

CAPE CANAVERAL AIR FORCE STATION

TECHNICAL SPECIFICATIONS

FOR

Repair Chillers, Motion Lab, Fac 1605

DBEH 06-1588

Final

DATE: March 2012



TESS

Technical Engineering
And Spacelift Services

PROJECT TABLE OF CONTENTS

DIVISION 01 - GENERAL REQUIREMENTS

01 11 00.00 55	SUMMARY OF WORK
01 33 00	SUBMITTAL PROCEDURES
01 35 26	GENERAL SAFETY REQUIREMENTS
01 42 00	SOURCES FOR REFERENCE PUBLICATIONS
01 57 20.00 10	ENVIRONMENTAL PROTECTION
01 74 19	INTEGRATED SOLID WASTE MANAGEMENT
01 78 00	CLOSEOUT PROCEDURES

DIVISION 23 - HEATING, VENTILATING, AND AIR CONDITIONING

23 00 00	AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEMS
23 05 93	TESTING, ADJUSTING, AND BALANCING FOR HVAC
23 07 00	THERMAL INSULATION FOR MECHANICAL SYSTEMS

DIVISION 26 - ELECTRICAL

26 00 00.00 20	BASIC ELECTRICAL MATERIALS AND METHODS
26 20 00	INTERIOR DISTRIBUTION SYSTEM

-- End of Project Table of Contents --

SECTION TABLE OF CONTENTS

DIVISION 01 - GENERAL REQUIREMENTS

SECTION 01 11 00.00 55

SUMMARY OF WORK

PART 1 GENERAL

- 1.1 SUMMARY
- 1.2 PROJECT DESCRIPTION
 - 1.2.1 Mechanical
 - 1.2.2 Electrical
- 1.3 REFERENCES
- 1.4 SUBMITTALS
- 1.5 CONTRACT DRAWINGS
 - 1.5.1 Layout of Work and Elevations
- 1.6 WORK SCHEDULING
 - 1.6.1 Requirements
- 1.7 OCCUPANCY OF PREMISES/ACCESS REQUIREMENTS
 - 1.7.1 Facility Contents
 - 1.7.1.1 Responsibilities
 - 1.7.1.2 Maintain Clean Work Areas
 - 1.7.1.3 Damage To Existing Equipment
 - 1.7.1.4 New Material and Construction Equipment
 - 1.7.2 Construction Area Access And Control
 - 1.7.2.1 Access and Control Requirements
 - 1.7.3 Vehicle Parking
 - 1.7.3.1 Requirements
- 1.8 STORAGE, TRANSPORTATION AND PROTECTION
 - 1.8.1 Storage
 - 1.8.2 Protection
 - 1.8.3 Transportation
 - 1.8.4 Hazardous Materials
 - 1.8.5 Site Protection Plan
- 1.9 PROTECTION OF WORK
- 1.10 GOVERNMENT-FURNISHED MATERIALS - None
- 1.11 ON-SITE PERMITS
 - 1.11.1 Utility Outage Requests And Connection Requests
 - 1.11.1.1 Requirements
 - 1.11.2 Work Clearance Request
 - 1.11.3 Burn Permits
- 1.12 SALVAGE AND DISPOSAL OF MATERIAL AND EQUIPMENT
 - 1.12.1 Removal
 - 1.12.2 Housekeeping
 - 1.12.3 Salvage Of Material And Equipment
 - 1.12.3.1 Salvage Items - None
 - 1.12.4 Waste Disposal
 - 1.12.5 Cleanup
 - 1.12.6 Salvage And Disposal Record Keeping
- 1.13 RADIO FREQUENCY MANAGEMENT PROCEDURES
- 1.14 COMMUNICATION SECURITY

PART 2 PRODUCTS

PART 3 EXECUTION

- 3.1 CCAFS ACCESS REQUIREMENTS
 - 3.1.1 Badge Requirements
 - 3.1.1.1 Citizenship
 - 3.1.2 General Cape Entry Requirements
 - 3.1.3 Cape Entry Requirements for White Badge (Unescorted)
 - 3.1.4 Temporary Cape Entry Requirements for Pink Badge (Escort Required)
 - 3.1.5 Construction Site Requirement
 - 3.1.6 Air Force Restricted Area Requirements (Black & Blue Restricted Unescorted Badge)
- 3.2 BADGE CONTROL AND ACCOUNTABILITY
 - 3.2.1 Safeguarding Badges
 - 3.2.2 Reporting Lost Badges
 - 3.2.3 Returned Badges
- 3.3 CCAFS DELIVERIES
 - 3.3.1 Non-Hazardous Deliveries
 - 3.3.2 Hazardous Deliveries
- 3.4 RESPONSIBILITIES
- 3.5 EXCAVATION
 - 3.5.1 Dig/Utility Locate Permit Requirements
 - 3.5.1.1 Location of Buried Structures and Utility Lines
 - 3.5.1.2 Excavation, Trenching, and Backfilling
 - 3.5.1.3 Cutting of Roads, Streets, Driveways, and Paved Areas
 - 3.5.2 Restrictions
 - 3.5.3 Temporary Shoring, Bracing And Supports
 - 3.5.4 Barricades
- 3.6 LAND SURVEYING REQUIREMENTS
 - 3.6.1 Contractor Provided Survey Support
 - 3.6.1.1 Horizontal Reference Datum
 - 3.6.1.2 Vertical Reference Datum
- 3.7 WELDER QUALIFICATION REQUIREMENTS
 - 3.7.1 Welding And Brazing
- 3.8 HOISTING AND LIFTING
 - 3.8.1 Lifting Operation Plan
- 3.9 QUALITY CONTROL
 - 3.9.1 Licenses
 - 3.9.2 Government Inspection/Approval
 - 3.9.3 Inspection Files
- 3.10 SUPERINTENDENT
- 3.11 CONSTRUCTION SCHEDULING REQUIREMENTS
 - 3.11.1 Contractor Coordination Meetings
 - 3.11.2 On-Site Construction Sequence

-- End of Section Table of Contents --

SECTION 01 11 00.00 55

SUMMARY OF WORK

PART 1 GENERAL

1.1 SUMMARY

The work to be performed under this project is located at Cape Canaveral Air Force Station. Cape Canaveral Air Force Station is located at the end of State Road 401, north of Port Canaveral.

The work to be performed under this project consists of providing the labor, equipment and materials to replace and demolish two existing 50-ton Trane air-cooled package chillers serving the Motion Picture Lab, Facility 1605 with one new 100 ton high efficiency chiller. Removed third unit left abandoned in place and modify the existing chilled water piping to accommodate installation of new chiller. Temporary chilled water shall be provided to the facility during construction via temporary chiller tied into piping.

1.2 PROJECT DESCRIPTION

1.2.1 Mechanical

Demolish three existing air-cooled chillers and housekeeping pads at the north of the facility. Two units are operational and the third is abandoned in place. Existing chilled water piping to be modified as required to accommodate removal of existing units and installation of new 100 ton air cooled chiller specified. New 100 ton air cooled chiller mounted on new concrete pad shall be tied into the chilled water distribution piping for the facility and tested and balanced as required to meet the existing operation conditions. During construction the contractor is responsible for providing temporary chilled water to the facility via temporary chiller.

1.2.2 Electrical

Disconnect and remove power to existing HVAC components. Provide power for all newly installed HVAC components. Install new breaker in existing switchboard SWBW 1 to feed the new air cooled chiller..

1.3 REFERENCES

The Wing 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.

45TH SPACE WING (SWI)

45 SWI 31-101

CCAFS Physical Security Program

AMERICAN WELDING SOCIETY (AWS)

AWS B2.1

(2005; Errata 2006; Errata 2006) Welding
Procedure and Performance Qualification

AWS D1.1/D1.1M (2008) Structural Welding Code - Steel

ASME INTERNATIONAL (ASME)

ASME BPVC SEC IX (2007; Addenda 2008) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 241 Safeguarding Construction, Alteration, and Demolition Operations

U.S. AIR FORCE (USAF)

AFI 33-118 (2002) Radio Frequency (RF) Spectrum Management

U.S. ARMY CORPS OF ENGINEERS (USACE)

COE EM 385-1-1 Safety and Health Requirements Manual

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-600-01 (26 September 2006 Change 1, 14 July 2009) Fire Protection Engineering for Facilities

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910 Occupational Safety and Health Standards

29 CFR 1926 Safety and Health Regulations for Construction

1.4 SUBMITTALS

The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES in sufficient detail to show full compliance with the specification:

SD-01 Preconstruction Submittals

Submit the following items to the Contracting Officer (throughout this document, the term "Contracting Officer" shall mean "Contracting Officer or his Representative:")

Lifting Operation Plan

Utility Outage Requests

Connection Requests

Hazardous Materials (including all paint)

Disposal Log

1.5 CONTRACT DRAWINGS

See Drawing Index for list of project drawings.

Contract drawings, maps, and specifications will be furnished to the Contractor either hard copy or electronic at the Government's discretion (electronic drawings are to be provided in .dwg format). Reference publications will not be furnished.

Contractor shall immediately check furnished drawings and notify the Contracting Officer of any discrepancies. Verify all drawings are 100 percent final drawings released for construction.

The drawings indicate the general location and arrangement of existing conditions. It is mandatory that the Contractor visit the site to determine the complexity of the work and the existing conditions affecting the work. Field measurements may be necessary to determine the size and quantity of materials. Conditions which are obvious/visible or which should be reasonably anticipated by the Contractor on inspection will not be considered under the Differing Site Conditions clause of this contract.

1.5.1 Layout of Work and Elevations

Dimensions and elevations indicated in the layout of work shall be verified by the Contractor. Discrepancies between the drawings, specifications and/or existing conditions shall be referred to the Contracting Officer in writing, for review, before the affected work is performed. Failure to make notification shall place the responsibility upon the Contractor to carry out the work in a satisfactory and workmanlike manner.

1.6 WORK SCHEDULING

Work Schedules for all on-site activities must be reviewed and approved by the Contracting Officer prior to start of the project; and all activities coordinated with the Contracting Officer once work has begun. Due to the critical nature of the work location, all work pertaining to this contract shall be completed with minimal disruption to the operation of Facility 54800 operations..

Contractor shall allow for non-access days where construction activity is prohibited due to hazardous operations or launch activity. When possible, the Government will provide 24 hour notification each time the restrictions are invoked.

1.6.1 Requirements

Working hours will normally range between the hours of 7:30 AM and 4:00 PM (0730-1600) excluding Saturdays, Sundays and Federal Holidays. If work must be done during periods other than above, additional Government inspection and Range Support personnel may be required. Notification must be given to the Contracting Officer five working days in advance of intention to work during other periods to allow assignment of additional inspection forces when the Contracting Officer determines that they are reasonably available. If such support is reasonably available, the Contracting Officer may authorize work to be performed during periods other than normal duty hours/days. Work beyond normal hours/days will be required for major utility outages.

No construction work shall take place over the Christmas/New Year holiday period. This period will start one full work day before the Federal Christmas holiday and end the first work day after the Federal New Year Holiday. The Contractor may request to work during this time at the discretion of the Contracting Officer, however no base support will be available.

1.7 OCCUPANCY OF PREMISES/ACCESS REQUIREMENTS

Building(s) will be occupied during performance of work under this Contract. If occupied, occupancy notifications will be posted in a prominent location in the work area.

Before work is started, the Contractor shall submit a plan to the Contracting Officer or Representative for approval. The plan shall include a sequence of procedures, means of access, space plan for storage of materials and equipment, and use of approaches, corridors, and stairways.

This plan must comply with NFPA 241 requirements that all exits and exit access must be maintained at all times (Ref: UFC 3-600-01). Base Fire Department is required to approve any deviations which affect the exiting or exit access from the building.

1.7.1 Facility Contents

1.7.1.1 Responsibilities

The schedule of work shall be closely coordinated with the Contracting Officer. Unless otherwise stated, remove all furniture, equipment, curtains, drapes, pictures, blackboards, etc., as required to perform the work. Any movable or fixed furniture, equipment, carpet, etc., remaining in the work area shall be covered and protected from damage. All relocated items shall also be protected from damage throughout the construction period. After completion of work and prior to final acceptance, replace removed items in their original location.

Demolition of critical facility systems mechanical, electrical, etc. shall not be started until replacement equipment is on site or operational for new exhaust system. .

1.7.1.2 Maintain Clean Work Areas

All work areas shall be kept clean at all times. Contractor shall prevent introduction of dirt or dust into areas adjacent to the work areas. All materials, tools and equipment shall be thoroughly cleaned prior to being brought into the work areas or adjacent areas.

1.7.1.3 Damage To Existing Equipment

Any damage must be reported to the contracting officer immediately. Damage to existing materials, equipment or systems occurring from Contractor activities or neglect, shall, at the sole discretion of the Contracting Officer, be repaired or replaced by the Contractor at no cost to the Federal Government.

1.7.1.4 New Material and Construction Equipment

Only material and construction equipment designated for performance of

contract work may be stored at the construction site or located in Government-controlled warehouses or shop facilities.

1.7.2 Construction Area Access And Control

1.7.2.1 Access and Control Requirements

Exclusive use or control of any area will not be allowed as the Government must have access to all areas at all times. All work must be scheduled around operational constraints.

1.7.3 Vehicle Parking

1.7.3.1 Requirements

Job and support vehicles for workers will be parked in designated parking areas within reasonable access to the worksite. All vehicle operators must comply with all traffic laws including mandatory seat belt usage, speed limits and hauling restrictions. Contractor shall be responsible for repairing or replacing any facility/grounds damaged areas.

1.8 STORAGE, TRANSPORTATION AND PROTECTION

1.8.1 Storage

Contractor may be assigned a storage area upon written request to the Contracting Officer. Contractor's request shall indicate dimensions of trailer, size of storage area, and utilities required. Space at one of the base central storage areas will be assigned to the Contractor by the Contracting Officer. All trailers shall be in good and safe condition. Storage space may not be co-located with construction site, at the Contracting Officer's discretion.

1.8.2 Protection

Store and protect products in accordance with manufacturer's instructions. Store products with seals, labels intact and legible. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to the product. Products acceptable for exterior storage shall be on sloped supports above ground.

1.8.3 Transportation

Transport and handle products in accordance with manufacturer's instructions. Promptly inspect shipments to ensure the products comply with requirements, quantities are correct, and products are undamaged. Protect products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products. Store loose granular materials on solid flat surfaces in a well drained area. Prevent mixing with foreign materials.

1.8.4 Hazardous Materials

Hazardous Materials & petroleum product containers shall be stored on an impervious surface with containment. Incompatible materials shall be segregated and have separate containment systems. Additional HAZMAT requirements are provided in Section 01 57 20.00 10 ENVIRONMENTAL PROTECTION.

1.8.5 Site Protection Plan

Structures, utilities, sidewalks, pavements, and other facilities immediately adjacent to excavations shall be protected against damage. Contractor shall comply with UFC 3-600-01 and is required to protect areas adjacent to the construction site.

1.9 PROTECTION OF WORK

Prior to performing any excavation work or any surface penetrations on any ground surface, the Contractor shall obtain from the Contracting Office or representative, assistance for locating current subsurface utilities for the particular area to be worked on. Contractor shall stake out subsurface high voltage cables, communication cables, and pipe lines indicated within the scope of the work contemplated.

Contractor shall notify the Contracting Officer, 14 days 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, and allow Infrastructure O&M Services (IOMS) time to respond to scanning requests. Where emergency conditions preclude the 14 days advance notification, the Contractor shall immediately inform the Contracting Officer of his intention to initiate work prior to actual start of activity.

After excavation permit has been obtained and prior to any excavating, verify with Cape Support (853-5211) that there are no "Critical Days" that would prevent excavation.

Contractor shall temporarily halt any machine excavation work or other surface penetration when approaching within 5 feet of the existing utility line until the Contractor has exposed the utility line by hand excavation to fix its location.

1.10 GOVERNMENT-FURNISHED MATERIALS - None

1.11 ON-SITE PERMITS

1.11.1 Utility Outage Requests And Connection Requests

Work shall be scheduled to hold outages to a minimum.

Utility outages and Connection Requests required during the execution of work that affect existing systems shall be arranged at the convenience of the Government, which may require scheduling outside of the regular working hours or on weekends, at no additional cost to the Government.

Each Utility Outage and Connection Requests shall state the system involved, area involved, approximate duration of outage, and the nature of work involved.

1.11.1.1 Requirements

A written request for a utilities outage (electricity, communication, water, compressed air, gas, steam, air conditioning, fire detection and suppression systems, etc.) must be submitted to the Contracting Officer at least 14 calendar days in advance of the desired outage. Approval is required prior to scheduling any outage. All limitations noted on the approved outage authorization shall be carefully observed. Final verbal

coordination shall be made 4 hours prior to the outage by calling the Contracting Officer or his representative. A utilities outage without prior approval and coordination is prohibited.

Utility outages affecting fire alarm, fire detection, fire suppression, fire pumps and water supplies to fire protection systems greater than 4 hours will require a fire watch per NFPA 241 (Chapter 7).

Since many systems are critical to facility operations, the number and duration of utility outages shall be kept to an absolute minimum. All work effort shall be coordinated and sufficient manpower, materials, and equipment shall be provided to complete the work within the authorized outage window.

Existing utility services may be interrupted only when approved by the Contracting Officer. The interruption shall be scheduled at a time of minimum demand on the utility, convenient to the Government. Outages on weekends, holidays, or evenings shall be performed at no additional cost to the Government.

Contractor shall make all necessary arrangements to schedule and provide connections to existing utilities and to cause minimum interruption to system operation. All temporary utility hook-ups and disconnects shall be made by the Contractor.

If the Contractor fails to comply with a scheduled outage, the cost to reschedule the outage will be deducted from the final contract payment.

1.11.2 Work Clearance Request

All construction work requires a Work Clearance Request, AF IMT 103. This permit is processed by the Government and provided to the Contractor. It is required prior to the start of any construction at the project site and must be posted in a conspicuous location on site during all construction activities.

1.11.3 Burn Permits

Burn permits are required for any spark or flame producing activity. Burn Permits shall be obtained thru Cape Support (853-5211).

Permits shall be posted at a conspicuous location in the construction area.

Burning of trash or rubbish is not permitted on any USAF facility.

1.12 SALVAGE AND DISPOSAL OF MATERIAL AND EQUIPMENT

1.12.1 Removal

Remove and/or relocate only those materials or items of equipment specifically indicated in the drawings and specifications. Removal operations shall be performed in such a manner that adjacent areas, installed equipment, or existing utilities are not damaged. Repair all openings that occur due to removal or demolition operations to match adjacent, existing surfaces. Any damage incurred during removal operations shall be repaired at no additional cost to the Government.

1.12.2 Housekeeping

Sufficient personnel and equipment shall be provided to ensure compliance with all housekeeping requirements. Work will not be allowed in those areas that do not comply with the requirements of Section 14.C of COE EM 385-1-1. Job sites are to be kept clean on an ongoing, daily basis. All areas are to be thoroughly cleaned prior to leaving the jobsite at completion of project work.

1.12.3 Salvage Of Material And Equipment

All salvageable materials or items to be removed shall remain the property of the Federal Government. Salvageable items are listed below in the paragraph entitled, "Salvage Items". Salvageable items shall be transported to and deposited at the Defense Reutilization and Marketing Office (DRMO) at Cape Canaveral Air Force Station at the contractor's expense.

Salvageable material must be segregated and separated into categories before transport. Material shall be palletized or moveable by forklift (maximum 10,000 lbs). For material that is not palletized, it will be the responsibility of the Contractor to provide labor support for material removal. Scrap metal shall be maximum 15 feet in length and 4 feet in width.

Deliveries to DRMO shall be scheduled through the Contracting Officer a minimum of 72 hours in advance. All salvageable items delivered to DRMO shall be accompanied by a properly prepared DD Form 1348. This form will be furnished by the Contracting Officer. A signed copy by DRMO reflecting the turn in materials shall be furnished to the Contracting Officer.

Contractor shall maintain property control records for material or equipment designated as salvage. Contractor's system of property control may be used if approved by the Contracting Officer. Contractor shall be responsible for storage and protection of salvaged materials and equipment until disposition by the Contracting Officer.

Material to be salvaged and reinstalled by the Contractor shall be protected during removal and stored to prevent damage.

For reference purposes salvageable is defined as: items, material, equipment which can be refitted, reworked, and restored and put to use or sold. The Contracting Officer shall have sole discretion as to determining whether any particular item is salvageable.

1.12.3.1 Salvage Items - None

1.12.4 Waste Disposal

Non-salvageable material and debris shall be removed from work areas and disposed of daily. Contractor may use Cape Canaveral Air Force Station (CCAFS) landfill for disposal of CCAFS and PAFB C&D debris in accordance with Florida Department of Environmental Protection (FDEP) permits.

Asbestos waste shall be disposed of at the CCAFS asbestos mono-fill unless otherwise directed by the Contracting Officer.

Refer to Section 01 57 20.00 10 ENVIRONMENTAL PROTECTION for further waste disposal and record keeping requirements.

1.12.5 Cleanup

Upon completion of the construction each day, the Contractor shall leave the work premises in a clean, neat and workmanlike condition, satisfactory to the Contracting Officer.

1.12.6 Salvage And Disposal Record Keeping

Contractor shall maintain and submit quarterly and at the completion of the project to the contracting officer a Disposal Log of all materials removed from the job site. This inventory shall include waste materials disposed in landfills and materials reused on the job, sold for salvage and recycled. At a minimum the Contractor shall identify the type of materials, material weight, disposition (landfill or recycle), receiving facility (name, address and phone number).

1.13 RADIO FREQUENCY MANAGEMENT PROCEDURES

The following procedures shall be followed in obtaining radio frequency authorization:

The policy and procedures contained in AFI 33-118 shall be followed to obtain frequency allocation approval of electronic devices and USAF Radio Frequency Assignment.

1.14 COMMUNICATION SECURITY

Government telecommunications networks are continually subject to interception by hostile/unfriendly intelligent organizations. Therefore, the DOD has authorized the military departments to conduct COMSEC monitoring and recording of telephone calls from, or terminating at, DOD organizations. Contractor shall assume the responsibility for ensuring frequent dissemination of this information to all employees dealing with official DOD information.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 CCAFS ACCESS REQUIREMENTS

3.1.1 Badge Requirements

Employees working at CCAFS are required to have in their possession a current Cape Badge. Badges must be displayed above the waist in a visible location at all times. These badges are described below and may be obtained at the CCAFS Pass and ID office (Building 1068) after the required information/identified in the following paragraphs is submitted (Requests must be submitted AT LEAST 48 hours, 2 work days, prior to issue date to complete required checks). The CCAFS Pass and ID office hours are 0600 to 1600 for temporary badges and 0730 to 1530 for permanent badges (must have an appointment for permanent badges (321) 853-3458). Two forms of identification are required before any badge will be issued. One form must be from the primary list below:

Primary - State issued Drivers License with a photograph; State issued

Identification Card with a photograph; DOD, State, County or City Government ID Card with photograph; US Passport (current or expired); Resident Alien ID Card; Foreign Passport; US Coast Guard Merchant Marine ID Card

Secondary - US Birth Certificate; Certificate of US Citizenship; Certificate of Naturalization; Unexpired Temporary Resident Card; Voter Registration Card; Native American Tribal Document; US Social Security Card; Certificate of Birth Abroad issued by the Dept of State; Current photo already in PASS or AF Computer Badge System

Upon contract completion the Contractor shall be responsible for retrieval of the badges and return to CCAFS Pass and ID within 10 days of the completion date. All security paperwork must be returned to the 45th Security Forces.

When Contractor is mentioned within this document, this includes any and all Lower Tier Subcontractors.

Contractor is responsible for satisfying the prerequisites for unescorted entry. **Contractor is responsible for providing escort services for their personnel and subcontractors at contractor's expense.**

These badging requirements are subject to change.

3.1.1.1 Citizenship

If an employee is not a United States Citizen, 30 days notice must be given to the 45th Security Forces in order to obtain a CCAFS Badge. A Foreign Visit Request Form will be sent to 45th Space Wing Joint Plans and Customer Service, PAFB, for approval. Upon approval, a CCAFS Green Badge (Foreign National Badge) will be issued by PASS & ID. This CCAFS green badge requires continuous escort while on CCAFS and KSC. A US Government permanent or temporary green resident identification card must be presented to Pass & ID to obtain the CCAFS green badge.

Citizenship for all employees requesting a CCAFS entry badge must be verified by birth certificate, passport, voter registration card, resident alien card, or certificate of naturalization (Social Security cards and Driver's licenses will not be accepted as proof of citizenship). Proof of US citizenship must be verified before a badge is requested.

3.1.2 General Cape Entry Requirements

Contractor shall contact CCAFS Contracting (853-6146) to obtain an AFSPC Form 577 for signature authority for badging. Once the AFSPC Form 577 has been approved, the Contractor shall submit his/hers list of employees to be badged for the Cape on company letterhead (example obtained from Contracting) to CCAFS Contracting for approval. A CCAFS Temporary Pass Request must be completed for each employee obtaining a CCAFS Cape badge. All procedures under subpart entitled "CCAFS ACCESS REQUIREMENTS" of this section shall be followed/submitted in order to obtain a CCAFS badge.

Contractor shall submit a badge request at least 48 hours in advance on form 45 SFS/S6 Form 1, latest edition, which shall include the following information:

- a. Full Legal Name(s) (In Alphabetical Order- Last Name, First Name and Middle Name, as it appears on Drivers License)

- b. Citizenship with proof of US citizenship (if not USA, see paragraph entitled Citizenship of this section).
- c. Social Security Number of the Designated Individual(s)
- d. Driver's License Number, State of Issue
- e. Time of Required Badging (Start Date and Expiration Date)
- f. Name, Address and Phone Number of Prime Contractor
- g. Name, Address and Phone Number of Subcontractor

3.1.3 Cape Entry Requirements for White Badge (Unescorted)

All requirements for paragraph entitled "General Cape Entry Requirements" of this section shall be submitted along with the following to obtain a white unescorted Cape badge.

In accordance with CCAFS badging requirements, the Contractor requesting a White Badge for unescorted entry to general areas of CCAFS shall submit proof of US citizenship as stated in paragraph entitled "Citizenship" of this section. A White Unescorted Badge will be issued at the discretion of the 45th Security Forces.

3.1.4 Temporary Cape Entry Requirements for Pink Badge (Escort Required)

All requirements for paragraph entitled "General Cape Entry Requirements" of this section shall be submitted along with the following to obtain a pink escorted Cape badge.

For temporary entry onto CCAFS, a temporary Cape Entry Badge and escort are required. Contractor shall submit a badge request at least 48 hours in advance.

Contractor is responsible for satisfying the prerequisites for unescorted entry. Contractor is responsible for providing escort services for their personnel and subcontractors.

3.1.5 Construction Site Requirement

All on-site project work is confined to non-restricted areas. That is, no restricted area badge shall be necessary to accomplish the on-site work. However, normal access requirements into CCAFS must still be accomplished.

3.1.6 Air Force Restricted Area Requirements (Black & Blue Restricted Unescorted Badge)

Access to construction sites located in restricted areas requires a Black & Blue Restricted Area Unescorted Badge. Contractor is responsible for satisfying the prerequisites for unescorted entry and/or providing escorted entry to a restricted area for all their personnel and subcontractor personnel. Escort services will not be provided by the Government. It is the Contractor's responsibility to determine the minimum number of personnel needed and obtain the required badges with escort authority in order to meet the contract requirements. Failure to do so could result in denied access to the construction site, interruption of performance and negatively impact timely contract completion.

Individuals meeting the 45 SWI 31-101 security requirements will be allowed to acquire restricted area badges. This document is the 45th Space Wing Instructions that establishes USAF restricted areas and defines normal security operations for operational space launch resources located on CCAFS.

An investigation is required before a restricted area badge can be issued for entry into CCAFS restricted areas. The Contractor must have a completed a DD Form 254 (Department of Defense Contract Security Classification Specification) before being able to enter JPAS. The Contractor with badging authority (an AFSPC Form 577 on file at CCAFS Pass & ID) will input the subject's initial information into the Joint Personnel Adjudication System (JPAS) and issue instructions for access to the Electronic Questionnaire for Investigation Processing (e-QIP) system. The e-QIP system is a web-based system that can be accessed from anywhere there is Internet access. Since e-QIP is a web-based system, it is important that the Internet browser be properly configured (instructions will be issued).

The subject must begin completing the questionnaire within 30 days from the time the Badging Authority initiates the process in JPAS and must complete the form within 90 days of the initiation start date.

After completion, the subject must validate, review and certify their questionnaire. Print three copies (file, Badging Authority and subject), print out the three (3) releases and sign (make sure to use system generated releases), provide a copy of birth certificate and completed fingerprint card.

After a clearance has been issued by JPAS, the Contractor will complete an AF Form 2586 (signed by CCAFS Contracting in signature block #2) and transmit it to the Facility Manager of the restricted area for signature. After obtaining signatures, the individual must make an appointment with CCAFS Pass & ID to obtain a Restricted Area Badge.

If an individual has previously had a NASA badge, contact the NASA Security Officer and have the records transferred to CCAFS PASS & ID (Fax 321-853-3441). Call for specific instructions.

In order for Contractor personnel to enter restricted areas, a Restricted Area Badge for the area is required. Those individuals in possession of a White or Pink Badge must remain under the surveillance of the escorts at all times while working in the restricted area. Escorts are subject to having their base access privileges revoked if it is found that they are not in visual contact with the employees they are escorting. The required responsibilities and duties of an escort shall be adhered to by all Contractor and subcontractor personnel. 45 SWI 31-101 and Restricted Area Badge Processing Guide outline the requirements and procedures in obtaining a restricted area badge.

Contingent upon the location and nature of the work, a construction site "Free Zone" may be established by the Commander of the restricted area site. If the area is designated as a construction site "Free Zone", only normal access requirements to CCAFS will apply.

3.2 BADGE CONTROL AND ACCOUNTABILITY

The prime Contractor shall be accountable for all badges issued during the performance of this contract. Upon completion or termination of the

contract or expiration of the identification badges/passes, the prime Contractor shall ensure that all base identification badges/passes issued to employees and all subcontractor employees are returned to the issuing office. All badges must be returned to CCAFS Security Forces Pass & ID before a new badge will be issued.

3.2.1 Safeguarding Badges

Contractor badges issued by Pass and ID remain the property of the Government and shall be protected at all times. Badges must not be left unattended in vehicles on or off base. Misuse or tampering of badges is a criminal offense. Violators will lose their base access privilege and may be subject to prosecution.

3.2.2 Reporting Lost Badges

Lost badges must be reported within 24 hours. Contractor shall submit a letter to the Security Forces, through the Contracting Officer, explaining the details of the circumstances. As a minimum include the name and Social Security Number of the individual and when and where the badge was lost. This letter must be on file at the Security Forces Pass and ID before a new badge will be issued.

3.2.3 Returned Badges

Prior to submitting an invoice for final payment, the prime Contractor shall obtain a clearance certification from the issuing office which states all base identification badges/passes have been turned in, accounted for, or transferred to a follow-on contract. This certification shall be submitted to the Contracting Officer prior to submission of the final invoice for payment.

3.3 CCAFS DELIVERIES

3.3.1 Non-Hazardous Deliveries

All deliveries of construction material and equipment to job sites (including cement trucks) shall use the CCAFS South Gate for access. To the maximum extent possible, deliveries shall be scheduled between 1000 and 1500 hours to avoid the peak traffic volume times. The driver of each delivery vehicle and their passengers must have the following:

- a. A valid photo ID; and
- b. A valid bill of lading; and
- c. A known delivery point on CCAFS; and
- d. An on-base or local phone number and POC to vouch for delivery

Only deliveries that can be verified will be allowed to proceed. Special deliveries, deliveries after normal business hours, or deliveries that cannot negotiate through the barricades must be coordinated in advance.

All delivery vehicles shall be inspected by Security Forces personnel prior to being allowed to proceed onto the installation.

3.3.2 Hazardous Deliveries

Deliveries of fuel, large volume of chemicals, or other hazardous materials shall comply with this section. All hazardous deliveries shall enter through the same gates as non-hazardous deliveries and have the information required for non-hazardous deliveries (see subpart entitled "Non-Hazardous Deliveries" of this section). Only deliveries that can be verified will be allowed to proceed. In addition, hazardous deliveries must be scheduled a minimum of 48 hours in advance for escort by Security Forces to and from job site. Contractors shall contact the CCAFS Security at 321-853-2121 to arrange for hazardous delivery escorts. Deliveries that have not arranged in advance for Security Forces escorts will be turned away and must be re-scheduled.

3.4 RESPONSIBILITIES

The Government reserves the right to revoke badging authority, escort authority and/or base access privileges for any person, at any time and for any reason. Contractor understands that the Government has made every attempt to identify potential delays associated with background checks and badging requirements and that such delays have been considered in the construction schedule. Delays resulting from the Contractor's failure to follow the badging guidelines above shall not be considered grounds for contract extension or compensation.

3.5 EXCAVATION

3.5.1 Dig/Utility Locate Permit Requirements

Excavation shall be accomplished only after the Dig permit is received and utility locates accomplished and then with extreme caution to prevent damage to the existing buried utilities in the area. All open trenches must comply with OSHA regulations. All excavation must be further approved by daily contact with Cape Support (321-853-5211).

3.5.1.1 Location of Buried Structures and Utility Lines

Accurately locate and stake structures and utility lines indicated by the Government provided Utility Locators on CCAFS. If unidentified underground utilities are encountered during excavation, notify the Contracting Officer and cease operations until they are properly identified.

3.5.1.2 Excavation, Trenching, and Backfilling

Open only those trenches for which material is ready to be placed. As soon as approved by the Technical Representative, trenches shall be backfilled and tamped as required by the drawings and specifications. As a minimum, the topsoil shall be replaced and the disturbed area shall be grassed by seeding, watered and maintained for a minimum of 60 calendar days. All excavation shall be in compliance with OSHA regulations. Mark or barricade construction work which may present a hazard.

3.5.1.3 Cutting of Roads, Streets, Driveways, and Paved Areas

Repair roads, streets, and paved parking areas which require surface cutting under this project within 10 calendar days after initial cutting. The topping shall be a minimum of 2 inches of asphalt and match existing (concrete topping on asphalt areas is not allowed). Mark, barricade, and illuminate construction work on or near roads or streets which may present

a traffic hazard per OSHA 29 CFR 1910. Contractor shall provide signaling, lighting, and barricades in the construction area conforming to the Manual on Uniform Traffic Control Devices, OSHA 29 CFR 1926.201 and 1926.202. Closures of Streets, parking lots, and other traffic areas will not be permitted unless approved by the Contracting Officer after written request 14 calendar days before the scheduled closure.

3.5.2 Restrictions

All excavation at the work site must be accomplished by hand only. Excavating machinery is prohibited.

Hand digging is required within five feet of located underground utilities.

3.5.3 Temporary Shoring, Bracing And Supports

All new excavation and trenching work shall be securely and safely supported during installation with temporary, but substantial, shoring, bracing, hangers and other supports as required by OSHA regulations. After new work is completed and completely cured (if required) and all permanent fasteners, anchors and supports are properly installed, the temporary supports shall be removed.

3.5.4 Barricades

Guardrails, fences or other suitable barricades and warning lights shall be placed at all open excavations/trenches which are adjacent to paths, walkways, sidewalks, vehicle parking areas, and other pedestrian or vehicle thoroughfares.

3.6 LAND SURVEYING REQUIREMENTS

Land surveying, to include all projections and datum points, shall be required for all modifications affecting civil site plans (e.g., utilities, additions, new construction or storm water modifications). The survey shall be performed by a State of Florida Professional Licensed Surveyor (PLS) and shall be submitted by the Contractor in digital and hard copy format.

3.6.1 Contractor Provided Survey Support

Record drawings shall reflect all civil site developments such as new facility and/or land modifications, external structural changes to aboveground structures, and changes to underground structures and utilities external to facilities located on lands owned by or held in leasehold interest of the federal government.

Information in record drawings shall include, but not be limited to:

Location of all new lines, conduits, valves, fittings, fire hydrants, meters, terminal points using at least two ties to permanent points (manholes, power poles, curbs, or storm water inlets). Locate manhole, catch basin, and storm water control structures noting top of rim, inverts, weirs, dimensions and conduit sizes and material entering the structure. An acceptable station and offset system may be used for service lines and fittings only.

Location of new lines from property easement lines or edges of pavement at intervals of 300 feet.

All utility routing and interface changes shall be reflected on the drawings to scale and defined with sufficient dimensions.

Locate with elevation all improvements constructed or modified including but not limited to pavement, striping, curbs, sidewalks, signs, gutters, walls, fences, buildings, pads, open stormwater conveyance systems, stormwater retention/detention ponds, etc. Elevation information should be adequate to illustrate flow patterns, retention capacity and overflow levels. Ground contours at intervals of 1 foot in elevation shall be shown on unpaved areas of the site on the sketch of survey

Contractor shall facilitate the receipt of surveyed coordinates for facility footprint corners coordinates and underground structures and utilities external to facilities by submitting digital data using the spatial reference identified below to 45 CES through the Contracting Officer within five (5) working days of foundation construction, or open excavation.

Record drawing prints will be drawn at a minimum scale of 1 inch = 100 feet. Areas requiring additional detail shall be enlarged as necessary.

Record drawings shall be provided in digital format. Information should be provided in separate layers/levels as specified by GIS and in at least the same degree of separation as the design drawings that were provided. Designation for naming of layers/levels shall adhere to current DOD, A/E/C CAD Standards with strict adherence to layer format. <https://cadbim.usace.army.mil/>. New like items shall be contained in the same levels to permit easy conversion to GIS layers.

All lines, letters, and details shall be sharp, clean, and fully legible.

3.6.1.1 Horizontal Reference Datum

All surveys shall be referenced to Florida State Plane Coordinate System, East Zone, North American Datum 1983/1990 adjustment based on Second order Class II horizontal control monument.

3.6.1.2 Vertical Reference Datum

All surveys shall be referenced to North American Vertical Datum (NAVD) 1988. The survey shall include a description of the reference benchmarks from which the NAVD has been determined.

3.7 WELDER QUALIFICATION REQUIREMENTS

3.7.1 Welding And Brazing

Before assigning any welder/brazer to work in pipe and/or structural fabrication on this project, names shall be provided to the Contracting Officer of all welders/solderers together with written certification that these welders/brazers have passed Qualification Tests as prescribed by AWS D1.1/D1.1M, AWS B2.1, and/or ASME BPVC SEC IX, as applicable. All piping and/or structural welds shall be performed by persons holding current certifications. If testing is required, the test and certification shall be by an independent organization regularly engaged in the testing and certification of welders. Date of certification for each welder/brazer

shall not be over one year prior to date of contract award.

3.8 HOISTING AND LIFTING

3.8.1 Lifting Operation Plan

Contractor shall have a Lifting Operation Plan and procedure that is fully in accordance with the requirements of OSHA regulations, and shall include drawings/sketches of lifting slings, lifting equipment, and tag lines. The plan shall show weights, center of gravity, and clearances of load over entire lift. Plans shall have details showing any structural mounting of hoisting equipment on sheaves or structural steel, and shall show loading calculations on any such structural mounting showing forces, weights, turning moments, etc. A procedure shall accompany the drawings describing all lifting operations. Use spreader bars wherever necessary to prevent hoisting cables from contacting equipment/material.

3.9 QUALITY CONTROL

It is the Contractor's responsibility to provide, inspect and document the level of quality that has been established by all applicable standards, codes and guidelines. The Contractor shall use skilled workers, an adequate number of which are thoroughly trained and have a minimum of 3 years experience in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for the proper performance of the work in each section of these specifications.

3.9.1 Licenses

Contractor or their subcontractors shall be licensed by the State of Florida or have an equivalent out-of-state license in all areas applicable to this contract. Refrigerant Technicians shall provide the Contracting Officer copies of their EPA approved Technician Certificates. Asbestos Abatement Contractor shall be licensed by the State of Florida.

3.9.2 Government Inspection/Approval

When the Contractor considers that the work is acceptable to the Government and is complete, he/she shall inform the Contracting Officer, or designated representative, and the Government Project Manager that the work is complete and ready for inspections. In the event that the work is not acceptable, the Contractor shall record a list of items noted by the Government Project Manager, A subsequent inspection may take place in order to review the corrected items. The Government is not required to inspect all work.

3.9.3 Inspection Files

The Contractor shall be responsible for keeping inspection files for all projects. Files shall include on site records of all inspections conducted by the Contractor and the necessary corrective actions taken. all ongoing projects shall be inspected by the Contractor at least once daily using AF Form 1477, (Construction Inspection Record). The records of the inspection shall be kept and made available to the Government throughout the contract performance period and for the period after completion until final settlement of any claims made under this contract.

3.10 SUPERINTENDENT

Provide name and qualifications and past experience for review. Designate a competent superintendent who shall have full authority to act for the Contractor and who shall be the primary contact with the Government until acceptance. Contractor's superintendent shall be at the job site at all times when work is taking place and shall have full authority to act for the Contractor.

3.11 CONSTRUCTION SCHEDULING REQUIREMENTS

3.11.1 Contractor Coordination Meetings

Contractor shall attend weekly project meetings, not to exceed 3 hours, scheduled by the Government. Contractor's Superintendent shall attend the scheduled coordination meetings. Subcontractor representatives shall attend as required.

Discussion shall address the progress schedule, potential factors of delay, deficiencies, material delivery schedules, submittals, and safety issues.

3.11.2 On-Site Construction Sequence

The required work shall be performed in a sequence to minimize the time when potable water, air conditioning, panelboards, transformers, power supply, etc. are inoperative or out-of-service. Remove a single item of equipment, install the new replacement item, tie in required utilities, test, and restore the new item of equipment to fully operational status before removing subsequent equipment.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 01 - GENERAL REQUIREMENTS

SECTION 01 33 00

SUBMITTAL PROCEDURES

PART 1 GENERAL

- 1.1 SUMMARY
- 1.2 REFERENCES
- 1.3 SUBMITTALS
- 1.4 PREPARATION
 - 1.4.1 Marking
 - 1.4.2 Drawing Format
 - 1.4.3 Data Format
 - 1.4.4 Samples
- 1.5 SUBMISSION REQUIREMENTS
 - 1.5.1 Submittal Register
 - 1.5.1.1 Contractor Use of Submittal Register
 - 1.5.1.2 Contracting Officer Use of Submittal Register
 - 1.5.2 Drawing Submittals
 - 1.5.3 Data Submittals
 - 1.5.4 Samples
- 1.6 PROCEDURES FOR SUBMITTALS
 - 1.6.1 Reviewing, Certifying, Approving Authority
 - 1.6.2 Constraints
- 1.7 GOVERNMENT'S REVIEW
 - 1.7.1 Review Notations
 - 1.7.2 Sample Approval
- 1.8 PROGRESS SCHEDULE
 - 1.8.1 Progress Schedule
- 1.9 STATUS REPORT ON MATERIALS ORDERS

PART 2 PRODUCTS

- 2.1 Material Submittals

PART 3 EXECUTION

- 3.1 GENERAL

-- End of Section Table of Contents --

SECTION 01 33 00

SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 SUMMARY

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

1.2 REFERENCES

The Wing 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.

U.S. AIR FORCE (USAF)

AF Form 3000

MATERIAL APPROVAL SUBMITTAL

AF Form 3064

CONTRACT PROGRESS SCHEDULE

1.3 SUBMITTALS

Five (5) copies of submittal information (or electronic PDF files of the submittal package) for all listed items must be submitted on AF Form 3000. Material submittals must be submitted as a complete package for each specification section, ready for the Contracting Officer's approval.

Submittal Description (SD): Drawings, diagrams, layouts, schematics, descriptive literature, illustrations, schedules, performance and test data, and similar materials to be furnished by the Contractor explaining in detail specific portions of the work required by the contract.

The following items are descriptions of data to be submitted for the project. The requirements to actually furnish the applicable items will be called out in each specification.

SD-01 Preconstruction Submittals

Submittals which are required prior to start of onsite construction on a new contract shall be an Accident Prevention Plan (APP) and certifications if required. Submittals are required prior to the start of the next major phase of the construction on a multi-phase contract; Schedules or tabular list of data or tabular list including location, features, or other pertinent information regarding products, materials, equipment, or components to be used in the work. And must be submitted prior to contract notice to proceed or next major phase of construction.

SD-02 Shop Drawings

Submittals which graphically show relationship of various components of the work, schematic diagrams of systems, detail of fabrications, layout of particular elements, connections, and other relational aspects of the work.

SD-03 Product Data

Data composed of catalog cuts, brochures, circulars, specifications and product data, and printed information in sufficient detail and scope to verify compliance with requirements of the contract documents.

SD-04 Samples

Samples, including both fabricated and unfabricated physical examples of materials, products, and units of work as complete units or as portions of units of work.

SD-05 Design Data

Design calculations, mix design analyses, or other data, written in nature, and pertaining to a part of the work.

SD-06 Test Reports

Written reports of a manufacturer's findings of his product during field inspections, attesting that the products are installed in accordance with the manufacturer's installation instructions, shop drawings, or other manufacturer's requirements. Written reports by a general Contractor or his subcontractors including daily logs reporting on the progress of daily activities or attesting that the work has been installed in accordance with the contract plans and specifications.

SD-07 Certificates

A document, required of the Contractor, or through the Contractor by way of a supplier, installer, manufacturer, or other Lower Tier Contractor, the purpose of which is to verify the quality or proper progression of a portion of the work by documenting procedures, acceptability of methods or personnel, qualifications, or other verification of quality.

Statements signed by responsible officials of a manufacturer of a product, system, or material attesting that the product, system or material meet specified requirements. Statements must be dated after the award of this contract, name the project, and list the specific requirements which it is intended to address.

SD-08 Manufacturer's Instructions

Preprinted material describing installation of a product, system, or material, including special notices and material safety data sheets, if any concerning impedances, hazards, and safety precautions.

SD-09 Manufacturer's Field Reports

A written report which includes the findings of a test made at the job site, in the vicinity of the job site, or on a sample taken from the job site, on a portion of the work, during or after installation. Report must be signed by an authorized official of a testing laboratory or agency and must state the test results; and indicate whether the material, product, or system has passed or failed the test.

SD-10 Operation and Maintenance Data

Data intended to be incorporated in an operations and maintenance manual.

SD-11 Closeout Submittals

Special requirements necessary to properly close out a construction contract. For example, as-built drawings, manufacturer's help and product lines necessary to maintain and install equipment. Also, submittal requirements necessary to properly close out a major phase of construction on a multi-phase contract. See Section 01 78 00, CLOSEOUT PROCEDURES.

1.4 PREPARATION

1.4.1 Marking

Permanent marking shall be provided on each submittal to identify it by contract number; transmittal date; Contractor's, Subcontractor's, and supplier's name, address(es) and telephone number(s); submittal name; specification or drawing reference; and similar information to distinguish it from other submittals. Submittal identification shall include space to receive the review action by the Contracting Officer.

1.4.2 Drawing Format

Drawing submittals shall be prepared on sheets not less than 8 1/2 inches by 11 inches nor larger than 30 inches 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. Contractor may use his own number system.

Copies of each drawing shall have the following information clearly marked thereon:

- a. Job name, which shall be the general title of the contract drawings.
- b. Date of the drawings and revisions.
- c. Name of Contractor.
- d. Name of Subcontractor.
- e. Name of the item, material, or equipment detailed thereon.
- f. Number of the submittal (e.g., first submittal, etc.) in a uniform location adjacent to the title block.
- g. Government contract number shall appear in the margin, immediately below the title block.

1.4.3 Data Format

Required data submittals for each specific material, product, unit of work, or system shall be collected into a single submittal and marked for choices, options, and portions applicable to the submittal. Marking of each copy of product data submitted shall be identical. Partial submittals

will be accepted for expedition of construction effort.

1.4.4 Samples

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.

1.5 SUBMISSION REQUIREMENTS

1.5.1 Submittal Register

The submittal register is furnished at the end of this section. It is a listing of required submittals for this project and should be used for reference. However, Contractor is responsible for providing all submittals required by the specifications and/or drawings. Contractor shall thoroughly examine all contract documents and confirm that all submittal requirements are listed on this register. Any submittal items missing from the register shall be immediately reported to the Contracting Officer. Contractor shall fill out the "Date Due from Contractor" block and submit it to the Contracting Officer within 10 days of contract award.

1.5.1.1 Contractor Use of Submittal Register

Complete the following on the register:

Column (f) Contractor Submit Date; Scheduled date for the Contracting Officer to receive submittals.

1.5.1.2 Contracting Officer Use of Submittal Register

Construction Management will review the submittal register upon receipt of the initial Contractor input and, if necessary, inform the Contracting Officer of any discrepancies and/or resubmission of Contractor dates.

Construction Management will update the following fields:

Column (g) List date of submittal receipt.

Column (l) List date returned to Contractor.

Contract Officer will fill out Columns (h) through (k).

1.5.2 Drawing Submittals

Five (5) blackline of each drawing shall be submitted. One print, marked with review notations by the Contracting Officer, will be returned to the Contractor.

1.5.3 Data Submittals

Five (5) complete sets of indexed product data shall be submitted. One set, marked with review notations by the Contracting Officer, will be returned to the Contractor.

1.5.4 Samples

One set of identified samples shall be submitted. 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.

1.6 PROCEDURES FOR SUBMITTALS

1.6.1 Reviewing, Certifying, Approving Authority

Design Engineering shall be responsible for reviewing and approving submittals to ensure that they are in compliance with technical requirements as specified in the SOW.

1.6.2 Constraints

- a. Submittals listed or specified in this contract shall conform to provisions of this section, unless explicitly stated otherwise.
- b. Submittals shall be complete for each definable feature of work; components of definable feature interrelated as a system shall be submitted at same time.
- c. When acceptability of a submittal is dependent on conditions, items, or materials included in separate subsequent submittals, submittal will be returned without review.
- d. Approval of a separate material, product, or component does not imply approval of assembly in which item functions.

1.7 GOVERNMENT'S REVIEW

1.7.1 Review Notations

Contracting Officer will review submittals and provide pertinent notation. Submittals will be returned to the Contractor with the following notations:

- a. Submittals marked "approved" authorize the Contractor to proceed with the work covered.
- b. Submittals marked "approved as noted" authorize the Contractor to proceed with the work covered provided he complies with the corrections, otherwise a resubmission is required. Notes shall be incorporated prior to submission of the final submittal.
- c. Submittals marked "not approved" or "disapproved" indicate noncompliance with the contract requirements and shall be

re-submitted with appropriate changes. No item requiring a submittal shall be accomplished until the submittals are approved or approved as noted.

- d. Contractor shall make corrections required by the Contracting Officer. 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. 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. Contractor shall be responsible for the dimensions and design of connection details and construction of work. Failure to point out deviations may result in the Government requiring rejection and removal of such work at the Contractor's expense.
- e. If changes are necessary to approved submittals, 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.
- f. Government shall have 14 calendar days from date received to respond to submittals.

1.7.2 Sample Approval

Contractor shall furnish, for the approval of the Contracting Officer, samples required by the specifications or by the Contracting Officer. 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.

Each sample shall have a label indicating:

- 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 samples applies.
- g. Samples of furnished material shall have additional markings that will identify them under the finished schedules.

Contractor shall submit to the Contracting Officer one sample of materials where samples are requested. Contractor shall transmit with each sample a AF Form 3000 "Material Approval Form" containing the above information.

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, 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.

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 own expense, if so requested.

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. Government reserves the right to disapprove any material or equipment which previously has proved unsatisfactory in service.

Variations from contract requirements shall be specifically pointed out in transmittal letters. Failure to point out deviations may result in the Government requiring rejection and removal of such work at no additional cost to the Government.

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. Contractor shall replace such materials or equipment to meet contract requirements.

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

1.8 PROGRESS SCHEDULE

1.8.1 Progress Schedule

Contractor shall:

- a. Submit five (5) copies of the progress schedule, for approval by the Contracting Officer.
- b. Prepare the progress schedule utilizing AF Form 3064 "Construction Progress Chart".
- c. Include no less than the following information on the progress chart:
 - (1) Break out by major headings for primary work activity.
 - (2) A line item break out under each major heading sufficient to track the progress of the work.
 - (3) A line item showing contract finalization task which includes punch list, clean-up and demolition, and final construction drawings.
 - (4) The percentage of total contract for each materials and labor section on the chart.
- d. Update the progress schedule and submit 5 copies when requested by the Contracting Officer.

1.9 STATUS REPORT ON MATERIALS ORDERS

Within 21 days after approval of material submittal, Contractor shall submit an initial status report on material orders. This report will be updated and re-submitted as the status on material orders change.

Report shall list, in chronological order by need date, materials orders necessary for completion of the contract. The following information will be required for each material order listed:

- a. Material name, supplier, and invoice number.
- b. Progress chart line item and/or CPM activity number affected by the order.
- c. Delivery date needed to allow directly and indirectly related work to be completed within the contract performance period.
- d. Current delivery date agreed on by supplier.

PART 2 PRODUCTS

2.1 Material Submittals

Submit product data in accordance with SD-03 Product Data

PART 3 EXECUTION

3.1 GENERAL

Contractor shall provide exactly those materials and equipment as submitted or as indicated in the specifications and drawings. If a material or equipment deviation is elected, it must be approved by the design engineer prior to installation of that item. A deviation is defined as any material or equipment variation, exception, alternate, or departure from contract specifications or drawings. The submittal shall clearly highlight or mark all deviations (in particular, equipment/component electrical requirements and performance characteristics as compared to those in the contract specifications).

NOTE: Approval of submittal data by the Contracting Officer containing deviations from the specifications not specifically noted by the Contractor will not constitute approval of such deviations. Discovery of such deviations not noted by the Contractor will immediately rescind any prior approval by the Contracting Officer. Contractor shall then be required to resubmit for approval either corrected submittals noting deviations or new submittals. In the event that unapproved material or equipment deviations have been installed and the Contractor is unable to obtain approval of same, Contractor shall completely remove that material or equipment from the job site and replace with approved material or equipment at no additional cost to the Government.

The rescission of approval may go beyond one piece of equipment or a

particular material in cases where compatibility of components is essential in a system affected by a rescission of approval. The extent of removal and replacement shall be at the sole discretion of the Contracting Officer.

-- End of Section --

TITLE: Repair Chillers, Motion Lab, Fac 1605

JOB NAME:

LOCATION:

CONTRACT NO:

CONTRACTOR:

SUBMITTAL REGISTER

								CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY							
Line	Activity #	Transmittal #	Specification Section	SD #	SD Description	Item Submitted	Paragraph #	Classification: GOVT or A/E Revwr	Submit	Approval Needed By	Material Needed By	Action Code	Date Of Action	Date FWD to APPR / Auth - Date RCD From CONTR	Date FWD To Other Revwr	Date RCD From Other Revwr	Action Code	Date Of Action	Mailed To CONTR/ Date RCD From APPR Authority	Remarks
1			01 11 00.00 55	01	Preconstruction Submittals	Lifting Operation Plan	3.8.1													
2			01 11 00.00 55	01	Preconstruction Submittals	Utility Outage Requests	1.11.1													
3			01 11 00.00 55	01	Preconstruction Submittals	Connection Requests	1.11.1													
4			01 11 00.00 55	01	Preconstruction Submittals	Hazardous Materials	1.8.4													
5			01 11 00.00 55	01	Preconstruction Submittals	Disposal Log	1.12.6													
6			01 35 26	07	Certificates	Accident Prevention Plan	1.4													
7			01 35 26	07	Certificates	License Certificates	1.12													
8			01 57 20.00 10	01	Preconstruction Submittals	Map	3.1.2													
9			01 74 19	01	Preconstruction Submittals	WASTE MANAGEMENT PLAN	1.5													
10			01 74 19	09	Manufacturer's Field Reports	Quarterly Reports	1.7													
11			01 74 19	09	Manufacturer's Field Reports	Final Report	1.7													
12			01 74 19	11	Closeout Submittals	Final Report	1.7													
13			01 74 19	11	Closeout Submittals	laboratory documents	1.7													
14			01 74 19	11	Closeout Submittals	KSC form 26-551V3	1.7													
15			01 74 19	11	Closeout Submittals	close-out form	1.7													
16			01 74 19	11	Closeout Submittals	Records	1.6													
17			01 78 00	08	Manufacturer's Instructions	Preventative Maintenance and Inspection	1.3													
18			01 78 00	08	Manufacturer's Instructions	Posted Instructions	1.3													
19			01 78 00	10	Operation and Maintenance Data	Operation and Maintenance Manuals	1.3													
20			01 78 00	11	Closeout Submittals	As-built drawings	1.3													
21			01 78 00	11	Closeout Submittals	As-built drawings	1.3													
22			01 78 00	11	Closeout Submittals	Reproducible Drawings	1.3													
23			01 78 00	11	Closeout Submittals	CAD System Drawings	1.3													
24			01 78 00	11	Closeout Submittals	Final Survey	1.3													
25			01 78 00	11	Closeout Submittals	Manufacturer's Warranty	3.1													
26			01 78 00	11	Closeout Submittals	Contractor's One Year Workmanship letter	1.3													
27			23 00 00	02	Shop Drawings	Detail Drawings	1.4.5													
28			23 00 00	03	Product Data	Air Handling Units	3.2.1													
29			23 00 00	03	Product Data	Variable Volume, Single Duct Terminal Units	2.8.1													
30			23 00 00	03	Product Data	Operation and Maintenance Training	3.11													
31			23 00 00	06	Test Reports	Performance Tests	3.9													
32			23 00 00	06	Test Reports	Performance Tests	3.11													
33			23 00 00	08	Manufacturer's Instructions	Manufacturer's Installation Instructions	3.2													
34			23 00 00	08	Manufacturer's Instructions	Operation and Maintenance Training	3.11													

TITLE: Repair Chillers, Motion Lab, Fac 1605										SUBMITTAL REGISTER									
JOB NAME:																			
LOCATION:																			
CONTRACT NO:																			
CONTRACTOR:																			

										CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY						
Line	Activity #	Transmittal #	Specification Section	SD #	SD Description	Item Submitted	Paragraph #	Classification: GOVT or A/E Revwr	Submit	Approval Needed By	Material Needed By	Action Code	Date Of Action	Date FWD to APPR / Auth - Date RCD From CONTR	Date FWD To Other Revwr	Date RCD From Other Revwr	Action Code	Date Of Action	Mailed To CONTR/ Date RCD From APPR Authority	Remarks	
35			23 00 00	10	Operation and Maintenance Data	Operation and Maintenance Manuals	3.11														
36			23 00 00	10	Operation and Maintenance Data	Fire Dampers	2.2														
37			23 00 00	10	Operation and Maintenance Data	Air Handling Units	3.2.1														
38			23 00 00	10	Operation and Maintenance Data	Variable Volume, Single Duct Terminal Units	2.8.1														
39			23 05 93	01	Preconstruction Submittals	Records of Existing Conditions	1.3														
40			23 05 93	01	Preconstruction Submittals	Records of Existing Conditions	1.3.2														
41			23 05 93	01	Preconstruction Submittals	TAB Firm	1.5.4.1														
42			23 05 93	01	Preconstruction Submittals	TAB team assistants	1.2														
43			23 05 93	01	Preconstruction Submittals	TAB team engineer	1.2														
44			23 05 93	01	Preconstruction Submittals	Specialist	1.5.4.2														
45			23 05 93	01	Preconstruction Submittals	TAB team field leader	1.2														
46			23 05 93	02	Shop Drawings	TAB Schematic Drawings and Report Forms	1.3.2														
47			23 05 93	03	Product Data	Equipment and Performance Data	1.3														
48			23 05 93	03	Product Data	TAB Related HVAC Submittals	1.5.4.4														
49			23 05 93	03	Product Data	TAB Procedures Summary	3.7														
50			23 05 93	03	Product Data	Calibration	1.5.2														
51			23 05 93	03	Product Data	Systems Readiness Check	1.3.2														
52			23 05 93	03	Product Data	TAB Work Execution Schedule	3.7														
53			23 05 93	03	Product Data	TAB procedures	1.5.2														
54			23 05 93	03	Product Data	TAB execution	1.5.5														
55			23 05 93	06	Test Reports	Design review report	1.3.2														
56			23 05 93	06	Test Reports	Design review report	1.6.3.1														
57			23 05 93	06	Test Reports	Design review report	3.7														
58			23 05 93	06	Test Reports	TAB report for Season 1	1.5.6.1														
59			23 05 93	07	Certificates	Independent TAB agency and personnel qualifications	1.5.1	G													
60			23 05 93	07	Certificates	Independent TAB agency and personnel qualifications	1.5.1	G													
61			23 05 93	07	Certificates	Completed Pre-TAB Work Checklist	3.7														
62			23 05 93	07	Certificates	TAB Firm	1.5.4.1														
63			23 05 93	07	Certificates	TAB Submittal and Work Schedule	1.6.1														
64			23 05 93	07	Certificates	TAB Submittal and Work Schedule	1.6.3														
65			23 05 93	07	Certificates	Design review report	1.3.2														
66			23 05 93	07	Certificates	Design review report	1.6.3.1														
67			23 05 93	07	Certificates	Design review report	3.7														
68			23 05 93	07	Certificates	Pre-field TAB engineering report	1.6.3.2														

TITLE: Repair Chillers, Motion Lab, Fac 1605										SUBMITTAL REGISTER									
JOB NAME:																			
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69			23 07 00	02	Shop Drawings	MICA Plates	3.2.2.4														
70			23 07 00	02	Shop Drawings	Pipe Insulation Systems	2.3														
71			23 07 00	02	Shop Drawings	Pipe Insulation Systems	3.2														
72			23 07 00	02	Shop Drawings	Duct Insulation Systems	3.3														
73			23 07 00	02	Shop Drawings	Equipment Insulation Systems	3.4														
74			23 07 00	03	Product Data	Pipe Insulation Systems	2.3														
75			23 07 00	03	Product Data	Pipe Insulation Systems	3.2														
76			23 07 00	03	Product Data	Duct Insulation Systems	3.3														
77			23 07 00	03	Product Data	Equipment Insulation Systems	3.4														
78			23 07 00	04	Samples	Thermal Insulation	2.2.1.3														
79			23 07 00	08	Manufacturer's Instructions	Pipe Insulation Systems	2.3														
80			23 07 00	08	Manufacturer's Instructions	Pipe Insulation Systems	3.2														
81			23 07 00	08	Manufacturer's Instructions	Duct Insulation Systems	3.3														
82			23 07 00	08	Manufacturer's Instructions	Equipment Insulation Systems	3.4														
83			26 20 00	03	Product Data	Circuit breakers	2.10.1														
84			26 20 00	03	Product Data	Switches	2.7														
85			26 20 00	06	Test Reports	600-volt wiring test	3.5.2														

SECTION TABLE OF CONTENTS

DIVISION 01 - GENERAL REQUIREMENTS

SECTION 01 35 26

GENERAL SAFETY REQUIREMENTS

PART 1 GENERAL

- 1.1 SUMMARY
- 1.2 REFERENCES
- 1.3 SUBMITTALS
- 1.4 ACCIDENT PREVENTION PLAN
- 1.5 GENERAL SAFETY PROVISIONS
 - 1.5.1 Safety Briefing
 - 1.5.2 Field Supervisor
 - 1.5.3 Housekeeping
 - 1.5.4 Road Construction Safety
- 1.6 ACCIDENT TREATMENT AND RECORDS
- 1.7 FIRE PREVENTION AND PROTECTION
 - 1.7.1 Firewatch
 - 1.7.2 Smoking/Open Flames
 - 1.7.3 Smoking Restrictions
 - 1.7.4 Flammable Materials
 - 1.7.5 Fire Protection During Construction
- 1.8 USE OF EXPLOSIVES
 - 1.8.1 Powder Actuated Tools
- 1.9 ELECTRICAL
 - 1.9.1 Temporary Lighting
- 1.10 UNDERGROUND UTILITIES
 - 1.10.1 Buried Warning and Identification Tape
 - 1.10.1.1 Detectable Warning Tape for Non-Metallic Piping
 - 1.10.2 Buried Tracer Wire
- 1.11 SPECIAL SAFETY REQUIREMENTS
 - 1.11.1 Elevated Work Areas
 - 1.11.2 Facility Evacuation For Hazardous Operations/Conditions At Project Site
 - 1.11.3 Hazardous Wind Velocities
- 1.12 RADIATION SAFETY REQUIREMENTS
 - 1.12.1 Use Of Radioactive Materials And Radiation Emitters
- 1.13 FACILITY OCCUPANCY CLOSURE
 - 1.13.1 Fire And Exit Lanes
 - 1.13.2 Clean Work Areas
- 1.14 CONFINED SPACES
- 1.15 FALL HAZARD PROTECTION AND PREVENTION PROGRAM
 - 1.15.1 Training
 - 1.15.2 Fall Protection Equipment and Systems
 - 1.15.2.1 Personal Fall Arrest Equipment
 - 1.15.3 Fall Protection for Roofing Work
 - 1.15.4 Existing Anchorage
 - 1.15.5 Horizontal Lifelines
 - 1.15.6 Guardrails and Safety Nets
 - 1.15.7 Rescue and Evacuation Procedures

- 1.16 ROOFING AND COATING
- 1.17 WELDING AND FLAME CUTTING
 - 1.17.1 Welding, Burning, Spark Or Slag Producing Operations
- 1.18 SEVERE STORM PLAN
 - 1.18.1 CCAFS Lightning Alert System
 - 1.18.1.1 "Phase 1 Lightning Alert"
 - 1.18.1.2 "Phase 2 Lightning Warning"

PART 2 PRODUCTS

PART 3 EXECUTION

-- End of Section Table of Contents --

SECTION 01 35 26

GENERAL SAFETY REQUIREMENTS

PART 1 GENERAL

1.1 SUMMARY

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

1.2 REFERENCES

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.

45TH SPACE WING (SWI)

45 SWI 32-2001 Fire and Emergency Service Program

45 SWI 32-7001 Exterior Lighting Management

AMERICAN SOCIETY OF SAFETY ENGINEERS (ASSE/SAFE)

ASSE/SAFE A10.32 (2004) Fall Protection

ASSE/SAFE Z359.1 (2007) Safety Requirements for Personal Fall Arrest Systems, Subsystems and Components

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 241 Safeguarding Construction, Alteration, and Demolition Operations

U.S. AIR FORCE (USAF)

AFOSH 91-5 Welding, Cutting and Brazing

AFOSH Std 91-25 Air force Occupational Safety and Health Standard

U.S. ARMY CORPS OF ENGINEERS (USACE)

COE EM 385-1-1 Safety and Health Requirements Manual

EM 385-1-1 (2008) Safety and Health Requirements Manual

U.S. FEDERAL HIGHWAY ADMINISTRATION (FHWA)

MUTCD Manual of Uniform Traffic Control Devices

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

- 29 CFR 1910 Occupational Safety and Health Standards
- 29 CFR 1926 Safety and Health Regulations for Construction
- 29 CFR 1926.500 Fall Protection

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES in sufficient detail to show full compliance with the specification:

SD-07 Certificates

Statements for the following items shall be submitted in accordance with paragraphs entitled, "Accident Prevention Plan" of this section.

Accident Prevention Plan

License Certificates for radiation materials and equipment shall be submitted to the Contracting Officer prior to beginning work.

1.4 ACCIDENT PREVENTION PLAN

Contractor is required to follow all OSHA regulations. Contractor may not expose government property, workers of the government or any other Contractor, or the general public to hazards they may create. Contractor shall submit an Accident Prevention Plan for approval to the Contracting Office, to the Wing Ground Safety Office (45 SW/SEG 494-2202), prior to commencement of work. This plan must detail how government property, the public and workers from other employers will be protected, but shall not include details of the Contractor's internal safety program for the protection of their workers, since that is an issue between the Contractor and OSHA.

1.5 GENERAL SAFETY PROVISIONS

1.5.1 Safety Briefing

All personnel may attend QG100CAS, CCAFS General Safety. This briefing is held, with a 24 hour advance appointment, in the Training Office, Building 1723, CCAFS. The Contracting Officer will schedule this briefing per your request. In addition, all personnel may attend additional training, depending on the location of work. Employers are responsible to ensure compliance with OSHA for the protection of their workers.

1.5.2 Field Supervisor

Maintain, full time for the duration of the project, a qualified and capable supervisor who **shall be in attendance at the project site at all times work is being preformed.** The field supervisor may be a "working" supervisor. He shall be authorized to act on all project work.

1.5.3 Housekeeping

Sufficient personnel and equipment shall be provided to ensure compliance with all housekeeping requirements. Work will not be allowed in those areas that do not comply with the requirements of Section 14.C "Housekeeping" of COE EM 385-1-1. Job sites are to be kept clean on an ongoing, daily basis. All areas are to be thoroughly cleaned prior to leaving the jobsite at completion of project work.

1.5.4 Road Construction Safety

Contractor shall comply with State of Florida Department of Transportation regulations in regard to safety, barrier and marking requirement for road construction/work and the Manual of Uniform Traffic Control Devices (MUTCD) as published by the U.S. Department of Transportation and adopted by the State of Florida.

1.6 ACCIDENT TREATMENT AND RECORDS

Contractor shall post emergency first aid and ambulance information at the project site.

Emergency medical support is available by dialing (911 from any base hard-wired telephone, or 321-853-0911 from any cellular phone on CCAFS). EMS technicians will respond to provide on-site evaluation and transport for seriously injured personnel to the nearest clinic or area hospital. Personnel with non-life-threatening emergencies will be advised to have their supervisor provide transportation. Such treatment shall be recorded by the Contractor and reported to the Contracting Officer.

1.7 FIRE PREVENTION AND PROTECTION

Open-flame heating devices will not be permitted except by approval in writing from the Base Fire Department through the Contracting Officer. Approval for the use of open fires and open-flame heating devices will not relieve the Contractor from the responsibility for any damage incurred because of fires.

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

1.7.1 Firewatch

A firewatch will be required for any cutting, welding or operation with any equipment producing sparks and/or having an open flame. The field supervisor shall be responsible for designating one of his personnel as a dedicated firewatch and providing his own fully-charged fire extinguishers of the appropriate type and number as required. No cutting, welding or open flame operations shall be started without the proper firewatch and without a burn permit. Burn permits, issued by the Base Fire Department, will be provided by the Contracting Officer or his representative. Requests for burn permits must be made at least 72 hours prior to starting the operation. Saturday and Sunday requests are to be submitted by 1200 hours on the Thursday preceding the day of request. The construction superintendent is required to sign acknowledging the permit requirements in accordance with AFOSH 91-5.

1.7.2 Smoking/Open Flames

Smoking, any open flames, non explosion-proof electrical equipment and

tools, and spark producing devices are strictly prohibited in all areas where explosive vapors from adhesives, dopes, varnishes, lacquers, thinners, or paints may be present and when these materials are used.

Burning of trash or rubbish on PAFB, CCAFS, or any other 45SW facility is prohibited.

1.7.3 Smoking Restrictions

Smoking is restricted in many areas of CCAFS. All of the prohibitions listed below are applicable and Supervisory personnel are responsible for compliance.

Smoking is prohibited within any Government Facility.

Smoking will be permitted only in areas designated by the U.S. Air Force. This is a controlled area and the "NO SMOKING" requirement shall be strictly enforced. All cigarette lighting items, i.e., lighters, matches, etc., shall be surrendered to the Gate Security Guard before entering the Launch Complexes and other designated facilities where propellants or explosives may be used, handled or stored.

Smoking will be permitted only in areas designated by the U.S. Air Force. Smoking areas are clearly defined by the lines painted on the concrete or asphalt surfaces (with exception of the guard shacks). Flame, spark, or heat producing devices are not allowed on the on launch complexes or any other area where explosives or propellants are used, handled or stored. They must be left in a suitable container at the entrance to each facility.

1.7.4 Flammable Materials

Storage of flammable materials shall not be allowed in the work areas. Other materials may be stored in areas designated by the Contracting Officer.

1.7.5 Fire Protection During Construction

Contract specifications shall be in accordance with COE EM 385-1-1, 45 SWI 32-2001 and NFPA 241 and shall contain the requirements that the activity's fire regulations be followed.

1.8 USE OF EXPLOSIVES

Explosives shall not be used or brought to the project site without prior written approval. Requests shall be submitted to the Contracting Officer for approval by Wing Weapons Safety, 45 SW/SEW, 494 2520. Such approval shall not relieve the Contractor of responsibility for injury to persons or for damage to property due to explosive operations.

Storage of explosives, when permitted on Government property, shall be only where directed and in approved storage facilities. These facilities shall be kept locked at all times except for inspection, delivery, and withdrawal of explosives.

Powder actuated tools are not permitted to be used or stored at this construction site.

1.8.1 Powder Actuated Tools

No powder actuated tools/equipment shall be used or stored at the construction site.

1.9 ELECTRICAL

Contractor shall appoint an individual responsible for the electrical safety of each work team to restrict entry to dangerous locations to those authorized by him jointly with the Government.

1.9.1 Temporary Lighting

Any temporary lighting used during the performance of the contract work including installation and material (fixtures, wiring, cables, cords, receptacles, plugs, and associated equipment) used and/or installed shall comply with all requirements of the National Electrical Code, the National Fire Protection Association, and 45 SWI 32-7001 (45 Space Wing Instruction Exterior Lighting Management).

1.10 UNDERGROUND UTILITIES

Safety clearance is required before any Contractor personnel enters a manhole. Contractor shall follow all OSHA requirements for work in confined spaces.

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

Contractor shall fully aerate manholes for at least one-half hour using a blower or fan before air sampling. Air monitoring shall be performed by the contractor.

1.10.1 Buried Warning and Identification Tape

Install warning and identification tape with all underground utilities. Polyethylene plastic warning tape manufactured specifically for warning and identification of buried utility lines. Provide tape on rolls, 3 inch minimum width, color coded as specified below for the intended utility with warning and identification imprinted in bold black letters continuously over the entire tape length. Warning and identification to read, "CAUTION, BURIED (intended service) LINE BELOW" or similar wording. Color and printing shall be permanent, unaffected by moisture or soil.

Warning Tape Color Codes

Red: Electric

Warning/Identification tape shall be buried 12 inches to 24 inches below grade over the top of the utility.

1.10.1.1 Detectable Warning Tape for Non-Metallic Piping

Polyethylene plastic tape shall conform to the width, color, and printing requirements specified above. Minimum thickness of the tape shall be 0.004 inch (4 mil). Tape shall have a minimum strength of 1500 psi lengthwise and 1250 psi crosswise. Tape shall be manufactured with integral wires, foil backing, or other means of enabling detection by a metal detector when tape is buried up to 3 feet deep. Encase metallic element of the tape in a

protective jacket or provide with other means of corrosion protection.

1.10.2 Buried Tracer Wire

Trace wire shall be installed with all buried utilities laying on top of or wrapped around the utility conduit. Trace wire shall be No.6 gage wire.

1.11 SPECIAL SAFETY REQUIREMENTS

1.11.1 Elevated Work Areas

Rope off and barricade all areas to 20 feet on all sides beneath work in elevated areas. All tools shall be tethered during work operations in designated areas.

1.11.2 Facility Evacuation For Hazardous Operations/Conditions At Project Site

Upon hearing an alarm or an evacuation announcement, all personnel in the facility affected are to immediately proceed to their designated Emergency Evacuation Assembly Point (EEAP). Each facility has a clearly marked primary and secondary EEAP. All personnel should evacuate to the primary EEAP unless they are unable to do so due to the location and nature of the emergency. Security guards will be at all EEAP's after an evacuation has begun. All personnel evacuating controlled areas will deposit their controlled area badges at the EEAP. All evacuees are to remain at the EEAP until receiving further instructions from Security and Safety.

All personnel working in the affected areas are required to adhere to the Facility Evacuation Procedure and to ensure that the personnel under their control are aware of the evacuation requirements. The location of EEAP's for the area of work will be included in the Safety Orientation required for work in the project area. On occasion, access to facilities may be denied due to hazardous operations or conditions in progress. The Contracting Officer or his representative shall be immediately notified of denied access/evacuation incidents, their time of occurrence and duration.

From time to time, the U.S. Air Force will conduct evacuation drills in the area. Evacuation drills may or may not affect personnel working at these sites; however, two (2) hours per week interruption shall be allowed for an evacuation drill.

1.11.3 Hazardous Wind Velocities

No work shall be performed on any unprotected elevated structures over 6 feet high when winds are 30 knots or more.

1.12 RADIATION SAFETY REQUIREMENTS

License Certificates for radiation materials and equipment shall be submitted to the Contracting Officer for all specialized material and equipment brought onto CCAFS.

Loss of radioactive material shall be reported immediately to the Contracting Officer.

Actual exposure of the radiographic film or unshielding the source shall not be initiated until after 1700 on weekdays.

When exposing radiographic material, proper cordons and markings shall be established and maintained.

1.12.1 Use Of Radioactive Materials And Radiation Emitters

Contractor will apply for and receive a Radiation Use Authorization (RUA) prior to bringing any radioactive material or source of ionizing radiation; or any laser or radio frequency radiation emitter onto CCAFS. Any Contractor licensed by the State of Florida to possess and use any radioactive by-product material will apply for and receive reciprocal approval (NRC Form 241) from the Nuclear Regulatory Commission prior to bringing any radioactive by-product material onto Patrick AFB and Cape Canaveral AFS. Contractor shall comply with all provisions of the RUA including requests to conduct radiation protection surveys and audits intending to protect the general base population. To submit a request for a RUA, contact the Contracting Officer or the 45th Space Wing Radiation Protection Officer, 1380 S. Patrick Drive, Patrick AFB, FL 32925; 321-494-5435.

1.13 FACILITY OCCUPANCY CLOSURE

Streets, walks, and other facilities occupied and used by the Government shall not be closed or obstructed without written permission from the Contracting Officer.

1.13.1 Fire And Exit Lanes

Fire lanes and exit lanes must be kept clear at all times.

1.13.2 Clean Work Areas

Contractor shall prevent the introduction of dirt or dust into areas adjacent to work areas.

1.14 CONFINED SPACES

Contractor shall comply with 29 CFR 1910.146 "Permit-Required Confined Spaces". Contractor shall brief the Contracting Officer in writing of any hazards encountered during the confined space entry. Contractor shall coordinate emergency rescue responsibilities with the Contracting Officer and entry operations and procedures with the Government and agree upon the permit space entry system to be used when both the Government organizational and Contractor personnel will be working in a permit-required confined space in accordance with Air Force Instruction AFOSH Std 91-25, Chapter 7. Contractor shall provide a copy of their Permit Confined Space Program to the Contracting officer for approval prior to beginning work.

The 45 SW/SEG maintains a master list of all identified confined spaces on PAFB and CCAFS. They can be reached at 321-494-2202 for information about any confined spaces. Special requirements, coordination, and precautions will apply to Permit-Required Confined Spaces. Testing, surveillance and type of monitoring shall be required by Contractor personnel in these work spaces, prior to entry. Notify the Contracting Officer of any confined spaces requiring entry that are not identified but suspected as Permit-Required Confined Spaces.

1.15 FALL HAZARD PROTECTION AND PREVENTION PROGRAM

Establish a fall protection and prevention program, for the protection of all employees exposed to fall hazards. Within the program include company policy, identify responsibilities, education and training requirements, fall hazard identification, prevention and control measures, inspection, storage, care and maintenance of fall protection equipment and rescue and evacuation procedures.

1.15.1 Training

Institute a fall protection training program. As part of the Fall Hazard Protection and Prevention Program, provide training for each employee who might be exposed to fall hazards. Provide training by a competent person for fall protection accordance with USACE EM 385-1-1, section 21.A.16.

1.15.2 Fall Protection Equipment and Systems

Enforce use of the fall protection equipment and systems designated for each specific work activity in the Fall Protection and Prevention Plan and/or AHA at all times when an employee is exposed to a fall hazard. Protect employees from fall hazards as specified in EM 385-1-1, section 21. In addition to the required fall protection systems, safety skiff, personal floatation devices, life rings etc., are required when working above or next to water in accordance with USACE EM 385-1-1, paragraphs 05.H. and 05.I. Personal fall arrest systems are required when working from an articulating or extendible boom, swing stages, or suspended platform. In addition, personal fall arrest systems are required when operating other equipment such as scissor lifts if the work platform is capable of being positioned outside the wheelbase. The need for tying-off in such equipment is to prevent ejection of the employee from the equipment during raising, lowering, or travel. Fall protection must comply with 29 CFR 1926.500, Subpart M, USACE EM 385-1-1 and ASSE/SAFE A10.32.

1.15.2.1 Personal Fall Arrest Equipment

Personal fall arrest equipment, systems, subsystems, and components shall meet ASSE/SAFE Z359.1. Only a full-body harness with a shock-absorbing lanyard or self-retracting lanyard is an acceptable personal fall arrest body support device. Body belts may only be used as a positioning device system (for uses such as steel reinforcing assembly and in addition to an approved fall arrest system). Harnesses shall have a fall arrest attachment affixed to the body support (usually a Dorsal D-ring) and specifically designated for attachment to the rest of the system. Only locking snap hooks and carabineers shall be used. Webbing, straps, and ropes shall be made of synthetic fiber. The maximum free fall distance when using fall arrest equipment shall not exceed 6 feet. The total fall distance and any swinging of the worker (pendulum-like motion) that can occur during a fall shall always be taken into consideration when attaching a person to a fall arrest system.

1.15.3 Fall Protection for Roofing Work

Implement fall protection controls based on the type of roof being constructed and work being performed. Evaluate the roof area to be accessed for its structural integrity including weight-bearing capabilities for the projected loading.

- a. Low Sloped Roofs:

(1) For work within 1.8 m (6 feet) of an edge, on low-slope roofs, Protect personnel from falling by use of personal fall arrest systems, guardrails, or safety nets. A safety monitoring system is not adequate fall protection and is not authorized.

(2) For work greater than 1.8 m (6 feet) from an edge, erect and install warning lines in accordance with 29 CFR 1926.500 and USACE EM 385-1-1.

b. Steep-Sloped Roofs: Work on steep-sloped roofs requires a personal fall arrest system, guardrails with toe-boards, or safety nets. This requirement also includes residential or housing type construction.

1.15.4 Existing Anchorage

Certified (or re-certified) by a qualified person for fall protection existing anchorages, to be used for attachment of personal fall arrest equipment in accordance with ASSE/SAFE Z359.1. Existing horizontal lifeline anchorages must be certified (or re-certified) by a registered professional engineer with experience in designing horizontal lifeline systems.

1.15.5 Horizontal Lifelines

Design, install, certify and use under the supervision of a qualified person horizontal lifelines for fall protection as part of a complete fall arrest system which maintains a safety factor of 2 (29 CFR 1926.500).

1.15.6 Guardrails and Safety Nets

Design, install and use guardrails and safety nets in accordance with EM 385-1-1 and 29 CFR 1926 Subpart M.

1.15.7 Rescue and Evacuation Procedures

When personal fall arrest systems are used, the contractor must ensure that the mishap victim can self-rescue or can be rescued promptly should a fall occur. Prepare a Rescue and Evacuation Plan and include a detailed discussion of the following: methods of rescue; methods of self-rescue; equipment used; training requirement; specialized training for the rescuers; procedures for requesting rescue and medical assistance; and transportation routes to a medical facility. Include the Rescue and Evacuation Plan within the Activity Hazard Analysis (AHA) for the phase of work, in the Fall Protection and Prevention (FP&P) Plan.

1.16 ROOFING AND COATING

At the beginning of each work day the Contractor shall check with the Contracting Officer before proceeding to work on the roof to ensure safe work conditions. Tar pot operations shall comply with 45 SWI 32-2001, Paragraph 4.28.

1.17 WELDING AND FLAME CUTTING

Contractor shall clear welding, cutting, or spark producing operations with the Contracting Officer before operations begin. A burn permit is required for welding and cutting operations. Contractor shall provide his own fire watch and appropriate number of fire extinguishers of the proper size and type for the operation being performed.

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 after discontinuing these operations to make thorough inspection of the area for possible sources of latent combustion. He shall be equipped with two full 10 pound dry chemical fire extinguishers. Extinguishers shall be rated for Class A, B and C fires. Current inspection sticker shall be affixed to the extinguisher. Any unsafe conditions shall be reported to the Fire Inspector.

During operations involving possible fire hazard, the Contractor shall notify the Contracting Officer and not proceed until clearance is obtained in writing.

1.17.1 Welding, Burning, Spark Or Slag Producing Operations

These operations shall be permitted only in the presence of a firewatch, and only during specific periods approved by the U.S. Air Force. Slag blankets or welding blankets shall be used in all areas to contain any hot sparks or slag material. Flashback arrestors shall be utilized on all compressed gas welding operations.

1.18 SEVERE STORM PLAN

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

- a. Secure outside equipment and materials and place materials exposed to damage in protected locations.
- b. Check surrounding area, including roof, for loose material, equipment, debris, and other objects that could be blown away or against existing facilities.
- c. Ensure that temporary erosion controls are adequate.

1.18.1 CCAFS Lightning Alert System

There are two types of lightning alert announcements, each made over the Base Aural Warning System.

1.18.1.1 "Phase 1 Lightning Alert"

Announced when lightning is expected to be within 5 miles of a specific area within 30 minutes of the announcement.

Required Action during Lightning Alert (Phase 1) Period: All personnel shall withdraw to a safe area as designated by the USAF. When working in an open exposed area or performing an electrical operation or cross-country piping operation, the operation shall be secured and personnel shall proceed to a lightning safe area prior to the Phase 2 Lightning Warning start time. If a hoisting operation is in progress, the lift will be promptly completed or returned to ground level, secured and the area cleared. Loads may not be left suspended.

1.18.1.2 "Phase 2 Lightning Warning"

Announced when lightning is imminent or occurring within 5 miles of a specific area.

Required Action during Lightning Warning (Phase 2) Period: All personnel shall remain within a safe area as designated by the USAF. No hoisting operation, electrical operation (connecting or disconnecting), power tool operation, or cross-country piping system work shall be performed during a Phase 2 lightning warning period.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 01 - GENERAL REQUIREMENTS

SECTION 01 42 00

SOURCES FOR REFERENCE PUBLICATIONS

PART 1 GENERAL

1.1 REFERENCES

1.2 ORDERING INFORMATION

-- End of Section Table of Contents --

SECTION 01 42 00

SOURCES FOR REFERENCE PUBLICATIONS

PART 1 GENERAL

1.1 REFERENCES

Various publications are referenced in other sections of the specifications to establish requirements for the work. These references are identified in each section by document number, date and title. The document number used in the citation is the number assigned by the standards producing organization, (e.g. ASTM B 564 Nickel Alloy Forgings). However, when the standards producing organization has not assigned a number to a document, an identifying number has been assigned for reference purposes.

1.2 ORDERING INFORMATION

The addresses of the standards publishing organizations whose documents are referenced in other sections of these specifications are listed below, and if the source of the publications is different from the address of the sponsoring organization, that information is also provided. Documents listed in the specifications with numbers which were not assigned by the standards producing organization should be ordered from the source by title rather than by number.

ACI INTERNATIONAL (ACI)
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Fax: 248-848-3701
Internet: <http://www.aci-int.org>

AIR CONDITIONING AND REFRIGERATION INSTITUTE (ARI)
4100 North Fairfax Drive, Suite 200
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Ph: 703-524-8800
Fax: 703-528-3816
E-mail: ari@ari.org
Internet: <http://www.ari.org>

UNIFIED FACILITIES CRITERIA (UFC)
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139 Barnes Dr Suite 1
Tyndall AFB FL 32403-5319
Ph: 1-888-232-3721
DSN: 523-6995
Internet:

AIR CONDITIONING CONTRACTORS OF AMERICA (ACCA)
2800 Shirlington Road, Suite 300
Arlington, VA 22206
Ph: 703-575-4477
FAX: 703-575-4449
Internet: <http://www.acca.org>

E-mail: info@acca.org

AIR DIFFUSION COUNCIL (ADC)
1000 East Woodfield Road, Suite 102
Shaumburg, IL 60173-5921
Ph: 847-706-6750
Fax: 847-706-6751
Internet: <http://www.flexibleduct.org>
E-mail: info@flexibleduct.org

AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL (AMCA)
30 West University Drive
Arlington Heights, IL 60004-1893
Ph: 847-394-0150
Fax: 847-253-0088
Internet: <http://www.amca.org>
E-Mail: amca@amca.org

ALUMINUM ASSOCIATION (AA)
900 19th Street N.W., Suite 300
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Fax: 202-862-5164
Internet: <http://www.aluminum.org>

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1827 Walden Office Square
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Schaumburg, IL 60173-4268
Ph: 847-303-5664
Fax: 847-303-5774
Internet: <http://www.aamanet.org>
E-mail: webmaster@aamanet.org

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
(AASHTO)
444 North Capital Street, NW, Suite 249
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Ph: 202-624-5800
Fax: 202-624-5806
Internet: <http://www.aashto.org>
E-Mail: info@ashto.org

AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS (AATCC)
P.O. Box 12215
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Fax: 919-549-8933
Internet: <http://www.aatcc.org>

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E-mail: abma@fdc.sba.com

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Fax: 703-522-2665
Internet: <http://www.abma.com>

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222 West Las Colinas Boulevard, Suite 641
Irving, TX 75039-5423
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Fax: 972-506-7682
Internet: <http://www.concrete-pipe.org>
E-mail: info@concrete-pipe.org

AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH)
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Internet: <http://www.acgih.org>
E-mail: mail@acgih.org

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American Wood Council
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Fax: 202-463-2785
Internet: <http://www.afandpa.org/>

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Internet: <http://www.aga.org>
E-mail: webmaster@aga.org

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Internet: <http://www.aga.org>

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Internet: <http://www.arema.org>

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Website: <http://www.bsi-global.com>

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New York, NY 10017
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Fax: 212-370-9047
E-mail: assocmgmt@aol.com
Internet: <http://www.buildershardware.com>

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Fax: 706-278-8835
Internet: <http://www.carpet-rug.com>

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Fax: 423-892-0817
Internet: <http://www.cispi.org>

CEILINGS & INTERIOR SYSTEMS CONSTRUCTION ASSOCIATION (CISCA)
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St. Charles, IL 60174
Ph: 630-584-1919
Fax: 630-584-2003
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Internet: <http://www.cisca.org>

CENTERS FOR DISEASE CONTROL AND PREVENTION (CDC)
1600 Clifton Road
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1919 S. Eads St.
Arlington, VA 22202
PH: 866-858-1555 or 703-907-7600
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California Energy Commission
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E-mail: cffa@chemicalfabricsandfilm.com
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COUNCIL OF AMERICAN BUILDING OFFICIALS (CABO)
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Internet: http://www.mhia.org/psc/psc_products_cranes.cfm

DISTRICT OF COLUMBIA MUNICIPAL REGULATIONS (DCMR)
441 4th Street NW, Suite 520
Washington DC 20001
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Internet: <http://www.abfa.com/dcdocs/dcmrlist.htm>

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-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 01 - GENERAL REQUIREMENTS

SECTION 01 57 20.00 10

ENVIRONMENTAL PROTECTION

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 DEFINITIONS
 - 1.2.1 Environmental Pollution and Damage
 - 1.2.2 Environmental Protection
 - 1.2.3 Land Application for Discharge Water
 - 1.2.4 Surface Discharge
 - 1.2.5 Waters of the United States
 - 1.2.6 Wetlands
 - 1.2.7 Hazardous Materials
 - 1.2.8 Pre-existing environmental conditions
 - 1.2.9 Solid Waste Management Unit
- 1.3 GENERAL REQUIREMENTS
- 1.4 SUBCONTRACTORS
- 1.5 SUBMITTALS
- 1.6 SPECIAL ENVIRONMENTAL REQUIREMENTS
- 1.7 ENVIRONMENTAL ASSESSMENT OF CONTRACT DEVIATIONS
- 1.8 NOTIFICATION

PART 2 PRODUCTS

PART 3 EXECUTION

- 3.1 LAND RESOURCES
 - 3.1.1 Erosion and Sediment Controls
 - 3.1.2 Contractor Facilities and Work Areas
- 3.2 WATER RESOURCES
- 3.3 AIR RESOURCES
 - 3.3.1 Burning
 - 3.3.2 Asbestos
 - 3.3.3 Ozone Depleting Substances (ODS)
 - 3.3.4 LEAD-BASED PAINT
 - 3.3.5 POLYCHLORINATED BIPHENYLS (PCBs)
- 3.4 CHEMICAL MATERIALS MANAGEMENT AND WASTE DISPOSAL
 - 3.4.1 Solid Wastes
 - 3.4.2 Chemicals and Chemical Wastes
 - 3.4.3 Contractor Generated Hazardous Wastes/Excess Hazardous Materials
 - 3.4.4 Oil and Lubricants Storage
- 3.5 RECYCLING AND WASTE MINIMIZATION
- 3.6 HAZARDOUS MATERIALS MANAGEMENT PROCESS (HMMP)
- 3.7 HISTORICAL, ARCHAEOLOGICAL, AND CULTURAL RESOURCES
- 3.8 BIOLOGICAL RESOURCES
- 3.9 PREVIOUSLY USED EQUIPMENT
- 3.10 MAINTENANCE OF POLLUTION FACILITIES

- 3.11 MILITARY MUNITIONS
- 3.12 CONTAMINATED MEDIA MANAGEMENT
- 3.13 POST CONSTRUCTION CLEANUP

-- End of Section Table of Contents --

SECTION 01 57 20.00 10

ENVIRONMENTAL PROTECTION

PART 1 GENERAL

1.1 REFERENCES

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.

U.S. AIR FORCE (USAF)

45 SW Management Plan 19-14 (2011) Waste Petroleum Products and Hazardous Waste Management

AFI 32-7086 Hazardous Material Management

U.S. ARMY CORPS OF ENGINEERS (USACE)

WETLANDS DELINEATION MANUAL (1987) Corps of Engineers Wetlands Delineation Manual

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

33 CFR 328 Definitions of Waters of the United States

40 CFR 112 Oil Pollution Prevention

40 CFR 260 Hazardous Waste Management System: General

40 CFR 261 Identification and Listing of Hazardous Waste

40 CFR 279 Standards for the Management of Used Oil

40 CFR 82 Protection of Stratospheric Ozone

49 CFR 171 - 178 Hazardous Materials Regulations

1.2 DEFINITIONS

1.2.1 Environmental Pollution and Damage

Environmental pollution and damage is the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances of importance to human life; affect other species of importance to humankind; or degrade the environment aesthetically, culturally and/or historically.

1.2.2 Environmental Protection

Environmental protection is the prevention/control of pollution and habitat disruption that may occur to the environment during construction. The

control of environmental pollution and damage requires consideration of land, water, and air; biological and cultural resources; and includes management of visual aesthetics; noise; solid, chemical, gaseous, and liquid waste; radiant energy and radioactive material as well as other pollutants.

1.2.3 Land Application for Discharge Water

The term "Land Application" for discharge water implies that the Contractor must discharge water at a rate which allows the water to percolate into the soil. No sheeting action, soil erosion, discharge into storm sewers, discharge into defined drainage areas, or discharge into the "waters of the United States" must occur. Land Application must be in compliance with all applicable Federal, State, and local laws and regulations.

1.2.4 Surface Discharge

The term "Surface Discharge" implies that the water is discharged with possible sheeting action and subsequent soil erosion may occur. Waters that are surface discharged may terminate in drainage ditches, storm sewers, creeks, and/or "waters of the United States".

1.2.5 Waters of the United States

All waters which are under the jurisdiction of the Clean Water Act, as defined in 33 CFR 328.

1.2.6 Wetlands

Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, and bogs. Official determination of whether or not an area is classified as a wetland must be done in accordance with WETLANDS DELINEATION MANUAL.

1.2.7 Hazardous Materials

To meet the intent of the Air Force Hazardous Materials Management Process (HMMP), the term HAZMAT includes all items (including medical supply items, but excluding drugs in their finished form and pharmaceuticals in individual-issued items) covered under the Emergency Planning and Community Right-To-Know Act (EPCRA) tracking requirement, the OSHA HAZCOM Standard, and all Class I and Class II Ozone Depleting Substances. It does not include munitions or Hazardous Waste.

1.2.8 Pre-existing environmental conditions

Pre-existing environmental conditions refers to known contaminated environmental media (soil, groundwater, sediment, surface water) found on a SWMU as defined in the current Base RCRA permit.

1.2.9 Solid Waste Management Unit

Solid Waste Management Unit is a regulated unit under RCRA, which may have specific assessment, cleanup, reporting, and land use control requirements

1.3 GENERAL REQUIREMENTS

Minimize environmental pollution and damage that may occur as the result of construction operations. The environmental resources within the project boundaries and those affected outside the limits of permanent work must be protected during the entire duration of this contract. Comply with all applicable environmental Federal, State, and local laws and regulations. Any delays resulting from failure to comply with environmental laws and regulations will be the Contractor's responsibility.

1.4 SUBCONTRACTORS

Ensure compliance with this section by subcontractors.

1.5 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Map

1.6 SPECIAL ENVIRONMENTAL REQUIREMENTS

Comply with the special environmental requirements listed here and attached at the end of this section.

1.7 ENVIRONMENTAL ASSESSMENT OF CONTRACT DEVIATIONS

Any deviations from the drawings, plans and specifications, requested by the Contractor and which may have an environmental impact, will be subject to approval by the Contracting Officer and may require an extended review, processing, and approval time. The Contracting Officer reserves the right to disapprove alternate methods, even if they are more cost effective, if the Contracting Officer determines that the proposed alternate method will have an adverse environmental impact.

1.8 NOTIFICATION

The Contracting Officer will notify the Contractor in writing of any observed noncompliance with Federal, State or local environmental laws or regulations, permits. After receipt of such notice, the Contractor will inform the Contracting Officer of the proposed corrective action and take such action when approved by the Contracting Officer. The Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No time extensions will be granted or equitable adjustments allowed for any such suspensions. This is in addition to any other actions the Contracting Officer may take under the contract, or in accordance with the Federal Acquisition Regulation or Federal Law.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.1 LAND RESOURCES

Confine all activities to areas defined by the drawings and specifications. Identify any land resources to be preserved within the work area prior to the beginning of any construction. Do not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, topsoil, and land forms without approval, except in areas indicated on the drawings or specified to be cleared. Ropes, cables, or guys will not be fastened to or attached to any trees for anchorage unless specifically authorized. Provide effective protection for land and vegetation resources at all times, as defined in the following subparagraphs. Remove stone, soil, or other materials displaced into uncleared areas.

3.1.1 Erosion and Sediment Controls

Providing erosion and sediment control measures in accordance with Federal, State, and local laws and regulations is the Contractor's responsibility. The erosion and sediment controls selected and maintained by the Contractor shall be such that water quality standards are not violated as a result of construction activities. The area of bare soil exposed at any one time by construction operations should be kept to a minimum. Construct or install temporary and permanent erosion and sediment control best management practices (BMPs). Select applicable best management practices from the Florida Stormwater Erosion and Sedimentation Control Inspector's Manual. Remove any temporary measures after the area has been stabilized to 70 percent.

3.1.2 Contractor Facilities and Work Areas

Submit a Map showing proposed lay down area for approval. Place field offices, staging areas, stockpile storage, and temporary buildings in areas designated on the drawings or as directed by the Contracting Officer. Temporary movement or relocation of Contractor facilities will be made only when approved. Erosion and sediment controls must be provided for onsite borrow and spoil areas to prevent sediment from entering nearby waters. Temporary excavation and embankments for plant and/or work areas must be controlled to protect adjacent areas.

3.2 WATER RESOURCES

Monitor all water areas affected by construction activities to prevent pollution of surface and ground waters. Do not apply toxic or hazardous chemicals to soil or vegetation unless otherwise indicated. For construction activities immediately adjacent to impaired surface waters, the Contractor must be capable of quantifying sediment or pollutant loading to that surface water when required by State or Federally issued Clean Water Act permits.

3.3 AIR RESOURCES

Dust particles; aerosols and gaseous by-products from construction activities; and processing and preparation of materials, such as from asphaltic batch plants; must be controlled at all times, including weekends, holidays and hours when work is not in progress. Sprinkling, chemical treatment of an approved type, or other methods will be permitted to control particulates in the work area.

3.3.1 Burning

Burning is prohibited on the Government premises.

3.3.2 Asbestos

If the Contractor suspects the presence of Asbestos Containing Materials (ACM) not shown on the drawings or must disturb ACM which is not part of the contract, Contractor shall immediately inform the Contracting Officer. The Contracting Officer will determine whether removal of the questionable material is required and who will accomplish the removal. Contractor shall not disturb, remove, enclose, or otherwise cause a potential asbestos fiber release.

This project contains no known ACM. In the event ACM is found and must be removed, removal of ACM is normally accomplished by the Government through the use of a separate Asbestos Removal Contractor.

Use of CCAFS landfill is mandatory for all CCAFS and PAFB asbestos disposal per the conditions of the FDEP permits. All concrete removed during a project must be taken to the CCAFS landfill either for stockpiling for recycling or for disposal in the asbestos monofill, depending on the analytical results. A copy of the test report and "Landfill Verification Form" and if/when necessary, the Uniform Hazardous Waste Manifest must be provided before it can be taken to the landfill.

3.3.3 Ozone Depleting Substances (ODS)

Class I and II ODS as defined and identified herein will not be used in the performance of this contract, nor be provided as part of the equipment. This prohibition will be considered to prevail over any other provision, specification, drawing, or referenced documents. Regulations related to the protection of stratosphere ozone may be found in 40 CFR 82.

Heating and air conditioning technicians must be certified through an EPA-approved program. Copies of certifications shall be maintained at the employees' place of business and be carried as a wallet card by the technician, as provided by environmental law. Accidental venting of a refrigerant is a release and shall be reported to the Contracting Officer.

3.3.4 LEAD-BASED PAINT

Lead-based paint (LBP) has not been identified in the contract work area. If the Contractor suspects the presence of LBP not shown on the drawings or must disturb LBP which is not part of the contract, Contractor shall immediately inform the Contracting Officer.

3.3.5 POLYCHLORINATED BIPHENYLS (PCBs)

No equipment containing polychlorinated biphenyls (PCBs) may be used in the project. Any electrical equipment removed, including fluorescent light ballasts, which contains PCBs, shall be managed in accordance with applicable environmental law and installation instructions. If the equipment has any leaks, the contractor is responsible for repairing these prior to delivery to the storage facility. No leaking equipment will be accepted into this facility. Contact the Environmental Support Contractor through the Contracting Officer for disposal guidance.

3.4 CHEMICAL MATERIALS MANAGEMENT AND WASTE DISPOSAL

Disposal of wastes will be as directed below, unless otherwise specified in other sections and/or shown on the drawings.

3.4.1 Solid Wastes

Place solid wastes (excluding clearing debris) in containers which are emptied on a regular schedule. Handling, storage, and disposal must be conducted to prevent contamination. Employ segregation measures so that no hazardous or toxic waste will become co-mingled with solid waste. Waste materials will be hauled to the Government landfill site designated by the Contracting Officer at the expense of the contractor.

3.4.2 Chemicals and Chemical Wastes

Dispense chemicals ensuring no spillage to the ground or water. Perform and document periodic inspections of dispensing areas to identify leakage and initiate corrective action. This documentation will be periodically reviewed by the Government. Collect chemical waste in corrosion resistant, compatible containers. Collection drums must be monitored and removed to a staging or storage area when contents are within 6 inches of the top. On site storage for 90 days is allowed. Wastes will be classified, managed, stored, and disposed of in accordance with Federal, State, and local laws and regulations.

3.4.3 Contractor Generated Hazardous Wastes/Excess Hazardous Materials

Hazardous wastes are defined in 40 CFR 261, or are as defined by applicable State and local regulations. Hazardous materials are defined in 49 CFR 171 - 178. At a minimum, manage and store hazardous waste in compliance with 45 SW Management Plan 19-14. Take sufficient measures to prevent spillage of hazardous and toxic materials during dispensing. Segregate hazardous waste from other materials and wastes, protect it from the weather by placing it in a safe covered location, and take precautionary measures such as berming or other appropriate measures against accidental spillage. Storage, describing, packaging, labeling, marking, and placarding of hazardous waste and hazardous material in accordance with 49 CFR 171 - 178, State, and local laws and regulations is the Contractor's responsibility. Transport Contractor generated hazardous waste off Government property within 60 days in accordance with the Environmental Protection Agency and the Department of Transportation laws and regulations. Dispose of hazardous waste in compliance with Federal, State and local laws and regulations. Spills of hazardous or toxic materials must be immediately reported to the Contracting Officer. Cleanup and cleanup costs due to spills are the Contractor's responsibility.

3.4.4 Oil and Lubricants Storage

Fueling and lubrication of equipment and motor vehicles must be conducted in a manner that affords the maximum protection against spill and evaporation. Used lubricants and used oil to be discarded must be stored in marked corrosion-resistant containers and recycled or disposed in accordance with 40 CFR 279, State, and local laws and regulations.

If on-site oil storage is required at any time throughout the duration of the contract and the storage containers or equipment are owned and operated by the contractor, the contractor shall provide a means of impervious secondary containment for their storage tanks, drums or portable equipment

(generators, lighting, HVAC units, etc.) that contain oil greater than or equal to 55 gallons. The secondary containment structure shall contain the entire capacity of the largest single container stored within the containment structure in addition to 10% for additional freeboard (precipitation). The containment shall be kept free of debris and un-contaminated rainwater shall be properly drained within one business day of any rain event. Note: Secondary containment will not be required for mobile heavy equipment.

The contractor shall thoroughly inspect all containers and equipment on a daily basis for worn parts, leaks, drips, cracks, faulty gauges/sensors, inoperable release detection devices, corrosion, etc. The visual daily inspection that falls on the first business day of every week (e.g. Monday) shall be recorded by the contractor. At a minimum, the recorded inspection must provide what portion of the container or equipment was inspected, indicating deficiencies when identified. If any deficiencies are identified during the recorded weekly or visual daily inspections that could contribute to an oil release in any manner, the contractor shall immediately repair or replace the affected containers or equipment. All oil filled containers or equipment shall be properly closed and secured at all times excluding filling or emptying operations.

If the contractor requires on-site aggregate oil storage in quantities greater than or equal to 1,320 gallons, the contractor will be responsible for developing and implementing a Spill Prevention Control and Countermeasure (SPCC) Plan in accordance with 40 CFR 112. The 45 SW Environmental Quality office must be notified of the introduction of such equipment or containers greater than or equal to 55 gallons within one week of their arrival on-site.

Definitions

OIL: Oil means oil of any kind or in any form, including, but not limited to: fats, oils, or greases of animal, fish, or marine mammal origin; vegetable oils, including oils from seeds, nuts, fruits, or kernels; and, other oils and greases, including petroleum, fuel oil, sludge, synthetic oils, mineral oils, oil refuse, or oil mixed with wastes other than dredged spoil.

3.5 RECYCLING AND WASTE MINIMIZATION

Participate in State and local government sponsored recycling programs. The Contractor is further encouraged to minimize solid waste generation throughout the duration of the project.

3.6 HAZARDOUS MATERIALS MANAGEMENT PROCESS (HMMP)

No hazardous material shall be brought onto government property that does not directly relate to requirements for the performance of this contract.

Authorization shall be obtained prior to bringing HAZMAT on to 45th Space Wing Installations complying with the requirements of AFI 32-7086, AFSPC Supplement (1 August 2006), Section 2.5.5. The Standard Operating Procedure (SOP) to comply with the HMMP is entitled the 45th SW HAZMAT Tracking Procedures for Construction and Service Contractors.

The contractor shall ensure compliance with these requirements by their employees and Subcontractors.

Keep copies of the MSDS for hazardous materials on site at all times and provide them to the Contracting Officer at the end of the project.

3.7 HISTORICAL, ARCHAEOLOGICAL, AND CULTURAL RESOURCES

If during excavation or other construction activities any previously unidentified or unanticipated historical, archaeological, and cultural resources are discovered or found, all activities that may damage or alter such resources will be temporarily suspended. Resources covered by this paragraph include but are not limited to: any human skeletal remains or burials; artifacts; shell, midden, bone, charcoal, or other deposits; rock or coral alignments, pavings, wall, or other constructed features; and any indication of agricultural or other human activities. Upon such discovery or find, immediately notify the Contracting Officer so that the appropriate authorities may be notified and a determination made as to their significance and what, if any, special disposition of the finds should be made. Cease all activities that may result in impact to or the destruction of these resources. Secure the area and prevent employees or other persons from trespassing on, removing, or otherwise disturbing such resources.

3.8 BIOLOGICAL RESOURCES

Minimize interference with, disturbance to, and damage to fish, wildlife, and plants including their habitat. The protection of threatened and endangered animal and plant species, including their habitat, is the Contractor's responsibility in accordance with Federal, State, Regional, and local laws and regulations.

3.9 PREVIOUSLY USED EQUIPMENT

Clean all previously used construction equipment prior to bringing it onto the project site. Ensure that the equipment is free from soil residuals, egg deposits from plant pests, noxious weeds, and plant seeds. Consult with the USDA jurisdictional office for additional cleaning requirements.

3.10 MAINTENANCE OF POLLUTION FACILITIES

Maintain permanent and temporary pollution control facilities and devices for the duration of the contract or for that length of time construction activities create the particular pollutant.

3.11 MILITARY MUNITIONS

In the event military munitions, as defined in 40 CFR 260, are discovered or uncovered, the Contractor will immediately stop work in that area and immediately inform the Contracting Officer.

3.12 CONTAMINATED MEDIA MANAGEMENT

Contractor is not responsible for general remediation of known pre-existing contamination at the work site, but is responsible for managing, treating, and/or controlling pre-existing contamination that impacts or is impacted by work activities. This includes planning, implementing and maintaining any treatment or control measures necessary to comply with contract documents during construction activities, protecting workers from exposure to pre-existing contamination, minimizing contaminant migration and re-distribution, and ensuring compliance with regulatory requirements for waste disposal, treatment, or management.

3.13 POST CONSTRUCTION CLEANUP

The Contractor will clean up all areas used for construction in accordance with Contract Clause: "Cleaning Up". Unless otherwise instructed in writing by the Contracting Officer, obliterate all signs of temporary construction facilities such as haul roads, work area, structures, foundations of temporary structures, stockpiles of excess or waste materials, and other vestiges of construction prior to final acceptance of the work. The disturbed area must be graded, filled and the entire area seeded unless otherwise indicated.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 01 - GENERAL REQUIREMENTS

SECTION 01 74 19

INTEGRATED SOLID WASTE MANAGEMENT

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SUBMITTALS
- 1.3 GOVERNMENT POLICY
- 1.4 MANAGEMENT
- 1.5 WASTE MANAGEMENT PLAN
- 1.6 RECORDS
 - 1.6.1 Non Hazardous Waste
 - 1.6.2 Hazardous Waste
- 1.7 REPORTS
- 1.8 MUNICIPAL SOLID WASTE
 - 1.8.1 Collection
 - 1.8.2 Disposal
 - 1.8.2.1 Recycle.
 - 1.8.2.2 Waste.
- 1.9 Construction and Demolition (C&D) Waste
 - 1.9.1 ASBESTOS DISPOSAL
 - 1.9.2 CONCRETE/ROAD DEMOLITION DEBRIS
 - 1.9.3 CCAFS LANDFILL OPERATION HOURS
 - 1.9.4 CCAFS C&D LANDFILL WILL NOT ACCEPT THE ITEMS LISTED BELOW:
- 1.10 HAZARDOUS AND UNIVERSAL WASTE
 - 1.10.1 Hazardous Waste Training
 - 1.10.2 Record Keeping
 - 1.10.2.1 Job Description
 - 1.10.2.2 Certificate Of Training
- 1.11 CONTROL AND MANAGEMENT OF HAZARDOUS WASTE
 - 1.11.1 Generated Hazardous Waste
 - 1.11.2 Cleanup and Disposal
- 1.12 HAZARDOUS AND UNIVERSAL WASTE
- 1.13 HAZARDOUS WASTE MANAGEMENT
- 1.14 UNIVERSAL WASTE/E-WASTE MANAGEMENT
 - 1.14.1 Fluorescent Lamps Management
 - 1.14.2 Switches
 - 1.14.3 Batteries
 - 1.14.4 Electronic Waste
- 1.15 OTHER WASTE
 - 1.15.1 Heavy Metals in Paint and Coatings
 - 1.15.2 PCB Containing Items or Equipment
 - 1.15.2.1 Independent Laboratory Analysis
 - 1.15.3 Mercury Materials
 - 1.15.4 Removal and Disposal of Electrical Potheads
- 1.16 PETROLEUM PRODUCTS AND REFUELING
 - 1.16.1 Oily And Hazardous Substances
 - 1.16.2 Inadvertent Discovery Of Petroleum Contaminated Soil Or Hazardous Wastes

PART 2 PRODUCTS

PART 3 EXECUTION

-- End of Section Table of Contents --

SECTION 01 74 19

INTEGRATED SOLID WASTE MANAGEMENT

PART 1 GENERAL

1.1 REFERENCES

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.

ASTM INTERNATIONAL (ASTM)

ASTM E 1609 (2001) Development and Implementation of a Pollution Prevention Program

FLORIDA ADMINISTRATIVE CODE (FAC)

FAC 62-730 HAZARDOUS WASTE

U.S. AIR FORCE (USAF)

45 SW Management Plan 19-14 (2011) Waste Petroleum Products and Hazardous Waste Management

45 SW Management Plan 32-7042 (2008) Integrated Solid Waste Management Plan (ISWMP)

AFI 32-7042 (2009) Waste Management

U.S. GREEN BUILDING COUNCIL (USGBC)

LEED (2002; R 2005) Leadership in Energy and Environmental Design(tm) Green Building Rating System for New Construction (LEED-NC)

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 112 Oil Pollution Prevention

40 CFR 262 Standards Applicable to Generators of Hazardous Waste

40 CFR 265 Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities

40 CFR 279 Standards for the Management of Used Oil

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

WASTE MANAGEMENT PLAN

SD-09 Manufacturer's Field Reports

Quarterly Reports

Final Report

SD-11 Closeout Submittals

Final Report

laboratory documents

KSC form 26-551V3

close-out form

Records; (LEED)

1.3 GOVERNMENT POLICY

Government policy is to apply sound environmental principles in the design, construction and use of facilities. As part of the implementation of that policy the Contractor shall: (1) practice efficient waste management when sizing, cutting, and installing products and materials and (2) use all reasonable means to divert construction and demolition waste from landfills and incinerators and to facilitate their recycling or reuse. The Air Force goal of 50 percent by weight of total project solid waste shall be diverted from the landfill.

1.4 MANAGEMENT

Develop and implement a waste management program in accordance with ASTM E 1609 and as specified. Take a pro-active, responsible role in the management of construction and demolition waste and require all subcontractors, vendors, and suppliers to participate in the effort. The Environmental Manager shall be responsible for instructing workers and overseeing and documenting results of the Waste Management Plan for the project. Construction and demolition waste includes products of demolition or removal, excess or unusable construction materials, packaging materials for construction products, and other materials generated during the construction process but not incorporated into the work. In the management of waste consideration shall be given to the availability of viable markets, the condition of the material, the ability to provide the material in suitable condition and in a quantity acceptable to available markets, and time constraints imposed by internal project completion mandates. The Contractor is responsible for implementation of any special programs involving rebates or similar incentives related to recycling of waste. Revenues or other savings obtained for salvage, or recycling accrue to the Contractor. Also, provide on-site instruction of appropriate separation, handling, recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.

1.5 WASTE MANAGEMENT PLAN

A waste management plan shall be submitted within 15 days after notice to proceed and not less than 10 days before the preconstruction meeting. The

plan shall demonstrate how the project waste diversion goal shall be met and shall include the following:

- a. Name of individuals on the Contractor's staff responsible for waste prevention and management.
- b. Actions that will be taken to reduce solid waste generation, including coordination with subcontractors to ensure awareness and participation.
- c. Description of the specific approaches to be used in recycling/reuse of the various materials generated, including the areas on site and equipment to be used for processing, sorting, and temporary storage of wastes.
- d. Characterization, including estimated types and quantities, of the waste to be generated.
- e. Name of landfill and/or incinerator to be used.
- f. List of specific waste materials that will be salvaged for resale, salvaged and reused on the current project, salvaged and stored for reuse on a future project, or recycled. Recycling facilities that will be used shall be identified by name.
- g. Description of the means by which any waste materials identified in item (f) above will be protected from contamination.
- h. Description of the means of transportation of the recyclable materials (whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler and removed from the site).
- i. Description of possible hazardous waste and hazardous waste management practices.

1.6 RECORDS

1.6.1 Non Hazardous Waste

Records shall be maintained to document the quantity of waste generated; the quantity of waste diverted through sale, reuse, or recycling; and the quantity of waste disposed by landfill or incineration. Quantities may be measured by weight or by volume, but must be consistent throughout. List each type of waste separately noting the disposal or diversion date. Identify the landfill, recycling center, waste processor, or other organization used to process or receive the solid waste.

1.6.2 Hazardous Waste

Records shall be maintained to document Personnel training and job descriptions.

1.7 REPORTS

Provide solid waste Quarterly Reports and a Final Report to 45 CES/CEAN, solid Waste Manager, at Fax Number 321-494-5965 by the 5th day of new quarter; January, April, July and October. Quarterly and final reports shall include project name, information for waste generated this quarter, and cumulative totals for the project. Each report shall include supporting

documentation to include manifests, weight tickets, receipts, and invoices specifically identifying the project and waste material.

Provide laboratory documents and analysis results, Process Waste Questionnaire/Technical Response Package (KSC form 26-551V3) and a copy of the close-out form for all hazardous waste accumulation sites operated by the Contractor

1.8 MUNICIPAL SOLID WASTE

1.8.1 Collection

Separate, store, protect, and handle at the site identified recyclable and salvageable waste products in a manner that maximizes recyclability and salvageability of identified materials. Provide the necessary containers, bins and storage areas to facilitate effective waste management and clearly and appropriately identify them. Provide materials for barriers and enclosures around recyclable material storage areas which are nonhazardous and recyclable or reusable. Locate out of the way of construction traffic. Provide adequate space for pick-up and delivery and convenience to subcontractors. Recycling and waste bin areas are to be kept neat and clean, and recyclable materials shall be handled to prevent contamination of materials from incompatible products and materials.

1.8.2 Disposal

Control accumulation of waste materials and trash. Recycle or dispose of collected materials off-site at intervals approved by the Contracting Officer and in compliance with waste management procedures. Except as otherwise specified in other sections of the specifications, disposal shall be in accordance with the following:

1.8.2.1 Recycle.

Waste materials not suitable for reuse, but having value as being recyclable, shall be made available for recycling. All fluorescent lamps, HID lamps, and mercury-containing thermostats removed from the site shall be recycled. Arrange for timely pickups from the site or deliveries to recycling facilities in order to prevent contamination of recyclable materials.

1.8.2.2 Waste.

Materials with no practical use or economic benefit shall be disposed at a landfill or incinerator.

1.9 Construction and Demolition (C&D) Waste

Non-salvageable material and debris shall be removed from work areas and disposed of correctly. Contractor may use Cape Canaveral Air Force Station (CCAFS) landfill for disposal of CCAFS Construction and Demolition (C&D) debris. For quantities larger than 90 tons/day for C&D debris, the disposal should be coordinated with 45 SW Environmental Section and landfill operators through the Contracting Officer to allow for planning for the expected number of trucks per day to avoid operational issues. Contractor may utilize an off-site facility permitted by the State of Florida to accept the waste for disposal of PAFB Construction and Demolition (C&D) debris. Contractor shall submit a tip sheet from the landfill for each load.

For all C&D debris going to the CCAFS landfill, the Contractor is responsible for accurately completing and coordinating the landfill use approval forms. An authorized Air Force Contract Monitor or a CE Representative must sign these forms. The authorization form must accompany the first vehicle working on the project number and contract number at the landfill entrance. As soon as the number of loads is exceeded, the Contract Monitor or Civil Engineering Representative must re-authorize the form.

The CCAFS Landfill is a State permitted Construction and Demolition (C&D) debris Landfill. Only refuse directly associated with construction or demolition activities will be accepted.

1.9.1 ASBESTOS DISPOSAL

Use of CCAFS landfill is mandatory for all CCAFS and PAFB asbestos disposal per the conditions of the FDEP permits. For quantities larger than 10 cubic yards/day, the disposal shall be coordinated with 45 SW Environmental Section and landfill operators through the Contracting Officer to allow for planning for the expected number of trucks per day to avoid operational issues.

1.9.2 CONCRETE/ROAD DEMOLITION DEBRIS

Concrete shall be separated from other C&D debris since concrete is disposed of at the landfill in separate cells. Concrete must be no larger than 36 inches in any direction with no more than 18 inches of protruding rebar, and must have asbestos test results.

Road demolition debris such as asphalt millings and chunks and lime rock are accepted by the CCAFS landfill subject to the quantity limitations of the FDEP permits. Contact InDyne, the Installation Operations and Maintenance Service (IOMS) Contractor through the Contracting Officer for guidance.

1.9.3 CCAFS LANDFILL OPERATION HOURS

The hours of operation for the CCAFS landfill are 0730-1130 and 1215-1500 Monday through Friday for C&D debris. Asbestos waste is accepted from 0730-1130 and 1215-1400 only on Tuesdays and Thursdays with 24 hour notice to the landfill operator through the Contracting Officer. The landfill is closed on weekends and holidays. Landfill available days and hours are subjected to change. Contact the landfill operator through the Contracting Officer to arrange for delivery. Vehicles must check in with attendant and be inspected prior to disposal of any material(s).

1.9.4 CCAFS C&D LANDFILL WILL NOT ACCEPT THE ITEMS LISTED BELOW:

- a. Polychlorinated biphenyls (PCBs); contact 45 SW Environmental Section through the Contracting Officer to arrange for drop off at Facility 44200.
- b. Garbage items of any kind; Use dumpsters or Brevard County Landfill.
- c. Paper, this includes, but is not limited to, office paper, newspapers, and magazines; contact Recycling Office at PAFB through the Contracting Officer to arrange for delivery.
- d. Cardboard of any type; contact Recycling Office at PAFB through the Contracting Officer to arrange for delivery.

- e. Cans or Bottles; contact Recycling Office at PAFB through the Contracting Officer to arrange for delivery.
 - f. Tires; contact IOMS Environmental through the Contracting Officer for disposal guidance.
 - g. Pressure Treated/Painted Wood or Lumber; use Brevard Co. Landfill.
 - h. Recyclable wood, broken pallets, no bolts, not painted or treated, use appropriate CCAFS "wood recycling only" marked dumpsters.
 - i. Plastic Sheeting; use Brevard Co. Landfill.
 - j. Tarps; use Brevard Co. Landfill.
 - k. Fluorescent Light Bulbs; contact 45 SW Environmental Section through the Contracting Officer to arrange drop off at Building 55118.
 - l. Any metal that can be salvaged; contact 45 SW PAFB Qualified Recycling Program Manager through the Contracting Officer to arrange for drop off.
 - m. Wet Paint Cans; contact ESC (SpecPro) Environmental through the Contracting Officer for disposal guidance.
 - n. Steel cable; contact RMO 45 SW PAFB Qualified Recycling Program Manager through the Contracting Officer for salvage instructions.
 - o. Good Pallets; use DRMO or IOMS Supply, Facility 1621.
 - p. Brush(land clearing) or Yard Trash; use Brevard Co. Landfill.
 - q. Sludge; contact ESC (SpecPro) Environmental through the Contracting Officer for sampling and disposal.
 - r. Batteries; they should be double-wrapped or the terminals isolated with tape. Contact DRMO through the Contracting Officer for delivery of magnesium, silver, carbon zinc, and lead acid batteries. Contact 45 SW Environmental Section through the Contracting Officer to arrange for delivery of nickel cadmium, lithium, and mercury batteries at Facility 55118.
 - s. Oil Filters; Oil filters must be hot drained of liquids prior to collection or crushing for recycling. Contact 45 CES/CEAN Environmental Office at 494-9269 for information on recycling. Oil filters are NOT to be disposed of in normal refuse. Recycling of used oil filters is mandatory. Contact Recycling Office at PAFB to arrange for drop off.
 - t. Liquid Waste of any kind; contact ESC (SpecPro) through the Contracting Officer for disposal guidance.
 - u. Aerosol Cans; contact 45 SW Environmental Section through the Contracting Officer to arrange for instruction and drop off at Facility 55118.
- 1.10 HAZARDOUS AND UNIVERSAL WASTE

The contractor shall contact the 45 CES/CEAN (Environmental Office) to coordinate the establishment of hazardous waste management procedures prior

to generating any hazardous waste. If any waste is determined to be hazardous, as defined in 40 CFR 261, the Contracting Officer must be notified immediately. All hazardous waste shall be managed IAW State, Federal, and Air Force regulations by the Contractor and final disposal shall be accomplished by the Air Force under the Installation EPA identification number.

1.10.1 Hazardous Waste Training

Contractor shall provide the Contracting Officer and the 45 CES/CEAN (Environmental Office) with documentation for completed RCRA hazardous waste and DOT training prior to generating any waste, reference 40 CFR 265.16 and AFI 32-7042. All individuals involved in generating waste shall be properly trained

1.10.2 Record Keeping

Personnel training records and job descriptions must be maintained at or near the hazardous waste accumulation areas. It is the generating organization's responsibility to keep all records and job descriptions up-to-date and valid.

1.10.2.1 Job Description

The following must be included in the Job Description: Job title, hazardous waste duties, and employee name. This job description must also include a description of all required introductory and annual refresher training required for this position. The date of last training and the date the next training must be completed may also be included.

1.10.2.2 Certificate Of Training

A copy of all training certificates must be maintained.

1.11 CONTROL AND MANAGEMENT OF HAZARDOUS WASTE

1.11.1 Generated Hazardous Waste

Generated hazardous waste is materials that, if abandoned or disposed of, may meet the definition of a hazardous waste. These waste streams would typically consist of material brought on site by the contractor to execute work, but are not fully consumed during the course of construction. Examples include but are not limited to, excess or waste thinners and solvents (i.e. methyl ethyl ketone, toluene, etc.), paint, aerosol containers and adhesives.

The contractor shall contact the 45 CES/CEAN (Environmental Office) to coordinate the establishment of hazardous waste management procedures prior to generating any hazardous waste.

Contractor shall provide the Contracting Officer and the 45 CES/CEAN (Environmental Office) with documentation for completed RCRA hazardous waste and DOT training prior to generating any waste, reference 40 CFR 265.16 and AFI 32-7042. All individuals involved in generating waste shall be properly trained.

If any waste is determined to be hazardous, as defined in 40 CFR 261, the Contracting Officer must be notified immediately.

All hazardous waste shall be managed IAW State, Federal and Air Force

regulations by the Contractor and final disposal shall be accomplished by the Air Force under the Installation EPA identification number.

Contractor shall be responsible for sampling all wastes at the time of generation to determine whether they are hazardous or non-hazardous. Laboratory analyses documents and results shall be submitted to the Contracting Officer for transmittal to the 45 SW Environmental Section. All laboratory analyses results shall include the laboratory name, the EPA certification number, and the EPA approved method code used for the analysis.

1.11.2 Cleanup and Disposal

Hazardous wastes shall be managed by the Contractor in accordance with 40 CFR 262, FAC Chapter 62-730, AFI 32-7042 and 45 SW Management Plan 19-14 at the Contractor's expense, and shall include the following at a minimum:

- a. Management of one or more hazardous waste accumulation sites.
- b. Provide portable fire extinguishers, eyewash stations and required signs for each hazardous waste accumulation site.
- c. Provide appropriate Department of Transportation (DOT) containers for storage and disposal of hazardous wastes.
- d. Properly mark and label container.
- e. Perform and document required weekly hazardous waste accumulation site inspections.
- f. Provide spill prevention and clean-up equipment.
- g. Provide drum handling equipment.
- h. Provide sampling and certified laboratory analysis of wastes generated.
- i. Submit analysis results to the Contracting Officer and the 45 CES/CEAN (Environmental Office).
- j. Follow Process Waste Questionnaire/Technical Response Package (PWQ/TRP) process prior to request of hazardous waste disposal services
- k. Prepare internal manifest and deliver the drums of hazardous waste to the designated on-base storage facility within timeframes specified by the Government.

Locations of accumulation sites shall be approved by the Government prior to generating hazardous waste. Contractor shall provide enclosed, lockable storage for hazardous waste containers. The Prime Contractor shall be responsible for ensuring Subcontractors are in compliance with all hazardous waste requirements (45 SW Management Plan 19-14).

No waste or rinsates shall be discharged to the CCAFS sanitary sewer system without prior authorization provided by the 45 CES/CEAN Environmental offices and Infrastructure Operations and Maintenance Support (IOMS) contractor.

No waste or rinsates shall be discharged to the PAFB sanitary sewer system without prior authorization provided by the 45 CES/CEAN Environmental offices.

Contractor shall submit to the Contracting Officer a copy of the close-out form for all hazardous waste accumulation sites operated by the Contractor.

Note that the CCAFS Landfill will not accept the items listed below. Disposal of these items will be coordinated with the referenced organization. Details on organizational contacts and disposal procedures will be provided by the Government.

1. Fluorescent Light Bulbs

- a. Used fluorescent lamps (bulbs) at CCAFS will be turned-in at the universal waste collection facility, Building 55118 (phone 476-2928) every Tuesday and Thursday between the hours of 1300 and 1400.
- b. Used fluorescent lamps (bulbs) at PAFB will be turned-in to the HazMart in Building 984 (phone 494-9663) on Tuesdays and Thursdays between the hours of 0800 and 1200.

2. Wet Paint Cans

Contact the Environmental Support Contractor (ESC) through the 45 SW Environmental Offices for disposal guidance

3. Sludge

Contact the Environmental Support Contractor (ESC) through the 45 SW Environmental Offices for sampling and disposal.

4. Liquid Waste of any kind

Contact the Environmental Support Contractor (ESC) through the 45 SW Environmental Offices for disposal guidance.

5. Aerosol Cans

Contact the Environmental Support Contractor (ESC) through the 45 SW Environmental Offices for disposal guidance.

1.12 HAZARDOUS AND UNIVERSAL WASTE

The contractor shall contact the 45 CES/CEAN (Environmental Office) to coordinate the establishment of hazardous waste management procedures prior to generating any hazardous waste. If any waste is determined to be hazardous, as defined in 40 CFR 261, the Contracting Officer must be notified immediately. All hazardous waste shall be managed IAW State, Federal, and Air Force regulations by the Contractor and final disposal shall be accomplished by the Air Force under the Installation EPA identification number.

1.13 HAZARDOUS WASTE MANAGEMENT

Hazardous wastes shall be managed by the Contractor in accordance with 40 CFR 262, FAC 62-730, AFI 32-7042 and 45 SW Management Plan 19-14 at the Contractor's expense, and shall include the following at a minimum:

- a. Management of one or more hazardous waste accumulation sites. Locations of accumulation sites shall be approved by the government prior to generating hazardous waste.
- b. Provide portable fire extinguishers, eyewash stations and required signs for each hazardous waste accumulation site.
- c. Provide appropriate Department of Transportation (DOT) containers for storage and disposal of hazardous wastes. Contractor shall provide enclosed, lockable storage for hazardous waste containers.
- d. Properly mark and label container.
- e. Perform and document required weekly hazardous waste accumulation site inspections.
- f. Provide sampling and certified laboratory analysis of wastes generated. Contractor shall be responsible for sampling all wastes at the time of generation to determine whether they are hazardous or non-hazardous.
- g. Submit laboratory documents and analysis results to the Contracting Officer and the 45 CES/CEAN (Environmental Office). All laboratory analyses results shall include the laboratory name, the EPA certification number, and the EPA approved method code used for the analysis.
- h. Follow Process Waste Questionnaire/Technical Response Package (PWQ/TRP) process prior to request of hazardous waste disposal services.
- i. Prepare internal manifest and deliver the drums of hazardous waste to the designated on-base storage facility within timeframes specified by the Government.
- j. No waste or rinsates shall be discharged to the CCAFS sanitary sewer system without prior authorization provided by the 45 CES/CEAN Environmental offices and Infrastructure Operations and Maintenance Support (IOMS) contractor.
- k. No waste or rinsates shall be discharged to the PAFB sanitary sewer system without prior authorization provided by the 45 CES/CEAN Environmental offices.
- l. Contractor shall submit to the Contracting Officer a copy of the close-out form for all hazardous waste accumulation sites operated by the Contractor.

1.14 UNIVERSAL WASTE/E-WASTE MANAGEMENT

Universal waste can include but not limited to some mercury container building products, such as fluorescent lamps; mercury vapor lamps; high pressure sodium lamps; mercury containing devices (switches and thermometers); mercury thermostats; and electrical equipment containing PCBs. E-waste is considered batteries, CRTs and consumed electronic devices. Contractor will coordinate the management and disposal of Universal Wastes with the 45 SW Environmental Office and deliver them to the designated on-base storage facility at no additional cost to the Government in accordance with federal, state, local laws and the

45 SW Management Plan 19-14.

1.14.1 Fluorescent Lamps Management

The contractor shall package all lamps by type. Lamps shall be packaged in cardboard boxes specifically designed to ship fluorescent lamps. Lamps shall not be taped or fastened to each other. With a marker write "Used lamps", "Waste Lamps" or "Universal Waste Lamps" on the box if a Universal Waste label is not available. Date the box when the first used lamp is placed inside. All containers must be taped closed on all sides including any holes or penetrations in the box to ensure it is a "closed container". This box must be kept dry. The container should only be opened if lamps are being added or removed. When the box is full, annotate on the box the number of lamps and length of lamps. Used lamps must be turned in for disposal NLT 6 months from the collection start date. Used fluorescent lamps at CCAFS will be turned-in at the universal waste collection facility, Building 55118 (phone 476-2928) every Tuesday and Thursday between the hours of 1300 and 1400.

1.14.2 Switches

Each switch must be double bagged and sealed.

1.14.3 Batteries

Batteries must be properly containerized and labeled.

1.14.4 Electronic Waste

All electronic waste will be disposed of at the Material Recycling Facility, Bldg 631 at PAFB.

1.15 OTHER WASTE

Manage all other waste generated on site in accordance with 40 CFR 279, 45 SW Management Plan 19-14, 45 SW Management Plan 32-7042 and AFI 32-7042.

1.15.1 Heavy Metals in Paint and Coatings

All loose paint, paint chips, blast media and any other suspected contaminated soil residue shall be collected, containerized, labeled and sampled. Wash and rinse water shall be containerized and sampled. Contractor shall obtain written authorization from the Contracting Officer prior to discharging process waters to sanitary sewer or grade. Discharging process waters to surface waters or storm sewers will NEVER be permitted. Containerized waste shall be tested by an independent laboratory utilizing the Toxic Characteristic Leaching Procedure (TCLP). If analysis indicates the waste is a hazardous waste, Contractor shall manage the waste in accordance with 4.0 Hazardous and Universal Waste. Blast media with analytical results proving non-hazardous status can be disposed as solid waste.

1.15.2 PCB Containing Items or Equipment

Contractor shall manage all PCB in accordance with 45 SW Management Plan 19-16, PCB Item Control Plan. Contractor is responsible for determining the PCB concentration in accordance with 40 CFR 761 of dielectric fluid container in electrical equipment effected by the contract. Contractor shall be responsible for sampling/analyzing all suspected PCB wastes

including oils and paints/surface coatings to determine whether they contain PCBs. Copies of all laboratory analyses with the equipment description; serial number; and location shall be provided to the Contracting Officer for transmittal to the 45 SW Environmental Office.

1.15.2.1 Independent Laboratory Analysis

Analysis indicating less than 50ppm are considered non-PCB containing equipment. Analysis results greater than or equal to 50ppm but less than 500ppm are considered PCB-contaminated equipment. Analysis results greater than or equal to 500ppm are considered to be PCB equipment.

The Contractor shall notify the Contracting Officer immediately if equipment test results are greater than 50ppm PCB. This equipment shall be delivered to Facility 44200 on CCAFS. Contractor is responsible for the safe transportation and off-loading of this equipment. The Contracting Officer will make the necessary arrangement with the 45 SW Environmental Office to gain access into this secured facility and will provide the laboratory analyses to the 45 SW Environmental Office. Contractor is responsible for ensuring the equipment has no leaks and will be responsible repairing any leaks prior to transportation as no leaking equipment will be accepted into this facility. If a leak is severe and the item small enough, the Contractor shall pack the electrical equipment into a container meeting the DOTs performance oriented packaging requirements (UN1A2). If the item is too large, the Contractor shall be responsible for draining the dielectric fluid from the item. This fluid shall be placed in proper DOT containers (UN1A1). Contractor shall provide secondary containment for the equipment when the oil is removed. All containers shall be marked with a "Contains PCBs" label and the serial number of the equipment the oil was removed from should be noted on the top of the container(s). If any oil is spilled onto the ground, immediately notify the Contracting Officer and dial 911 from any base phone or (321-853-0911 from cellular phone on CCAFS) so that emergency response personnel can be dispatched. Contractor shall make every effort to contain the release while ensuring worker safety.

1.15.3 Mercury Materials

Mercury is prohibited in the performance of this contract, unless specified otherwise, and with the exception of mercury vapor lamps and fluorescent lamps. Dumping of mercury-containing materials and devices such as mercury vapor lamps, fluorescent lamps, and mercury switches, in rubbish containers is prohibited. Transport out of the activity in an unbroken condition for disposal as directed in the "Universal Waste" sub-part of this section. Immediately report to the Environmental Office and the Contracting Officer instances of breakage or mercury spillage. Clean mercury spill area to the satisfaction of the Contracting Officer. Cleanup of a mercury spill shall not be recycled and shall be managed as a hazardous waste for disposal in accordance with the "Hazardous Waste Management" sub-part of this section.

1.15.4 Removal and Disposal of Electrical Potheads

All potheads to be removed shall be transported to 45 SW Environmental TSD Facility 44200 on CCAFS. Coordinate transport with the Environmental Support Contractor (ESC) through the 45 SW Environmental Office. Prior to transport, each pothead shall be completely inspected to ensure insulating compound is not leaking and packaged on a wood pallet. If there is any evidence of leaking, the pothead must be double-bagged in plastic prior to being placed on the pallet. Leaking items that are not properly wrapped will be rejected at Facility 44200 on CCAFS unless immediately corrected by

the Contractor.

1.16 PETROLEUM PRODUCTS AND REFUELING

Conduct the fueling and lubricating of equipment in a manner that protects against spills and evaporation. Manage all used oil generated on site in accordance with 40 CFR 279, 45 SW Management Plan 19-14 and 45 SW Management Plan 32-7042. Determine if any used oil generated while on-site exhibits a characteristic of hazardous waste. Used oil containing 1000 parts per million of solvents will be considered a hazardous waste and disposed in accordance with federal, state, local requirements and 45 SW Management Plan 19-14. Used oil mixed with a hazardous waste will also be considered a hazardous waste.

All fuels drained from motor vehicles, heavy equipment, power generators, etc., shall be recovered and returned to the same source from which taken or returned to base stocks. Ground fuels unfit for use in ground equipment grades shall be blended/reused/recycled or disposed of in accordance with the established Technical Response Package (TRP).

Disposition of Oils

Used oil may include:

- Spent crankcase oil
- Compressor oils
- Transmission fluid
- Turbine oils
- Brake fluid
- Bearing oils
- Gearbox oils Hydraulic oil
- Synthetic oils

Used oils should be segregated from oils which are subject to PCB contamination such as electrical and transformer oils. Used oils should be segregated from hazardous waste solvents, antifreeze and other materials unless specifically authorized in the TRP.

Contamination of used oil by water can be avoided by use of drum covers, by not overfilling drums and by keeping drums closed and in secure areas.

Containers that previously contained halogenated materials/wastes or incompatible materials must not be used for the collection of recoverable petroleum products.

Recoverable petroleum products that are collected in tanks will be sampled from the tank prior to disposal. Tanks should not be pumped out until the sampling results have been received.

Used oil containing more than 1,000 ppm total halogens is presumed to be a hazardous waste.

Oily rags and spill cleanup material from small oil spills (less than 1 quart) can be discarded in normal refuse unless the oil is PCB containing oil, used oil which contains metals (lead, cadmium, or chromium), or oil which is determined to be hazardous waste because of its halogen content; in these cases the oily rags or spill cleanup material must be collected and managed as PCB or hazardous waste. Analysis of the oil (if used) or an MSDS for unused oil should be used to determine which method of disposal to use for oily rags and spill cleanup material.

1.16.1 Oily And Hazardous Substances

Prevent oil or hazardous substances from entering the ground, drainage areas, or navigable waters. In accordance with 40 CFR 112, surround all 55 gallon or greater temporary fuel oil or petroleum storage tanks with a temporary berm or containment of sufficient size and strength to contain the contents of the tanks, plus 10 percent freeboard for precipitation. The berm will be impervious to oil for 72 hours and be constructed so that any discharge will not permeate, drain, infiltrate, or otherwise escape before cleanup occurs.

1.16.2 Inadvertent Discovery Of Petroleum Contaminated Soil Or Hazardous Wastes

If petroleum contaminated soil or suspected hazardous waste is found during construction that was not identified in the contract documents, the contractor shall immediately notify the contracting officer. The contractor shall not disturb this material until authorized by the contracting officer.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 01 - GENERAL REQUIREMENTS

SECTION 01 78 00

CLOSEOUT PROCEDURES

PART 1 GENERAL

- 1.1 SUMMARY
- 1.2 SUBMITTALS
- 1.3 RECORD DOCUMENTS

PART 2 PRODUCTS

PART 3 EXECUTION

- 3.1 OPERATIONS AND MAINTENANCE DATA AND AS-BUILT DRAWINGS
- 3.2 OPERATION AND MAINTENANCE TRAINING AND FINAL ACCEPTANCE
 - 3.2.1 Training Sessions
 - 3.2.2 Final Inspection and Acceptance
 - 3.2.2.1 Pre-Final Inspection
 - 3.2.2.2 Final Inspection
- 3.3 Completed Work Order/Project Checklist for Construction document
(Attachment 3)

-- End of Section Table of Contents --

SECTION 01 78 00

CLOSEOUT PROCEDURES

PART 1 GENERAL

1.1 SUMMARY

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

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01 33 00 SUBMITTALS PROCEDURES in sufficient detail to show full compliance with the specification:

SD-08 Manufacturer's Instructions

The following shall be submitted in accordance with paragraph entitled, "General," of this section.

Preventative Maintenance and Inspection

Posted Instructions

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals shall be submitted in accordance with paragraph entitled, "Operation and Maintenance," of this section.

SD-11 Closeout Submittals

As-built drawings

Reproducible Drawings

CAD System Drawings

Final Survey

Manufacturer's Warranty

Contractor's One Year Workmanship letter

1.3 RECORD DOCUMENTS

Reproducible Drawings and CAD System Drawings shall be submitted as follows:

Four hard copies of each drawing or product data record; and electronic versions on a CD ROM showing each drawing, or product data record, shall be submitted for historical record. Electronic drawings shall be in AutoCAD format and in A/E/C CAD standard. The drawings will be labeled "AS-BUILT" electronically and on paper copy. All drawings will have the proper x-ref attached if applicable and additional pictures or

other information attached to drawings will be on the final disc with the other drawings. Civil drawings with the footprint of the construction will be geo-referenced to their location on the base and all exterior utilities will be properly located and geo-referenced the same way. Geo-referencing will be projected in NAD 1983 State Plan Florida East 0901 Feet.

Final drawings shall incorporate contract changes and plan deviations. Lines, letters, and details will be sharp, clear, and legible. Additions or corrections to the drawings will be drawn to the scale of the original drawing. One copy, marked with review notations by the Contracting Officer, will be returned to the Contractor. Drawings are to be resubmitted within 30 calendar days after the completion of the representative work effort.

Documents shall be current. Contractor shall not conceal record information until as-built drawings have been made. Record drawings shall be submitted with a Air Force Form 3000.

Redlined As-Built Drawings shall be submitted under the following criteria:

Redlined as-built drawings shall be submitted by the Contractor to incorporate contract changes and plan deviations. Lines, letters, and details shall be sharp, clear, and legible. Redlined as-built drawings are to be signed by the Contractor.

Preventative Maintenance and Inspection schedules shall be submitted by the Contractor with instructions that state when systems should be retested.

Repair requirements shall inform operators how to check out, troubleshoot, repair, and replace components of the system. Instructions shall include electrical and mechanical schematics and diagrams and diagnostic techniques necessary to enable operation and troubleshooting of the system after acceptance.

Posted Instructions shall be submitted by the Contractor with labels, signs, and templates of operating instructions that are required to be mounted or installed on or near the product for normal, safe operation.

Operation and Maintenance Manuals shall be consistent with the manufacturer's standard brochures, schematics, printed instructions, troubleshooting guides, general operating procedures, and safety precautions.

Contractor shall submit classroom and field instructions in the operation and maintenance of systems equipment where required by the technical provisions.

Contractor shall submit 4 copies of the project operation and maintenance manuals 30 days prior to testing the system involved. Data shall be updated and resubmitted for final approval no later than 30 days prior to contract completion.

Spare Parts Data shall indicate manufacturer's name, phone number, part number, nomenclature, and stock level required for maintenance and repair. List those items that may be standard to the normal maintenance of the system.

The following list of documents is required to be completed by the

Contractor at the time of the written request for final construction inspection. A final construction inspection date will not be granted by the Government until the following documents are completed, submitted and approved via AF Form 3000 <http://www.e-publishing.af.mil/shared/media/epubs/AF3000.XFD> by the Contracting Officer. The Contractor shall submit these documents with the written request for a final inspection. The Government will have five (5) working days to review, accept or reject these documents before a final inspection date is granted. The Contractor is encouraged to discuss with the Government Inspector the content of the information required to properly complete the following forms and requirements. The closeout documents are listed as follows:

1. As-built drawings
2. Any required Final Survey's for Permitting Processes by a Florida Licensed Engineer (P.E.) as required by the Contract Specifications or Drawings.
3. Contractor's One Year Workmanship letter.

PART 2 PRODUCTS

-NONE

PART 3 EXECUTION

3.1 OPERATIONS AND MAINTENANCE DATA AND AS-BUILT DRAWINGS

Provide four (4) complete sets of all vendor Installation/Operation/Maintenance/Repair/Overhaul Manuals and Spare Parts Data for approval.

The Manual shall include the following as a minimum:

- a. Internal and interconnecting wiring and control diagrams with data to explain detailed operations and control of the system or equipment.
- b. A control sequence describing startup, operation, and shutdown.
- c. Description of the function of each principal item of equipment.
- d. Installation instructions.
- e. Maintenance procedures, to include: repair, overhaul, testing, troubleshooting, and emergency procedures.
- f. Testing methods and procedures.
- g. Performance data.
- h. Safety precautions, diagrams, and illustrations.
- i. Manufacturer's Warranty

The Spare Parts Data shall include complete parts lists with part numbers and manufacturer's stock numbers with drawings and/or schematics that will provide the necessary information for ordering spare or replacement parts.

A set of redlined as-built drawings shall also be provided. The redlined as-built drawings shall consist of a bound set of the Contract Drawings which have been red-lined to indicate any field changes made.

3.2 OPERATION AND MAINTENANCE TRAINING AND FINAL ACCEPTANCE

3.2.1 Training Sessions

Training sessions shall be provided to instruct operations and maintenance personnel in the proper operation, maintenance, and trouble shooting of all equipment installed on this contract. Date(s) of training session(s) shall be approved by the Contracting Officer. See equipment specification sections for any additional requirements for O&M training on installed equipment or materials.

3.2.2 Final Inspection and Acceptance

3.2.2.1 Pre-Final Inspection

Contractor shall request approval, in writing and 10 days in advance, from the Contracting Officer for the scheduled date of the pre-final/final inspection. The advance notice will give the government sufficient time to invite the appropriate government agencies to attend the final inspection. Contractor's final inspection request shall include 4 complete sets of all vendor Installation/Operation/Maintenance/Repair Manuals and Spare Parts data and four sets of redlined as-built drawings.

At the Government's discretion, a pre-final inspection will be conducted before approving the final inspection date. The pre-final inspection shall be conducted by the Contracting Officer's Representative and Contractor's Representative. Contractor shall correct all the discrepancies noted during the pre-final inspection before the scheduled final inspection date.

Prior to requesting final acceptance, all Contractor trailers shall be removed and all utility connections terminated in accordance with local codes. Equipment required for final acceptance shall be removed before final payment is made to the Contractor.

3.2.2.2 Final Inspection

Contractor shall request approval 10 days in advance from the Contracting Officer for the scheduled date of the final acceptance. At a minimum, the Contractor shall schedule the final inspection the day before the contract completion date. Contractor shall correct all the discrepancies noted during the pre-final inspection before the scheduled date of the final inspection. Final inspection will not be accomplished if the Contractor has not corrected all the discrepancies noted during the pre-final inspection and if all other contract requirements are not completed by the Contractor.

3.3 Completed Work Order/Project Checklist for Construction document
(Attachment 3)

45 CES/CECC

PREPARATION OF CONSTRUCTION DATA LISTS FOR REAL PROPERTY RECORDS

1. **PURPOSE:** This operating instruction establishes the use of the Construction Data List for all in-house and contract work orders in order to fully identify the changes made to facilities at the time of construction so that real property records may be updated accurately and in a reasonable time frame.
2. **PROCEDURES:** A checklist will be placed in each work order folder. Responsibility for completion will be:
 - a. **IN-HOUSE WORK ORDERS:** Work orders completed by the Operations Flight (CEO) will also include Self-Help. Superintendents will identify the work coordinator to be responsible for providing information to complete the checklist and will approve and sign the checklist when received from the coordinator. The completed work order package will then be sent to CEO, Processing Civil Engineering Work Requests, AF Form 332, to update floor plans etc, and in turn, routed to Real Estate who will remove the checklist and update the real property records as required.
 - b. **CONTRACT WORK ORDERS:** Engineering Flight work orders will be completed by individual contract or the IDIQ or SABER Programs. The contractor is required to complete the Construction Checklist under the contract terms or it will be prepared by the contract monitor/inspector. Responsibilities of project officer on new facilities: AFI 32-1023, Chap 6 states that the monitor of the contract makes sure the Construction Agent (CA) delivers the fully completed checklist to the Project Manager/Inspector for approval. The completed checklist will be routed to CERF and to CERR (Real Property). The remainder of the package will be returned to Funds Management for filing.

COMPLETED WORK ORDER/PROJECT CHECKLIST INSTRUCTIONS

1. Complete checklist as thoroughly as possible. Only those items which have been upgraded need to be filled in. Ignore the ones which do not apply.
2. Page 1 applies to new construction. New construction is defined as adding something which did not exist previously, i.e., a/c, fire systems, fences (security, interior), additional exterior lighting, etc. If the size of the building is increased, please provide the dimensions of the addition.
3. Each blank related to a line item needs to be filled in. If you are adding a sprinkler system to a facility, the number of square feet covered by the sprinklers and the number of sprinkler heads are required to complete the records. Same information (the additional square feet and heads) is required when an existing system is expanded.
4. If a facility has been renovated, please annotate if data pertains to replacement items, i.e.;

A/C Plt 5 to 25 TN TN 15 \$ 35,000 Replacement

5. If, in the above example, a 10 ton is being replaced with a 15 ton or window units are being replaced by a central A/C system, the records need to be adjusted. When this occurs, list to the side "Replaced 10 ton".
6. When a facility is totally demolished, just list the facility number and the unit of measure. If Primary Distribution Lines Overhead are affected list LF, same with sidewalks, water lines, sanitary mains.
7. If, during the course of a project, a part of a facility is demolished, then replaced, without changing square feet, that replacement is not reported.

COMPLETED WORK ORDER/PROJECT CHECKLIST
CONSTRUCTION

WORK ORDER NO. _____ PROJECT NO. _____

BUILDING NO. _____ DATE COMPLETED: _____

1. GENERAL DATA REQUIRED FOR NEW _____ DEMOLISHED _____ BLDG (check one)

a. Outside dimensions (if addition to existing building, only note the additional SF):

	Length	Width	Amount Added	Amount Removed
(1) Main building	_____	_____	SF _____	SF _____
(2) Wings	_____	_____	SF _____	SF _____

b. Number of Floors: _____

c. Construction:

- (1) Foundations (such as concrete) TYPE _____
- (2) Roof (such as built-up, shingle) TYPE _____

d. Utilities within building: YES _____ NO _____

- (1) Water _____
- (2) Gas _____
- (3) Sewer _____
- (4) Electric _____

MISCELLANEOUS ITEMS:

- (1) 750-17* Athletic Fields Type _____ Number _____
- (2) 750-347 Courts Tennis _____ EA Volleyball _____ EA
- (3) 750-347 Recreation Pavilions Number _____ SF _____
- (4) 690-432 Flagpoles _____ EA
- (5) Dune Crossovers Number _____ LF _____
- (6) 152-111 Waterfront Improvement (Docks) LF _____
- (7) 690-252 Billboards EA _____
- (8) 740-657 Antenna Support Structures EA _____
- (9) 841-166 Non-potable Water Wells Gallons/Hour _____

OTHER: _____

2. FIRE PROTECTION:

Category Nomenclature Code	Unit of Measure	Amount Installed	Cost	Amount Removed
880-211 Closed Head Auto Sprinklers	SF	_____	_____	_____
	Heads	_____	_____	_____
880-212 Open Head Deluge System	SF	_____	_____	_____
	Heads	_____	_____	_____
880-221 Auto Fire Detection System (Heat/Smoke Detectors)	SF	_____	_____	_____
	EA	_____	_____	_____
880-222 Manual Fire Alarm System (Pull Stations, Bells)	EA	_____	_____	_____
880-231 C02 Fire System	EA	_____	_____	_____
880-232 Foam Fire System	EA	_____	_____	_____
880-233 Other Fire System	EA	_____	_____	_____
880-234 Halon 1301 Fire System	EA	_____	_____	_____

3. SECURITY:

Category Nomenclature Code	Unit of Measure	Amount Installed	Cost	Amount Removed
872-841 Security Alarm System	EA	_____	_____	_____
	EA	_____	_____	_____
	EA	_____	_____	_____
	EA	_____	_____	_____
	EA	_____	_____	_____
	EA	_____	_____	_____

4. MECHANICAL:

Category Nomenclature Code	Unit of Measure	Amount Installed	Cost	Amount Removed
890-126 A/C Window Units	TN	_____	_____	_____
890-125 A/C Plt Less than 5 TN	TN	_____	_____	_____
	SF	_____	_____	_____
890-121 A/C Plt 5 to 25 TN	TN	_____	_____	_____
826-122 A/C Plt 25 to 100 TN	TN	_____	_____	_____
826-123 A/C Plt Over 100 TN	TN	_____	_____	_____
890-124 A/C Fr Cen Plt	SF	_____	_____	_____
821-113 Htg Fr Cen Plt	SF	_____	_____	_____
821-115 Heating Plt 750/3500 MB	MB	_____	_____	_____
821-116 Heating Plt Over 3500 MB	MB	_____	_____	_____
811-147 Electric Emergency Power Generator Plant	KW	_____	_____	_____
890-171- Tanks, Storage Type	BL	_____	_____	_____

5. ELECTRIC:

Category Nomenclature Code	Unit of Measure	Amount Installed	Cost	Amount Removed
812-223 Primary Distribution Line Overhead	LF	_____	_____	_____
812-224 Secondary Distribution Line Overhead	LF	_____	_____	_____
812-225 Primary Distribution Line Underground	LF	_____	_____	_____
812-226 Secondary Distribution Line Underground	LF	_____	_____	_____
812-926 Exterior Lighting (Street or Parking Area Lights)	EA	_____	_____	_____

6. INFRASTRUCTURE:

Category Nomenclature Code	Unit of Measure	Amount Installed	Cost	Amount Removed
824-464 Gas Mains	LF	_____	_____	_____
832-266 Sanitary Sewer	LF	_____	_____	_____
842-245 Water Distribution Mains	LF	_____	_____	_____
843-315 Fire Hydrants	EA	_____	_____	_____
844-368 Irrigation (Non-Potable)	LF	_____	_____	_____
851-143 Curbs & Gutters	LF	_____	_____	_____
871-183 Storm Drain	LF	_____	_____	_____
872-247 Fence, Security	LF	_____	_____	_____
872-248 Fence, Interior	LF	_____	_____	_____
135-583 Telephone Duct Facility	LF	_____	_____	_____
890-134 Air Compressors	HP	_____	_____	_____
890-144 Compressed Air Distribution	LF	_____	_____	_____
890-158 Load and Unload Platform	SF	_____	_____	_____
832-255 Industrial Waste Main	LF	_____	_____	_____
890-269 Cathodic Protection System	EA	_____	_____	_____
890-272 EMCS Field Equipment	EA	_____	_____	_____

7. PAVEMENTS: Please provide type of construction, such as asphalt, concrete or gravel:

Category Nomenclature Code	Unit of Measure	Amount Installed	Cost	Amount Removed
851-145 Driveway	SY	_____	_____	_____
851-147 Road	SY	_____	_____	_____
852-289 Sidewalk	SY	_____	_____	_____
852-261 Veh Pking, Ops (organizational vehicle parking)	SY	_____	_____	_____
852-262 Veh Pking, N/Orgn (gen pub parking)	SY	_____	_____	_____
452-252 Open Storage Area	SY	_____	_____	_____

8. OTHER:

Category Code	Nomenclature	Unit of Measure	Amount Installed	Cost	Amount Removed
-					
-					
-					

9. REMARKS:

SIGNATURE OF PROJECT MONITOR/INSPECTOR

STATEMENT OF CONDITION TO BE COMPLETED BY 45 CES/CECB

Project has extended the useful life of the facility Yes___ No___.
Current condition code is _____. Project has upgraded condition
code to _____.

SIGNATURE OF ENGINEER

APPROVED

FLIGHT CHIEF

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 23 - HEATING, VENTILATING, AND AIR CONDITIONING

SECTION 23 00 00

AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEMS

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SYSTEM DESCRIPTION
 - 1.2.1 Mechanical Equipment Identification
 - 1.2.2 Service Labeling
 - 1.2.3 Color Coding
- 1.3 SUBMITTALS
- 1.4 QUALITY ASSURANCE
 - 1.4.1 Prevention of Corrosion
 - 1.4.2 Asbestos Prohibition
 - 1.4.3 Ozone Depleting Substances Used as Refrigerants
 - 1.4.4 Use of Ozone Depleting Substances, Other than Refrigerants
 - 1.4.5 Detail Drawings
- 1.5 DELIVERY, STORAGE, AND HANDLING

PART 2 PRODUCTS

- 2.1 STANDARD PRODUCTS
- 2.2 STANDARD PRODUCTS
- 2.3 IDENTIFICATION PLATES
- 2.4 EQUIPMENT GUARDS AND ACCESS
- 2.5 ELECTRICAL WORK
- 2.6 ANCHOR BOLTS
- 2.7 AIR SYSTEMS EQUIPMENT
 - 2.7.1 Fans
 - 2.7.2 Coils
 - 2.7.2.1 Water Coils
- 2.8 TERMINAL UNITS
 - 2.8.1 Variable Volume, Single Duct Terminal Units
- 2.9 SUPPLEMENTAL COMPONENTS/SERVICES
 - 2.9.1 Insulation
 - 2.9.2 Controls

PART 3 EXECUTION

- 3.1 EXAMINATION
- 3.2 INSTALLATION
 - 3.2.1 Equipment and Installation
 - 3.2.2 Access Panels
 - 3.2.3 Power Transmission Components Adjustment
- 3.3 EQUIPMENT PADS
- 3.4 CUTTING AND PATCHING
- 3.5 CLEANING
- 3.6 PENETRATIONS
- 3.7 FIELD PAINTING OF MECHANICAL EQUIPMENT

- 3.8 IDENTIFICATION SYSTEMS
- 3.9 PERFORMANCE TESTS
- 3.10 CLEANING AND ADJUSTING
- 3.11 OPERATION AND MAINTENANCE TRAINING

-- End of Section Table of Contents --

SECTION 23 00 00

AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

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.

AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL (AMCA)

AMCA 201	(2002) Fans and Systems
AMCA 210	(2007) Laboratory Methods of Testing Fans for Aerodynamic Performance Rating
AMCA 300	(2005) Reverberant Room Method for Sound Testing of Fans
AMCA 301	(2006; INT 2007; Errata 2008) Methods for Calculating Fan Sound Ratings from Laboratory Test Data

AIR-CONDITIONING, HEATING AND REFRIGERATION INSTITUTE (AHRI)

AHRI 410	(2001; Addendum 2002) Standard for Forced-Circulation Air-Cooling and Air-Heating Coils
AHRI Guideline D	(1996) Application and Installation of Central Station Air-Handling Units

ASTM INTERNATIONAL (ASTM)

ASTM A 123/A 123M	(2009) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 53/A 53M	(2010) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM B 766	(1986; R 2008) Standard Specification for Electrodeposited Coatings of Cadmium
ASTM C 553	(2008) Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1	(2009) Motors and Generators
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NEMA MG 10 (2001; R 2007) Energy Management Guide for Selection and Use of Fixed Frequency Medium AC Squirrel-Cage Polyphase Induction Motors

NEMA MG 11 (1977; R 2007) Energy Management Guide for Selection and Use of Single Phase Motors

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-STD-101 (Rev B) Color Code for Pipelines & for Compressed Gas Cylinders

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 82 Protection of Stratospheric Ozone

UNDERWRITERS LABORATORIES (UL)

UL 6 (2007) Standard for Electrical Rigid Metal Conduit-Steel

UL 705 (2004; Rev thru Oct 2009) Standard for Power Ventilators

UL Bld Mat Dir (2010) Building Materials Directory

1.2 SYSTEM DESCRIPTION

Furnish ductwork, piping offsets, fittings, and accessories as required to provide a complete installation. Coordinate the work of the different trades to avoid interference between piping, equipment, structural, and electrical work. Provide complete, in place, all necessary offsets in piping and ductwork, and all fittings, and other components, required to install the work as indicated and specified.

1.2.1 Mechanical Equipment Identification

Provide chart listing of equipment by designation numbers and capacities such as flow rates, pressure and temperature differences, heating and cooling capacities, horsepower, pipe sizes, and voltage and current characteristics. Diagrams shall be neat mechanical drawings provided with extruded aluminum frames and 1/8-inch acrylic plastic protection. Location is as directed by the Contracting Officer. The number of charts and diagrams shall be equal to or greater than the number of mechanical equipment rooms. Where more than one chart per space is required, mount these in edge pivoted, swinging leaf, extruded aluminum frame holders which open to 170 degrees.

1.2.2 Service Labeling

Label equipment, including fans, air handlers, terminal units, etc. with labels made of self-sticking, plastic film designed for permanent installation. Labels shall be in accordance with the typical examples below:

SERVICE

LABEL AND TAG DESIGNATION

Chiller unit number CH-1
 Chilled water pump unit number CHP-1 & 2

Identify similar services with different temperatures or pressures. Where pressures could exceed 125 pounds per square inch, gage, include the maximum system pressure in the label. Label and arrow piping in accordance with the following:

- a. Each point of entry and exit of pipe passing through walls.
- b. Each change in direction, i.e., elbows, tees.
- c. In congested or hidden areas and at all access panels at each point required to clarify service or indicated hazard.
- d. In long straight runs, locate labels at distances within eyesight of each other not to exceed 75 feet. All labels shall be visible and legible from the primary service and operating area.

For Bare or Insulated Pipes
for Outside Diameters of

Lettering

1/2 thru 1-3/8 inch	1/2 inch
1-1/2 thru 2-3/8 inch	3/4 inch
2-1/2 inch and larger	1-1/4 inch

1.2.3 Color Coding

Color coding of all piping systems shall be in accordance with MIL-STD-101.

1.3 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings

Drawings as specified in Paragraph Detail Drawings and throughout this Section.

SD-03 Product Data

Standard Products: Manufacturer's catalog data included with the detail drawings for the following items. Highlight the data to show model, size, options, etc., that are intended for consideration. Provide adequate data to demonstrate compliance with contract requirements for the following:

Air Handling Units
 Variable Volume, Single Duct Terminal Units

Operation and Maintenance Training

Proposed On-site Training schedule, submitted concurrently with the Operation and Maintenance Manuals.

SD-06 Test Reports

Performance Tests

SD-08 Manufacturer's Instructions

Manufacturer's Installation Instructions
Operation and Maintenance Training

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals

Six manuals at least 2 weeks prior to field training. Submit data complying with the requirements specified in Section 01 78 00 CLOSEOUT PROCEDURES. Submit Data Package 3 for the following:

Fire Dampers
Air Handling Units
Variable Volume, Single Duct Terminal Units

1.4 QUALITY ASSURANCE

Except as otherwise specified, approval of materials and equipment is based on manufacturer's published data.

- a. Where materials and equipment are specified to conform to the standards of the Underwriters Laboratories, the label of or listing with reexamination in UL Bld Mat Dir, and UL 6 is acceptable as sufficient evidence that the items conform to Underwriters Laboratories requirements. In lieu of such label or listing, submit a written certificate from any nationally recognized testing agency, adequately equipped and competent to perform such services, stating that the items have been tested and that the units conform to the specified requirements. Outline methods of testing used by the specified agencies.
- b. Where materials or equipment are specified to be constructed or tested, or both, in accordance with the standards of the ASTM International (ASTM), the ASME International (ASME), or other standards, a manufacturer's certificate of compliance of each item is acceptable as proof of compliance.
- c. Conformance to such agency requirements does not relieve the item from compliance with other requirements of these specifications.

1.4.1 Prevention of Corrosion

Protect metallic materials against corrosion. Manufacturer shall provide rust-inhibiting treatment and standard finish for the equipment enclosures. Do not use aluminum in contact with earth, and where connected to dissimilar metal. Protect aluminum by approved fittings, barrier material, or treatment. Ferrous parts such as anchors, bolts, braces, boxes, bodies, clamps, fittings, guards, nuts, pins, rods, shims, thimbles, washers, and miscellaneous parts not of corrosion-resistant steel or

nonferrous materials shall be hot-dip galvanized in accordance with ASTM A 123/A 123M for exterior locations and cadmium-plated in conformance with ASTM B 766 for interior locations.

1.4.2 Asbestos Prohibition

Do not use asbestos and asbestos-containing products.

1.4.3 Ozone Depleting Substances Used as Refrigerants

Minimize releases of Ozone Depleting Substances (ODS) during repair, maintenance, servicing or disposal of appliances containing ODS's by complying with all applicable sections of 40 CFR 82 Part 82 Subpart F.

In addition, provide copies of all applicable certifications to the Contracting Officer at least 14 calendar days prior to initiating maintenance, repair, servicing, dismantling or disposal of appliances, including:

- a. Proof of Technician Certification
- b. Proof of Equipment Certification for recovery or recycling equipment.
- c. Proof of availability of certified recovery or recycling equipment.

1.4.4 Use of Ozone Depleting Substances, Other than Refrigerants

The use of Class I or Class II ODS's listed as nonessential in 40 CFR 82 Part 82.66 Subpart C is prohibited. These prohibited materials and uses include:

- a. Any plastic party spray streamer or noise horn which is propelled by a chlorofluorocarbon
- b. Any cleaning fluid for electronic and photographic equipment which contains a chlorofluorocarbon; including liquid packaging, solvent wipes, solvent sprays, and gas sprays
- c. Any plastic flexible or packaging foam product which is manufactured with or contains a chlorofluorocarbon, including, open cell foam, open cell rigid polyurethane poured foam, closed cell extruded polystyrene sheet foam, closed cell polyethylene foam and closed cell polypropylene foam except for flexible or packaging foam used in coaxial
- d. Any aerosol product or other pressurized dispenser which contains a chlorofluorocarbon, except for those listed in 40 CFR 82 Part 82.66 Subpart C.

Request a waiver if a facility requirement dictates that a prohibited material is necessary to achieve project goals. Submit the waiver request in writing to the Contracting Officer. The waiver will be evaluated and dispositioned.

1.4.5 Detail Drawings

Submit detail drawings showing equipment layout, including assembly and installation details and electrical connection diagrams; ductwork layout showing the location of all supports and hangers, typical hanger details, gauge reinforcement, reinforcement spacing rigidity classification, and

static pressure and seal classifications. Include any information required to demonstrate that the system has been coordinated and functions properly as a unit on the drawings and show equipment relationship to other parts of the work, including clearances required for operation and maintenance. Submit drawings showing bolt-setting information, and foundation bolts prior to concrete foundation construction for all equipment indicated or required to have concrete foundations. Submit function designation of the equipment and any other requirements specified throughout this Section with the shop drawings.

1.5 DELIVERY, STORAGE, AND HANDLING

Protect stored equipment at the jobsite from the weather, humidity and temperature variations, dirt and dust, or other contaminants. Additionally, cap or plug all pipes until installed.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Provide components and equipment that are "standard products" of a manufacturer regularly engaged in the manufacturing of products that are of a similar material, design and workmanship. "Standard products" is defined as being in satisfactory commercial or industrial use for 2 years before bid opening, including applications of components and equipment under similar circumstances and of similar size, satisfactorily completed by a product that is sold on the commercial market through advertisements, manufacturers' catalogs, or brochures. Products having less than a 2-year field service record are acceptable if a certified record of satisfactory field operation, for not less than 6000 hours exclusive of the manufacturer's factory tests, can be shown. Provide equipment items that are supported by a service organization. Where applicable, provide equipment that is an ENERGY STAR Qualified product or a Federal Energy Management Program (FEMP) designated product.

2.2 STANDARD PRODUCTS

Except for the fabricated duct, plenums and casings specified in paragraphs "Metal Ductwork" and "Plenums and Casings for Field-Fabricated Units", provide components and equipment that are standard products of manufacturers regularly engaged in the manufacturing of products that are of a similar material, design and workmanship. This requirement applies to all equipment, including diffusers, registers, fire dampers, and balancing dampers.

- a. Standard products are defined as components and equipment that have been in satisfactory commercial or industrial use in similar applications of similar size for at least two years before bid opening.
- b. Prior to this two year period, these standard products shall have been sold on the commercial market using advertisements in manufacturers' catalogs or brochures. These manufacturers' catalogs, or brochures shall have been copyrighted documents or have been identified with a manufacturer's document number.
- c. Provide equipment items that are supported by a service organization. Where applicable, provide equipment that is an ENERGY STAR Qualified product or a Federal Energy Management Program (FEMP) designated product.

2.3 IDENTIFICATION PLATES

In addition to standard manufacturer's identification plates, provide engraved laminated phenolic identification plates for each piece of mechanical equipment. Identification plates are to designate the function of the equipment. Submit designation with the shop drawings. Identification plates shall be three layers, black-white-black, engraved to show white letters on black background. Letters shall be upper case. Identification plates 1-1/2-inches high and smaller shall be 1/16-inch thick, with engraved lettering 1/8-inch high; identification plates larger than 1-1/2-inches high shall be 1/8-inch thick, with engraved lettering of suitable height. Identification plates 1-1/2-inches high and larger shall have beveled edges. Install identification plates using a compatible adhesive.

2.4 EQUIPMENT GUARDS AND ACCESS

Fully enclose or guard belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts exposed to personnel contact according to OSHA requirements. Properly guard or cover with insulation of a type specified, high temperature equipment and piping exposed to contact by personnel or where it creates a potential fire hazard.

2.5 ELECTRICAL WORK

- a. Provide motors, controllers, integral disconnects, contactors, and controls with their respective pieces of equipment, except controllers indicated as part of motor control centers. Provide manual or automatic control and protective or signal devices required for the operation specified and control wiring required for controls and devices specified, but not shown. For packaged equipment, include manufacturer provided controllers with the required monitors and timed restart.
- b. For single-phase motors, provide high-efficiency type, fractional-horsepower alternating-current motors, including motors that are part of a system, in accordance with NEMA MG 11. Integral size motors shall be the premium efficiency type in accordance with NEMA MG 1.
- c. For polyphase motors, provide squirrel-cage medium induction motors, including motors that are part of a system, and that meet the efficiency ratings for premium efficiency motors in accordance with NEMA MG 1. Select premium efficiency polyphase motors in accordance with NEMA MG 10.
- d. Provide motors in accordance with NEMA MG 1 and of sufficient size to drive the load at the specified capacity without exceeding the nameplate rating of the motor. Provide motors rated for continuous duty with the enclosure specified. Provide motor duty that allows for maximum frequency start-stop operation and minimum encountered interval between start and stop. Provide motor torque capable of accelerating the connected load within 20 seconds with 80 percent of the rated voltage maintained at motor terminals during one starting period. Provide motor starters complete with thermal overload protection and other necessary appurtenances. Fit motor bearings with grease supply fittings and grease relief to outside of the enclosure.

2.6 ANCHOR BOLTS

Provide anchor bolts for equipment placed on concrete equipment pads or on concrete slabs. Bolts to be of the size and number recommended by the equipment manufacturer and located by means of suitable templates. Installation of anchor bolts shall not degrade the surrounding concrete.

2.7 AIR SYSTEMS EQUIPMENT

2.7.1 Fans

Test and rate fans according to AMCA 210. Calculate system effect on air moving devices in accordance with AMCA 201 where installed ductwork differs from that indicated on drawings. Install air moving devices to minimize fan system effect. Where system effect is unavoidable, determine the most effective way to accommodate the inefficiencies caused by system effect on the installed air moving device. The sound power level of the fans shall not exceed 85 dBA when tested according to AMCA 300 and rated in accordance with AMCA 301. Provide all fans with an AMCA seal. Connect fans to the motors either directly or indirectly with V-belt drive. Use V-belt drives designed for not less than 150 percent of the connected driving capacity. Provide variable pitch motor sheaves for 15 hp and below, and fixed pitch as defined by AHRI Guideline D. Select variable pitch sheaves to drive the fan at a speed which can produce the specified capacity when set at the approximate midpoint of the sheave adjustment. When fixed pitch sheaves are furnished, provide a replaceable sheave when needed to achieve system air balance. Provide motors for V-belt drives with adjustable rails or bases. Provide removable metal guards for all exposed V-belt drives, and provide speed-test openings at the center of all rotating shafts. Provide fans with personnel screens or guards on both suction and supply ends, except that the screens need not be provided, unless otherwise indicated, where ducts are connected to the fan. Provide fan and motor assemblies with vibration-isolation supports or mountings as indicated. Use vibration-isolation units that are standard products with published loading ratings. Select each fan to produce the capacity required at the fan static pressure indicated. Provide sound power level as indicated. Obtain the sound power level values according to AMCA 300. Provide standard AMCA arrangement, rotation, and discharge as indicated. Provide power ventilators that conform to UL 705 and have a UL label.

2.7.2 Coils

Provide fin-and-tube type coils constructed of seamless copper tubes and copper fins mechanically bonded or soldered to the tubes. Provide copper tube wall thickness that is a minimum of 0.020 inches. Provide copper fins that are 0.0045 inch minimum thickness. Provide casing and tube support sheets that are not lighter than 16 gauge galvanized steel, formed to provide structural strength. When required, provide multiple tube supports to prevent tube sag. Test each coil at the factory under water at not less than 400 psi air pressure and make suitable for 200 psi working pressure and 300 degrees F operating temperature unless otherwise stated. Mount coils for counterflow service. Rate and certify coils to meet the requirements of AHRI 410.

2.7.2.1 Water Coils

Install water coils with a pitch of not less than 1/8 inch/foot of the tube length toward the drain end. Use headers constructed of copper. Furnish each coil with a plugged vent and drain connection extending through the

unit casing. Provide removable water coils with drain pans.

2.8 TERMINAL UNITS

2.8.1 Variable Volume, Single Duct Terminal Units

Provide variable volume, single duct, terminal units with a calibrated air volume sensing device, air valve or damper, actuator, and accessory relays. Provide units that control air volume to within plus or minus 5 percent of each air set point volume as determined by the thermostat with variations in inlet pressures from 3/4 to 6 inch water gauge. Provide units with an internal resistance not exceeding 0.4 inch water gauge at maximum flow range. Provide external differential pressure taps separate from the control pressure taps for air flow measurement with a 0 to 1 inch water gauge range.

2.9 SUPPLEMENTAL COMPONENTS/SERVICES

2.9.1 Insulation

The requirements for shop and field applied insulation are specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

2.9.2 Controls

New controls for pumps and chillers to tie into building controller located in mechanical room.

PART 3 EXECUTION

3.1 EXAMINATION

After becoming familiar with all details of the work, verify all dimensions in the field, and advise the Contracting Officer of any discrepancy before performing the work.

3.2 INSTALLATION

- a. Install materials and equipment in accordance with the requirements of the contract drawings and approved manufacturer's installation instructions. Accomplish installation by workers skilled in this type of work. Perform installation so that there is no degradation of the designed fire ratings of walls, partitions, ceilings, and floors.
- b. No installation is permitted to block or otherwise impede access to any existing machine or system. Install all hinged doors to swing open a minimum of 120 degrees. Provide an area in front of all access doors that clears a minimum of 3 feet. In front of all access doors to electrical circuits, clear the area the minimum distance to energized circuits as specified in OSHA Standards, part 1910.333 (Electrical-Safety Related work practices) and an additional 3 feet.
- c. Except as otherwise indicated, install emergency switches and alarms in conspicuous locations. Mount all indicators, to include gauges, meters, and alarms in order to be easily visible by people in the area.

3.2.1 Equipment and Installation

Provide frames and supports for tanks, compressors, pumps, valves, air

handling units, fans, coils, dampers, and other similar items requiring supports. Floor mount or ceiling hang air handling units as indicated. Anchor and fasten as detailed. Set floor-mounted equipment on not less than 6 inch concrete pads or curbs doweled in place unless otherwise indicated. Make concrete foundations heavy enough to minimize the intensity of the vibrations transmitted to the piping, duct work and the surrounding structure, as recommended in writing by the equipment manufacturer. In lieu of a concrete pad foundation, build a concrete pedestal block with isolators placed between the pedestal block and the floor. Make the concrete foundation or concrete pedestal block a mass not less than three times the weight of the components to be supported. Provide the lines connected to the pump mounted on pedestal blocks with flexible connectors. Submit foundation drawings as specified in paragraph
DETAIL DRAWINGS.

3.2.2 Access Panels

Install access panels for concealed valves, vents, controls, dampers, and items requiring inspection or maintenance of sufficient size, and locate them so that the concealed items are easily serviced and maintained or completely removed and replaced.

3.2.3 Power Transmission Components Adjustment

Test V-belts and sheaves for proper alignment and tension prior to operation and after 72 hours of operation at final speed. Uniformly load belts on drive side to prevent bouncing. Make alignment of direct driven couplings to within 50 percent of manufacturer's maximum allowable range of misalignment.

3.3 EQUIPMENT PADS

Provide equipment pads to the dimensions shown or, if not shown, to conform to the shape of each piece of equipment served with a minimum 3-inch margin around the equipment and supports. Allow equipment bases and foundations, when constructed of concrete or grout, to cure a minimum of 14 calendar days before being loaded.

3.4 CUTTING AND PATCHING

Install work in such a manner and at such time that a minimum of cutting and patching of the building structure is required. Make holes in exposed locations, in or through existing floors, by drilling and smooth by sanding. Use of a jackhammer is permitted only where specifically approved. Make holes through masonry walls to accommodate sleeves with an iron pipe masonry core saw.

3.5 CLEANING

Thoroughly clean surfaces of piping and equipment that have become covered with dirt, plaster, or other material during handling and construction before such surfaces are prepared for final finish painting or are enclosed within the building structure. Before final acceptance, clean mechanical equipment, including piping, ducting, and fixtures, and free from dirt, grease, and finger marks. When the work area is in an occupied space such as office, laboratory or warehouse protect all furniture and equipment from dirt and debris. Incorporate housekeeping for field construction work which leaves all furniture and equipment in the affected area free of construction generated dust and debris; and, all floor surfaces

vacuum-swept clean.

3.6 PENETRATIONS

Provide sleeves and prepared openings for duct mains, branches, and other penetrating items, and install during the construction of the surface to be penetrated. Cut sleeves flush with each surface. Place sleeves for round duct 15 inches and smaller. Build framed, prepared openings for round duct larger than 15 inches and square, rectangular or oval ducts. Sleeves and framed openings are also required where grilles, registers, and diffusers are installed at the openings. Provide one inch clearance between penetrating and penetrated surfaces except at grilles, registers, and diffusers. Pack spaces between sleeve or opening and duct or duct insulation with mineral fiber conforming with ASTM C 553, Type 1, Class B-2.

- a. Sleeves: Fabricate sleeves, except as otherwise specified or indicated, from 20 gauge thick mill galvanized sheet metal. Where sleeves are installed in bearing walls or partitions, provide black steel pipe conforming with ASTM A 53/A 53M, Schedule 20.
- b. Framed Prepared Openings: Fabricate framed prepared openings from 20 gauge galvanized steel, unless otherwise indicated.
- c. Closure Collars: Provide closure collars of a minimum 4 inches wide, unless otherwise indicated, for exposed ducts and items on each side of penetrated surface, except where equipment is installed. Install collar tight against the surface and fit snugly around the duct or insulation. Grind sharp edges smooth to prevent damage to penetrating surface. Fabricate collars for round ducts 15 inches in diameter or less from 20 gauge galvanized steel. Fabricate collars for square and rectangular ducts, or round ducts with minimum dimension over 15 inches from 18 gauge galvanized steel. Fabricate collars for square and rectangular ducts with a maximum side of 15 inches or less from 20 gauge galvanized steel. Install collars with fasteners a maximum of 6 inches on center. Attach to collars a minimum of 4 fasteners where the opening is 12 inches in diameter or less, and a minimum of 8 fasteners where the opening is 20 inches in diameter or less.
- d. Firestopping: Where ducts pass through fire-rated walls, fire partitions, and fire rated chase walls, seal the penetration with fire stopping materials as specified.

3.7 FIELD PAINTING OF MECHANICAL EQUIPMENT

Clean, pretreat, prime and paint metal surfaces; except aluminum surfaces need not be painted. Apply coatings to clean dry surfaces. Clean the surfaces to remove dust, dirt, rust, oil and grease by wire brushing and solvent degreasing prior to application of paint, except clean to bare metal on metal surfaces subject to temperatures in excess of 120 degrees F. Where more than one coat of paint is specified, apply the second coat after the preceding coat is thoroughly dry. Lightly sand damaged painting and retouch before applying the succeeding coat. Provide aluminum or light gray finish coat.

- a. Temperatures less than 120 degrees F: Immediately after cleaning, apply one coat of pretreatment primer applied to a minimum dry film thickness of 0.3 mil, one coat of primer applied to a minimum dry film thickness of one mil; and two coats of enamel applied to a minimum dry film thickness of one mil per coat to metal surfaces subject to temperatures

less than 120 degrees F.

- b. Temperatures between 120 and 400 degrees F: Apply two coats of 400 degrees F heat-resisting enamel applied to a total minimum thickness of two mils to metal surfaces subject to temperatures between 120 and 400 degrees F.
- c. Temperatures greater than 400 degrees F: Apply two coats of 315 degrees C 600 degrees F heat-resisting paint applied to a total minimum dry film thickness of two mils to metal surfaces subject to temperatures greater than 400 degrees F.

3.8 IDENTIFICATION SYSTEMS

Provide identification tags made of brass, engraved laminated plastic, or engraved anodized aluminum, indicating service and item number on all valves and dampers. Provide tags that are 1-3/8 inch minimum diameter with stamped or engraved markings. Make indentations black for reading clarity. Attach tags to valves with No. 12 AWG 0.0808-inch diameter corrosion-resistant steel wire, copper wire, chrome-plated beaded chain or plastic straps designed for that purpose.

3.9 PERFORMANCE TESTS

After testing, adjusting, and balancing is complete as specified, test each system as a whole to see that all items perform as integral parts of the system and temperatures and conditions are evenly controlled throughout the building. Record the testing during the applicable season. Make corrections and adjustments as necessary to produce the conditions indicated or specified. Conduct capacity tests and general operating tests by an experienced engineer. Provide tests that cover a period of not less than days for each system and demonstrate that the entire system is functioning according to the specifications. Make coincidental chart recordings at points indicated on the drawings for the duration of the time period and record the temperature at space thermostats or space sensors, the humidity at space humidistats or space sensors and the ambient temperature and humidity in a shaded and weather protected area.

3.10 CLEANING AND ADJUSTING

All strainers shall be cleaned after restart of new system.

3.11 OPERATION AND MAINTENANCE TRAINING

Conduct a training course for the members of the operating staff as designated by the Contracting Officer. Make the training period consist of a total of 8 hours of normal working time and start it after all work specified herein is functionally completed and the Performance Tests have been approved. Conduct field instruction that covers all of the items contained in the Operation and Maintenance Manuals as well as demonstrations of routine maintenance operations. Notify the Contracting Officer at least 14 days prior to the date of proposed conduct of the training course.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 23 - HEATING, VENTILATING, AND AIR CONDITIONING

SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 DEFINITIONS
 - 1.2.1 Similar Terms
- 1.3 WORK DESCRIPTION
 - 1.3.1 Water Distribution Systems
 - 1.3.2 TAB SCHEMATIC DRAWINGS
 - 1.3.3 Related Requirements
- 1.4 SUBMITTALS
- 1.5 QUALITY ASSURANCE
 - 1.5.1 Independent Tab Agency and Personnel Qualifications
 - 1.5.2 Tab Standard
 - 1.5.3 Sustainability
 - 1.5.4 Qualifications
 - 1.5.4.1 TAB Firm
 - 1.5.4.2 TAB Specialist
 - 1.5.4.3 TAB Specialist Responsibilities
 - 1.5.4.4 Tab Related HVAC Submittals
 - 1.5.5 Responsibilities
 - 1.5.5.1 Contractor
 - 1.5.5.2 TAB Agency
 - 1.5.5.3 TAB Team Supervisor
 - 1.5.5.4 TAB Team Field Leader
 - 1.5.6 Test Reports
 - 1.5.6.1 Certified TAB Reports
- 1.6 SEQUENCING AND SCHEDULING
 - 1.6.1 TAB Submittal and Work Schedule
 - 1.6.2 Projects with Phased Construction
 - 1.6.2.1 Phasing of Work
 - 1.6.3 TAB Submittal and Work Schedule
 - 1.6.3.1 Design Review Report
 - 1.6.3.2 Pre-Field TAB Engineering Report
- 1.7 WARRANTY

PART 2 PRODUCTS

PART 3 EXECUTION

- 3.1 WORK DESCRIPTIONS OF PARTICIPANTS
- 3.2 PRE-TAB MEETING
- 3.3 DALT PROCEDURES
 - 3.3.1 Instruments, Consumables and Personnel
- 3.4 TAB PROCEDURES
 - 3.4.1 TAB Field Work

- 3.4.2 Preliminary Procedures
- 3.4.3 TAB Air Distribution Systems
- 3.4.4 TAB Water Distribution Systems
 - 3.4.4.1 Chilled Water
- 3.4.5 TAB Work on Performance Tests Without Seasonal Limitations
 - 3.4.5.1 Performance Tests
 - 3.4.5.2 Ambient Temperatures
 - 3.4.5.3 Water Chillers
 - 3.4.5.4 Coils
- 3.4.6 Workmanship
- 3.4.7 Deficiencies
- 3.4.8 TAB Reports
- 3.4.9 Quality Assurance - COTR TAB Field Acceptance Testing
 - 3.4.9.1 TAB Field Acceptance Testing
 - 3.4.9.2 Additional COTR TAB Field Acceptance Testing
 - 3.4.9.3 Prerequisite for Approval
- 3.5 MARKING OF SETTINGS
- 3.6 MARKING OF TEST PORTS
- 3.7 APPENDICES

-- End of Section Table of Contents --

SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 **GENERAL**

1.1 REFERENCES

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.

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 62.1 (2007; INT 2007; INT 2-15 2008; Errata 2008; Addenda a, b, e, f and h 2008) Ventilation for Acceptable Indoor Air Quality

ASSOCIATED AIR BALANCE COUNCIL (AABC)

AABC MN-1 (2002) National Standards for Total System Balance

AABC MN-4 (1996) Test and Balance Procedures

NATIONAL ENVIRONMENTAL BALANCING BUREAU (NEBB)

NEBB MASV (2006) Procedural Standards for Measurements and Assessment of Sound and Vibration

NEBB PROCEDURAL STANDARDS (2005) Procedural Standards for TAB (Testing, Adjusting and Balancing) Environmental Systems

SHEET METAL & AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA 1780 (2002; 3rd Ed) HVAC Systems - Testing, Adjusting and Balancing

SMACNA 1858 (2004) HVAC Sound And Vibration Manual - First Edition

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 82 Protection of Stratospheric Ozone

1.2 DEFINITIONS

- a. AABC: Associated Air Balance Council.
- b. COTR: Contracting Officer's Technical Representative.

- c. HVAC: Heating, ventilating, and air conditioning; or heating, ventilating, and cooling.
- d. NEBB: National Environmental Balancing Bureau
- e. Out-of-tolerance data: Pertains only to field acceptance testing of Final TAB report. When applied to TAB work this phase means "a measurement taken during TAB field acceptance testing which does not fall within the range of plus 5 to minus 5 percent of the original measurement reported on the TAB Report for a specific parameter."
- f. Season of maximum heating load: The time of year when the outdoor temperature at the project site remains within plus or minus 30 degrees Fahrenheit of the project site's winter outdoor design temperature, throughout the period of TAB data recording.
- g. Season of maximum cooling load: The time of year when the outdoor temperature at the project site remains within plus or minus 5 degrees Fahrenheit of the project site's summer outdoor design temperature, throughout the period of TAB data recording.
- h. Season 1, Season 2: Depending upon when the project HVAC is completed and ready for TAB, Season 1 is defined, thereby defining Season 2. Season 1 could be the season of maximum heating load, or the season of maximum cooling load.
- i. Sound measurements terminology: Defined in AABC MN-1, NEBB MASV, or SMACNA 1858 (TABB).
- j. TAB: Testing, adjusting, and balancing (of HVAC systems).
- k. TAB'd: HVAC Testing/Adjusting/Balancing procedures performed.
- l. TAB Agency: TAB Firm
- m. TAB team field leader: TAB team field leader
- n. TAB team supervisor: TAB team engineer.
- o. TAB team technicians: TAB team assistants.
- p. TABB: Testing Adjusting and Balancing Bureau.

1.2.1 Similar Terms

In some instances, terminology differs between the Contract and the TAB Standard primarily because the intent of this Section is to use the industry standards specified, along with additional requirements listed herein to produce optimal results.

The following table of similar terms is provided for clarification only. Contract requirements take precedent over the corresponding AABC, NEBB, or TABB requirements where differences exist.

SIMILAR TERMS

Contract Term	AABC	NEBB	TABB
	Term	Term	Term

SIMILAR TERMS

TAB Standard	National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems	Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems	International Standards for Environmental Systems Balance
TAB Specialist	TAB Engineer	TAB Supervisor	TAB Supervisor
Systems Readiness Check	Construction Phase Inspection	Field Readiness Check & Preliminary Field Procedures.	Field Readiness Check & Prelim. Field Procedures

1.3 WORK DESCRIPTION

The work includes testing, adjusting, and balancing (TAB) of new heating, ventilating, and cooling (HVAC) air and water distribution systems including equipment and performance data, ducts, and piping which are located within, on, under, between, and adjacent to buildings, including records of existing conditions.

Perform TAB in accordance with the requirements of the TAB procedural standard recommended by the TAB trade association that approved the TAB Firm's qualifications. Comply with requirements of AABC MN-1, NEBB PROCEDURAL STANDARDS, or SMACNA 1780 (TABB) as supplemented and modified by this specification section. All recommendations and suggested practices contained in the TAB procedural standards are considered mandatory.

Conduct TAB of the indicated existing systems and equipment and submit the specified TAB reports for approval. Conduct TAB work in accordance with the requirements of this section.

1.3.1 Water Distribution Systems

TAB systems in compliance with this section. Obtain Contracting Officer's written approval before applying insulation to water distribution systems as specified under Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS. At Contractor's option and with Contracting Officer's written approval, the piping systems may be insulated before systems are TAB'd.

Terminate piping insulation immediately adjacent to each flow control valve, automatic control valve, or device. Seal the ends of pipe insulation and the space between ends of pipe insulation and piping, with waterproof vapor barrier coating.

After completion of work under this section, insulate the flow control valves and devices as specified under Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

1.3.2 TAB SCHEMATIC DRAWINGS

Show the following information on TAB Schematic Drawings:

1. A unique number or mark for each piece of equipment or terminal.
2. Water quantities and temperatures in thermal energy transfer equipment schedules.
3. Water quantities and heads in pump schedules.
4. Water flow measurement fittings and balancing fittings.

The Testing, Adjusting, and Balancing (TAB) Specialist must review the Contract Plans and Specifications and advise the Contracting Officer of any deficiencies that would prevent the effective and accurate TAB of the system, including records of existing conditions, and systems readiness check. The TAB Specialist must provide a Design Review Report individually listing each deficiency and the corresponding proposed corrective action necessary for proper system operation.

Submit copies of the TAB Schematic Drawings and Report Forms to the Contracting Officer, no later than 21 days prior to the start of TAB field measurements.

1.3.3 Related Requirements

Section 23 00 00 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEMS applies to work specified in this section.

Specific requirements relating to Reliability Centered Maintenance (RCM) principals and Predictive Testing and Inspection (PTI), by the construction contractor to detect latent manufacturing and installation defects must be followed as part of the Contractor's Quality Control program. Refer to the paragraph titled "Sustainability" for detailed requirements.

1.4 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Records of Existing Conditions

TAB Firm

Designation of TAB team assistants

Designation of TAB team engineer Specialist

Designation of TAB team field leader

SD-02 Shop Drawings

TAB Schematic Drawings and Report Forms

SD-03 Product Data

Equipment and Performance Data

TAB Related HVAC Submittals

A list of the TAB Related HVAC Submittals, no later than 7 days after the approval of the TAB team engineer.

TAB Procedures Summary

Proposed procedures for TAB, submitted with the TAB Schematic Drawings and Report Forms.

Calibration

Systems Readiness Check

TAB Work Execution Schedule

TAB procedures

TAB execution

SD-06 Test Reports

Design review report

TAB report for Season 1

SD-07 Certificates

Independent TAB agency and personnel qualifications; G

Completed Pre-TAB Work Checklist

TAB Firm

Independent TAB Agency and Personnel Qualifications

TAB Submittal and Work Schedule

Design review report

Pre-field TAB engineering report

1.5 QUALITY ASSURANCE

1.5.1 Independent Tab Agency and Personnel Qualifications

To secure approval for the proposed agency, submit information certifying that the TAB agency is a first tier subcontractor who is not affiliated with any other company participating in work on this contract, including design, furnishing equipment, or construction. Further, submit the following, for the agency, to Contracting Officer for approval:

a. Independent AABC or NEBB or TABB TAB agency:

TAB agency: AABC registration number and expiration date of current certification; or NEBB certification number and expiration date of current certification; or TABB certification number and expiration date of current certification.

TAB team supervisor: Name and copy of AABC or NEBB or TABB TAB supervisor certificate and expiration date of current

certification.

TAB team field leader: Name and documented evidence that the team field leader has satisfactorily performed full-time supervision of TAB work in the field for not less than 3 years immediately preceding this contract's bid opening date.

TAB team field technicians: Names and documented evidence that each field technician has satisfactorily assisted a TAB team field leader in performance of TAB work in the field for not less than one year immediately preceding this contract's bid opening date.

Current certificates: Registrations and certifications are current, and valid for the duration of this contract. Renew Certifications which expire prior to completion of the TAB work, in a timely manner so that there is no lapse in registration or certification. TAB agency or TAB team personnel without a current registration or current certification are not to perform TAB work on this contract.

- b. TAB Team Members: TAB team approved to accomplish work on this contract are full-time employees of the TAB agency. No other personnel is allowed to do TAB work on this contract.
- c. Replacement of TAB team members: Replacement of members may occur if each new member complies with the applicable personnel qualifications and each is approved by the Contracting Officer.

1.5.2 Tab Standard

Perform TAB in accordance with the requirements of the standard under which the TAB Firm's qualifications are approved, i.e., AABC MN-1, NEBB PROCEDURAL STANDARDS, or SMACNA 1780 unless otherwise specified herein. All recommendations and suggested practices contained in the TAB Standard are considered mandatory. Use the provisions of the TAB Standard, including checklists, report forms, etc., as nearly as practical, to satisfy the Contract requirements. Use the TAB Standard for all aspects of TAB, including qualifications for the TAB Firm and Specialist and calibration of TAB instruments. Where the instrument manufacturer calibration recommendations are more stringent than those listed in the TAB Standard, adhere to the manufacturer's recommendations.

All quality assurance provisions of the TAB Standard such as performance guarantees are part of this contract. For systems or system components not covered in the TAB Standard, TAB procedures must be developed by the TAB Specialist. Where new procedures, requirements, etc., applicable to the Contract requirements have been published or adopted by the body responsible for the TAB Standard used (AABC, NEBB, or TABB), the requirements and recommendations contained in these procedures and requirements are considered mandatory, including the latest requirements of ASHRAE 62.1.

1.5.3 Sustainability

Contractor must submit the following as part of the Quality Control Plan for acceptance testing:

- a. List all test equipment to be used, including its manufacturer, model number, calibration date, and serial number.

- b. Certificates of test personnel qualifications and certifications. Provide certification of compliance with 40 CFR 82.
- c. Proof of equivalency if the contractor desires to substitute a test requirement.

1.5.4 Qualifications

1.5.4.1 TAB Firm

The TAB Firm must be either a member of AABC or certified by the NEBB or the TABB and certified in all categories and functions where measurements or performance are specified on the plans and specifications, including TAB of environmental systems the measuring of sound and vibration in environmental systems.

Certification must be maintained for the entire duration of duties specified herein. If, for any reason, the firm loses subject certification during this period, the Contractor must immediately notify the Contracting Officer and submit another TAB Firm for approval. Any firm that has been the subject of disciplinary action by either the AABC, the NEBB, or the TABB within the five years preceding Contract Award is not be eligible to perform any duties related to the HVAC systems, including TAB. All work specified in this Section and in other related Sections to be performed by the TAB Firm will be considered invalid if the TAB Firm loses its certification prior to Contract completion and must be performed by an approved successor.

These TAB services are to assist the prime Contractor in performing the quality oversight for which it is responsible. The TAB Firm must be a prime subcontractor of the Contractor and be financially and corporately independent of the mechanical subcontractor, reporting directly to and paid by the Contractor.

1.5.4.2 TAB Specialist

The TAB Specialist must be either a member of AABC, an experienced technician of the Firm certified by the NEBB, or a Supervisor certified by the TABB. The certification must be maintained for the entire duration of duties specified herein. If, for any reason, the Specialist loses subject certification during this period, immediately notify the Contracting Officer and submit another TAB Specialist for approval. Any individual that has been the subject of disciplinary action by either the AABC, the NEBB, or the TABB within the five years preceding Contract Award is not eligible to perform any duties related to the HVAC systems, including TAB. All work specified in this Section and in other related Sections performed by the TAB Specialist will be considered invalid if the TAB Specialist loses its certification prior to Contract completion and must be performed by the approved successor.

1.5.4.3 TAB Specialist Responsibilities

TAB Specialist responsibilities include all TAB work specified herein and in related sections under his direct guidance. The TAB specialist is required to be onsite on a daily basis to direct TAB efforts. The TAB Specialist must participate in the commissioning process.

1.5.4.4 Tab Related HVAC Submittals

The TAB Specialist must prepare a list of the submittals from the Contract Submittal Register that relate to the successful accomplishment of all HVAC TAB. Accompany the submittals identified on this list with a letter of approval signed and dated by the TAB Specialist when submitted to the Government. Ensure that the location and details of ports, terminals, connections, etc., necessary to perform TAB are identified on the submittals.

1.5.5 Responsibilities

The Contractor is responsible for ensuring compliance with the requirements of this section. The following delineation of specific work responsibilities is specified to facilitate TAB execution of the various work efforts by personnel from separate organizations. This breakdown of specific duties is specified to facilitate adherence to the schedule listed in paragraph entitled "TAB Submittal and Work Schedule."

1.5.5.1 Contractor

- a. TAB personnel: Ensure that the TAB work is accomplished by a group meeting the requirements specified in paragraph entitled "TAB Personnel Qualification Requirements."
- b. Pre-TAB meeting: Attend the meeting with the TAB Supervisor, and ensure that a representative is present for the sheetmetal contractor, mechanical contractor, electrical contractor, and automatic temperature controls contractor.
- c. HVAC documentation: Furnish one complete set of the following HVAC-related documentation to the TAB agency:
 - (1) Contract drawings and specifications
 - (2) Approved submittal data for equipment
 - (3) Construction work schedule
 - (4) Up-to-date revisions and change orders for the previously listed items
- d. Submittal and work schedules: Ensure that the schedule for submittals and work required by this section and specified in paragraph entitled "TAB Submittal and Work Schedule," is met.
- e. Coordination of supporting personnel:

Provide the technical personnel, such as factory representatives or HVAC controls installer required by the TAB field team to support the TAB field measurement work.

Provide equipment mechanics to operate HVAC equipment and ductwork mechanics to provide the field designated test ports to enable TAB field team to accomplish the TAB field measurement work. Ensure these support personnel are present at the times required by the TAB team, and cause no delay in the TAB field work.

Conversely, ensure that the HVAC controls installer has required

support from the TAB team field leader to complete the controls check out.

- f. Deficiencies: Ensure that the TAB Agency supervisor submits all Design/Construction deficiency notifications directly to the Contracting officer within 3 days after the deficiency is encountered. Further, ensure that all such notification submittals are complete with explanation, including documentation, detailing deficiencies.
- g. Prerequisite HVAC work: Complete check out and debugging of HVAC equipment, ducts, and controls prior to the TAB engineer arriving at the project site to begin the TAB work. Debugging includes searching for and eliminating malfunctioning elements in the HVAC system installations, and verifying all adjustable devices are functioning as designed. Include as prerequisite work items, the deficiencies pointed out by the TAB team supervisor in the design review report.
- h. Prior to the TAB field team's arrival, ensure completion of the applicable inspections and work items listed in the TAB team supervisor's pre-field engineering report. Do not allow the TAB team to commence TAB field work until all of the following are completed.
 - (1) HVAC system installations are fully complete.
 - (2) HVAC prerequisite checkout work lists specified in the paragraph "Pre-Field TAB Engineering Report" are completed, submitted, and approved. Ensure that the TAB Agency gets a copy of the approved prerequisite HVAC work checklist.
 - (3) HVAC system filters are clean for both Season 1 and Season 2 TAB field work.
- i. Advance notice: Furnish to the Contracting Officer with advance written notice for the commencement for the commencement of the TAB field work.

1.5.5.2 TAB Agency

Provide the services of a TAB team which complies with the requirements of paragraph entitled "Independent TAB Agency Personnel Qualifications". The work to be performed by the TAB agency is limited to testing, adjusting, and balancing of HVAC air and water systems to satisfy the requirements of this specification section.

1.5.5.3 TAB Team Supervisor

- a. Overall management: Supervise and manage the overall TAB team work effort, including preliminary and technical TAB procedures and TAB team field work.
- b. Pre-TAB meeting: Attend meeting with Contractor.
- c. Design review report: Review project specifications and accompanying drawings to verify that the air systems and water systems are designed in such a way that the TAB engineer can accomplish the work in compliance with the requirements of this section. Verify the presence and location of permanently installed test ports and other devices needed, including gauge cocks, thermometer wells, flow control devices, circuit setters, balancing valves, and manual volume dampers.

- d. Support required: Specify the technical support personnel required from the Contractor other than the TAB agency; such as factory representatives for temperature controls or for complex equipment. Inform the Contractor in writing of the support personnel needed and when they are needed. Furnish the notice as soon as the need is anticipated, either with the design review report, or the pre-field engineering report, the during the DALT or TAB field work.
- e. Pre-field engineering report: Utilizing the following HVAC-related documentation; contract drawings and specifications, approved submittal data for equipment, up-to-date revisions and change orders; prepare this report.
- f. Prerequisite HVAC work checklist: Ensure the Contractor gets a copy of this checklist at the same time as the pre-field engineering report is submitted.
- g. Certified TAB report: Certify the TAB report. This certification includes the following work:
 - (1) Review: Review the TAB field data report. From this field report, prepare the certified TAB report.
 - (2) Verification: Verify adherence, by the TAB field team, to the TAB plan prescribed by the pre-field engineering report and verify adherence to the procedures specified in this section.
- h. Design/Construction deficiencies: Within 3 working days after the TAB Agency has encountered any design or construction deficiencies, the TAB Supervisor must submit written notification directly to the Contracting Officer, with a separate copy to the Contractor, of all such deficiencies. Provide in this submittal a complete explanation, including supporting documentation, detailing deficiencies. Where deficiencies are encountered that are believed to adversely impact successful completion of TAB, the TAB Agency must issue notice and request direction in the notification submittal.
- i. TAB Field Check: The TAB team supervisor must attend and supervise TAB field check.

1.5.5.4 TAB Team Field Leader

- a. Field manager: Manage, in the field, the accomplishment of the work specified in Part 3, "Execution."
- b. Full time: Be present at the contract site when TAB field work is being performed by the TAB team; ensure day-to-day TAB team work accomplishments are in compliance with this section.
- c. Prerequisite HVAC work: Do not bring the TAB team to the contract site until a copy of the prerequisite HVAC Checklist, with all work items certified by the Contractor to be working as designed, reaches the office of the TAB Agency.

1.5.6 Test Reports

1.5.6.1 Certified TAB Reports

Submit: TAB Report for Season 1 in the following manner:

a. Report format: Submit the completed pre-field data forms approved in the pre-field TAB Engineering Report completed by TAB field team, reviewed and certified by the TAB supervisor. Bind the report with a waterproof front and back cover. Include a table of contents identifying by page number the location of each report. Report forms and report data must be typewritten. Handwritten report forms or report data are not acceptable.

b. Instruments: List the types of instruments actually used to measure the tab data. Include in the listing each instrument's unique identification number, calibration date, and calibration expiration date.

Instrumentation, used for taking wet bulb temperature readings must provide accuracy of plus or minus 5 percent at the measured face velocities. Submit instrument manufacturer's literature to document instrument accuracy performance is in compliance with that specified.

c. Certification: Include the typed name of the TAB supervisor and the dated signature of the TAB supervisor.

d. Performance Curves: The TAB Supervisor must include, in the TAB Reports, factory pump curves and fan curves for pumps and fans TAB'd on the job.

e. Calibration Curves: The TAB Supervisor must include, in the TAB Reports, a factory calibration curve for installed flow control balancing valves, flow venturi's and flow orifices TAB'd on the job.

1.6 SEQUENCING AND SCHEDULING

1.6.1 TAB Submittal and Work Schedule

Comply with additional requirements specified in Appendix C: DALT AND TAB SUBMITTAL AND WORK SCHEDULE included at the end of this section

1.6.2 Projects with Phased Construction

This specification section is structured as though the HVAC construction, and thereby the TAB work, will be completed in a single phase. When the construction is completed in phases, the TAB work must be planned, completed, and accepted for each construction phase.

1.6.2.1 Phasing of Work

This specification section is structured as though the HVAC construction, and thereby the TAB work, is going to be completed in a single phase. All elements of the TAB work are addressed on this premise. When a contract is to be completed in construction phases, including the TAB work, the TAB work must be planned for, completed and approved by the Contracting Officer with each phase. An example of this case would be one contract that requires the rehabilitation of the HVAC in each of several separated buildings. At the completion of the final phase, compile all approved

reports and submit as one document.

1.6.3 TAB Submittal and Work Schedule

Submit this schedule, and TAB Schematic Drawings, adapted for this particular contract, to the Contracting Officer (CO) for review and approval. Include with the submittal the planned calendar dates for each submittal or work item. Resubmit an updated version for CO approval every 90 calendar days. Compliance with the following schedule is the Contractor's responsibility.

Qualify TAB Personnel: Within 45 calendar days after date of contract award, submit TAB agency and personnel qualifications.

Pre-TAB Meeting: Within 30 calendar days after the date of approval of the TAB agency and personnel, meet with the COTR.

Design Review Report: Within 60 calendar days after the date of the TAB agency personnel qualifications approval, submit design review report.

Pre-Field TAB Engineering Report: Within 15 calendar days after approval of the TAB agency Personnel Qualifications, submit the Pre-Field TAB Engineering Report.

Prerequisite HVAC Work Check Out List and Advanced Notice For TAB Field Work: At a minimum of 45 calendar days prior to CCD, submit prerequisite HVAC work check out list certified as complete, and submit advance notice of commencement of TAB field work.

TAB Field Work: At a minimum of 90 calendar days prior to CCD, accomplish TAB field work.

Submit TAB Report: Within 15 calendar days after completion of TAB field work, submit TAB report.

TAB Field Check: 30 calendar days after Season 1 TAB report is approved by the Contracting Officer, conduct field check.

Complete TAB Work: Prior to CCD, complete all TAB work.

TAB Field Work: At a minimum of 90 calendar days prior to CCD, TAB field work; submit TAB report; and conduct field check.

Complete TAB Work: Prior to CCD, complete all TAB work.

1.6.3.1 Design Review Report

Submit typed report describing omissions and deficiencies in the HVAC system's design that would preclude the TAB team from accomplishing the duct leakage testing work and the TAB work requirements of this section. Provide a complete explanation including supporting documentation detailing the design deficiency. State that no deficiencies are evident if that is the case.

1.6.3.2 Pre-Field TAB Engineering Report

Submit report containing the following information:

- a. Step-by-step TAB procedure:
- (1) Strategy: Describe the method of approach to the TAB field work from start to finish. Include in this description a complete methodology for accomplishing each seasonal TAB field work session.
 - (2) Procedural steps: Delineate fully the intended procedural steps to be taken by the TAB field team to accomplish the required TAB work of each air distribution system and each water distribution system. Include intended procedural steps for TAB work for subsystems and system components.
- b. Pre-field data: Submit AABC or NEBB or SMACNA 1780 data report forms with the following pre-field information filled in:
- (1) Design data obtained from system drawings, specifications, and approved submittals.
 - (2) Notations detailing additional data to be obtained from the contract site by the TAB field team.
 - (3) Designate the actual data to be measured in the TAB field work.
 - (4) Provide a list of the types of instruments, and the measuring range of each, which are anticipated to be used for measuring in the TAB field work. By means of a keying scheme, specify on each TAB data report form submitted, which instruments will be used for measuring each item of TAB data. If the selection of which instrument to use, is to be made in the field, specify from which instruments the choice will be made. Place the instrument key number in the blank space where the measured data would be entered.
- c. Prerequisite HVAC work checkout list: Provide a list of inspections and work items which are to be completed by the Contractor. This list must be acted upon and completed by the Contractor and then submitted and approved by the Contracting Officer prior to the TAB team coming to the contract site.

At a minimum, a list of the applicable inspections and work items listed in the NEBB PROCEDURAL STANDARDS, Section III, "Preliminary TAB Procedures" under paragraphs titled, "Air Distribution System Inspection" and "Hydronic Distribution System Inspection" must be provided for each separate system to be TAB'd.

1.7 WARRANTY

Furnish workmanship and performance warranty for the TAB system work performed for a period not less than 2 years from the date of Government acceptance of the work; issued directly to the Government. Include provisions that if within the warranty period the system shows evidence of major performance deterioration, or is significantly out of tolerance, resulting from defective TAB or DALT workmanship, the corrective repair or replacement of the defective materials and correction of the defective workmanship is the responsibility of the TAB firm. Perform corrective action that becomes necessary because of defective materials and workmanship while system TAB is under warranty 7 days after notification, unless additional time is approved by the Contracting Officer. Failure to perform repairs within the specified period of time constitutes grounds for

having the corrective action and repairs performed by others and the cost billed to the TAB firm. The Contractor must also provide a 1 year contractor installation warranty.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 WORK DESCRIPTIONS OF PARTICIPANTS

Comply with requirements of this section as specified in Appendix A WORK DESCRIPTIONS OF PARTICIPANTS.

3.2 PRE-TAB MEETING

Meet with the Contracting Officer's technical representative (COTR) to develop a mutual understanding relative to the details of the TAB work requirements. Ensure that the TAB supervisor is present at this meeting. Requirements to be discussed include required submittals, work schedule, and field quality control.

3.3 DALT PROCEDURES

3.3.1 Instruments, Consumables and Personnel

Provide instruments, consumables and personnel required to accomplish the DALT field work. Follow the same basic procedure specified below for TAB Field Work, including maintenance and calibration of instruments, accuracy of measurements, preliminary procedures, field work, workmanship and treatment of deficiencies. Calibrate and maintain instruments in accordance with manufacturer's written procedures.

3.4 TAB PROCEDURES

3.4.1 TAB Field Work

Test, adjust, and balance the HVAC systems until measured flow rates (air and water flow) are within plus or minus 5 percent of the design flow rates as specified or indicated on the contract documents.

That is, comply with the the requirements of AABC MN-1 NEBB PROCEDURAL STANDARDS, NEBB MASV, or SMACNA 1780 (TABB) and SMACNA 1858 (TABB), except as supplemented and modified by this section.

Provide instruments and consumables required to accomplish the TAB work. Calibrate and maintain instruments in accordance with manufacturer's written procedures.

Test, adjust, and balance the HVAC systems until measured flow rates (air and water flow) are within plus or minus 5 percent of the design flow rates as specified or indicated on the contract documents. Conduct TAB work, including measurement accuracy, and sound measurement work in conformance with the AABC MN-1 and AABC MN-4, or NEBB TABES and NEBB MASV, or SMACNA 1780 (used by TABB) and SMACNA 1858 sound measurement procedures, except as supplemented and modified by this section.

3.4.2 Preliminary Procedures

Use the approved pre-field engineering report as instructions and procedures for accomplishing TAB field work. TAB engineer is to locate, in the field, test ports required for testing. It is the responsibility of the sheet metal contractor to provide and install test ports as required by the TAB engineer.

3.4.3 TAB Air Distribution Systems

3.4.4 TAB Water Distribution Systems

3.4.4.1 Chilled Water

Chilled water systems including chillers, pumps, coils, system balance valves and flow measuring devices.

For water chillers, report data as required by AABC, NEBB and TABB standard procedures, including refrigeration operational data.

3.4.5 TAB Work on Performance Tests Without Seasonal Limitations

3.4.5.1 Performance Tests

In addition to the TAB proportionate balancing work on the air distribution systems and the water distribution systems, accomplish TAB work on the HVAC systems which directly transfer thermal energy. TAB the operational performance of the cooling systems.

3.4.5.2 Ambient Temperatures

On each tab report form used for recording data, record the outdoor and indoor ambient dry bulb temperature range and the outdoor and indoor ambient wet bulb temperature range within which the report form's data was recorded. Record these temperatures at beginning and at the end of data taking.

3.4.5.3 Water Chillers

For water chillers, report data as required by NEBB Form TAB 15-83, NEBB PROCEDURAL STANDARDS, including refrigeration operational data.

3.4.5.4 Coils

Report heating and cooling performance capacity tests for chilled water for the purpose of verifying that the coils meet the indicated design capacity. Submit the following data and calculations with the coil test reports:

- a. For Central station air handlers with capacities greater than 7.5 tons (90,000 Btu) cooling, such as factory manufactured units, central built-up units and rooftop units, conduct capacity tests in accordance with AABC MN-4, procedure 3.5, "Coil Capacity Testing".

Entering and leaving wet and dry bulb temperatures are not determined by single point measurement, but the average of multiple readings in compliance with paragraph 3.5-5, "Procedures", (in subparagraph d.) of AABC MN-4, Procedure 3.5, "Coil Capacity Testing."

Submit part-load coil performance data from the coil manufacturer converting test conditions to design conditions; use the data for the purpose of verifying that the coils meet the indicated design capacity in compliance with AABC MN-4, Procedure 3.5, "Coil Capacity Testing," paragraph 3.5.7, "Actual Capacity Vs. Design Capacity" (in subparagraph c.).

3.4.6 Workmanship

Conduct TAB work on the HVAC systems until measured flow rates are within plus or minus 5 percent of the design flow rates as specified or indicated on the contract documents. This TAB work includes adjustment of balancing valves, balancing dampers, and sheaves. Further, this TAB work includes changing out fan sheaves and pump impellers if required to obtain air and water flow rates specified or indicated. If, with these adjustments and equipment changes, the specified or indicated design flow rates cannot be attained, contact the Contracting Officer for direction.

3.4.7 Deficiencies

Strive to meet the intent of this section to maximize the performance of the equipment as designed and installed. However, if deficiencies in equipment design or installation prevent TAB work from being accomplished within the range of design values specified in the paragraph entitled "Workmanship," provide written notice as soon as possible to the Contractor and the Contracting Officer describing the deficiency and recommended correction.

Responsibility for correction of installation deficiencies is the Contractor's. If a deficiency is in equipment design, call the TAB team supervisor for technical assistance. Responsibility for reporting design deficiencies to Contractor is the TAB team supervisor's.

3.4.8 TAB Reports

Additional requirements for TAB Reports are specified in Appendix B REPORTS - TAB

After completion of the TAB work, prepare a pre-final TAB report using the reporting forms approved in the pre-field engineering report. Data required by those approved data report forms is to be furnished by the TAB team. Except as approved otherwise in writing by the Contracting Officer, the TAB work and the TAB report is considered incomplete until the TAB work is accomplished to within the accuracy range specified in the paragraph entitled "Workmanship" of this section

Prepare the report neatly and legibly; the pre-final TAB report is the final TAB report minus the TAB supervisor's review and certification. Obtain, at the contract site, the TAB supervisor's review and certification of the TAB report.

Verbally notify the COTR that the field check of the TAB report data can commence; give this verbal notice 48 hours in advance of field check commencement. Do not schedule field check of the TAB report until the specified workmanship requirements have been met or written approval of the deviations from the requirements have been received from the Contracting Officer.

3.4.9 Quality Assurance - COTR TAB Field Acceptance Testing

3.4.9.1 TAB Field Acceptance Testing

During the field acceptance testing, verify, in the presence of the COTR, random selections of data (water, air quantities, air motion, recorded in the TAB Report. Points and areas for field acceptance testing are to be selected by the COTR. Measurement and test procedures are the same as approved for TAB work for the TAB Report.

Field acceptance testing includes verification of TAB Report data recorded for the following equipment groups:

Group 1: Chiller

Group 2: Pumps

Further, if any data on the TAB Report for Groups 2 through 5 is found not to fall within the range of plus 5 to minus 5 percent of the TAB Report data, additional group data verification is required in the presence of the COTR. Verify TAB Report data for one additional piece of equipment in that group. Continue this additional group data verification until out-of-tolerance data ceases to be found.

3.4.9.2 Additional COTR TAB Field Acceptance Testing

If any of the acceptance testing measurements for a given equipment group is found not to fall within the range of plus 5 to minus 5 percent of the TAB Report data, terminate data verification for all affected data for that group. The affected data for the given group will be disapproved. Make the necessary corrections and prepare a revised TAB Report. Reschedule acceptance testing of the revised report data with the COTR.

Further, if any data on the TAB Report for a given field acceptance test group is out-of-tolerance, then field test data for one additional field test group as specified herein. Continue this increase field test work until out-of-tolerance data ceases to be found. This additional field testing is up and above the original 25 percent of the of reported data entries to be field tested.

If there are no more similar field test groups from which to choose, additional field testing from another, but different, type of field testing group must be tested.

3.4.9.3 Prerequisite for Approval

Compliance with the field acceptance testing requirements of this section is a prerequisite for the final Contracting Officer approval of the TAB Report submitted.

3.5 MARKING OF SETTINGS

Upon the final TAB work approval, permanently mark the settings of HVAC adjustment devices including valves, gauges, splitters, and dampers so that adjustment can be restored if disturbed at any time. Provide permanent markings clearly indicating the settings on the adjustment devices which result in the data reported on the submitted TAB report.

3.6 MARKING OF TEST PORTS

The TAB team is to permanently and legibly mark and identify the location points of the duct test ports. If the ducts have exterior insulation, make these markings on the exterior side of the duct insulation. Show the location of test ports on the as-built mechanical drawings with dimensions given where the test port is covered by exterior insulation.

3.7 APPENDICES

Appendix A WORK DESCRIPTIONS OF PARTICIPANTS

Appendix B REPORTS - TAB

Appendix A

WORK DESCRIPTIONS OF PARTICIPANTS

The Contractor is responsible for ensuring compliance with all requirements of this specification section. However, the following delineation of specific work items is provided to facilitate and co-ordinate execution of the various work efforts by personnel from separate organizations.

1. Contractor

- a. HVAC documentation: Provide pertinent contract documentation to the TAB Firm, to include the following: the contract drawings and specifications; copies of the approved submittal data for all HVAC equipment, air distribution devices, and air/water measuring/balancing devices; the construction work schedule; and other applicable documents requested by the TAB Firm. Provide the TAB Firm copies of contract revisions and modifications as they occur.
- b. Schedules: Ensure the requirements specified under the paragraph "TAB Schedule" are met.
- c. Pre-TAB meeting: Arrange and conduct the Pre-DALT and TAB meeting. Ensure that a representative is present for the sheet metal contractor, the mechanical contractor, the electrical contractor, and the automatic temperature controls contractor.
- d. Coordinate Support: Provide and coordinate support personnel required by the TAB Firm in order to accomplish the TAB field work. Support personnel may include factory representatives, HVAC controls installers, HVAC equipment mechanics, sheet metal workers, pipe fitters, and insulators. Ensure support personnel are present at the work site at the times required.
- e. Correct Deficiencies: Ensure the notifications of Construction Deficiencies are provided as specified herein. Refer to the paragraph entitled "Construction Deficiencies." Correct each deficiency as soon as practical with the Contracting Officer, and submit revised schedules and other required documentation.
- f. Pre-TAB Work Checklists: Complete check out and debugging of HVAC equipment, ducts, and controls prior to the TAB engineer arriving at the project site to begin the TAB work. Debugging includes searching for and eliminating malfunctioning elements in the HVAC system installations, and verifying all adjustable devices are functioning as designed. Include as pre-TAB work checklist items, the deficiencies pointed out by the TAB team supervisor in the design review report.

Prior to the TAB field team's arrival, ensure completion of the applicable inspections and work items listed in the TAB team supervisor's TAB Work Procedures Summary. Do not allow the TAB team to commence TAB field work until all of the following are completed.

- g. Give Notice of Testing: Submit advance notice of TAB field work accompanied by completed prerequisite HVAC Work List

2. TAB Team Supervisor

- a. Overall management: Supervise and manage the overall TAB team work effort, including preliminary and technical TAB procedures and TAB team field work.
- b. Schedule: Ensure the requirements specified under the paragraph "TAB Schedule" are met.
- c. Submittals: Provide the submittals specified herein.
- d. Pre-TAB meeting: Attend meeting with Contractor. Ensure TAB personnel that will be involved in the TAB work under this contract attend the meeting.
- e. Design Review Report: Submit typed report describing omissions and deficiencies in the HVAC system's design that would preclude the TAB team from accomplishing the duct leakage testing work and the TAB work requirements of this section. Provide a complete explanation including supporting documentation detailing the design deficiency. State that no deficiencies are evident if that is the case.
- f. Support required: Specify the technical support personnel required from the Contractor other than the TAB agency; such as factory representatives for temperature controls or for complex equipment. Inform the Contractor in writing of the support personnel needed and when they are needed. Furnish the notice as soon as the need is anticipated, either with the design review report, or the DALT and TAB Procedures Summary, the during the TAB field work.

Ensure the Contractor is properly notified and aware of all support personnel needed to perform the TAB work. Maintain communication with the Contractor regarding support personnel throughout the duration of the TAB field work, including the TAB field acceptance testing checking.

Ensure all inspections and verifications for the Pre-Final DALT and Pre-TAB Checklists are completely and successfully conducted before DALT and TAB field work is performed.

- g. Advance Notice: Monitor the completion of the duct system installations and provide the Advance Notice for Pre-Final DALT field work as specified herein.
 - h. Technical Assistance: Provide technical assistance to the DALT and TAB field work.
 - i. Deficiencies Notification: Ensure the notifications of Construction Deficiencies are provided as specified herein. Comply with requirements of the paragraph entitled "Construction Deficiencies." Resolve each deficiency as soon as practical and submit revised schedules and other required documentation.
 - j. Procedures: Develop the required TAB procedures for systems or system components not covered in the TAB Standard.
3. TAB Team Field Leader
 - a. Field manager: Manage, in the field, the accomplishment of the work specified in Part 3, "Execution."
 - b. Full time: Be present at the contract site when DALT field work or TAB

field work is being performed by the TAB team; ensure day-to-day TAB team work accomplishments are in compliance with this section.

- c. Prerequisite HVAC work: Do not bring the TAB team to the contract site until a copy of the prerequisite HVAC work list, with all work items certified by the Contractor to be working as designed, reaches the office of the TAB Agency.

Appendix B

REPORTS - TAB

All submitted documentation must be typed, neat, and organized. All reports must have a waterproof front and back cover, a title page, a certification page, sequentially numbered pages throughout, and a table of contents. Tables, lists, and diagrams must be titled. Generate and submit for approval the following documentation:

1. TAB Work Execution Schedule

Submit a detailed schedule indicating the anticipated calendar date for each submittal and each portion of work required under this section. For each work entry, indicate the support personnel (such as controls provider, HVAC mechanic, etc.) that are needed to accomplish the work. Arrange schedule entries chronologically.

2. TAB Procedures Summary

Submit a detailed narrative describing all aspects of the TAB field work to be performed. Include the following:

- a. A list of the intended procedural steps for the DALT and TAB field work from start to finish. Indicate how each type of data measurement will be obtained. Include what Contractor support personnel are required for each step, and the tasks they need to perform.
- b. A list of the project's submittals that are needed by the TAB Firm in order to meet this Contract's requirements.
- c. The schematic drawings to be used in the required reports, which may include building floor plans, mechanical room plans, duct system plans, and equipment elevations. Indicate intended TAB measurement locations, including where test ports need to be provided by the Contractor.
- d. The data presentation forms to be used in the report, with the preliminary information and initial design values filled in.
- e. A list of TAB instruments to be used, edited for this project, to include the instrument name and description, manufacturer, model number, scale range, published accuracy, most recent calibration date, and what the instrument will be used for on this project.
- f. A thorough checklist of the work items and inspections that need to be accomplished before the TAB field work can be performed. The Contractor must complete, submit, and receive approval of the Completed Pre-TAB Work Checklist before the TAB field work can be accomplished.
- h. The checklists specified above shall be individually developed and tailored specifically for the work under this contract. Refer to NEBB PROCEDURAL STANDARDS, Section III, "Preliminary TAB Procedures" under the paragraphs titled, "Air Distribution System Inspection" and "Hydronic Distribution System Inspection" for examples of items to include in the checklists.

3. Design Review Report

Submit report containing the following information:

- a. Review the contract specifications and drawings to verify that the TAB work can be successfully accomplished in compliance with the requirements of this section. Verify the presence and location of permanently installed test ports and other devices needed, including gauge cocks, thermometer wells, flow control devices, circuit setters, balancing valves, and manual volume dampers.
 - b. Submit a typed report describing omissions and deficiencies in the HVAC system's design that would preclude the TAB team from accomplishing the DALT work and the TAB work requirements of this section. Provide a complete explanation including supporting documentation detailing the design deficiency. If no deficiencies are evident, state so in the report.
4. TAB Reports: Submit in the following manner:
- a. Procedure Summary: Submit a copy of the approved DALT and TAB Procedures Summary. When applicable, provide notations describing how actual field procedures differed from the procedures listed.
 - b. Report format: Submit the completed data forms approved in the pre-field TAB Engineering Report completed by TAB field team, reviewed, approved and signed by the TAB supervisor. Bind the report with a waterproof front and back cover. Include a table of contents identifying by page number the location of each report. Report forms and report data shall be typewritten. Handwritten report forms or report data are not acceptable.
 - c. Temperatures: On each TAB report form reporting TAB work accomplished on HVAC thermal energy transfer equipment, include the indoor and outdoor dry bulb temperature range and indoor and outdoor wet bulb temperature range within which the TAB data was recorded. Include in the TAB report continuous time versus temperature recording data of wet and dry bulb temperatures for the rooms, or zones, as designated in the following list:
 - (1) Data shall be measured and compiled on a continuous basis for the period in which TAB work affecting those rooms is being done.
 - (2) Data shall be measured/recorded only after the HVAC systems installations are complete, the systems fully balanced and the HVAC systems controls operating in fully automatic mode. Provide a detailed explanation wherever a final measurement did not achieve the required value.
 - (3) Data may be compiled using direct digital controls trend logging where available. Otherwise, the Contractor shall temporarily install calibrated time versus temperature/humidity recorders for this purpose. The HVAC systems and controls shall have been fully operational a minimum of 24 hours in advance of commencing data compilation. The specified data shall be included in the TAB Report.
 - d. Instruments: List the types of instruments actually used to measure the tab data. Include in the listing each instrument's unique identification number, calibration date, and calibration expiration date.

Instrumentation, used for taking wet bulb temperature readings shall provide accuracy of plus or minus 5 percent at the measured face velocities. Submit instrument manufacturer's literature to document instrument accuracy performance is in compliance with that specified.

- e. Performance Curves: The TAB Supervisor shall include, in the TAB Reports, factory pump curves and fan curves for pumps and fans TAB'd on the job.
- f. Calibration Curves: The TAB Supervisor shall include, in the TAB Reports, a factory calibration curve for installed flow control balancing valves, flow venturis and flow orifices TAB'd on the job.
- g. Data From Tab Field Work: After completion of the TAB field work, prepare the TAB field data for TAB supervisor's review and approval signature, using the reporting forms approved in the pre-field engineering report. Data required by those approved data report forms shall be furnished by the TAB team. Except as approved otherwise in writing by the Contracting Officer, the TAB work and thereby the TAB report shall be considered incomplete until the TAB work is accomplished to within the accuracy range specified in the paragraph entitled "Workmanship."

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 23 - HEATING, VENTILATING, AND AIR CONDITIONING

SECTION 23 07 00

THERMAL INSULATION FOR MECHANICAL SYSTEMS

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 SYSTEM DESCRIPTION
 - 1.2.1 General
 - 1.2.2 Surface Burning Characteristics
 - 1.2.3 Recycled Materials
- 1.3 SUBMITTALS
- 1.4 QUALITY ASSURANCE
- 1.5 DELIVERY, STORAGE, AND HANDLING

PART 2 PRODUCTS

- 2.1 STANDARD PRODUCTS
- 2.2 MATERIALS
 - 2.2.1 Adhesives
 - 2.2.1.1 Acoustical Lining Insulation Adhesive
 - 2.2.1.2 Mineral Fiber Insulation Cement
 - 2.2.1.3 Lagging Adhesive
 - 2.2.2 Contact Adhesive
 - 2.2.3 Caulking
 - 2.2.4 Corner Angles
 - 2.2.5 Finishing Cement
 - 2.2.6 Fibrous Glass Cloth and Glass Tape
 - 2.2.7 Staples
 - 2.2.8 Jackets
 - 2.2.8.1 Aluminum Jackets
 - 2.2.8.2 Polyvinyl Chloride (PVC) Jackets
 - 2.2.8.3 Vapor Barrier/Weatherproofing Jacket
 - 2.2.9 Vapor Retarder Required
 - 2.2.9.1 White Vapor Retarder All Service Jacket (ASJ)
 - 2.2.9.2 Vapor Retarder/Vapor Barrier Mastic Coatings
 - 2.2.9.3 Laminated Film Vapor Retarder
 - 2.2.9.4 Polyvinylidene Chloride (PVDC) Film Vapor Retarder
 - 2.2.9.5 Polyvinylidene Chloride Vapor Retarder Adhesive Tape
 - 2.2.9.6 Vapor Barrier
 - 2.2.10 Vapor Retarder Not Required
 - 2.2.11 Wire
 - 2.2.12 Insulation Bands
 - 2.2.13 Sealants
- 2.3 PIPE INSULATION SYSTEMS
 - 2.3.1 Aboveground Cold Pipeline (-30 to 60 deg. F)
- 2.4 DUCT INSULATION SYSTEMS
 - 2.4.1 Duct Insulation
 - 2.4.1.1 Rigid Insulation
 - 2.4.1.2 Blanket Insulation

2.5 EQUIPMENT INSULATION SYSTEMS

PART 3 EXECUTION

- 3.1 APPLICATION - GENERAL
 - 3.1.1 Installation
 - 3.1.2 Firestopping
 - 3.1.3 Installation of Flexible Elastomeric Cellular Insulation
 - 3.1.4 Welding
 - 3.1.5 Pipes/Ducts/Equipment which Require Insulation
- 3.2 PIPE INSULATION SYSTEMS INSTALLATION
 - 3.2.1 Pipe Insulation
 - 3.2.1.1 General
 - 3.2.1.2 Pipes Passing Through Walls, Roofs, and Floors
 - 3.2.1.3 Pipes Passing Through Hangers
 - 3.2.1.4 Flexible Elastomeric Cellular Pipe Insulation
 - 3.2.1.5 Pipes in high abuse areas.
 - 3.2.1.6 Pipe Insulation Material and Thickness
 - 3.2.2 Aboveground Cold Pipelines
 - 3.2.2.1 Insulation Material and Thickness
 - 3.2.2.2 Factory or Field applied Jacket
 - 3.2.2.3 Installing Insulation for Straight Runs Hot and Cold Pipe
 - 3.2.2.4 Insulation for Fittings and Accessories
 - 3.2.2.5 Optional PVC Fitting Covers
 - 3.2.3 Aboveground Hot Pipelines
 - 3.2.4 Piping Exposed to Weather
 - 3.2.4.1 Stainless Steel Jacket
 - 3.2.4.2 Insulation for Fittings
- 3.3 DUCT INSULATION SYSTEMS INSTALLATION
 - 3.3.1 Duct Insulation Thickness
 - 3.3.2 Insulation and Vapor Retarder/Vapor Barrier for Cold Air Duct
 - 3.3.2.1 Installation on Concealed Duct
 - 3.3.2.2 Installation on Exposed Duct Work
 - 3.3.3 Insulation for Warm Air Duct
 - 3.3.3.1 Installation on Concealed Duct
 - 3.3.3.2 Installation on Exposed Duct
 - 3.3.4 Ducts Handling Air for Dual Purpose
 - 3.3.5 Insulation for Evaporative Cooling Duct
 - 3.3.6 Duct Test Holes
 - 3.3.7 Duct Exposed to Weather
 - 3.3.7.1 Installation
 - 3.3.7.2 Round Duct
 - 3.3.7.3 Fittings
 - 3.3.7.4 Rectangular Ducts
- 3.4 EQUIPMENT INSULATION SYSTEMS INSTALLATION
 - 3.4.1 General
 - 3.4.2 Insulation for Cold Equipment
 - 3.4.2.1 Insulation Type
 - 3.4.2.2 Pump Insulation
 - 3.4.2.3 Other Equipment
 - 3.4.2.4 Vapor Retarder/Vapor Barrier
 - 3.4.3 Other Equipment
 - 3.4.4 Equipment Handling Dual Temperature Media
 - 3.4.5 Equipment Exposed to Weather
 - 3.4.5.1 Installation
 - 3.4.5.2 Optional Panels

-- End of Section Table of Contents --

SECTION 23 07 00

THERMAL INSULATION FOR MECHANICAL SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

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. At the discretion of the Government, the manufacturer of any material supplied will be required to furnish test reports pertaining to any of the tests necessary to assure compliance with the standard or standards referenced in this specification.

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING
ENGINEERS (ASHRAE)

ASHRAE 90.1 - IP (2007; Supplement 2008; Errata 2009;
Errata 2009) Energy Standard for Buildings
Except Low-Rise Residential Buildings, I-P
Edition

ASTM INTERNATIONAL (ASTM)

ASTM A 167 (1999; R 2009) Standard Specification for
Stainless and Heat-Resisting
Chromium-Nickel Steel Plate, Sheet, and
Strip

ASTM A 580/A 580M (2008) Standard Specification for
Stainless Steel Wire

ASTM B 209 (2007) Standard Specification for Aluminum
and Aluminum-Alloy Sheet and Plate

ASTM C 1126 (2004) Standard Specification for Faced or
Unfaced Rigid Cellular Phenolic Thermal
Insulation

ASTM C 1136 (2010) Standard Specification for
Flexible, Low Permeance Vapor Retarders
for Thermal Insulation

ASTM C 1290 (2006e1) Standard Specification for
Flexible Fibrous Glass Blanket Insulation
Used to Externally Insulate HVAC Ducts

ASTM C 1427 (2007) Specification for Preformed
Flexible Cellular Polyolefin Thermal
Insulation in Sheet and Tubular Form

ASTM C 195 (2000) Standard Specification for Mineral
Fiber Thermal Insulating Cement

ASTM C 449	(2007) Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement
ASTM C 534/C 534M	(2008) Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form
ASTM C 547	(2008e1) Standard Specification for Mineral Fiber Pipe Insulation
ASTM C 552	(2007) Standard Specification for Cellular Glass Thermal Insulation
ASTM C 553	(2008) Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
ASTM C 591	(2009) Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
ASTM C 612	(2009) Mineral Fiber Block and Board Thermal Insulation
ASTM C 647	(2008) Properties and Tests of Mastics and Coating Finishes for Thermal Insulation
ASTM C 665	(2006) Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
ASTM C 795	(2008) Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel
ASTM C 916	(1985; R 2007) Standard Specification for Adhesives for Duct Thermal Insulation
ASTM C 920	(2008) Standard Specification for Elastomeric Joint Sealants
ASTM C 921	(2009) Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation
ASTM D 774/D 774M	(1997; R 2007) Bursting Strength of Paper
ASTM D 882	(2009) Tensile Properties of Thin Plastic Sheeting
ASTM E 2231	(2007a) Specimen Preparation and Mounting of Pipe and Duct Insulation Materials to Assess Surface Burning Characteristics
ASTM E 84	(2010) Standard Test Method for Surface Burning Characteristics of Building Materials

ASTM E 96/E 96M (2005) Standard Test Methods for Water Vapor Transmission of Materials

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-69 (2003; R 2004) Standard for Pipe Hangers and Supports - Selection and Application

MIDWEST INSULATION CONTRACTORS ASSOCIATION (MICA)

MICA Insulation Stds (1999) National Commercial & Industrial Insulation Standards

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 255 (2005; Errata 2006) Standard Method of Test of Surface Burning Characteristics of Building Materials

NFPA 90A (2009; Errata 09-1) Standard for the Installation of Air Conditioning and Ventilating Systems

NFPA 90B (2009) Standard for the Installation of Warm Air Heating and Air Conditioning Systems

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-A-3316 (Rev C; Am 2) Adhesives, Fire-Resistant, Thermal Insulation

UNDERWRITERS LABORATORIES (UL)

UL 723 (2008) Standard for Test for Surface Burning Characteristics of Building Materials

1.2 SYSTEM DESCRIPTION

1.2.1 General

Provide field-applied insulation and accessories on mechanical systems as specified herein; factory-applied insulation is specified under the piping, duct or equipment to be insulated.

1.2.2 Surface Burning Characteristics

Unless otherwise specified, insulation shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E 84. Flame spread, and smoke developed indexes, shall be determined by ASTM E 84, NFPA 255 or UL 723. Insulation shall be tested in the same density and installed thickness as the material to be used in the actual construction. Test specimens shall be prepared and mounted according to ASTM E 2231. Insulation materials located exterior to the building perimeter are not required to be fire rated.

1.2.3 Recycled Materials

Provide thermal insulation containing recycled materials to the extent practicable, provided that the materials meets all other requirements of this section. The minimum recycled material content of the following insulation are:

Rock Wool - 75 percent slag of weight
Fiberglass - 20-25 percent glass cullet by weight
Rigid Foam - 9 percent recovered material

1.3 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

Submit the three SD types, SD-02 Shop Drawings, SD-03 Product Data, and SD-08 Manufacturer's Instructions at the same time for each system.

SD-02 Shop Drawings

MICA Plates
Pipe Insulation Systems and Associated Accessories
Duct Insulation Systems and Associated Accessories
Equipment Insulation Systems and Associated Accessories

A booklet containing completed MICA Insulation Stds plates detailing each insulating system for each pipe, duct, or equipment insulating system, after approval of materials and prior to applying insulation.

- a. The MICA plates shall detail the materials to be installed and the specific insulation application. Submit all MICA plates required showing the entire insulating system, including plates required to show insulation penetrations, vessel bottom and top heads, legs, and skirt insulation as applicable. The MICA plates shall present all variations of insulation systems including locations, materials, vaporproofing, jackets and insulation accessories.
- b. If the Contractor elects to submit detailed drawings instead of edited MICA Plates, the detail drawings shall be technically equivalent to the edited MICA Plate submittal.

SD-03 Product Data

Pipe Insulation Systems
Duct Insulation Systems
Equipment Insulation Systems

A complete list of materials, including manufacturer's descriptive technical literature, performance data, catalog cuts, and installation instructions. The product number, k-value, thickness and furnished accessories including adhesives, sealants and jackets for each mechanical system requiring insulation shall be included. The product data must be copywrited, have an identifying or publication number, and shall have been published prior to the issuance date of this solicitation. Materials furnished under this section of the specification shall be

submitted together in a booklet and in conjunction with the MICA plates booklet (SD-02). Annotate the product data to indicate which MICA plate is applicable.

SD-04 Samples

Thermal Insulation

After approval of materials, actual sections of installed systems, properly insulated in accordance with the specification requirements, shall be displayed. Such actual sections must remain accessible to inspection throughout the job and will be reviewed from time to time for controlling the quality of the work throughout the construction site. Each material used shall be identified, by indicating on an attached sheet the specification requirement for the material and the material by each manufacturer intended to meet the requirement. The Contracting Officer will inspect display sample sections at the jobsite. Approved display sample sections shall remain on display at the jobsite during the construction period. Upon completion of construction, the display sample sections will be closed and sealed.

Pipe Insulation Display Sections: Display sample sections shall include as a minimum an elbow or tee, a valve, dielectric waterways and flanges, a hanger with protection shield and insulation insert, or dowel as required, at support point, method of fastening and sealing insulation at longitudinal lap, circumferential lap, butt joints at fittings and on pipe runs, and terminating points for each type of pipe insulation used on the job, and for hot pipelines and cold pipelines, both interior and exterior, even when the same type of insulation is used for these services.

Duct Insulation Display Sections: Display sample sections for rigid and flexible duct insulation used on the job. A temporary covering shall be used to enclose and protect display sections for duct insulation exposed to weather.

SD-08 Manufacturer's Instructions

Pipe Insulation Systems
Duct Insulation Systems
Equipment Insulation Systems

Submit a booklet containing manufacturer's published installation instructions for the insulation systems in coordination with the submitted MICA Insulation Stds plates booklet. Annotate their installation instructions to indicate which product data and which MICA plate are applicable. The instructions must be copywrited, have an identifying or publication number, and shall have been published prior to the issuance date of this solicitation.

1.4 QUALITY ASSURANCE

Qualified installers shall have successfully completed three or more similar type jobs within the last 5 years.

1.5 DELIVERY, STORAGE, AND HANDLING

Materials shall be delivered in the manufacturer's unopened containers. Materials delivered and placed in storage shall be provided with protection from weather, humidity, dirt, dust and other contaminants. The Contracting Officer may reject insulation material and supplies that become dirty, dusty, wet, or contaminated by some other means. Packages or standard containers of insulation, jacket material, cements, adhesives, and coatings delivered for use, and samples required for approval shall have manufacturer's stamp or label attached giving the name of the manufacturer and brand, and a description of the material. Insulation packages and containers shall be asbestos free.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Provide materials which are the standard products of manufacturers regularly engaged in the manufacture of such products and that essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Provide insulation systems in accordance with the approved MICA National Insulation Standards plates as supplemented by this specification. Provide field-applied insulation for heating, ventilating, and cooling (HVAC) air distribution systems and piping systems which are located within, on, under, and adjacent to buildings; and for plumbing systems.

2.2 MATERIALS

Provide insulation that meets or exceed the requirements of ASHRAE 90.1 - IP. Insulation exterior shall be cleanable, grease resistant, non-flaking and non-peeling. Materials shall be compatible and shall not contribute to corrosion, soften, or otherwise attack surfaces to which applied in either wet or dry state. Materials to be used on stainless steel surfaces shall meet ASTM C 795 requirements. Materials shall be asbestos free and conform to the following:

2.2.1 Adhesives

2.2.1.1 Acoustical Lining Insulation Adhesive

Adhesive shall be a nonflammable, fire-resistant adhesive conforming to ASTM C 916, Type I.

2.2.1.2 Mineral Fiber Insulation Cement

Cement shall be in accordance with ASTM C 195.

2.2.1.3 Lagging Adhesive

Lagging is the material used for thermal insulation, especially around a cylindrical object. This may include the insulation as well as the cloth/material covering the insulation. Lagging adhesives shall be nonflammable and fire-resistant and shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E 84. Adhesive shall be MIL-A-3316, Class 1, pigmented white and be suitable for bonding fibrous glass cloth to faced and unfaced fibrous glass insulation board; for bonding cotton brattice cloth to faced and unfaced fibrous glass insulation board; for sealing edges of and bonding

glass tape to joints of fibrous glass board; for bonding lagging cloth to thermal insulation; or Class 2 for attaching fibrous glass insulation to metal surfaces. Lagging adhesives shall be applied in strict accordance with the manufacturer's recommendations for pipe and duct insulation.

2.2.2 Contact Adhesive

Adhesives may be any of, but not limited to, the neoprene based, rubber based, or elastomeric type that have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E 84. The adhesive shall not adversely affect, initially or in service, the insulation to which it is applied, nor shall it cause any corrosive effect on metal to which it is applied. Any solvent dispersing medium or volatile component of the adhesive shall have no objectionable odor and shall not contain any benzene or carbon tetrachloride. The dried adhesive shall not emit nauseous, irritating, or toxic volatile matters or aerosols when the adhesive is heated to any temperature up to 212 degrees F. The dried adhesive shall be nonflammable and fire resistant. Natural cross-ventilation, local (mechanical) pickup, and/or general area (mechanical) ventilation shall be used to prevent an accumulation of solvent vapors, keeping in mind the ventilation pattern must remove any heavier-than-air solvent vapors from lower levels of the workspaces. Gloves and spectacle-type safety glasses are recommended in accordance with safe installation practices.

2.2.3 Caulking

ASTM C 920, Type S, Grade NS, Class 25, Use A.

2.2.4 Corner Angles

Nominal 0.016 inch aluminum 1 by 1 inch with factory applied kraft backing. Aluminum shall be ASTM B 209, Alloy 3003, 3105, or 5005.

2.2.5 Finishing Cement

ASTM C 449: Mineral fiber hydraulic-setting thermal insulating and finishing cement. All cements that may come in contact with Austenitic stainless steel must comply with ASTM C 795.

2.2.6 Fibrous Glass Cloth and Glass Tape

Fibrous glass cloth, with 20X20 maximum mesh size, and glass tape shall have maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E 84. Tape shall be 4 inch wide rolls. Class 3 tape shall be 4.5 ounces/square yard.

2.2.7 Staples

Outward clinching type ASTM A 167, Type 304 or 316 stainless steel.

2.2.8 Jackets

2.2.8.1 Aluminum Jackets

Aluminum jackets shall be corrugated, embossed or smooth sheet, 0.016 inch nominal thickness; ASTM B 209, Temper H14, Temper H16, Alloy 3003, 5005, or 3105. Corrugated aluminum jacket shall not be used outdoors. Aluminum jacket securing bands shall be Type 304 stainless steel, 0.015 inch thick,

1/2 inch wide for pipe under 12 inch diameter and 3/4 inch wide for pipe over 12 inch and larger diameter. Aluminum jacket circumferential seam bands shall be 2 by 0.016 inch aluminum matching jacket material. Bands for insulation below ground shall be 3/4 by 0.020 inch thick stainless steel, or fiberglass reinforced tape. The jacket may, at the option of the Contractor, be provided with a factory fabricated Pittsburgh or "Z" type longitudinal joint. When the "Z" joint is used, the bands at the circumferential joints shall be designed by the manufacturer to seal the joints and hold the jacket in place.

2.2.8.2 Polyvinyl Chloride (PVC) Jackets

Polyvinyl chloride (PVC) jacket and fitting covers shall have high impact strength, UV resistant rating or treatment and moderate chemical resistance with minimum thickness 0.030 inch.

2.2.8.3 Vapor Barrier/Weatherproofing Jacket

Vapor barrier/weatherproofing jacket shall be laminated self-adhesive, greater than 3 plys standard grade, silver, white, black and embossed or greater than 8 ply (minimum 2.9 mils adhesive); with 0.0000 permeability when tested in accordance with ASTM E 96/E 96M; heavy duty, white or natural; and UV resistant.

2.2.9 Vapor Retarder Required

ASTM C 921, Type I, minimum puncture resistance 50 Beach units on all surfaces except concealed ductwork, where a minimum puncture resistance of 25 Beach units is acceptable. Minimum tensile strength, 35 pounds/inch width. ASTM C 921, Type II, minimum puncture resistance 25 Beach units, tensile strength minimum 20 pounds/inch width. Jackets used on insulation exposed in finished areas shall have white finish suitable for painting without sizing. Based on the application, insulation materials that require factory applied jackets are mineral fiber, cellular glass, polyisocyanurate, and phenolic foam. Insulation materials that do not require jacketing are flexible elastomerics. All non-metallic jackets shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E 84.

2.2.9.1 White Vapor Retarder All Service Jacket (ASJ)

Standard reinforced fire retardant jacket for use on hot/cold pipes, ducts, or equipment. Vapor retarder jackets used on insulation exposed in finished areas shall have white finish suitable for painting without sizing.

2.2.9.2 Vapor Retarder/Vapor Barrier Mastic Coatings

- a. The vapor barrier shall be self adhesive (minimum 2 mils adhesive, 3 mils embossed) greater than 3 plys standard grade, silver, white, black and embossed white jacket for use on hot/cold pipes. Less than 0.02 permeability when tested in accordance with ASTM E 96/E 96M. Meeting UL 723 or ASTM E 84 flame and smoke requirements; UV resistant.
- b. The vapor retarder coating shall be fire and water resistant and appropriately selected for either outdoor or indoor service. Color shall be white. The water vapor permeance of the compound shall be determined according to procedure B of ASTM E 96/E 96M utilizing apparatus described in ASTM E 96/E 96M. The coating shall be a nonflammable, fire resistant type. All other application and service

properties shall be in accordance with ASTM C 647.

2.2.9.3 Laminated Film Vapor Retarder

ASTM C 1136, Type I, maximum moisture vapor transmission 0.02 perms, minimum puncture resistance 50 Beach units on all surfaces except concealed ductwork, where Type II, maximum moisture vapor transmission 0.02 perms, a minimum puncture resistance of 25 Beach units is acceptable. Vapor retarder shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E 84.

2.2.9.4 Polyvinylidene Chloride (PVDC) Film Vapor Retarder

The PVDC film vapor retarder shall have a maximum moisture vapor transmission of 0.02 perms, minimum puncture resistance of 150 Beach units, a minimum tensile strength in any direction of 30 lb/inch when tested in accordance with ASTM D 882, and a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E 84.

2.2.9.5 Polyvinylidene Chloride Vapor Retarder Adhesive Tape

Requirements must meet the same as specified for Laminated Film Vapor Retarder above.

2.2.9.6 Vapor Barrier

The vapor barrier shall be greater than 3 ply self adhesive laminate -white vapor barrier jacket- superior performance (less than 0.0000 permeability when tested in accordance with ASTM E 96/E 96M). Vapor barrier shall meet UL 723 or ASTM E 84 25 flame and 50 smoke requirements; and UV resistant. Minimum burst strength 185 psi in accordance with ASTM D 774/D 774M. Tensile strength 68 lb/inch width (PSTC-1000). Tape shall be as specified for laminated film vapor barrier above.

2.2.10 Vapor Retarder Not Required

ASTM C 921, Type II, Class D, minimum puncture resistance 50 Beach units on all surfaces except ductwork, where Type IV, maximum moisture vapor transmission 0.10, a minimum puncture resistance of 25 Beach units is acceptable. Jacket shall have a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E 84.

2.2.11 Wire

Soft annealed ASTM A 580/A 580M Type 304 or 316 stainless steel, 16 or 18 gauge.

2.2.12 Insulation Bands

Insulation bands shall be 1/2 inch wide; 26 gauge stainless steel.

2.2.13 Sealants

Sealants shall be chosen from the butyl polymer type, the styrene-butadiene rubber type, or the butyl type of sealants. Sealants shall have a maximum moisture vapor transmission of 0.02 perms, and a maximum flame spread index of 25 and a maximum smoke developed index of 50 when tested in accordance with ASTM E 84.

2.3 PIPE INSULATION SYSTEMS

Insulation materials shall conform to Table 1. Insulation thickness shall be as listed in Table 2 and meet or exceed the requirements of ASHRAE 90.1 - IP. Insulation thickness shall be a minimum of 1-1/2 inch. Pipe insulation materials shall be limited to those listed herein and shall meet the following requirements:

2.3.1 Aboveground Cold Pipeline (-30 to 60 deg. F)

Insulation for outdoor, indoor, exposed or concealed applications, shall be as follows:

- a. Cellular Glass: ASTM C 552, Type II, and Type III. Supply the insulation with manufacturer's recommended factory-applied jacket/vapor barrier.
- b. Flexible Elastomeric Cellular Insulation: ASTM C 534/C 534M, Grade 1, Type I or II. Type II shall have vapor retarder/vapor barrier skin on one or both sides of the insulation. Insulation with pre-applied adhesive shall not be used.
- c. Phenolic Insulation: ASTM C 1126, Type III. Phenolic insulations shall comply with ASTM C 795 and with the ASTM C 665 paragraph Corrosiveness. Supply the insulation with manufacturer's recommended factory-applied jacket/vapor barrier.
- d. Polyisocyanurate Insulation: ASTM C 591, type I. Supply the insulation with manufacturer's recommended factory-applied vapor retarder/vapor barrier. Insulation with pre-applied adhesive shall not be used.
- e. Flexible Polyolefin Cellular Insulation: ASTM C 1427, Grade 1 Type I or II.
- f. Mineral Fiber Insulation with Integral Wicking Material (MFIWM): ASTM C 547. Install in accordance with manufacturer's instructions.

2.4 DUCT INSULATION SYSTEMS

2.4.1 Duct Insulation

Provide factory-applied elastomeric insulation. Provide factory applied elastomeric closed cell or phenolic foam insulation according to manufacturer's recommendations for insulation with insulation manufacturer's standard reinforced fire-retardant vapor barrier, with identification of installed thermal resistance (R) value and out-of-package R value.

2.4.1.1 Rigid Insulation

Rigid mineral fiber in accordance with ASTM C 612, Class 2 (maximum surface temperature 400 degrees F), 3 pcf average, 1-1/2 inch thick, Type IA, IB, II, III, and IV. Alternately, minimum thickness may be calculated in accordance with ASHRAE 90.1 - IP.

2.4.1.2 Blanket Insulation

Blanket flexible mineral fiber insulation conforming to ASTM C 553, Type 1,

Class B-3, 3/4 pcf nominal, 2.0 inches thick or Type II up to 250 degrees F. Also ASTM C 1290 Type III may be used. Alternately, minimum thickness may be calculated in accordance with ASHRAE 90.1 - IP.

2.5 EQUIPMENT INSULATION SYSTEMS

Insulate equipment and accessories as specified in Tables 4 and 5. In outside locations, provide insulation 1/2 inch thicker than specified. Increase the specified insulation thickness for equipment where necessary to equal the thickness of angles or other structural members to make a smooth, exterior surface.

PART 3 EXECUTION

3.1 APPLICATION - GENERAL

Insulation shall only be applied to unheated and uncooled piping and equipment. Flexible elastomeric cellular insulation shall not be compressed at joists, studs, columns, ducts, hangers, etc. The insulation shall not pull apart after a one hour period; any insulation found to pull apart after one hour, shall be replaced.

3.1.1 Installation

Except as otherwise specified, material shall be installed in accordance with the manufacturer's written instructions. Insulation materials shall not be applied until tests and heat tracing specified in other sections of this specification are completed. Material such as rust, scale, dirt and moisture shall be removed from surfaces to receive insulation. Insulation shall be kept clean and dry. Insulation shall not be removed from its shipping containers until the day it is ready to use and shall be returned to like containers or equally protected from dirt and moisture at the end of each workday. Insulation that becomes dirty shall be thoroughly cleaned prior to use. If insulation becomes wet or if cleaning does not restore the surfaces to like new condition, the insulation will be rejected, and shall be immediately removed from the jobsite. Joints shall be staggered on multi layer insulation. Mineral fiber thermal insulating cement shall be mixed with demineralized water when used on stainless steel surfaces. Insulation, jacketing and accessories shall be installed in accordance with MICA Insulation Stds plates except where modified herein or on the drawings.

3.1.2 Firestopping

Where pipes and ducts pass through fire walls, fire partitions, above grade floors, and fire rated chase walls, the penetration shall be sealed with fire stopping materials. The protection of ducts at point of passage through firewalls must be in accordance with NFPA 90A and/or NFPA 90B. All other penetrations, such as piping, conduit, and wiring, through firewalls must be protected with a material or system of the same hourly rating that is listed by UL, FM, or a NRTL.

3.1.3 Installation of Flexible Elastomeric Cellular Insulation

Flexible elastomeric cellular insulation shall be installed with seams and joints sealed with rubberized contact adhesive. Flexible elastomeric cellular insulation shall not be used on surfaces greater than 200 degrees F. Seams shall be staggered when applying multiple layers of insulation. Insulation exposed to weather and not shown to have jacketing shall be protected with two coats of UV resistant finish or PVC or metal jacketing

as recommended by the manufacturer after the adhesive is dry and cured. A brush coating of adhesive shall be applied to both butt ends to be joined and to both slit surfaces to be sealed. The adhesive shall be allowed to set until dry to touch but tacky under slight pressure before joining the surfaces. Insulation seals at seams and joints shall not be capable of being pulled apart one hour after application. Insulation that can be pulled apart one hour after installation shall be replaced.

3.1.4 Welding

No welding shall be done on piping, duct or equipment without written approval of the Contracting Officer. The capacitor discharge welding process may be used for securing metal fasteners to duct.

3.1.5 Pipes/Ducts/Equipment which Require Insulation

Insulation is required on all pipes, ducts, or equipment, except for omitted items, as specified.

3.2 PIPE INSULATION SYSTEMS INSTALLATION

Install pipe insulation systems in accordance with the approved MICA Insulation Stds plates as supplemented by the manufacturer's published installation instructions.

3.2.1 Pipe Insulation

3.2.1.1 General

Pipe insulation shall be installed on aboveground hot and cold pipeline systems as specified below to form a continuous thermal retarder/barrier, including straight runs, fittings and appurtenances unless specified otherwise. Installation shall be with full length units of insulation and using a single cut piece to complete a run. Cut pieces or scraps abutting each other shall not be used. Pipe insulation shall be omitted on the following:

- a. Pipe used solely for fire protection.
- b. Chromium plated pipe to plumbing fixtures. However, fixtures for use by the physically handicapped shall have the hot water supply and drain, including the trap, insulated where exposed.
- c. Sanitary drain lines.
- d. Air chambers.
- e. Adjacent insulation.
- f. ASME stamps.
- g. Access plates of fan housings.
- h. Cleanouts or handholes.

3.2.1.2 Pipes Passing Through Walls, Roofs, and Floors

- a. Pipe insulation shall be continuous through the sleeve.

b. An aluminum jacket or vapor barrier/weatherproofing - self adhesive jacket (minimum 2 mils adhesive, 3 mils embossed) less than 0.0000 permeability, greater than 3 ply standard grade, silver, white, black and embossed with factory applied moisture retarder shall be provided over the insulation wherever penetrations require sealing.

c. Where pipes penetrate interior walls, the aluminum jacket or vapor barrier/weatherproofing - self adhesive jacket (minimum 2 mils adhesive, 3 mils embossed) less than 0.0000 permeability, greater than 3 plys standard grade, silver, white, black and embossed shall extend 2 inches beyond either side of the wall and shall be secured on each end with a band.

d. Where penetrating floors, the aluminum jacket shall extend from a point below the backup material to a point 10 inches above the floor with one band at the floor and one not more than 1 inch from the end of the aluminum jacket.

e. Where penetrating waterproofed floors, the aluminum jacket shall extend from below the backup material to a point 2 inches above the flashing with a band 1 inch from the end of the aluminum jacket.

f. Where penetrating exterior walls, the aluminum jacket required for pipe exposed to weather shall continue through the sleeve to a point 2 inches beyond the interior surface of the wall.

g. Where penetrating roofs, pipe shall be insulated as required for interior service to a point flush with the top of the flashing and sealed with vapor retarder coating. The insulation for exterior application shall butt tightly to the top of flashing and interior insulation. The exterior aluminum jacket shall extend 2 inches down beyond the end of the insulation to form a counter flashing. The flashing and counter flashing shall be sealed underneath with caulking.

h. For hot water pipes supplying lavatories or other similar heated service that requires insulation, the insulation shall be terminated on the backside of the finished wall. The insulation termination shall be protected with two coats of vapor barrier coating with a minimum total thickness of 1/16 inch applied with glass tape embedded between coats (if applicable). The coating shall extend out onto the insulation 2 inches and shall seal the end of the insulation. Glass tape seams shall overlap 1 inch. The annular space between the pipe and wall penetration shall be caulked with approved fire stop material. The pipe and wall penetration shall be covered with a properly sized (well fitting) escutcheon plate. The escutcheon plate shall overlap the wall penetration at least 3/8 inches.

i. For domestic cold water pipes supplying lavatories or other similar cooling service that requires insulation, the insulation shall be terminated on the finished side of the wall (i.e., insulation must cover the pipe throughout the wall penetration). The insulation shall be protected with two coats of vapor barrier coating with a minimum total thickness of 1/16 inch. The coating shall extend out onto the insulation 2 inches and shall seal the end of the insulation. The annular space between the outer surface of the pipe insulation and the wall penetration shall be caulked with an approved fire stop material having vapor retarder properties. The pipe and wall penetration shall be covered with a properly sized (well fitting) escutcheon plate. The escutcheon plate shall overlap the wall penetration by at least 3/8

inches.

3.2.1.3 Pipes Passing Through Hangers

a. Insulation, whether hot or cold application, shall be continuous through hangers. All horizontal pipes 2 inches and smaller shall be supported on hangers with the addition of a Type 40 protection shield to protect the insulation in accordance with MSS SP-69. Whenever insulation shows signs of being compressed, or when the insulation or jacket shows visible signs of distortion at or near the support shield, insulation inserts as specified below for piping larger than 2 inches shall be installed, or factory insulated hangers (designed with a load bearing core) can be used.

b. Horizontal pipes larger than 2 inches at 60 degrees F and above shall be supported on hangers in accordance with MSS SP-69, as detailed on drawings.

c. Horizontal pipes larger than 2 inches and below 60 degrees F shall be supported on hangers with the addition of a Type 40 protection shield in accordance with MSS SP-69. An insulation insert of cellular glass, perlite above 80 degrees F, or the necessary strength polyisocyanurate shall be installed above each shield. The insert shall cover not less than the bottom 180-degree arc of the pipe. Inserts shall be the same thickness as the insulation, and shall extend 2 inches on each end beyond the protection shield. When insulation inserts are required in accordance with the above, and the insulation thickness is less than 1 inch, wooden or cork dowels or blocks may be installed between the pipe and the shield to prevent the weight of the pipe from crushing the insulation, as an option to installing insulation inserts. The insulation jacket shall be continuous over the wooden dowel, wooden block, or insulation insert.

d. Vertical pipes shall be supported with either Type 8 or Type 42 riser clamps with the addition of two Type 40 protection shields in accordance with MSS SP-69 covering the 360-degree arc of the insulation. An insulation insert of cellular glass or calcium silicate shall be installed between each shield and the pipe. The insert shall cover the 360-degree arc of the pipe. Inserts shall be the same thickness as the insulation, and shall extend 2 inches on each end beyond the protection shield. When insulation inserts are required in accordance with the above, and the insulation thickness is less than 1 inch, wooden or cork dowels or blocks may be installed between the pipe and the shield to prevent the hanger from crushing the insulation, as an option instead of installing insulation inserts. The insulation jacket shall be continuous over the wooden dowel, wooden block, or insulation insert. The vertical weight of the pipe shall be supported with hangers located in a horizontal section of the pipe. When the pipe riser is longer than 30 feet, the weight of the pipe shall be additionally supported with hangers in the vertical run of the pipe that are directly clamped to the pipe, penetrating the pipe insulation. These hangers shall be insulated and the insulation jacket sealed as indicated herein for anchors in a similar service.

e. Inserts shall be covered with a jacket material of the same appearance and quality as the adjoining pipe insulation jacket, shall overlap the adjoining pipe jacket 1-1/2 inches, and shall be sealed as required for the pipe jacket. The jacket material used to cover inserts in flexible elastomeric cellular insulation shall conform to

ASTM C 1136, Type 1, and is allowed to be of a different material than the adjoining insulation material.

3.2.1.4 Flexible Elastomeric Cellular Pipe Insulation

Flexible elastomeric cellular pipe insulation shall be tubular form for pipe sizes 6 inches and less. Grade 1, Type II sheet insulation used on pipes larger than 6 inches shall not be stretched around the pipe. On pipes larger than 12 inches, the insulation shall be adhered directly to the pipe on the lower 1/3 of the pipe. Seams shall be staggered when applying multiple layers of insulation. Sweat fittings shall be insulated with miter-cut pieces the same size as on adjacent piping. Screwed fittings shall be insulated with sleeved fitting covers fabricated from miter-cut pieces and shall be overlapped and sealed to the adjacent pipe insulation.

3.2.1.5 Pipes in high abuse areas.

In high abuse areas such as janitor closets and traffic areas in equipment rooms, kitchens, and mechanical rooms, stainless steel, aluminum or flexible laminate cladding (comprised of elastomeric, plastic or metal foil laminate) laminated self-adhesive (minimum 2 mils adhesive, 3 mils embossed) vapor barrier/weatherproofing jacket, - less than 0.0000 permeability; (greater than 3 ply, standard grade, silver, white, black and embossed) aluminum jackets shall be utilized. Pipe insulation to the 6 foot level shall be protected.

3.2.1.6 Pipe Insulation Material and Thickness

TABLE 1
Insulation Material For Piping (°F)

Service	Material	Spec.	Type	Class	Vapor Retarder/ Vapor Barrier Required
Chilled Water (Supply & Return, Dual Temperature Piping, 40°F nominal)	Cellular Glass	ASTM C 552	II	2	No
	Flex Elast Cell'r	ASTM C 534/C	534M	I	No
	Faced Phenol Foam	ASTM C 1126	III		Yes
	Polyisocianurate	ASTM C 591	I		Yes
Cold Domestic Water Piping, Makeup Water & Drinking Fount Drain Piping	Mineral Fiber with	ASTM C 547	I		Yes
	Polyisocianurate	ASTM C 591	I		Yes
	Cellular Glass	ASTM C 552	II	2	No
	Flex Elast Cell'r	ASTM C 534/C	534M	I	No
A/C condensate Drain Located Inside Bldg.	Faced Phenol Foam	ASTM C 1126	III		Yes
	Polyofin Clos'cell	ASTM C 1427	I		No
	Polyisocianurate	ASTM C 591	I		Yes
	Cellular Glass	ASTM C 552	II	2	No
	Flex Elast Cell'r	ASTM C 534/C	534M	I	No
	Faced Phenol Foam	ASTM C 1126	II		Yes

TABLE 1
Insulation Material For Piping (°F)

Service	Material	Spec.	Type	Class	Vapor Retarder/ Vapor Barrier Required
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TABLE 2
Piping Insulation Thickness (inch and °F)

Service	Material	Tube And Pipe Size (Inches)					
		<1	1- <1.5	1.5- <4	4- <8	>or = to 8	
Chilled Water (Supply & Return, & Dual Temperature Piping) (40°F Nominal)	Cellular Glass	1.5	2	2	2.5	3	
	Faced Phenol Foam	1	1	1	1.5	1.5	
	Polyisocyanurate	1	1	1	1	1	
	Mineral Fiber with Wicking Material	1	1.5	1.5	2	2	
Chilled Water	Cellular Glass	1.5	1.5	1.5	1.5	2	
Cold Domestic Water Piping, Makeup Water, & Drinking Fountain Drain Piping	Cellular Glass	1.5	1.5	1.5	1.5	1.5	
	Flex Elas Cell'r	1	1	1	N/A	N/A	
	Faced Phenol Foam	1	1	1	1	1	
A/C condensate Drain Located Inside Bldg.	Polyisocyanurate	1	1	1	1	1	
	Cellular Glass	1.5	1.5	1.5	1.5	1.5	
	Flex Elas Cell'r	1	1	1	N/A	N/A	
	Faced Phenol Foam	1	1	1	1	1	

3.2.2 Aboveground Cold Pipelines

The following cold pipelines for minus 30 to plus 60 degrees F, shall be insulated in accordance with Table 2 except those piping listed in subparagraph Pipe Insulation in PART 3 as to be omitted. This includes but is not limited to the following:

- a. Domestic cold and chilled drinking water.
- b. Make-up water.
- c. Chilled water.
- d. Air conditioner condensate drains.

3.2.2.1 Insulation Material and Thickness

Insulation thickness for cold pipelines shall be determined using Table 2.

3.2.2.2 Factory or Field applied Jacket

Insulation shall be covered with a factory applied vapor retarder jacket/vapor barrier or field applied seal welded PVC jacket or greater than 3 ply laminated self-adhesive (minimum 2 mils adhesive, 3 mils embossed) vapor barrier/weatherproofing jacket - less than 0.0000 permeability, standard grade, silver, white, black and embossed for use with Mineral Fiber, Cellular Glass, Phenolic Foam, and Polyisocyanurate Foam Insulated Pipe. Insulation inside the building, to be protected with an aluminum jacket or greater than 3ply vapor barrier/weatherproofing self-adhesive (minimum 2 mils adhesive, 3 mils embossed) product, less than 0.0000 permeability, standard grade, Embossed Silver, White & Black, shall have the insulation and vapor retarder jacket installed as specified herein. The aluminum jacket or greater than 3ply vapor barrier/weatherproofing self-adhesive (minimum 2 mils adhesive, 3 mils embossed) product, less than 0.0000 permeability, standard grade, embossed silver, White & Black, shall be installed as specified for piping exposed to weather, except sealing of the laps of the aluminum jacket is not required. In high abuse areas such as janitor closets and traffic areas in equipment rooms, kitchens, and mechanical rooms, aluminum jackets or greater than 3ply vapor barrier/weatherproofing self-adhesive (minimum 2 mils adhesive, 3 mils embossed) product, less than 0.0000 permeability, standard grade, embossed silver, white & black, shall be provided for pipe insulation to the 6 ft level.

3.2.2.3 Installing Insulation for Straight Runs Hot and Cold Pipe

- a. Insulation shall be applied to the pipe with joints tightly butted. All butted joints and ends shall be sealed with joint sealant and sealed with a vapor retarder coating, greater than 3 ply laminate jacket - less than 0.0000 perm adhesive tape or PVDC adhesive tape.
- b. Longitudinal laps of the jacket material shall overlap not less than 1-1/2 inches. Butt strips 3 inches wide shall be provided for circumferential joints.
- c. Laps and butt strips shall be secured with adhesive and stapled on 4 inch centers if not factory self-sealing. If staples are used, they shall be sealed in accordance with item "e." below. Note that staples are not required with cellular glass systems.
- d. Factory self-sealing lap systems may be used when the ambient temperature is between 40 and 120 degrees F during installation. The lap system shall be installed in accordance with manufacturer's recommendations. Stapler shall be used only if specifically recommended by the manufacturer. Where gaps occur, the section shall be replaced or the gap repaired by applying adhesive under the lap and then stapling.
- e. All Staples, including those used to repair factory self-seal lap systems, shall be coated with a vapor retarder coating or PVDC adhesive tape or greater than 3 ply laminate jacket - less than 0.0000 perm adhesive tape. All seams, except those on factory self-seal systems shall be coated with vapor retarder coating or PVDC adhesive tape or greater than 3 ply laminate jacket - less than 0.0000 perm adhesive tape.
- f. Breaks and punctures in the jacket material shall be patched by wrapping a strip of jacket material around the pipe and securing it

with adhesive, stapling, and coating with vapor retarder coating or PVDC adhesive tape or greater than 3 ply laminate jacket - less than 0.0000 perm adhesive tape. The patch shall extend not less than 1-1/2 inches past the break.

g. At penetrations such as thermometers, the voids in the insulation shall be filled and sealed with vapor retarder coating or PVDC adhesive tape or greater than 3 ply laminate jacket - less than 0.0000 perm adhesive tape or greater than 3 ply laminate jacket - less than 0.0000 perm adhesive tape.

h. Installation of flexible elastomeric cellular pipe insulation shall be by slitting the tubular sections and applying them onto the piping or tubing. Alternately, whenever possible slide un-slit sections over the open ends of piping or tubing. All seams and butt joints shall be secured and sealed with adhesive. When using self seal products only the butt joints shall be secured with adhesive. Insulation shall be pushed on the pipe, never pulled. Stretching of insulation may result in open seams and joints. All edges shall be clean cut. Rough or jagged edges of the insulation shall not be permitted. Proper tools such as sharp knives shall be used. Grade 1, Type II sheet insulation when used on pipe larger than 6 inches shall not be stretched around the pipe. On pipes larger than 12 inches, adhere sheet insulation directly to the pipe on the lower 1/3 of the pipe.

3.2.2.4 Insulation for Fittings and Accessories

a. Pipe insulation shall be tightly butted to the insulation of the fittings and accessories. The butted joints and ends shall be sealed with joint sealant and sealed with a vapor retarder coating or PVDC adhesive tape or greater than 3 ply laminate jacket - less than 0.0000 perm adhesive tape.

b. Precut or preformed insulation shall be placed around all fittings and accessories and shall conform to MICA plates except as modified herein: 5 for anchors; 10, 11, and 13 for fittings; 14 for valves; and 17 for flanges and unions. Insulation shall be the same insulation as the pipe insulation, including same density, thickness, and thermal conductivity. Where precut/preformed is unavailable, rigid preformed pipe insulation sections may be segmented into the shape required. Insulation of the same thickness and conductivity as the adjoining pipe insulation shall be used. If nesting size insulation is used, the insulation shall be overlapped 2 inches or one pipe diameter. Elbows insulated using segments shall conform to MICA Tables 12.20 "Mitered Insulation Elbow".

c. Upon completion of insulation installation on flanges, unions, valves, anchors, fittings and accessories, terminations, seams, joints and insulation not protected by factory vapor retarder jackets or PVC fitting covers shall be protected with PVDC or greater than 3 ply laminate jacket - less than 0.0000 perm adhesive tape or two coats of vapor retarder coating with a minimum total thickness of 1/16 inch, applied with glass tape embedded between coats. Tape seams shall overlap 1 inch. The coating shall extend out onto the adjoining pipe insulation 2 inches. Fabricated insulation with a factory vapor retarder jacket shall be protected with either greater than 3 ply laminate jacket - less than 0.0000 perm adhesive tape, standard grade, silver, white, black and embossed or PVDC adhesive tape or two coats of vapor retarder coating with a minimum thickness of 1/16 inch and with a

2 inch wide glass tape embedded between coats. Where fitting insulation butts to pipe insulation, the joints shall be sealed with a vapor retarder coating and a 4 inch wide ASJ tape which matches the jacket of the pipe insulation.

d. Anchors attached directly to the pipe shall be insulated for a sufficient distance to prevent condensation but not less than 6 inches from the insulation surface.

e. Insulation shall be marked showing the location of unions, strainers, and check valves.

3.2.2.5 Optional PVC Fitting Covers

At the option of the Contractor, premolded, one or two piece PVC fitting covers may be used in lieu of the vapor retarder and embedded glass tape. Factory precut or premolded insulation segments shall be used under the fitting covers for elbows. Insulation segments shall be the same insulation as the pipe insulation including same density, thickness, and thermal conductivity. The covers shall be secured by PVC vapor retarder tape, adhesive, seal welding or with tacks made for securing PVC covers. Seams in the cover, and tacks and laps to adjoining pipe insulation jacket, shall be sealed with vapor retarder tape to ensure that the assembly has a continuous vapor seal.

3.2.3 Aboveground Hot Pipelines

3.2.4 Piping Exposed to Weather

Piping exposed to weather shall be insulated and jacketed as specified for the applicable service inside the building. After this procedure, a laminated self-adhesive (minimum 2 mils adhesive, 3 mils embossed) vapor barrier/weatherproofing jacket - less than 0.0000 permeability (greater than 3 ply, standard grade, silver, white, black and embossed stainless steel jacket) shall be applied. PVC jacketing requires no factory-applied jacket beneath it, however an all service jacket shall be applied if factory applied jacketing is not furnished. Flexible elastomeric cellular insulation exposed to weather shall be treated in accordance with paragraph INSTALLATION OF FLEXIBLE ELASTOMERIC CELLULAR INSULATION in PART 3.

3.2.4.1 Stainless Steel Jacket

The jacket for hot piping may be factory applied. The jacket shall overlap not less than 2 inches at longitudinal and circumferential joints and shall be secured with bands at not more than 12 inch centers. Longitudinal joints shall be overlapped down to shed water and located at 4 or 8 o'clock positions. Joints on piping 60 degrees F and below shall be sealed with caulking while overlapping to prevent moisture penetration. Where jacketing on piping 60 degrees F and below abuts an un-insulated surface, joints shall be caulked to prevent moisture penetration. Joints on piping above 60 degrees F shall be sealed with a moisture retarder.

3.2.4.2 Insulation for Fittings

Flanges, unions, valves, fittings, and accessories shall be insulated and finished as specified for the applicable service. Two coats of breather emulsion type weatherproof mastic (impermeable to water, permeable to air) recommended by the insulation manufacturer shall be applied with glass tape

embedded between coats. Tape overlaps shall be not less than 1 inch and the adjoining aluminum jacket not less than 2 inches. Factory preformed aluminum jackets may be used in lieu of the above. Molded PVC fitting covers shall be provided when PVC jackets are used for straight runs of pipe. PVC fitting covers shall have adhesive welded joints and shall be weatherproof laminated self-adhesive (minimum 2 mils adhesive, 3 mils embossed) vapor barrier/weatherproofing jacket - less than 0.0000 permeability, (greater than 3 ply, standard grade, silver, white, black and embossed, and UV resistant).

3.3 DUCT INSULATION SYSTEMS INSTALLATION

Install duct insulation systems in accordance with the approved MICA Insulation Stds plates as supplemented by the manufacturer's published installation instructions.

Corner angles shall be installed on external corners of insulation on ductwork in exposed finished spaces before covering with jacket.

3.3.1 Duct Insulation Thickness

Duct insulation thickness shall be in accordance with Table 4.

Table 4 - Minimum Duct Insulation (inches)

Cold Air Ducts	2.0
Relief Ducts	1.5
Fresh Air Intake Ducts	1.5
Warm Air Ducts	2.0
Relief Ducts	1.5
Fresh Air Intake Ducts	1.5

3.3.2 Insulation and Vapor Retarder/Vapor Barrier for Cold Air Duct

Insulation and vapor retarder/vapor barrier shall be provided for the following cold air ducts and associated equipment.

- a. Supply ducts.
- b. Return air ducts.
- c. Relief ducts.
- d. Flexible run-outs (field-insulated).
- e. Plenums.
- f. Duct-mounted coil casings.
- g. Coil headers and return bends.
- h. Coil casings.
- i. Fresh air intake ducts.
- j. Filter boxes.

- k. Mixing boxes (field-insulated).
- l. Supply fans (field-insulated).
- m. Site-erected air conditioner casings.
- n. Ducts exposed to weather.
- o. Combustion air intake ducts.

Insulation for rectangular ducts shall be flexible type where concealed, minimum density 3/4 pcf, and rigid type where exposed, minimum density 3 pcf. Insulation for both concealed or exposed round/oval ducts shall be flexible type, minimum density 3/4 pcf or a semi rigid board, minimum density 3 pcf, formed or fabricated to a tight fit, edges beveled and joints tightly butted and staggered. Insulation for all exposed ducts shall be provided with either a white, paint-able, factory-applied Type I jacket or a field applied vapor retarder/vapor barrier jacket coating finish as specified, the total field applied dry film thickness shall be approximately 1/16 inch. Insulation on all concealed duct shall be provided with a factory-applied Type I or II vapor retarder/vapor barrier jacket. Duct insulation shall be continuous through sleeves and prepared openings except firewall penetrations. Duct insulation terminating at fire dampers, shall be continuous over the damper collar and retaining angle of fire dampers, which are exposed to unconditioned air and which may be prone to condensate formation. Duct insulation and vapor retarder/vapor barrier shall cover the collar, neck, and any un-insulated surfaces of diffusers, registers and grills. Vapor retarder/vapor barrier materials shall be applied to form a complete unbroken vapor seal over the insulation. Sheet Metal Duct shall be sealed in accordance with Section 23 00 00 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM.

3.3.2.1 Installation on Concealed Duct

- a. For rectangular, oval or round ducts, flexible insulation shall be attached by applying adhesive around the entire perimeter of the duct in 6 inch wide strips on 12 inch centers.
- b. For rectangular and oval ducts, 24 inches and larger insulation shall be additionally secured to bottom of ducts by the use of mechanical fasteners. Fasteners shall be spaced on 16 inch centers and not more than 16 inches from duct corners.
- c. For rectangular, oval and round ducts, mechanical fasteners shall be provided on sides of duct risers for all duct sizes. Fasteners shall be spaced on 16 inch centers and not more than 16 inches from duct corners.
- d. Insulation shall be impaled on the mechanical fasteners (self stick pins) where used and shall be pressed thoroughly into the adhesive. Care shall be taken to ensure vapor retarder/vapor barrier jacket joints overlap 2 inches. The insulation shall not be compressed to a thickness less than that specified. Insulation shall be carried over standing seams and trapeze-type duct hangers.
- e. Where mechanical fasteners are used, self-locking washers shall be installed and the pin trimmed and bent over.
- f. Jacket overlaps shall be secured with staples and tape as necessary

to ensure a secure seal. Staples, tape and seams shall be coated with a brush coat of vapor retarder coating or PVDC adhesive tape or greater than 3 ply laminate (minimum 2 mils adhesive, 3 mils embossed) - less than 0.0000 perm adhesive tape.

g. Breaks in the jacket material shall be covered with patches of the same material as the vapor retarder jacket. The patches shall extend not less than 2 inches beyond the break or penetration in all directions and shall be secured with tape and staples. Staples and tape joints shall be sealed with a brush coat of vapor retarder coating or PVDC adhesive tape or greater than 3 ply laminate (minimum 2 mils adhesive, 3 mils embossed) - less than 0.0000 perm adhesive tape.

h. At jacket penetrations such as hangers, thermometers, and damper operating rods, voids in the insulation shall be filled and the penetration sealed with a brush coat of vapor retarder coating or PVDC adhesive tape greater than 3 ply laminate (minimum 2 mils adhesive, 3 mils embossed) - less than 0.0000 perm adhesive tape.

i. Insulation terminations and pin punctures shall be sealed and flashed with a reinforced vapor retarder coating finish or tape with a brush coat of vapor retarder coating.. The coating shall overlap the adjoining insulation and un-insulated surface 2 inches. Pin puncture coatings shall extend 2 inches from the puncture in all directions.

j. Where insulation standoff brackets occur, insulation shall be extended under the bracket and the jacket terminated at the bracket.

3.3.2.2 Installation on Exposed Duct Work

a. For rectangular ducts, rigid insulation shall be secured to the duct by mechanical fasteners on all four sides of the duct, spaced not more than 12 inches apart and not more than 3 inches from the edges of the insulation joints. A minimum of two rows of fasteners shall be provided for each side of duct 12 inches and larger. One row shall be provided for each side of duct less than 12 inches. Mechanical fasteners shall be as corrosion resistant as G60 coated galvanized steel, and shall indefinitely sustain a 50 lb tensile dead load test perpendicular to the duct wall.

b. Duct insulation shall be formed with minimum jacket seams. Each piece of rigid insulation shall be fastened to the duct using mechanical fasteners. When the height of projections is less than the insulation thickness, insulation shall be brought up to standing seams, reinforcing, and other vertical projections and shall not be carried over. Vapor retarder/barrier jacket shall be continuous across seams, reinforcing, and projections. When height of projections is greater than the insulation thickness, insulation and jacket shall be carried over. Apply insulation with joints tightly butted. Neatly bevel insulation around name plates and access plates and doors.

c. Insulation shall be impaled on the fasteners; self-locking washers shall be installed and the pin trimmed and bent over.

d. Joints in the insulation jacket shall be sealed with a 4 inch wide strip of tape. Tape seams shall be sealed with a brush coat of vapor retarder coating.

e. Breaks and ribs or standing seam penetrations in the jacket

material shall be covered with a patch of the same material as the jacket. Patches shall extend not less than 2 inches beyond the break or penetration and shall be secured with tape and stapled. Staples and joints shall be sealed with a brush coat of vapor retarder coating.

f. At jacket penetrations such as hangers, thermometers, and damper operating rods, the voids in the insulation shall be filled and the penetrations sealed with a brush coat of vapor retarder coating.

g. Insulation terminations and pin punctures shall be sealed and flashed with a reinforced vapor retarder coating finish. The coating shall overlap the adjoining insulation and un-insulated surface 2 inches. Pin puncture coatings shall extend 2 inches from the puncture in all directions.

h. Oval and round ducts, flexible type, shall be insulated with factory Type I jacket insulation with minimum density of 3/4 pcf, attached as in accordance with MICA standards.

3.3.3 Insulation for Warm Air Duct

Insulation and vapor barrier shall be provided for the following warm air ducts and associated equipment:.

- a. Supply ducts.
- b. Return air ducts.
- c. Relief air ducts
- d. Flexible run-outs (field insulated).
- e. Plenums.
- f. Duct-mounted coil casings.
- g. Coil-headers and return bends.
- h. Coil casings.
- i. Fresh air intake ducts.
- j. Filter boxes.
- k. Mixing boxes.
- l. Supply fans.
- m. Site-erected air conditioner casings.
- n. Ducts exposed to weather.

Insulation for rectangular ducts shall be flexible type where concealed, and rigid type where exposed. Insulation on exposed ducts shall be provided with a white, paint-able, factory-applied Type II jacket, or finished with adhesive finish. Flexible type insulation shall be used for round ducts, with a factory-applied Type II jacket. Insulation on concealed duct shall be provided with a factory-applied Type II jacket. Adhesive finish where indicated to be used shall be accomplished by

applying two coats of adhesive with a layer of glass cloth embedded between the coats. The total dry film thickness shall be approximately 1/16 inch. Duct insulation shall be continuous through sleeves and prepared openings. Duct insulation shall terminate at fire dampers and flexible connections.

3.3.3.1 Installation on Concealed Duct

- a. For rectangular, oval and round ducts, insulation shall be attached by applying adhesive around the entire perimeter of the duct in 6 inch wide strips on 12 inch centers.
- b. For rectangular and oval ducts 24 inches and larger, insulation shall be secured to the bottom of ducts by the use of mechanical fasteners. Fasteners shall be spaced on 18 inch centers and not more than 18 inches from duct corner.
- c. For rectangular, oval and round ducts, mechanical fasteners shall be provided on sides of duct risers for all duct sizes. Fasteners shall be spaced on 18 inch centers and not more than 18 inches from duct corners.
- d. The insulation shall be impaled on the mechanical fasteners where used. The insulation shall not be compressed to a thickness less than that specified. Insulation shall be carried over standing seams and trapeze-type hangers.
- e. Self-locking washers shall be installed where mechanical fasteners are used and the pin trimmed and bent over.
- f. Insulation jacket shall overlap not less than 2 inches at joints and the lap shall be secured and stapled on 4 inch centers.

3.3.3.2 Installation on Exposed Duct

- a. For rectangular ducts, the rigid insulation shall be secured to the duct by the use of mechanical fasteners on all four sides of the duct, spaced not more than 16 inches apart and not more than 6 inches from the edges of the insulation joints. A minimum of two rows of fasteners shall be provided for each side of duct 12 inches and larger and a minimum of one row for each side of duct less than 12 inches.
- b. Duct insulation with factory-applied jacket shall be formed with minimum jacket seams, and each piece of rigid insulation shall be fastened to the duct using mechanical fasteners. When the height of projection is less than the insulation thickness, insulation shall be brought up to standing seams, reinforcing, and other vertical projections and shall not be carried over the projection. Jacket shall be continuous across seams, reinforcing, and projections. Where the height of projections is greater than the insulation thickness, insulation and jacket shall be carried over the projection.
- c. Insulation shall be impaled on the fasteners; self-locking washers shall be installed and pin trimmed and bent over.
- d. Joints on jacketed insulation shall be sealed with a 4 inch wide strip of tape and brushed with vapor retarder coating.
- e. Breaks and penetrations in the jacket material shall be covered with a patch of the same material as the jacket. Patches shall extend

not less than 2 inches beyond the break or penetration and shall be secured with adhesive and stapled.

f. Insulation terminations and pin punctures shall be sealed with tape and brushed with vapor retarder coating.

g. Oval and round ducts, flexible type, shall be insulated with factory Type I jacket insulation, minimum density of 3/4 pcf attached by staples spaced not more than 16 inches and not more than 6 inches from the degrees of joints. Joints shall be sealed in accordance with item "d." above.

3.3.4 Ducts Handling Air for Dual Purpose

For air handling ducts for dual purpose below and above 60 degrees F, ducts shall be insulated as specified for cold air duct.

3.3.5 Insulation for Evaporative Cooling Duct

Evaporative cooling supply duct located in spaces not evaporatively cooled, shall be insulated. Material and installation requirements shall be as specified for duct insulation for warm air duct.

3.3.6 Duct Test Holes

After duct systems have been tested, adjusted, and balanced, breaks in the insulation and jacket shall be repaired in accordance with the applicable section of this specification for the type of duct insulation to be repaired.

3.3.7 Duct Exposed to Weather

3.3.7.1 Installation

Ducts exposed to weather shall be insulated and finished as specified for the applicable service for exposed duct inside the building. After the above is accomplished, the insulation shall then be further finished as detailed in the following subparagraphs.

3.3.7.2 Round Duct

Laminated self-adhesive (minimum 2 mils adhesive, 3 mils embossed) vapor barrier/weatherproofing jacket - Less than 0.0000 permeability, (greater than 3 ply, standard grade, silver, white, black and embossed or greater than 8 ply, heavy duty, white and natural) membrane shall be applied overlapping material by 3 inches no bands or caulking needed - see manufacturer's recommended installation instructions. Aluminum jacket with factory applied moisture retarder shall be applied with the joints lapped not less than 3 inches and secured with bands located at circumferential laps and at not more than 12 inch intervals throughout. Horizontal joints shall lap down to shed water and located at 4 or 8 o'clock position. Joints shall be sealed with caulking to prevent moisture penetration. Where jacketing abuts an un-insulated surface, joints shall be sealed with caulking.

3.3.7.3 Fittings

Fittings and other irregular shapes shall be finished as specified for rectangular ducts.

3.3.7.4 Rectangular Ducts

Two coats of weather barrier mastic reinforced with fabric or mesh for outdoor application shall be applied to the entire surface. Each coat of weatherproof mastic shall be 1/16 inch minimum thickness. The exterior shall be a metal jacketing applied for mechanical abuse and weather protection, and secured with screws.

3.4 EQUIPMENT INSULATION SYSTEMS INSTALLATION

Install equipment insulation systems in accordance with the approved MICA Insulation Stds plates as supplemented by the manufacturer's published installation instructions.

3.4.1 General

Removable insulation sections shall be provided to cover parts of equipment that must be opened periodically for maintenance including vessel covers, fasteners, flanges and accessories. Equipment insulation shall be omitted on the following:

- a. Hand-holes.
- b. Cleanouts.
- c. ASME stamps.
- d. Manufacturer's nameplates.
- e. Duct Test/Balance Test Holes.

3.4.2 Insulation for Cold Equipment

Cold equipment below 60 degrees F: Insulation shall be furnished on equipment handling media below 60 degrees F including the following:

- a. Pumps.
- b. Refrigeration equipment parts that are not factory insulated.
- c. Drip pans under chilled equipment.
- d. Cold water storage tanks.
- e. Cold and chilled water pumps.
- f. Air handling equipment parts that are not factory insulated.
- g. Expansion and air separation tanks.

3.4.2.1 Insulation Type

Insulation shall be suitable for the temperature encountered. Material and thicknesses shall be as shown in Table 5:

Legend

RMF: Rigid Mineral Fiber

- FMF: Flexible Mineral Fiber
- CS: Calcium Silicate
- PL: Perlite
- CG: Cellular Glass
- FC: Flexible Elastomeric Cellular
- PF: Phenolic Foam
- PC: Polyisocyanurate Foam
- PE: Polyolefin closed cell

TABLE 5
Insulation Thickness for Cold Equipment (Inches and °F)

Equipment handling media at indicated temperature:	Material	Thickness
35 to 60 degrees F	CG	1.5 inches
	PF	1.5 inches
	FC	1.0 inches
	PC	1.0 inches
	PE	1.0 inches

Equipment handling media Material Thickness
at indicated temperature:

3.4.2.2 Pump Insulation

- a. Insulate pumps by forming a box around the pump housing. The box shall be constructed by forming the bottom and sides using joints that do not leave raw ends of insulation exposed. Joints between sides and between sides and bottom shall be joined by adhesive with lap strips for rigid mineral fiber and contact adhesive for flexible elastomeric cellular insulation. The box shall conform to the requirements of MICA Insulation Stds plate No. 49 when using flexible elastomeric cellular insulation. Joints between top cover and sides shall fit tightly forming a female shiplap joint on the side pieces and a male joint on the top cover, thus making the top cover removable.
- b. Exposed insulation corners shall be protected with corner angles.
- c. Upon completion of installation of the insulation, including removable sections, two coats of vapor retarder coating shall be applied with a layer of glass cloth embedded between the coats. The total dry thickness of the finish shall be 1/16 inch. A parting line shall be provided between the box and the removable sections allowing the removable sections to be removed without disturbing the insulation coating. Caulking shall be applied to parting line, between equipment and removable section insulation, and at all penetrations.

3.4.2.3 Other Equipment

- a. Insulation shall be formed or fabricated to fit the equipment. To ensure a tight fit on round equipment, edges shall be beveled and joints shall be tightly butted and staggered.
- b. Insulation shall be secured in place with bands or wires at intervals as recommended by the manufacturer but not more than 12 inch

centers except flexible elastomeric cellular which shall be adhered with contact adhesive. Insulation corners shall be protected under wires and bands with suitable corner angles.

c. Phenolic foam insulation shall be set in a coating of bedding compound and joints shall be sealed with bedding compound as recommended by the manufacturer. Cellular glass shall be installed in accordance with manufacturer's instructions. Joints and ends shall be sealed with joint sealant, and sealed with a vapor retarder coating.

d. Insulation on heads of heat exchangers shall be removable. Removable section joints shall be fabricated using a male-female shiplap type joint. The entire surface of the removable section shall be finished by applying two coats of vapor retarder coating with a layer of glass cloth embedded between the coats. The total dry thickness of the finish shall be 1/16 inch.

e. Exposed insulation corners shall be protected with corner angles.

f. Insulation on equipment with ribs shall be applied over 6 by 6 inches by 12 gauge welded wire fabric which has been cinched in place, or if approved by the Contracting Officer, spot welded to the equipment over the ribs. Insulation shall be secured to the fabric with J-hooks and 2 by 2 inches washers or shall be securely banded or wired in place on 12 inch centers.

3.4.2.4 Vapor Retarder/Vapor Barrier

Upon completion of installation of insulation, penetrations shall be caulked. Two coats of vapor retarder coating or vapor barrier jacket shall be applied over insulation, including removable sections, with a layer of open mesh synthetic fabric embedded between the coats. The total dry thickness of the finish shall be 1/16 inch. Caulking or vapor barrier tape shall be applied to parting line between equipment and removable section insulation.

TABLE 6

shall be submitted to substantiate insulation and thickness selection.

TABLE 7

Class 1,

3.4.3 Other Equipment

a. Insulation shall be formed or fabricated to fit the equipment. To ensure a tight fit on round equipment, edges shall be beveled and joints shall be tightly butted and staggered.

b. Insulation shall be secured in place with bands or wires at intervals as recommended by the manufacturer but not greater than 12 inch centers except flexible elastomeric cellular which shall be adhered. Insulation corners shall be protected under wires and bands

with suitable corner angles.

c. On high vibration equipment, cellular glass insulation shall be set in a coating of bedding compound as recommended by the manufacturer, and joints shall be sealed with bedding compound. Mineral fiber joints shall be filled with finishing cement.

d. Insulation on heads of heat exchangers shall be removable. The removable section joint shall be fabricated using a male-female shiplap type joint. Entire surface of the removable section shall be finished as specified.

e. Exposed insulation corners shall be protected with corner angles.

f. On equipment with ribs, such as boiler flue gas connection, draft fans, and fly ash or soot collectors, insulation shall be applied over 6 by 6 inch by 12 gauge welded wire fabric which has been cinched in place, or if approved by the Contracting Officer, spot welded to the equipment over the ribs. Insulation shall be secured to the fabric with J-hooks and 2 by 2 inch washers or shall be securely banded or wired in place on 12 inch (maximum) centers.

g. On equipment handling media above 600 degrees F, insulation shall be applied in two or more layers with joints staggered.

h. Upon completion of installation of insulation, penetrations shall be caulked. Two coats of adhesive shall be applied over insulation, including removable sections, with a layer of glass cloth embedded between the coats. The total dry thickness of the finish shall be 1/16 inch. Caulking shall be applied to parting line between equipment and removable section insulation.

3.4.4 Equipment Handling Dual Temperature Media

Below and above 60 degrees F: equipment handling dual temperature media shall be insulated as specified for cold equipment.

3.4.5 Equipment Exposed to Weather

3.4.5.1 Installation

Equipment exposed to weather shall be insulated and finished in accordance with the requirements for ducts exposed to weather in paragraph DUCT INSULATION INSTALLATION.

3.4.5.2 Optional Panels

At the option of the Contractor, prefabricated metal insulation panels may be used in lieu of the insulation and finish previously specified. Thermal performance shall be equal to or better than that specified for field applied insulation. Panels shall be the standard catalog product of a manufacturer of metal insulation panels. Fastenings, flashing, and support system shall conform to published recommendations of the manufacturer for weatherproof installation and shall prevent moisture from entering the insulation. Panels shall be designed to accommodate thermal expansion and to support a 250 pound walking load without permanent deformation or permanent damage to the insulation. Exterior metal cover sheet shall be aluminum and exposed fastenings shall be stainless steel or aluminum.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 26 - ELECTRICAL

SECTION 26 00 00.00 20

BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 RELATED REQUIREMENTS
- 1.3 DEFINITIONS
- 1.4 ADDITIONAL SUBMITTALS INFORMATION
 - 1.4.1 Shop Drawings (SD-02)
 - 1.4.2 Product Data (SD-03)
- 1.5 QUALITY ASSURANCE
 - 1.5.1 Regulatory Requirements
 - 1.5.2 Standard Products
 - 1.5.2.1 Alternative Qualifications
 - 1.5.2.2 Material and Equipment Manufacturing Date
- 1.6 WARRANTY
- 1.7 POSTED OPERATING INSTRUCTIONS
- 1.8 MANUFACTURER'S NAMEPLATE
- 1.9 FIELD FABRICATED NAMEPLATES
- 1.10 ELECTRICAL REQUIREMENTS
- 1.11 INSTRUCTION TO GOVERNMENT PERSONNEL

PART 2 PRODUCTS

- 2.1 FACTORY APPLIED FINISH

PART 3 EXECUTION

- 3.1 FIELD APPLIED PAINTING
- 3.2 FIELD FABRICATED NAMEPLATE MOUNTING
- 3.3 WARNING SIGN MOUNTING

-- End of Section Table of Contents --

SECTION 26 00 00.00 20

BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D 709 (2001; R 2007) Laminated Thermosetting Materials

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2 (2007; Errata 2007; INT 2008) National Electrical Safety Code

IEEE Std 100 (2000) The Authoritative Dictionary of IEEE Standards Terms

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250 (2008) Enclosures for Electrical Equipment (1000 Volts Maximum)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2011) National Electrical Code

UNIFIED FACILITIES CRITERIA (UFC)

UFC 3-520-01 (2010) Interior Electrical Systems

1.2 RELATED REQUIREMENTS

This section applies to certain sections of Divisions 22 and 23, PLUMBING and HEATING VENTILATING AND AIR CONDITIONING. This section applies to all sections of Division 26 and 33, ELECTRICAL and UTILITIES, of this project specification unless specified otherwise in the individual sections.

1.3 DEFINITIONS

- a. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, shall be as defined in IEEE Std 100.
- b. The technical sections referred to herein are those specification sections that describe products, installation procedures, and equipment operations and that refer to this section for detailed description of submittal types.

- c. The technical paragraphs referred to herein are those paragraphs in PART 2 - PRODUCTS and PART 3 - EXECUTION of the technical sections that describe products, systems, installation procedures, equipment, and test methods.

1.4 ADDITIONAL SUBMITTALS INFORMATION

Submittals required in other sections that refer to this section must conform to the following additional requirements as applicable.

1.4.1 Shop Drawings (SD-02)

Include wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure a coordinated installation. Wiring diagrams shall identify circuit terminals and indicate the internal wiring for each item of equipment and the interconnection between each item of equipment. Drawings shall indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices.

1.4.2 Product Data (SD-03)

Submittal shall include performance and characteristic curves.

1.5 QUALITY ASSURANCE

1.5.1 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70 and UFC 3-520-01 unless more stringent requirements are specified or indicated.

1.5.2 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in the technical section.

1.5.2.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.5.2.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site shall not be used, unless specified otherwise.

1.6 WARRANTY

The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

1.7 POSTED OPERATING INSTRUCTIONS

Provide for each system and principal item of equipment as specified in the technical sections for use by operation and maintenance personnel. The operating instructions shall include the following:

- a. Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.
- b. Start up, proper adjustment, operating, lubrication, and shutdown procedures.
- c. Safety precautions.
- d. The procedure in the event of equipment failure.
- e. Other items of instruction as recommended by the manufacturer of each system or item of equipment.

Print or engrave operating instructions and frame under glass or in approved laminated plastic. Post instructions where directed. For operating instructions exposed to the weather, provide weather-resistant materials or weatherproof enclosures. Operating instructions shall not fade when exposed to sunlight and shall be secured to prevent easy removal or peeling.

1.8 MANUFACTURER'S NAMEPLATE

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

1.9 FIELD FABRICATED NAMEPLATES

ASTM D 709. Provide laminated plastic nameplates for each equipment enclosure, relay, switch, and device; as specified in the technical sections or as indicated on the drawings. Each nameplate inscription shall identify the function and, when applicable, the position. Nameplates shall be melamine plastic, 0.125 inch thick, white with black center core. Surface shall be matte finish. Corners shall be square. Accurately align lettering and engrave into the core. Minimum size of nameplates shall be one by 2.5 inches. Lettering shall be a minimum of 0.25 inch high normal block style.

1.10 ELECTRICAL REQUIREMENTS

Electrical installations shall conform to IEEE C2, NFPA 70, and requirements specified herein.

1.11 INSTRUCTION TO GOVERNMENT PERSONNEL

Where specified in the technical sections, furnish the services of competent instructors to give full instruction to designated Government personnel in the adjustment, operation, and maintenance of the specified systems and equipment, including pertinent safety requirements as required. Instructors shall be thoroughly familiar with all parts of the installation and shall be trained in operating theory as well as practical operation and maintenance work. Instruction shall be given during the first regular work week after the equipment or system has been accepted and turned over to the Government for regular operation. The number of man-days (8 hours per day) of instruction furnished shall be as specified in the individual section.

PART 2 PRODUCTS

2.1 FACTORY APPLIED FINISH

Electrical equipment shall have factory-applied painting systems which shall, as a minimum, meet the requirements of NEMA 250 corrosion-resistance test.

PART 3 EXECUTION

3.1 FIELD APPLIED PAINTING

Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria.

3.2 FIELD FABRICATED NAMEPLATE MOUNTING

Provide number, location, and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two sheet-metal screws or two rivets.

3.3 WARNING SIGN MOUNTING

Provide the number of signs required to be readable from each accessible side, but space the signs a maximum of 30 feet apart.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 26 - ELECTRICAL

SECTION 26 20 00

INTERIOR DISTRIBUTION SYSTEM

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 DEFINITIONS
- 1.3 SUBMITTALS
- 1.4 QUALITY ASSURANCE
 - 1.4.1 Fuses
 - 1.4.2 Regulatory Requirements
 - 1.4.3 Standard Products
 - 1.4.3.1 Alternative Qualifications
 - 1.4.3.2 Material and Equipment Manufacturing Date
- 1.5 WARRANTY

PART 2 PRODUCTS

- 2.1 MATERIALS AND EQUIPMENT
- 2.2 CONDUIT AND FITTINGS
 - 2.2.1 Rigid Metallic Conduit
 - 2.2.1.1 Rigid, Threaded Zinc-Coated Steel Conduit
 - 2.2.2 Rigid Nonmetallic Conduit
 - 2.2.3 Electrical, Zinc-Coated Steel Metallic Tubing (EMT)
 - 2.2.4 Flexible Metal Conduit
 - 2.2.4.1 Liquid-Tight Flexible Metal Conduit, Steel
 - 2.2.5 Fittings for Metal Conduit, EMT, and Flexible Metal Conduit
 - 2.2.5.1 Fittings for Rigid Metal Conduit and IMC
 - 2.2.5.2 Fittings for EMT
- 2.3 CABINETS, JUNCTION BOXES, AND PULL BOXES
- 2.4 WIRES AND CABLES
 - 2.4.1 Conductors
 - 2.4.1.1 Minimum Conductor Sizes
 - 2.4.2 Color Coding
 - 2.4.3 Insulation
 - 2.4.4 Bonding Conductors
- 2.5 SPLICES AND TERMINATION COMPONENTS
- 2.6 DEVICE PLATES
- 2.7 SWITCHES
 - 2.7.1 Toggle Switches
 - 2.7.2 Disconnect Switches
- 2.8 FUSES
 - 2.8.1 Fuseholders
 - 2.8.2 Cartridge Fuses, Current Limiting Type (Class R)
 - 2.8.3 Cartridge Fuses, High-Interrupting Capacity, Current Limiting Type (Classes J, L, and CC)
 - 2.8.4 Cartridge Fuses, Current Limiting Type (Class T)
- 2.9 RECEPTACLES
 - 2.9.1 Ground-Fault Circuit Interrupter Receptacles

- 2.10 CIRCUIT BREAKERS FOR EXISTING SWITCHBOARDS
 - 2.10.1 Circuit Breakers
 - 2.10.1.1 Multipole Breakers
 - 2.10.1.2 Circuit Breakers for HVAC Equipment
- 2.11 MOTOR SHORT-CIRCUIT PROTECTOR (MSCP)
- 2.12 MOTORS
 - 2.12.1 High Efficiency Single-Phase Motors
 - 2.12.2 Premium Efficiency Polyphase Motors
 - 2.12.3 Motor Sizes
 - 2.12.4 Wiring and Conduit
- 2.13 MOTOR CONTROLLERS
 - 2.13.1 Control Wiring
 - 2.13.2 Control Circuit Terminal Blocks
 - 2.13.2.1 Types of Terminal Blocks
 - 2.13.3 Control Circuits
 - 2.13.4 Enclosures for Motor Controllers
- 2.14 LOCKOUT REQUIREMENTS
- 2.15 GROUNDING AND BONDING EQUIPMENT
 - 2.15.1 Ground Rods
- 2.16 MANUFACTURER'S NAMEPLATE
- 2.17 FIELD FABRICATED NAMEPLATES
- 2.18 WARNING SIGNS
- 2.19 FIRESTOPPING MATERIALS
- 2.20 WIREWAYS
- 2.21 SURGE PROTECTIVE DEVICES
- 2.22 FACTORY APPLIED FINISH

PART 3 EXECUTION

- 3.1 INSTALLATION
 - 3.1.1 Underground Conductors
 - 3.1.2 Labels
 - 3.1.3 Wiring Methods
 - 3.1.3.1 Pull Wire
 - 3.1.4 Conduit Installation
 - 3.1.4.1 Restrictions Applicable to Aluminum Conduit
 - 3.1.4.2 Restrictions Applicable to EMT
 - 3.1.4.3 Restrictions Applicable to Nonmetallic Conduit
 - 3.1.4.4 Restrictions Applicable to Flexible Conduit
 - 3.1.4.5 Underground Conduit
 - 3.1.4.6 Conduit Installed Under Floor Slabs
 - 3.1.4.7 Conduit Through Floor Slabs
 - 3.1.4.8 Stub-Ups
 - 3.1.4.9 Conduit Support
 - 3.1.4.10 Directional Changes in Conduit Runs
 - 3.1.4.11 Locknuts and Bushings
 - 3.1.4.12 Flexible Connections
 - 3.1.5 Boxes, Outlets, and Supports
 - 3.1.5.1 Boxes
 - 3.1.5.2 Pull Boxes
 - 3.1.5.3 Extension Rings
 - 3.1.6 Mounting Heights
 - 3.1.7 Marking Strips
 - 3.1.8 Splices
 - 3.1.9 Termination to Copper Bus
 - 3.1.10 Covers and Device Plates
 - 3.1.11 Electrical Penetrations
 - 3.1.12 Grounding and Bonding
 - 3.1.12.1 Ground Rods

- 3.1.12.2 Grounding Connections
- 3.1.13 Equipment Connections
- 3.1.14 Repair of Existing Work
 - 3.1.14.1 Workmanship
 - 3.1.14.2 Existing Concealed Wiring to be Removed
- 3.1.15 Surge Protective Devices
- 3.2 FIELD FABRICATED NAMEPLATE MOUNTING
- 3.3 WARNING SIGN MOUNTING
- 3.4 FIELD APPLIED PAINTING
- 3.5 FIELD QUALITY CONTROL
 - 3.5.1 Devices Subject to Manual Operation
 - 3.5.2 600-Volt Wiring Test
 - 3.5.3 Ground-Fault Receptacle Test
 - 3.5.4 Grounding System Test

-- End of Section Table of Contents --

SECTION 26 20 00

INTERIOR DISTRIBUTION SYSTEM

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM B 1	(2001; R 2007) Standard Specification for Hard-Drawn Copper Wire
ASTM B 8	(2004) Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
ASTM D 709	(2001; R 2007) Laminated Thermosetting Materials

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2	(2007; Errata 2007; INT 2008) National Electrical Safety Code
IEEE Std 100	(2000) The Authoritative Dictionary of IEEE Standards Terms

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(2008) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA C80.1	(2005) Standard for Electrical Rigid Steel Conduit (ERSC)
NEMA C80.3	(2005) Standard for Electrical Metallic Tubing (EMT)
NEMA FU 1	(2002; R 2007) Low Voltage Cartridge Fuses
NEMA ICS 1	(2000; R 2005; R 2008) Standard for Industrial Control and Systems: General Requirements
NEMA ICS 2	(2000; Errata 2006; R 2005; Errata 2008) Standard for Controllers, Contactors, and Overload Relays Rated 600 V
NEMA ICS 4	(2005) Industrial Control and Systems: Terminal Blocks

NEMA ICS 6	(1993; R 2001; R 2006) Standard for Enclosures
NEMA KS 1	(2001; R 2006) Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum)
NEMA MG 1	(2009) Motors and Generators
NEMA MG 10	(2001; R 2007) Energy Management Guide for Selection and Use of Fixed Frequency Medium AC Squirrel-Cage Polyphase Induction Motors
NEMA MG 11	(1977; R 2007) Energy Management Guide for Selection and Use of Single Phase Motors
NEMA TC 2	(2003) Standard for Electrical Polyvinyl Chloride (PVC) Tubing and Conduit
NEMA WD 1	(1999; R 2005) Standard for General Color Requirements for Wiring Devices
NEMA WD 6	(2002; R 2008) Standard for Wiring Devices - Dimensional Requirements
NEMA Z535.4	(2007; Errata 2007) Product Safety Signs and Labels

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2011) National Electrical Code
NFPA 70E	(2009; Errata 2009) Standard for Electrical Safety in the Workplace

UNDERWRITERS LABORATORIES (UL)

UL 1	(2005; Rev thru Jul 2007) Standard for Flexible Metal Conduit
UL 1063	(2006) Standard for Safety Machine-Tools Wires and Cables
UL 1449	(2006; Rev thru Sep 2009) Surge Protective Devices
UL 198M	(2003; Rev thru Oct 2007) Mine-Duty Fuses
UL 20	(2000 ; Rev thru Dec 2008) Standard for General-Use Snap Switches
UL 360	(2009; Rev thru Jun 2009) Liquid-Tight Flexible Steel Conduit
UL 4248	(2007) UL Standard for Safety Fuseholders
UL 44	(2005; Rev thru Nov 2005) Thermoset-Insulated Wires and Cables

UL 467	(2007) Standard for Grounding and Bonding Equipment
UL 486A-486B	(2003; Rev thru Apr 2009) Standard for Wire Connectors
UL 486C	(2004; Rev thru Apr 2009) Standard for Splicing Wire Connectors
UL 489	(2009) Standard for Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures
UL 498	(2001; Rev thru Jul 2009) Attachment Plugs and Receptacles
UL 50	(2007) Standard for Enclosures for Electrical Equipment
UL 506	(2000; Rev thru May 2006) Standard for Specialty Transformers
UL 508	(1999; Rev thru Sep 2008) Standard for Industrial Control Equipment
UL 510	(2005; Rev thru Aug 2005) Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape
UL 514B	(2004; Rev thru Aug 2007) Standard for Conduit, Tubing and Cable Fittings
UL 6	(2007) Standard for Electrical Rigid Metal Conduit-Steel
UL 651	(2005; Rev thru May 2007) Standard for Schedule 40 and 80 Rigid PVC Conduit and Fittings
UL 797	(2007) Standard for Electrical Metallic Tubing -- Steel
UL 83	(20086) Standard for Thermoplastic-Insulated Wires and Cables
UL 870	(1995; Rev thru Jul 2003) Standard for Wireways, Auxiliary Gutters, and Associated Fittings
UL 943	(2006; Rev thru Feb 2008) Ground-Fault Circuit-Interrupters
UL 984	(1996; Rev thru Sept 2005) Hermetic Refrigerant Motor-Compressors

1.2 DEFINITIONS

Unless otherwise specified or indicated, electrical and electronics terms

used in these specifications, and on the drawings, shall be as defined in IEEE Std 100.

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Circuit breakers

Switches

Submittals shall include performance and characteristic curves.

SD-06 Test Reports

600-volt wiring test

SD-10 Operation and Maintenance Data

Submit operation and maintenance data.

1.4 QUALITY ASSURANCE

1.4.1 Fuses

1.4.2 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship shall be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated.

1.4.3 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items shall be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

1.4.3.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.4.3.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site shall not be used, unless specified otherwise.

1.5 WARRANTY

The equipment items shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Materials, equipment, and devices shall, as a minimum, meet requirements of UL, where UL standards are established for those items, and requirements of NFPA 70.

2.2 CONDUIT AND FITTINGS

Shall conform to the following:

2.2.1 Rigid Metallic Conduit

2.2.1.1 Rigid, Threaded Zinc-Coated Steel Conduit

NEMA C80.1, UL 6.

2.2.2 Rigid Nonmetallic Conduit

PVC Type EPC-40 in accordance with NEMA TC 2, UL 651.

2.2.3 Electrical, Zinc-Coated Steel Metallic Tubing (EMT)

UL 797, NEMA C80.3.

2.2.4 Flexible Metal Conduit

UL 1.

2.2.4.1 Liquid-Tight Flexible Metal Conduit, Steel

UL 360.

2.2.5 Fittings for Metal Conduit, EMT, and Flexible Metal Conduit

UL 514B. Ferrous fittings shall be cadmium- or zinc-coated in accordance with UL 514B.

2.2.5.1 Fittings for Rigid Metal Conduit and IMC

Threaded-type. Split couplings unacceptable.

2.2.5.2 Fittings for EMT

Steel compression type.

2.3 CABINETS, JUNCTION BOXES, AND PULL BOXES

Volume greater than 100 cubic inches, UL 50, hot-dip, zinc-coated, if sheet steel.

2.4 WIRES AND CABLES

Wires and cables shall meet applicable requirements of NFPA 70 and UL for type of insulation, jacket, and conductor specified or indicated. Wires and cables manufactured more than 12 months prior to date of delivery to site shall not be used.

2.4.1 Conductors

Conductors No. 8 AWG and larger diameter shall be stranded. Conductors No. 10 AWG and smaller diameter shall be solid, except that conductors for remote control, alarm, and signal circuits, classes 1, 2, and 3, shall be stranded unless specifically indicated otherwise. Conductor sizes and capacities shown are based on copper, unless indicated otherwise. All conductors shall be copper. Larger diameter shall be either copper or aluminum, unless type of conductor material is specifically indicated, or specified, or required by equipment manufacturer.

2.4.1.1 Minimum Conductor Sizes

Minimum size for branch circuits shall be No. 12 AWG; for Class 1 remote-control and signal circuits, No. 14 AWG; for Class 2 low-energy, remote-control and signal circuits, No. 16 AWG; and for Class 3 low-energy, remote-control, alarm and signal circuits, No. 22 AWG.

2.4.2 Color Coding

Provide for service, feeder, branch, control, and signaling circuit conductors. Color shall be green for grounding conductors and white for neutrals; except where neutrals of more than one system are installed in same raceway or box, other neutrals shall be white with a different colored (not green) stripe for each. Color of ungrounded conductors in different voltage systems shall be as follows:

- a. 208/120 volt, three-phase
 - (1) Phase A - black
 - (2) Phase B - red
 - (3) Phase C - blue
- b. 480/277 volt, three-phase
 - (1) Phase A - brown
 - (2) Phase B - orange
 - (3) Phase C - yellow
- c. 120/240 volt, single phase: Black and red as required by NFPA 70

2.4.3 Insulation

Unless specified or indicated otherwise or required by NFPA 70, power and lighting wires shall be 600-volt, Type THWN/THHN conforming to UL 83, except that grounding wire may be type TW conforming to UL 83; remote-control and signal circuits shall be Type TW or TF, conforming to UL 83. Where lighting fixtures require 90-degree Centigrade (C) conductors, provide only conductors with 90-degree C insulation or better.

2.4.4 Bonding Conductors

ASTM B 1, solid bare copper wire for sizes No. 8 AWG and smaller diameter; ASTM B 8, Class B, stranded bare copper wire for sizes No. 6 AWG and larger diameter.

2.5 SPLICES AND TERMINATION COMPONENTS

UL 486A-486B for wire connectors and UL 510 for insulating tapes. Connectors for No. 10 AWG and smaller diameter wires shall be insulated, pressure-type in accordance with UL 486A-486B or UL 486C (twist-on splicing connector). Provide solderless terminal lugs on stranded conductors.

2.6 DEVICE PLATES

Provide UL listed, one-piece device plates for outlets to suit the devices installed. For metal outlet boxes, plates on unfinished walls shall be of zinc-coated sheet steel or cast metal having round or beveled edges. For nonmetallic boxes and fittings, other suitable plates may be provided. Plates on finished walls shall be nylon or lexan, minimum 0.03 inch wall thickness. Plates shall be same color as receptacle or toggle switch with which they are mounted. Screws shall be machine-type with countersunk heads in color to match finish of plate. Sectional type device plates will not be permitted. Plates installed in wet locations shall be gasketed and UL listed for "wet locations."

2.7 SWITCHES

2.7.1 Toggle Switches

NEMA WD 1, UL 20, single pole, double pole, three-way, and four-way, totally enclosed with bodies of thermoplastic or thermoset plastic and mounting strap with grounding screw. Handles shall be white thermoplastic. Wiring terminals shall be screw-type, side-wired or of the solderless pressure type having suitable conductor-release arrangement. Contacts shall be silver-cadmium and contact arm shall be one-piece copper alloy. Switches shall be rated quiet-type ac only, 120/277 volts, with current rating and number of poles indicated.

2.7.2 Disconnect Switches

NEMA KS 1. Provide heavy duty-type switches where indicated, where switches are rated higher than 240 volts, and for double-throw switches. Fused switches shall utilize Class R fuseholders and fuses, unless indicated otherwise. Switches serving as motor-disconnect means shall be horsepower rated. Provide switches in NEMA 1 enclosure per NEMA ICS 6.

2.8 FUSES

NEMA FU 1. Provide complete set of fuses for each fusible switch. Fuses

shall have voltage rating not less than circuit voltage.

2.8.1 Fuseholders

Provide in accordance with UL 4248.

2.8.2 Cartridge Fuses, Current Limiting Type (Class R)

UL 198M, Class RK-1 or RK-5. Associated fuseholders shall be Class R only.

2.8.3 Cartridge Fuses, High-Interrupting Capacity, Current Limiting Type (Classes J, L, and CC)

UL 198M, Class J for zero to 600 amperes, Class L for 601 to 6,000 amperes, and Class CC for zero to 30 amperes.

2.8.4 Cartridge Fuses, Current Limiting Type (Class T)

UL 198M, Class T for zero to 1,200 amperes, 300 volts; and zero to 800 amperes, 600 volts.

2.9 RECEPTACLES

UL 498, hard use, heavy-duty, grounding-type. Ratings and configurations shall be as indicated. Bodies shall be of ivory as per NEMA WD 1. Face and body shall be thermoplastic supported on a metal mounting strap. Dimensional requirements shall be per NEMA WD 6. Provide screw-type, side-wired wiring terminals. Connect grounding pole to mounting strap. The receptacle shall contain triple-wipe power contacts and double or triple-wipe ground contacts.

2.9.1 Ground-Fault Circuit Interrupter Receptacles

UL 943, duplex type for mounting in standard outlet box. Device shall be capable of detecting current leak of 6 milliamperes or greater and tripping per requirements of UL 943 for Class A GFI devices. Provide screw-type, side-wired wiring terminals or pre-wired (pigtail) leads.

2.10 CIRCUIT BREAKERS FOR EXISTING SWITCHBOARDS

2.10.1 Circuit Breakers

UL 489, thermal magnetic-type having a minimum short-circuit current rating equal to the short-circuit current rating of the panelboard in which the circuit breaker shall be mounted. Breaker terminals shall be UL listed as suitable for type of conductor provided. Series rated circuit breakers and plug-in circuit breakers without a self-contained bracket and not secured by a positive locking device requiring mechanical release for removal are unacceptable. Breakers shall have a short circuit rating of 65,000 amps to match the existing switchboard rating.

2.10.1.1 Multipole Breakers

Provide common trip-type with single operating handle. Breaker design shall be such that overload in one pole automatically causes all poles to open. Maintain phase sequence throughout each panel so that any three adjacent breaker poles are connected to Phases A, B, and C, respectively.

2.10.1.2 Circuit Breakers for HVAC Equipment

Circuit breakers for HVAC equipment having motors (group or individual) shall be marked for use with HACR type and UL listed as HACR type.

2.11 MOTOR SHORT-CIRCUIT PROTECTOR (MSCP)

Motor short-circuit protectors, also called motor circuit protectors (MCPs); shall conform to UL 508 and UL 489 and shall be provided as shown. MSCPs shall consist of an adjustable instantaneous trip circuit breaker used only in conjunction with a combination motor controller which provides coordinated motor branch-circuit overload and short-circuit protection. MSCPs shall be rated in accordance with the requirements of NFPA 70.

2.12 MOTORS

NEMA MG 1 hermetic-type sealed motor compressors shall also comply with UL 984. Provide the size in terms of HP, or kVA, or full-load current, or a combination of these characteristics, and other characteristics, of each motor as indicated or specified. Determine specific motor characteristics to ensure provision of correctly sized starters and overload heaters. Motors for operation on 208-volt, 3-phase circuits shall have terminal voltage rating of 200 volts, and those for operation on 480-volt, 3-phase circuits shall have terminal voltage rating of 460 volts. Motors shall be designed to operate at full capacity with voltage variation of plus or minus 10 percent of motor voltage rating. Unless otherwise indicated, motors rated 1 HP and above shall be continuous duty type.

Where fuse protection is specifically recommended by the equipment manufacturer, provide fused switches in lieu of non-fused switches indicated.

2.12.1 High Efficiency Single-Phase Motors

Single-phase fractional-horsepower alternating-current motors shall be high efficiency types corresponding to the applications listed in NEMA MG 11. In exception, for motor-driven equipment with a minimum seasonal or overall efficiency rating, such as a SEER rating, provide equipment with motor to meet the overall system rating indicated.

2.12.2 Premium Efficiency Polyphase Motors

Polyphase motors shall be selected based on high efficiency characteristics relative to typical characteristics and applications as listed in NEMA MG 10. In addition, continuous rated, polyphase squirrel-cage medium induction motors shall meet the requirements for premium efficiency electric motors in accordance with NEMA MG 1, including the NEMA full load efficiency ratings. In exception, for motor-driven equipment with a minimum seasonal or overall efficiency rating, such as a SEER rating, provide equipment with motor to meet the overall system rating indicated.

2.12.3 Motor Sizes

Provide size for duty to be performed, not exceeding the full-load nameplate current rating when driven equipment is operated at specified capacity under most severe conditions likely to be encountered. When motor size provided differs from size indicated or specified, make adjustments to wiring, disconnect devices, and branch circuit protection to accommodate equipment actually provided. Provide controllers for motors rated 1-hp and

above with electronic phase-voltage monitors designed to protect motors from phase-loss, undervoltage, and overvoltage. Provide protection for motors from immediate restart by a time adjustable restart relay.

2.12.4 Wiring and Conduit

Provide internal wiring for components of packaged equipment as an integral part of the equipment. Provide power wiring and conduit for field-installed equipment as specified herein. Power wiring and conduit shall conform to the requirements specified herein. Control wiring shall be provided under, and conform to the requirements of the section specifying the associated equipment.

2.13 MOTOR CONTROLLERS

UL 508, NEMA ICS 1, and NEMA ICS 2. Controllers shall have thermal overload protection in each phase and shall have one spare normally open and one spare normally closed auxiliary contact. Provide controllers for motors rated 1-hp and above with electronic phase-voltage monitors designed to protect motors from phase-loss, undervoltage, and overvoltage. Provide protection for motors from immediate restart by a time adjustable restart relay. Magnetic-type motor controllers shall have undervoltage protection when used with momentary-contact pushbutton stations or switches and shall have undervoltage release when used with maintained-contact pushbutton stations or switches. When used with pressure, float, or similar automatic-type or maintained-contact switch, controller shall have hand/off/automatic selector switch. Connections to selector switch shall be such that only normal automatic regulatory control devices are bypassed when switch is in "hand" position. Safety control devices, such as low and high pressure cutouts, high temperature cutouts, and motor overload protective devices, shall be connected in motor control circuit in "hand" and "automatic" positions. Control circuit connections to hand/off/automatic selector switch or to more than one automatic regulatory control device shall be made in accordance with indicated or manufacturer's approved wiring diagram. For each motor not in sight of controller or where controller disconnecting means is not in sight of motor location and driven machinery location, controller disconnecting means shall be capable of being locked in open position. As an alternative, provide a manually operated, lockable, nonfused switch which disconnects motor from supply source within sight of motor. Overload protective devices shall provide adequate protection to motor windings; be thermal inverse-time-limit type; and include manual reset-type pushbutton on outside of motor controller case. Cover of combination motor controller and manual switch or circuit breaker shall be interlocked with operating handle of switch or circuit breaker so that cover cannot be opened unless handle of switch or circuit breaker is in "off" position.

2.13.1 Control Wiring

All control wire shall be stranded tinned copper switchboard wire with 600-volt flame-retardant insulation Type SIS meeting UL 44, or Type MTW meeting UL 1063, and shall pass the VW-1 flame tests included in those standards. Hinge wire shall have Class K stranding. Current transformer secondary leads shall be not smaller than No. 10 AWG. The minimum size of control wire shall be No. 14 AWG. Power wiring for 480-volt circuits and below shall be of the same type as control wiring and the minimum size shall be No. 12 AWG. Special attention shall be given to wiring and terminal arrangement on the terminal blocks to permit the individual conductors of each external cable to be terminated on adjacent terminal

points.

2.13.2 Control Circuit Terminal Blocks

NEMA ICS 4. Control circuit terminal blocks for control wiring shall be molded or fabricated type with barriers, rated not less than 600 volts. The terminals shall be removable binding, fillister or washer head screw type, or of the stud type with contact and locking nuts. The terminals shall be not less than No. 10 in size and shall have sufficient length and space for connecting at least two indented terminals for 10 AWG conductors to each terminal. The terminal arrangement shall be subject to the approval of the Contracting Officer and not less than four (4) spare terminals or 10 percent, whichever is greater, shall be provided on each block or group of blocks. Modular, pull apart, terminal blocks will be acceptable provided they are of the channel or rail-mounted type. The Contractor shall submit data showing that the proposed alternate will accommodate the specified number of wires, are of adequate current-carrying capacity, and are constructed to assure positive contact between current-carrying parts.

2.13.2.1 Types of Terminal Blocks

- a. Short-Circuiting Type: Short-circuiting type terminal blocks shall be furnished for all current transformer secondary leads and shall have provision for shorting together all leads from each current transformer without first opening any circuit. Terminal blocks shall meet the requirements of paragraph CONTROL CIRCUIT TERMINAL BLOCKS above.
- b. Load Type: Load terminal blocks rated not less than 600 volts and of adequate capacity shall be provided for the conductors for NEMA Size 3 and smaller motor controllers and for other power circuits, except those for feeder tap units. The terminals shall be of either the stud type with contact nuts and locking nuts or of the removable screw type, having length and space for at least two indented terminals of the size required on the conductors to be terminated. For conductors rated more than 50 amperes, screws shall have hexagonal heads. Conducting parts between connected terminals shall have adequate contact surface and cross-section to operate without overheating. Each connected terminal shall have the circuit designation or wire number placed on or near the terminal in permanent contrasting color.

2.13.3 Control Circuits

Control circuits shall have maximum voltage of 120 volts derived from control transformer in same enclosure. Transformers shall conform to UL 506, as applicable. Transformers, other than transformers in bridge circuits, shall have primaries wound for voltage available and secondaries wound for correct control circuit voltage. Size transformers so that 80 percent of rated capacity equals connected load. Provide disconnect switch on primary side. One secondary lead shall be fused; other shall be grounded.

2.13.4 Enclosures for Motor Controllers

NEMA ICS 6.

2.14 LOCKOUT REQUIREMENTS

Provide disconnecting means capable of being locked out for machines and other equipment to prevent unexpected startup or release of stored energy in accordance with 29 CFR 1910.147. Mechanical isolation of machines and other equipment shall be in accordance with requirements of Division 23, "Mechanical."

2.15 GROUNDING AND BONDING EQUIPMENT

2.15.1 Ground Rods

UL 467. Ground rods shall be sectional type, copper-clad steel, with minimum diameter of 3/4 inch and minimum length of 10 feet.

2.16 MANUFACTURER'S NAMEPLATE

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

2.17 FIELD FABRICATED NAMEPLATES

ASTM D 709. Provide laminated plastic nameplates for each equipment enclosure, relay, switch, and device; as specified or as indicated on the drawings. Each nameplate inscription shall identify the function and, when applicable, the position. Nameplates shall be melamine plastic, 0.125 inch thick, white with black center core. Surface shall be matte finish. Corners shall be square. Accurately align lettering and engrave into the core. Minimum size of nameplates shall be one by 2.5 inches. Lettering shall be a minimum of 0.25 inch high normal block style.

2.18 WARNING SIGNS

Provide warning signs for flash protection in accordance with NFPA 70E and NEMA Z535.4 for switchboards, panelboards, industrial control panels, and motor control centers that are in other than dwelling occupancies and are likely to require examination, adjustment, servicing, or maintenance while energized. Provide field installed signs to warn qualified persons of potential electric arc flash hazards when warning signs are not provided by the manufacturer. The marking shall be clearly visible to qualified persons before examination, adjustment, servicing, or maintenance of the equipment.

2.19 FIRESTOPPING MATERIALS

Provide firestopping around electrical penetrations.

2.20 WIREWAYS

UL 870. Material shall be steel 16 gauge for heights and depths up to 6 by 6 inches, and 14 gauge for heights and depths up to 12 by 12 inches. Provide in length required for the application with screw-cover NEMA 1, enclosure per NEMA ICS 6.

2.21 SURGE PROTECTIVE DEVICES

Provide parallel type surge protective devices which comply with UL 1449 at

panelboards. Provide surge protectors in a NEMA 1 enclosure per NEMA ICS 6. Provide the following modes of protection:

FOR SINGLE PHASE AND THREE PHASE WYE CONNECTED SYSTEMS-
 Each phase to neutral (L-N)
 Neutral to ground (N-G)
 Phase to ground (L-G)

Surge protective devices at the service entrance shall have a minimum surge current rating of 80,000 amperes per mode minimum. The maximum line to neutral (L-N) Suppressed Voltage Rating (SVR) shall be:

500V for 120V, single phase system
 500V for 120/240V, single phase system
 500V for 208Y/120V, three phase system
 900V for 480Y/277V, three phase system

The minimum MCOV (Maximum Continuous Operating Voltage) rating shall be:

150V for 120V, single phase system
 300/150V for 120/240V, single phase system
 300/150V for 208Y/120V, three phase system
 600/320V for 480Y/277V, three phase system

EMI/RFI filtering shall be provided for each mode with the capability to attenuate high frequency noise. Minimum attenuation shall be 20db.

2.22 FACTORY APPLIED FINISH

Electrical equipment shall have factory-applied painting systems which shall, as a minimum, meet the requirements of NEMA 250 corrosion-resistance test and the additional requirements as specified herein. Interior and exterior steel surfaces of equipment enclosures shall be thoroughly cleaned and then receive a rust-inhibitive phosphatizing or equivalent treatment prior to painting. Exterior surfaces shall be free from holes, seams, dents, weld marks, loose scale or other imperfections. Interior surfaces shall receive not less than one coat of corrosion-resisting paint in accordance with the manufacturer's standard practice. Exterior surfaces shall be primed, filled where necessary, and given not less than two coats baked enamel with semigloss finish. Equipment located indoors shall be ANSI Light Gray, and equipment located outdoors shall be ANSI Dark Gray. Provide manufacturer's coatings for touch-up work and as specified in paragraph FIELD APPLIED PAINTING.

PART 3 EXECUTION

3.1 INSTALLATION

Electrical installations, including weatherproof and hazardous locations and ducts, plenums and other air-handling spaces, shall conform to requirements of NFPA 70 and IEEE C2 and to requirements specified herein.

3.1.1 Underground Conductors

Underground conductors and associated conduit shall be continuous from switchboard equipment to outdoor HVAC system connection.

3.1.2 Labels

Wherever work results in service entrance disconnect devices in more than one enclosure, as permitted by NFPA 70, each enclosure, new and existing, shall be labeled as one of several enclosures containing service entrance disconnect devices. Label, at minimum, shall indicate number of service entrance disconnect devices housed by enclosure and shall indicate total number of enclosures that contain service disconnect devices. Provide laminated plastic labels conforming to paragraph FIELD FABRICATED NAMEPLATES. Use lettering of at least 0.25 inch in height, and engrave on black-on-white matte finish. Service entrance disconnect devices in more than one enclosure, shall be provided only as permitted by NFPA 70.

3.1.3 Wiring Methods

Provide insulated conductors installed in rigid steel conduit, IMC, rigid nonmetallic conduit, or EMT, except where specifically indicated or specified otherwise or required by NFPA 70 to be installed otherwise. Grounding conductor shall be separate from electrical system neutral conductor. Provide insulated green equipment grounding conductor for circuit(s) installed in conduit and raceways. Minimum conduit size shall be 1/2 inch in diameter for low voltage lighting and power circuits. Vertical distribution in multiple story buildings shall be made with metal conduit in fire-rated shafts. Metal conduit shall extend through shafts for minimum distance of 6 inches. Conduit which penetrates fire-rated walls, fire-rated partitions, or fire-rated floors shall be firestopped.

3.1.3.1 Pull Wire

Install pull wires in empty conduits. Pull wire shall be plastic having minimum 890-N (200-pound) 200-pound force tensile strength. Leave minimum 915 mm (36 inches) 36 inches of slack at each end of pull wire.

3.1.4 Conduit Installation

Unless indicated otherwise, conceal conduit under floor slabs and within finished walls, ceilings, and floors. Keep conduit minimum 6 inches away from parallel runs of flues and steam or hot water pipes. Install conduit parallel with or at right angles to ceilings, walls, and structural members where located above accessible ceilings and where conduit will be visible after completion of project.

3.1.4.1 Restrictions Applicable to Aluminum Conduit

- a. Do not install underground or encase in concrete or masonry.
- b. Do not use brass or bronze fittings.
- c. Do not use when the enclosed conductors must be shielded from the effects of High-altitude Electromagnetic Pulse (HEMP).

3.1.4.2 Restrictions Applicable to EMT

- a. Do not install underground.
- b. Do not encase in concrete, mortar, grout, or other cementitious materials.

- c. Do not use in areas subject to severe physical damage including but not limited to equipment rooms where moving or replacing equipment could physically damage the EMT.
- d. Do not use in hazardous areas.
- e. Do not use outdoors.
- f. Do not use in fire pump rooms.
- g. Do not use when the enclosed conductors must be shielded from the effects of High-altitude Electromagnetic Pulse (HEMP).

3.1.4.3 Restrictions Applicable to Nonmetallic Conduit

a. PVC Schedule 40 and PVC Schedule 80

(1) Do not use in areas where subject to severe physical damage, including but not limited to, mechanical equipment rooms, electrical equipment rooms, hospitals, power plants, missile magazines, and other such areas.

(2) Do not use in hazardous (classified) areas.

(3) Do not use in fire pump rooms.

(4) Do not use in penetrating fire-rated walls or partitions, or fire-rated floors.

(5) Do not use above grade, except where allowed in this section for rising through floor slab or indicated otherwise.

(6) Do not use when the enclosed conductors must be shielded from the effects of High-altitude Electromagnetic Pulse (HEMP).

3.1.4.4 Restrictions Applicable to Flexible Conduit

Use only as specified in paragraph FLEXIBLE CONNECTIONS. Do not use when the enclosed conductors must be shielded from the effects of High-altitude Electromagnetic Pulse (HEMP).

3.1.4.5 Underground Conduit

Plastic-coated rigid steel; plastic-coated steel IMC; PVC, Type EPC-40. Plastic coating shall extend minimum 150 mm 6 inches above floor.

3.1.4.6 Conduit Installed Under Floor Slabs

Conduit run under floor slab shall be located a minimum of (12 inches) 12 inches below the vapor barrier. Seal around conduits at penetrations thru vapor barrier.

3.1.4.7 Conduit Through Floor Slabs

Where conduits rise through floor slabs, curved portion of bends shall not be visible above finished slab.

3.1.4.8 Stub-Ups

Provide conduits stubbed up through concrete floor for connection to free-standing equipment with adjustable top or coupling threaded inside for plugs, set flush with finished floor. Extend conductors to equipment in rigid steel conduit, except that flexible metal conduit may be used 150 mm (6 inches) 6 inches above floor. Where no equipment connections are made, install screwdriver-operated threaded flush plugs in conduit end.

3.1.4.9 Conduit Support

Support conduit by pipe straps, wall brackets, hangers, or ceiling trapeze. Fasten by wood screws to wood; by toggle bolts on hollow masonry units; by concrete inserts or expansion bolts on concrete or brick; and by machine screws, welded threaded studs, or spring-tension clamps on steel work. Threaded C-clamps may be used on rigid steel conduit only. Do not weld conduits or pipe straps to steel structures. Load applied to fasteners shall not exceed one-fourth proof test load. Fasteners attached to concrete ceiling shall be vibration resistant and shock-resistant. Holes cut to depth of more than 1 1/2 inches in reinforced concrete beams or to depth of more than 3/4 inch in concrete joints shall not cut main reinforcing bars. Fill unused holes. In partitions of light steel construction, use sheet metal screws. In suspended-ceiling construction, run conduit above ceiling. Do not support conduit by ceiling support system. Conduit and box systems shall be supported independently of both (a) tie wires supporting ceiling grid system, and (b) ceiling grid system into which ceiling panels are placed. Supporting means shall not be shared between electrical raceways and mechanical piping or ducts. Installation shall be coordinated with above-ceiling mechanical systems to assure maximum accessibility to all systems. Spring-steel fasteners may be used for lighting branch circuit conduit supports in suspended ceilings in dry locations. Where conduit crosses building expansion joints, provide suitable expansion fitting that maintains conduit electrical continuity by bonding jumpers or other means. For conduits greater than 2 1/2 inches inside diameter, provide supports to resist forces of 0.5 times the equipment weight in any direction and 1.5 times the equipment weight in the downward direction.

3.1.4.10 Directional Changes in Conduit Runs

Make changes in direction of runs with symmetrical bends or cast-metal fittings. Make field-made bends and offsets with hickey or conduit-bending machine. Do not install crushed or deformed conduits. Avoid trapped conduits. Prevent plaster, dirt, or trash from lodging in conduits, boxes, fittings, and equipment during construction. Free clogged conduits of obstructions.

3.1.4.11 Locknuts and Bushings

Fasten conduits to sheet metal boxes and cabinets with two locknuts where required by NFPA 70, where insulated bushings are used, and where bushings cannot be brought into firm contact with the box; otherwise, use at least minimum single locknut and bushing. Locknuts shall have sharp edges for digging into wall of metal enclosures. Install bushings on ends of conduits, and provide insulating type where required by NFPA 70.

3.1.4.12 Flexible Connections

Provide flexible steel conduit between 3 and 6 feet in length for recessed

and semirecessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for motors. Install flexible conduit to allow 20 percent slack. Minimum flexible steel conduit size shall be 1/2 inch diameter. Provide liquidtight flexible conduit in wet and damp locations for equipment subject to vibration, noise transmission, movement or motors. Provide separate ground conductor across flexible connections.

3.1.5 Boxes, Outlets, and Supports

Provide boxes in wiring and raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures. Boxes for metallic raceways shall be cast-metal, hub-type when located in wet locations, when surface mounted on outside of exterior surfaces, and when specifically indicated. Boxes in other locations shall be sheet steel, except that aluminum boxes may be used with aluminum conduit, and nonmetallic boxes may be used with nonmetallic conduit system. Each box shall have volume required by NFPA 70 for number of conductors enclosed in box. Boxes for mounting lighting fixtures shall be minimum 100 mm (4 inches) 4 inches square, or octagonal, except that smaller boxes may be installed as required by fixture configurations, as approved. Boxes for use in masonry-block or tile walls shall be square-cornered, tile-type, or standard boxes having square-cornered, tile-type covers. Provide gaskets for cast-metal boxes installed in wet locations and boxes installed flush with outside of exterior surfaces. Provide separate boxes for flush or recessed fixtures when required by fixture terminal operating temperature; fixtures shall be readily removable for access to boxes unless ceiling access panels are provided. Support boxes and pendants for surface-mounted fixtures on suspended ceilings independently of ceiling supports. Fasten boxes and supports with wood screws on wood, with bolts and expansion shields on concrete or brick, with toggle bolts on hollow masonry units, and with machine screws or welded studs on steel. In open overhead spaces, cast boxes threaded to raceways need not be separately supported except where used for fixture support; support sheet metal boxes directly from building structure or by bar hangers. Where bar hangers are used, attach bar to raceways on opposite sides of box, and support raceway with approved-type fastener maximum 610 mm 24 inches from box. When penetrating reinforced concrete members, avoid cutting reinforcing steel.

3.1.5.1 Boxes

Boxes for use with raceway systems shall be minimum 40 mm (1 1/2 inches) 1 1/2 inches deep, except where shallower boxes required by structural conditions are approved. Boxes for other than lighting fixture outlets shall be minimum 100 mm (4 inches) 4 inches square, except that 100 by 50 mm (4 by 2 inch) 4 by 2 inch boxes may be used where only one raceway enters outlet. Telecommunications outlets shall be a minimum of 100 mm square by 54 mm deep (4 inches square by 2 1/8 inches deep) 120 mm square by 54 mm deep (4 11/16 inches square by 2 1/8 inches) 4 inches square by 2 1/8 inches deep. Mount outlet boxes flush in finished walls.

3.1.5.2 Pull Boxes

Construct of at least minimum size required by NFPA 70. Provide boxes with screw-fastened covers. Where several feeders pass through common pull box, tag feeders to indicate clearly electrical characteristics, circuit number, and panel designation.

3.1.5.3 Extension Rings

Extension rings are not permitted for new construction. Use only on existing boxes in concealed conduit systems where wall is furred out for new finish.

3.1.6 Mounting Heights

Mount panelboards, circuit breakers, and disconnecting switches so height of operating handle at its highest position is maximum 78 inches above floor. Mount lighting switches 48 inches above finished floor. Mount receptacles and telecommunications outlets 18 inches above finished floor, unless otherwise indicated. Wall-mounted telecommunications outlets shall be mounted at height 1525 mm 60 inches above finished floor. Mount other devices as indicated. Measure mounting heights of wiring devices and outlets in non-hazardous areas to center of device or outlet.

3.1.7 Marking Strips

White or other light-colored plastic marking strips, fastened by screws to each terminal block, shall be provided for wire designations. The wire numbers shall be made with permanent ink. The marking strips shall be reversible to permit marking both sides, or two marking strips shall be furnished with each block. Marking strips shall accommodate the two sets of wire numbers. Each device to which a connection is made shall be assigned a device designation in accordance with NEMA ICS 1 and each device terminal to which a connection is made shall be marked with a distinct terminal marking corresponding to the wire designation used on the Contractor's schematic and connection diagrams. The wire (terminal point) designations used on the Contractor's wiring diagrams and printed on terminal block marking strips may be according to the Contractor's standard practice; however, additional wire and cable designations for identification of remote (external) circuits shall be provided for the Government's wire designations. Prints of the marking strips drawings submitted for approval will be so marked and returned to the Contractor for addition of the designations to the terminal strips and tracings, along with any rearrangement of points required.

3.1.8 Splices

Make splices in accessible locations. Make splices in conductors No. 10 AWG and smaller diameter with insulated, pressure-type connector. Make splices in conductors No. 8 AWG and larger diameter with solderless connector, and cover with insulation material equivalent to conductor insulation.

3.1.9 Termination to Copper Bus

Terminate aluminum conductors to copper bus either by: (a) inline splicing a copper pigtail, of ampacity at least that of aluminum conductor, or (b)utilizing circumferential, compression-type, aluminum-bodied terminal lug UL listed for AL/CU, and steel Belleville cadmium-plated hardened steel spring washers, flat washers, bolts, and nuts. Carefully install Belleville spring washers with crown up toward nut or bolt head, with concave side of Belleville bearing on heavy-duty, wide series flat washer of larger diameter than Belleville. Tighten nuts sufficiently to flatten Belleville, and leave in position. Lubricate hardware with joint compound prior to making connection. Wire brush and apply joint compound to conductor prior to inserting in lug.

3.1.10 Covers and Device Plates

Install with edges in continuous contact with finished wall surfaces without use of mats or similar devices. Plaster fillings are not permitted. Install plates with alignment tolerance of 1/16 inch. Use of sectional-type device plates are not permitted. Provide gasket for plates installed in wet locations.

3.1.11 Electrical Penetrations

Seal openings around electrical penetrations through fire resistance-rated walls, partitions, floors, or ceilings.

3.1.12 Grounding and Bonding

Provide in accordance with NFPA 70. Ground exposed, non-current-carrying metallic parts of electrical equipment, metallic raceway systems, grounding conductor in metallic and nonmetallic raceways, telecommunications system grounds, and neutral conductor of wiring systems.

3.1.12.1 Ground Rods

Provide cone pointed ground rods. The resistance to ground shall be measured using the fall-of-potential method described in IEEE 81. The maximum resistance of a driven ground shall not exceed 25 ohms under normally dry conditions. If this resistance cannot be obtained with a single rod, additional rods not less than 1830 mm (6 feet) 6 feet on centers, If the resultant resistance exceeds 25 ohms measured not less than 48 hours after rainfall, notify the Contracting Officer who will decide on the number of ground rods to add.

3.1.12.2 Grounding Connections

Make grounding connections which are buried or otherwise normally inaccessible, by exothermic weld or compression connector.

- a. Make exothermic welds strictly in accordance with the weld manufacturer's written recommendations. Welds which are "puffed up" or which show convex surfaces indicating improper cleaning are not acceptable. Mechanical connectors are not required at exothermic welds.
- b. Make compression connections using a hydraulic compression tool to provide the correct circumferential pressure. Tools and dies shall be as recommended by the manufacturer. An embossing die code or other standard method shall provide visible indication that a connector has been adequately compressed on the ground wire.

3.1.13 Equipment Connections

Provide power wiring for the connection of motors and control equipment under this section of the specification. Except as otherwise specifically noted or specified, automatic control wiring, control devices, and protective devices within the control circuitry are not included in this section of the specifications but shall be provided under the section specifying the associated equipment.

3.1.14 Repair of Existing Work

Repair of existing work, shall be performed as follows:

3.1.14.1 Workmanship

Lay out work in advance. Exercise care where cutting, channeling, chasing, or drilling of floors, walls, partitions, ceilings, or other surfaces is necessary for proper installation, support, or anchorage of conduit, raceways, or other electrical work. Repair damage to buildings, piping, and equipment using skilled craftsmen of trades involved.

3.1.14.2 Existing Concealed Wiring to be Removed

Existing concealed wiring to be removed shall be disconnected from its source. Remove conductors; cut conduit flush with floor, underside of floor, and through walls; and seal openings.

3.1.15 Surge Protective Devices

Connect the surge protective devices in parallel to the power source, keeping the conductors as short and straight as practically possible.

3.2 FIELD FABRICATED NAMEPLATE MOUNTING

Provide number, location, and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two sheet-metal screws or two rivets.

3.3 WARNING SIGN MOUNTING

Provide the number of signs required to be readable from each accessible side. Space the signs in accordance with NFPA 70E.

3.4 FIELD APPLIED PAINTING

Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria.

3.5 FIELD QUALITY CONTROL

Furnish test equipment and personnel and submit written copies of test results. Give Contracting Officer 5 working days notice prior to each test.

3.5.1 Devices Subject to Manual Operation

Each device subject to manual operation shall be operated at least five times, demonstrating satisfactory operation each time.

3.5.2 600-Volt Wiring Test

Test wiring rated 600 volt and less to verify that no short circuits or accidental grounds exist. Perform insulation resistance tests on wiring No. 6 AWG and larger diameter using instrument which applies voltage of approximately 500 volts to provide direct reading of resistance. Minimum resistance shall be 250,000 ohms.

3.5.3 Ground-Fault Receptacle Test

Test ground-fault receptacles with a "load" (such as a plug in light) to verify that the "line" and "load" leads are not reversed.

3.5.4 Grounding System Test

Test grounding system to ensure continuity, and that resistance to ground is not excessive. Test each ground rod for resistance to ground before making connections to rod; tie grounding system together and test for resistance to ground. Make resistance measurements in dry weather, not earlier than 48 hours after rainfall. Submit written results of each test to Contracting Officer, and indicate location of rods as well as resistance and soil conditions at time measurements were made.

-- End of Section --