respiratory Protection Program

1. Furnish each employee required to wear a negative pressure or other appropriate type respirator with a respirator fit test at the time of initial fitting and at least each year thereafter as required by 29 CFR 1926.62.
2. Establish and implement a respiratory protection program as required by 29 CFR 1910.134 and 29 CFR 1926.62.

F. Hazard Communication Program

1. Establish and implement a Hazard Communication Program as required by 29 CFR 1910.1200.

1.5 SAFETY AND HEALTH COMPLIANCE

A. In addition to the detailed requirements of this specification, comply with laws, ordinances, rules, and regulations of federal, state, and local authorities regarding removing, handling and storing of lead waste materials. Comply with the applicable requirements of the current issue of 29 CFR 1926.62. Submit matters regarding interpretation of standards to the Contracting Officer for resolution before starting work. Where specification requirements and the referenced documents vary, the most stringent requirement shall apply.

1.6 SUBMITTALS

A. SD-08: Manufacturer's instructions for use of paint removal materials including material safety data sheet (MSDS).

B. SD-01: Lead Compliance Plan - Submit a detailed, job-specific plan of the work procedures to be used in the disturbance and/or removal of Material Containing Lead/Paint with Lead. The plan shall be prepared by a certified planner/project designer in the State of Alabama. Include as a minimum the following:

1. Sketch showing the location, size and details of the control areas, critical barriers, physical boundaries, location and details of decontamination room, change room and shower facilities. Supplement with written description as required.
2. Detailed description of mechanical ventilation.
3. Description of equipment and materials, work practices, controls, and job responsibilities for each activity from which lead is emitted.
4. Eating, drinking, smoking, hygiene facilities and sanitary procedures.
5. Interface of trades and the sequencing of lead related work. This shall also include a description of arrangements made among contractors on multi-contractor worksites to inform affected employees and to clarify responsibilities to control exposures.
6. Procedures for waste water collection, if applicable.
7. Procedures to capture dust containing lead and debris, to include blast media when applicable.

8. Procedures to monitor air samples to include occupational and environmental sampling, training and strategy, sampling and analysis strategy and methodology, frequency of sampling, duration of sampling, and qualifications of sampling personnel.
9. Personal blood, respirator, and personal protective equipment (PPE) monitoring procedures.
10. Method of containment to ensure that airborne concentrations of lead do not exceed 30 micrograms per cubic meter of air outside the lead control area.
11. Site preparation, clean-up, and clearance procedures.
12. Identification and classification of wastes associated with the work.
13. Names and qualifications of each contractor that will be transporting, storing, treating, and disposing of the wastes. Include the facility location and operator and a 24-hour point of contact.
14. Names and qualifications, to include experience and training, of personnel who will be working on-site with hazardous wastes.
15. List of waste handling equipment to be used in performing the work, to include cleaning, volume reduction, and transport equipment.
16. Spill prevention, containment, and clean-up contingency measures.
17. Work plan and schedule for waste containment, removal, and disposal. Proper containment of waste includes using acceptable waste containers (e.g. 55-galn drums) as well as proper marking/labeling of containers. Wastes shall be cleaned up and containerized daily.
18. Include any process that may alter or treat waste rendering a hazardous was non-hazardous.

C. Certification of worker medical examinations

D. Certification of employee training

E. Employee exposure notification

F. Competent person qualifications

G. Lead waste management plan

H. Written evidence that treatment, storage, disposal facility is approved for lead disposal.

I. SD-01: Close-Out Submittals - Completed and signed waste delivery ticket(s)

PART 2 - PRODUCTS

2.1 PAINT REMOVAL PRODUCTS

A. Submit material safety data sheets (MSDS) for approval of paint removal products prior to use.

B. The soluble metal content and total metal content of abrasive materials shall not exceed values which would cause the material to be classified as hazardous waste.

2.2 EQUIPMENT

A. Have available for the A/E two complete sets of personal protective equipment (PPE) daily as required for entry into lead control area if needed. PPE shall include disposable whole body covering including foot, head, and hand protection.

B. Furnish workers appropriate NIOSH approved respirators for use in atmospheres containing lead dust. Comply with 29 CFR 1926.62 and 29 CFR 1910.134.

C. Furnish personal protective equipment (PPE) to workers exposed to lead-contaminated dust. PPE shall include whole body covering, foot covering and disposable plastic or rubber gloves. If protective clothing used for lead abatement work is to be laundered, a letter of communication from the contractor to the laundering facility indicating that lead-contaminated clothing will be delivered to the launderer shall be provided to the COTR prior to commencing work. Additionally, a letter from the laundering facility acknowledging they are receiving lead-contaminated clothing and stating that they are capable of receiving lead-contaminated clothing and have appropriate employee and environmental controls in place shall be received by the COTR prior to commencing work.

D. The government inspectors will provide their own respirators as required.

E. If rental equipment is used during lead-containing paint removal, handling and disposal, notify the rental agency in writing concerning the intended use of the equipment. Submit a copy of the notification to the A/E.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the facility and site to determine existing conditions.

B. The Contractor shall thoroughly clean the site of visible, existing Material Containing Lead/Paint with Lead that may be on the ground or in the proposed lead control area prior to the commencement of work.

C. Report conditions that differ from those described in the contract documents.

3.2 PROTECTION

A. Establish a lead control area around each work site where surface preparation is being performed.

B. If surface preparation operations produce exposure to lead dust in excess of the PEL, provide containment which, together with powered negative air pressure inside the enclosure, will prevent lead-containing dust from entering the atmosphere outside the lead control area and which shall facilitate collection of dust and debris for disposal. The containment enclosure may be localized or enclose the entire work area.

C. Provide a change room, shower facility and hand washing facility for personnel exiting from the lead control area.

D. Protect adjacent facilities and area from damage and contamination by lead-contaminated dust. Clean, repair and restore surroundings to original condition or better

E. Provide physical boundaries around work area designated on the drawings in accordance with 29 CFR 1926.62

3.3 MECHANICAL VENTILATION SYSTEM

A. Use adequate ventilation to control personnel exposure to lead in accordance with 29 CFR 1926.57

B. To the extent feasible, use fixed local exhaust ventilation connected to HEPA filters approved by the A/E. Local exhaust ventilation systems shall be designed, constructed, installed, and maintained in accordance with ANSI Z9.2.

3.4 WARNING SIGNS

A. Provide warning signs at each approach to the lead control area. Follow 29 CFR 1926.62. Signs shall read:

WARNING
LEAD WORK AREA
POISON
NO SMOKING OR EATING

3.5 WORK PROCEDURES

A. Perform work in accordance with approved Lead Compliance Plan

B. Provide engineering controls to limit exposure to lead

C. Provide worker protection including work practice controls and administrative controls

D. Provide a CIH or "Competent Person" trained in lead abatement procedures, health effects of lead, OSHA and EPA regulations. The CIH or Competent Person shall be present while work is being performed and shall ensure that all regulations are being properly carried out. Such person shall have the authority to stop work and make proper corrections if improper or unsafe conditions occur.

3.6 INITIAL EXPOSURE ASSESSMENT

A. Prior to beginning work assume that the worker exposure to lead dust will be in excess of 50 micrograms per cubic meter (PEL).

B. Perform personal monitoring of employees within the lead control area representative of a full shift including at least one sample for each job classification in each work area either for each shift or for the shift with the highest exposure level. Follow 29 CFR 1926.62.

C. Until the actual exposure is determined by personal monitoring, provide interim protection in accordance with 29 CFR 1926.62 as follows:

1. Appropriate respiratory protection
2. Appropriate personal protective clothing
3. Change areas
4. Hand washing facilities
5. Biological monitoring to consist of blood sampling and analysis for lead and zinc protoporphyrin levels
6. Training
7. Hazard communication

3.7 CONTINUAL MONITORING

A. If initial monitoring indicates exposure to lead in excess of the PEL, perform continual monitoring as required by 29 CFR 1926.62.

B. Conduct additional monitoring whenever there is a change of equipment, process, control, personnel or a new task initiated.

3.8 EMPLOYEE NOTIFICATION

A. Within 5 working days after completion of the exposure assessment notify each employee in writing the results which represent that employee's exposure.

B. Follow 29 CFR 1926.62

3.9 HEARING PROTECTION

A. Provide hearing protection for employees exposed to noise levels in excess of 85 dBA over an 8 hour time weighted average.

B. Follow 29 CFR 1910.95

3.10 METHODS OF COMPLIANCE

A. Provide engineering and work practice controls including administrative controls to reduce and maintain employee exposure to lead to or below the PEL to the extent that such controls are feasible. Supplement the engineering controls by the use of respiratory protection complying with 29 CFR 1926.62.

B. Establish and implement a written compliance program to achieve compliance with these specifications.

C. Follow 29 CFR 1926.62.

3.11 PERSONNEL EXITING PROCEDURES

A. Whenever personnel exit the lead control area, ensure that they perform the following:

1. Vacuum themselves off with HEPA filtered vacuums
2. Remove protective clothing in the decontamination room and place them in an approved impermeable disposal bag.
3. Shower and wash hands and face
4. Change into clean clothing in the change room prior to leaving the physical boundary of the job site.

3.12 EATING FACILITIES

A. Provide a lead free environment area outside the lead control area for eating and drinking.

B. Prior to entering the eating area ensure that employees perform the personal exiting procedures listed above. Showering is not required except at the end of the shift.

C. Ensure that no eating, drinking, chewing or smoking is allowed within the lead control area or decontamination area.

3.13 MEDICAL SURVEILLANCE

A. Provide initial medical surveillance of employees including biological monitoring in the form of blood sampling and analysis for lead and zinc protoporphyrin levels prior to exposure to lead.

B. Provide continuing biological monitoring of employees exposed to lead in excess of the action level in accordance with 29 CFR 1926.62.

C. Temporarily remove employees whose blood lead level is at or above 50 microgram per deciliter of whole blood. Removal, medical surveillance and return of removed employees shall be in accordance with 29 CFR 1926.62 including required medical removal protection benefits.

3.14 SURFACE PREPARATION

A. Clean surfaces of dirt, loose rust, and other gross contamination by any method outlined in SSPC-SP 1, Solvent Cleaning, or pressure water washing.

B. Remove loose rust by SSPC-SP 2, Hand Tool Cleaning, or SSPC-SP 3, Power Tool Cleaning. Feather edges around rust spots to produce a smooth painted surface. When using methods SP 2 or SP 3, contain and collect paint dust and debris using vacuums equipped with HEPA filters.

C. Spot prime rusted areas immediately after removing loose rust applying the specified primer at the specified thickness.

D. Roughen the entire existing paint surface with abrasive paper, hand wire brushing, power wire brushing or other approved method to produce a tooth for adhesion of new paint as required by the specified coating system. Contain and collect paint dust by using vacuums equipped with a HEPA filter.

E. Manual or power sanding or grinding of lead surfaces or materials is not permitted unless tools are equipped with HEPA attachments or wet methods are used. The dry sanding or grinding of surfaces that contain lead is prohibited. Provide methodology for removing lead in the Lead Compliance Plan.

3.15 INSPECTION

A. Notify the Government Inspector when surfaces are ready for inspection at the following stages of preparation:

1. After removing rust before spot priming
2. After final surface preparation before applying finish coating system

B. Do not proceed until approved by the Government Inspector.

3.16 ALTERNATE SURFACE PREPARATION

A. Rust may be removed and existing paint surface roughened by method SSPC-SP 7, Brush-off Blast Cleaning, provided the following are met:

1. Contain and collect abrasives, paint dust and debris using a closed cycle vacuum recovery system equipped with HEPA filters.
2. Handle and dispose of abrasives, paint dust and debris as specified in Section 01 60 50 “Exterior Performance Requirements”.
3. Ensure that no visible emissions of lead-containing dust escape the enclosed vacuum recovery system.
4. Place two layers of 6 mil polyethylene under each work area extended twenty feet minimum beyond the work area in all directions to collect dust and debris that may escape the enclosed recovery system. Remove and dispose of the top layer as hazardous waste at the end of each shift. Contain and protect hazardous materials from escaping the lead control area due to wind or other means. Remove both layers of polyethylene upon completion.

3.17 CLEAN - UP

A. Maintain surfaces of the lead control area free of accumulation of dust and debris. Restrict the spread of dust and debris; keep waste from being distributed over the work area.

B. Do not dry sweep or use pressurized air to clean up the lead control area.

C. At end of each shift and when the lead operation has been completed, clean the controlled area of visible contamination by vacuuming with a HEPA filtered vacuum cleaner, wet mopping the area, and wet wiping the area as indicated by the Lead Compliance Plan. After visible dust and debris is removed, wet wipe and HEPA vacuum all surfaces in the controlled area.

D. If adjacent areas become contaminated at any time during the work process - clean, visually inspect, and then wipe sample all contaminated areas.

E. For phased construction, clean each phase as completed.

F. The competent person shall submit certification in writing that the area has been cleaned of lead contamination prior to clearance testing. Clearance testing to be accomplished per the Lead Compliance Plan.

3.18 DISPOSAL

A. All material, whether hazardous or non-hazardous, shall be disposed of in accordance with all laws and provisions and all federal, State, or local regulations. Ensure all waste is properly characterized. The result of each waste characterization (Toxicity Characteristic Leaching Procedure for Resource Conservation and Recovery Act materials) will dictate disposal requirements.

B. At the end of each day's work or prior to leaving the work site, the Contractor shall segregate waste. Collect lead-contaminated waste, scrap, debris, bags, containers, equipment, and clothing that may produce airborne concentrations of lead particles. Label the containers in accordance with 29 CFR 1926.62 and 40 CFR 262. Contractor shall furnish containers unless otherwise noted on the drawings that the Government will provide the containers. For Government provided containers, the Government will remove and properly dispose of containers as controlled or hazardous waste.

C. Store waste materials in U.S. Department of Transportation (49 CFR 178) approved 55 gallon drums. For hazardous waste, the collection drums shall be marked and labeled in accordance with 40 CFR 262 during the accumulation and collection time frame. The Contracting Officer or authorized representative will assign an area for interim storage of the waste-containing drums. Drums containing hazardous waste shall not be maintained in interim storage longer than 90 calendar days from the date affixed to each drum.

D. For Contractor provided containers, dispose of lead-contaminated material classified as hazardous waste at an approved hazardous waste treatment, storage, or disposal facility off Government property.

3.19 HANDLING, DUST CONTROL, AND DISPOSITION OF LEAD COATINGS

A. The following requirements, except as noted in Paragraph entitled “Requirements for Removing Lead Coatings- Small Scale / Short Duration,” shown below, apply to all work performed in connection with the removal of lead-based coatings or materials coated with the lead-based materials:

1. Worker protection and work practices shall conform with OSHA Safety and Health Standards, 29 CFR 1926.62.
2. Methods utilized to remove lead-based coatings shall minimize the amount of dust generated, and shall be in accordance with the Contractor’s approved lead coatings safety plan. Engineering controls shall be employed to insure that airborne lead exposures do not exceed 50 micrograms / cubic meter. Contaminated air shall be filtered before it is discharged into the environment away from the source of intake air, in accordance with 29 CFR 1926.353.
3. All workers in the controlled lead abatement area shall wear NIOSH approved respirators with high efficiency filters and protective clothing as required by 29 CFR 1926.62. Use of respirators shall comply with 29 CFR 1910.134. All lead particulate and waste shall

be collected and sealed in non-permeable accumulation containers in accordance with article 2.01 of this Section.

4. The Contractor shall submit a written detailed plan, for approval, which describes the methods and equipment to be used to achieve the lead removal in conformance with the requirements listed above. This submittal shall, as a minimum, include the following:

   a. Removal, containment and/or ventilation plans and drawings
   b. Plan for protection of ambient air, soil and water
   c. Worker protection programs
   d. Plan for handling and disposal of debris

3.20 REQUIREMENTS FOR REMOVING LEAD COATINGS- SMALL SCALE/SHORT DURATION

A. The following minimum requirements shall be followed when removing material by grinding, cutting, or welding, which is attached to the steel structure.

1. Comply with 29 CFR 1926.62.
2. Local exhaust shall be used to ventilate the area during welding, cutting, or burning of lead coatings.
3. Personnel required to conduct welding, cutting, or burning of lead coatings, as a minimum, shall be outfitted with a powered air purifying respirator (PAPR) equipped with high efficiency filter. Under certain conditions, i.e. poor ventilation, supplied air respiratory protection may be required.
4. Personnel required to conduct welding, cutting, or burning of lead coatings shall wear protective clothing. Contractors shall arrange for the laundering of protective clothing; or, if disposable protective clothing is used, the Contractor shall maintain an adequate supply at the worksite and arrange for its safe disposal according to applicable Federal (40 CFR 260) and State regulations.
5. Following welding, cutting, or burning of lead coatings, employees must exercise good personal hygiene (i.e., washing hands and face) since lead can become an ingestion hazard.

END OF SECTION 02 83 00

SECTION 26 05 01 - ELECTRICAL TESTING

PART 1 GENERAL

1.1 This section covers the general and administrative requirements for testing of electrical systems, materials, and equipment.

A. The Contractor shall engage the services of a recognized independent testing firm for the purpose of performing inspections and tests as herein specified and in other Division 26 Sections. The Contractor shall submit the name and qualifications of the testing firm to the COTR for approval within 30 days after Notice to Proceed.

B. The testing firm shall provide all material, equipment, labor, and technical supervision to perform such tests and inspections.

C. It is the purpose of these specifications to ensure that all tested electrical equipment is operational and within industry and manufacturer's tolerances and is installed in accordance with design specifications.

D. The tests and inspections shall determine suitability for energization.

E. Refer to individual Division 26 sections for equipment and systems to be tested and detailed test requirements.

1.2 QUALITY ASSURANCE

A. Testing Firm

1. The testing firm shall be an independent testing organization which can function as an unbiased testing authority, professionally independent of the manufacturers, suppliers, and installers of equipment or systems evaluated by the testing firm.
2. The testing firm shall be regularly engaged in the testing of electrical equipment devices, installations, and systems.
3. The testing firm shall utilize technicians who are regularly employed by the firm for testing services.
4. The testing firm shall submit proof of the above qualifications for approval from the Engineer.

B. Suitability of Test Equipment

1. All test equipment shall be in good mechanical and electrical condition.
2. Field test metering used to check power system meter calibration must have an accuracy higher than that of the instrument being checked.
3. Accuracy of metering in test equipment shall be appropriate for the test being performed but not in excess of 2 percent of the scale used.
4. Waveshape and frequency of test equipment output waveforms shall be appropriate for the test and tested equipment.

C. Test Instrument Calibration

1. The accuracy shall be directly traceable to the National Institute of Standards and Technology (NIST).

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

   a. Field Instruments: Analog, 6 months maximum; Digital, 12 months maximum
   b. Laboratory Instruments: 12 months
   c. Leased Specialty Equipment: 12 months where accuracy is guaranteed.

3. Dated calibration labels shall be visible on all test equipment.
4. Records, which show date and results of instruments calibrated or tested, must be included in the test report.
5. Calibrating standard shall be of higher accuracy than that of the instrument tested.

1.3 DIVISION OF RESPONSIBILITY

A. The Contractor shall perform routine insulation-resistance, continuity, and rotation tests for all distribution and utilization equipment prior to and in addition to tests performed by the testing firm specified herein.

B. The Contractor shall supply electrical power to each test site. The testing firm shall specify the specific power requirements.

C. The Contractor shall notify the testing firm when equipment becomes available for acceptance tests. Work shall be coordinated to expedite project scheduling.

D. The Contractor shall provide and submit for approval a short-circuit analysis and coordination study prior to completion of testing. The Contractor shall provide a complete set of electrical plans, specifications and change orders, as well as pertinent shop drawings, and manufacturer's instructions to the testing firm prior to commencement of testing. Coordination study shall include required set-points for coordinated devices.

E. The testing firm shall notify the COTR two weeks prior to commencement of any testing.

F. Any system, material, or workmanship which is found defective on the basis of acceptance tests shall be reported. The COTR will direct the Contractor to repair or replace the defective materials or equipment depending upon the effect.

G. The testing firm shall maintain a written record of all tests and shall assemble and certify a final test report.

1.4 SUBMITTALS

A. Submittals for approval.
   1. Submit qualifications of testing firm for COR approval.
   2. Submit short circuit analysis and coordination study.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.1 The Contractor shall perform all tests required by individual Division 26 sections.

3.2 MOTOR TESTS: The independent testing firm shall perform and document the following inspections and tests on motors:

A. Visual and Mechanical Inspection

1. Compare equipment nameplate data with approved Shop Drawings.
2. Inspect physical and mechanical condition.
3. Inspect for correct anchorage, mounting, grounding, connection, and lubrication.
4. Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 10.12.
5. Verify the absence of unusual mechanical or electrical noise or signs of overheating during initial test run.

3.3 THERMOGRAPHIC SURVEY: The independent testing firm shall perform and document the baseline thermal operating conditions of all panels and electrical connections as described herein.

A. Visual and Mechanical Inspection

1. Inspect physical, electrical and mechanical condition.
2. Remove all necessary covers prior to thermographic inspection.

B. Provide report including the following:

1. Baseline conditions.
2. Discrepancies.
3. Temperature difference between the area of concern and the reference area.
4. Cause of temperature difference.
5. Areas inspected. Identify inaccessible and/or unobservable areas and/or equipment.
6. Identify load conditions at time of inspection.
7. Provide photographs and/or thermograms of the baseline conditions and of all deficiencies.

C. Test Parameters

1. Inspect distribution systems with imaging equipment capable of detecting a minimum temperature difference of 1 degree C at 30 degrees C.
2. Equipment shall detect emitted radiation and convert detected radiation to visual signal.
3. Thermographic surveys should be performed during periods of maximum possible loading but not less than 40 percent of rated load of the electrical equipment being inspected. Refer to NFPA 70B-1998, Section 18-17 (Infrared Inspection).

D. Test Results

1. Temperatures differences of 1 degree C to 3 degrees C indicate possible deficiency and shall be referred to the COR for direction to repair.
2. Temperature differences over 4 degrees C shall be repaired by the Contractor and retested by the testing firm.

END OF SECTION 260501

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.

1.3 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.

B. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN-THWN-2. Conductors shall be #12 CU minimum.

2.2 CONNECTORS AND SPLICES

A. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

B. Splices shall be compression type made out of copper.

2.3 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger, except VFC cable, which shall be extra flexible stranded.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type THHN-THWN-2, single conductors in raceway.

B. Exposed Feeders: Type THHN -THWN-2, single conductors in raceway.

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN -THWN-2, single conductors in raceway.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and underground: Type THHN -THWN-2, single conductors in raceway.

E. Exposed Branch Circuits, Including in Crawlspaces: Type THHN -THWN-2, single conductors in raceway.

F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN-2, single conductors in raceway.

G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN -THWN-2, single conductors in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

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

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

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

F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

3.4 CONNECTIONS

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

B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

3.5 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform the following tests and inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.

2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

D. Test and Inspection Reports: Prepare a written report to record the following:

1. Procedures used.
2. Results that comply with requirements.
3. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

E. Cables will be considered defective if they do not pass tests and inspections.

END OF SECTION 260519

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes grounding and bonding systems and equipment.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

2.2 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
4. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
5. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

2.3 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy.

C. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

3.2 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

3.3 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal. Make tests at ground rods before any conductors are connected.

   a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
   b. Perform tests by fall-of-potential method according to IEEE 81.

4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

E. Grounding system will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

G. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
4. Power Distribution Units or Panelboards Serving Electronic Equipment: 3 ohm(s).

H. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify NASA promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Hangers and supports for electrical equipment and systems.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. IMC: Intermediate metal conduit.

C. RMC: Rigid metal conduit.

1.4 PERFORMANCE REQUIREMENTS

A. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.5 ACTION SUBMITTALS

A. Product Data: For the following:

1. Steel slotted support systems.
2. Nonmetallic slotted support systems.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

1. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

2. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
3. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
4. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
5. Toggle Bolts: All-steel springhead type.
6. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC scheduled in NECA 1, where its Table 1 lists maximum spacings less than stated in NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with single-bolt conduit clamps using spring friction action for retention in support channel.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).

C. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Existing Concrete: Expansion anchor fasteners.
2. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts or Spring-tension clamps.
3. To Light Steel: Sheet metal screws.
4. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

B. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529

SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal conduits, tubing, and fittings.

1.3 DEFINITIONS

A. GRC: Galvanized rigid steel conduit.

B. IMC: Intermediate metal conduit.

C. PVC: Polyvinyl Chloride

D. EMT: Electrical Metallic Tubing

E. FMC: Flexible Metallic Conduit

F. LFMC: Liquid Tight Flexible Metallic Conduit

1.4 ACTION SUBMITTALS

A. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

A. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. GRC: Comply with ANSI C80.1 and UL 6.

C. IMC: Comply with ANSI C80.6 and UL 1242.

D. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.

1. Comply with NEMA RN 1.
2. Coating Thickness: 0.040 inch (1 mm), minimum.

E. EMT: Comply with ANSI C80.3 and UL 797.

F. FMC: Comply with UL 1; zinc-coated steel.

G. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360. Seal tight type UA conduit.

H. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
2. Fittings for EMT:

a. Material: Steel.
b. Type: compression.
c. Insulated throat

3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.

2.2 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 12 unless otherwise indicated, and sized according to NFPA 70.

B. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

C. Wireway Covers: Flanged-and-gasketed type unless otherwise indicated.

D. Finish: Manufacturer's standard enamel finish.

2.3 SURFACE RACEWAYS

A. Listing and Labeling: Surface raceways and tele-power poles shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Surface Metal Raceways: Galvanized steel with snap-on covers complying with UL 5.

2.4 BOXES, ENCLOSURES, AND CABINETS

A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

D. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

E. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, galvanized, cast iron with gasketed cover.

F. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

G. Device Box Dimensions: 4 inches by 2-1/8 inches by 2-1/8 inches deep (100 mm by 60 mm by 60 mm deep).

H. Gangable boxes are allowed.

I. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 12 with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

J. Cabinets:

1. NEMA 250, Type 12 galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC.
2. Concealed Conduit, Aboveground: EMT.
3. Underground Conduit: RNC, Type EPC-40-PVC concrete encased.
3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
4. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Indoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Severe Physical Damage: EMT.
3. Exposed and Subject to Severe Physical Damage: GRC.

4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
6. Damp or Wet Locations: GRC.

C. Minimum Raceway Size 3/4-inch (21-mm) trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. EMT: Use compression, steel fittings. Comply with NEMA FB 2.10.
3. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

F. Install surface raceways only where indicated on Drawings.

G. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F (49 deg C).

3.2 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

B. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.

E. Arrange stub-ups so curved portions of bends are not visible above finished slab.

F. Install no more than the equivalent of four 90-degree bends in any conduit run. Support within 12 inches (300 mm) of changes in direction.

G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

H. Support conduit within 12 inches (300 mm) of enclosures to which attached.

I. Stub-ups to Above Recessed Ceilings:

1. Use EMT, IMC, or RMC for raceways.
2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

J. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

K. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

L. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch (35mm) trade size and insulated throat metal bushings on 1-1/2-inch (41-mm) trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

M. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

N. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

O. Cut conduit perpendicular to the length. For conduits 2-inch (53-mm) trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

P. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

Q. Surface Raceways:

1. Install surface raceway with a minimum 2-inch (50-mm)radius control at bend points.
2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches (1200 mm) and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

R. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.

S. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.

2. Where an underground service raceway enters a building or structure.
3. Where otherwise required by NFPA 70.

T. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

U. Expansion-Joint Fittings:
1. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
2. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

V. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches (1830 mm) of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.

W. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to bottom of box unless otherwise indicated.

X. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

Y. Locate boxes so that cover or plate will not span different building finishes.

Z. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

AA. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

3.3 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.4 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

END OF SECTION 260533

SECTION 260538 - PULL AND JUNCTION BOXES

PART 1 GENERAL

1.1 WORK INCLUDED

A. Provide pull and junction boxes of appropriate size and depth or as indicated on the drawings and as specified hereinafter.

1.2 SUBMITTALS

A. Submittals of products furnished under this section are not required.

PART 2 PRODUCTS

2.1 MATERIALS

A. For interior work, provide galvanized sheet metal boxes of code thickness with lapped and welded joints, 3/4 inch flanges, screw covers, etc.

PART 3 EXECUTION

3.1 INSTALLATION

A. Provide junction boxes as shown on drawings and otherwise where required, sized according to number of conductors in box or type of service to be provided. Minimum junction box size 4 inches square and 2-1/8 inches deep. Provide screw covers for junction boxes.

B. Use minimum 16 gauge steel for pull boxes and provide with screw cover.

C. Install boxes in conduit runs wherever necessary to avoid long runs or excessive bends. Do not exceed 100 foot runs, or four 90 degree bends, without pull boxes.

D. Rigidly secure boxes to walls, structure or ceilings. Use of conduit as a support is not acceptable.

E. Install boxes in accessible locations. Size boxes in accordance with Articles No. 312 and No. 314 of the latest edition of the National Electrical Code.

F. Install boxes so that the covers will be accessible at all times.

G. Do not install pull or junction boxes for joint use of line voltage and signal or low voltage controls unless all conductors are insulated for the highest voltage being used in the same

box. Emergency system and normal system circuits shall not be routed through a common pull or junction box.

H. Contractor to spot paint all boxes inside and out per the following color code:
   1. Green: Emergency Power/Equipment Branch
   2. Red: Fire Alarm System

I. Contractor to label each junction box with the associated branch circuit installed.

END OF SECTION 260538

SECTION 260543 - UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Concrete-encased conduit, ducts, and duct accessories.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

   1. Include duct-bank materials, including separators and miscellaneous components.
   2. Include ducts and conduits and their accessories, including elbows, end bells, bends, fittings, and solvent cement.
   3. Include warning tape.
   4. Include warning planks.

1.4 INFORMATIONAL SUBMITTALS

A. Duct-Bank Coordination Drawings: Show duct profiles and coordination with other utilities and underground structures.

   1. Include plans and sections, drawn to scale, and show bends and locations of expansion fittings.
   2. Drawings shall be signed and sealed by a qualified professional engineer.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

1.6 FIELD CONDITIONS

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions, and then only after arranging to provide temporary electrical service according to requirements indicated in specifications and drawings.

1. Notify COR in advance of proposed interruption of electrical service.
   a. Two days for emergency outage
   b. Two weeks for scheduled minor outage
   c. Four weeks for scheduled major outage
2. Do not proceed with interruption of electrical service without COR's written permission.

B. Ground Water: Assume ground-water level is at grade level unless a lower water table is noted on Drawings.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR DUCTS AND RACEWAYS

A. Comply with ANSI C2.

2.2 CONDUIT

A. Rigid Steel Conduit: Galvanized. Comply with ANSI C80.1.

B. RNC: NEMA TC 2, Type EPC-40-PVC, UL 651, with matching fittings by same manufacturer as the conduit, complying with NEMA TC 3 and UL 514B.

2.3 NONMETALLIC DUCTS AND DUCT ACCESSORIES

A. Underground Plastic Utilities Duct: NEMA TC 2, UL 651, ASTM F 512, Type EPC-40, with matching fittings complying with NEMA TC 3 by same manufacturer as the duct.

B. Underground Plastic Utilities Duct: NEMA TC 6 & 8, ASTM F 512, UL 651A, Type HDPE, with matching fittings complying with NEMA TC 9 by same manufacturer as the duct.

C. Duct Accessories:

1. Duct Separators: Factory-fabricated rigid PVC interlocking spacers, sized for type and size of ducts with which used, and selected to provide minimum duct spacing indicated while supporting ducts during concreting or backfilling.
2. Warning Tape: Underground-line warning tape specified in Section 260553 "Identification for Electrical Systems."

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate layout and installation of ducts with final arrangement of other utilities, site grading, and surface features as determined in the field. Notify COR if there is a conflict between areas of excavation and existing structures or archaeological sites to remain.

B. Coordinate elevations of ducts and duct-bank entrances with final locations and profiles of ducts and duct banks, as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations as required to suit field conditions.

3.2 UNDERGROUND DUCT APPLICATION

A. Ducts for Electrical Feeders 600 V and Less: RNC, NEMA Type EPC-40 PVC, in concrete-encased duct bank unless otherwise indicated.

B. Underground Ducts Crossing Paved Paths, Walks and Driveways: RNC, NEMA Type EPC-40-PVC, encased in reinforced concrete.

3.3 EARTHWORK

A. Restore surface features at areas disturbed by excavation, and re-establish original grades unless otherwise indicated. Replace removed sod immediately after backfilling is completed.

B. Cut and patch existing pavement in the path of underground ducts and utility structures.

3.4 DUCT INSTALLATION

A. Install ducts according to NEMA TCB 2.

B. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 48 inches (1200 mm), both horizontally and vertically, at other locations unless otherwise indicated.

C. Joints: Use solvent-cemented joints in ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in same plane.

D. Installation Adjacent to High-Temperature Steam Lines: Where duct banks are installed parallel to underground steam lines, perform calculations showing the duct bank will not be subject to environmental temperatures above 40 deg C. Where environmental temperatures are calculated to rise above 40 deg C, and anywhere the duct bank crosses above an underground steam line, install insulation blankets listed for direct burial to isolate the duct bank from the steam line.

E. Building Wall Penetrations: Make a transition from underground duct to rigid steel conduit at least 10 feet (3 m) outside the building wall, without reducing duct line slope away from the building, and without forming a trap in the line. Use fittings manufactured for duct-to-conduit transition. Install conduit penetrations of building walls as specified in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

F. Sealing: Provide temporary closure at terminations of ducts that have cables pulled. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15-psig (1.03-MPa) hydrostatic pressure.

G. Pulling Cord: Install 100-lbf- (445-N-) test nylon cord in empty ducts.

H. Concrete-Encased Ducts: Support ducts on duct separators.

1. Excavate trench bottom to provide firm and uniform support for duct bank. Prepare trench bottoms for pipes less than 6 inches (150 mm) in nominal diameter.
2. Width: Excavate trench 12 inches (300 mm) wider than duct bank on each side.
3. Width: Excavate trench 3 inches (75 mm) wider than duct bank on each side.
4. Depth: Install top of duct bank at least 24 inches (600 mm) below finished grade in areas not subject to deliberate traffic, and at least 30 inches (750 mm) below finished grade in deliberate traffic paths for vehicles unless otherwise indicated.
5. Support ducts on duct separators coordinated with duct size, duct spacing, and outdoor temperature.
6. Separator Installation: Space separators close enough to prevent sagging and deforming of ducts, with not less than four spacers per 20 feet (6 m) of duct. Secure separators to earth and to ducts to prevent floating during concreting. Stagger separators approximately 6 inches (150 mm) between tiers. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
7. Elbows: Use manufactured rigid steel conduit elbows for stub-ups at poles and equipment, at building entrances through floor, and at changes of direction in duct run.

    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete.
    b. Stub-Ups to Equipment: For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of base. Install insulated grounding bushings on terminations at equipment.

8. Reinforcement: Reinforce concrete-encased duct banks where they cross disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.
9. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
10. Concrete Cover: Install a minimum of 3 inches (75 mm) of concrete cover at top and bottom, and a minimum of 2 inches (50 mm) on each side of duct bank.
11. Concreting Sequence: Pour each run of envelope between terminations in one continuous operation.

    a. Start at one end and finish at the other, allowing for expansion and contraction of ducts as their temperature changes during and after the pour. Use expansion fittings installed according to manufacturer's written recommendations, or use other specific measures to prevent expansion-contraction damage.
    b. If more than one pour is necessary, terminate each pour in a vertical plane and install 3/4-inch (15-mm) reinforcing-rod dowels extending a minimum of 18 inches (450 mm) into concrete on both sides of joint near corners of envelope.

12. Pouring Concrete: Place concrete carefully during pours to prevent voids under and between conduits and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Allow concrete to flow to center of bank and rise up in middle, uniformly filling all open spaces. Do not use vibrators unless specifically designed for duct-bank application.

I. Warning Tape: Bury warning tape approximately 12 inches (300 mm) above all concrete-encased ducts and duct banks. Align tape parallel to and within 3 inches (75 mm) of centerline of duct bank. Provide an additional warning tape for each 12-inch (300-mm) increment of duct-bank width over a nominal 18 inches (450 mm). Space additional tapes 12 inches (300 mm) apart, horizontally.

3.5 GROUNDING

A. Ground underground ducts and utility structures according to Section 260526 "Grounding and Bonding for Electrical Systems."

3.6 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:

1. Demonstrate capability and compliance with requirements on completion of installation of underground ducts and utility structures.
2. Pull solid aluminum or wood test mandrel through duct to prove joint integrity and adequate bend radii, and test for out-of-round duct. Provide a minimum 6-inch- (150-mm-) long mandrel equal to 80 percent fill of duct. If obstructions are indicated, remove obstructions and retest.

B. Correct deficiencies and retest as specified above to demonstrate compliance.

3.7 CLEANING

A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.

END OF SECTION 260543

SECTION 260544 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
2. Sleeve-seal systems.
3. Sleeve-seal fittings.
4. Grout.
5. Silicone sealants.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Wall Sleeves:

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.

B. Sleeves for Rectangular Openings:

1. Material: Galvanized sheet steel.
2. Minimum Metal Thickness:

a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and with no side larger than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
b. For sleeve cross-section rectangle perimeter 50 inches (1270 mm) or more and one or more sides larger than 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Stainless steel.
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.

2.4 GROUT

A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Comply with NEMA VE 2 for cable tray and cable penetrations.

C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:

1. Interior Penetrations of Non-Fire-Rated Walls and Floors:

a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint.
b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.

2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
3. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.
4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level. Install sleeves during erection of floors.

D. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

E. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.

B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION 260544

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Identification for raceways.
2. Identification for power and control cables.
3. Identification for conductors.
4. Underground-line warning tape.
5. Warning labels and signs.
6. Miscellaneous identification products.
7. Wiring device identification labels.

1.3 QUALITY ASSURANCE

A. Comply with ASME A13.1.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.4 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 POWER AND CONTROL RACEWAY IDENTIFICATION MATERIALS

A. Comply with ASME A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Colors for Raceways Carrying Circuits at 600V and less:

1. Black letters on an orange field.
2. Legend: Indicate voltage.

C. Colors for Raceways Carrying Circuits at More Than 600V:

1. Black letters on an orange field.
2. Legend: “DANGER CONCEALED HIGH VOLTAGE WIRING.”

D. Vinyl Labels for Raceways Carrying Circuits at 600V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing ends of legend label.

2.2 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

B. Self-Adhesive, Self-Laminating Polyester Labels: Preprinted or write-on, 3-mil-thick flexible label with acrylic pressure-sensitive adhesive that provides a clear, weather- and chemical-resistant, self-laminating, protective shield over the legend. Labels sized to fit the conductor diameter such that the clear shield overlaps the entire printed legend.

C. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

2.3 FLOOR MARKING TAPE

A. 2-inch-wide, 5-mil pressure sensitive vinyl tape, with yellow and black stripes and clear vinyl overlay.

2.4 UNDERGROUND-LINE WARNING TAPE

A. Tape:

1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.

2. Printing on tape shall be permanent and shall not be damaged by burial operations.
3. Tape materials and ink shall be chemically inert and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.

B. Color and Printing:

1. Comply with ANSI Z535.1 through ANSI Z535.5.
2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE.
3. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE.

C. Marking Tape Requirements:

1. Reinforced, detectable three-layer laminate, consisting of a printed pigmented woven scrim, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core, bright-colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
2. Overall Thickness: 7 mils.
3. Foil Core Thickness: 0.35 mil.
4. Weight: 35 lb/1000 sq. ft.
5. 3-Inch Tensile According to ASTM D 882: 300 lbf and 12,500 psi.

2.5 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.

C. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."

2.6 EQUIPMENT IDENTIFICATION LABELS

A. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

2.7 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

2.8 WIRING DEVICE IDENTIFICATION LABELS

A. 1/2-inch clear permanent polyester tape for industrial purposes.

B. 1/4-inch black letters on clear tape with circuit numbers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Attach signs and plastic labels with mechanical fasteners appropriate to the location and substrate.

F. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.

G. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

A. Accessible Raceways, Armored and Metal-Clad Cables More Than 600 V: Self-adhesive vinyl labels. Install labels at 10-foot maximum intervals.

B. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A and 120 V to Ground: Identify with self-adhesive vinyl label. Install labels at 30-foot maximum intervals.

C. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:

1. Emergency Power.
2. Power.
3. UPS.

D. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.

1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for conductors.

a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG.
b. Colors for 208/120-V Circuits:

1) Phase A: Black.
2) Phase B: Red.
3) Phase C: Blue.
4) Neutral: White with color strip to indicate associated phase or white with color tape to indicate associated phase.

c. Colors for 480/277-V Circuits:

1) Phase A: Brown.
2) Phase B: Orange.
3) Phase C: Yellow.
4) Neutral: Gray with color strip to indicate associated phase or gray with color tape to indicate associated phase.

d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

E. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive vinyl labels with the conductor or cable designation, origin, and destination.

F. Control-Circuit Conductor Termination Identification: For identification at terminations provide self-adhesive vinyl labels with the conductor designation.

G. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and Operation and Maintenance Manual.

H. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.

1. Install underground-line warning tape for both direct-buried cables and cables in raceway.

I. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

J. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.

1. Comply with 29 CFR 1910.145.
2. Identify system voltage with black letters on an orange background.
3. Apply to exterior of door, cover, or other access.
4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:

   a. Power transfer switches.
   b. Controls with external control power connections.

K. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:

   a. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high label; where 2 lines of text are required, use labels 2 inches high.
   b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
   c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
   d. Fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

2. Equipment to Be Labeled:

   a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Circuits to be traced down by the electrical contractor. No circuit shall be named “Existing Circuit”. Panelboard identification shall be engraved laminated acrylic or melamine label.
   b. Enclosures and electrical cabinets.
   c. Switchgear.
   d. Switchboards.
   e. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
   f. Substations.
   g. Emergency system boxes and enclosures.
   h. Motor-control centers.
   i. Enclosed switches.
   j. Enclosed circuit breakers.

k. Enclosed controllers.
l. Variable-speed controllers.
m. Push-button stations.
n. Wiring device cover plates.

L. Wiring Devices: Make and install a polyester tape label with branch circuit number on each wiring device.

M. Junction Boxes:
1. Permanent black marker on blank cover with circuit number(s).

END OF SECTION 260553

SECTION 260572 - OVERCURRENT PROTECTIVE DEVICE SHORT-CIRCUIT STUDY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes a computer-based, fault-current study to determine the minimum interrupting capacity of circuit protective devices.

1.3 DEFINITIONS

A. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

B. One-Line Diagram: A diagram which shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.

C. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion from the system.

D. SCCR: Short-circuit current rating.

E. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

1.4 ACTION SUBMITTALS

A. Product Data: For computer software program to be used for studies.

B. Other Action Submittals: Submit the following after the approval of system protective devices submittals. Submittals may be in digital form.

1. Short-circuit study input data, including completed computer program input data sheets.
2. Short-circuit study and equipment evaluation report; signed, dated, and sealed by a qualified professional engineer.

    a. Submit study report for action prior to receiving final approval of the distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary

submittal of sufficient study data to ensure that the selection of devices and associated characteristics is satisfactory.

b. Revised single-line diagram, reflecting field investigation results and results of short-circuit study.

1.5 INFORMATIONAL SUBMITTALS

A. Product Certificates: For short-circuit study software, certifying compliance with IEEE 399.

1.6 QUALITY ASSURANCE

A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are unacceptable.

B. Short-Circuit Study Software Developer Qualifications: An entity that owns and markets computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.

1. The computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.

C. Short-Circuit Study Specialist Qualifications: Professional engineer in charge of performing the study and documenting recommendations, licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.

PART 2 - PRODUCTS

2.1 COMPUTER SOFTWARE

A. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output.

2.2 SHORT-CIRCUIT STUDY REPORT CONTENTS

A. Executive summary.

B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of the computer printout.

C. One-line diagram, showing the following:

1. Protective device designations and ampere ratings.
2. Cable size and lengths.
3. Transformer kilovolt ampere (kVA) and voltage ratings.

4. Motor and generator designations and kVA ratings.
5. Switchgear, switchboard, motor-control center, and panelboard designations.

D. Comments and recommendations for system improvements, where needed.

E. Protective Device Evaluation:

1. Evaluate equipment and protective devices and compare to short-circuit ratings.
2. Tabulations of circuit breaker, fuse, and other protective device ratings versus calculated short-circuit duties.
3. For 600-V overcurrent protective devices, ensure that interrupting ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
4. For devices and equipment rated for asymmetrical fault current, apply multiplication factors listed in the standards to 1/2-cycle symmetrical fault current.
5. Verify adequacy of phase conductors at maximum three-phase bolted fault currents; verify adequacy of equipment grounding conductors and grounding electrode conductors at maximum ground-fault currents. Ensure that short-circuit withstand ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.

F. Short-Circuit Study Input Data: As described in "Power System Data" Article in the Evaluations.

G. Short-Circuit Study Output:

1. Low-Voltage Fault Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

   a. Voltage.
   b. Calculated fault-current magnitude and angle.
   c. Fault-point X/R ratio.
   d. Equivalent impedance.

2. Momentary Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

   a. Voltage.
   b. Calculated symmetrical fault-current magnitude and angle.
   c. Fault-point X/R ratio.
   d. Calculated asymmetrical fault currents:

      1) Based on fault-point X/R ratio.
      2) Based on calculated symmetrical value multiplied by 1.6.

3. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

   a. Voltage.
   b. Calculated symmetrical fault-current magnitude and angle.
   c. Fault-point X/R ratio.
   d. No AC Decrement (NACD) ratio.
   e. Equivalent impedance.

f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a total basis.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Obtain all data necessary for the conduct of the study.

1. Verify completeness of data supplied on the one-line diagram. Call any discrepancies to the attention of Architect.
2. For equipment provided that is Work of this Project, use characteristics submitted under the provisions of action submittals and information submittals for this Project.
3. For relocated equipment and that which is existing to remain, obtain required electrical distribution system data by field investigation and surveys, conducted by qualified technicians and engineers. The qualifications of technicians and engineers shall be qualified as defined by NFPA 70E.

B. Gather and tabulate the following input data to support the short-circuit study. Comply with recommendations in IEEE 551 as to the amount of detail that is required to be acquired in the field. Field data gathering shall be under the direct supervision and control of the engineer in charge of performing the study, and shall be by the engineer or its representative who holds NETA ETT Level III certification or NICET Electrical Power Testing Level III certification.

1. Product Data for Project's overcurrent protective devices involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
2. Obtain electrical power utility impedance at the service.
3. Power sources and ties.
4. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.
5. For reactors, provide manufacturer and model designation, voltage rating, and impedance.
6. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip, SCCR, current rating, and breaker settings.
7. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
8. Busway manufacturer and model designation, current rating, impedance, lengths, and conductor material.
9. Motor horsepower and NEMA MG 1 code letter designation.
10. Cable sizes, lengths, number, conductor material and conduit material (magnetic or nonmagnetic).

3.2 SHORT-CIRCUIT STUDY

A. Perform study following the general study procedures contained in IEEE 399.

B. Calculate short-circuit currents according to IEEE 551.

C. Base study on the device characteristics supplied by device manufacturer.

D. Begin short-circuit current analysis at the service, extending down to the system overcurrent protective devices as follows:

1. To normal system low-voltage load buses where fault current is 10 kA or less.
2. Exclude equipment rated 240-V ac or less when supplied by a single transformer rated less than 125 kVA.

E. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Study all cases of system-switching configurations and alternate operations that could result in maximum fault conditions.

F. The calculations shall include the ac fault-current decay from induction motors, synchronous motors, and asynchronous generators and shall apply to low- and medium-voltage, three-phase ac systems. The calculations shall also account for the fault-current dc decrement, to address the asymmetrical requirements of the interrupting equipment.

1. For grounded systems, provide a bolted line-to-ground fault-current study for areas as defined for the three-phase bolted fault short-circuit study.

G. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault at each of the following:

1. Electric utility's supply termination point.
2. Incoming switchgear.
3. Low-voltage switchgear.
4. Motor-control centers.
5. Control panels.
6. Standby generators and automatic transfer switches.
7. Branch circuit panelboards.
8. Disconnect switches.

3.3 ADJUSTING

A. Make minor modifications to equipment as required to accomplish compliance with short-circuit study.

3.4 DEMONSTRATION

A. Train Owner's operating and maintenance personnel in the use of study results.

END OF SECTION 260572

SECTION 260573 - OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes computer-based, overcurrent protective device coordination studies to determine overcurrent protective devices and to determine overcurrent protective device settings for selective tripping.

1.3 DEFINITIONS

A. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

B. One-Line Diagram: A diagram which shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.

C. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion from the system.

D. SCCR: Short-circuit current rating.

E. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

1.4 ACTION SUBMITTALS

A. Product Data: For computer software program to be used for studies.

B. Other Action Submittals: Submit the following after the approval of system protective devices submittals. Submittals may be in digital form.

1. Coordination-study input data, including completed computer program input data sheets.
2. Study and equipment evaluation reports.
3. Overcurrent protective device coordination study report; signed, dated, and sealed by a qualified professional engineer.

    a. Submit study report for action prior to receiving final approval of the distribution equipment submittals. If formal completion of studies will cause delay in

equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that the selection of devices and associated characteristics is satisfactory.

1.5 INFORMATIONAL SUBMITTALS

A. Product Certificates: For overcurrent protective device coordination study software, certifying compliance with IEEE 399.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For the overcurrent protective devices to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017820 "Operation and Maintenance Data," include the following:

a. The following parts from the Protective Device Coordination Study Report:

1) One-line diagram.
2) Protective device coordination study.
3) Time-current coordination curves.

b. Power system data.

1.7 QUALITY ASSURANCE

A. Coordination Study Specialist Qualifications: Professional engineer in charge of performing the study and documenting recommendations, licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.

PART 2 - PRODUCTS

2.1 COMPUTER SOFTWARE DEVELOPERS

A. Analytical features of device coordination study computer software program shall have the capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

B. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output. Computer software program shall report device settings and ratings of all overcurrent protective devices and shall demonstrate selective coordination by computer-generated, time-current coordination plots.

1. Optional Features:

a. Arcing faults.
b. Simultaneous faults.
c. Explicit negative sequence.
d. Mutual coupling in zero sequence.

2.2 PROTECTIVE DEVICE COORDINATION STUDY REPORT CONTENTS

A. Executive summary.

B. Study descriptions, purpose, basis and scope. Include case descriptions, definition of terms and guide for interpretation of the computer printout.

C. One-line diagram, showing the following:

1. Protective device designations and ampere ratings.
2. Cable size and lengths.
3. Transformer kilovolt ampere (kVA) and voltage ratings.
4. Motor and generator designations and kVA ratings.
5. Switchgear, switchboard, motor-control center, and panelboard designations.

D. Study Input Data: As described in "Power System Data" Article.

E. Short-Circuit Study:

1. Low-Voltage Fault Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

a. Voltage.
b. Calculated fault-current magnitude and angle.
c. Fault-point X/R ratio.
d. Equivalent impedance.

2. Momentary Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

a. Voltage.
b. Calculated symmetrical fault-current magnitude and angle.
c. Fault-point X/R ratio.
d. Calculated asymmetrical fault currents:

1) Based on fault-point X/R ratio.
2) Based on calculated symmetrical value multiplied by 1.6.
3) Based on calculated symmetrical value multiplied by 2.7.

3. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

a. Voltage.
b. Calculated symmetrical fault-current magnitude and angle.
c. Fault-point X/R ratio.

d. No AC Decrement (NACD) ratio.
e. Equivalent impedance.
f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a symmetrical basis.
g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a total basis.

F. Protective Device Coordination Study:

1. Report recommended settings of protective devices, ready to be applied in the field. Use manufacturer's data sheets for recording the recommended setting of overcurrent protective devices when available.

a. Phase and Ground Relays:

1) Device tag.
2) Relay current transformer ratio and tap, time dial, and instantaneous pickup value.
3) Recommendations on improved relaying systems, if applicable.

b. Circuit Breakers:

1) Adjustable pickups and time delays (long time, short time, ground).
2) Adjustable time-current characteristic.
3) Adjustable instantaneous pickup.
4) Recommendations on improved trip systems, if applicable.

c. Fuses: Show current rating, voltage, and class.

G. Time-Current Coordination Curves: Determine settings of overcurrent protective devices to achieve selective coordination. Graphically illustrate that adequate time separation exists between devices installed in series, including power utility company's upstream devices. Prepare separate sets of curves for the switching schemes and for emergency periods where the power source is local generation. Show the following information:

1. Device tag and title, one-line diagram with legend identifying the portion of the system covered.
2. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which the device is exposed.
3. Identify the device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.
4. Plot the following listed characteristic curves, as applicable:

a. Power utility's overcurrent protective device.
b. Medium-voltage equipment overcurrent relays.
c. Medium- and low-voltage fuses including manufacturer's minimum melt, total clearing, tolerance, and damage bands.
d. Low-voltage equipment circuit-breaker trip devices, including manufacturer's tolerance bands.
e. Transformer full-load current, magnetizing inrush current, and ANSI through-fault protection curves.
f. Cables and conductors damage curves.

g. Ground-fault protective devices.
h. Motor-starting characteristics and motor damage points.
i. Generator short-circuit decrement curve and generator damage point.
j. The largest feeder circuit breaker in each motor-control center and panelboard.

5. Series rating on equipment allows the application of two series interrupting devices for a condition where the available fault current is greater than the interrupting rating of the downstream equipment. Both devices share in the interruption of the fault and selectivity is sacrificed at high fault levels. Maintain selectivity for tripping currents caused by overloads.
6. Provide adequate time margins between device characteristics such that selective operation is achieved.
7. Comments and recommendations for system improvements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine Project overcurrent protective device submittals for compliance with electrical distribution system coordination requirements and other conditions affecting performance. Devices to be coordinated are indicated on Drawings.

1. Proceed with coordination study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to coordination study may not be used in study.

3.2 PROTECTIVE DEVICE COORDINATION STUDY

A. Comply with IEEE 242 for calculating short-circuit currents and determining coordination time intervals.

B. Comply with IEEE 399 for general study procedures.

C. The study shall be based on the device characteristics supplied by device manufacturer.

D. Begin analysis at the service, extending down to the system overcurrent protective devices as follows:

1. To normal system low-voltage load buses where fault current is 10 kA or less.
2. Exclude equipment rated 240-V ac or less when supplied by a single transformer rated less than 125 kVA.

E. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Study all cases of system-switching configurations and alternate operations that could result in maximum fault conditions.

F. Transformer Primary Overcurrent Protective Devices:

1. Device shall not operate in response to the following:

a. Inrush current when first energized.
b. Self-cooled, full-load current or forced-air-cooled, full-load current, whichever is specified for that transformer.
c. Permissible transformer overloads according to IEEE C57.96 if required by unusual loading or emergency conditions.

2. Device settings shall protect transformers according to IEEE C57.12.00, for fault currents.

G. Motor Protection:

1. Select protection for low-voltage motors according to IEEE 242 and NFPA 70.
2. Select protection for motors served at voltages more than 600 V according to IEEE 620.

H. Conductor Protection: Protect cables against damage from fault currents according to ICEA P-32-382, ICEA P-45-482, and protection recommendations in IEEE 242. Demonstrate that equipment withstands the maximum short-circuit current for a time equivalent to the tripping time of the primary relay protection or total clearing time of the fuse. To determine temperatures that damage insulation, use curves from cable manufacturers or from listed standards indicating conductor size and short-circuit current.

I. Generator Protection: Select protection according to manufacturer's written recommendations and to IEEE 242.

J. The calculations shall include the ac fault-current decay from induction motors, synchronous motors, and asynchronous generators and shall apply to low- and medium-voltage, three-phase ac systems. The calculations shall also account for the fault-current dc decrement, to address the asymmetrical requirements of the interrupting equipment.

1. For grounded systems, provide a bolted line-to-ground fault-current study for areas as defined for the three-phase bolted fault short-circuit study.

K. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault and single line-to-ground fault at each of the following:
1. Switchgear.
2. Low-voltage switchgear.
3. Motor-control centers.
4. Standby generators and automatic transfer switches.
5. Branch circuit panelboards.

L. Protective Device Evaluation:

1. Evaluate equipment and protective devices and compare to short-circuit ratings.
2. Adequacy of switchgear, motor-control centers, and panelboard bus bars to withstand short-circuit stresses.

3.3 LOAD-FLOW AND VOLTAGE-DROP STUDY

A. Perform a load-flow and voltage-drop study to determine the steady-state loading profile of the system. Analyze power system performance two times as follows:

1. Determine load-flow and voltage drop based on full-load currents obtained in "Power System Data" Article.
2. Determine load-flow and voltage drop based on 80 percent of the design capacity of the load buses.
3. Prepare the load-flow and voltage-drop analysis and report to show power system components that are overloaded, or might become overloaded; show bus voltages that are less than as prescribed by NFPA 70.

3.4 MOTOR-STARTING STUDY

A. Perform a motor-starting study to analyze the transient effect of the system's voltage profile during motor starting. Calculate significant motor-starting voltage profiles and analyze the effects of the motor starting on the power system stability.

B. Prepare the motor-starting study report, noting light flicker for limits proposed by IEEE 141 and voltage sags so as not to affect the operation of other utilization equipment on the system supplying the motor.

3.5 POWER SYSTEM DATA

A. Obtain all data necessary for the conduct of the overcurrent protective device study.

1. Verify completeness of data supplied in the one-line diagram on Drawings. Call discrepancies to the attention of Architect.
2. For new equipment, use characteristics submitted under the provisions of action submittals and information submittals for this Project.
3. For existing equipment, whether or not relocated obtain required electrical distribution system data by field investigation and surveys, conducted by qualified technicians and engineers. The qualifications of technicians and engineers shall be qualified as defined by NFPA 70E.

B. Gather and tabulate the following input data to support coordination study. The list below is a guide. Comply with recommendations in IEEE 241 and IEEE 551 for the amount of detail required to be acquired in the field. Field data gathering shall be under the direct supervision and control of the engineer in charge of performing the study.

1. Product Data for overcurrent protective devices specified in other Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
2. Electrical power utility impedance at the service.
3. Power sources and ties.
4. Short-circuit current at each system bus, three phase and line-to-ground.
5. Full-load current of all loads.
6. Voltage level at each bus.
7. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.
8. For reactors, provide manufacturer and model designation, voltage rating, and impedance.

9. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip and available range of settings, SCCR, current rating, and breaker settings.
10. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
11. For relays, provide manufacturer and model designation, current transformer ratios, potential transformer ratios, and relay settings.
12. Maximum demands from service meters.
13. Busway manufacturer and model designation, current rating, impedance, lengths, and conductor material.
14. Motor horsepower and NEMA MG 1 code letter designation.
15. Low-voltage cable sizes, lengths, number, conductor material, and conduit material (magnetic or nonmagnetic).
16. Medium-voltage cable sizes, lengths, conductor material, and cable construction and metallic shield performance parameters.
17. Data sheets to supplement electrical distribution system diagram, cross-referenced with tag numbers on diagram, showing the following:

    a. Special load considerations, including starting inrush currents and frequent starting and stopping.
    b. Transformer characteristics, including primary protective device, magnetic inrush current, and overload capability.
    c. Motor full-load current, locked rotor current, service factor, starting time, type of start, and thermal-damage curve.
    d. Generator thermal-damage curve.
    e. Ratings, types, and settings of utility company's overcurrent protective devices.
    f. Special overcurrent protective device settings or types stipulated by utility company.
    g. Time-current-characteristic curves of devices indicated to be coordinated.
    h. Manufacturer, frame size, interrupting rating in amperes rms symmetrical, ampere or current sensor rating, long-time adjustment range, short-time adjustment range, and instantaneous adjustment range for circuit breakers.
    i. Manufacturer and type, ampere-tap adjustment range, time-delay adjustment range, instantaneous attachment adjustment range, and current transformer ratio for overcurrent relays.
    j. Panelboards, switchboards, motor-control center ampacity, and SCCR in amperes rms symmetrical.
    k. Identify series-rated interrupting devices for a condition where the available fault current is greater than the interrupting rating of the downstream equipment. Obtain device data details to allow verification that series application of these devices complies with NFPA 70 and UL 489 requirements.

3.6 FIELD ADJUSTING

A. Adjust relay and protective device settings according to the recommended settings provided by the coordination study. Field adjustments shall be completed by the engineering service division of the equipment manufacturer under the Startup and Acceptance Testing contract portion.

B. Make minor modifications to equipment as required to accomplish compliance with short-circuit and protective device coordination studies.

3.7 DEMONSTRATION

A. Engage the Coordination Study Specialist to train Owner's maintenance personnel in the following:

1. Acquaint personnel in the fundamentals of operating the power system in normal and emergency modes.
2. Hand-out and explain the objectives of the coordination study, study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpreting the time-current coordination curves.
3. Adjust, operate, and maintain overcurrent protective device settings.

END OF SECTION 260573

SECTION 260574 – ARC FLASH HAZARD ANALYSIS AND OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY

PART 1 - GENERAL

1.1 SCOPE

A. The MSFC contractor shall be furnished short-circuit and protective device coordination studies as prepared by MSFC Contractor Engineering Services or approved equal.

B. The MSFC Contractor Engineering Services shall furnish an Arc Flash Hazard Analysis Study per the requirements set forth in the current issue of NFPA 70E -Standard for Electrical Safety in the Workplace. The arc flash hazard analysis shall be performed according to the IEEE Standard 1584 – 2002, the IEEE Guide for Performing Arc-Flash Calculations.

C. The scope of the studies shall include the electrical distribution equipment as identified by the MSFC under this contract.

1.2 RELATED SECTIONS

A. Drawings and general provisions of the Contract.

1.3 REFERENCES

A. Institute of Electrical and Electronics Engineers, Inc. (IEEE):

1. IEEE 141 – Recommended Practice for Electric Power Distribution and Coordination of Industrial and Commercial Power Systems
2. IEEE 242 – Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems
3. IEEE 399 – Recommended Practice for Industrial and Commercial Power System Analysis
4. IEEE 241 – Recommended Practice for Electric Power Systems in Commercial Buildings
5. IEEE 1015 – Recommended Practice for Applying Low-Voltage Circuit Breakers Used in Industrial and Commercial Power Systems.
6. IEEE 1584 -Guide for Performing Arc-Flash Hazard Calculations

B. American National Standards Institute (ANSI):

1. ANSI C57.12.00 – Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers
2. ANSI C37.13 – Standard for Low Voltage AC Power Circuit Breakers Used in Enclosures
3. ANSI C37.010 – Standard Application Guide for AC High Voltage Circuit Breakers Rated on a Symmetrical Current Basis
4. ANSI C 37.41 – Standard Design Tests for High Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches and Accessories.

C. The National Fire Protection Association (NFPA)

1. NFPA 70 -National Electrical Code, latest edition
2. NFPA 70E – Standard for Electrical Safety in the Workplace

1.4 SUBMITTALS FOR REVIEW/APPROVAL

A. The studies shall be submitted to the MSFC for review and approval prior to final completion. The studies shall be submitted to the design engineer prior to receiving final approval of the distribution equipment shop drawings and/or prior to release of equipment drawings for manufacturing. If formal completion of the study may cause delays in equipment shipments, approval from the Engineer may be obtained for a preliminary submittal of data to ensure that the selection of device ratings and characteristics will be satisfactory to properly select the distribution equipment. The formal study will be provided to verify preliminary findings.

1.5 FINAL SUBMITTALS FOR REVIEW/APPROVAL FOR CONSTRUCTION

A. The results of the short-circuit, protective device coordination and arc flash hazard analysis studies shall be summarized in a final report. A minimum of five (5) bound copies of the complete final report shall be submitted. For large system studies, submittals requiring more than five (5) copies of the report will be provided without the section containing the computer printout of the short-circuit input and output data. Electronic PDF copies of the report shall be provided upon request.

B. The report shall include the following sections:

1. Executive Summary including Introduction, Scope of Work and Results/Recommendations.
2. Short-Circuit Methodology Analysis Results and Recommendations
3. Short-Circuit Device Evaluation Table
4. Protective Device Coordination Methodology Analysis Results and Recommendations
5. Protective Device Settings Table
6. Time-Current Coordination Graphs and Recommendations
7. Arc Flash Hazard Methodology Analysis Results and Recommendations including the details of the incident energy and flash protection boundary calculations, along with Arc Flash boundary distances, working distances, Incident Energy levels and Personal Protection Equipment levels.
8. Arc Flash Labeling section showing types of labels to be provided. Section will contain descriptive information as well as typical label images.
9. One-line system diagram that shall be computer generated and will clearly identify individual equipment buses, bus numbers used in the short-circuit analysis, cable and bus connections between the equipment, calculated maximum short-circuit current at each bus location, device numbers used in the time-current coordination analysis, and other information pertinent to the computer analysis.

1.6 QUALIFICATIONS

A. The short-circuit, protective device coordination and arc flash hazard analysis studies shall be conducted under the responsible charge and approval of a Registered Professional Electrical Engineer skilled in performing and interpreting the power system studies.

B. The Registered Professional Electrical Engineer shall be an employee of the approved engineering firm.

C. The Registered Professional Electrical Engineer shall have a minimum of five (5) years of experience in performing power system studies.

D. The approved MSFC contractor engineering firm shall demonstrate experience with Arc Flash Hazard Analysis by submitting names of at least ten actual arc flash hazard analyses it has performed in the past year.

E. The MSFC contractor engineering firm shall have a minimum of twenty-five (25) years experience in performing power system studies.

1.7 COMPUTER ANALYSIS SOFTWARE

A. The studies shall be performed using SKM Systems Analysis Power*Tools for Windows (PTW) software program.

PART 2 - PRODUCTS

2.1 STUDIES

A. The MSFC Contractor Engineering Services shall furnish an Arc Flash Hazard Analysis Study per NFPA 70E -Standard for Electrical Safety in the Workplace, reference Article 130.3 and Annex D. This study shall also include short-circuit and protective device coordination studies. All studies to be prepared by the same MSFC contractor engineering services.

2.2 DATA COLLECTION

A. Field data collection shall be performed by a MSFC Contractor Service Technician, qualified (as defined by NFPA 70E – 2004) to ensure accurate equipment modeling. The technician shall have completed an 8-hour instructor-led Electrical Safety Training Course. The course shall include NFPA 70E training which includes the selection and use of personal protective equipment.

B. The MSFC contractor will visually inspect to verify the equipment ratings, conductor ratings and overcurrent device data by removing panels, covers and doors where required to document the necessary data used in the analysis. The MSFC contractor can perform these inspections with the equipment energized provided the incident energy values are less than 40cal/cm², greater values or unusual site conditions will require an equipment shutdown so the equipment can be inspected de-energized.

C. The MSFC shall provide qualified personnel to show the MSFC Contractor Service technician the equipment location and to open all equipment doors, locks, etc. necessary to collect nameplate data.

D. The MSFC Contractor Engineering Services will verify the MSFC facility one-line drawings and provide marked corrections where discrepancies are found..

E. Data collection shall begin downstream from the utility service and continue down through the MSFC electrical distribution system as defined under scope of work. The study shall not include any single phase AC circuits or DC distribution systems as these types of circuits and systems are excluded from IEEE 1584-2002 Arc Flash calculation guidelines. The study will not include equipment rated 240 volts or less per NFPA 70E, when supplied by a single transformer rated less than 125kVA.

F. The MSFC contractor shall obtain from the utility the minimum, normal, and maximum operating service voltage levels, three-phase short circuit MVA and X/R ratio, as well as line-to-ground short circuit MVA and X/R ratio at the point of connection as shown on the drawings.

G. The MSFC Contractor shall furnish all data as required for the power system studies. The Engineer performing the short-circuit, protective device coordination and arc flash hazard analysis studies shall furnish the Contractor with a listing of required data immediately after award of the contract. The MSFC Contractor shall expedite collection of the data to assure completion of the studies as required for final approval of the distribution equipment shop drawings and/or prior to the release of the equipment for manufacturing.

H. Source combination may include present and future motors and generators.

I. Load data utilized may include existing and proposed loads obtained from Contract Documents provided by the MSFC.

J. If applicable, include fault contribution of existing motors in the study. The MSFC Contractor shall obtain required existing equipment data, if necessary, to satisfy the study requirements.

2.3 SHORT-CIRCUIT ANALYSIS

A. Transformer design impedances shall be used when test impedances are not available.

B. Provide the following:

1. Calculation methods and assumptions
2. Selected base per unit quantities
3. One-line diagram of the system being evaluated that clearly identifies individual equipment buses, bus numbers used in the short-circuit analysis, cable and bus connections between the equipment, calculated maximum short-circuit current at each bus location and other information pertinent to the computer analysis
4. The study shall include input circuit data including electric utility system characteristics, source impedance data, conductor lengths, number of conductors per phase, conductor impedance values, insulation types, transformer impedances and X/R ratios, motor contributions, and other circuit information as related to the short-circuit calculations.

5. Tabulations of calculated quantities including short-circuit currents, X/R ratios, equipment short-circuit interrupting or withstand current ratings and notes regarding adequacy or inadequacy of the equipment rating.
6. Results, conclusions, and recommendations. A comprehensive discussion section evaluating the adequacy or inadequacy of the equipment must be provided and include recommendations as appropriate for improvements to the system.

C. For solidly-grounded systems, provide a bolted line-to-ground fault current study for applicable buses as determined by the engineer performing the study.

D. Protective Device Evaluation:

1. Evaluate equipment and protective devices and compare to short circuit ratings
2. Adequacy of switchgear, motor control centers, and panelboard bus bars to withstand short-circuit stresses
3. The MSFC contractor shall notify MSFC in writing, of any circuit protective devices improperly rated for the calculated available fault current.

2.4 PROTECTIVE DEVICE TIME-CURRENT COORDINATION ANALYSIS

A. Protective device coordination time-current curves (TCC) shall be displayed on log-log scale graphs.

B. Include on each TCC graph, a complete title with descriptive device names.

C. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which the device is exposed.

D. Identify the device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.

E. Plot the following characteristics on the TCC graphs, where applicable:

1. Electric utility’s overcurrent protective device
2. Medium voltage equipment overcurrent relays
3. Medium and low voltage fuses including manufacturer’s minimum melt, total clearing, tolerance, and damage bands
4. Low voltage equipment circuit breaker trip devices, including manufacturer’s tolerance bands
5. Transformer full-load current, magnetizing inrush current, and ANSI through-fault protection curves
6. Medium voltage conductor damage curves
7. Ground fault protective devices, as applicable
8. Pertinent motor starting characteristics and motor damage points, where applicable
9. Pertinent generator short-circuit decrement curve and generator damage point
10. The largest feeder circuit breaker in each motor control center and applicable panelboard.

F. Provide adequate time margins between device characteristics such that selective operation is provided, while providing proper protection.

G. Provide the following:

1. A One-line diagram shall be provided which clearly identifies individual equipment buses, bus numbers, device identification numbers and the maximum available short-circuit current at each bus when known.
2. A sufficient number of log-log plots shall be provided to indicate the degree of system protection and coordination by displaying the time-current characteristics of series connected overcurrent devices and other pertinent system parameters.
3. Computer printouts shall accompany the log-log plots and will contain descriptions for each of the devices shown, settings of the adjustable devices, and device identification numbers to aid in locating the devices on the log-log plots and the system one-line diagram.
4. The study shall include a separate, tabular printout containing the recommended settings of all adjustable overcurrent protective devices, the equipment designation where the device is located, and the device number corresponding to the device on the system one-line diagram
5. A discussion section which evaluates the degree of system protection and service continuity with overcurrent devices, along with recommendations as required for addressing system protection or device coordination deficiencies.
6. The MSFC contractor shall notify MSFC in writing of any significant deficiencies in protection and/or coordination. Provide recommendations for improvements.

2.5 ARC FLASH HAZARD ANALYSIS

A. The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA70E-2009, Annex D. The arc flash hazard analysis shall be performed in conjunction with the short-circuit analysis (Section 2.03) and the protective device time-current coordination analysis (Section 2.04)

B. The flash protection boundary and the incident energy shall be calculated at significant locations in the electrical distribution system (switchboards, switchgear, motor-control centers, panelboards, busway and splitters) where work could be performed on energized parts.

C. Circuits 240V or less fed by single transformer rated less than 125 kVA may be omitted from the computer model and will be assumed to have a hazard risk category 0 per NFPA 70E.

D. Working distances shall be based on IEEE 1584. The calculated arc flash protection boundary shall be determined using those working distances.

E. When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short-circuit and coordination study model. Ground overcurrent relays should not be taken into consideration when determining the clearing time when performing incident energy calculations

F. The short-circuit calculations and the corresponding incident energy calculations for multiple system scenarios must be compared and the greatest incident energy must be uniquely reported for each equipment location in a single table. Calculations must be performed to represent the maximum and minimum contributions of fault current magnitude for normal and emergency operating conditions. The minimum calculation will assume that the utility contribution is at a minimum. Conversely, the maximum calculation will assume a maximum contribution from the

utility. Calculations shall take into consideration the parallel operation of synchronous generators with the electric utility, where applicable as well as any stand-by generator applications.

G. The Arc-Flash Hazard Analysis shall be performed utilizing mutually agreed upon facility operational conditions, and the final report shall describe, when applicable, how these conditions differ from worst-case bolted fault conditions.

H. The incident energy calculations must consider the accumulation of energy over time when performing arc flash calculations on buses with multiple sources. Iterative calculations must take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors should be decremented as follows:

1. Fault contribution from induction motors should not be considered beyond 5 cycles.

I. For each piece of ANSI rated equipment with an enclosed main device, two calculations shall be made. A calculation shall be made for the main cubicle, sides, or rear; and shall be based on a device located upstream of the equipment to clear the arcing fault. A second calculation shall be made for the front cubicles and shall be based on the equipment's main device to clear the arcing fault. For all other non-ANSI rated equipment, only one calculation shall be required and it shall be based on a device located upstream of the equipment to clear the arcing fault.

J. When performing incident energy calculations on the line side of a main breaker (as required per above), the line side and load side contributions must be included in the fault calculation.

K. Mis-coordination should be checked amongst all devices within the branch containing the immediate protective device upstream of the calculation location and the calculation should utilize the fastest device to compute the incident energy for the corresponding location.

L. Arc Flash calculations shall be based on actual overcurrent protective device clearing time. A maximum clearing time of 2 seconds will be used based on IEEE 1584-2002 section B.1.2. Where it is not physically possible to move outside of the flash protection boundary in less than 2 seconds during an arc flash event, a maximum clearing time based on the specific location shall be utilized.

M. Provide the following:

1. Results of the Arc-Flash Hazard Analysis shall be submitted in tabular form, and shall include device or bus name, bolted fault and arcing fault current levels, flash protection boundary distances, working distances, personal-protective equipment classes and AFIE (Arc Flash Incident Energy) levels.
2. The Arc-Flash Hazard Analysis shall report incident energy values based on recommended device settings for equipment within the scope of the study.
3. The Arc-Flash Hazard Analysis may include recommendations to reduce AFIE levels and enhance worker safety.

PART 3 - EXECUTION

3.1 FIELD ADJUSTMENT

A. The MSFC contractor shall adjust relay and protective device settings according to the recommended settings table provided by the coordination study.

B. Field adjustments to be completed by MSFC Contractor Services under the separate Startup and Acceptance Testing contract portion of project specifications.

C. The MSFC Contractor shall make minor modifications to equipment as required to accomplish conformance with short circuit and protective device coordination studies.

D. The MSFC contractor shall notify MSFC in writing of any required major equipment modifications.

3.2 ARC FLASH LABELS

A. The MSFC Contractor Engineering Services shall provide a 4.0 in. x 4.0 in. thermal transfer type label of high adhesion polyester for each work location analyzed.

B. The labels shall be designed according to the following standards:

1. UL969 – Standard for Marking and Labeling Systems
2. ANSI Z535.4 – Product Safety Signs and Labels
3. NFPA 70 (National Electric Code) – Article 110.16

C. The label shall include the following information:

1. System Voltage
2. Flash protection boundary
3. Personal Protective Equipment category
4. Arc Flash Incident energy value (cal/cm²)
5. Limited, restricted, and prohibited Approach Boundaries
6. Study report number and issue date

D. Labels shall be printed by a thermal transfer type printer, with no field markings.

E. Arc flash labels shall be provided for equipment as identified in the study and the respective equipment access areas per the following:

1. Floor Standing Equipment - Labels shall be provided on the front of each individual section. Equipment requiring rear and/or side access shall have labels provided on each individual section access area. Equipment line-ups containing sections with multiple incident energy and flash protection boundaries shall be labeled as identified in the Arc Flash Analysis table.
2. Wall Mounted Equipment – Labels shall be provided on the front cover or a nearby adjacent surface, depending upon equipment configuration.
3. General Use Safety labels shall be installed on equipment in coordination with the Arc Flash labels. The General Use Safety labels shall warn of general electrical hazards

associated with shock, arc flash, and explosions, and instruct workers to turn off power prior to work.

F. Label Installation

1. Labels shall be field installed by the MSFC Contractor Services. The technician providing the installation shall have completed an 8-Hour instructor led Electrical Safety Training Course with includes NFPA 70E material including the selection of personal protective equipment.

3.3 ARC FLASH TRAINING

A. The MSFC Contractor supplying the Arc Flash Hazard Analysis shall train the MSFC qualified electrical personnel of the potential arc flash hazards associated with working on energized equipment (minimum of 4 hours). The training shall be certified for continuing education units (CEUs) by the International Association for Continuing Education Training (IACET) or equivalent. The trainer shall be an authorized OSHA Outreach instructor.

B. The MSFC Contractor supplying the Arc Flash Hazard Analysis shall offer instructor led and online NFPA -70E training classes.

END OF SECTION 260574

SECTION 262200 - LOW-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following types of dry-type transformers rated 600 V and less, with capacities up to 1000 kVA:

1. Distribution transformers.

1.3 ACTION SUBMITTALS

A. Product Data: Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer indicated.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Wiring Diagrams: Power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For transformers to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each transformer type through one source from a single manufacturer.

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

C. Comply with IEEE C57.12.91, "Test Code for Dry-Type Distribution and Power Transformers."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

1.7 COORDINATION

A. Coordinate size and location of concrete bases with actual transformer provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

B. Coordinate installation of wall-mounting and structure-hanging supports with actual transformer provided.

PART 2 - PRODUCTS

2.1 GENERAL TRANSFORMER REQUIREMENTS

A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.

B. Cores: Grain-oriented, non-aging silicon steel.

C. Coils: Continuous windings without splices except for taps.

1. Internal Coil Connections: Brazed or pressure type.
2. Coil Material: Copper.

2.2 DISTRIBUTION TRANSFORMERS

A. Comply with NEMA ST 20, and list and label as complying with UL 1561.

B. Cores: One leg per phase.

C. Enclosure: Ventilated, NEMA 250, Type 2.

1. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.

D. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and two 2.5 percent taps below normal full capacity.

E. Insulation Class: 220 deg C, UL-component-recognized insulation system with a maximum of 115 deg C rise above 40 deg C ambient temperature.

F. Low-Sound-Level Requirements: Minimum of 3 dBA less than NEMA ST 20 standard sound levels when factory tested according to IEEE C57.12.91.

2.3 IDENTIFICATION DEVICES

A. Nameplates: Engraved, laminated-plastic or metal nameplate for each distribution transformer, mounted with corrosion-resistant screws. Nameplates and label products are specified in Section 260553 "Identification for Electrical Systems."

2.4 SOURCE QUALITY CONTROL

A. Test and inspect transformers according to IEEE C57.12.91.

B. Factory Sound-Level Tests: Conduct sound-level tests on equipment for this Project.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.

B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.

C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.

D. Verify that ground connections are in place and requirements in Section 260526 "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance shall be 5 ohms at location of transformer.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Construct concrete bases and anchor floor-mounting transformers according to manufacturer's written instructions and requirements in Section 260529 "Hangers and Supports for Electrical Systems."

3.3 CONNECTIONS

A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

C. Remove and replace units that do not pass tests or inspections and retest as specified above.

3.5 ADJUSTING

A. Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.

B. Output Settings Report: Prepare a written report recording output voltages and tap settings.

3.6 CLEANING

A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

END OF SECTION 262200

SECTION 262413 - SWITCHBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Service and distribution switchboards rated 600 V and less.
2. Transient voltage suppression devices.
3. Disconnecting and overcurrent protective devices.
4. Instrumentation.
5. Control power.
6. Accessory components and features.
7. Identification.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of switchboard, overcurrent protective device, transient voltage suppression device, ground-fault protector, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

B. Shop Drawings: For each switchboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Detail short-circuit current rating of switchboards and overcurrent protective devices.
5. Include descriptive documentation of optional barriers specified for electrical insulation and isolation.
6. Detail utility company's metering provisions with indication of approval by utility company.
7. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
8. Include time-current coordination curves for each type and rating of overcurrent protective device included in switchboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.
9. Include schematic and wiring diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Field Quality-Control Reports:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For switchboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017820 "Operation and Maintenance Data," include the following:

1. Routine maintenance requirements for switchboards and all installed components.
2. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
3. Time-current coordination curves for each type and rating of overcurrent protective device included in switchboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers qualified as defined in NEMA PB 2.1 and trained in electrical safety as required by NFPA 70E.

B. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

C. Source Limitations: Obtain switchboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

D. Product Selection for Restricted Space: Drawings indicate maximum dimensions for switchboards including clearances between switchboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

F. Comply with NEMA PB 2.

G. Comply with NFPA 70.

H. Comply with UL 891.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver switchboards in sections or lengths that can be moved past obstructions in delivery path.

B. Remove loose packing and flammable materials from inside switchboards and install temporary electric heating (250 W per section) to prevent condensation.

C. Handle and prepare switchboards for installation according to NECA 400.

1.8 PROJECT CONDITIONS

A. Installation Pathway: Remove and replace access fencing, doors, lift-out panels, and structures to provide pathway for moving switchboards into place.

B. Environmental Limitations:

1. Do not deliver or install switchboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above switchboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

   a. Ambient Temperature: Not exceeding 104 deg F (40 deg C).

C. Service Conditions: NEMA PB 2, usual service conditions, as follows:

1. Ambient temperatures within limits specified.

D. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify COR no fewer than 14 days in advance of proposed interruption of electric service.
2. Indicate method of providing temporary electric service.
3. Do not proceed with interruption of electric service without COR written permission.
4. Comply with NFPA 70E.

1.9 COORDINATION

A. Coordinate layout and installation of switchboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Front-Connected, Front-Accessible Switchboards:

1. Main Devices: Panel mounted.
2. Branch Devices: Panel mounted.
3. Sections front and rear aligned.

B. Front- and Side-Accessible Switchboards:

1. Main Devices: Fixed, individually mounted.
2. Branch Devices: Panel mounted.
3. Sections front and rear aligned.

C. Front- and Rear-Accessible Switchboards:

1. Main Devices: Fixed, individually mounted.
2. Branch Devices: Fixed and individually compartmented mounted.
3. Sections Rear aligned.

D. Nominal System Voltage: 480Y/277 V and 208Y/120 V.

E. Main-Bus Continuous: 3000, 2500, 2000, 1600 and 1200 A.

F. Indoor Enclosures: Steel, NEMA 250, Type 1.

G. Enclosure Finish for Indoor Units: Factory-applied finish in manufacturer's standard gray finish over a rust-inhibiting primer on treated metal surface.

H. Barriers: Between adjacent switchboard sections.

I. Insulation and isolation for main and vertical buses of feeder sections.

J. Cubical Space Heaters: Factory-installed electric space heaters of sufficient wattage in each vertical section to maintain enclosure temperature above expected dew point.

1. Space-Heater Control: Thermostats to maintain temperature of each section above expected dew point.
2. Space-Heater Power Source: Transformer, factory installed in switchboard.

K. Utility Metering Compartment: Fabricated, barrier compartment and section complying with utility company's requirements; hinged sealed door; buses provisioned for mounting utility company's current transformers and potential transformers or potential taps as required by utility company. If separate vertical section is required for utility metering, match and align with basic switchboard. Provide service entrance label and necessary applicable service entrance features.

L. Customer Metering Compartment: A separate customer metering compartment and section with front hinged door, for indicated metering, and current transformers for each meter. Current transformer secondary wiring shall be terminated on shorting-type terminal blocks.

M. Bus Transition and Incoming Pull Sections: Matched and aligned with basic switchboard.

N. Hinged Front Panels: Allow access to circuit breaker, metering, accessory, and blank compartments.

O. Pull Box on Top of Switchboard:

1. Adequate ventilation to maintain temperature in pull box within same limits as switchboard.
2. Set back from front to clear circuit-breaker removal mechanism.
3. Removable covers shall form top, front, and sides. Top covers at rear shall be easily removable for drilling and cutting.
4. Bottom shall be insulating, fire-resistive material with separate holes for cable drops into switchboard.
5. Cable supports shall be arranged to facilitate cabling and adequate to support cables indicated, including those for future installation.

P. Buses and Connections: Three phase, four wire unless otherwise indicated.

1. Phase- and Neutral-Bus Material: Hard-drawn copper of 98 percent conductivity with tin-plated aluminum or copper feeder circuit-breaker line connections.
2. Load Terminals: Insulated, rigidly braced, runback bus extensions, of same material as through buses, equipped with compression connectors for outgoing circuit conductors. Provide load terminals for future circuit-breaker positions at full-ampere rating of circuit-breaker position.
3. Ground Bus: 1/4-by-2-inch- (6-by-50-mm-) hard-drawn copper of 98 percent conductivity, equipped with compression connectors for feeder and branch-circuit ground conductors. For busway feeders, extend insulated equipment grounding cable to busway ground connection and support cable at intervals in vertical run.
4. Main Phase Buses and Equipment Ground Buses: Uniform capacity for entire length of switchboard's main and distribution sections. Provide for future extensions from both ends.
5. Neutral Buses: 100 percent of the ampacity of phase buses unless otherwise indicated, equipped with compression connectors for outgoing circuit neutral cables. Brace bus extensions for busway feeder neutral bus.
6. Isolation Barrier Access Provisions: Permit checking of bus-bolt tightness.

Q. Future Devices: Equip compartments with mounting brackets, supports, bus connections, and appurtenances at full rating of circuit-breaker compartment.

R. Bus-Bar Insulation: Factory-applied, flame-retardant, tape wrapping of individual bus bars or flame-retardant, spray-applied insulation. Minimum insulation temperature rating of 105 deg C.

2.2 TRANSIENT VOLTAGE SUPPRESSION DEVICES

A. Surge Protection Device Description: IEEE C62.41-compliant, integrally mounted, wired-in, solid-state, parallel-connected, modular (with field-replaceable modules) type, with sine-wave tracking suppression and filtering modules, UL 1449, second edition, short-circuit current rating matching or exceeding the switchboard short-circuit rating, and with the following features and accessories:

1. Fuses, rated at 200-kA interrupting capacity.
2. Fabrication using bolted compression lugs for internal wiring.
3. Integral disconnect switch.
4. Redundant suppression circuits.
5. Redundant replaceable modules.
6. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
7. LED indicator lights for power and protection status.
8. Audible alarm, with silencing switch, to indicate when protection has failed.
9. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of system operation. Contacts shall reverse position on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.
10. Six-digit, transient-event counter set to totalize transient surges.

B. Peak Single-Impulse Surge Current Rating: 120 kA per mode/240 kA per phase.

C. Withstand Capabilities: 12,000 IEEE C62.41, Category C3 (10 kA), 8-by-20-mic.sec. surges with less than 5 percent change in clamping voltage.

D. Protection modes and UL 1449 SVR for grounded wye circuits with 480Y/277V or 120Y/208V, three-phase, four-wire circuits shall be as follows:

1. Line to Neutral: 800 V for 480Y/277 or 400 V for 208Y/120.
2. Line to Ground: 800 V for 480Y/277 or 400 V for 208Y/120.
3. Neutral to Ground: 800 V for 480Y/277 or 400 V for 208Y/120.

E. Protection modes and UL 1449 SVR for 240-, 480-, or 600-V, three-phase, three-wire, delta circuits shall be as follows:

1. Line to Line: 2000 V for 480 V or 1000 V for 240 V.
2. Line to Ground: 1500 V for 480 V or 800 V for 240 V.

2.3 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:

    a. Instantaneous trip.
    b. Long- and short-time pickup levels.
    c. Long- and short-time time adjustments.
    d. Ground-fault pickup level, time delay, and I^2t response.

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
5. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker; trip activation on fuse opening or on opening of fuse compartment door.
6. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
7. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
8. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

    a. Standard frame sizes, trip ratings, and number of poles.
    b. Lugs: Compression style, suitable for number, size, trip ratings, and conductor material.
    c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
    d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
    e. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.
    f. Communication Capability: Universal-mounted communication module with functions and features compatible with power monitoring and control system.
    g. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.
    h. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
    i. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.

B. Insulated-Case Circuit Breaker (ICCB): 80 percent rated, sealed, insulated-case power circuit breaker with interrupting capacity rating to meet available fault current.

1. Fixed circuit-breaker mounting.
2. Two-step, stored-energy closing.
3. Standard function, microprocessor-based trip units with interchangeable rating plug, trip indicators, and the following field-adjustable settings:

a. Instantaneous trip.
b. Long- and short-time time adjustments.
c. Ground-fault pickup level, time delay, and I^2t response.

4. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.
5. Remote trip indication and control.
6. Communication Capability: Integral communication module with functions and features compatible with power monitoring and control system specified in Section 260913 "Electrical Power Monitoring and Control."
7. Control Voltage: 120-V ac.

C. Bolted-Pressure Contact Switch: Operating mechanism uses rotary-mechanical-bolting action to produce and maintain high clamping pressure on the switch blade after it engages the stationary contacts.

1. Main-Contact Interrupting Capability: Minimum of 12 times the switch current rating.
2. Operating Mechanism: Manual handle operation to close switch; stores energy in mechanism for opening and closing.

a. Electrical Trip: Operation of lever or push-button trip switch, or trip signal from ground-fault relay or remote-control device, causes switch to open.

3. Auxiliary Switches: Factory installed, single pole, double throw, with leads connected to terminal block, and including one set more than quantity required for functional performance indicated.
4. Service-Rated Switches: Labeled for use as service equipment.
5. Ground-Fault Relay: Comply with UL 1053; self-powered type with mechanical ground-fault indicator, test function, tripping relay with internal memory, and three-phase current transformer/sensor.

a. Configuration: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
b. Internal Memory: Integrates the cumulative value of intermittent arcing ground-fault currents and uses the effect to initiate tripping.
c. No-Trip Relay Test: Permits ground-fault simulation test without tripping switch.
d. Test Control: Simulates ground fault to test relay and switch (or relay only if "no-trip" mode is selected).

6. Open-Fuse Trip Device: Arranged to trip switch open if a phase fuse opens.

D. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.

E. Fuses are specified in Section 262813 "Fuses."

2.4 INSTRUMENTATION

A. Instrument Transformers: IEEE C57.13, NEMA EI 21.1, and the following:

1. Potential Transformers: IEEE C57.13; 120 V, 60 Hz, tapped secondary; disconnecting type with integral fuse mountings. Burden and accuracy shall be consistent with connected metering and relay devices.
2. Current Transformers: IEEE C57.13; 5 A, 60 Hz, secondary; wound type; double secondary winding and secondary shorting device. Burden and accuracy shall be consistent with connected metering and relay devices.
3. Control-Power Transformers: Dry type, mounted in separate compartments for units larger than 3 kVA.
4. Current Transformers for Neutral and Ground-Fault Current Sensing: Connect secondary wiring to ground overcurrent relays, via shorting terminals, to provide selective tripping of main and tie circuit breaker. Coordinate with feeder circuit-breaker, ground-fault protection.

B. Multifunction Digital-Metering Monitor: Microprocessor-based unit suitable for three- or four-wire systems and with the following features:

1. Switch-selectable digital display of the following values with maximum accuracy tolerances as indicated:

   a. Phase Currents, Each Phase: Plus or minus 1 percent.
   b. Phase-to-Phase Voltages, Three Phase: Plus or minus 1 percent.
   c. Phase-to-Neutral Voltages, Three Phase: Plus or minus 1 percent.
   d. Megawatts: Plus or minus 2 percent.
   e. Megavars: Plus or minus 2 percent.
   f. Power Factor: Plus or minus 2 percent.
   g. Frequency: Plus or minus 0.5 percent.
   h. Accumulated Energy, Megawatt Hours: Plus or minus 2 percent; accumulated values unaffected by power outages up to 72 hours.
   i. Megawatt Demand: Plus or minus 2 percent; demand interval programmable from five to 60 minutes.
   j. Contact devices to operate remote impulse-totalizing demand meter.

2. Mounting: Display and control unit flush or semiflush mounted in instrument compartment door.

C. Ammeters, Voltmeters, and Power-Factor Meters: ANSI C39.1.

1. Meters: 4-inch (100-mm) diameter or 6 inches (150 mm) square, flush or semiflush, with antiparallax 250-degree scales and external zero adjustment.
2. Voltmeters: Cover an expanded-scale range of nominal voltage plus 10 percent.

D. Instrument Switches: Rotary type with off position.

1. Voltmeter Switches: Permit reading of all phase-to-phase voltages and, where a neutral is indicated, phase-to-neutral voltages.
2. Ammeter Switches: Permit reading of current in each phase and maintain current-transformer secondary in a closed-circuit condition at all times.

E. Feeder Ammeters: 2-1/2-inch (64-mm) minimum size with 90- or 120-degree scale. Meter and transfer device with off position, located on overcurrent device door for indicated feeder circuits only.

F. Watt-Hour Meters and Wattmeters:

1. Comply with ANSI C12.1.
2. Three-phase induction type with two stators, each with current and potential coil, rated 5 A, 120 V, 60 Hz.
3. Suitable for connection to three- and four-wire circuits.
4. Potential indicating lamps.
5. Adjustments for light and full load, phase balance, and power factor.
6. Four-dial clock register.
7. Integral demand indicator.
8. Contact devices to operate remote impulse-totalizing demand meter.
9. Ratchets to prevent reverse rotation.
10. Removable meter with drawout test plug.
11. Semiflush mounted case with matching cover.
12. Appropriate multiplier tag.

G. Impulse-Totalizing Demand Meter:

1. Comply with ANSI C12.1.
2. Suitable for use with switchboard watt-hour meter, including two-circuit totalizing relay.
3. Cyclometer.
4. Four-dial, totalizing kilowatt-hour register.
5. Positive chart drive mechanism.
6. Capillary pen holding a minimum of one month's ink supply.
7. Roll chart with minimum 31-day capacity; appropriate multiplier tag.
8. Capable of indicating and recording five 15 minute integrated demand of totalized system.

2.5 CONTROL POWER

A. Control Circuits: 120-V ac, supplied from remote branch circuit.

B. Control-Power Fuses: Primary and secondary fuses for current-limiting and overload protection of transformer and fuses for protection of control circuits.

C. Control Wiring: Factory installed, with bundling, lacing, and protection included. Provide flexible conductors for No. 8 AWG and smaller, for conductors across hinges, and for conductors for interconnections between shipping units.

2.6 ACCESSORY COMPONENTS AND FEATURES

A. Portable Test Set: For testing functions of solid-state trip devices without removing from switchboard. Include relay and meter test plugs suitable for testing switchboard meters and switchboard class relays.

2.7 IDENTIFICATION

A. Mimic Bus: Entire single-line switchboard bus work, as depicted on factory record drawing, on a photoengraved nameplate.

1. Nameplate: At least 0.032-inch- (0.813-mm-) thick anodized aluminum, located at eye level on front cover of the switchboard incoming service section.

B. Coordinate mimic-bus segments with devices in switchboard sections to which they are applied. Produce a concise visual presentation of principal switchboard components and connections.

C. Presentation Media: Painted graphics in color contrasting with background color to represent bus and components, complete with lettered designations.

D. Service Equipment Label: NRTL labeled for use as service equipment for switchboards with one or more service disconnecting and overcurrent protective devices.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Receive, inspect, handle, and store switchboards according to NECA 400.

B. Examine switchboards before installation. Reject switchboards that are moisture damaged or physically damaged.

C. Examine elements and surfaces to receive switchboards for compliance with installation tolerances and other conditions affecting performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install switchboards and accessories according to NECA 400.

B. Equipment Mounting: Install switchboards on concrete base, 4-inch (100-mm) nominal thickness.

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to switchboards.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from switchboard units and components.

D. Operating Instructions: Frame and mount the printed basic operating instructions for switchboards, including control and key interlocking sequences and emergency procedures. Fabricate frame of finished wood or metal and cover instructions with clear acrylic plastic. Mount on front of switchboards.

E. Install filler plates in unused spaces of panel-mounted sections.

F. Install overcurrent protective devices, transient voltage suppression devices, and instrumentation.

1. Set field-adjustable switches and circuit-breaker trip ranges.

G. Install spare-fuse cabinet.

H. Comply with NECA 1.

3.3 CONNECTIONS

A. Comply with requirements for terminating feeder bus specified in Section 262500 "Enclosed Bus Assemblies." Drawings indicate general arrangement of bus, fittings, and specialties.

3.4 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

B. Switchboard Nameplates: Label each switchboard compartment with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

C. Device Nameplates: Label each disconnecting and overcurrent protective device and each meter and control device mounted in compartment doors with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

A. Testing Agency Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Acceptance Testing Preparation:

1. Test insulation resistance for each switchboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

E. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Perform the following infrared scan tests and inspections and prepare reports:

a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switchboard. Remove front panels so joints and connections are accessible to portable scanner.
b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switchboard 11 months after date of Substantial Completion.
c. Instruments and Equipment:

1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

F. Switchboard will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports, including a certified report that identifies switchboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.6 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip as specified in Section 260573 "Overcurrent Protective Device Coordination Study."

3.7 PROTECTION

A. Temporary Heating: Apply temporary heat, to maintain temperature according to manufacturer's written instructions, until switchboard is ready to be energized and placed into service.

3.8 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain switchboards, overcurrent protective devices, instrumentation, and accessories, and to use and reprogram microprocessor-based trip, monitoring, and communication units.

END OF SECTION 262413

SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.
3. Load centers.

1.3 DEFINITIONS

A. SVR: Suppressed voltage rating.

B. TVSS: Transient voltage surge suppressor.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types and details for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Short-circuit current rating of panelboards and overcurrent protective devices.
5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
6. Include wiring diagrams for power, signal, and control wiring.
7. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

1.5 INFORMATIONAL SUBMITTALS

A. Field Quality-Control Reports:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

B. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section ~~017823~~ 017820 "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. Comply with NEMA PB 1.

F. Comply with NFPA 70.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.

B. Handle and prepare panelboards for installation according to NECA 407.

1.9 PROJECT CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.

C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify COR no fewer than 14 days in advance of proposed interruption of electric service.
2. Do not proceed with interruption of electric service without COR’s written permission.
3. Comply with NFPA 70E.

1.10 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

1.11 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Enclosures: Flush- and surface mounted cabinets.

1. Rated for environmental conditions at installed location.

a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
b. Outdoor Locations: NEMA 250, Type 3R.
c. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
d. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
4. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
5. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
6. Finishes:

a. Panels and Trim: Galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
b. Back Boxes: Same finish as panels and trim.
c. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components.

7. Directory Card: Inside panelboard door, mounted in transparent card holder.

B. Incoming Mains Location: Top and bottom.

C. Phase, Neutral, and Ground Buses:

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
3. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box.

D. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Main and Neutral Lugs: Compression type.
3. Ground Lugs and Bus-Configured Terminators: Compression type.
4. Feed-Through Lugs: Compression type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.

5. Subfeed (Double) Lugs: Compression type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
6. Gutter-Tap Lugs: Compression type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.

E. Service Equipment Label: NRTL labeled for use as service equipment for panelboards or load centers with one or more main service disconnecting and overcurrent protective devices.

F. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

G. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.2 PERFORMANCE REQUIREMENTS

A. Surge Suppression: Factory installed as an integral part of indicated panelboards, complying with UL 1449 SPD Type 2.

2.3 DISTRIBUTION PANELBOARDS

A. Panelboards: NEMA PB 1, power and feeder distribution type.

B. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

1. For doors more than 36 inches (914 mm) high, provide two latches, keyed alike.

C. Mains: Circuit breaker.

D. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.

E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

F. Branch Overcurrent Protective Devices: Fused switches.

G. Contactors in Main Bus: NEMA ICS 2, Class A, electrically held, general-purpose controller, with same short-circuit interrupting rating as panelboard.

1. Internal Control-Power Source: Control-power transformer, with fused primary and secondary terminals, connected to main bus ahead of contactor connection.
2. External Control-Power Source: 120-V branch circuit.

2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

B. Mains: Circuit breaker.

C. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

D. Contactors in Main Bus: NEMA ICS 2, Class A, electrically held, general-purpose controller, with same short-circuit interrupting rating as panelboard.

1. Internal Control-Power Source: Control-power transformer, with fused primary and secondary terminals, connected to main bus ahead of contactor connection.
2. External Control-Power Source: 120-V branch circuit.

E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

F. Column-Type Panelboards: Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.

2.5 LOAD CENTERS

A. Load Centers: Comply with UL 67.

B. Mains: Circuit breaker.

C. Branch Overcurrent Protective Devices: Plug-in circuit breakers, replaceable without disturbing adjacent units.

D. Conductor Connectors: Mechanical type for main, neutral, and ground lugs and buses.

2.6 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:

   a. Instantaneous trip.
   b. Long- and short-time pickup levels.
   c. Long- and short-time time adjustments.

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
5. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).

6. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
7. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

    a. Standard frame sizes, trip ratings, and number of poles.
    b. Lugs: Compression style, suitable for number, size, trip ratings, and conductor materials.
    c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
    d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
    e. Shunt Trip: 120 V trip coil energized from separate circuit, set to trip at **75** percent of rated voltage.
    f. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage with field-adjustable 0.1- to 0.6-second time delay.
    g. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts and "b" contacts operate in reverse of circuit-breaker contacts.
    h. Alarm Switch: Single-pole, normally open contact that actuates only when circuit breaker trips.
    i. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
    j. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function with other upstream or downstream devices.
    k. Multipole units enclosed in a single housing or factory assembled to operate as a single unit.
    l. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.
    m. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Receive, inspect, handle, and store panelboards according to NECA 407.

B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.

C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install panelboards and accessories according to NECA 407.

B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

C. Mount top of trim 90 inches (2286 mm) above finished floor unless otherwise indicated.

D. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

E. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.

F. Install filler plates in unused spaces.

G. Stub four 1-inch (27-GRC) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch (27-GRC) empty conduits into raised floor space or below slab not on grade.

H. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

I. Comply with NECA 1.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 260553 "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

D. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

E. Panelboards will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as specified in Section 260573 "Overcurrent Protective Device Coordination Study."

C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.

1. Measure as directed during period of normal system loading.
2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

3.6 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION 262416

SECTION 262500 - ENCLOSED BUS ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Feeder-bus assemblies.
2. Plug-in bus assemblies.
3. Bus plug-in devices.

1.3 DEFINITIONS

A. TVSS: Transient voltage surge suppressor.

1.4 ACTION SUBMITTALS

A. Shop Drawings: For each type of bus assembly and plug-in device.

1. Show fabrication and installation details for enclosed bus assemblies. Include plans, elevations, and sections of components. Designate components and accessories, including clamps, brackets, hanger rods, connectors, straight lengths, and fittings.
2. Show fittings, materials, fabrication, and installation methods for listed fire-stop barriers.
3. Indicate required clearances, method of field assembly, and location and size of each field connection.
4. Detail connections to switchgear, switchboards, transformers, and panelboards.
5. Wiring Diagrams: Power wiring.
6. Seismic-Restraint Details: Signed and sealed by a qualified professional engineer.

    a. Design Calculations: Calculate requirements for selecting seismic restraints.
    b. Detail fabrication, including anchorages and attachments to structure and to supported equipment.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Floor plans and sections, drawn to scale. Include scaled bus-assembly layouts and relationships between components and adjacent structural, mechanical, and electrical elements. Show the following:

1. Vertical and horizontal enclosed bus-assembly runs, offsets, and transitions.
2. Clearances for access above and to the side of enclosed bus assemblies.
3. Vertical elevation of enclosed bus assemblies above the floor or bottom of structure.
4. Support locations, type of support, and weight on each support.

B. Location of adjacent construction elements including light fixtures, HVAC and plumbing equipment, fire sprinklers and piping, signal and control devices, and other equipment.

C. Product Certificates: For each type of enclosed bus assembly, signed by product manufacturer.

D. Field quality-control test reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For enclosed bus assemblies to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

B. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

C. Source Limitations: Obtain enclosed bus assemblies and plug-in devices through one source from a single manufacturer.

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

E. Comply with NEMA BU 1, "Busways."

F. Comply with NFPA 70.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle enclosed bus assemblies according to NEMA BU 1.1, "General Instructions for Proper Handling, Installation, Operation and Maintenance of Busway Rated 600 Volts or Less."

1.9 PROJECT CONDITIONS

A. Derate enclosed bus assemblies for continuous operation at indicated ampere ratings for ambient temperature not exceeding 122 deg F (50 deg C).

1.10 COORDINATION

A. Coordinate layout and installation of enclosed bus assemblies and suspension system with other construction that penetrates ceilings or floors or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

B. Coordinate size and location of concrete curbs around openings for vertical bus. Concrete, reinforcement, and formwork requirements are specified with concrete.

PART 2 - PRODUCTS

2.1 ENCLOSED BUS ASSEMBLIES

A. Feeder-Bus Assemblies: NEMA BU 1, low-impedance bus assemblies in nonventilated housing; single-bolt joints; ratings as indicated.
   1. Voltage: 120/208 and 480V; 3 phase; 100 percent neutral capacity.
   2. Temperature Rise: 55 deg C above 40 deg C ambient maximum for continuous rated current.
   3. Bus Materials: Current-carrying copper conductors, fully insulated with Class 130C insulation except at joints; plated surface at joints.
   4. Ground:
      a. 50 percent capacity internal bus bars of material matching bus material.
   5. Enclosure: Steel with manufacturer's standard finish.
   6. Fittings and Accessories: Manufacturer's standard.
   7. Mounting: Arranged flat, edgewise, or vertically without derating.

B. Plug-in Bus Assemblies: NEMA BU 1, low-impedance bus assemblies in nonventilated housing; single-bolt joints; ratings as indicated.
   1. Voltage: 120/208 and 480 V; 3 phase; 100 percent neutral capacity.
   2. Temperature Rise: 55 deg C above 40 deg C ambient maximum for continuous rated current.
   3. Bus Materials: Current-carrying copper conductors, fully insulated with Class 130C insulation except at stabs and joints; plated surface at stabs and joints.
   4. Ground:
      a. 50 percent capacity internal bus bar of material matching bus material.
   5. Enclosure: Steel, with manufacturer's standard finish, plug-in openings 24 inches (610 mm) o.c., and hinged covers over unused openings.
   6. Fittings and Accessories: Manufacturer's standard.
   7. Mounting: Arranged flat, edgewise, or vertically without derating.

2.2 PLUG-IN DEVICES

A. Fusible Switches: NEMA KS 1, heavy duty; with J-type fuse clips to accommodate specified fuses; hookstick-operated handle, lockable with two padlocks, and interlocked with cover in closed position. See Section 262813 "Fuses" for fuses and fuse installation requirements.

B. Molded-Case Circuit Breakers: NEMA AB 1; hookstick-operated handle, lockable with two padlocks, and interlocked with cover in closed position.

C. TVSS: NEMA 250, Type 1 enclosure with NEMA KS 1, fusible, disconnect switch and external handle to isolate TVSS from busway. TVSS product and installation requirements are specified in Section 264313 "Surge Protection for Low-Voltage Electrical Power Circuits."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Support bus assemblies independent of supports for other elements such as equipment enclosures at connections to panelboards and switchboards, pipes, conduits, ceilings, and ducts.
   1. Design each fastener and support to carry 200 lb (90 kg) or 4 times the weight of bus assembly, whichever is greater.
   2. Support bus assembly to prevent twisting from eccentric loading.
   3. Support bus assembly with not less than 3/8-inch (10-mm) steel rods. Install side bracing to prevent swaying or movement of bus assembly. Modify supports after completion to eliminate strains and stresses on bus bars and housings.
   4. Fasten supports securely to building structure according to Section 260529 "Hangers and Supports for Electrical Systems."

B. Install expansion fittings at locations where bus assemblies cross building expansion joints. Install at other locations so distance between expansion fittings does not exceed manufacturer's recommended distance between fittings.

C. Install a concrete curb at least 4 inches (100 mm) high around bus-assembly floor penetrations.

D. Coordinate bus-assembly terminations to equipment enclosures to ensure proper phasing, connection, and closure.

E. Tighten bus-assembly joints with torque wrench or similar tool recommended by bus-assembly manufacturer. Tighten joints again after bus assemblies have been energized for 30 days.

F. Install bus-assembly, plug-in units. Support connecting conduit independent of plug-in unit.

3.2 CONNECTIONS

A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to provide dimensions, inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.

C. Perform tests and inspections and prepare test reports.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

E. Remove and replace units that do not pass tests and inspections and retest as specified above.

F. Infrared Scanning: Two months after Substantial Completion, perform an infrared scan of bus assembly including joints and plug-in units.

1. Use an infrared-scanning device designed to measure temperature or detect significant deviations from normal values. Provide documentation of device calibration.
2. Perform 2 follow-up infrared scans of bus assembly, one at 4 months and the other at 11 months after Substantial Completion.
3. Prepare a certified report identifying bus assembly checked and describing results of scanning. Include notation of deficiencies detected, remedial action taken, and scanning observations after remedial action.

G. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.

3.4 ADJUSTING

A. Set field-adjustable, circuit-breaker trip ranges as indicated.

3.5 CLEANING

A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

3.6 PROTECTION

A. Provide final protection to ensure that moisture does not enter bus assembly.

END OF SECTION 262500

SECTION 262713 - ELECTRICITY METERING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes equipment for electricity metering by Owner.

1.3 DEFINITIONS

A. KY Pulse: Term used by the metering industry to describe a method of measuring consumption of electricity that is based on a relay opening and closing in response to the rotation of the disk in the meter.

B. PC: Personal computer.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For electricity-metering equipment.

1. Dimensioned plans and sections or elevation layouts.
2. Wiring Diagrams: For power, signal, and control wiring. Identify terminals and wiring designations and color-codes to facilitate installation, operation, and maintenance. Indicate recommended types, wire sizes, and circuiting arrangements for field-installed wiring, and show circuit protection features.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, store, and handle modular meter center according to NECA 400.

1.8 PROJECT CONDITIONS

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:
   As shown on drawings
   1. Do not proceed with interruption of electrical service without COR written permission.

1.9 COORDINATION

A. Electrical Service Connections: Coordinate with utility companies and components they furnish as follows:

   1. Comply with requirements of utilities providing electrical power services.
   2. Coordinate installation and connection of utilities and services, including provision for electricity-metering components.

PART 2 - PRODUCTS

2.1 EQUIPMENT FOR ELECTRICITY METERING BY OWNER

A. General Requirements for Owner's Meters:

   1. Comply with UL 1244.
   2. Enclosure: NEMA 250, Type 3R minimum, with hasp for padlocking or sealing.
   3. Identification: Comply with requirements in Section 260553 "Identification for Electrical Systems."
   4. Memory Backup: Self-contained to maintain memory throughout power outages of 72 hours, minimum.
   5. Sensors: Current-sensing type, with current or voltage output, selected for optimum range and accuracy for meters indicated for this application.

      a. Type: solid core.

   6. Current-Transformer Cabinet: Listed or recommended by metering equipment manufacturer for use with sensors indicated.
   7. Building Automation System (BAS) Interface: One digital KY pulse to a user-definable increment of energy measurement. Match signal to BAS input and arrange to convey the instantaneous, integrated, demand level measured by meter to provide data for processing and possible programmed demand control action by destination system.

B. Kilowatt-hour Meter: Electronic single and three phase meters, measuring electricity used.

   1. Voltage and Phase Configuration: Meter shall be designed for use on circuits with voltage rating and phase configuration indicated for its application.

2. Display: LCD with characters not less than 0.25 inch (6 mm) high, indicating accumulative kilowatt-hours and current kilowatt load. Retain accumulated kilowatt-hour in a nonvolatile memory, until reset.

C. Kilowatt-hour/Demand Meter: Electronic single and three phase meters, measuring electricity use and demand. Demand shall be integrated over a 15-minute interval.

1. Voltage and Phase Configuration: Meter shall be designed for use on circuits with voltage rating and phase configuration indicated for its application.
2. Display: LCD with characters not less than 0.25 inch (6 mm) high, indicating accumulative kilowatt-hours, current time and date, current demand, historic peak demand, and time and date of historic peak demand. Retain accumulated kilowatt-hour and historic peak demand in a nonvolatile memory, until reset.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with equipment installation requirements in NECA 1.

B. Install modular meter center according to NECA 400 switchboard installation requirements.

3.2 IDENTIFICATION

A. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

1. Series Combination Warning Label: Self-adhesive type, with text as required by NFPA 70.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Connect a load of known kilowatt rating, 1.5 kW minimum, to a circuit supplied by metered feeder.
2. Turn off circuits supplied by metered feeder and secure them in off condition.
3. Run test load continuously for eight hours minimum, or longer, to obtain a measurable meter indication. Use test-load placement and setting that ensures continuous, safe operation.

4. Check and record meter reading at end of test period and compare with actual electricity used, based on test-load rating, duration of test, and sample measurements of supply voltage at test-load connection. Record test results.

C. Electricity metering will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION 262713

SECTION 262813 - FUSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Plug fuses rated 125-V ac and less for use in plug-fuse-type fuseholders.
2. Plug-fuse adapters for use in Edison-base, plug-fuse sockets.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material, dimensions, descriptions of individual components, and finishes for spare-fuse cabinets. Include the following for each fuse type indicated:

1. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.

   a. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
   b. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.

2. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
3. Current-limitation curves for fuses with current-limiting characteristics.
4. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse.
5. Coordination charts and tables and related data.
6. Fuse sizes for elevator feeders and elevator disconnect switches.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017820 "Operation and Maintenance Data," include the following:

1. Ambient temperature adjustment information.
2. Current-limitation curves for fuses with current-limiting characteristics.
3. Coordination charts and tables and related data.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NEMA FU 1 for cartridge fuses.

C. Comply with NFPA 70.

D. Comply with UL 248-11 for plug fuses.

1.6 PROJECT CONDITIONS

A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F (5 deg C) or more than 100 deg F (38 deg C), apply manufacturer's ambient temperature adjustment factors to fuse ratings.

1.7 COORDINATION

A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

PART 2 - PRODUCTS

2.1 PLUG FUSES

A. Characteristics: UL 248-11, nonrenewable plug fuses; 125-V ac.

2.2 PLUG-FUSE ADAPTERS

A. Characteristics: Adapters for using Type S, rejection-base plug fuses in Edison-base fuseholders or sockets; ampere ratings matching fuse ratings; irremovable once installed.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.

B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.

C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

A. Plug Fuses:

1. Motor Branch Circuits: Type S, dual element time delay.
2. Other Branch Circuits: Type S, dual-element time delay.

3.3 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

3.4 IDENTIFICATION

A. Install labels complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems" and indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION 262813

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fusible switches.
2. Nonfusible switches.
3. Receptacle switches.
4. Shunt trip switches.
5. Molded-case circuit breakers (MCCBs).
6. Molded-case switches.
7. Enclosures.

1.3 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current ratings (interrupting and withstand, as appropriate).
4. Include evidence of NRTL listing for series rating of installed devices.
5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
6. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

B. Manufacturer's field service report.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017820 "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
2. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. Comply with NFPA 70.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F (minus 30 deg C) and not exceeding 104 deg F (40 deg C).

B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify NASA–no fewer than 14 days in advance of proposed interruption of electric service.
2. Indicate method of providing temporary electric service.
3. Do not proceed with interruption of electric service without COR's written permission.
4. Comply with NFPA 70E.

1.9 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

A. Type HD, Heavy Duty, Single Throw, 240 or 600 V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

B. Type HD, Heavy Duty, Double Throw, 240 or 600 V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
4. Hookstick Handle: Allows use of a hookstick to operate the handle.
5. Lugs: Compression type, suitable for number, size, and conductor material.
6. Service-Rated Switches: Labeled for use as service equipment.

2.2 NONFUSIBLE SWITCHES

A. Type HD, Heavy Duty, Single Throw, 240 or 600 V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

B. Type HD, Heavy Duty, Double Throw, 240 or 600 V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Hookstick Handle: Allows use of a hookstick to operate the handle.
4. Lugs: Compression type, suitable for number, size, and conductor material.

2.3 RECEPTACLE SWITCHES

A. Type HD, Heavy-Duty, Single-Throw Fusible Switch: 240 or 600 V ac, 30, 60 or 100 A; UL 98 and NEMA KS 1; horsepower rated, with clips or bolt pads to accommodate indicated fuses; lockable handle with capability to accept three padlocks; interlocked with cover in closed position.

B. Type HD, Heavy-Duty, Single-Throw Nonfusible Switch: 240 or 600 V ac, 30, 60 or 100 A; UL 98 and NEMA KS 1; horsepower rated, lockable handle with capability to accept three padlocks; interlocked with cover in closed position.

2.4 SHUNT TRIP SWITCHES

A. General Requirements: Comply with ASME A17.1, UL 50, and UL 98, with 200-kA interrupting and short-circuit current rating when fitted with Class J fuses.

B. Control Circuit: 120-V ac; obtained from integral control power transformer, with primary and secondary fuses, with a control power transformer source of enough capacity to operate shunt trip, connected pilot, and indicating and control devices.

C. Accessories:

1. Oiltight key switch for key-to-test function.
2. Oiltight red ON pilot light.
3. Isolated neutral lug; 100 percent rating.
4. Mechanically interlocked auxiliary contacts that change state when switch is opened and closed.
5. Form C alarm contacts that change state when switch is tripped.
6. Three-pole, double-throw, fire-safety and alarm relay; 120-V ac coil voltage.

2.5 MOLDED-CASE CIRCUIT BREAKERS

A. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.

B. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

C. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

D. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:

1. Instantaneous trip.
2. Long- and short-time time adjustments.
3. Ground-fault pickup level, time delay, and I^2t response.

E. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.

F. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker and trip activation on fuse opening or on opening of fuse compartment door.

G. Ground-Fault, Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).

H. Ground-Fault, Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).

I. Features and Accessories:

1. Standard frame sizes, trip ratings, and number of poles.
2. Lugs: Compression type, suitable for number, size, trip ratings, and conductor material.
3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
4. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
5. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
6. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
7. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
8. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.

2.6 MOLDED-CASE SWITCHES

A. General Requirements: MCCB with fixed, high-set instantaneous trip only, and short-circuit withstand rating equal to equivalent breaker frame size interrupting rating.

B. Features and Accessories:

1. Standard frame sizes and number of poles.
2. Lugs: Compression type, suitable for number, size, trip ratings, and conductor material.
3. Ground-Fault Protection: Comply with UL 1053; remote-mounted and powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
4. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
5. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.

2.7 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 12.
2. Outdoor Locations: NEMA 250, Type 3R.
3. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
4. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

C. Install fuses in fusible devices.

D. Comply with NECA 1.

3.3 IDENTIFICATION

A. Comply with requirements in Section 260553 "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

D. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

E. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as specified in Section 260573 "Overcurrent Protective Device Coordination Study."

END OF SECTION 262816

SECTION 264313 - SURGE PROTECTION FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes field-mounted SPDs for low-voltage (120 to 600 V) power distribution and control equipment.

1.3 DEFINITIONS

A. Inominal: Nominal discharge current.

B. MCOV: Maximum continuous operating voltage.

C. Mode(s), also Modes of Protection: The pair of electrical connections where the VPR applies.

D. MOV: Metal-oxide varistor; an electronic component with a significant non-ohmic current-voltage characteristic.

E. OCPD: Overcurrent protective device.

F. SCCR: Short-circuit current rating.

G. SPD: Surge protective device.

H. VPR: Voltage protection rating.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
2. Copy of UL Category Code VZCA certification, as a minimum, listing the tested values for VPRs, Inominal ratings, MCOVs, type designations, OCPD requirements, model numbers, system voltages, and modes of protection.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For SPDs to include in maintenance manuals.

1.7 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to replace or replace SPDs that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL SPD REQUIREMENTS

A. SPD with Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Comply with UL 1449.

D. MCOV of the SPD shall be the nominal system voltage.

2.2 SERVICE ENTRANCE SUPPRESSOR

A. SPDs: Comply with UL 1449, Type 1.

B. SPDs: Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1449, Type 1

1. SPDs with the following features and accessories:

a. Integral disconnect switch.
b. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
c. Indicator light display for protection status.
d. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.

e. Surge counter.

C. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 240kA. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.

D. Protection modes and UL 1449 VPR for grounded wye circuits with 480Y/277 V or 208Y/120 V, three-phase, four-wire circuits shall not exceed the following:

1. Line to Neutral: 1200 V for 480Y/277 V and 700 V for 208Y/120 V.
2. Line to Ground: 1200 V for 480Y/277 V and 1200 V for 208Y/120 V.
3. Line to Line: 2000 V for 480Y/277 V and 1000 V for 208Y/120 V.

E. SCCR: Equal or exceed 100 kA.

2.3 PANEL SUPPRESSORS

A. SPDs: Comply with UL 1449, Type 1.

1. Include LED indicator lights for power and protection status.
2. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
3. Include Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.

B. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 160 KA. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.

C. Protection modes and UL 1449 VPR for grounded wye circuits with 480Y/277 V or 208Y/120 V, three-phase, four-wire circuits shall not exceed the following:

1. Line to Neutral: 1200 V for 480Y/277 V or 700 V for 208Y/120 V.
2. Line to Ground: 1200 V for 480Y/277 V or 700 V for 208Y/120 V.
3. Neutral to Ground: 1200 V for 480Y/277 V or 700 V for 208Y/120 V.
4. Line to Line: 2000 V for 480Y/277 V or 1200 V for 208Y/120 V

D. Protection modes and UL 1449 VPR for 240/120-V, single-phase, three-wire circuits shall not exceed the following:

1. Line to Neutral: 700 V.
2. Line to Ground: 700 V.
3. Neutral to Ground: 700 V.
4. Line to Line: 1200 V.

E. SCCR: Equal or exceed 100 kA.

2.4 ENCLOSURES

A. Indoor Enclosures: NEMA 250, Type 1.

2.5 CONDUCTORS AND CABLES

A. Class 1 Control Cables: Multiconductor cable with copper conductors not smaller than No. 14 AWG, complying with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1.

B. Install an OCPD or disconnect as required to comply with the UL listing of the SPD.

C. Install SPDs with conductors between suppressor and points of attachment as short and straight as possible, and adjust circuit-breaker positions to achieve shortest and straightest leads. Do not splice and extend SPD leads unless specifically permitted by manufacturer. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.

D. Use crimped connectors and splices only. Wire nuts are unacceptable.

E. Wiring:

1. Power Wiring: Comply with wiring methods in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
2. Controls: Comply with wiring methods in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.2 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative.

1. Compare equipment nameplate data for compliance with Drawings and Specifications.
2. Inspect anchorage, alignment, grounding, and clearances.
3. Verify that electrical wiring installation complies with manufacturer's written installation requirements.

B. An SPD will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.3 STARTUP SERVICE

A. Complete startup checks according to manufacturer's written instructions.

B. Do not perform insulation-resistance tests of the distribution wiring equipment with SPDs installed. Disconnect SPDs before conducting insulation-resistance tests, and reconnect them immediately after the testing is over.

C. Energize SPDs after power system has been energized, stabilized, and tested.

3.4 DEMONSTRATION

A. Train Owner's maintenance personnel to operate and maintain SPDs.

END OF SECTION 264313