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SECTION 00 01 15

LIST OF DRAWINGS

02/11

PART 1 GENERAL

1.1 SUMMARY

This document lists the drawings for the project pursuant to contract clause "DFARS 252.236-7001, Contract Drawings, Maps and Specifications."

1.1.1 DFARS 252.236.7001, CONTRACT DRAWINGS, MAPS AND SPECIFICATIONS (AUG 2000)

(a) The Government will provide to the Contractor, without charge, one set of contract drawings and specifications, except publications incorporated into the technical provisions by reference, in electronic or paper media as chosen by the Contracting Officer.

(b) The Contractor shall-

- (1) Check all drawings furnished immediately upon receipt;
- (2) Compare all drawings and verify the figures before laying out the work;
- (3) Promptly notify the Contracting Officer of any discrepancies;
- (4) Be responsible for any errors that might have been avoided by complying with this paragraph (b); and
- (5) Reproduce and print contract drawings and specifications as needed.

(c) In general-

- (1) Large-scale drawings shall govern small-scale drawings; and
- (2) The Contractor shall follow figures marked on drawings in preference to scale measurements.

(d) Omissions from the drawings or specifications or the misdescription of details of work that are manifestly necessary to carry out the intent of the drawings and specifications, or that are customarily performed, shall not relieve the Contractor from performing such omitted or misdescribed details of the work. The Contractor shall perform such details as if fully and correctly set forth and described in the drawings and specifications.

(e) The work shall conform to the specifications and the contract drawings.

Contract drawings for Project CP12024M are as follows:

DRAWING NO.	NAVFAC DWG NO.	TITLE
G-001	12618363	COVER SHEET

DRAWING NO.	NAVFAC DWG NO.	TITLE
G-002	12618364	INDEX OF DRAWINGS
G-003	12618365	FIRST FLOOR PHASING PLAN
G-004	12618366	SECOND FLOOR PHASING PLAN
H-101	12618367	FIRST FLOOR SAMPLE AND MATERIAL LOCATIONS
H-102	12618368	SECOND FLOOR SAMPLE AND MATERIAL LOCATIONS
H-103	12618369	ROOF SAMPLE AND MATERIAL LOCATIONS
S-001	12618370	GENERAL NOTES
S-101	12618371	PARTIAL ROOF FRAMING PLAN
S-102	12618372	PARTIAL & ENLARGED ROOF FRAMING PLANS
S-103	12618373	ENLARGED STAIR PLANS
S-201	12618374	SECTIONS & DETAILS
S-202	12618375	SECTIONS & DETAILS
A-100	12618376	GENERAL NOTES, ABBREVIATIONS AND SYMBOLS
AD101	12618377	PARTIAL FIRST FLOOR REFLECTED CEILING PLAN - DEMOLITION
AD102	12618378	PARTIAL FIRST FLOOR REFLECTED CEILING PLAN - DEMOLITION
AD103	12618379	SECOND FLOOR REFLECTED CEILING PLAN - DEMOLITION
AD104	12618380	PARTIAL ROOF PLAN - DEMOLITION
AD105	12618381	PARTIAL ROOF PLAN - DEMOLITION
AD201	12618382	ELEVATIONS - DEMOLITION
AD901	12618383	PHOTOS
A-101	12618384	PARTIAL FIRST FLOOR REFLECTED CEILING PLAN - NEW WORK
A-102	12618385	PARTIAL FIRST FLOOR REFLECTED CEILING PLAN - NEW WORK
A-103	12618386	PARTIAL FIRST FLOOR REFLECTED CEILING PLAN - NEW WORK
A-104	12618387	PARTIAL FIRST FLOOR REFLECTED CEILING PLAN - NEW WORK
A-105	12618388	PARTIAL FIRST FLOOR REFLECTED CEILING PLAN - NEW WORK
A-106	12618389	PARTIAL FIRST FLOOR REFLECTED CEILING PLAN - NEW WORK
A-107	12618390	SECOND FLOOR REFLECTED CEILING PLAN - NEW WORK
A-108	12618391	SECOND FLOOR REFLECTED CEILING PLAN - NEW WORK
A-109	12618392	PARTIAL ROOF PLAN - NEW WORK
A-110	12618393	PARTIAL ROOF PLAN - NEW WORK
A-201	12618394	ELEVATIONS - NEW WORK
A-501	12618395	ROOF DETAILS
A-502	12618396	ROOF DETAILS
A-503	12618397	STAIR DETAILS
A-504	12618398	STAIR DETAILS
A-601	12618399	WINDOW TYPES AND DETAILS
FA001	12618400	LEGEND, NOTES NOTES AND RISER DIAGRAMS
FA501	12618401	DETAILS
M-001	12618402	LEGEND AND ABBREVIATIONS
MD101	12618403	PARTIAL FIRST FLOOR DUCTWORK PLAN - DEMOLITION
MD102	12618404	PARTIAL FIRST FLOOR DUCTWORK PLAN - DEMOLITION
MD103	12618405	PARTIAL FIRST FLOOR DUCTWORK PLAN - DEMOLITION
MD104	12618406	PARTIAL FIRST FLOOR DUCTWORK PLAN - DEMOLITION
MD105	12618407	PARTIAL FIRST FLOOR DUCTWORK PLAN - DEMOLITION
MD106	12618408	PARTIAL FIRST FLOOR DUCTWORK PLAN - DEMOLITION
MD107	12618409	PARTIAL SECOND FLOOR DUCTWORK PLAN - DEMOLITION
MD108	12618410	PARTIAL SECOND FLOOR DUCTWORK PLAN - DEMOLITION
MD109	12618411	PARTIAL FIRST FLOOR PIPING PLAN - DEMOLITION

DRAWING NO.	NAVFAC DWG NO.	TITLE
MD110	12618412	PARTIAL FIRST FLOOR PIPING PLAN - DEMOLITION
MD111	12618413	PARTIAL FIRST FLOOR PIPING PLAN - DEMOLITION
MD112	12618414	PARTIAL FIRST FLOOR PIPING PLAN - DEMOLITION
MD113	12618415	PARTIAL FIRST FLOOR PIPING PLAN - DEMOLITION
MD114	12618416	PARTIAL FIRST FLOOR PIPING PLAN - DEMOLITION
MD115	12618417	PARTIAL ROOF PLAN - DEMOLITION
MD116	12618418	PARTIAL ROOF PLAN - DEMOLITION
MD117	12618419	MEZZANINE ROOF PLAN - DEMOLITION
MD401	12618420	ENLARGED FIRST FLOOR PLAN - DEMOLITION
MD402	12618421	ENLARGED FIRST FLOOR PLAN - DEMOLITION
MD403	12618422	ENLARGED FIRST FLOOR PLAN - DEMOLITION
M-101	12618423	PARTIAL FIRST FLOOR DUCTWORK PLAN - NEW WORK
M-102	12618424	PARTIAL FIRST FLOOR DUCTWORK PLAN - NEW WORK
M-103	12618425	PARTIAL FIRST FLOOR DUCTWORK PLAN - NEW WORK
M-104	12618426	PARTIAL FIRST FLOOR DUCTWORK PLAN - NEW WORK
M-105	12618427	PARTIAL FIRST FLOOR DUCTWORK PLAN - NEW WORK
M-106	12618428	PARTIAL FIRST FLOOR DUCTWORK PLAN - NEW WORK
M-107	12618429	PARTIAL SECOND FLOOR DUCTWORK PLAN - NEW WORK
M-108	12618430	PARTIAL SECOND FLOOR DUCTWORK PLAN - NEW WORK
M-109	12618431	PARTIAL FIRST FLOOR PIPING PLAN - NEW WORK
M-110	12618432	PARTIAL FIRST FLOOR PIPING PLAN - NEW WORK
M-111	12618433	PARTIAL FIRST FLOOR PIPING PLAN - NEW WORK
M-112	12618434	PARTIAL FIRST FLOOR PIPING PLAN - NEW WORK
M-113	12618435	PARTIAL FIRST FLOOR PIPING PLAN - NEW WORK
M-114	12618436	PARTIAL FIRST FLOOR PIPING PLAN - NEW WORK
M-115	12618437	PARTIAL SECOND FLOOR PIPING PLAN - NEW WORK
M-116	12618438	PARTIAL SECOND FLOOR PIPING PLAN - NEW WORK
M-117	12618439	PARTIAL ROOF PLAN - NEW WORK
M-118	12618440	PARTIAL ROOF PLAN - NEW WORK
M-119	12618441	MEZZANINE ROOF PLAN - NEW WORK
M-401	12618442	ENLARGED FIRST FLOOR PLAN - NEW WORK
M-402	12618443	ENLARGED FIRST FLOOR PLAN - NEW WORK
M-501	12618444	DETAILS
M-502	12618445	DETAILS
M-503	12618446	DETAILS
M-504	12618447	DETAILS
M-505	12618448	DETAILS
M-506	12618449	DETAILS
M-601	12618450	SCHEDULES
M-602	12618451	SCHEDULES
M-603	12618452	SCHEDULES
M-604	12618453	DIAGRAMS
M-605	12618454	DIAGRAMS
M-701	12618455	CONTROLS
M-702	12618456	CONTROLS
M-703	12618457	CONTROLS
M-704	12618458	CONTROLS
M-705	12618459	CONTROLS
M-706	12618460	CONTROLS
M-901	12618461	PHOTOGRAPHS
M-902	12618462	PHOTOGRAPHS
E-001	12618463	LEGEND AND ABBREVIATIONS
ED101	12618464	PARTIAL FIRST FLOOR LIGHTING PLAN - DEMOLITION
ED102	12618465	PARTIAL FIRST FLOOR LIGHTING PLAN - DEMOLITION
ED103	12618466	SECOND FLOOR LIGHTING PLAN - DEMOLITION
ED104	12618467	PARTIAL FIRST FLOOR HVAC POWER PLAN - DEMOLITION

DRAWING NO.	NAVFAC DWG NO.	TITLE
ED105	12618468	PARTIAL FIRST FLOOR HVAC POWER PLAN - DEMOLITION
ED106	12618469	SECOND FLOOR HVAC POWER PLAN - DEMOLITION
ED107	12618470	PARTIAL ROOF PLAN - DEMOLITION
ED108	12618471	PARTIAL ROOF PLAN - DEMOLITION
ED109	12618472	MEZZANINE ROOF PLAN - DEMOLITION
ED401	12618473	ENLARGED FIRST FLOOR PLAN - DEMOLITION
E-101	12618474	PARTIAL FIRST FLOOR LIGHTING PLAN - NEW WORK
E-102	12618475	PARTIAL FIRST FLOOR LIGHTING PLAN - NEW WORK
E-103	12618476	SECOND FLOOR LIGHTING PLAN - NEW WORK
E-104	12618477	PARTIAL FIRST FLOOR HVAC POWER PLAN - NEW WORK
E-105	12618478	PARTIAL FIRST FLOOR HVAC POWER PLAN - NEW WORK
E-106	12618479	SECOND FLOOR HVAC POWER PLAN - NEW WORK
E-107	12618480	PARTIAL ROOF PLAN - NEW WORK
E-108	12618481	PARTIAL ROOF PLAN - NEW WORK
E-401	12618482	ENLARGED FIRST FLOOR PLAN - NEW WORK
E-501	12618483	DETAILS
E-502	12618484	DETAILS
E-601	12618485	SCHEDULES
E-901	12618486	PHOTOGRAPHS

Contract drawings for Project WR5899390 (hangar bay lighting portion of Project CP12024M) are as follows:

DRAWING NO.	NAVFAC DWG NO.	TITLE
G-001	12618719	TITLE SHEET/INDEX OF DRAWINGS
E-001	12618720	ELECTRICAL LEGEND AND GENERAL NOTES
E-101	12618721	ELECTRICAL LIGHTING DEMOLITION PLAN
E-102	12618722	ELECTRICAL LIGHTING DEMOLITION PLAN
E-103	12618723	ELECTRICAL LIGHTING NEW WORK PLAN
E-104	12618724	ELECTRICAL LIGHTING NEW WORK PLAN
E-501	12618725	ELECTRICAL DETAILS AND SCHEDULES
E-502	12618726	ELECTRICAL DETAILS
E-503	12618727	ELECTRICAL SCHEDULES

-- End of Document --

SECTION 01 11 00

SUMMARY OF WORK

08/11

PART 1 GENERAL

1.1 WORK COVERED BY CONTRACT DOCUMENTS

1.1.1 Project Description

The work for Project CP12024M includes replacement of roof, HVAC, office and workshop lights, windows, and incidental related work. The work for Project WR5899390 includes replacement of hangar bay lighting and incidental related work.

1.1.2 Location

The work shall be located at the facility, approximately as indicated. The exact location will be shown by the Contracting Officer.

1.2 OCCUPANCY OF PREMISES

Building will be occupied during performance of work under this Contract. Occupancy notifications will be posted in a prominent location in the work area.

Before work is started, the Contractor shall arrange with the Contracting Officer a sequence of procedure, means of access, space for storage of materials and equipment, and use of approaches, corridors, and stairways.

1.3 EXISTING WORK

In addition to "FAR 52.236-9, Protection of Existing Vegetation, Structures, Equipment, Utilities, and Improvements":

- a. Remove or alter existing work in such a manner as to prevent injury or damage to any portions of the existing work which remain.
- b. Repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work, as approved by the Contracting Officer. At the completion of operations, existing work shall be in a condition equal to or better than that which existed before new work started.

1.4 LOCATION OF UNDERGROUND FACILITIES

It shall be the responsibility of the contractor to locate all existing underground utilities that are within the limits of work, prior to any excavation activities. These include but are not limited to the following buried utilities: water lines, sanitary and storm sewers, steam condensate, fuel lines, gas lines, electrical ducts and direct buried conductors, commercial telephone, Base telephone, commercial cable TV, Base instructional cable TV, EMCS and fire alarm. The contractor shall employ the services of a qualified Utility locating company to locate, identify, and mark all underground utilities. The entire construction limits shall be thoroughly scanned and researched to determine existing utility locations. Any existing utilities that are indicated on the project

drawings shall be considered for reference use by the locating company and shall be verified. All underground utilities shall be clearly marked with flags, paint or stakes prior to any digging operation except that required to determine exact utility location and depth. CAUTION shall be used when trenching or excavating around or near buried utilities. The contractor shall be responsible for the timely repair and/or replacement of direct and collateral damage on any and all underground utilities that are severed, crushed, broken, displaced or otherwise disturbed by the construction operation. The Government shall not incur any additional cost for such repair or replacement. The contractor shall notify the ROICC a minimum of three working days prior to utility location. Do not continue with excavation or installation of new work without resolving elevation discrepancies and conflicts.

Notify the Contracting Officer at least 48 hours prior to starting excavation work.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --

SECTION 01 14 00

WORK RESTRICTIONS

07/12

PART 1 GENERAL

1.1 SPECIAL SCHEDULING REQUIREMENTS

- a. The facility will remain in operation during the entire construction period. The Contractor shall conduct his operations so as to cause the least possible interference with normal operations of the activity.

1.2 CONTRACTOR ACCESS AND USE OF PREMISES

1.3 Regulations

Ensure that Contractor personnel employed on the Activity become familiar with and obey Activity regulations. Keep within the limits of the work and avenues of ingress and egress. Wear hard hats in designated areas. Do not enter any restricted areas unless required to do so and until cleared for such entry. The Contractor's equipment shall be conspicuously marked for identification.

1.4 Working Hours

Regular working hours shall consist of an 8 1/2 hour period normally between the hours of 7:00 am to 4:30 pm, Monday through Friday, excluding Government holidays.

1.5 Work Outside Regular Hours

Work outside regular working hours requires Contracting Officer approval. Make application 15 calendar days prior to such work to allow arrangements to be made by the Government for inspecting the work in progress. During periods of darkness, the different parts of the work shall be lighted in a manner approved by the Contracting Officer.

1.6 Occupied Building

The Contractor shall be working in an existing building which is occupied. Do not enter the building without prior approval of the Contracting Officer.

The existing building and its contents shall be kept secure at all times. Provide temporary closures as required to maintain security as directed by the Contracting Officer.

Provide dust covers or protective enclosures to protect existing work that remains and Government material located in the facility during the construction period.

Relocate movable furniture as required to perform the work, protect the furniture, and replace the furniture in its original location upon completion of the work. Leave attached equipment in place, and protect it against damage, or temporarily disconnect, relocate, protect, and reinstall it at the completion of the work.

1.7 Utility Cutovers and Interruptions

- a. Permission to interrupt any Activity utility service shall be requested in writing a minimum of 15 calendar days prior to desired date of interruption.
- b. Make utility cutovers and interruptions after normal working hours or on Saturdays, Sundays, and Government holidays. Conform to procedures required in the paragraph "Work Outside Regular Hours."
- c. Ensure that new utility lines are complete, except for the connection, before interrupting existing service.
- d. Interruption to water, sanitary sewer, storm sewer, telephone service, electric service, air conditioning, heating, fire alarm, and compressed air, shall be considered utility cutovers pursuant to the paragraph entitled "Work Outside Regular Hours."
- e. Operation of Station Utilities: The Contractor shall not operate nor disturb the setting of control devices in the station utilities system, including water, sewer, electrical, and steam services. The Government will operate the control devices as required for normal conduct of the work. The Contractor shall notify the Contracting Officer giving reasonable advance notice when such operation is required.

1.8 SECURITY REQUIREMENTS

1.8.1 Station Regulations

No employee or representative of the contractor will be admitted to the work site without an Identification Badge or is specifically authorized admittance to the work site by the OIC, NAVFAC Contracts.

1.8.2 Contractor Access to MCAS Cherry Point and Outlying Areas

Documentation requirements for granting access to MCAS Cherry Point for commercial and contract and employers and employees. This document is an aid in meeting ASO 5500.14_ requirements and is not a substitute for the order.

1. Prime Contractor will provide a list of employees (prime and/or sub-contractor) that require Station access on company letterhead and include the contract number and a copy of the "base access table" outlined in your contract. NOTE: This list should include employee names ONLY. Do NOT include other personally identifiable information (PII) such as Social Security Number, Date of Birth, etc... Contractors who are hired for a period more than 30 days will be issued a contractor's badge after the conditions outlined in this document are met. The badge must be carried in plain view or readily accessible at all times while on Station. All badges will be issued for a period NOT TO EXCEED ONE YEAR regardless of the length of the contract. Upon the expiration of the badge, the company/employee will provide a new 50 state/national criminal records check and LRC prior to being re-badged. Any access from 1 day to less than 30 days, employers will provide the same documentation as stated above. In place of a badge a copy of this letter with the worker's name highlighted, stamped with the "Pass & ID" stamp, "Criminal Records Check (CRC) Sighted", and we will also annotate below the stamps the following

statement: "Valid until (expiration date) then date and initial it." This document will be issued to each worker and IS their authorization to be aboard the installation. This letter must be carried on their person or readily accessible at all times while on Station.

2. Contractor personnel requesting access to MCAS Cherry Point must complete and sign the attached Local Records Check (LRC) Form.

3. Contractor personnel requesting access to MCAS Cherry Point can personally deliver the (original) LRC and the national background check to MCAS Pass & ID 2 full work days prior to requiring a badge or you may send the completed LRC (original) form to include the national background check in via U.S. Mail only to arrive 2 to 5 days prior to your arrival. Address: Provost Marshal, Attn: Pass & ID Office, Marine Corps Air Station, Cherry Point, NC 28533-0035 or Provost Marshal's Office, Postal Service Center Box 8035, Marine Corps Air Station, Cherry Point, North Carolina 28533-0035. SSN and photo ID will be verified at this time. NOTE: Due to the sensitivity of the personal information contained in the LRC Release, these documents CAN NOT In order to get a badge, you must be present, as it is photo badge. be faxed or e-mailed to MCAS Pass & ID. Per Air Station Order 5500.14. If the vetting process works correctly, we should have your approved paperwork on hand pending your arrival.

4. MCAS Pass & ID will complete the local records check prior to contractor arriving for badging. If negative results are found, the sponsoring company (prime contractor) will be notified. NOTE: LRC's are only valid for 15 days, therefore the contractor must receive their badge within 15 days or they will have to resubmit the paperwork. 5. Individual Contractor Personnel report to Pass & ID for badging according to the following schedule:

LRC & Background Check Submitted:

Monday Thursday

Earliest Badging Opportunity:

Tuesday Friday

Wednesday Monday (the following week)

Thursday Tuesday (the following week)

Friday Wednesday (the following week)

6. Individual Contractor Personnel MUST bring the following documents when reporting to Pass & ID for badging:

-Copy of LRC release previously submitted above.

-Picture ID (typically a driver's license)

-Social Security Card or official document listing SSN

-Birth Certificate or Passport to verify citizenship

-If NOT US citizen, provide proof of immigration status

-Copy of 50-State Background Check (must be less than 30-days old)

IMPORTANT NOTE: ROICC personnel (Construction Managers, Engineering Techs, or Contract Specialists) and FSC personnel (Contract Surveillance Reps) will not receive, process, re-transmit or otherwise handle in any way PII information related to the badging process. Do NOT forward any of this information to ROICC or FSC.

7. All employers/employees must provide a CRC from any internet investigative service or any other investigative service company that provides a 50

state/national criminal records check and a check of the Sexual Offenders List. (Local county/state checks are not authorized and will not be accepted.) This records check must be a "complete" check covering the period from at the minimum their 18th birthday to present. The CRC must also have a statement in the records check that this is a "national records check" or the terminology the agency uses to indicate such. Please be sure of what you are requesting. If it is anything less than a national check, it will be rejected. The CRC can not be more than 30 days old at the time it is presented to Pass & ID personnel. CRCs may be obtained from, but not limited to the following sources (*):

- A) WWW.SENTRYLINK.COM
- B) WWW.INTEGRASCAN.COM
- C) WWW.CRIMINALWATCHDOG.COM
- D) WWW.INTELLICORP.NET
- E) WWW.CASTLEBRANCH.COM
- F) WWW.PEOPLESCANNER.COM
- G) WWW.KROLLBACKGROUNDSCREENING.COM
- H) WWW.BACKGROUNDCHECKS.COM
- I) WWW.INSTANTPEOPLECHECK.COM
- J) WWW.AMERICANBACKGROUND.COM
- K) WWW.LEXISNEXIS.COM

Cost of a background check can vary anywhere from \$19 to \$60 based on the type or amount of services requested. Minimum information required for a background check is the individual's last name, first name, middle name (optional) and date of birth, which must match exactly with your name and DOB on your driver's license or state ID. A social security number verification is also available at an additional cost.

8. In accordance with ASO 5500.14_ (not an all inclusive list), access will be denied if the individual:

- A) Is on the National Terrorist Watch List.
- B) Is illegally present in the United States.
- C) Is currently debarred or banned from military installations.
- D) Is a registered sex offender or been convicted of any child abuse or related offense(s).
- E) Is a convicted felon within the past 5 years.
- F) Convicted of any
- G) Is subject to an outstanding warrant or is currently pending trial. drug offense within the past 5 years.
- H) Has knowingly submitted a false/fraudulent employment questionnaire.
- I) Any reason the Installation Commander deems reasonable for good order & discipline.
- J) Individuals convicted of a DUI/DWI within the past year will be allowed aboard but not be permitted to drive.

9. Picture ID from a state or federal agency (i.e., valid driver's license or state identification card).

10. Social Security Card or any official document listing the SSN (letter from Social Security Administration listing the SSN, W-2 (tax form), DD-214, pay stub listing complete SSN). An additional source may be through the internet with E-Verify.

11. Birth certificates and passports are used when necessary to verify citizenship and are never used

12. If the employee is not a U.S. Citizen, as a means to verify social security numbers. PROOF OF IMMIGRATION STATUS

13. Due to recent changes with Privacy laws, please do not include social security numbers in the company letters being sent to this office. must be provided and carried on their person or be readily accessible at all times while on station. Proof must also be provided if an individual is a naturalized U.S. citizen. Additionally, all criminal record checks must be hand carried by the individual worker or brought in by the supervisor

14. As of 19 Dec 07 security clearances are no longer valid as a means for requesting access to the installation. All personnel hired as commercial or contractor employees to work for a company aboard the installation will be required to provide a 50 state/national criminal check.

15. The changes in this document are effective as of 29 Feb 2012.
Note: Until further notice, ID cards and vehicle passes issued to contractors at Camp Lejeune and New River are not valid at Cherry Point without a 50 state/national CRC in their possession at the time they are requesting access at MCAS Cherry Point.

(*) The United States Government and the United States Marine Corps does not endorse nor are they affiliated with any of the screening services mentioned above. We must be able to verify/validate the information contained in the CRC via telephone. If we are unable to validate the CRC the clearance information will not be accepted.

(**) Due to recent developments concerning the screening services of Criminal CBS (also DBA US Criminal Checks, INC), Net Detective, and ABI (Accurate Background Investigations), they are no longer authorized as a means for entry at MCAS Cherry Point. Questions on these revised procedures should be addressed directly with Pass & ID personnel at CHPT_PASS-ID_OMB@USMC.MIL or 252-466-4683/5921.

1.9 FLIGHTLINE SECURITY REQUIREMENTS

Work involved under this contract is in the Flightline Security Area. No employee or representative of the Contractor will be admitted to the work site unless they (1) are specifically authorized admittance by the OIC, NAVFAC Contracts, and (2) has a security badge. The Contractor shall obtain clearance and flightline security badges for all personnel required to be on the project site prior to performing any work. The Contractor shall submit a written request for security badges to the OIC, NAVFAC Contracts and to Pass & ID. Each employee will be required to go to PASS & ID at Building 251 to obtain his security badge with flightline access. A limited number of Contractor vehicles will be allowed access to the site of work subject to meeting regular Station access requirements. No personal vehicles will be allowed behind the security fence. Parking of vehicles shall be restricted to the immediate project site as determined by the OIC, NAVFAC Contracts. The security badges issued under this contract are valid for this specific project and are not transferable to another project.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- End of Section --

Authorization for Release of Information

Carefully read this authorization to release information about you, then sign and date it in ink.

I Authorize any investigator, special agent, or other duly accredited representative of the OPM, the Federal Bureau of Investigation, the Department of Defense, the Department of State, and any other authorized Federal agency, to request criminal record information about me from criminal justice agencies for the purpose of determining my eligibility for requesting access to the facilities aboard Marine Corps Air Station Cherry Point N.C.

I Authorize custodians of records and other sources of information pertaining to me to release such information upon request of the investigator, special agent, or other duly accredited representative of any Federal agency authorized above regardless of any previous agreement to the contrary.

I Understand that, for some sources of information, a separate specific release will be needed, and I may be contacted for such a release at a later date.

I Understand that the information released by records custodians and sources of information is for official use by the Federal Government only for the purposes provided above, and it may be disclosed by the Government only as authorized by law.

Photocopies of this authorization that show my signature are NOT VALID.

Signature (sign in ink)	Full Name (First, Middle, Last)	Date Signed(mm/dd/yyyy)
Other Names used	Date of Birth	Social Security Number
Current Street Address	City, State, Zip Code	Contact Telephone Number



UNITED STATES MARINE CORPS
 PROVOST MARSHAL'S OFFICE
 POSTAL SERVICE CENTER BOX 8035
 MARINE CORPS AIR STATION
 CHERRY POINT, NORTH CAROLINA 28533-0035

IN REPLY REFER TO:
 5512.
 PMO

From: Pass & Identification Office
 To: (1) PMO Records Manager
 (2) Criminal Investigation Division Office

Subj: Request for Local Records check for the below named individual.

Ref: ASO 5500.14

Attach: (1) Individual 50 State Criminal History Report
 (2) Authorization to Release of Information (back of this page)

1. The following information is provided for pending access aboard MCAS, Cherry Point, NC

FULL NAME: _____

FULL SSN: _____

COMPANY/ SPONOR'S NAME: _____

DATE OF BIRTH: _____

CURRENT ADDRESS: _____

CONTACT PHONE NUMBER: _____

SIGNATURE: _____

PMO / CID USE ONLY

Provost Marshal's Office

Date : _____

Time: _____

Results: _____

Name of Processor _____

PMO RECORDS

TLO VERIFIED(DATE/TIME/INITIALS)

Provost Marshal's Office

Date : _____

Time: _____

Results: _____

Name of Processor _____

Criminal Investigation Division

INDIVIDUAL CONTACTED (DATE/TIME/INITIALS) : _____

APPROVED DENIED

 APPROVAL OFFICIAL SIGNATURE

SECTION 01 20 00.00 20

PRICE AND PAYMENT PROCEDURES

07/06

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. ARMY CORPS OF ENGINEERS (USACE)

EP-1110-1-8 (2003) Construction Equipment Ownership and Operating Expense Schedule, Vol 1-12

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for A/E approval. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Schedule of prices; G

1.3 SCHEDULE OF PRICES

1.3.1 Data Required

Within 15 calendar days of notice of award, prepare and deliver to the Contracting Officer a schedule of prices (construction contract). Provide a detailed breakdown of the contract price, giving quantities for each of the various kinds of work, unit prices, and extended prices therefore.

1.3.2 Schedule Instructions

Payments will not be made until the Schedule of Prices has been submitted to and accepted by the Contracting Officer. Identify the cost for site work, and include incidental work to the 5 foot line. Identify costs for the building(s), and include work out to the 5 foot line. Work out to the 5 foot line shall include construction encompassed within a theoretical line 5 feet from the face of exterior walls and shall include attendant construction, such as cooling towers, placed beyond the 5 foot line.

1.3.3 Schedule Requirements for HVAC TAB

The field work Section 23 08 00.00 20, "HVAC Testing/Adjusting/Balancing" shall be broken down in the Schedule of Prices and in the Construction Progress Documentation by separate line items which reflect measurable deliverables. Specific payment percentages for each line item shall be determined on a case by case basis for each contract. The line items shall be as follows:

- a. Approval of Design Review Report: The TABS Agency is required to

conduct a review of the project plans and specifications to identify any feature, or the lack thereof, that would preclude successful testing and balancing of the project HVAC systems. The resulting findings shall be submitted to the Government to allow correction of the design. The progress payment shall be issued after review and approval of the report.

- b. Approval of the pre-field engineering report: The TABS Agency submits a report which outlines the scope of field work. The report shall contain details of what systems will be tested, procedures to be used, sample report forms for reporting test results and a quality control checklist of work items that must be completed before TABS field work commences.
- c. Season I field work: Incremental payments are issued as the TABS field work progresses. The TABS Agency mobilizes to the project site and executes the field work as outlined in the pre-field engineering report. The HVAC water and air systems are balanced and operational data shall be collected for one seasonal condition (either summer or winter depending on project timing).
- d. Approval of Season I report: On completion of the Season I field work, the data is compiled into a report and submitted to the Government. The report is reviewed, and approved, after ensuring compliance with the pre-field engineering report scope of work.
- e. Completion of Season I field QA check: Contract QC and Government representatives meet the TABS Agency at the jobsite to retest portions of the systems reported in the Season I report. The purpose of these tests are to validate the accuracy and completeness of the previously submitted Season I report.
- f. Approval of Season II report: The TABS Agency completes all Season II field work, which is normally comprised mainly of taking heat transfer temperature readings, in the season opposite of that under which Season I performance data was compiled. This data shall be compiled into a report and submitted to the Government. On completion of submittal review to ensure compliance with the pre-field engineering report scope, progress payment is issued. Progress payment is less than that issued for the Season I report since most of the water and air balancing work effort is completed under Season I.

1.4 CONTRACT MODIFICATIONS

In conjunction with the Contract Clause "DFARS 252.236-7000, Modification Proposals-Price Breakdown," and where actual ownership and operating costs of construction equipment cannot be determined from Contractor accounting records, equipment use rates shall be based upon the applicable provisions of the EP-1110-1-8.

1.5 CONTRACTOR'S INVOICE

1.5.1 Content of Invoice

Requests for payment in accordance with the terms of the contract shall consist of the following:

- a. Contractor's Invoice on NAVFAC Form 7300/30, which shall show, in

summary form, the basis for arriving at the amount of the invoice.

- b. Contractor's Monthly Estimate for Voucher (LANTNAVFACENGCOM Form 4-4330/110 (New 7/84)), with subcontractor and supplier payment certification.
- c. Affidavit to accompany invoice (LANTDIV NORVA Form 4-4235/4 (Rev. 5/81)).
- d. Updated copy of submittal register.
- e. Updated copy of progress schedule. Furnish as specified in "FAR 52.236-15, Schedules for Construction Contracts."

1.5.2 Monthly Invoices and Supporting Forms

Forms will be furnished by the Contracting Officer. Requests for payment shall be processed in accordance with "FAR 52.232-5, Payments Under Fixed-Price Construction Contracts." Monthly invoices and supporting forms for work performed through the anniversary award date of the contract shall be submitted to the Contracting Officer between the 1st - 7th if contract's last digit is 0, 1, 2; 8th - 14th if contract's last digit is 3 or 4; 15th - 21st if contract's last digit is 5, 6, or 7; 22nd and last if the contract's last digit is 8th or 9th day of the month. Payments will be using Wide Area Workflow (WAWF). Submit the following documents with invoice WAWF:

- a. Contractor's invoice
- b. Contractor's monthly estimate for voucher
- c. Affidavit
- d. Updated submittal register
- e. Progress schedule
- f. Certificate of Progress Payments
- g. Contractor Safety Self Evaluation Checklist

1.6 PAYMENTS TO THE CONTRACTOR

Payments will be made on submission of itemized requests by the Contractor which comply with the requirements of this section, and will be subject to reduction for overpayments or increase for underpayments made on previous payments to the Contractor.

1.6.1 Obligation of Government Payments

The obligation of the Government to make payments required under the provisions of this contract will, at the discretion of the Contracting Officer, be subject to reductions and/or suspensions permitted under the FAR and agency regulations including the following in accordance with "FAR 32.503-6:

- a. Reasonable deductions due to defects in material or workmanship;
- b. Claims which the Government may have against the Contractor under

or in connection with this contract;

- c. Unless otherwise adjusted, repayment to the Government upon demand for overpayments made to the Contractor; and
- d. Failure to provide up to date record drawings not current as stated in Contract Clause "FAC 5252.236-9310, Record Drawings."

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --

SECTION 01 30 00

ADMINISTRATIVE REQUIREMENTS

05/11

PART 1 GENERAL

1.1 SUBMITTALS

The following shall be submitted per Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

List of contact personnel

1.2 MINIMUM INSURANCE REQUIREMENTS

Procure and maintain during the entire period of performance under this contract the following minimum insurance coverage:

- a. Comprehensive general liability: \$500,000 per occurrence
- b. Automobile liability: \$200,000 per person, \$500,000 per occurrence for bodily injury, \$20,000 per occurrence for property damage
- c. Workmen's compensation as required by Federal and State workers' compensation and occupational disease laws.
- d. Employer's liability coverage of \$100,000, except in States where workers compensation may not be written by private carriers,
- e. Others as required by North Carolina State law.
- f. The Cancellation clause on the insurance certificate should read:

"Cancellation or any material change in the policies adversely affecting the interest of the Government in such insurance shall not be effective for such period as may be prescribed by the laws of the State in which this contract is to be performed and in no event less than **thirty (30)** days after written notice thereof to the Contracting Officer."

1.3 CONTRACTOR PERSONNEL REQUIREMENTS

1.3.1 Subcontractors and Personnel

Furnish a list of contact personnel of the Contractor and subcontractors including addresses and telephone numbers for use in the event of an emergency. As changes occur and additional information becomes available, correct and change the information contained in previous lists.

1.3.2 Identification Badges

Identification badges will be furnished without charge. Application for and use of badges will be as directed. Immediately report instances of lost or stolen badges to the Contracting Officer.

Commercial and contract employees will be issued a contractor's badge good for one year. Commercial and contract employees are required to resubmit a complete 50 state criminal records check in order to renew their contractor's badge.

If an employee is terminated prior to end of the contract, the contractor shall return the base identification card to the Contracting Officer. This requirement also applies to all sub-contract employees.

In no event will a contractor employee be permitted access to the US Marine Corps Air Station for the purpose of on-site performance without the documentation.

1.3.3 Subcontractor Special Requirements

1.3.3.1 Asbestos Containing Material

All contract requirements assigned to the Private Qualified Person (PQP) shall be accomplished directly by a first tier subcontractor.

1.3.4 Contractor Personnel Requirements

Follow Security requirements addressed in 01 14 00 WORK RESTRICTIONS.

1.4 SUPERVISION

Have at least one qualified supervisor capable of reading, writing, and conversing fluently in the English language on the job site during working hours. In addition, if a Quality Control (QC) representative is required on the contract, then that individual shall also have fluent English communication skills.

1.5 PRECONSTRUCTION CONFERENCE

After award of the contract but prior to commencement of any work at the site, meet with the Contracting Officer to discuss and develop a mutual understanding relative to the administration of the value engineering and safety program, preparation of the schedule prices, shop drawings, and other submittals, scheduling programming, and prosecution of the work. Major subcontractors who will engage in the work shall also attend.

1.6 LEVEL "C" PARTNERING

To most effectively accomplish the contract, the Government requires the formation of a cohesive partnership with the contractor and its subcontractors. The partnering relationship is based upon trust, dedication to common goals, an understanding of each other's expectations and values, and a commitment to success. The goals of the partnering process are improved communication, efficiency and cost effectiveness, increased opportunity for innovation, and the continuous improvement of product quality. The partnership will strive to draw in the strength of each organization in an effort to achieve a quality project done right the first time, within budget, on schedule, and without any safety mishaps, thereby providing the opportunity for the contractor to make a reasonable profit. This level of partnering is an introduction to partnering concepts and benefits and should become a part of the preconstruction conference. The senior ROICC and contract persons present will jointly host the initial session. The partners will determine the frequency of the follow-on sessions. Partnering sessions should be held at or near the location of

the ROICC office.

1.7 ELECTRONIC MAIL (E-MAIL) ADDRESS

The Contractor shall establish and maintain electronic mail (e-mail) capability along with the capability to open various electronic attachments in Microsoft, Adobe Acrobat, and other similar formats. Within 10 days after contractor award, the Contractor shall provide the Contracting Officer a single (only one) e-mail address for electronic communications from the Contracting Officer related to this contract including, but not limited to contract documents, invoice information, request for proposals, and other correspondence. The Contracting Officer may also use e-mail to notify the Contractor of base access conditions when emergency conditions warrant, such as hurricanes, terrorist threats, etc. Multiple e-mail addresses will not be allowed.

It is the Contractor's responsibility to make timely distribution of all Contracting Officer initiated e-mail with its own organization including the field office(s). The Contractor shall promptly notify the Contracting Officer, in writing, of any changes to this e-mail address.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --

SECTION 01 33 00

SUBMITTAL PROCEDURES

05/11

PART 1 GENERAL

1.1 DEFINITIONS

1.1.1 Submittal

Contract Clauses "FAR 52.236-5, Material and Workmanship," paragraph (b) and "FAR 52.236-21, Specifications and Drawings for Construction," paragraphs (d), (e), and (f) apply to all "submittals."

1.1.2 Submittal Descriptions (SD)

Submittals requirements are specified in the technical sections. Submittals are identified by SD numbers and titles as follows.

SD-01 Preconstruction Submittals

Certificates of insurance.
Surety bonds.
List of proposed subcontractors.
List of proposed products.
Construction Progress Schedule.
Submittal register.
Schedule of prices.
Health and safety plan.
Work plan.
Quality control plan.
Environmental protection plan.

SD-02 Shop Drawings

Drawings, diagrams and schedules specifically prepared to illustrate some portion of the work.

Diagrams and instructions from a manufacturer or fabricator for use in producing the product and as aids to the Contractor for integrating the product or system into the project.

Drawings prepared by or for the Contractor to show how multiple systems and interdisciplinary work will be coordinated.

SD-03 Product Data

Catalog cuts, illustrations, schedules, diagrams, performance charts, instructions and brochures illustrating size, physical appearance and other characteristics of materials, systems or equipment for some portion of the work.

Samples of warranty language when the contract requires extended product warranties.

SD-04 Samples

Fabricated or unfabricated physical examples of materials, equipment or workmanship that illustrate functional and aesthetic characteristics of a material or product and establish standards by which the work can be judged.

Color samples from the manufacturer's standard line (or custom color samples if specified) to be used in selecting or approving colors for the project.

Field samples and mock-ups constructed on the project site establish standards by which the ensuring work can be judged. Includes assemblies or portions of assemblies which are to be incorporated into the project and those which will be removed at conclusion of the work.

SD-05 Design Data

Design calculations, mix designs, analyses or other data pertaining to a part of work.

SD-06 Test Reports

Report signed by authorized official of testing laboratory that a material, product or system identical to the material, product or system to be provided has been tested in accord with specified requirements. (Testing must have been within three years of date of contract award for the project.)

Report which includes findings of a test required to be performed by the Contractor on an actual portion of the work or prototype prepared for the project before shipment to job site.

Report which includes finding of a test made at the job site or on sample taken from the job site, on portion of work during or after installation.

Investigation reports.

Daily logs and checklists.

Final acceptance test and operational test procedure.

SD-07 Certificates

Statements printed on the manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements. Must be dated after award of project contract and clearly name the project.

Document required of Contractor, or of a manufacturer, supplier, installer or subcontractor through Contractor, the purpose of which is to further quality of orderly progression of a portion of the work by documenting procedures, acceptability of methods or personnel qualifications.

Confined space entry permits.

Text of posted operating instructions.

SD-08 Manufacturer's Instructions

Preprinted material describing installation of a product, system or material, including special notices and Material Safety Data sheets concerning impedances, hazards and safety precautions.

SD-09 Manufacturer's Field Reports

Documentation of the testing and verification actions taken by manufacturer's representative 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, to confirm compliance with manufacturer's standards or instructions. The documentation 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.

Factory test reports.

SD-10 Operation and Maintenance Data

Data that is furnished by the manufacturer, or the system provider, to the equipment operating and maintenance personnel. This data is needed by operating and maintenance personnel for the safe and efficient operation, maintenance and repair of the item.

This Data is intended to be incorporated in an operations and maintenance manual or control system.

SD-11 Closeout Submittals

A collection of documents representing materials and systems installed or provided to the Government during the course of completing all contract requirements. Closeout submittals must include all approved material submittals and other requirements that describe the finished product provided to the Government. Operational and maintenance manuals, if required, are included in these submittals. As-built drawings must actually describe any deviations that were approved by the Contracting Officer. Refer to the specific closeout procedures required by specification section 01 78 00, "Closeout Procedures".

1.1.3 Approving Authority

Office or designated person authorized to approve submittal.

1.1.4 Work

As used in this section, on- and off-site construction required by contract documents, including labor necessary to produce submittals, construction, materials, products, equipment, and systems incorporated or to be incorporated in such construction.

1.2 SUBMITTALS

1.2.1 Submittal information applying to the entire contract

The Contractor is cautioned that symbols used in the "SUBMITTALS" paragraph of each Section may not always be consistent from one Section to another.

For example, in one Section a "G" symbol may indicate that the submittal should go to the Engineer Of Record; whereas in another Section the single letter "G" may indicate that the submittal should go directly to the Government, with a "GA" or "A" symbol used for submittals intended for the Engineer of Record. In the event of any such inconsistency, the provisions of the particular Section shall govern submittals required by that Section.

1.2.2 Submittal information applying only to this Section (Section 01 33 00, SUBMITTAL PROCEDURES)

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

SD-01 Preconstruction Submittals

Submittal register; G

1.3 USE OF SUBMITTAL REGISTER

Submittal register will be delivered to the Contractor. will have the following fields completed, to the extent that will be required by the Government during subsequent usage.

Column (c): Lists specification section in which submittal is required.

Column (d): Lists each submittal description (SD No. and type, e.g. SD-04 Drawings) required in each specification section.

Column (e): Lists one principal paragraph in specification section where a material or product is specified. This listing is only to facilitate locating submitted requirements. Do not consider entries in column (e) as limiting project requirements.

Column (f): Indicate approving authority for each submittal. A "G" indicates approval by Contracting Officer; a blank indicates approval by QC manager.

Prepare and maintain submittal register, as the work progresses. Do not change data which is output in columns (c), (d), (e), and (f) as delivered by Government; retain data which is output in columns (a), (g), (h), and (i) as approved.

1.3.1 Submittal Register

Submit submittal register with quality control plan and project schedule required by Section 01 45 00.00 20 CONSTRUCTION QUALITY CONTROL. Verify that all submittals required for project are listed and add missing submittals. Complete the following on the register:

Column (a) Activity Number: Activity number from the project schedule.

Column (g) Contractor Submit Date: Scheduled date for approving authority to receive submittals.

Column (h) Contractor Approval Date: Date Contractor needs approval of submittal.

Column (i) Contractor Material: Date that Contractor needs material

delivered to Contractor control.

1.3.2 Contractor Use of Submittal Register

Update the following fields in the Government-furnished submittal register program. .

Column (b) Transmittal Number: Contractor assigned list of consecutive numbers.

Column (j) Action Code (k): Date of action used to record Contractor's review when forwarding submittals to QC.

Column (l) List date of submittal transmission.

Column (q) List date approval received.

1.3.3 Approving Authority Use of Submittal Register

Update the following fields in the Government-furnished submittal register program. .

Column (b).

Column (l) List date of submittal receipt.

Column (m) through (p).

Column (q) List date returned to Contractor.

1.3.4 Contractor Action Code and Action Code

Entries used shall be as follows (others may be prescribed by Transmittal Form):

NR - Not Received

AN - Approved as noted

A - Approved

RR - Disapproved, Revise, and Resubmit

1.3.5 Copies Delivered to the Government

Deliver one copy of submittal register updated by Contractor to Government with each invoice request. Deliver in electronic format, unless a paper copy is requested by Contracting Officer.

1.4 PROCEDURES FOR SUBMITTALS

1.4.1 Reviewing, Certifying, Approving Authority

QC organization shall be responsible for reviewing and certifying that submittals are in compliance with contract requirements. At each "Submittal" paragraph in individual specification sections, a notation "G," following a submittal item, indicates Contracting Officer is approving authority for that submittal item. A blank indicates the Architect-Engineer of Record is the approving authority.

1.4.2 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.

1.4.3 Scheduling

- a. Coordinate scheduling, sequencing, preparing and processing of submittals with performance of work so that work will not be delayed by submittal processing. Allow for potential requirements to resubmit.
- b. Except as specified otherwise, allow review period, beginning with receipt by approving authority, that includes at least 15 working days for submittals for QC Manager approval and 20 working days for submittals for Contracting Officer approval. Period of review for submittals with Contracting Officer approval begins when Government receives submittal from QC organization. Period of review for each resubmittal is the same as for initial submittal.
- c. For submittals requiring review by fire protection engineer, allow review period, beginning when Government receives submittal from QC organization, of 30 working days for return of submittal to the Contractor. Period of review for each resubmittal is the same as for initial submittal.

1.4.4 Variations

Variations from contract requirements require Government approval pursuant to contract Clause entitled "FAR 52.236-21, Specifications and Drawings for Construction" and will be considered where advantageous to Government.

1.4.4.1 Considering Variations

Discussion with Contracting Officer prior to submission, will help ensure functional and quality requirements are met and minimize rejections and resubmittals. When contemplating a variation which results in lower cost, consider submission of the variation as a Value Engineering Change Proposal (VECP).

1.4.4.2 Proposing Variations

When proposing variation, deliver written request to the Contracting Officer, with documentation of the nature and features of the variation and why the variation is desirable and beneficial to Government. If lower cost is a benefit, also include an estimate of the cost saving. In addition to documentation required for variation, include the submittals required for

the item. Clearly mark the proposed variation in all documentation.

1.4.4.3 Warranting That Variations Are Compatible

When delivering a variation for approval, Contractor warrants that this contract has been reviewed to establish that the variation, if incorporated, will be compatible with other elements of work.

1.4.4.4 Review Schedule Is Modified

In addition to normal submittal review period, a period of 10 working days will be allowed for consideration by the Government of submittals with variations.

1.4.5 Contractor's Responsibilities

- a. Determine and verify field measurements, materials, field construction criteria; review each submittal; and check and coordinate each submittal with requirements of the work and contract documents.
- b. Transmit submittals to QC organization in accordance with schedule on approved Submittal Register, and to prevent delays in the work, delays to Government, or delays to separate Contractors.
- c. Advise Contracting Officer of variation, as required by paragraph entitled "Variations."
- d. Correct and resubmit submittal as directed by approving authority. When resubmitting disapproved transmittals or transmittals noted for resubmittal, the Contractor shall provide copy of that previously submitted transmittal including all reviewer comments for use by approving authority. Direct specific attention in writing or on resubmitted submittal, to revisions not requested by approving authority on previous submissions.
- e. Furnish additional copies of submittal when requested by Contracting Officer, to a limit of 20 copies per submittal.
- f. Complete work which must be accomplished as basis of a submittal in time to allow submittal to occur as scheduled.
- g. Ensure no work has begun until submittals for that work have been returned as "approved," or "approved as noted", except to the extent that a portion of work must be accomplished as basis of submittal.

1.4.6 QC Organization Responsibilities

- a. Note date on which submittal was received from Contractor on each submittal.
- b. Review each submittal; and check and coordinate each submittal with requirements of work and contract documents.
- c. Review submittals for conformance with project design concepts and compliance with contract documents.
- d. Act on submittals, determining appropriate action based on QC

organization's review of submittal.

(1) When Architect-Engineer of Record is approving authority, forward the submittal to the A&E with the certifying statement or return submittal marked "not reviewed" or "revise and resubmit" as appropriate.

(2) When Contracting Officer is approving authority or when variation has been proposed, forward submittal to Government with certifying statement or return submittal marked "not reviewed" or "revise and resubmit" as appropriate.

- e. Ensure that material is clearly legible.
- f. Stamp each sheet of each submittal with QC certifying statement or approving statement, except that data submitted in bound volume or on one sheet printed on two sides may be stamped on the front of the first sheet only.

(1) When approving authority is Contracting Officer, QC organization will certify submittals forwarded to Contracting Officer with the following certifying statement:

"I hereby certify that the (equipment) (material) (article) shown and marked in this submittal is that proposed to be incorporated with contract Number (____), is in compliance with the contract drawings and specification, can be installed in the allocated spaces, and is submitted for Government approval.

Certified by Submittal Reviewer _____, Date _____
(Signature when applicable)

Certified by QC Manager _____, Date _____"
(Signature)

- g. Sign certifying statement or approval statement. The person signing certifying statements shall be QC organization member designated in the approved QC plan. The signatures shall be in original ink. Stamped signatures are not acceptable.
- h. Update submittal register as submittal actions occur and maintain the submittal register at project site until final acceptance of all work by Contracting Officer.
- i. Retain a copy of approved submittals at project site, including Contractor's copy of approved samples.

1.4.7 Government's Responsibilities

When approving authority is Contracting Officer or Architect-Engineer, , the approving authority will:

- a. Note date on which submittal was received from QC manager, on each submittal for which the Contracting Officer is approving authority.
- b. Review submittals for approval within scheduling period specified and only for conformance with project design concepts and compliance with contract documents.

- c. Identify returned submittals with one of the actions defined in paragraph entitled "Actions Possible" and with markings appropriate for action indicated.

1.4.8 Actions Possible

Submittals will be returned with one of the following notations:

- a. Submittals marked "not reviewed" will indicate submittal has been previously reviewed and approved, is not required, does not have evidence of being reviewed and approved by Contractor, or is not complete. A submittal marked "not reviewed" will be returned with an explanation of the reason it is not reviewed. Resubmit submittals returned for lack of review by Contractor or for being incomplete, with appropriate action, coordination, or change.
- b. Submittals marked "approved" "approved as submitted" authorize Contractor to proceed with work covered.
- c. Submittals marked "approved as noted" or "approval except as noted; resubmission not required" authorize Contractor to proceed with work as noted provided Contractor takes no exception to the notations.
- d. Submittals marked "revise and resubmit" or "disapproved" indicate submittal is incomplete or does not comply with design concept or requirements of the contract documents and shall be resubmitted with appropriate changes. No work shall proceed for this item until resubmittal is approved.

1.5 FORMAT OF SUBMITTALS

1.5.1 Transmittal Form

Transmit each submittal, except sample installations and sample panels, to office of approving authority. Transmit submittals with transmittal form prescribed by Contracting Officer and standard for project. The transmittal form shall identify Contractor, indicate date of submittal, and include information prescribed by transmittal form and required in paragraph entitled "Identifying Submittals." Process transmittal forms to record actions regarding sample panels and sample installations.

1.5.2 Identifying Submittals

Identify submittals, except sample panel and sample installation, with the following information permanently adhered to or noted on each separate component of each submittal and noted on transmittal form. Mark each copy of each submittal identically, with the following:

- a. Project title and location.
- b. Construction contract number.
- c. Section number of the specification section by which submittal is required.
- d. Submittal description (SD) number of each component of submittal.
- e. When a resubmission, add alphabetic suffix on submittal

description, for example, SD-10A, to indicate resubmission.

- f. Name, address, and telephone number of subcontractor, supplier, manufacturer and any other second tier Contractor associated with submittal.
- g. Product identification and location in project.

1.5.3 Format for SD-02 Shop Drawings

- a. Shop drawings shall not be less than 8 1/2 by 11 inches nor more than 30 by 42 inches.
- b. Present 8 1/2 by 11 inches sized shop drawings as part of the bound volume for submittals required by section. Present larger drawings in sets.
- c. Include on each drawing the drawing title, number, date, and revision numbers and dates, in addition to information required in paragraph entitled "Identifying Submittals."
- d. Dimension drawings, except diagrams and schematic drawings; prepare drawings demonstrating interface with other trades to scale. Shop drawing dimensions shall be the same unit of measure as indicated on the contract drawings. Identify materials and products for work shown.
- e. Drawings shall include the nameplate data, size and capacity. Also include applicable federal, military, industry and technical society publication references.

1.5.4 Format of SD-03 Product Data and SD-08 Manufacturer's Instruction

- a. Present product data submittals for each section as a complete, bound volume. Include table of contents, listing page and catalog item numbers for product data.
- b. Indicate, by prominent notation, each product which is being submitted; indicate specification section number and paragraph number to which it pertains.
- c. Supplement product data with material prepared for project to satisfy submittal requirements for which product data does not exist. Identify this material as developed specifically for project.
- e. Product data shall include the manufacturer's name, trade name, place of manufacture, and catalog model or number. Submittals shall also include applicable federal, military, industry and technical society publication references. Should manufacturer's data require supplemental information for clarification, the supplemental information shall be submitted as specified for SD-07 Certificates.
- f. Where equipment or materials are specified to conform to industry and technical society reference standards of the organizations such as American National Standards Institute (ANSI), ASTM International (ASTM), National Electrical Manufacturer's Association (NEMA), Underwriters Laboratories (UL), and

Association of Edison Illuminating Companies (AEIC), submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance. In lieu of the label or listing, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Contracting Officer. The certificate shall state that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard.

- g. Submit manufacturer's instruction prior to installation.

1.5.5 Format of SD-04 Samples

- a. Furnish samples in sizes below, unless otherwise specified or unless the manufacturer has prepackaged samples of approximately same size as specified:
 - (1) Sample of Equipment or Device: Full size.
 - (2) Sample of Materials Less Than 2 by 3 inches: Built up to 8 1/2 by 11 inches.
 - (3) Sample of Materials Exceeding 8 1/2 by 11 inches: Cut down to 8 1/2 by 11 inches and adequate to indicate color, texture, and material variations.
 - (4) Sample of Linear Devices or Materials: 10 inch length or length to be supplied, if less than 10 inches. Examples of linear devices or materials are conduit and handrails.
 - (5) Sample of Non-Solid Materials: Pint. Examples of non-solid materials are sand and paint.
 - (6) Color Selection Samples: 2 by 4 inches.
 - (7) Sample Panel: 4 by 4 feet.
 - (8) Sample Installation: 100 square feet.
- b. Samples Showing Range of Variation: Where variations are unavoidable due to nature of the materials, submit sets of samples of not less than three units showing extremes and middle of range.
- c. Reusable Samples: Incorporate returned samples into work only if so specified or indicated. Incorporated samples shall be in undamaged condition at time of use.
- d. Recording of Sample Installation: Note and preserve the notation of area constituting sample installation but remove notation at final clean up of project.
- e. When color, texture or pattern is specified by naming a particular manufacturer and style, include one sample of that manufacturer and style, for comparison.

1.5.6 Format of SD-05 Design Data and SD-07 Certificates

- a. Provide design data and certificates on 8 1/2 by 11 inches

paper. Provide a bound volume for submittals containing numerous pages.

1.5.7 Format of SD-06 Test Reports and SD-09 Manufacturer's Field Reports

- a. Provide reports on 8 1/2 by 11 inches paper in a complete bound volume.
- b. Indicate by prominent notation, each report in the submittal. Indicate specification number and paragraph number to which it pertains.

1.5.8 Format of SD-10 Operation and Maintenance Data (O&M)

- a. O&M Data format shall comply with the requirements specified in Section 01 78 23 OPERATION AND MAINTENANCE DATA

1.5.9 Format of SD-01 Preconstruction Submittals and SD-11 Closeout Submittals

- a. When submittal includes a document which is to be used in project or become part of project record, other than as a submittal, do not apply Contractor's approval stamp to document, but to a separate sheet accompanying document.

1.6 QUANTITY OF SUBMITTALS

1.6.1 Number of Copies of SD-02 Shop Drawings

- a. Submit six copies of submittals of shop drawings requiring review and approval only by QC organization and seven copies of shop drawings requiring review and approval by Contracting Officer.

1.6.2 Number of Copies of SD-03 Product Data and SD-08 Manufacturer's Instructions

Submit in compliance with quantity requirements specified for shop drawings.

1.6.3 Number of Samples SD-04 Samples

- a. Submit one sample showing range of variation, of each required item. One approved sample or set of samples will be retained by approving authority and one will be returned to Contractor.
- b. Submit one sample panel. Include components listed in technical section or as directed.
- c. Submit one sample installation, where directed.
- d. Submit one sample of non-solid materials.

1.6.4 Number of Copies SD-05 Design Data and SD-07 Certificates

- a. Submit in compliance with quantity requirements specified for shop drawings.

1.6.5 Number of Copies SD-06 Test Reports and SD-09 Manufacturer's Field Reports

- b. Submit in compliance with quantity with quality requirements specified for shop drawings.

1.6.6 Number of Copies of SD-10 Operation and Maintenance Data

Submit Five copies of O&M Data to the Contracting Officer for review and approval.

1.6.7 Number of Copies of SD-01 Preconstruction Submittals and SD-11 Closeout Submittals

- a. Unless otherwise specified, submit administrative submittals compliance with quantity requirements specified for shop drawings.

1.7 FORWARDING SUBMITTALS

1.7.1 Submittals Required from the Contractor

As soon as practicable after award of contract, and before procurement of fabrication, forward to the Architect-Engineer: Bowman Foster & Assocs., #4 Interstate Corp. Center, Norfolk, VA 23502, submittals required in the technical sections of this specification, including shop drawings, product data and samples, for Project CP12024M. All submittals associated with Project WR5899390 (hangar bay lighting replacement) shall be forwarded to CEMS Engineering, 3509 Iron Horse Drive, Ladson, SC 29456. One copy of the transmittal form for all submittals shall be forwarded to the Resident Officer in Charge of Construction, NAVFAC MIDLANT, PSC Box 8006, Cherry Point, North Carolina 28533-0006. Submit to the Resident Officer in Charge of Construction, NAVFAC MIDLANT Contracts, at the above address, for review and approval, the following:.

As an exception to the standard submittal procedure specified above, submit to the Resident Officer In Charge of Construction, NAVFAC MIDLANT Contracts, at the above address, for reiview and approval, the following:

- All submittals required by Division 01 - General Requirements.
All Submittals with "G" designations.

1.7.1.1 O&M Data

NAVFAC MIDLANT will review and approve for the Contracting Officer O&M Data to verify the submittals comply with the contract requirements; submit data specified for a given item within 30 calendar days after the item is delivered to the contract site.

- a. In the event the Contractor fails to deliver O&M Data within the time limits specified, the Contracting Officer may withhold from progress payments 50 percent of the price of the item with which such O&M Data are applicable.

1.8 SUBMITTAL CLASSIFICATION

Submittals are classified as follows:

1.9 Government Approved

Government approval is required for extensions of design, critical materials, deviations, equipment whose compatibility with the entire system must be checked, and other items as designated by the Contracting Officer. Within the terms of the Contract Clause entitled "Specifications and Drawings for Construction," they are considered to be "shop drawings."

1.10 Information Only

All submittals not requiring Government or Architect-Engineer of Record approval will be for information only. They are not considered to be "shop drawings" within the terms of the Contract Clause referred to above.

1.10.1 APPROVED SUBMITTALS

The Contracting Officer's and Architect-Engineer's approval of submittals shall not be construed as a complete check, but will indicate only that the general method of construction, materials, detailing and other information are satisfactory. Approval will not relieve the Contractor of the responsibility for any error which may exist, as the Contractor under the Contractor Quality Control (CQC) requirements of this contract is responsible for dimensions, the design of adequate connections and details, and the satisfactory construction of all work. After submittals have been approved by the approving authority, no resubmittal for the purpose of substituting materials or equipment will be considered unless accompanied by an explanation of why a substitution is necessary.

1.10.1.1 DISAPPROVED SUBMITTALS

The Contractor shall make all corrections required by the Contracting Officer and promptly furnish a corrected submittal in the form and number of copies specified for the initial submittal. If the Contractor considers any correction indicated on the submittals to constitute a change to the contract, a notice in accordance with the Contract Clause "Changes" shall be given promptly to the Contracting Officer.

1.11 WITHHOLDING OF PAYMENT

Payment for materials incorporated in the work will not be made if required approvals have not been obtained.

1.12 GENERAL

The contractor shall make submittals as required by the specifications. The Contracting Officer may request submittals in addition to those specified when deemed necessary to adequately describe the work covered in the respective sections. Units of weights and measures used on all submittals shall be the same as those used in the contract drawings. Each submittal shall be complete and in sufficient details to allow ready determination of compliance with contract requirements. Prior to submittal, all items shall be checked and approved by the contractor's Quality Control (CQC) System Manager and each item shall be stamped, signed, and dated by the CQC System Manager indicating action taken. Proposed deviations from the contract requirements shall be clearly identified. Submittals shall include items such as: Contractor's manufacturer's, or fabricator's drawings; descriptive literature including (but not limited to) catalog cuts, diagrams, operating charts or curves;

test report; test cylinders; samples; O&M manuals (including parts list); certifications; warranties; and other such required submittals. Submittals requiring Government approval shall be scheduled and made prior to the acquisition of the material or equipment covered thereby. Samples remaining upon completion of the work shall be picked up and disposed of in accordance with manufacturer's Material Safety Data Sheets (MSDS) and in compliance with existing laws and regulations.

1.13 SUBMITTAL REGISTER

At the end of this section is a submittal register showing items of equipment and materials for which submittals are required by the specifications; this list may not be all inclusive and additional submittals may be required. The Government will provide the initial submittal register. Thereafter, the Contractor shall maintain a complete list of all submittals, including completion of all data columns. Dates on which submittals are received and returned by the Government will be included in its export file to the Contractor. The Contractor shall track all submittals.

1.14 SCHEDULING

Submittals covering component items forming a system or items that are interrelated shall be scheduled to be coordinated and submitted concurrently. Certifications to be submitted with the pertinent drawings shall be so scheduled. Adequate time (a minimum of 14 calendar days exclusive of mailing time) shall be allowed and shown on the register for review and approval. No delay damages or time extensions will be allowed for time lost in late submittals.

1.15 TRANSMITTAL FORM (ENG FORM 4025)

The sample transmittal form (ENG Form 4025) attached to this section shall be used for submitting both Government approved and information only submittals in accordance with the instructions on the reverse side of the form. These forms will be furnished to the Contractor. This form shall be properly completed by filling out all the heading blank spaces and identifying each time submitted. Special care shall be exercised to ensure proper listing of the specification paragraph and/or sheet number of the contract drawings pertinent to the data submitted for each item.

1.16 SUBMITTAL PROCEDURES

Submittals shall be made as follows:

1.16.1 Procedures

The Government will further discuss detailed submittal procedures with the contractor at the Preconstruction Conference.

1.16.1.1 Deviations

For submittals which include proposed deviations requested by the Contractor, the column "variation" of ENG form 4025 shall be checked. The Contractor shall set forth in writing the reason for any deviations and annotate such deviations on the submittal. The Government reserves the right to rescind inadvertent approval of submittals containing unnoted deviations.

1.17 CONTROL OF SUBMITTALS

The Contractor shall carefully control his procurement operations to ensure that each individual submittal is made on or before the Contractor scheduled submittal date shown on the approved "Submittal Register".

1.18 GOVERNMENT AND ARCHITECT-ENGINEER

Upon completion of review of submittals requiring Government approval, the submittal will be identified as having received approval by being so stamped and dated. One copy of the submittal will be retained by the Architect-Engineer, three copies will be retained by the Contracting Officer and three copies will be returned to the Contractor.

1.19 INFORMATION ONLY

Normally submittals for information only will not be returned. Approval of the Contracting Officer is not required on information only submittals. The Government reserves the right to require the Contractor to resubmit any item found not to comply with the contract. This does not relieve the Contractor from the obligation to furnish material conforming to the plans and specifications; will not prevent the Contracting Officer from requiring removal and replacement of nonconforming material incorporate in the work; and does not relieve the Contractor of the requirement to furnish samples for testing by the Government laboratory or for check testing by the Government in those instances where the technical specifications so prescribe.

1.20 STAMPS

Stamps used by the Contractor on the submittal data to certify that the submittal meets contract requirements shall be similar to the following:

CONTRACTOR (Firm Name)
_____ Approved
_____ Approved with corrections as noted on submittal data and/or attached sheets(s).
SIGNATURE: _____
TITLE: _____
DATE: _____

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- End of Section --

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
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CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASSIFICATION REVIEW	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				REMARKS		
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE		DATE OF ACTION	MAILED TO CONTR/ DATE RCD FRM APPR AUTH
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		01 20 00.00 20	SD-01 Preconstruction Submittals														
			Schedule of prices	1.3	G												
		01 30 00	SD-01 Preconstruction Submittals														
			List of contact personnel	1.3.1													
		01 33 00	SD-01 Preconstruction Submittals														
			Submittal register	1.3.1	G												
		01 45 00.00 20	SD-01 Preconstruction Submittals														
			Construction Quality Control (QC) Plan	1.6.1	G												
		01 57 19.00 20	SD-01 Preconstruction Submittals														
			Preconstruction Survey	1.5.1	G												
			Solid Waste Management Plan and Permit	3.4	G												
			Regulatory Notification	1.5.2	G												
			Environmental Protection Plan	3.1	G												
			Contractor/Vendor Environmental Service Agreement	1.5.6	G												
			SD-06 Test Reports														
			Laboratory Analysis	3.5.2													
			Disposal Requirements	3.15.2													
			SD-11 Closeout Submittals														
			Waste Determination Documentation	3.5													
			Disposal Documentation for Hazardous and Regulated Waste	3.6.1													

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		01 57 19.00 20	Contractor 40 CFR Employee Training Records	1.5.5													
			Solid Waste Management Report	3.4.1													
			Contractor Hazardous Material Inventory Log	3.5.1	G												
			Contractor Hazardous Material Inventory Log	3.6	G												
			Hazardous Waste/Debris Management	3.13.1													
		01 78 00	SD-10 Operation and Maintenance Data														
			Equipment/Product Warranty List	1.4.1	G												
			SD-11 Closeout Submittals														
			As-Built Drawings	1.3.1	G												
			Record Of Materials	1.3.2	G												
			Form DD1354	1.6	G												
			Checklist for Form DD1354	1.6	G												
		02 41 00	SD-01 Preconstruction Submittals														
			Existing Conditions	1.11													
			SD-07 Certificates														
			Demolition Plan	1.2.1													
			Notification	1.7													
			SD-11 Closeout Submittals														
			Receipts	3.2.4													
		02 83 13.00 20	SD-01 Preconstruction Submittals														

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		02 83 13.00 20	Occupational and Environmental Assessment Data Report	1.5.2.3	G												
			Lead Compliance Plan	1.5.2.2	G												
			Competent Person	1.5.1.1	G												
			Training Certification	1.5.1.2	G												
			lead waste management plan	1.5.2.8	G												
			written evidence	3.5.2.1	G												
			Medical Examinations	1.5.2.4	G												
			SD-06 Test Reports														
			sampling results	1.5.2.3	G												
			Occupational and Environmental Assessment Data Report	1.5.2.3	G												
			SD-07 Certificates														
			Testing laboratory	1.5.1.3	G												
			Occupant Notification	3.1.1.1	G												
			Third party consultant qualifications	1.5.1.4	G												
			Clearance Certification	3.5.1.1	G												
			SD-11 Closeout Submittals														
			hazardous waste manifest	3.5.2.1	G												
			turn-in documents or weight tickets	3.5.2.1	G												
		02 84 16	SD-07 Certificates														
			Qualifications of CIH	1.8.1													
			Training Certification	1.8.1													

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		02 84 16	PCB and Lamp Removal Work Plan	1.8.2													
			PCB and Lamp Disposal Plan	1.8.3													
			SD-11 Closeout Submittals														
			Transporter certification	3.5.2													
			Certification of Decontamination	3.2.4													
			Certificate of Disposal and/or recycling	3.5.2.1													
			DD Form 1348-1	3.5.3.1													
		05 12 00	SD-02 Shop Drawings														
			Erection Plan	1.5.2.1													
			Fabrication drawings	1.5.1													
			SD-03 Product Data														
			Shop primer	2.4													
			Welding electrodes and rods	2.3.1													
			SD-07 Certificates														
			Steel	2.1													
			Bolts, nuts, and washers	2.2													
			AISC Quality Certification	1.4													
			Welding procedures and qualifications	1.5.2.2													
		05 30 00	SD-03 Product Data														
			Accessories	2.2													
			Galvanizing Repair Paint	2.1.4													
			Joint Sealant Material	2.1.3													
			SD-07 Certificates														

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		05 30 00	Wind Storm Resistance	1.3.2.1													
		05 51 00	SD-02 Shop Drawings														
			Iron and Steel Hardware	2.1													
			Steel Shapes, Plates, Bars and Strips	2.1													
			Metal Stair System	2.6													
			SD-03 Product Data														
			Structural Steel Plates, Shapes, and Bars	2.2													
			Structural Steel Tubing	2.3													
			Protective Coating	2.7													
			Steel Pan Stairs	2.8													
			Steel Stairs	2.8.4													
			SD-07 Certificates														
			Welder Qualification	1.3													
			SD-08 Manufacturer's Instructions														
			Structural Steel Plates, Shapes, and Bars	2.2													
			Structural Steel Tubing	2.3													
			Protective Coating	2.7													
		05 52 00	SD-02 Shop Drawings														
			Iron and Steel Hardware	2.1													
			Iron and Steel Hardware	3.1													
			Steel Shapes, Plates, Bars and Strips	2.1													

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(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		05 52 00	Steel Shapes, Plates, Bars and Strips	3.1													
			SD-03 Product Data														
			Structural Steel Plates, Shapes, and Bars	2.3													
			Structural Steel Tubing	2.4													
			Protective Coating	2.7													
			Steel Railings and Handrails	2.8													
			SD-07 Certificates														
			Welder Qualification	1.3.1													
			SD-08 Manufacturer's Instructions														
			Installation Instructions	3.1													
		06 10 00	SD-02 Shop Drawings														
			Nailing Strips	2.1.1													
			SD-07 Certificates														
			Preservative treatment	1.4													
		07 22 00	SD-02 Shop Drawings														
			Wood nailers	2.5													
			SD-03 Product Data														
			Fasteners	2.4													
			Insulation	2.1													
			SD-06 Test Reports														
			Flame spread and smoke developed ratings	1.4.1													
			SD-07 Certificates														
			qualifications	1.3													

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ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT OR CLASSIFICATION REVIEW	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				REMARKS		
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		07 22 00	SD-08 Manufacturer's Instructions														
			fasteners	2.4													
			insulation	2.1													
		07 52 00	SD-02 Shop Drawings														
			Roof plan	1.4.5													
			SD-03 Product Data														
			Modified Bitumen Sheets	2.1													
			Cold-Applied Membrane	2.3													
			Adhesive														
			Fiberglass Felt	2.1													
			Primer	2.5													
			Modified Bitumen Roof Cement	2.6													
			Pre-Manufactured Accessories	2.8													
			Fasteners And Plates	2.7													
			Warranty	1.8													
			SD-05 Design Data														
			Wind Uplift Calculations	1.4.4													
			SD-07 Certificates														
			Qualification of Manufacturer	1.4.1													
			Qualification of Applicator	1.4.2													
			Wind Uplift Resistance	1.4.4													
			Fire Resistance	1.4.3													
			SD-08 Manufacturer's Instructions														
			Modified Bitumen Membrane	3.3.4													
			Application														
			Flashing	3.3.5													

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(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		07 52 00	Cold Adhesive Applied Modified Bitumen Membrane	3.3.3.1													
			Primer	2.5													
			Fasteners	2.7.1													
			Coating Application	3.3.8.1													
			Cold Weather Installation	1.6													
			SD-11 Closeout Submittals														
			Warranty	1.8													
			Information Card	3.7													
			Instructions To Government	3.6													
			Personnel														
		07 60 00	SD-02 Shop Drawings														
			Gutters	3.1.15													
			Downspouts	3.1.16													
			Gravel stops and fascias	3.1.13													
			Base flashing	3.1.10													
			Counterflashing	3.1.11													
			Flashing at roof penetrations	3.1.17													
			Reglets	3.1.12													
			Copings	3.1.19													
			Drip edge	3.1.14													
		07 84 00	SD-02 Shop Drawings														
			Firestopping Materials	2.1													
			SD-07 Certificates														
			Manufacturer's Technical Representative	1.4.2													

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		07 84 00	Firestopping Materials	2.1													
			Installer Qualifications	1.4.1													
			Inspection	3.3													
		07 92 00	SD-03 Product Data														
			Sealants	2.1													
			Primers	2.2													
			Bond breakers	2.3													
			Backstops	2.4													
			SD-07 Certificates														
			Sealant	3.3.6													
		08 51 13	SD-02 Shop Drawings														
			Windows	2.1													
			Fabrication Drawings	1.10													
			SD-03 Product Data														
			Windows	2.1													
			Fasteners	2.2.2													
			Window performance	1.11													
			Thermal-Barrier Windows	2.3													
			Mullions	2.4													
			Accessories	2.2.5													
			Thermal performance	1.11.4													
			SD-06 Test Reports														
			Minimum condensation resistance factor	1.4.2													
			SD-10 Operation and Maintenance Data														

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		08 51 13	Windows	2.1													
			Plastic Identification	1.7.1													
		08 62 50	SD-02 Shop Drawings														
			Tubular Daylighting Devices	2.1													
			SD-03 Product Data														
			Tubular Daylighting Devices	2.1													
			SD-06 Test Reports														
			Tubular Daylighting Devices	2.1													
		08 81 00	SD-03 Product Data														
			Insulating Glass	1.5.1													
			SD-04 Samples														
			Insulating Glass	1.5.1													
			Sealant	2.3.1.1													
			SD-07 Certificates														
			Insulating Glass	1.5.1													
			SD-08 Manufacturer's Instructions														
			Setting and sealing materials	2.3													
			Glass setting	3.2													
		09 51 00	SD-02 Shop Drawings														
			Approved Detail Drawings	1.2													
			SD-07 Certificates														
			Acoustical Units	2.1													
		09 90 00	SD-03 Product Data														
			Materials	2.1													
		23 00 00	SD-02 Shop Drawings														
			Detail Drawings	1.4.4													

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		23 00 00	SD-03 Product Data														
			Insulated Nonmetallic Flexible Duct Runouts	2.8.1.1													
			Duct Connectors	2.8.1.1													
			Duct Access Doors	2.8.2													
			Manual Balancing Dampers	2.8.3													
			Sound Attenuation Equipment	2.8.5													
			Acoustical Duct Liner	2.8.5													
			Diffusers	2.8.6.1	G												
			Registers and Grilles	2.8.6.3													
			Centrifugal Type Power Roof Ventilators	2.9.1.1													
			Air Handling Units	2.10													
			Variable Volume, Single Duct Terminal Units	2.11.1.1													
			Test Procedures	1.4.5													
			Diagrams	1.2.1.2													
			SD-06 Test Reports														
			Performance Tests	3.12													
			Damper Acceptance Test	3.10													
			SD-07 Certificates														
			Bolts	1.4.1													
			SD-08 Manufacturer's Instructions														
			Manufacturer's Installation Instructions	3.2													

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		23 00 00	Operation and Maintenance Training	3.14.2													
			SD-10 Operation and Maintenance Data														
			Operation and Maintenance Manuals	3.14.1													
			Manual Balancing Dampers	2.8.3													
			Centrifugal Type Power Roof Ventilators	2.9.1.1													
			Air Handling Units	2.10													
			Variable Volume, Single Duct Terminal Units	2.11.1.1													
			Reheat Units	2.11.1.2													
		23 05 93	SD-01 Preconstruction Submittals														
			TAB Firm	1.7													
			TAB team assistants;	1.2													
			TAB team engineer;	1.2													
			TAB team field leader;	1.2													
			SD-02 Shop Drawings														
			TAB Schematic Drawings and Report Forms;	1.3.3													
			SD-03 Product Data														
			TAB Procedures;	1.6													
			Calibration;	1.6													
			SD-06 Test Reports														

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		23 05 93	DALT and TAB Work Execution Schedule	3.6													
			DALT and TAB Procedures Summary	3.6													
			Design review report	1.8.2.1													
			Design review report	3.6													
			Pre-Final DALT report	1.8.2													
			Pre-Final DALT report	3.2.5													
			Final DALT report	1.8.2													
			Final DALT report	3.2.8													
			DALT and TAB Submittal and Work Schedule	1.8.1													
			TAB report for Season 1	3.6													
			TAB report for Season 2	3.6													
			SD-07 Certificates														
			Independent TAB agency and personnel qualifications	1.5.1													
			Advance notice of Pre-Final DALT field work	3.2.2													
			Completed Pre-Final DALT Work Checklist	3.6													
			Completed Pre-Final DALT Work Checklist	3.6													
			Advance Notice of Season 1 TAB Field Work	1.8.2													

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		23 05 93	Advance Notice of Season 1 TAB Field Work	3.6													
			Completed Season 1 Pre-TAB Work Checklist	3.6													
			Completed Season 1 Pre-TAB Work Checklist	3.6													
			Advance Notice of Season 2 TAB Field Work	1.8.2													
			Advance Notice of Season 2 TAB Field Work	3.6													
			Completed Season 2 Pre-TAB Work Checklist	3.6													
			Completed Season 2 Pre-TAB Work Checklist	3.6													
			Pre-Field DALT Preliminary Notification	1.8.2.2													
			Pre-Field TAB Engineering Report	1.8.2.3													
			Prerequisite HVAC Work Check Out List For Season 1	1.8.2													
			Prerequisite HVAC Work Check Out List For Season 2	1.8.2													
		23 07 00	SD-03 Product Data														
			Pipe Insulation Systems	2.3													
			Pipe Insulation Systems	3.2													
			Duct Insulation Systems	3.3													

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		23 07 00	Equipment Insulation Systems	3.4													
			SD-08 Manufacturer's Instructions														
			Pipe Insulation Systems	2.3													
			Pipe Insulation Systems	3.2													
			Duct Insulation Systems	3.3													
			Equipment Insulation Systems	3.4													
		23 09 23.13 20	SD-02 Shop Drawings														
			Control system drawings title sheet	1.4.1.1													
			List of I/O Points	1.4.1.2													
			Control System Components List	1.4.1.3													
			Control system schematics	1.4.1.4													
			HVAC Equipment Electrical Ladder diagrams	1.4.1.5													
			Component wiring diagrams	1.4.1.6													
			Terminal strip diagrams	1.4.1.7													
			Communication architecture schematic	1.4.1.8													
			SD-03 Product Data														
			Direct Digital Controllers	2.1.1													
			BACnet Gateways	2.1.1.10													
			BACnet Protocol Analyzer	2.1.4													
			DDC Software	2.1.3													
			Sensors and Input Hardware	2.2													
			Output Hardware	2.3													
			Surge and transient protection	2.4.2													

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		23 09 23.13 20	Indicators	2.6													
			Duct smoke detectors	2.5.1													
			SD-05 Design Data														
			Performance Verification Testing Plan	3.3.2													
			Pre-Performance Verification Testing Checklist	3.3.4													
			SD-06 Test Reports														
			Performance Verification Testing Report	3.3.11													
			SD-07 Certificates														
			Contractor's Qualifications	1.6.6													
			SD-09 Manufacturer's Field Reports														
			Pre-PVT Checklist	3.3.1													
			SD-10 Operation and Maintenance Data														
			BACnet Direct Digital Control Systems	1.4													
			SD-11 Closeout Submittals														
			Training documentation	3.4.1													
		23 21 13.00 20	SD-02 Shop Drawings														
			Hot water heating system	1.3.1													
			SD-03 Product Data														
			Pumps	2.3.1													
			Expansion tanks	2.3.2													

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		23 21 13.00 20	Ultrasonic Flowmeter	2.3.4													
			Ultrasonic Flowmeter	2.3.4													
			External air separation tanks	2.3.3													
			Hot water heating pipe	2.1.1													
			SD-06 Test Reports														
			Hydrostatic test of piping system	3.3.1													
			SD-07 Certificates														
			Report of prior installations	1.5.2.1													
			Welding procedures	1.5.2.2													
			Welder's qualifications	1.5.2.3													
		23 22 26.00 20	SD-03 Product Data														
			Convertors	2.2													
			Condensate return pumping units	2.3.1													
			Valves	2.1.7													
			Steam meters	2.1.10.1													
			Traps	2.1.10.3													
			Strainers	2.1.10.4													
			Flash Tanks	2.1.10.7													
			Instrumentation	2.1.9													
			SD-06 Test Reports														
			Steam piping	2.1.1													
			Copper tubing	2.1.2.1													
			Valves	2.1.7													
			Instrumentation	2.1.9													
			Pipe and pipe system	2.1													
			Convertors	2.2													

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																		(a)
		23 22 26.00 20	Condensate return pumping units	2.3.1														
			SD-07 Certificates															
			Welding procedure	1.4.1														
			Welder's Performance	1.4.2														
			Qualification Record															
			List of welders and welder's symbols	1.4.2														
			SD-08 Manufacturer's Instructions															
			Convertors	2.2														
			Condensate return pumping units	2.3.1														
		23 64 10	SD-03 Product Data															
			Water Chiller	3.1														
			Water Chiller	3.1														
			Water Chiller	3.4.1														
			Water Chiller	3.4.1														
			Water Chiller	3.4.2														
			Water Chiller	3.4.2														
			Posted Instructions	3.6														
			Verification of Dimensions	1.5.1														
			Manufacturer's Multi-Year Compressor Warranty	1.7														
			System Performance Tests	3.5														
			Demonstrations	3.6														
			SD-06 Test Reports															
			Field Acceptance Testing	3.4														
			Water Chiller	3.1														

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		23 64 10	Water Chiller	3.4.1													
			Water Chiller	3.4.2													
			System Performance Tests	3.5													
			SD-07 Certificates														
			Refrigeration System	3.1.1													
			SD-08 Manufacturer's Instructions														
			Water Chiller	3.1													
			Water Chiller	3.4.1													
			Water Chiller	3.4.2													
			SD-10 Operation and Maintenance														
			Data														
			Operation and Maintenance	3.6													
			Manuals														
		23 64 26	SD-03 Product Data														
			Calibrated Balancing Valves	2.4.8													
			Pump Discharge Valve	2.4.9													
			Water Temperature Mixing Valve	2.4.10													
			Water Temperature Regulating	2.4.11													
			Valves														
			Water Pressure Reducing Valve	2.4.12													
			Pressure Relief Valve	2.4.13													
			Combination Pressure and	2.4.14													
			Temperature Relief Valves														
			Pumps	2.6													
			Combination Strainer and Pump	2.5.3													
			Suction Diffuser														

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		23 64 26	Expansion Tanks	2.7													
			Air Separator Tanks	2.8													
			Ultrasonic flow meter	2.9													
			Ultrasonic flow meter	2.9													
			SD-06 Test Reports														
			Piping welds NDE report	3.1.1.3													
			Pressure tests reports	3.4.2													
			SD-07 Certificates														
			Employer's Record Documents (For Welding)	3.1.1.1													
			Welding Procedures and Qualifications	3.1.1.2													
			SD-10 Operation and Maintenance Data														
			Calibrated Balancing Valves	2.4.8													
			Pump Discharge Valve	2.4.9													
			Water Temperature Mixing Valve	2.4.10													
			Water Pressure Reducing Valve	2.4.12													
			Pressure Relief Valve	2.4.13													
			Combination Pressure and Temperature Relief Valves	2.4.14													
			Pumps	2.6													
			Combination Strainer and Pump Suction Diffuser	2.5.3													
			Expansion Tanks	2.7													
			Air Separator Tanks	2.8													

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		23 81 00.00 20	SD-02 Shop Drawings														
			Field-assembled refrigerant piping	2.5.2													
			Control system wiring diagrams	1.4.2													
			SD-03 Product Data														
			Air conditioners	2.1													
			Filters	2.2													
			Refrigerant piping and accessories	2.5													
			Coatings for finned tube coils	2.3													
			SD-06 Test Reports														
			Salt-spray tests	2.7.1													
			Start-up and initial operational tests	3.7.3													
			SD-08 Manufacturer's Instructions														
			Air conditioners	2.1													
			Refrigerant piping and accessories	2.5													
			SD-10 Operation and Maintenance Data														
			Air conditioners	2.1													
			SD-11 Closeout Submittals														
			Posted operating instructions	1.4.4													
		23 82 00.00 20	SD-03 Product Data														
			Unit heaters	2.1													

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
 Facility Energy Repairs, Building 131 CP12024M/CP12024R 5899390

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT OR CLASSIFICATION REVIEW	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				REMARKS		
						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 REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE		DATE OF ACTION	MAILED TO CONTR/ DATE RCD FRM APPR AUTH
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		23 82 00.00 20	SD-10 Operation and Maintenance Data														
			Unit heaters	2.1													
		26 20 00	SD-02 Shop Drawings														
			Panelboards	2.10													
			SD-03 Product Data														
			Receptacles	2.9													
			Circuit breakers	2.10.3													
			Switches	2.7													
			SD-06 Test Reports														
			600-volt wiring test	3.5.2													
			Grounding system test	3.5.4													
			Ground-fault receptacle test	3.5.3													
			SD-07 Certificates														
			Fuses	2.8													
		26 29 23	SD-02 Shop Drawings														
			Schematic diagrams	1.5.1													
			Interconnecting diagrams	1.5.2													
			Installation drawings	1.5.3													
			SD-03 Product Data														
			Variable frequency drives	2.1													
			Wires and cables	2.3													
			Equipment schedule	1.5.4													
			SD-06 Test Reports														
			VFD Test	3.2.1													
			Performance Verification Tests	3.2.2													

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
 Facility Energy Repairs, Building 131 CP12024M/CP12024R 5899390

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH	GOVT CLASSIFICATION REVIEW	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS		
						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE			DATE OF ACTION	
																		(a)
		26 29 23	Endurance Test	3.2.3														
			SD-08 Manufacturer's Instructions															
			Installation instructions	1.5.5														
			SD-09 Manufacturer's Field Reports															
			VFD Factory Test Plan	2.5.1														
			Factory test results	1.5.6														
			SD-10 Operation and Maintenance Data															
			Variable frequency drives	2.1														
		26 51 00.00 20	SD-03 Product Data															
			LED High Bay Lighting Fixtures	2.1	G													
			Occupancy sensors	2.4	G													
			Energy Efficiency	1.6.2.3														
			SD-06 Test Reports															
			Operating test	3.3														
			SD-10 Operation and Maintenance Data															
			Lighting Control System	1.4.1	G													
			Operational Service	1.8														
		28 31 63.00 20	SD-02 Shop Drawings															
			Battery power calculations	1.5.1														
			SD-03 Product Data															
			Smoke sensors	2.2.3														
			Wiring	2.2.4.2														
			Wiring	2.3														

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION

Facility Energy Repairs, Building 131 CP12024M/CP12024R 5899390

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH #	GOVT CLASSIFICATION	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		APPROVING AUTHORITY				REMARKS		
						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 REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE		DATE OF ACTION	MAILED TO CONTR/ DATE RCD FRM APPR AUTH
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		28 31 63.00 20	Smoke sensor testing procedures	2.2.3.3													
			SD-07 Certificates														
			Qualifications of installer	1.5.2													
			SD-10 Operation and Maintenance														
			Data														
			INTERIOR FIRE ALARM SYSTEM	2.2													
			Record drawing software	1.5.3													

SECTION 01 35 26

GOVERNMENTAL SAFETY REQUIREMENTS

02/11

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.

ASME INTERNATIONAL (ASME)

ASME B30.22	(2010) Articulating Boom Cranes
ASME B30.3	(2009) Tower Cranes
ASME B30.5	(2007) Mobile and Locomotive Cranes
ASME B30.8	(2010) Floating Cranes and Floating Derricks

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 10	(2010) Standard for Portable Fire Extinguishers
NFPA 241	(2009) Standard for Safeguarding Construction, Alteration, and Demolition Operations
NFPA 51B	(2009; TIA 09-1) Standard for Fire Prevention During Welding, Cutting, and Other Hot Work
NFPA 70	(2011; TIA 11-1; Errata 2011) National Electrical Code
NFPA 70E	(2009; Errata 09-1) Standard for Electrical Safety in the Workplace

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2008; Errata 1-2010; Changes 1-3 2010; Changes 4-6 2011) Safety and Health Requirements Manual
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U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910	Occupational Safety and Health Standards
29 CFR 1910.146	Permit-required Confined Spaces
29 CFR 1915	Confined and Enclosed Spaces and Other Dangerous Atmospheres in Shipyard Employment

29 CFR 1926 Safety and Health Regulations for Construction

29 CFR 1926.500 Fall Protection

1.2 SUBMITTALS

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

SD-01 Preconstruction Submittals

Accident Prevention Plan (APP); G

Activity Hazard Analysis (AHA); G

Crane Critical Lift Plan; G

Proof of qualification for Crane Operators; G

SD-06 Test Reports

Reports

Submit reports as their incidence occurs, in accordance with the requirements of the paragraph entitled, "Reports."

Accident Reports

Monthly Exposure Reports

Crane Reports

Regulatory Citations and Violations

SD-07 Certificates

Confined Space Entry Permit

Hot work permit

Contractor Safety Self-Evaluation Checklist; G, A

Submit one copy of each permit/certificate attached to each Daily Production Report.

Machinery & Mechanized Equipment Certification Form

1.2 DEFINITIONS

a. High Visibility Accident. Any mishap which may generate publicity and/or high visibility.

b. Medical Treatment. Treatment administered by a physician or by registered professional personnel under the standing orders of a physician. Medical treatment does not include first aid treatment even through provided by a physician or registered personnel.

c. Recordable Injuries or Illnesses. Any work-related injury or illness that results in:

- (1) Death, regardless of the time between the injury and death, or the length of the illness;
- (2) Days away from work (any time lost after day of injury/illness onset);
- (3) Restricted work;
- (4) Transfer to another job;
- (5) Medical treatment beyond first aid;
- (6) Loss of consciousness; or
- (7) A significant injury or illness diagnosed by a physician or other licensed health care professional, even if it did not result in (1) through (6) above.

d. "USACE" property and equipment specified in USACE EM 385-1-1 should be interpreted as Government property and equipment.

e. Weight Handling Equipment (WHE) Accident. A WHE accident occurs when any one or more of the six elements in the operating envelope fails to perform correctly during operation, including operation during maintenance or testing resulting in personnel injury or death; material or equipment damage; dropped load; derailment; two-blocking; overload; and/or collision, including unplanned contact between the load, crane, and/or other objects. A dropped load, derailment, two-blocking, overload and collision are considered accidents even though no material damage or injury occurs. A component failure (e.g., motor burnout, gear tooth failure, bearing failure) is not considered an accident solely due to material or equipment damage unless the component failure results in damage to other components (e.g., dropped boom, dropped load, roll over, etc.).

1.3 CONTRACTOR SAFETY SELF-EVALUATION CHECKLIST

Contracting Officer will provide a "Contractor Safety Self-Evaluation checklist" to the Contractor at the pre-construction conference. The checklist will be completed monthly by the Contractor and submitted with each request for payment voucher. An acceptable score of 90 or greater is required. Failure to submit the completed safety self-evaluation checklist or achieve a score of at least 90, will result in a retention of up to 10 percent of the voucher.

1.5 REGULATORY REQUIREMENTS

In addition to the detailed requirements included in the provisions of this contract, work performed shall comply with USACE EM 385-1-1. Submit matters of interpretation of standards to the appropriate administrative agency for resolution before starting work. Where the requirements of this specification, applicable laws, criteria, ordinances, regulations, and referenced documents vary, the most stringent requirements shall apply.

1.4 SITE QUALIFICATIONS, DUTIES AND MEETINGS

1.4.1 Personnel Qualifications

1.4.1.1 Site Safety and Health Officer (SSHO)

Site Safety and Health Officer (SSHO) shall be provided at the work site at all times to perform safety and occupational health management, surveillance, inspections, and safety enforcement for the Contractor. The Contractor Quality Control (QC) person can be the SSHO on this project. The SSHO shall meet the following requirements:

Level 1:

Worked on similar projects.

10-hour OSHA construction safety class or equivalent within last 3 years.

Competent person training as needed.

1.4.1.2 Crane Operators

Crane operators shall meet the requirements in USACE EM 385-1-1, Section 16 and Appendix G. In addition, for mobile cranes with Original Equipment Manufacturer (OEM) rated capacities of 50,000 pounds or greater, crane operators shall be designated as qualified by a source that qualifies crane operators (i.e., union, a government agency, or an organization that tests and qualifies crane operators). Proof of current qualification shall be provided.

1.4.2 Personnel Duties

1.4.2.1 Site Safety and Health Officer (SSHO)/Superintendent

a. Conduct daily safety and health inspections and maintain a written log which includes area/operation inspected, date of inspection, identified hazards, recommended corrective actions, estimated and actual dates of corrections. Safety inspection logs shall be attached to the Contractors' daily production report.

b. Conduct mishap investigations and complete required reports. Maintain the OSHA Form 300 and Daily Production reports for prime and sub-contractors.

c. Maintain applicable safety reference material on the job site.

d. Attend the pre-construction conference, pre-work meetings including preparatory inspection meeting, and periodic in-progress meetings.

e. Implement and enforce accepted APPS and AHAs.

f. Maintain a safety and health deficiency tracking system that monitors outstanding deficiencies until resolution. A list of unresolved safety and health deficiencies shall be posted on the safety bulletin board.

g. Ensure sub-contractor compliance with safety and health requirements.

Failure to perform the above duties will result in dismissal of the superintendent and/or SSHO, and a project work stoppage. The project work

stoppage will remain in effect pending approval of a suitable replacement.

1.4.3 Meetings

1.4.3.1 Preconstruction Conference

a. Contractor representatives who have a responsibility or significant role in accident prevention on the project shall attend the preconstruction conference. This includes the project superintendent, site safety and health officer, quality control supervisor, or any other assigned safety and health professionals who participated in the development of the APP (including the Activity Hazard Analyses (AHAs) and special plans, program and procedures associated with it).

b. The Contractor shall discuss the details of the submitted APP to include incorporated plans, programs, procedures and a listing of anticipated AHAs that will be developed and implemented during the performance of the contract. This list of proposed AHAs will be reviewed at the conference and an agreement will be reached between the Contractor and the Contracting Officer's representative as to which phases will require an analysis. In addition, a schedule for the preparation, submittal, review, and acceptance of AHAs shall be established to preclude project delays.

c. Deficiencies in the submitted APP will be brought to the attention of the Contractor at the preconstruction conference, and the Contractor shall revise the plan to correct deficiencies and re-submit it for acceptance. Work shall not begin until there is an accepted APP.

d. The functions of a Preconstruction conference may take place at the Post-Award Kickoff meeting for Design Build Contracts.

1.5 Safety Meetings

Shall be conducted and documented as required by EM 385-1-1. Minutes showing contract title, signatures of attendees and a list of topics discussed shall be attached to the Contractors' daily production report.

1.6 ACCIDENT PREVENTION PLAN (APP)

The Contractor shall use a qualified person to prepare the written site-specific APP. Prepare the APP in accordance with the format and requirements of USACE EM 385-1-1 and as supplemented herein. Cover all paragraph and subparagraph elements in USACE EM 385-1-1, Appendix A, "Minimum Basic Outline for Accident Prevention Plan". Specific requirements for some of the APP elements are described below. The APP shall be job-specific and shall address any unusual or unique aspects of the project or activity for which it is written. The APP shall interface with the Contractor's overall safety and health program. Any portions of the Contractor's overall safety and health program referenced in the APP shall be included in the applicable APP element and made site-specific. The Government considers the Prime Contractor to be the "controlling authority" for all work site safety and health of the subcontractors. Contractors are responsible for informing their subcontractors of the safety provisions under the terms of the contract and the penalties for noncompliance, coordinating the work to prevent one craft from interfering with or creating hazardous working conditions for other crafts, and inspecting subcontractor operations to ensure that accident prevention responsibilities are being carried out. The APP shall be signed by the

person and firm (senior person) preparing the APP, the Contractor, the on-site superintendent, the designated site safety and health officer and any designated CSP and/or CIH.

Submit the APP to the Contracting Officer 15 calendar days prior to the date of the preconstruction conference for acceptance. Work cannot proceed without an accepted APP.

Once accepted by the Contracting Officer, the APP and attachments will be enforced as part of the contract. Disregarding the provisions of this contract or the accepted APP will be cause for stopping of work, at the discretion of the Contracting Officer, until the matter has been rectified.

Once work begins, changes to the accepted APP shall be made with the knowledge and concurrence of the Contracting Officer, project superintendent, SSHO and quality control manager. Should any hazard become evident, stop work in the area, secure the area, and develop a plan to remove the hazard. Notify the Contracting Officer within 24 hours of discovery. Eliminate/remove the hazard. In the interim, all necessary action shall be taken to restore and maintain safe working conditions in order to safeguard onsite personnel, visitors, the public (as defined by ANSI/ASSE A10.34,) and the environment.

Copies of the accepted plan will be maintained at the Contracting Officer's office and at the job site.

The APP shall be continuously reviewed and amended, as necessary, throughout the life of the contract. Unusual or high-hazard activities not identified in the original APP shall be incorporated in the plan as they are discovered.

1.6.1 EM 385-1-1 Contents

In addition to the requirements outlines in Appendix A of USACE EM 385-1-1, the following is required:

- a. Names and qualifications (resumes including education, training, experience and certifications) of all site safety and health personnel designated to perform work on this project to include the designated site safety and health officer and other competent and qualified personnel to be used such as CSPs, CIHs, STSs, CHSTs. The duties of each position shall be specified.
- b. Qualifications of competent and of qualified persons. As a minimum, competent persons shall be designated and qualifications submitted for each of the following major areas: excavation; scaffolding; fall protection; hazardous energy; confined space; health hazard recognition, evaluation and control of chemical, physical and biological agents; personal protective equipment and clothing to include selection, use and maintenance.
- c. Confined Space Entry Plan. Develop a confined space entry plan in accordance with USACE EM 385-1-1, applicable OSHA standards 29 CFR 1910, 29 CFR 1915, and 29 CFR 1926, and any other federal, state and local regulatory requirements identified in this contract. Identify the qualified person's name and qualifications, training, and experience. Delineate the qualified person's authority to direct work stoppage in the event of hazardous conditions. Include procedure for rescue by contractor personnel and the coordination with emergency responders.

(If there is no confined space work, include a statement that no confined space work exists and none will be created.)

d. Crane Critical Lift Plan. Prepare and sign weight handling critical lift plans for lifts over 75 percent of the capacity of the crane or hoist (or lifts over 50 percent of the capacity of a barge mounted mobile crane's hoists) at any radius of lift; lifts involving more than one crane or hoist; lifts of personnel; and lifts involving non-routine rigging or operation, sensitive equipment, or unusual safety risks. The plan shall be submitted 15 calendar days prior to on-site work and include the requirements of USACE EM 385-1-1, paragraph 16.C.18. and the following:

(1) For lifts of personnel, the plan shall demonstrate compliance with the requirements of 29 CFR 1926.550(g).

e. Fall Protection and Prevention (FP&P) Plan. The plan shall be site specific and address all fall hazards in the work place and during different phases of construction. It shall address how to protect and prevent workers from falling to lower levels when they are exposed to fall hazards above 1.8 m (6 feet). A qualified person for fall protection shall prepare and sign the plan. The plan shall include fall protection and prevention systems, equipment and methods employed for every phase of work, responsibilities, assisted rescue, self-rescue and evacuation procedures, training requirements, and monitoring methods. Fall Protection and Prevention Plan shall be revised for lengthy projects, reflecting any changes during the course of construction due to changes in personnel, equipment, systems or work habits. The accepted Fall Protection and Prevention Plan shall be kept and maintained at the job site for the duration of the project. The Fall Protection and Prevention Plan shall be included in the Accident Prevention Plan (APP).

f. Lead Compliance Plan. The safety and health aspects of lead work, prepared in accordance with Section 02 83 13.00 20 LEAD IN CONSTRUCTION.

g. Site Demolition Plan. The safety and health aspects prepared in accordance with Section 02 41 00 DEMOLITION and referenced sources.

1.7 ACTIVITY HAZARD ANALYSIS (AHA)

The Activity Hazard Analysis (AHA) format shall be in accordance with USACE EM 385-1-1. Submit the AHA for review at least 15 calendar days prior to the start of each phase. Format subsequent AHAs as amendments to the APP. The analysis should be used during daily inspections to ensure the implementation and effectiveness of the activity's safety and health controls.

The AHA list will be reviewed periodically (at least monthly) at the Contractor supervisory safety meeting and updated as necessary when procedures, scheduling, or hazards change.

The activity hazard analyses shall be developed using the project schedule as the basis for the activities performed. Any activities listed on the project schedule will require an AHA. The AHAs will be developed by the contractor, supplier or subcontractor and provided to the prime contractor for submittal to the Contracting Officer.

1.8 DISPLAY OF SAFETY INFORMATION

Within 1 calendar days after commencement of work, erect a safety bulletin board at the job site. The safety bulletin board shall include information and be maintained as required by EM 385-1-1, section 01.A.06. Additional items required to be posted include:

- a. Confined space entry permit.
- b. Hot work permit.

1.9 SITE SAFETY REFERENCE MATERIALS

Maintain safety-related references applicable to the project, including those listed in the article "References." Maintain applicable equipment manufacturer's manuals.

1.10 EMERGENCY MEDICAL TREATMENT

Contractors will arrange for their own emergency medical treatment. Government has no responsibility to provide emergency medical treatment.

1.11 REPORTS

1.11.1 Accident Reports

a. For recordable injuries and illnesses, and property damage accidents resulting in at least \$2,000 in damages, the Prime Contractor shall conduct an accident investigation to establish the root cause(s) of the accident, complete the and provide the report to the Contracting Officer within 5 calendar day(s) of the accident. The Contracting Officer will provide copies of any required or special forms.

b. For any weight handling equipment accident (including rigging gear accidents) the Prime Contractor shall conduct an accident investigation to establish the root cause(s) of the accident, complete the WHE Accident Report (Crane and Rigging Gear) form and provide the report to the Contracting Officer within 30 calendar days of the accident. Crane operations shall not proceed until cause is determined and corrective actions have been implemented to the satisfaction of the contracting officer. The Contracting Officer will provide a blank copy of the accident report form.

1.11.2 Accident Notification

Notify the Contracting Officer as soon as practical, but not later than four hours, after any accident meeting the definition of Recordable Injuries or Illnesses or High Visibility Accidents, property damage equal to or greater than \$2,000, or any weight handling equipment accident. Information shall include contractor name; contract title; type of contract; name of activity, installation or location where accident occurred; date and time of accident; names of personnel injured; extent of property damage, if any; extent of injury, if known, and brief description of accident (to include type of construction equipment used, PPE used, etc.). Preserve the conditions and evidence on the accident site until the Government investigation team arrives on-site and Government investigation is conducted.

1.11.3 Monthly Exposure Reports

Monthly exposure reporting to the Contracting Officer is required to be attached to the monthly billing request. This report is a compilation of employee-hours worked each month for all site workers, both prime and subcontractor. The Contracting Officer will provide copies of any special forms.

1.11.4 Crane Reports

Submit crane inspection reports required in accordance with USACE EM 385-1-1, Appendix H and as specified herein with Daily Reports of Inspections.

1.12 HOT WORK

Prior to performing "Hot Work" (welding, cutting, etc.) or operating other flame-producing/spark producing devices, a written permit shall be requested from the Fire Division. CONTRACTORS ARE REQUIRED TO MEET ALL CRITERIA BEFORE A PERMIT IS ISSUED. The Contractor will provide at least two (2) twenty (20) pound 4A:20 BC rated extinguishers for normal "Hot Work". All extinguishers shall be current inspection tagged, approved safety pin and tamper resistant seal. It is also mandatory to have a designated FIRE WATCH for any "Hot Work" done at this activity. The Fire Watch shall be trained in accordance with NFPA 51B and remain on-site for a minimum of 30 minutes after completion of the task or as specified on the hot work permit.

When starting work in the facility, Contractors shall require their personnel to familiarize themselves with the location of the nearest fire alarm boxes and place in memory the emergency Fire Division phone number. ANY FIRE, NO MATTER HOW SMALL, SHALL BE REPORTED TO THE RESPONSIBLE FIRE DIVISION IMMEDIATELY.

PART 2 PRODUCTS

2.1 CONFINED SPACE SIGNAGE

The Contractor shall provide permanent signs integral to or securely attached to access covers for new permit-required confined spaces. Signs wording: "DANGER--PERMIT-REQUIRED CONFINED SPACE - DO NOT ENTER -" in bold letters a minimum of 25 mm (one inch) in height and constructed to be clearly legible with all paint removed. The signal word "DANGER" shall be red and readable from 1.52 m (5 feet).

2.2 FALL PROTECTION ANCHORAGE

Fall protection anchorage, conforming to ANSI Z359.1, installed under the supervision of a qualified person in fall protection, shall be left in place for continued customer use and so identified by signage stating the capacity of the anchorage (strength and number of persons who may be tied-off to it at any one time).

PART 3 EXECUTION

3.1 CONSTRUCTION AND/OR OTHER WORK

The Contractor shall comply with USACE EM 385-1-1, NFPA 241, the APP, the AHA, Federal and/or State OSHA regulations, and other related submittals and activity fire and safety regulations. The most stringent standard

shall prevail.

3.1.1 Hazardous Material Use

Each hazardous material must receive approval prior to being brought onto the job site or prior to any other use in connection with this contract. Allow a minimum of 10 working days for processing of the request for use of a hazardous material.

3.1.2 Hazardous Material Exclusions

Notwithstanding any other hazardous material used in this contract, radioactive materials or instruments capable of producing ionizing/non-ionizing radiation (with the exception of radioactive material and devices used in accordance with USACE EM 385-1-1 such as nuclear density meters for compaction testing and laboratory equipment with radioactive sources) as well as materials which contain asbestos, mercury or polychlorinated biphenyls, di-isocyanates, lead-based paint are prohibited. The Contracting Officer, upon written request by the Contractor, may consider exceptions to the use of any of the above excluded materials.

3.1.3 Unforeseen Hazardous Material

The design should have identified materials such as PCB, lead paint, and friable and non-friable asbestos. If material, not indicated, that may be hazardous to human health upon disturbance during construction operations is encountered, stop that portion of work and notify the Contracting Officer immediately. Within 14 calendar days the Government will determine if the material is hazardous. If material is not hazardous or poses no danger, the Government will direct the Contractor to proceed without change. If material is hazardous and handling of the material is necessary to accomplish the work, the Government will issue a modification pursuant to "FAR 52.243-4, Changes" and "FAR 52.236-2, Differing Site Conditions."

3.2 PRE-OUTAGE COORDINATION MEETING

Contractors are required to apply for utility outages at least 15 days in advance. As a minimum, the request should include the location of the outage, utilities being affected, duration of outage and any necessary sketches. Special requirements for electrical outage requests are contained elsewhere in this specification section. Once approved, and prior to beginning work on the utility system requiring shut down, the Contractor shall attend a pre-outage coordination meeting with the Contracting Officer to review the scope of work and the lock-out/tag-out procedures for worker protection. No work will be performed on energized electrical circuits unless proof is provided that no other means exist.

3.3 FALL HAZARD PROTECTION AND PREVENTION PROGRAM

The Contractor shall establish a fall protection and prevention program, for the protection of all employees exposed to fall hazards. The program shall 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.

3.3.1 Training

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

3.3.2 Fall Protection Equipment and Systems

The Contractor shall 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. Employees shall be protected 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 ANSI A10.32.

3.3.2.1 Personal Fall Arrest Equipment

Personal fall arrest equipment, systems, subsystems, and components shall meet ANSI 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 carabiners 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 1.8 m (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.

3.3.3 Fall Protection for Roofing Work

Fall protection controls shall be implemented based on the type of roof being constructed and work being performed. The roof area to be accessed shall be evaluated 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, personnel shall be protected from falling by use of personal fall arrest systems, guardrails, or safety nets.

(2) For work greater than 1.8 m (6 feet) from an edge, warning lines shall be erected and installed 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.

3.3.4 Existing Anchorage

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

3.3.5 Horizontal Lifelines

Horizontal lifelines shall be designed, installed, certified and used under the supervision of a qualified person for fall protection as part of a complete fall arrest system which maintains a safety factor of 2 (29 CFR 1926.500).

3.3.6 Guardrails and Safety Nets

Guardrails and safety nets shall be designed, installed and used in accordance with EM 385-1-1 and 29 CFR 1926 Subpart M.

3.3.7 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. A Rescue and Evacuation Plan shall be prepared by the contractor 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. The Rescue and Evacuation Plan shall be included in the Activity Hazard Analysis (AHA) for the phase of work, in the Fall Protection and Prevention (FP&P) Plan, and the Accident Prevention Plan (APP).

3.4 SCAFFOLDING

3.5 EQUIPMENT

3.5.1 Material Handling Equipment

a. Material handling equipment such as forklifts shall not be modified with work platform attachments for supporting employees unless specifically delineated in the manufacturer's printed operating instructions.

b. The use of hooks on equipment for lifting of material must be in accordance with manufacturer's printed instructions.

c. Operators of forklifts or power industrial trucks shall be licensed in accordance with OSHA.

3.5.2 Weight Handling Equipment

- a. Cranes and derricks shall be equipped as specified in EM 385-1-1, section 16.
- b. The Contractor shall notify the Contracting Officer 15 days in advance of any cranes entering the activity so that necessary quality assurance spot checks can be coordinated. Prior to cranes entering federal activities, a Crane Access Permit must be obtained from the Contracting Officer. A copy of the permitting process will be provided at the Preconstruction Conference. Contractor's operator shall remain with the crane during the spot check.
- c. The Contractor shall comply with the crane manufacturer's specifications and limitations for erection and operation of cranes and hoists used in support of the work. Erection shall be performed under the supervision of a designated person (as defined in ASME B30.5). All testing shall be performed in accordance with the manufacturer's recommended procedures.
- d. The Contractor shall comply with ASME B30.5 for mobile and locomotive cranes, ASME B30.22 for articulating boom cranes, ASME B30.3 for construction tower cranes, and ASME B30.8 for floating cranes and floating derricks.
- e. Under no circumstance shall a Contractor make a lift at or above 90% of the cranes rated capacity in any configuration.
- f. When operating in the vicinity of overhead transmission lines, operators and riggers shall be alert to this special hazard and shall follow the requirements of USACE EM 385-1-1 section 11 and ASME B30.5 or ASME B30.22 as applicable.
- g. Crane suspended personnel work platforms (baskets) shall not be used unless the Contractor proves that using any other access to the work location would provide a greater hazard to the workers or is impossible. Personnel shall not be lifted with a line hoist or friction crane.
- h. Portable fire extinguishers shall be inspected, maintained, and recharged as specified in NFPA 10, Standard for Portable Fire Extinguishers.
- i. All employees shall be kept clear of loads about to be lifted and of suspended loads.
- j. The Contractor shall use cribbing when performing lifts on outriggers.
- k. The crane hook/block must be positioned directly over the load. Side loading of the crane is prohibited.
- l. A physical barricade must be positioned to prevent personnel from entering the counterweight swing (tail swing) area of the crane.
- m. Certification records which include the date of inspection, signature of the person performing the inspection, and the serial number or other identifier of the crane that was inspected shall always be available for review by Contracting Officer personnel.

n. Written reports listing the load test procedures used along with any repairs or alterations performed on the crane shall be available for review by Contracting Officer personnel.

o. Certify that all crane operators have been trained in proper use of all safety devices (e.g. anti-two block devices).

p. Take steps to ensure that wind speed does not contribute to loss of control of the load during lifting operations. Prior to conducting lifting operations the contractor shall set a maximum wind speed at which a crane can be safely operated based on the equipment being used, the load being lifted, experience of operators and riggers, and hazards on the work site. This maximum wind speed determination shall be included as part of the activity hazard analysis plan for that operation.

3.5.3 Equipment and Mechanized Equipment

a. Proof of qualifications for operator shall be kept on the project site for review.

b. Manufacture specifications or owner's manual for the equipment shall be on-site and reviewed for additional safety precautions or requirements that are sometimes not identified by OSHA or USACE EM 385-1-1. Such additional safety precautions or requirements shall be incorporated into the AHAs.

3.6 EXCAVATIONS

The competent person shall perform soil classification in accordance with 29 CFR 1926.

3.6.1 Utility Locations

Prior to digging, the appropriate digging permit must be obtained. All underground utilities in the work area must be positively identified by a private utility locating service in addition to any station locating service and coordinated with the station utility department. Any markings made during the utility investigation must be maintained throughout the contract.

3.6.2 Utility Location Verification

The Contractor must physically verify underground utility locations by hand digging using wood or fiberglass handled tools when any adjacent construction work is expected to come within three feet of the underground system. Digging within 0.061 m (2 feet) of a known utility must not be performed by means of mechanical equipment; hand digging shall be used. If construction is parallel to an existing utility the utility shall be exposed by hand digging every 30.5 m (100 feet) if parallel within 1.5 m (5 feet) of the excavation.

3.6.3 Shoring Systems

Trench and shoring systems must be identified in the accepted safety plan and AHA. Manufacture tabulated data and specifications or registered engineer tabulated data for shoring or benching systems shall be readily available on-site for review. Job-made shoring or shielding shall have the

registered professional engineer stamp, specifications, and tabulated data. Extreme care must be used when excavating near direct burial electric underground cables.

3.6.4 Trenching Machinery

Trenching machines with digging chain drives shall be operated only when the spotters/laborers are in plain view of the operator. Operator and spotters/laborers shall be provided training on the hazards of the digging chain drives with emphasis on the distance that needs to be maintained when the digging chain is operating. Documentation of the training shall be kept on file at the project site.

3.7 UTILITIES WITHIN CONCRETE SLABS

Utilities located within concrete slabs or pier structures, bridges, and the like, are extremely difficult to identify due to the reinforcing steel used in the construction of these structures. Whenever contract work involves concrete chipping, saw cutting, or core drilling, the existing utility location must be coordinated with station utility departments in addition to a private locating service. Outages to isolate utility systems shall be used in circumstances where utilities are unable to be positively identified. The use of historical drawings does not alleviate the contractor from meeting this requirement.

3.8 ELECTRICAL

3.8.1 Conduct of Electrical Work

Underground electrical spaces must be certified safe for entry before entering to conduct work. Cables that will be cut must be positively identified and de-energized prior to performing each cut. Positive cable identification must be made prior to submitting any outage request for electrical systems. Arrangements are to be coordinated with the Contracting Officer and Station Utilities for identification. The Contracting Officer will not accept an outage request until the Contractor satisfactorily documents that the circuits have been clearly identified. Perform all high voltage cable cutting remotely using hydraulic cutting tool. When racking in or live switching of circuit breakers, no additional person other than the switch operator will be allowed in the space during the actual operation. Plan so that work near energized parts is minimized to the fullest extent possible. Use of electrical outages clear of any energized electrical sources is the preferred method. When working in energized substations, only qualified electrical workers shall be permitted to enter. When work requires Contractor to work near energized circuits as defined by the NFPA 70, high voltage personnel must use personal protective equipment that includes, as a minimum, electrical hard hat, safety shoes, insulating gloves with leather protective sleeves, fire retarding shirts, coveralls, face shields, and safety glasses. In addition, provide electrical arc flash protection for personnel as required by NFPA 70E. Insulating blankets, hearing protection, and switching suits may also be required, depending on the specific job and as delineated in the Contractor's AHA.

3.8.2 Portable Extension Cords

Portable extension cords shall be sized in accordance with manufacturer ratings for the tool to be powered and protected from damage. All damaged extension cords shall be immediately removed from service. Portable

extension cords shall meet the requirements of NFPA 70.

3.9 WORK IN CONFINED SPACES

The Contractor shall comply with the requirements in Section 06.I of USACE EM 385-1-1, OSHA 29 CFR 1910.146 and OSHA 29 CFR 1926.21(b)(6). Any potential for a hazard in the confined space requires a permit system to be used.

a. Entry Procedures. Prohibit entry into a confined space by personnel for any purpose, including hot work, until the qualified person has conducted appropriate tests to ensure the confined or enclosed space is safe for the work intended and that all potential hazards are controlled or eliminated and documented. (See Section 06.I.06 of USACE EM 385-1-1 for entry procedures.) All hazards pertaining to the space shall be reviewed with each employee during review of the AHA.

b. Forced air ventilation is required for all confined space entry operations and the minimum air exchange requirements must be maintained to ensure exposure to any hazardous atmosphere is kept below its' action level.

c. Sewer wet wells require continuous atmosphere monitoring with audible alarm for toxic gas detection.

-- End of Section --

SECTION 01 45 00.00 20

CONSTRUCTION QUALITY CONTROL
02/10

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.

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1 (2003) Safety -- Safety and Health Requirements

1.2 SUBMITTALS

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

SD-01 Preconstruction Submittals

Construction Quality Control (QC) Plan; G

Submit a Construction QC Plan within 20 calendar days after receipt of Notice of Award.

The QC Plan shall include a preliminary submittal of the list of definable features of work that shall cover the first 90 days of construction.

1.3 INFORMATION FOR THE CONTRACTING OFFICER

At the Preconstruction Conference, the Contractor can obtain a single copy set of the current report forms from the Contracting Officer. The report forms will consist of the Contractor Production Report, Contractor Production Report (Continuation Sheet), Contractor Quality Control Report, Contractor Quality Control Report (Continuation Sheet), Preparatory Phase Checklist, Initial Phase Checklist, Rework Items List, and Testing Plan and Log, Other reports referenced below may be in formats customarily used by the Contractor, Testing laboratories, etc. and will contain the information required by this specification.

Deliver the following to the Contracting Officer during Construction:

- a. Combined Contractor Production Report/Contractor Quality Control Report; original and 1 copy by 10:00AM the next working day after each day that work is performed.
- b. Preparatory Phase Checklist: Original attached to the original Contractor Quality Control Report and 1 copy attached to each copy.
- c. Initial Phase Checklist: Original attached to the original Contractor Quality Control Report and 1 copy attached to each copy.

- d. Field Test Reports: 2 copies, with 2 working days after the test is performed, attached to the Contractor Quality Control Report.
- e. Monthly Summary Report of Tests: 2 copies attached to the Contractor Quality Control Report.
- f. Testing Plan and Log: 2 copies at the end of each month.
- g. Rework Items List: 2 copies, by the last working day of the month.
- h. CQC Meeting Minutes: 2 copies, within 2 working days after the meeting.
- i. QC Certifications: As required by the paragraph entitled "QC Certifications."

1.4 QC PROGRAM REQUIREMENTS

Establish and maintain a QC program as described in this section. This QC program is a key element in meeting the objectives of NAVFAC Commissioning. The QC program consists of a QC Organization, QC Plan, QC Plan Meeting(s), a Coordination and Mutual Understanding Meeting, QC meetings, three phases of control, submittal review and approval, testing, completion inspections, and QC certifications and documentation necessary to provide materials, equipment, workmanship, fabrication, construction and operations which comply with the requirements of this Contract. The QC program shall cover on-site and off-site work and shall be keyed to the work sequence. No construction work or testing may be performed unless the QC Manager is on the work site. The QC Manager shall report to an officer of the firm and shall not be subordinate to the Project Superintendent or the Project Manager. The QC Manager, Project Superintendent and Project Manager must work together effectively. Although the QC Manager is the primary individual responsible for quality control, all individuals will be held responsible for the quality of work on the job.

1.4.1 Acceptance of the Construction Quality Control (QC) Plan

Acceptance of the QC Plan is required prior to the start of construction. The Contracting Officer reserves the right to require changes in the QC Plan and operations as necessary, including removal of personnel, to ensure the specified quality of work. The Contracting Officer reserves the right to interview any member of the QC organization at any time in order to verify the submitted qualifications. All QC organization personnel shall be subject to acceptance by the Contracting Officer. The Contracting Officer may require the removal of any individual for non-compliance with quality requirements specified in the Contract.

1.4.2 Preliminary Construction Work Authorized Prior to Acceptance

The only construction work that is authorized to proceed prior to the acceptance of the QC Plan is mobilization of storage and office trailers, temporary utilities, and surveying.

1.4.2.1 Approval

Approval of the QC Plan is required prior to the start of construction. The contracting Officer reserves the right to require changes in the QC Plan and operations as necessary, including removal of personnel, to ensure the specified quality of work. The Contracting Officer reserves the right

to interview any member of the QC organization at any time in order to verify the submitted qualifications. All QC organization personnel shall be subject to acceptance by the Contracting Officer. The Contracting Officer may require the removal of any individual for non-compliance with quality requirements specified in the contract.

1.4.3 Notification of Changes

Notify the Contracting Officer, in writing, of any proposed changes in the QC Plan or changes to the QC organization personnel, a minimum of 7 work days prior to a proposed change. Proposed changes shall be subject to acceptance by the Contracting Officer.

1.5 QC ORGANIZATION

1.5.1 QC Manager

1.5.1.1 Duties

Provide a QC Manager at the work site to implement and manage the QC program. In addition to implementing and managing the QC program, the QC Manager may perform the duties of Project Superintendent. The QC Manager shall be designated as the safety competent person as defined by EM 385-1-1. The QC Manager is required to attend the partnering meetings, QC Plan Meetings, Coordination and Mutual Understanding Meeting, conduct the QC meetings, perform the three phases of control, perform submittal review and approval, ensure testing is performed and provide QC certifications and documentation required in this Contract. The QC Manager is responsible for managing and coordinating the three phases of control and documentation performed by testing laboratory personnel and any other inspection and testing personnel required by this Contract. The QC Manager is the manager of all QC activities.

1.5.1.2 Qualifications

An individual with a minimum of 10 years combined experience in the following positions: Project Superintendent, QC Manager, Project Manager, Project Engineer or Construction Manager on similar size and type construction contracts which included the major trades that are part of this Contract. The individual shall have at least two years experience as a QC Manager. The individual must be familiar with the requirements of EM 385-1-1, and have experience in the areas of hazard identification, safety compliance, and sustainability or a graduate of a four year accredited college or university program in one of the following disciplines: Engineering, Architecture, Construction Management, Engineering Technology, Building Construction, or Building Science, with a minimum of 5 years experience as a Project Superintendent, QC Manager, Project Manager, Project Engineer or Construction Manager on similar size and type construction contracts which included the major trades that are part of this Contract. The individual shall have at least two years experience as a QC Manager. The individual must be familiar with the requirements of EM 385-1-1, and have experience in the areas of hazard identification, safety compliance, and sustainability.

1.5.2 Construction Quality Management Training

In addition to the above experience and education requirements, the QC Manager shall have completed the course entitled "Construction Quality Management (CQM) for Contractors." If the QC Manager does not have a current certification, they shall obtain the CQM for Contractors course

certification within 90 days of award. This course is periodically offered by the Naval Facilities Engineering Command and the Army Corps of Engineers. Contact the Contracting Officer for information on the next scheduled class.

1.5.3 Alternate QC Manager Duties and Qualifications

Designate an alternate for the QC Manager at the work site to serve in the event of the designated QC Manager's absence. The period of absence may not exceed two weeks at one time, and not more than 30 workdays during a calendar year. The qualification requirements for the Alternate QC Manager shall be the same as for the QC Manager.

1.6 QUALITY CONTROL (QC) PLAN

1.6.1 Construction Quality Control (QC) Plan

1.6.1.1 Requirements

Provide, for acceptance by the Contracting Officer, a Construction QC Plan submitted in a three-ring binder that includes a table of contents, with major sections identified with tabs, with pages numbered sequentially that covers both on-site and off-site work and includes the following:

I. QC ORGANIZATION: A chart showing the QC organizational structure.

II. NAMES AND QUALIFICATIONS: Names and qualifications, in resume format, for each person in the QC organization. Include the CQM for Contractors course certifications for the QC Manager and Alternate QC Manager as required by the paragraphs entitled "Construction Quality Management Training" and "Alternate QC Manager Duties and Qualifications".

III. DUTIES, RESPONSIBILITY AND AUTHORITY OF QC PERSONNEL: Duties, responsibilities, and authorities of each person in the QC organization.

IV. OUTSIDE ORGANIZATIONS: A listing of outside organizations, such as architectural and consulting engineering firms, that will be employed by the Contractor and a description of the services these firms will provide.

V. APPOINTMENT LETTERS: Letters signed by an officer of the firm appointing the QC Manager and Alternate QC Manager and stating that they are responsible for implementing and managing the QC program as described in this Contract. Include in this letter the responsibility of the QC Manager and Alternate QC Manager to implement and manage the three phases of control, and their authority to stop work which is not in compliance with the Contract. The QC Manager shall issue letters of direction to all other QC Specialists outlining their duties, authorities, and responsibilities. Copies of the letters shall be included in the QC Plan.

VI. SUBMITTAL PROCEDURES AND INITIAL SUBMITTAL REGISTER: Procedures for reviewing, approving, and managing submittals. Provide the name(s) of the person(s) in the QC organization authorized to review and certify submittals prior to approval. Provide the initial submittal of the Submittal Register as specified in section 01 33 00 SUBMITTAL PROCEDURES.

VII. TESTING LABORATORY INFORMATION: Testing laboratory information required by the paragraphs entitled "Accreditation Requirements", as applicable.

VIII. TESTING PLAN AND LOG: A Testing Plan and Log that includes the tests required, referenced by the specification paragraph number requiring the test, the frequency, and the person responsible for each test.

IX. PROCEDURES TO COMPLETE REWORK ITEMS: Procedures to identify, record, track, and complete rework items. Use Government forms to record and track rework items.

X. DOCUMENTATION PROCEDURES: Use Government form.

XI. LIST OF DEFINABLE FEATURES: A Definable Feature of Work (DFOW) is a task that is separate and distinct from other tasks and has control requirements and work crews unique to that task, has the same control requirements and work crews.. A DFOW is identified by different trades or disciplines and is an item or activity on the construction schedule. The list of DFOWs shall include, but not be limited to, all critical path activities on the NAS. Include all activities for which this specification requires. Each design development stage and submittal package shall have separate DFOWs in the Network Analysis Schedule.

XII. PROCEDURES FOR PERFORMING THE THREE PHASES OF CONTROL: Identify procedures you will use to ensure the three phases of control are used to manage the quality on this project. For each DFOW, a Preparatory and Initial phase checklist will be filled out during the Preparatory and Initial phase meetings. The Preparatory and Initial Phases and meetings shall be conducted with a view towards obtaining quality construction by planning ahead and identifying potential problems for each DFOW.

XIII. PERSONNEL MATRIX: A personnel matrix showing for each section of the specification who will review and approve submittals, who will perform and document the three phases of control, and who will perform and document the testing.

XIV. PROCEDURES FOR COMPLETION INSPECTION: Procedures for identifying and documenting the completion inspection process. Include in these procedures the responsible party for punch out inspection, pre-final inspection, and final acceptance inspection.

XV. ORGANIZATION AND PERSONNEL CERTIFICATIONS LOG: Procedures for coordinating, tracking and documenting all certifications on subcontractors, testing laboratories, suppliers, personnel, etc. QC Manager will ensure that certifications are current, appropriate for the work being performed, and will not lapse during any period of the contract that the work is being performed.

1.7 QC PLAN MEETINGS

Prior to submission of the QC Plan, the QC Manager will meet with the Contracting Officer to discuss the QC Plan requirements of this Contract. The purpose of this meeting is to develop a mutual understanding of the QC Plan requirements prior to plan development and submission and to agree on the Contractor's list of DFOWs.

1.8 COORDINATION AND MUTUAL UNDERSTANDING MEETING

After submission of the QC Plan, and prior to the start of construction, the QC Manager will meet with the Contracting Officer to present the QC program required by this Contract. When a new QC Manager is appointed, the coordination and mutual understanding meeting shall be repeated.

1.8.1 Purpose

The purpose of this meeting is to develop a mutual understanding of the QC details, including documentation, administration for on-site and off-site work, , coordination of activities to be performed, and the coordination of the Contractor's management, production, and QC personnel. At the meeting, the Contractor will be required to explain in detail how three phases of control will be implemented for each DFOW, as well as how each DFOW will be affected by each management plan or requirement as listed below:

1.8.2 Coordination of Activities

Activities included in various sections shall be coordinated to assure efficient and orderly installation of each component. Coordinate operations included under different sections that are dependent on each other for proper installation and operation. Schedule construction operations with consideration for indoor air quality as specified in the IAQ Management Plan. Coordinate prefunctional tests and startup testing with Cx.

1.8.3 Attendees

As a minimum, the Contractor's personnel required to attend shall include an officer of the firm, the Project Manager, Project Superintendent, QC Manager, Alternate QC Manager, and subcontractor representatives. Each subcontractor who will be assigned QC responsibilities shall have a principal of the firm at the meeting. Minutes of the meeting will be prepared by the QC Manager and signed by the Contractor and the Contracting Officer. The Contractor shall provide a copy of the signed minutes to all attendees.

1.9 QC MEETINGS

After the start of construction, the QC Manager shall conduct weekly QC meetings at the work site with the Project Superintendent and the foremen who are performing the work of the DFOWs. The QC Manager shall prepare the minutes of the meeting and provide a copy to the Contracting Officer within two working days after the meeting. The Contracting Officer may attend these meetings. As a minimum, the following shall be accomplished at each meeting:

- a. Review the minutes of the previous meeting;
- b. Review the schedule and the status of work and rework;
- c. Review the status of submittals;
- d. Review the work to be accomplished in the next two weeks and documentation required;
- e. Resolve QC and production problems (RFI, etc.);

- f. Address items that may require revising the QC Plan;
- g. Review Accident Prevention Plan (APP);
- h. Review environmental requirements and procedures;
- i. Review Waste Management Plan;

1.10 DESIGN REVIEW AND DOCUMENTATION

1.11 THREE PHASES OF CONTROL

The Three Phases of Control shall adequately cover both on-site and off-site work and shall include the following for each DFW.

1.11.1 Preparatory Phase

Notify the Contracting Officer at least two work days in advance of each preparatory phase meeting. The meeting shall be conducted by the QC Manager and attended by the Project Superintendent, and the foreman responsible for the DFW. When the DFW will be accomplished by a subcontractor, that subcontractor's foreman shall attend the preparatory phase meeting. Document the results of the preparatory phase actions in the daily Contractor Quality Control Report and in the Preparatory Phase Checklist. Perform the following prior to beginning work on each DFW:

- a. Review each paragraph of the applicable specification sections;
- b. Review the Contract drawings;
- c. Verify that field measurements are as indicated on construction and/or shop drawings before confirming product orders, in order to minimize waste due to excessive materials;
- d. Verify that appropriate shop drawings and submittals for materials and equipment have been submitted and approved. Verify receipt of approved factory test results, when required;
- e. Review the testing plan and ensure that provisions have been made to provide the required QC testing;
- f. Examine the work area to ensure that the required preliminary work has been completed;
- g. Coordinate the schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials;
- h. Arrange for the return of shipping/packaging materials, such as wood pallets, where economically feasible;
- i. Examine the required materials, equipment and sample work to ensure that they are on hand and conform to the approved shop drawings and submitted data;
- j. Discuss construction methods, construction tolerances, workmanship standards, and the approach that will be used to provide quality construction by planning ahead and identifying potential problems for

each DFOW;

k. Review the APP and appropriate Activity Hazard Analysis (AHA) to ensure that applicable safety requirements are met, and that required Material Safety Data Sheets (MSDS) are submitted; and

1.11.2 Initial Phase

Notify the Contracting Officer at least two work days in advance of each initial phase. When construction crews are ready to start work on a DFOW, conduct the initial phase with the Project Superintendent, and the foreman responsible for that DFOW. Observe the initial segment of the DFOW to ensure that the work complies with Contract requirements. Document the results of the initial phase in the daily CQC Report and in the Initial Phase Checklist. Repeat the initial phase for each new crew to work on-site, or when acceptable levels of specified quality are not being met. Perform the following for each DFOW:

- a. Establish the quality of workmanship required;
- b. Resolve conflicts;
- c. Ensure that testing is performed by the approved laboratory;
- d. Check work procedures for compliance with the APP and the appropriate AHA to ensure that applicable safety requirements are met; and

1.11.3 Follow-Up Phase

Perform the following for on-going work daily, or more frequently as necessary, until the completion of each DFOW and document in the daily CQC Report:

- a. Ensure the work is in compliance with Contract requirements;
- b. Maintain the quality of workmanship required;
- c. Ensure that testing is performed by the approved laboratory;
- d. Ensure that rework items are being corrected;
- e. Perform safety inspections; and

1.11.4 Additional Preparatory and Initial Phases

Additional preparatory and initial phases shall be conducted on the same DFOW if the quality of on-going work is unacceptable, if there are changes in the applicable QC organization, if there are changes in the on-site production supervision or work crew, if work on a DFOW is resumed after substantial period of inactivity, or if other problems develop.

1.11.5 Notification of Three Phases of Control for Off-Site Work

Notify the Contracting Officer at least two weeks prior to the start of the preparatory and initial phases.

1.12 SUBMITTAL REVIEW AND APPROVAL

Procedures for submission, review and approval of submittals are described in Section 01 33 00 SUBMITTAL PROCEDURES.

1.13 TESTING

Except as stated otherwise in the specification sections, perform sampling and testing required under this Contract.

1.13.1 Accreditation Requirements

Construction materials testing laboratories must be accredited by a laboratory accreditation authority and will be required to submit a copy of the Certificate of Accreditation and Scope of Accreditation. The laboratory's scope of accreditation must include the appropriate ASTM standards (E 329, C 1077, D 3666, D 3740, A 880, E 543) listed in the technical sections of the specifications. Laboratories engaged in Hazardous Materials Testing shall meet the requirements of OSHA and EPA. The policy applies to the specific laboratory performing the actual testing, not just the Corporate Office.

1.13.2 Laboratory Accreditation Authorities

Laboratory Accreditation Authorities include the National Voluntary Laboratory Accreditation Program (NVLAP) administered by the National Institute of Standards and Technology at <http://ts.nist.gov/ts/htdocs/210/214/214.htm>, the American Association of State Highway and Transportation Officials (AASHTO) program at <http://www.transportation.org/aashto/home.nsf/frontpage>, International Accreditation Services, Inc. (IAS) at <http://www.iasonline.org>, U. S. Army Corps of Engineers Materials Testing Center (MTC) at <http://www.wes.army.mil/SL/MTC/>, the American Association for Laboratory Accreditation (A2LA) program at <http://www.a2la.org/>, the Washington Association of Building Officials (WABO) at <http://www.wabo.org/> (Approval authority for WABO is limited to projects within Washington State), and the Washington Area Council of Engineering Laboratories (WACEL) at <http://www.wacel.org/labaccred.html> (Approval authority by WACEL is limited to projects within Facilities Engineering Command (FEC) Washington geographical area).

1.13.3 Capability Check

The Contracting Officer retains the right to check laboratory equipment in the proposed laboratory and the laboratory technician's testing procedures, techniques, and other items pertinent to testing, for compliance with the standards set forth in this Contract.

1.13.4 Test Results

Cite applicable Contract requirements, tests or analytical procedures used. Provide actual results and include a statement that the item tested or analyzed conforms or fails to conform to specified requirements. If the item fails to conform, notify the Contracting Officer immediately. Conspicuously stamp the cover sheet for each report in large red letters "CONFORMS" or "DOES NOT CONFORM" to the specification requirements, whichever is applicable. Test results shall be signed by a testing laboratory representative authorized to sign certified test reports. Furnish the signed reports, certifications, and other documentation to the

Contracting Officer via the QC Manager. Furnish a summary report of field tests at the end of each month, per the paragraph entitled "INFORMATION FOR THE CONTRACTING OFFICER".

1.13.5 Test Reports and Monthly Summary Report of Tests

The QC Manager shall furnish the signed reports, certifications, and a summary report of field tests at the end of each month to the Contracting Officer. Attach a copy of the summary report to the last daily Contractor Quality Control Report of each month. A copy of the signed test reports and certifications shall be provided to the OMSI preparer for inclusion into the OMSI documentation.

1.14 QC CERTIFICATIONS

1.14.1 CQC Report Certification

Each CQC Report shall contain the following statement: "On behalf of the Contractor, I certify that this report is complete and correct and equipment and material used and work performed during this reporting period is in compliance with the contract drawings and specifications to the best of my knowledge, except as noted in this report."

1.14.2 Invoice Certification

Furnish a certificate to the Contracting Officer with each payment request, signed by the QC Manager, attesting that as-built drawings are current, coordinated and attesting that the work for which payment is requested, including stored material, is in compliance with Contract requirements.

1.14.3 Completion Certification

Upon completion of work under this Contract, the QC Manager shall furnish a certificate to the Contracting Officer attesting that "the work has been completed, inspected, tested and is in compliance with the Contract."

1.15 COMPLETION INSPECTIONS

1.15.1 Punch-Out Inspection

Near the completion of all work or any increment thereof, established by a completion time stated in the Contract Clause entitled "Commencement, Prosecution, and Completion of Work," or stated elsewhere in the specifications, the QC Manager and the CA shall conduct an inspection of the work and develop a "punch list" of items which do not conform to the approved drawings, specifications and Contract. Include in the punch list any remaining items on the "Rework Items List", which were not corrected prior to the Punch-Out Inspection. The punch list shall include the estimated date by which the deficiencies will be corrected. A copy of the punch list shall be provided to the Contracting Officer. The QC Manager, or staff, shall make follow-on inspections to ascertain that all deficiencies have been corrected. Once this is accomplished, the Contractor shall notify the Government that the facility is ready for the Government "Pre-Final Inspection".

1.15.2 Pre-Final Inspection

The Government will perform this inspection to verify that the facility is complete and ready to be occupied. A Government "Pre-Final Punch List" may

be developed as a result of this inspection. The QC Manager shall ensure that all items on this list are corrected prior to notifying the Government that a "Final" inspection with the Client can be scheduled. Any items noted on the "Pre-Final" inspection shall be corrected in a timely manner and shall be accomplished before the contract completion date for the work, or any particular increment thereof, if the project is divided into increments by separate completion dates.

1.15.3 Final Acceptance Inspection

The Contractor shall notify the Contracting Officer at least 14 calendar days prior to the date a final acceptance inspection can be held. The notice shall state that all items previously identified on the pre-final punch list will be corrected and acceptable, along with any other unfinished Contract work, by the date of the final acceptance inspection. The Contractor shall be represented by the QC Manager, the Project Superintendent, the CA, and others deemed necessary. Attendees for the Government will include the Contracting Officer, other ROICC personnel, and personnel representing the Client. Failure of the Contractor to have all contract work acceptably complete for this inspection will be cause for the Contracting Officer to bill the Contractor for the Government's additional inspection cost in accordance with the Contract Clause entitled "Inspection of Construction."

1.16 DOCUMENTATION

Maintain current and complete records of on-site and off-site QC program operations and activities.

1.16.1 Construction Documentation

Reports are required for each day that work is performed and shall accompany the submission of the Contractor Quality Control Report prepared for the same day. Maintain current and complete records of on-site and off-site QC program operations and activities. The forms identified under the paragraph "INFORMATION FOR THE CONTRACTING OFFICER" shall be used. Reports are required for each day work is performed. Account for each calendar day throughout the life of the Contract. Every space on the forms must be filled in. Use N/A if nothing can be reported in one of the spaces. The Project Superintendent and the QC Manager must prepare and sign the Contractor Production and CQC Reports, respectively. The reporting of work shall be identified by terminology consistent with the construction schedule. In the "remarks" sections of the reports, enter pertinent information including directions received, problems encountered during construction, work progress and delays, conflicts or errors in the drawings or specifications, field changes, safety hazards encountered, instructions given and corrective actions taken, delays encountered and a record of visitors to the work site, quality control problem areas, deviations from the QC Plan, construction deficiencies encountered, meetings held. For each entry in the report(s), identify the Schedule Activity No. that is associated with the entered remark.

1.16.2 Quality Control Validation

Establish and maintain the following in a series of three ring binders. Binders shall be divided and tabbed as shown below. These binders shall be readily available to the Contracting Officer during all business hours.

- a. All completed Preparatory and Initial Phase Checklists, arranged by

specification section.

- b. All milestone inspections, arranged by Activity Number.
- c. An up-to-date copy of the Testing Plan and Log with supporting field test reports, arranged by specification section.
- d. Copies of all contract modifications, arranged in numerical order. Also include documentation that modified work was accomplished.
- e. An up-to-date copy of the Rework Items List.
- f. Maintain up-to-date copies of all punch lists issued by the QC staff to the Contractor and Sub-Contractors and all punch lists issued by the Government.

1.16.3 Testing Plan and Log

As tests are performed, the QC Manager shall record on the "Testing Plan and Log" the date the test was performed and the date the test results were forwarded to the Contracting Officer. Attach a copy of the updated "Testing Plan and Log" to the last daily CQC Report of each month.

1.16.4 Rework Items List

The QC Manager shall maintain a list of work that does not comply with the Contract, identifying what items need to be reworked, the date the item was originally discovered, the date the item will be corrected by, and the date the item was corrected. There is no requirement to report a rework item that is corrected the same day it is discovered. Attach a copy of the "Rework Items List" to the last daily CQC Report of each month. The Contractor shall be responsible for including those items identified by the Contracting Officer.

1.16.5 As-Built Drawings

The QC Manager is required to ensure the as-built drawings, required by Section 01 78 00 CLOSEOUT PROCEDURES are kept current on a daily basis and marked to show deviations which have been made from the Contract drawings. Ensure each deviation has been identified with the appropriate modifying documentation (e.g. PC No., Modification No., Request for Information No., etc.). The QC Manager shall initial each revision. Upon completion of work, the QC Manager shall furnish a certificate attesting to the accuracy of the as-built drawings prior to submission to the Contracting Officer.

1.17 NOTIFICATION ON NON-COMPLIANCE

The Contracting Officer will notify the Contractor of any detected non-compliance with the Contract. The Contractor shall take immediate corrective action after receipt of such notice. Such notice, when delivered to the Contractor at the work site, shall be deemed sufficient for the purpose of notification. If the Contractor fails or refuses to comply promptly, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders shall be made the subject of claim for extension of time for excess costs or damages by the Contractor.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 PREPARATION

Designate receiving/storage areas for incoming material to be delivered according to installation schedule and to be placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. Store and handle materials in a manner as to prevent loss from weather and other damage. Keep materials, products, and accessories covered and off the ground, and store in a dry, secure area. Prevent contact with material that may cause corrosion, discoloration, or staining. Protect all materials and installations from damage by the activities of other trades.

-- End of Section --

SECTION 01 50 00

TEMPORARY CONSTRUCTION FACILITIES AND CONTROLS
10/11

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.

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 241 (2004) Safeguarding
Construction, Alteration, and Demolition
Operations

NFPA 70 (2005) National Electrical Code

1.2 Contractor Utilities

1.3 Utilities at Special Locations

Reasonable amounts of utilities will be made available to the Contractor at the prevailing Government rates. These rates may be obtained upon application to the Commanding Officer, by way of the Contracting Officer. The Contractor will be responsible for making connections, providing transformers and meters, (THE CONTRACTOR MUST CERTIFY THAT ALL TRANSFORMERS INSTALLED ARE TEMPORARY POWER DURING THIS CONTRACT ARE PCB FREE), and making disconnections; and for providing backflow preventer devices on connections to domestic water lines. Under no circumstances will taps to base fire hydrants be allowed for obtaining domestic water. Neither potable water nor sanitary facilities will be available at the main Contractor laydown area at Marine Corps Air Station (MCAS), Cherry Point, NC.

1.4 WEATHER PROTECTION

Take necessary precautions to ensure that roof openings and other critical openings in the building are monitored carefully. Take immediate actions required to seal off such openings when rain or other detrimental weather is imminent, and at the end of each workday. Ensure that the openings are completely sealed off to protect materials and equipment in the building from damage.

1.4.1 Building and Site Storm Protection

When a warning of gale force winds is issued, take precautions to minimize danger to persons, and protect the work and nearby Government property. Precautions shall include, but are not limited to, closing openings; removing loose materials, tools and equipment from exposed locations; and removing or securing scaffolding and other temporary work. Close openings in the work when storms of lesser intensity pose a threat to the work or any nearby Government property.

1.4.1.1 Hurricane Condition of Readiness

Unless directed otherwise, comply with:

- a. Condition FOUR (Sustained winds of 50 knots or greater expected within 72 hours): Normal daily jobsite cleanup and good housekeeping practices. Collect and store in piles or containers scrap lumber, waste material, and rubbish for removal and disposal at the close of each work day. Maintain the construction site including storage areas, free of accumulation of debris. Stack form lumber in neat piles less than 4 feet high. Remove all debris, trash, or objects that could become missile hazards. Contact Contracting Officer for Condition of Readiness (COR) updates and completion of required actions.
- b. Condition THREE (Sustained winds of 50 knots or greater expected within 48 hours): Maintain "Condition FOUR" requirements and commence securing operations necessary for "Condition ONE" which cannot be completed within 18 hours. Cease all routine activities which might interfere with securing operations. Commence securing and stow all gear and portable equipment. Make preparations for securing buildings. Review requirements pertaining to "Condition TWO" and continue action as necessary to attain "Condition THREE" readiness. Contact Contracting Officer for weather and COR updates and completion of required actions.
- c. Condition TWO (Sustained winds of 50 knots or greater expected within 24 hours): Curtail or cease routine activities until securing operation is complete. Reinforce or remove form work and scaffolding. Secure machinery, tools, equipment, materials, or remove from the jobsite. Expend every effort to clear all missile hazards and loose equipment from general base areas. Contact Contracting Officer for weather and Condition of Readiness (COR) updates and completion of required actions.
- d. Condition ONE. (Sustained winds of 50 knots or greater expected within 12 hours): Secure the jobsite, and leave Government premises.

1.5 TEMPORARY SANITARY FACILITIES

Provide adequate sanitary conveniences of a type approved for the use of persons employed on the work, properly secluded from public observation, and maintained in such a manner as required and approved by the Contracting Officer. Maintain these conveniences at all times without nuisance. Upon completion of the work, remove the conveniences from the premises, leaving the premises clean and free from nuisance. Dispose of sewage through connection to a municipal, district sanitary sewage system. Where such systems are not available, use chemical toilets or comparably effective units, and periodically empty wastes into a municipal, district sanitary sewage system, or remove waste to a commercial facility. Obtain approval from the system owner prior to discharge into any municipal, district, or commercial sanitary sewer system. Any penalties and / or fines associated with improper discharge shall be the responsibility of the Contractor.

1.6 TEMPORARY BUILDINGS

Trailers or storage buildings will be permitted, where space is available, subject to the approval of the Contracting Officer. The trailers or

buildings shall be in good condition, free from visible damage rust and deterioration, and meet all applicable safety requirements. Trailers shall be roadworthy and comply with all appropriate state and local vehicle requirements. Failure to maintain storage trailers or buildings to these standards shall result in the removal of non-complying units at the Contractor's expense. A sign not smaller than 24 x 24 inches shall be conspicuously placed on the trailer depicting the company name, business phone number, and emergency phone number. Trailers shall be anchored to resist high winds and must meet applicable state and local standards for anchoring mobile trailers. A laydown site will be provided as indicated for trailers, storage buildings, and/or bulk storage within five miles of the construction site. All trailers or storage buildings shall be suitably painted, kept in a good state of repairs, and clearly identified with the Contractor's name and telephone number. All laydown sites, staging areas, and construction sites shall be kept free of debris and trash, fences properly maintained, and all vegetation trimmed. Failure of the Contractor to maintain his trailers or storage buildings in good condition will be considered sufficient reason to require their removal from the job site. Trailers shall be anchored to resist high winds and must meet applicable state or local standards for anchoring mobile trailers.

1.6.1 Maintenance of Temporary Facilities

Suitably paint and maintain the temporary facilities. Failure to do so will be sufficient reason to require their removal.

PART 2 PRODUCTS

PART 3 EXECUTION

3.1 TEMPORARY PHYSICAL CONTROLS

3.1.1 Access Controls

3.1.1.1 Temporary Barricades

Contractor shall provide for barricading around all work areas to prevent public access.

3.1.1.2 Fencing

Fencing shall be provided along the construction site for each road segment and isolated area of work to prevent access by unauthorized people (special emphasis shall be placed on preventing access by children). Fencing shall be a four feet high orange plastic grid supported at intervals sufficient to resist at least 250 pounds of force applied against the fence. Fencing shall be moved as work progresses. Place fencing on the side opposite the street side of the walkway to allow adequate work space for the Contractor's activities.

3.1.1.3 Signs

Place warning signs at the construction area perimeter designating the presence of construction hazards requiring unauthorized persons to keep out. Signs must be placed on all sides of the project, with at least one sign every 300 feet. All points of entry shall have signs designating the construction site as a hard hat area.

3.1.1.4 Traffic Work

All work around/involving roadways, to include roadway excavations and utility crossings, will be conducted in accordance with Manual of Traffic Control Devices. Contractors shall provide and ensure appropriate road closure and detour signs are established as necessary for motor traffic management. All road closures shall be coordinated with the Contracting Officer in advance. Self-illuminated (lighted) barricades shall be provided during hours of darkness. Brightly-colored (orange) vests are required for all personnel working in roadways. Road closures shall require a road closure plan showing the location of signage.

3.2 TEMPORARY WIRING

Provide temporary wiring in accordance with NFPA 241 and NFPA 70, Article 305-6(b), Assured Equipment Grounding Conductor Program. Program shall include frequent inspection of all equipment and apparatus.

3.3 GRASS CUTTING

Cut grass (or annual weeds) within construction and storage sites to a maximum 4 inch height at least once a week during the growing season unless the grass area is not visible to the public. Trim the grass around fences at time of grass cutting. Maintain grass or weeds on stockpiled earth as described above.

-- End of Section --

SECTION 01 57 19.00 20

TEMPORARY ENVIRONMENTAL CONTROLS

02/10

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. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910	Occupational Safety and Health Standards
29 CFR 1910.120	Hazardous Waste Operations and Emergency Response
40 CFR 112	Oil Pollution Prevention
40 CFR 241	Guidelines for Disposal of Solid Waste
40 CFR 243	Guidelines for the Storage and Collection of Residential, Commercial, and Institutional Solid Waste
40 CFR 258	Subtitle D Landfill Requirements
40 CFR 261	Identification and Listing of Hazardous Waste
40 CFR 262	Standards Applicable to Generators of Hazardous Waste
40 CFR 263	Standards Applicable to Transporters of Hazardous Waste
40 CFR 264	Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 265	Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 266	Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities
40 CFR 268	Land Disposal Restrictions
40 CFR 279	Standards for the Management of Used Oil
40 CFR 300	National Oil and Hazardous Substances Pollution Contingency Plan

40 CFR 355	Emergency Planning and Notification
40 CFR 372-SUBPART D	Specific Toxic Chemical Listings
49 CFR 173	Shippers - General Requirements for Shipments and Packagings
49 CFR 178	Specifications for Packagings

1.2 DEFINITIONS

1.2.1 Sediment

Soil and other debris that have eroded and have been transported by runoff water or wind.

1.2.2 Solid Waste

Garbage, refuse, debris, sludge, or other discharged material, including solid, liquid, semisolid, or contained gaseous materials resulting from domestic, industrial, commercial, mining, or agricultural operations. Types of solid waste typically generated at construction sites may include:

- a. Green waste: The vegetative matter from landscaping, land clearing and grubbing, including, but not limited to, grass, bushes, scrubs, small trees and saplings, tree stumps and plant roots. Marketable trees, grasses and plants that are indicated to remain, be re-located, or be re-used are not included.
- b. Surplus soil: Existing soil that is in excess of what is required for this work, including aggregates intended, but not used, for on-site mixing of concrete, mortars and paving. Contaminated soil meeting the definition of hazardous material or hazardous waste is not included.
- c. Debris: Non-hazardous solid material generated during the construction, demolition, or renovation of a structure which exceeds 2.5 inch particle size that is: a manufactured object; plant or animal matter; or natural geologic material (e.g. cobbles and boulders), broken or removed concrete, masonry, and rock asphalt paving; ceramics; roofing paper and shingles. Inert materials may be reinforced with or contain ferrous wire, rods, accessories and weldments. A mixture of debris and other material such as soil or sludge is also subject to regulation as debris if the mixture is comprised primarily of debris by volume, based on visual inspection..
- d. Wood: Dimension and non-dimension lumber, plywood, chipboard, hardboard. Treated and/or painted wood that meets the definition of lead contaminated or lead based contaminated paint is not included.
- e. Scrap metal: Scrap and excess ferrous and non-ferrous metals such as reinforcing steel, structural shapes, pipe and wire that are recovered or collected and disposed of as scrap. Scrap metal meeting the definition of hazardous material or hazardous waste is not included.

- f. Paint cans: Metal cans that are empty of paints, solvents, thinners and adhesives. If permitted by the paint can label, a thin dry film may remain in the can.
- g. Recyclables: Materials, equipment and assemblies such as doors, windows, door and window frames, plumbing fixtures, glazing and mirrors that are recovered and sold as recyclable. Metal meeting the definition of lead contaminated or lead based paint contaminated may be included as recyclable if sold to a scrap metal company. Paint cans may be included as recyclable if sold to a scrap metal company.
- h. Hazardous Waste: By definition, to be a hazardous waste a material must first meet the definition of a solid waste. Hazardous waste and hazardous debris are special cases of solid waste. They have additional regulatory controls and must be handled separately. They are thus defined separately in this document.

Material not regulated as solid waste are: nuclear source or byproduct materials regulated under the Federal Atomic Energy Act of 1954 as amended; suspended or dissolved materials in domestic sewage effluent or irrigation return flows, or other regulated point source discharges; regulated air emissions; and fluids or wastes associated with natural gas or crude oil exploration or production.

1.2.3 Hazardous Debris

As defined in Solid Waste paragraph, debris that contains listed hazardous waste (either on the debris surface, or in its interstices, such as pore structure) per 40 CFR 261; or debris that exhibits a characteristic of hazardous waste per 40 CFR 261.

1.2.4 Chemical Wastes

This includes salts, acids, alkalizes, herbicides, pesticides, and organic chemicals.

1.2.5 Garbage

Refuse and scraps resulting from preparation, cooking, dispensing, and consumption of food.

1.2.6 Hazardous Waste (Including Universal Hazardous Waste)

Hazardous Wastes are defined by the Resource Conservation and Recovery Act (RCRA - Subtitle C) as wastes which first meet the definition of "solid" wastes and are then further defined in 40CFR Parts 261.21, 261.22, 261.23, 261.24, 261.31, 261.32, 261.33(e), and 261.33(f) with regard to their hazardous waste properties and / or characteristics (to include U.S. EPA's lists of Hazardous Wastes. These regulations cover a wide range of process and product generated wastes, and discarded (including materials intended to be discarded) or unusable materials in solid, liquid, and gaseous forms.

Universal (Hazardous) Wastes are a subset of Hazardous Waste, and are defined in 40CFR Part 273.2, 273.3, 273.4, and 273.5 and include batteries, pesticides, mercury containing equipment, and lamps.

Contractors must be intimately familiar with the above-detailed Hazardous Waste regulations to ensure compliance with section 1.4.1.

1.2.7 Hazardous Materials

Hazardous material is any material that:

- a. Is regulated as a hazardous material per 49 CFR 173, or
- b. Requires a Material Safety Data Sheet (MSDS) per 29 CFR 1910.120, or
- c. During end use, treatment, handling, packaging, storage, transpiration, or disposal meets or has components that meet or have potential to meet the definition of a hazardous waste as defined by 40 CFR 261 Subparts A, B, C, or D.

Designation of a material by this definition, when separately regulated or controlled by other instructions or directives, does not eliminate the need for adherence to that hazard-specific guidance which takes precedence over this instruction for "control" purposes. Such material include ammunition, weapons, explosive actuated devices, propellants, pyrotechnics, chemical and biological warfare materials, medical and pharmaceutical supplies, medical waste and infectious materials, bulk fuels, radioactive materials, and other materials such as asbestos, mercury, and polychlorinated biphenyls (PCBs). Nonetheless, the exposure may occur incident to manufacture, storage, use and demilitarization of these items.

1.2.8 Waste Hazardous Material and Substances

Waste hazardous materials and substances are those materials which do not meet any of the regulatory definitions of either Hazardous Waste or Universal (Hazardous) Waste, but which still may pose a threat to human health or the environment or cause significant legal liabilities under CERCLA if not properly managed. In general, such materials may be defined as those which pose a threat to human health and / or the environment due to their quantity, concentration, or their physical, chemical, or infectious characteristics and which have been so designated by federal, state, or local agencies.

1.2.9 Used Oil and Oily Wastes

Used Oil is defined in 40CFR Part 279 to include a wide variety of oils and fuels and how they must be properly managed to ensure proper disposal, reclamation, and / or recycling. Animal and vegetable oils do not fall under this regulatory classification. Grease does not fall under this regulatory classification

Those materials which are, or were, mixed with used oil and have become separated from that used oil. Oily wastes also means materials, including wastewaters, centrifuge solids, filter residues or sludges, bottom sediments, tank bottoms, and sorbents which have come into contact with and have been contaminated by, used oil and may be appropriately tested and discarded in a manner which is in compliance with other State and local requirements.

This definition includes materials such as oily rags, "kitty litter" sorbent clay and organic sorbent material. These materials may be land filled provided that:

- a. It is not prohibited in other State regulations or local ordinances
- b. The amount generated is "de minimus" (a small amount)
- c. It is the result of minor leaks or spills resulting from normal process operations
- d. All free-flowing oil has been removed to the practical extent possible

Large quantities of this material, generated as a result of a major spill or in lieu of proper maintenance of the processing equipment, are a solid waste. As a solid waste, a hazardous waste determination must be performed prior to disposal. As this can be an expensive process, it is recommended that this type of waste be minimized through good housekeeping practices and employee education.

1.2.10 Regulated Waste

Those solid waste that have specific additional Federal, state, or local controls for handling, storage, or disposal.

1.2.11 Class I Ozone Depleting Substance (ODS)

Class I ODS is defined in Section 602(a) of The Clean Air Act and includes the following chemicals:

- | | |
|----------------------------------|----------------------------------|
| chlorofluorocarbon-11 (CFC-11) | chlorofluorocarbon-213 (CFC-213) |
| chlorofluorocarbon-12 (CFC-12) | chlorofluorocarbon-214 (CFC-214) |
| chlorofluorocarbon-13 (CFC-13) | chlorofluorocarbon-215 (CFC-215) |
| chlorofluorocarbon-111 (CFC-111) | chlorofluorocarbon-216 (CFC-216) |
| chlorofluorocarbon-112 (CFC-112) | chlorofluorocarbon-217 (CFC-217) |
| chlorofluorocarbon-113 (CFC-113) | halon-1211 |
| chlorofluorocarbon-114 (CFC-114) | halon-1301 |
| chlorofluorocarbon-115 (CFC-115) | halon-2402 |
| chlorofluorocarbon-211 (CFC-211) | carbon tetrachloride |
| chlorofluorocarbon-212 (CFC-212) | methyl chloroform |

1.3 SUBMITTALS

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

SD-01 Preconstruction Submittals

- Preconstruction Survey; G
- Solid Waste Management Plan and Permit; G
- Regulatory Notification; G
- Environmental Protection Plan; G
- Contractor/Vendor Environmental Service Agreement; G

SD-06 Test Reports

Laboratory Analysis

Disposal Requirements

SD-11 Closeout Submittals

Some of the records listed below are also required as part of other submittals. For the "Records" submittal, maintain on-site a separate three-ring Environmental Records binder and submit at the completion of the project. Make separate parts to the binder corresponding to each of the applicable sub items listed below.

Waste Determination Documentation

Disposal Documentation for Hazardous and Regulated Waste

Contractor 40 CFR Employee Training Records

Solid Waste Management Report

Contractor Hazardous Material Inventory Log; G

Hazardous Waste/Debris Management

1.4 ENVIRONMENTAL PROTECTION REQUIREMENTS

Provide and maintain, during the life of the contract, environmental protection as defined. Plan for and provide environmental protective measures to control pollution that develops during normal construction practice. Plan for and provide environmental protective measures required to correct conditions that develop during the construction of permanent or temporary environmental features associated with the project. Comply with Federal, State, and local regulations pertaining to the environment, including water, air, solid waste, hazardous waste and substances, oily substances, and noise pollution.

Marine Corps Air Station, Cherry Point is listed on the National Priorities List pursuant to the Comprehensive Environmental Response, Compensation and Liabilities Act 42 USCA, Section 9601 et seq. as amended April 15, 1996 (CERCLA). Bogue Field, Oakgrove, BT-11 and Atlantic Field are not listed on the National Priorities List. The Contractor shall immediately bring to the Contracting Officer's attention any unanticipated site condition which may involve hazardous materials or hazardous waste and the Contractor shall not disturb such conditions without the Contracting Officer's prior written documentation as to whether such conditions are outside the contract requirements.

1.4.1 Facility Hazardous Waste Generator Status

Marine Corps Air Station Cherry Point is designated as a Large Quantity Generator (LQG) of Hazardous Waste, a Large Quantity Handler of Universal (Hazardous) Waste, and maintains a Treatment, Storage, and Disposal facility. Accordingly, MCAS Cherry Point is required to actively maintain and comply with a RCRA Part "B" operating permit issued by the State of North Carolina. All work conducted within the boundaries of this activity must be in compliance with the Part B permit, and the generator's various designations and operational requirements. Contractors will comply with all federal, state, and local regulatory requirements governing the proper training of personnel, and proper identification, generation, management,

storage, handling, manifesting, transportation, and disposal of any Hazardous Waste(s) which they may cause to be generated in the course of the execution of their contract(s).

1.5 QUALITY ASSURANCE

1.5.1 Preconstruction Survey

Perform a Preconstruction Survey of the project site with the Contracting Officer, and take photographs showing existing environmental conditions in and adjacent to the site. Submit a report for the record.

1.5.2 Regulatory Notification

The Contractor is responsible for all Regulatory Notification requirements in accordance with Federal, State and local regulations. In cases where the Navy must also provide public notification (such as stormwater permitting), the Contractor must coordinate with the Contracting Officer. The Contractor shall submit copies of all regulatory notifications to the Contracting Officer prior to commencement of work activities. Typically, regulatory notifications must be provided for the following (this listing is not all inclusive): demolition, renovation, NPDES defined site work, remediation of controlled substances (asbestos, hazardous waste, lead paint).

1.5.3 Environmental Brief

Attend an environmental brief to be included in the preconstruction meeting. Provide the following information: types, quantities, and use of hazardous materials that will be brought onto the activity; types and quantities of wastes/wastewater that may be generated during the contract. Discuss the results of the Preconstruction Survey at this time.

Prior to initiating any work on site, meet with the Contracting Officer and activity environmental staff to discuss the proposed Environmental Protection Plan. Develop a mutual understanding relative to the details of environmental protection, including measures for protecting natural resources, required reports, required permits, permit requirements, and other measures to be taken.

1.5.4 Environmental Manager

Appoint in writing an Environmental Manager for the project site. The Environmental Manager will be directly responsible for coordinating contractor compliance with Federal, State, local, and station requirements. The Environmental Manager will ensure compliance with Hazardous Waste Program requirements (including hazardous waste handling, storage, manifesting, and disposal); implement the Environmental Protection Plan; ensure that all environmental permits are obtained, maintained, and closed out; ensure compliance with Storm Water Program Management requirements; ensure compliance with Hazardous Materials (storage, handling, and reporting) requirements; and coordinate any remediation of regulated substances (lead, asbestos, PCB transformers). This can be a collateral position; however the person in this position must be trained to adequately accomplish the following duties: ensure waste segregation and storage compatibility requirements are met; inspect and manage Satellite Accumulation areas; ensure only authorized personnel add wastes to containers; ensure all Contractor personnel are trained in 40 CFR requirements in accordance with their position requirements; coordinate

removal of waste containers; and maintain the Environmental Records binder and required documentation, including environmental permits compliance and close-out.

1.5.5 Contractor 40 CFR Employee Training Records

Prepare and maintain employee training records throughout the term of the contract meeting applicable 40 CFR requirements. The Contractor will ensure every employee completes a program of classroom instruction or on-the-job training that teaches them to perform their duties in a way that ensures compliance with Federal, State and local regulatory requirements for RCRA Large Quantity Generator. The Contractor will provide a Position Description for each employee, by subcontractor, based on the Davis-Bacon Wage Rate designation or other equivalent method, evaluating the employee's association with hazardous and regulated wastes. This Position Description will include training requirements as defined in 40 CFR 265 for a Large Quantity Generator facility. Submit these training records to the Contracting Officer at the conclusion of the project, unless otherwise directed.

1.5.6 Contractor Environmental Management System (EMS) Requirements

The Contractor shall perform work under this contract consistent with the policy, objectives, and targets identified in Marine Corps Air Station Cherry Point's Environmental Management System (EMS). Executive Order 13423, Strengthening Federal Environmental, Energy, and Transportation Management and Marine Corps Order P5090.2A, Environmental Compliance and Protection Manual require that all Federal agencies implement, utilize, and maintain an EMS. The Contractor shall perform work in a manner that does not circumvent objectives and targets, environmental programs goals, and operational controls identified by the EMS. The Contractor is also required not to impede compliance with the provisions of Executive Order 13423. The work performed under this contract affects practices that have been identified as significant, and requires more stringent requirements to adhere to the objectives and targets identified for MCAS Cherry Point.

The Contractor shall assume liability for nonconformances and noncompliances resulting from the Contractor's activities and work with Air Station personnel to conduct corrective and preventive actions. The Contractor is responsible for ensuring that their employees receive applicable environmental training, along with any applicable environmental management systems training, and are knowledgeable of current regulatory required specific training for the type of work to be conducted on-site. The Contractor personnel and their subcontractor personnel shall have the appropriate education, training, and experience in order to perform the work specified under this contract. Upon contract award, the Contractor shall review the Contractor Environmental Training Binder and Training Presentation and sign the Contractor/Vendor Environmental Service Agreement. Training and Service Agreement Documents are located on-line at <http://www.marines.mil/unit/mcascherrypoint/Pages/EA/EA.aspx>

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 ENVIRONMENTAL PROTECTION PLAN

Prior to initiating any work on site, the Contractor will meet with the Contracting Officer to discuss the proposed Environmental Protection Plan and develop a mutual understanding relative to the details of environmental protection, including measures for protecting natural resources, required reports, and other measures to be taken. The Environmental Protection Plan will be submitted in the following format and will, at a minimum, address the following elements:

- a. Description of the Environmental Protection Plan
 - (1) General overview and purpose
 - (2) General site information
- b. Protection of Natural Resources
 - (1) Land resources
 - (2) Tree protection
 - (3) Replacement of damaged landscape features
 - (4) Temporary construction
 - (5) Stream crossings
 - (6) Fish and wildlife resources
 - (7) Wetland areas
- c. Protection of Historical and Archaeological Resources
 - (1) Objectives
 - (2) Methods
- d. Storm Water Management and Control
 - (1) Ground cover
 - (2) Erodible soils
 - (3) Temporary measures
 - (a) Mechanical retardation and control of runoff
 - (b) Vegetation and mulch
- e. Protection of the Environment from Waste Derived from Contractor Operations
 - (1) Control and disposal of solid and sanitary waste
 - (2) Control and disposal of hazardous waste (Hazardous Waste Management Section)

This item will consist of the management procedures for all hazardous waste to be generated. The elements of those procedures will coincide with the Activity Hazardous Waste Management Plan. A copy of the Activity Hazardous Waste Management Plan will be provided by the Contracting Officer. As a minimum, include the following:

- (a) Procedures to be employed to ensure a written waste determination is made for appropriate wastes which are to be generated;
- (b) Sampling/analysis plan;
- (c) Methods of hazardous waste accumulation/storage (i.e., in tanks and/or containers);
- (d) Management procedures for storage, labeling, transportation, and disposal of waste (treatment of waste is not allowed unless specifically noted);
- (e) Management procedures and regulatory documentation ensuring disposal of hazardous waste complies with Land Disposal Restrictions (40 CFR 268);
- (f) Management procedures for recyclable hazardous materials such as lead-acid batteries, used oil, and the like;
- (g) Used oil management procedures in accordance with 40 CFR 279;
- (h) Pollution prevention\hazardous waste minimization procedures;
- (i) Plans for the disposal of hazardous waste by permitted facilities;
- (j) Procedures to be employed to ensure all required employee training records are maintained.

f. Prevention of Releases to the Environment

- (1) Procedures to prevent releases to the environment
- (2) Notifications in the event of a release to the environment

g. Regulatory Notification and Permits

- (1) List what notifications and permit applications must be made. Include copies of all applicable, environmental permits.

3.1.1.1 Environmental Protection Plan Review

Fourteen days after the environmental protection meeting, submit the proposed Environmental Protection Plan for further discussion, review, and approval. Commencement of work will not begin until the environmental protection plan has been approved.

3.1.2 Licenses and Permits

Obtain licenses and permits pursuant to the "Permits and Responsibilities" FAR Clause.

For permits obtained by the Contracting Officer, whether or not required by the permit, the Contractor is responsible for conforming to all permit requirements and performing all quality control inspections of the work in progress, and to submit notifications and certifications to the applicable regulatory agency via the Contracting Officer.

Where required by the State regulatory authority, the inspections and certifications will be provided through the services of a Professional Engineer (PE), registered in the State where the work is being performed. Where a PE is not required, the individual must be otherwise qualified by other current State licensure, specific training and prior experience (minimum 5 years). As a part of the quality control plan, which is required to be submitted for approval by the quality control section, provide a sub item containing the name, appropriate professional registration or licence number, address, and telephone number of the professionals or other qualified persons who will be performing the inspections and certifications for each permit.

3.2 PROTECTION OF NATURAL RESOURCES

Preserve the natural resources within the project boundaries and outside the limits of permanent work. Restore to an equivalent or improved condition upon completion of work. Confine construction activities to within the limits of the work indicated or specified. Conform to the national permitting requirements of the Clean Water Act.

Do not disturb fish and wildlife. Do not alter water flows or otherwise significantly disturb the native habitat adjacent to the project and critical to the survival of fish and wildlife, except as indicated or specified.

Except in areas to be cleared, do not remove, cut, deface, injure, or destroy trees or shrubs without the Contracting Officer's permission. Do not fasten or attach ropes, cables, or guys to existing nearby trees for anchorages unless authorized by the Contracting Officer. Where such use of attached ropes, cables, or guys is authorized, the Contractor will be responsible for any resultant damage.

Protect existing trees which are to remain and which may be injured, bruised, defaced, or otherwise damaged by construction operations. Remove displaced rocks from uncleared areas. By approved excavation, remove trees with 30 percent or more of their root systems destroyed. Remove trees and other landscape features scarred or damaged by equipment operations, and replace with equivalent, undamaged trees and landscape features. Obtain Contracting Officer's approval before replacement.

The Contracting Officer's approval is required before any equipment will be permitted to ford live streams. In areas where frequent crossings are required, install temporary culverts or bridges. Obtain Contracting Officer's approval prior to installation. Remove temporary culverts or bridges upon completion of work, and repair the area to its original condition.

3.3 HISTORICAL AND ARCHAEOLOGICAL RESOURCES

Carefully protect in-place and report immediately to the Contracting Officer historical and archaeological items or human skeletal remains discovered in the course of work. Upon discovery, notify the Contracting Officer. Stop work in the immediate area of the discovery until directed by the Contracting Officer to resume work. The Government retains ownership and control over historical and archaeological resources.

3.4 SOLID WASTE MANAGEMENT PLAN and PERMIT

Provide to the contracting officer written notification of the quantity of solid waste/debris that is anticipated to be generated by construction. Include in the report the locations where various types of waste will be disposed or recycled. Include letters of acceptance or as applicable, submit one copy of a State and local permit or license showing such agencies' approval of the disposal plan before transporting wastes off Government property.

3.4.1 Solid Waste management Report

Monthly, submit a solid waste disposal report to the Contracting Officer. For each waste, the report will state the classification (using the definitions provided in this section), amount, location, and name of the business receiving the solid waste. Include copies of the waste handling facilities' weight tickets, receipts, bills of sale, and other sales documentation. In lieu of sales documentation, the Contractor may submit a statement indicating the disposal location for the solid waste which is signed by an officer of the Contractor firm authorized to legally obligate or bind the firm. The sales documentation or Contractor certification will include the receiver's tax identification number and business, EPA or State registration number, along with the receiver's delivery and business addresses and telephone numbers. For each solid waste retained by the Contractor for his own use, the Contractor will submit on the solid waste disposal report the information previously described in this paragraph. Prices paid or received will not be reported to the Contracting Officer unless required by other provisions or specifications of this Contract or public law.

3.4.2 Control and Disposal of Solid Wastes

Pick up solid wastes, and place in covered containers which are regularly emptied. Do not prepare or cook food on the project site. Prevent contamination of the site or other areas when handling and disposing of wastes. At project completion, leave the areas clean. Recycling is encouraged and can be coordinated with the Contracting Officer and the activity recycling coordinator. Remove all solid waste (including non-hazardous debris) from Government property and dispose off-site at an approved landfill. Solid waste disposal off-site must comply with most stringent local, State, and Federal requirements including 40 CFR 241, 40 CFR 243, and 40 CFR 258.

3.5 WASTE DETERMINATION DOCUMENTATION

Complete a Waste Determination form (provided at the pre-construction conference) for all contractor derived wastes to be generated. Base the waste determination upon either a constituent listing from the manufacturer used in conjunction with consideration of the process by which the waste was generated, EPA approved analytical data, or laboratory analysis

(Material Safety Data Sheets (MSDS) by themselves are not adequate). Attach all support documentation to the Waste Determination form. As a minimum, a Waste Determination form must be provided for the following wastes (this listing is not all inclusive): oil and latex based painting and caulking products, solvents, adhesives, aerosols, petroleum products, and all containers of the original materials.

3.5.1 Contractor Hazardous Material Inventory Log

Submit the Contractor Hazardous Material Inventory Log (found at: <http://www.wbdg.org/ccb/NAVGRAPH/01575n.pdf>), which provides information required by (EPCRA Sections 312 and 313) along with corresponding Material Safety Data Sheets (MSDS) to the Contracting Officer at the start and at the end of construction (30 days from final acceptance), and update no later than January 31 of each calendar year during the life of the contract. Documentation for any spills/releases, environmental reports or off-site transfers may be requested by the Contracting Officer.

3.5.2 Laboratory Analysis

Submit a copy of a Laboratory Analysis of solid waste and debris with the potential of becoming classified as a hazardous waste (i.e., abrasive/sand blasting debris, etc.). Waste stream determinations are required at the point of generation and must sufficiently document whether the waste will be a solid waste, hazardous waste, or Resource Conservation and Recovery Act (RCRA) exempt waste. Determinations must use EPA approved methods and provide written rationale for whether the waste is classified as hazardous or non-hazardous. The Contractor will bear the cost of the waste stream determinations, and the Contracting Officer reserves the right to request waste stream determinations on questionable waste streams.

3.6 CONTRACTOR HAZARDOUS MATERIAL INVENTORY LOG

Submit the "Contractor Hazardous Material Inventory Log" (found at: <http://www.lantdiv.navfac.navy.mil/pls/lantdiv/docs/FOLDER/EICO/UFGS/GRAPHICS/01575.pdf>), which provides information required by (EPCRA Sections 312 and 313) along with corresponding Material Safety Data Sheets (MSDS) to the Contracting Officer at the start and at the end of construction (30 days from final acceptance), and update no later than January 31 of each calendar year during the life of the contract. Documentation for any spills/releases, environmental reports or off-site transfers may be requested by the Contracting Officer.

3.6.1 Disposal Documentation for Hazardous and Regulated Waste

Manifest, pack, ship and dispose of hazardous or toxic waste and universal waste that is generated as a result of construction in accordance with the generating facilities generator status under the Resource Conservation and Recovery Act. Contact the Contracting Officer for the facility RCRA identification number that is to be used on each manifest.

Submit a copy of the applicable EPA and State permit(s), manifest(s), or license(s) for transportation, treatment, storage, and disposal of hazardous and regulated waste by permitted facilities. Hazardous or toxic waste manifest must be reviewed, signed, and approved by the Navy before the Contractor may ship waste. To obtain specific disposal instructions the Contractor must coordinate with the Activity environmental office.

3.7 POLLUTION PREVENTION/HAZARDOUS WASTE MINIMIZATION

minimize the use of hazardous materials and the generation of hazardous waste. Include procedures for pollution prevention/ hazardous waste minimization in the Hazardous Waste Management Section of the Environmental Protection Plan. Consult with the activity Environmental Office for suggestions and to obtain a copy of the installation's pollution prevention/hazardous waste minimization plan for reference material when preparing this part of the plan. If no written plan exists, obtain information by contacting the Contracting Officer. Describe the types of the hazardous materials expected to be used in the construction when requesting information.

3.8 WHM/HW MATERIALS PROHIBITION

No waste hazardous material or hazardous waste shall be disposed of on government property. No hazardous material shall be brought onto government property that does not directly relate to requirements for the performance of this contract. The government is not responsible for disposal of Contractor's waste material brought on the job site and not required in the performance of this contract. The intent of this provision is to dispose of that waste identified as waste hazardous material/hazardous waste as defined herein that was generated as part of this contract and existed within the boundary of the Contract limits and not brought in from offsite by the Contractor. Incidental materials used to support the contract including, but not limited to aerosol cans, waste paint, cleaning solvents, contaminated brushes, rags, clothing, etc. are the responsibility of the Contractor. The list is illustrative rather than inclusive. The Contractor is not authorized to discharge any materials to sanitary sewer, storm drain, or to the river or conduct waste treatment or disposal on government property without written approval of the Contracting Officer.

3.9 HAZARDOUS MATERIAL CONTROL

Include hazardous material control procedures in the Safety Plan. Address procedures and proper handling of hazardous materials, including the appropriate transportation requirements. Submit a MSDS and estimated quantities to be used for each hazardous material to the Contracting Officer prior to bringing the material on base. Typical materials requiring MSDS and quantity reporting include, but are not limited to, oil and latex based painting and caulking products, solvents, adhesives, aerosol, and petroleum products. At the end of the project, provide the Contracting Officer with the maximum quantity of each material that was present at the site at any one time, the dates the material was present, the amount of each material that was used during the project, and how the material was used. Ensure that hazardous materials are utilized in a manner that will minimize the amount of hazardous waste that is generated. Ensure that all containers of hazardous materials have NFPA labels or their equivalent. 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. Certify that all hazardous materials removed from the site are hazardous materials and do not meet the definition of hazardous waste per 40 CFR 261.

3.10 PETROLEUM PRODUCTS

Conduct the fueling and lubricating of equipment and motor vehicles in a manner that protects against spills and evaporation. Manage all used oil

generated on site in accordance with 40 CFR 279. 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 of at Contractor's expense. Used oil mixed with a hazardous waste will also be considered a hazardous waste.

3.10.1 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 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.

3.11 FUEL TANKS

Petroleum products and lubricants required to sustain up to 30 days of construction activity may be kept on site. Storage and refilling practices shall comply with 40 CFR Part 112. Secondary containment shall be provided and be no less than 110 percent of the tank volume plus five inches of free-board. If a secondary berm is used for containment then the berm shall 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. Drips pans are required and the tanks must be covered during inclement weather.

3.12 RELEASES/SPILLS OF OIL AND HAZARDOUS SUBSTANCES

Exercise due diligence to prevent, contain, and respond to spills of hazardous material, hazardous substances, hazardous waste, sewage, regulated gas, petroleum, lubrication oil, and other substances regulated by environmental law. Maintain spill cleanup equipment and materials at the work site. In the event of a spill, take prompt, effective action to stop, contain, curtail, or otherwise limit the amount, duration, and severity of the spill/release. In the event of any releases of oil and hazardous substances, chemicals, or gases; immediately (within 15 minutes) notify the Base or Activity Fire Department, the activity's Command Duty Officer, and the Contracting Officer. If the contractor's response is inadequate, the Navy may respond. If this should occur, the contractor will be required to reimburse the government for spill response assistance and analysis.

The Contractor is responsible for verbal and written notifications as required by the federal 40 CFR 355, State, local regulations and Navy Instructions. Spill response will be in accordance with 40 CFR 300 and applicable State and local regulations. Contain and clean up these spills without cost to the Government. If Government assistance is requested or required, the Contractor will reimburse the Government for such assistance. Provide copies of the written notification and documentation that a verbal notification was made within 20 days.

Maintain spill cleanup equipment and materials at the work site. Clean up all hazardous and non-hazardous (WHM) waste spills. The Contractor shall reimburse the government for all material, equipment, and clothing generated during any spill cleanup. The Contractor shall reimburse the government for all costs incurred including sample analysis materials,

equipment, and labor if the government must initiate its own spill cleanup procedures, for Contractor responsible spills, when:

- a. The Contractor has not begun spill cleanup procedure within one hour of spill discovery/occurrence, or
- b. If, in the government's judgment, the Contractor's spill cleanup is not adequately abating life threatening situation and/or is a threat to any body of water or environmentally sensitive areas.

3.13 CONTROL AND DISPOSAL OF HAZARDOUS WASTES

3.13.1 Hazardous Waste/Debris Management

Identify all construction activities which will generate hazardous waste/debris. Provide a documented waste determination for all resultant waste streams. Hazardous waste/debris will be identified, labeled, handled, stored, and disposed of in accordance with all Federal, State, and local regulations including 40 CFR 261, 40 CFR 262, 40 CFR 263, 40 CFR 264, 40 CFR 265, 40 CFR 266, and 40 CFR 268. Hazardous waste will also be managed in accordance with the approved Hazardous Waste Management Section of the Environmental Protection Plan. Store hazardous wastes in approved containers in accordance with 49 CFR 173 and 49 CFR 178. Hazardous waste generated within the confines of Government facilities will be identified as being generated by the Government. Prior to removal of any hazardous waste from Government property, all hazardous waste manifests must be signed by activity personnel from the Station Environmental Office. No hazardous waste will be brought onto Government property. Provide to the Contracting Officer a copy of waste determination documentation for any solid waste streams that have any potential to be hazardous waste or contain any chemical constituents listed in 40 CFR 372-SUBPART D. For hazardous wastes spills, verbally notify the Contracting Officer immediately.

3.13.1.1 Regulated Waste Storage/Satellite Accumulation/90 Day Storage Areas

If the work requires the temporary storage/collection of regulated or hazardous wastes, the Contractor will request the establishment of a Regulated Waste Storage Area, a Satellite Accumulation Area, or a 90 Day Storage Area at the point of generation. The Contractor must submit a request in writing to the Contracting Officer providing the following information:

<u>Contract Number</u>	_____	<u>Contractor</u>	_____
<u>Haz/Waste or Regulated Waste POC</u>	_____	<u>Phone Number</u>	_____
<u>Type of Waste</u>	_____	<u>Source of Waste</u>	_____
<u>Emergency POC</u>	_____	<u>Phone Number</u>	_____

Location of the Site: _____
 (Attach Site Plan to the Request)

Attach a waste determination form. Allow ten working days for processing this request.

3.13.2 Class I ODS Prohibition

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.

3.14 DUST CONTROL

Keep dust down at all times, including during nonworking periods. Sprinkle or treat, with dust suppressants, the soil at the site, haul roads, and other areas disturbed by operations. Dry power brooming will not be permitted. Instead, use vacuuming, wet mopping, wet sweeping, or wet power brooming. Air blowing will be permitted only for cleaning nonparticulate debris such as steel reinforcing bars. Only wet cutting will be permitted for cutting concrete blocks, concrete, and bituminous concrete. Do not unnecessarily shake bags of cement, concrete mortar, or plaster.

3.14.1 Dirt and Dust Control Plan

Submit truck and material haul routes along with a plan for controlling dirt, debris, and dust on base roadways. As a minimum, identify in the plan the subcontractor and equipment for cleaning along the haul route and measures to reduce dirt, dust, and debris from roadways.

3.15 ABRASIVE BLASTING

3.15.1 Blasting Operations

The use of silica sand is prohibited in sandblasting.

Provide tarpaulin drop cloths and windscreens to enclose abrasive blasting operations to confine and collect dust, abrasive, agent, paint chips, and other debris. Perform work involving removal of hazardous material in accordance with 29 CFR 1910.

3.15.2 Disposal Requirements

Submit analytical results of the debris generated from abrasive blasting operations per paragraph entitled Laboratory Analysis of this section. Hazardous waste generated from blasting operations will be managed in accordance with paragraph entitled "Hazardous Waste\Debris Management" of this section and with the approved HWMP. Disposal of non-hazardous abrasive blasting debris will be in accordance with paragraph entitled, "Control and Disposal of Solid Wastes".

3.16 NOISE

Make the maximum use of low-noise emission products, as certified by the EPA. Blasting or use of explosives will not be permitted without written permission from the Contracting Officer, and then only during the designated times.

3.17 MERCURY MATERIALS

Mercury is prohibited in the construction of this facility, 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. Remove without breaking, pack to prevent breakage, and transport out of the activity in an unbroken condition for disposal as directed. Immediately report to the Contracting Officer instances of breakage or mercury spillage. Clean mercury spill area to the satisfaction of the Contracting Officer.

3.18 Soil

Soils encountered during project activities shall be managed per Air Station soil management polices in affect for the duration of the project. If soil is encountered during construction operations that may be contaminated (as indicated by odor, color, or unusual appearance) that was not previously indicated as contaminated, stop the portion of work immediately and notify the Contracting Officer immediately.

3.18.1 Quarantne for Imported Fire Ants

Onslow, Jones, and Carteret Counties and portions of Duplin and Craven Counties have been declared a generally infested area by the United States Department of Agriculture (USDA) for the imported fire ant. Compliance with the quarantine regulations established by this authority as set forth is USDA Publication 301.81 of 31 December 1992, is required for operations hereunder. Pertinent requirements of quarantine for materials originating on the Camp Lejeune reservation, the Marine Corps Air Station (Helicopter), New River and the Marine Corps Air Station, Cherry Point, which are to be transported outside Onslow County or adjacent suppression areas, include the following:

- a. Certification is required for the following articles and theu shall not be moved from the reservation to any point outside Onslow County and adjacent designated areas unless accompanied by a valid inspection certificate issued by an Officer of the Plant Protection and AQuarantine Program (PPQ) of the U.S. Department of Agriculture.
 - (1) Bulk soil
 - (2) Used Mechanized soil-moving equipment. (Used mechanized soil-moving equipment is exempt if cleaned of loose non compacted soil).
 - (3) Other products, articles, or means of conveyances, if it is determined by an inspector that they present a hazard of transporting spread of the imported fire ant and the person in possession therof has been so notified.
- b. Authorization for movement of equipment outside the imported fire and regulated area shall be obtained from USDA, APHIS, PPQ, Attn: JB Perry, C/o NCSPA, 113 Arendell St. Room 216, Morehead City, NC 28557, telephone (252) 726-4358, fax (252) 726-5713. Requests for inspection shall be made sufficiently in advance of the date of movement to permit arrangement for the services of authorized inspectors. The equipment shall be prepared and assembled so that it may be readily inspected. Soil on or attached to equipment, supplies, and materials shall be removed by washing with water or such other means as necessary to accomplish complete removal. Resulting spoil shall be wasted as necessary and as directed.

-- End of Section --

SECTION 01 62 35

RECYCLED / RECOVERED MATERIALS

07/06

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. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 247

Comprehensive Procurement Guideline for
Products Containing Recovered Materials

1.2 OBJECTIVES

Government procurement policy is to acquire, in a cost effective manner, items containing the highest percentage of recycled and recovered materials practicable consistent with maintaining a satisfactory level of competition without adversely affecting performance requirements or exposing suppliers' employees to undue hazards from the recovered materials. The Environmental Protection Agency (EPA) has designated certain items which must contain a specified percent range of recovered or recycled materials. EPA designated products specified in this contract comply with the stated policy and with the EPA guidelines. Make all reasonable efforts to use recycled and recovered materials in providing the EPA designated products and in otherwise utilizing recycled and recovered materials in the execution of the work.

1.3 EPA DESIGNATED ITEMS INCORPORATED IN THE WORK

Various sections of the specifications contain requirements for materials that have been designated by EPA as being products which are or can be made with recovered or recycled materials. These items, when incorporated into the work under this contract, shall contain at least the specified percentage of recycled or recovered materials unless adequate justification (non-availability) for non-use is provided. When a designated item is specified as an option to a non-designated item, the designated item requirements apply only if the designated item is used in the work.

1.4 EPA PROPOSED ITEMS INCORPORATED IN THE WORK

Products other than those designated by EPA are still being researched and are being considered for future Comprehensive Procurement Guideline (CPG) designation. It is recommended that these items, when incorporated in the work under this contract, contain the highest practicable percentage of recycled or recovered materials, provided specified requirements are also met.

1.5 EPA LISTED ITEMS USED IN CONDUCT OF THE WORK BUT NOT INCORPORATED IN THE WORK

There are many products listed in 40 CFR 247 which have been designated or proposed by EPA to include recycled or recovered materials that may be used by the Contractor in performing the work but will not be incorporated into the work. These products include office products, temporary traffic control products, and pallets. It is recommended that these non-construction products, when used in the conduct of the work, contain the highest practicable percentage of recycled or recovered materials and that these products be recycled when no longer needed.

PART 2 TITLE

Not Used

PART 3 TITLE

Not Used

-- End of Section --

SECTION 01 78 00

CLOSEOUT SUBMITTALS

05/10

PART 1 GENERAL

1.1 SUBMITTALS

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

SD-10 Operation and Maintenance Data

Equipment/Product Warranty List; G

Submit Data Package 1 in accordance with Section 01 78 23
OPERATION AND MAINTENANCE DATA.

SD-11 Closeout Submittals

As-Built Drawings; G

Record Of Materials; G

Form DD1354; G

Checklist for Form DD1354; G

1.2 CERTIFICATION OF EPA DESIGNATED ITEMS

Submit the Certification of EPA Designated Items as required by FAR 52.223-9, "Certification and Estimate of Percentage of Recovered Material Content for EPA Designated Items". The certification form shall include the following information: project name, project number, Contractor name, license number, Contractor address, and certification. The certification shall read as follows and shall be signed and dated by the Contractor. Each product used in the project that has a requirement or option of containing recycled content in accordance with Section 01 62 35 RECYCLED/RECOVERED MATERIALS shall be recorded, noting total price, total value of post-industrial recycled content, total value of post-consumer recycled content, total value of biobased content, exemptions (1, 2, 3, or 4, as indicated), and comments. Recycled and biobased content values may be determined by weight or volume percent, but must be consistent throughout.

1.3 PROJECT RECORD DOCUMENTS

1.3.1 As-Built Drawings

"NFAS 5252.236-9310, Record Drawings."

1.3.2 As-Built Record of Materials

Furnish a record of materials.

Where several manufacturers' brands, types, or classes of the item listed

have been used in the project, designate specific areas where each item was used. Designations shall be keyed to the areas and spaces depicted on the contract drawing. Furnish the record of materials used in the following format:

MATERIALS DESIGNATION	SPECIFICATION	MANUFACTURER	MATERIALS USED (MANUFACTURER'S DESIGNATION)	WHERE USED
(Roofing)	_____	_____	_____	_____
(_____)	_____	_____	_____	_____

1.4 EQUIPMENT/PRODUCT WARRANTIES

1.4.1 Equipment/Product Warranty List

Furnish to the Contracting Officer a bound and indexed notebook containing written warranties for equipment/products furnished under the contract, and prepare a complete listing of such equipment/products. The equipment/products list shall state the specification section applicable to the equipment/product, duration of the warranty therefore, start date of the warranty, ending date of the warranty, and the point of contact for fulfillment of the warranty. The warranty period shall begin on the same date as project acceptance and shall continue for the full product warranty period. Execute the full list and deliver to the Contracting Officer prior to final acceptance of the facility.

1.4.2 Equipment Warranty Tags and Guarantor's Local Representative

Furnish with each warranty the name, address, and telephone number of the guarantor's representative nearest to the location where the equipment and appliances are installed. The guarantor's representative, upon request of the station representative, shall honor the warranty during the warranty period, and shall provide the services prescribed by the terms of the warranty. At the time of installation, tag each item of warranted equipment with a durable, oil- and water-resistant tag approved by the Contracting Officer. Attach tag with copper wire and spray with a clear silicone waterproof coating. Leave the date of acceptance and QC's signature blank until project is accepted for beneficial occupancy. Tag shall show the following information:

EQUIPMENT/PRODUCT WARRANTY TAG

Type of Equipment/Product _____
 Warranty Period _____ From _____ To _____
 Contract No. _____
 Inspector's Signature _____ Date Accepted _____

Construction Contractor:
 Name: _____
 Address: _____
 Telephone: _____

Warranty Contact: _____
 Name: _____
 Address: _____
 Telephone: _____

STATION PERSONNEL TO PERFORM ONLY OPERATIONAL MAINTENANCE

1.5 CLEANUP

Leave premises "broom clean." Clean interior and exterior glass surfaces exposed to view; remove temporary labels, stains and foreign substances; polish transparent and glossy surfaces; vacuum carpeted and soft surfaces. Clean equipment and fixtures to a sanitary condition. Replace filters of operating equipment. Clean debris from roofs, gutters, downspouts and drainage systems. Sweep paved areas and rake clean landscaped areas. Remove waste and surplus materials, rubbish and construction facilities from the site.

1.6 REAL PROPERTY RECORD

Near the completion of Project, but a minimum of 60 days prior to final acceptance of the work, complete, update draft attached to this section, and submit an accounting of all installed property on Form DD1354 "Transfer and Acceptance of Military Real Property." Contact the Contracting Officer for any project specific information necessary to complete the DD Form 1354. For information purposes, a blank DD Form 1354 (fill-able) in ADOBE (PDF) may be obtained at the following web site:

<http://www.dtic.mil/whs/directives/infomgt/forms/eforms/dd1354.pdf>

Submit the completed Checklist for Form DD1354 of Government-Furnished and Contractor-Furnished/Contractor Installed items. Attach this list to the updated DD Form 1354. Instructions for completing the form and a blank checklist (fill-able) in ADOBE (PDF) may be obtained at the following web site:

<http://www.hnd.usace.army.mil/techinfo/UFC/UFC1-300-08/UFC1-300-08.pdf>
See Appendix D of this pdf for the checklist.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --

SECTION 01 78 23

OPERATION AND MAINTENANCE DATA

07/06

PART 1 GENERAL

1.1 SUBMISSION OF OPERATION AND MAINTENANCE DATA

Submit Operation and Maintenance (O&M) Data specifically applicable to this contract and a complete and concise depiction of the provided equipment, product, or system, stressing and enhancing the importance of system interactions, troubleshooting, and long-term preventative maintenance and operation. The subcontractors shall compile and prepare data and deliver to the Contractor prior to the training of Government personnel. The Contractor shall compile and prepare aggregate O&M data including clarifying and updating the original sequences of operation to as-built conditions. Organize and present information in sufficient detail to clearly explain O&M requirements at the system, equipment, component, and subassembly level. Include an index preceding each submittal. Submit in accordance with this section and Section 01 33 00 SUBMITTAL PROCEDURES.

1.1.1 Package Quality

Documents must be fully legible. Poor quality copies and material with hole punches obliterating the text or drawings will not be accepted.

1.1.2 Package Content

Data package content shall be as shown in the paragraph titled "Schedule of Operation and Maintenance Data Packages." Comply with the data package requirements specified in the individual technical sections, including the content of the packages and addressing each product, component, and system designated for data package submission, except as follows. Commissioned items without a specified data package requirement in the individual technical sections shall use Data Package 3. Commissioned items with a Data Package 1 or 2 requirement shall use instead Data Package 3.

1.1.3 Changes to Submittals

Manufacturer-originated changes or revisions to submitted data shall be furnished by the Contractor if a component of an item is so affected subsequent to acceptance of the O&M Data. Changes, additions, or revisions required by the Contracting Officer for final acceptance of submitted data, shall be submitted by the Contractor within 30 calendar days of the notification of this change requirement.

1.2 TYPES OF INFORMATION REQUIRED IN O&M DATA PACKAGES

1.2.1 Operating Instructions

Include specific instructions, procedures, and illustrations for the following phases of operation for the installed model and features of each system:

1.2.1.1 Safety Precautions

List personnel hazards and equipment or product safety precautions for all

operating conditions.

1.2.1.2 Operator Prestart

Include procedures required to install, set up, and prepare each system for use.

1.2.1.3 Startup, Shutdown, and Post-Shutdown Procedures

Provide narrative description for Startup, Shutdown and Post-shutdown operating procedures including the control sequence for each procedure.

1.2.1.4 Normal Operations

Provide narrative description of Normal Operating Procedures. Include Control Diagrams with data to explain operation and control of systems and specific equipment.

1.2.1.5 Emergency Operations

Include Emergency Procedures for equipment malfunctions to permit a short period of continued operation or to shut down the equipment to prevent further damage to systems and equipment. Include Emergency Shutdown Instructions for fire, explosion, spills, or other foreseeable contingencies. Provide guidance and procedures for emergency operation of all utility systems including required valve positions, valve locations and zones or portions of systems controlled.

1.2.1.6 Operator Service Requirements

Include instructions for services to be performed by the operator such as lubrication, adjustment, inspection, and recording gage readings.

1.2.1.7 Environmental Conditions

Include a list of Environmental Conditions (temperature, humidity, and other relevant data) that are best suited for the operation of each product, component or system. Describe conditions under which the item equipment should not be allowed to run.

1.2.2 Preventive Maintenance

Include the following information for preventive and scheduled maintenance to minimize corrective maintenance and repair for the installed model and features of each system. Include potential environmental and indoor air quality impacts of recommended maintenance procedures and materials.

1.2.2.1 Lubrication Data

Include preventative maintenance lubrication data, in addition to instructions for lubrication provided under paragraph titled "Operator Service Requirements":

- a. A table showing recommended lubricants for specific temperature ranges and applications.
- b. Charts with a schematic diagram of the equipment showing lubrication points, recommended types and grades of lubricants, and capacities.

c. A Lubrication Schedule showing service interval frequency.

1.2.2.2 Preventive Maintenance Plan and Schedule

Include manufacturer's schedule for routine preventive maintenance, inspections, tests and adjustments required to ensure proper and economical operation and to minimize corrective maintenance. Provide manufacturer's projection of preventive maintenance work-hours on a daily, weekly, monthly, and annual basis including craft requirements by type of craft. For periodic calibrations, provide manufacturer's specified frequency and procedures for each separate operation.

1.2.3 Corrective Maintenance (Repair)

Include manufacturer's recommended procedures and instructions for correcting problems and making repairs for the installed model and features of each system. Include potential environmental and indoor air quality impacts of recommended maintenance procedures and materials.

1.2.3.1 Troubleshooting Guides and Diagnostic Techniques

Include step-by-step procedures to promptly isolate the cause of typical malfunctions. Describe clearly why the checkout is performed and what conditions are to be sought. Identify tests or inspections and test equipment required to determine whether parts and equipment may be reused or require replacement.

1.2.3.2 Wiring Diagrams and Control Diagrams

Wiring diagrams and control diagrams shall be point-to-point drawings of wiring and control circuits including factory-field interfaces. Provide a complete and accurate depiction of the actual job specific wiring and control work. On diagrams, number electrical and electronic wiring and pneumatic control tubing and the terminals for each type, identically to actual installation configuration and numbering.

1.2.3.3 Maintenance and Repair Procedures

Include instructions and a list of tools required to repair or restore the product or equipment to proper condition or operating standards.

1.2.3.4 Removal and Replacement Instructions

Include step-by-step procedures and a list required tools and supplies for removal, replacement, disassembly, and assembly of components, assemblies, subassemblies, accessories, and attachments. Provide tolerances, dimensions, settings and adjustments required. Instructions shall include a combination of text and illustrations.

1.2.3.5 Spare Parts and Supply Lists

Include lists of spare parts and supplies required for maintenance and repair to ensure continued service or operation without unreasonable delays. Special consideration is required for facilities at remote locations. List spare parts and supplies that have a long lead-time to obtain.

1.2.4 Corrective Maintenance Work-Hours

Include manufacturer's projection of corrective maintenance work-hours including requirements by type of craft. Corrective maintenance that requires completion or participation of the equipment manufacturer shall be identified and tabulated separately.

1.2.5 Appendices

Provide information required below and information not specified in the preceding paragraphs but pertinent to the maintenance or operation of the product or equipment. Include the following:

1.2.5.1 Product Submittal Data

Provide a copy of all SD-03 Product Data submittals required in the applicable technical sections.

1.2.5.2 Manufacturer's Instructions

Provide a copy of all SD-08 Manufacturer's Instructions submittals required in the applicable technical sections.

1.2.5.3 O&M Submittal Data

Provide a copy of all SD-10 Operation and Maintenance Data submittals required in the applicable technical sections.

1.2.5.4 Parts Identification

Provide identification and coverage for all parts of each component, assembly, subassembly, and accessory of the end items subject to replacement. Include special hardware requirements, such as requirement to use high-strength bolts and nuts. Identify parts by make, model, serial number, and source of supply to allow reordering without further identification. Provide clear and legible illustrations, drawings, and exploded views to enable easy identification of the items. When illustrations omit the part numbers and description, both the illustrations and separate listing shall show the index, reference, or key number that will cross-reference the illustrated part to the listed part. Parts shown in the listings shall be grouped by components, assemblies, and subassemblies in accordance with the manufacturer's standard practice. Parts data may cover more than one model or series of equipment, components, assemblies, subassemblies, attachments, or accessories, such as typically shown in a master parts catalog

1.2.5.5 Warranty Information

List and explain the various warranties and clearly identify the servicing and technical precautions prescribed by the manufacturers or contract documents in order to keep warranties in force. Include warranty information for primary components such as the compressor of air conditioning system.

1.2.5.6 Personnel Training Requirements

Provide information available from the manufacturers that is needed for use in training designated personnel to properly operate and maintain the equipment and systems.

1.2.5.7 Testing Equipment and Special Tool Information

Include information on test equipment required to perform specified tests and on special tools needed for the operation, maintenance, and repair of components.

1.2.5.8 Testing and Performance Data

Include completed prefunctional checklists, functional performance test forms, and monitoring reports. Include recommended schedule for retesting and blank test forms.

1.2.5.9 Contractor Information

Provide a list that includes the name, address, and telephone number of the General Contractor and each Subcontractor who installed the product or equipment, or system. For each item, also provide the name address and telephone number of the manufacturer's representative and service organization that can provide replacements most convenient to the project site. Provide the name, address, and telephone number of the product, equipment, and system manufacturers.

1.3 TYPES OF INFORMATION REQUIRED IN CONTROLS O&M DATA PACKAGES

Include Data Package 5 and the following for control systems:

- a. Narrative description on how to perform and apply all functions, features, modes, and other operations, including unoccupied operation, seasonal changeover, manual operation, and alarms. Include detailed technical manual for programming and customizing control loops and algorithms.
- b. Full as-built sequence of operations.
- c. Copies of all checkout tests and calibrations performed by the Contractor (not Cx tests).

1.4 SCHEDULE OF OPERATION AND MAINTENANCE DATA PACKAGES

Furnish the O&M data packages specified in individual technical sections. The required information for each O&M data package is as follows:

1.4.1 Data Package 1

- a. Safety precautions
- b. Cleaning recommendations
- c. Maintenance and repair procedures
- d. Warranty information
- e. Contractor information
- f. Spare parts and supply list

1.4.2 Data Package 2

- a. Safety precautions
- b. Normal operations
- c. Environmental conditions
- d. Lubrication data
- e. Preventive maintenance plan and schedule
- f. Cleaning recommendations
- g. Maintenance and repair procedures
- h. Removal and replacement instructions
- i. Spare parts and supply list
- j. Parts identification
- k. Warranty information
- l. Contractor information

1.4.3 Data Package 3

- a. Safety precautions
- b. Operator prestart
- c. Startup, shutdown, and post-shutdown procedures
- d. Normal operations
- e. Emergency operations
- f. Environmental conditions
- g. Lubrication data
- h. Preventive maintenance plan and schedule
- i. Cleaning recommendations
- j. Troubleshooting guides and diagnostic techniques
- k. Wiring diagrams and control diagrams
- l. Maintenance and repair procedures
- m. Removal and replacement instructions
- n. Spare parts and supply list
- o. Product submittal data
- p. O&M submittal data

- q. Parts identification
- r. Warranty information
- s. Testing equipment and special tool information
- t. Testing and performance data
- u. Contractor information

1.4.4 Data Package 4

- a. Safety precautions
- b. Operator prestart
- c. Startup, shutdown, and post-shutdown procedures
- d. Normal operations
- e. Emergency operations
- f. Operator service requirements
- g. Environmental conditions
- h. Lubrication data
- i. Preventive maintenance plan and schedule
- j. Cleaning recommendations
- k. Troubleshooting guides and diagnostic techniques
- l. Wiring diagrams and control diagrams
- m. Maintenance and repair procedures
- n. Removal and replacement instructions
- o. Spare parts and supply list
- p. Corrective maintenance man-hours
- q. Product submittal data
- r. O&M submittal data
- s. Parts identification
- t. Warranty information
- u. Personnel training requirements
- v. Testing equipment and special tool information
- w. Testing and performance data

x. Contractor information

1.4.5 Data Package 5

- a. Safety precautions
- b. Operator prestart
- c. Start-up, shutdown, and post-shutdown procedures
- d. Normal operations
- e. Environmental conditions
- f. Preventive maintenance plan and schedule
- g. Troubleshooting guides and diagnostic techniques
- h. Wiring and control diagrams
- i. Maintenance and repair procedures
- j. Removal and replacement instructions
- k. Spare parts and supply list
- l. Product submittal data
- m. Manufacturer's instructions
- n. O&M submittal data
- o. Parts identification
- p. Testing equipment and special tool information
- q. Warranty information
- r. Testing and performance data
- s. Contractor information

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- End of Section --

SECTION 01 80 00

REPORTS

07/06

PART 1 GENERAL

1.1 REPORTS INCLUDED

1.1.1 Asbestos and Lead Paint Inspection Report

Asbestos and Lead Paint Survey Report of April 10, 2012

Asbestos and Lead Paint Survey Reports of May 09, 2012

1.2 USE OF INFORMATION

1.2.1 Warranty

The information disclosed in the referenced reports is based on data obtained in specific locations and is assumed to be representative of conditions throughout the site. This information is furnished without warranty and is only for general information to be used by the contractor in the preparation of his bid and work schedule. It is not intended as a replacement for personal investigation and judgment, or interpretation of the information furnished, as required of the contractor in the performance of this contract.

1.2.2 Site Visit

Bidders should visit the site and acquaint themselves with all existing conditions prior to preparing their bid. This will include a review of the conditions contained in the enclosed report as they relate to the site. The contractor is responsible for including in his bid and work schedule, procedures for handling existing site conditions delineated in the included reports in accord with applicable laws and regulations as those conditions may effect the work.

1.2.3 Application of Information

Recommendations contained in the reports are to be used by the contractor only to the extent that these recommendations comply with applicable laws, regulations, and other sections of the these specifications.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 VARYING CONDITIONS

If during the course of the work, conditions are encountered which are not covered in the included reports or are different from conditions that would be reasonably anticipated from the included reports, the contractor shall immediately notify the Officer in Charge of Construction. If such conditions are hazardous or the continuation of work would cause a hazardous condition to develop, he shall stop work and proceed as directed

by the Officer in Charge of Construction as directed by provisions contained in other sections of this specification. This may include modifications to, or the development of a new, Health and Safety Plan for this project, and alternate or additional appropriate abatement procedures.

3.2 CHANGES TO THE CONTRACT

Any changes to the contract made as a result of site conditions which differ from those delineated in the report may result in an adjustment of the contract amount. The adjustment will be an increase or decrease depending on the scope and nature of the change and will be in accord with other provisions of these specifications.

-- End of Section --

LEAD AND ASBESTOS REPORT

FACILITIES ENERGY REPAIRS, BUILDING 131 MCAS CHERRY POINT, NC

Prepared By:

BOWMAN FOSTER & ASSOCIATES, PC
Consulting Engineers
#4 Interstate Corporate Center, Suite 1
Norfolk, VA 23502-4118

FINAL SUBMITTAL
June 12, 2012
BFA Project No. 10-0050



April 10, 2012

Steven Robey
Bowman, Foster & Associates
6379 Center Drive
Norfolk, VA 23502

Re: PEC Job # 21-12-078-Ab-Pb-I; Asbestos and Lead Results – MCAS Cherry Point, Building 131

On April 5, 2012, Phoenix Enviro (PEC) conducted asbestos and lead testing of materials within the above referenced building. The purpose of this survey was to sample potential asbestos-containing and/or lead-containing materials that would potentially be disturbed during upcoming renovations.

ASBESTOS

Prior to conducting the inspection, a walk through and visual inspection was conducted to determine homogeneous materials/areas and sampling locations. Homogeneous areas were denoted by their color, texture, and function in the structure; and were designated by one of the following descriptions: Surfacing Materials, Thermal System Insulation, and Miscellaneous Materials. Both friable and non-friable suspect asbestos containing materials were considered during the course of the survey. Friable materials are defined as those materials that can be pulverized or reduced to powder by hand pressure.

Sampling locations were determined by reasonable assumption that suspect materials may contain asbestos or these materials by their function have historically been found to contain asbestos.

The collected samples were placed into individual sample containers, sealed, and assigned a unique identification number at the time of collection. The sample number included the date, inspector's initials (WP), and sample number. The sample information was logged onto a chain of custody/laboratory request form and submitted to a third party laboratory for analysis.

The completion of this survey included the collection of thirty six (36) bulk samples. The analysis of these samples was performed by Polarized Light Microscopy (PLM) utilizing dispersion staining techniques. Any multi-layered samples/ heterogeneous samples analyzed were first separated into sub-samples and analyzed separately per EPA protocol. Positive stop instructions were issued for all homogeneous samples of materials that previously tested positive for asbestos content. Upon completion of analysis, a total of thirty eight (38) samples were analyzed via PLM.

Asbestos Results

Of the homogeneous materials sampled during this inspection, the following were found contain no asbestos and are considered to be non-asbestos containing:

- Large diameter steam pipe TSI within the below ground pipe chase of the south side mechanical room
- Small diameter steam pipe TSI within the below ground pipe chase of the south side mechanical room
- Gray HVAC rigid duct mastic within the south side mechanical room pipe chase
- White pipe flange mastic within the south side mechanical room pipe chase
- Cloth pipe TSI wrap near the interior entrance to the south side mechanical room
- Mud elbow TSI near the interior entrance to the south side mechanical room
- Cloth rigid HVAC duct wrap platform that overhangs the bay area in the southwest section
- White mastic and cloth pipe TSI wrap platform that overhangs the bay area in the southwest section

- 2'x2' white ceiling tile within the south side administration offices
- Drywall within the south side administration offices
- Joint compound within the south side administration offices
- White to black 2nd layer window caulk exterior side of the south side administration offices
- White window caulk exterior side of the south side administration offices
- Black window glaze exterior side of the south side administration offices
- Cloth window stripping exterior side of the south side administration offices
- Exterior white to gray HVAC vent mastic exterior side of the south side administration offices
- Exterior gray vent hood mastic exterior side of the south side administration offices
- Exterior black pipe/flashing mastic exterior side of the south side administration offices
- Rolled shingle roof material exterior side of the south side administration offices

LEAD

The collected samples were placed into individual sample containers, sealed, and assigned a unique identification number at the time of collection. The sample number included the date, collector's initials (WP), and sample number. The sample information was logged onto a chain of custody/laboratory request form and submitted to a third party laboratory for analysis. The analysis of these samples was performed via Flame Atomic Absorption Spectroscopy, EPA SW-846 Ed. Method No. 3050B/Method No. 7420.

Lead Results

Sample #	Sample Area	Substrate	Color	Condition	Analysis % by weight
040512-WP-37	Rigid HVAC duct paint within south side mechanical room	Metal	Off-white	Good	0.011%
040512-WP-38	Pipe system within south side mechanical room	Metal	White	Fair	<0.003%
040512-WP-39	Condensate pump within south side mechanical room	Metal	Red	Fair	0.019%
040512-WP-40	Suction pump within south side mechanical room	Metal	Blue	Poor	0.006%
040512-WP-41	Yellow tank within south side mechanical room	Metal	Yellow	Fair	0.073%
040512-WP-42	Non-flammable gas tank within south side mechanical room	Metal	Greenish/gray	Good	<0.005%
040512-WP-43	Electrical conduit within south side administration offices	Metal	Off-white	Fair	0.018%
040512-WP-44	Cloth pipe system within south side administration offices	Cloth	Off-white	Poor	0.006%
040512-WP-45	Wall paint within south side administration offices	Drywall	Off-white	Fair	0.009%
040512-WP-46	Interior white paint around windows within south side administration offices	Metal	White	Fair	2.572%
040512-WP-47	Exterior window paint outside south side administration offices	Metal	Gray	Fair	9.357%

Analyses of the samples revealed that the following samples are lead-containing:

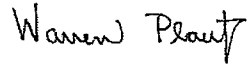
- Off-white paint on the rigid HVAC duct within the south side mechanical room
- Red paint on the condensate pump within the south side mechanical room
- Blue paint on the suction pump within the south side mechanical room
- Yellow paint on the tank within the south side mechanical room
- Off-white paint on the electrical conduit within the south side administration offices
- Off-white paint on the cloth pipe system within the south side administration offices
- Off-white paint on the walls within the south side administration offices
- White paint around the interior windows within the south side administration offices
- Gray paint on the exterior windows on the south side administration offices

OSHA considers any detectable level of lead a concern when renovations will impact lead based painted surfaces

Materials within the south side administration offices and mechanical room were tested for asbestos and lead during the inspection. If materials throughout the remainder of the building (north side administration offices and bay area) are determined not to be homogeneous in size, texture, and color to those tested in the south side areas, PEC recommends having those materials tested prior to their disturbance. In addition, if materials appear homogenous but were installed on different dates, those materials shall also be tested prior to their disturbance.

Sample analysis forms, chain of custody, and lab and inspector accreditations are included with this report.

Thank you,

A handwritten signature in black ink that reads "Warren Plautz". The signature is written in a cursive style with a large initial 'W' and a distinct 'P'.

Warren Plautz

SCHNEIDER LABORATORIES GLOBAL

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AIHA/ELLAP 100527, ISO/IEC 17025, NVLAP 101150-0, VELAP 460135, NYELAP/NELAC 11413

LABORATORY ANALYSIS REPORT

Asbestos Identification by EPA Method¹ 600/R-93/116

Using SLI A6

ACCOUNT #: 1301-12-760
CLIENT: PHOENIX ENVIROCORP
ADDRESS: 4020 SHIPYARD BLVD
WILMINGTON, NC 28403-6153

DATE COLLECTED: 4/5/2012
DATE RECEIVED: 4/9/2012
DATE ANALYZED: 4/10/2012
DATE REPORTED: 4/10/2012

PROJECT NAME: MCAS Cherry Point
JOB LOCATION: Building 131
PROJECT NO.: 21-12-078-AB-Pb-I
PO NO.:

SampleType: BULK

Client Sample No.	SLI Sample/ Layer ID	Sample Identification/ Layer Name	PLM Analysis Results	
			Asbestos Fibers	Other Materials
040512-WP-01	31418818	S Side Mechanical Room		
Layer 1:	TSI White, Powdery		None Detected	30% CELLULOSE FIBER 70% NON FIBROUS MATERIAL
040512-WP-02	31418819	S Side Mechanical Room		
Layer 1:	TSI White, Powdery		None Detected	30% CELLULOSE FIBER 70% NON FIBROUS MATERIAL
040512-WP-03	31418820	S Side Mechanical Room		
Layer 1:	TSI Beige, Brittle		None Detected	30% MINERAL/GLASS WOOL 70% NON FIBROUS MATERIAL
040512-WP-04	31418821	S Side Mechanical Room		
Layer 1:	TSI Beige, Brittle		None Detected	30% MINERAL/GLASS WOOL 70% NON FIBROUS MATERIAL

Total Number of Pages in Report: 6

Results relate only to samples as received by the laboratory.

Visit www.slabin.com for current certifications.

Samples analyzed by the EPA Test Method are subject to the limitations of light microscopy including matrix interference. Gravimetric reduction and correlative analyses are recommended for all non-friable, organically bound materials. This method has a reporting limit of 1% or greater. Visual estimation contains an inherent range of uncertainty. This report must not be reproduced except in full with the approval of the lab, and must not be used to claim NVLAP or other gov't agency endorsement.

Client Sample No.	SLI Sample/ Layer ID	Sample Identification/ Layer Name	PLM Analysis Results	
			Asbestos Fibers	Other Materials
040512-WP-05	31418822	S Side Mechanical Room	None Detected	10% WOLLASTONITE 90% NON FIBROUS MATERIAL
040512-WP-06	31418823	S Side Mechanical Room	None Detected	10% WOLLASTONITE 90% NON FIBROUS MATERIAL
040512-WP-07	31418824	S Side Mechanical Room	None Detected	100% NON FIBROUS MATERIAL
040512-WP-08	31418825	S Side Mechanical Room	None Detected	100% NON FIBROUS MATERIAL
040512-WP-09	31418826	S Side Mechanical Room	None Detected	70% CELLULOSE FIBER 10% METAL FOIL 20% NON FIBROUS MATERIAL
040512-WP-10	31418827	S Side Mechanical Room	None Detected	70% CELLULOSE FIBER 10% METAL FOIL 20% NON FIBROUS MATERIAL
040512-WP-11	31418828	S Side Mechanical Room	None Detected	35% MINERAL/GLASS WOOL 5% CELLULOSE FIBER 60% NON FIBROUS MATERIAL
040512-WP-12	31418829	S Side Mechanical Room	None Detected	35% MINERAL/GLASS WOOL 5% CELLULOSE FIBER 60% NON FIBROUS MATERIAL

Total Number of Pages in Report: 6

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Client Sample No.	SLI Sample/ Layer ID	Sample Identification/ Layer Name	PLM Analysis Results	
			Asbestos Fibers	Other Materials
040512-WP-13	31418830	S Side Administration Offices		
Layer 1:	Duct Wrap White, Fibrous		None Detected	60% CELLULOSE FIBER 15% MINERAL/GLASS WOOL 10% METAL FOIL 15% NON FIBROUS MATERIAL
040512-WP-14	31418831	S Side Administration Offices		
Layer 1:	Duct Wrap White, Fibrous		None Detected	60% CELLULOSE FIBER 15% MINERAL/GLASS WOOL 10% METAL FOIL 15% NON FIBROUS MATERIAL
040512-WP-15	31418832	S Side Administration Offices		
Layer 1:	Mastic White, Soft		None Detected	100% NON FIBROUS MATERIAL
Layer 2:	Cloth White, Fibrous		None Detected	90% CELLULOSE FIBER 10% NON FIBROUS MATERIAL
040512-WP-16	31418833	S Side Administration Offices		
Layer 1:	Mastic White, Soft		None Detected	100% NON FIBROUS MATERIAL
Layer 2:	Cloth White, Fibrous		None Detected	90% CELLULOSE FIBER 10% NON FIBROUS MATERIAL
040512-WP-17	31418834	S Side Administration Offices		
Layer 1:	Ceiling Tile White, Fibrous		None Detected	45% CELLULOSE FIBER 35% MINERAL/GLASS WOOL 10% FOAMED GLASS 10% NON FIBROUS MATERIAL
040512-WP-18	31418835	S Side Administration Offices		
Layer 1:	Ceiling Tile White, Fibrous		None Detected	45% CELLULOSE FIBER 35% MINERAL/GLASS WOOL 10% FOAMED GLASS 10% NON FIBROUS MATERIAL

Total Number of Pages in Report: 6

Results relate only to samples as received by the laboratory.

Visit www.slabinc.com for current certifications.

Samples analyzed by the EPA Test Method are subject to the limitations of light microscopy including matrix interference. Gravimetric reduction and correlative analyses are recommended for all non-friable, organically bound materials. This method has a reporting limit of 1% or greater. Visual estimation contains an inherent range of uncertainty. This report must not be reproduced except in full with the approval of the lab, and must not be used to claim NVLAP or other gov't agency endorsement.

Client Sample No.	SLI Sample/ Layer ID	Sample Identification/ Layer Name	PLM Analysis Results	
			Asbestos Fibers	Other Materials
040512-WP-19	31418836	S Side Administration Offices		
Layer 1:	Drywall White, Powdery No Joint Compound Found		None Detected	4% CELLULOSE FIBER 96% NON FIBROUS MATERIAL
040512-WP-20	31418837	S Side Administration Offices		
Layer 1:	Drywall White, Powdery No joint Compound Found		None Detected	4% CELLULOSE FIBER 96% NON FIBROUS MATERIAL
040512-WP-21	31418838	S Side Administration Offices		
Layer 1:	Window Caulk White/Black, Soft		None Detected	100% NON FIBROUS MATERIAL
040512-WP-22	31418839	S Side Administration Offices		
Layer 1:	Window Caulk White/Black, Soft		None Detected	100% NON FIBROUS MATERIAL
040512-WP-23	31418840	S Side Administration Offices		
Layer 1:	Window Caulk White, Soft		None Detected	100% NON FIBROUS MATERIAL
040512-WP-24	31418841	S Side Administration Offices		
Layer 1:	Window Caulk White, Soft		None Detected	100% NON FIBROUS MATERIAL
040512-WP-25	31418842	S Side Administration Offices		
Layer 1:	Window Glaze Black, Rubbery		None Detected	100% NON FIBROUS MATERIAL

Total Number of Pages in Report: 6

Results relate only to samples as received by the laboratory.

Visit www.slabinc.com for current certifications.

Samples analyzed by the EPA Test Method are subject to the limitations of light microscopy including matrix interference. Gravimetric reduction and correlative analyses are recommended for all non-friable, organically bound materials. This method has a reporting limit of 1% or greater. Visual estimation contains an inherent range of uncertainty. This report must not be reproduced except in full with the approval of the lab, and must not be used to claim NVLAP or other gov't agency endorsement.

Client Sample No.	SLI Sample/ Layer ID	Sample Identification/ Layer Name	PLM Analysis Results	
			Asbestos Fibers	Other Materials
040512-WP- 26	31418843	S Side Administration Offices		
Layer 1:	Window Glaze Black, Rubbery		None Detected	100% NON FIBROUS MATERIAL
040512-WP- 27	31418844	S Side Administration Offices		
Layer 1:	Cloth White, Fibrous		None Detected	80% SYNTHETIC FIBER 20% NON FIBROUS MATERIAL
040512-WP- 28	31418845	S Side Administration Offices		
Layer 1:	Cloth White, Fibrous		None Detected	80% SYNTHETIC FIBER 20% NON FIBROUS MATERIAL
040512-WP- 29	31418846	S Side Administration Offices		
Layer 1:	Mastic White/Gray, Soft		None Detected	15% SYNTHETIC FIBER 85% NON FIBROUS MATERIAL
040512-WP- 30	31418847	S Side Administration Offices		
Layer 1:	Mastic White/Gray, Soft		None Detected	15% SYNTHETIC FIBER 85% NON FIBROUS MATERIAL
040512-WP- 31	31418848	S Side Administration Offices		
Layer 1:	Mastic Gray, Soft		None Detected	100% NON FIBROUS MATERIAL
040512-WP- 32	31418849	S Side Administration Offices		
Layer 1:	Mastic Gray, Soft		None Detected	100% NON FIBROUS MATERIAL
040512-WP- 33	31418850	S Side Administration Offices		
Layer 1:	Mastic Black, Bituminous		None Detected	100% NON FIBROUS MATERIAL

Total Number of Pages in Report: 6

Results relate only to samples as received by the laboratory.

Visit www.slabin.com for current certifications.

Samples analyzed by the EPA Test Method are subject to the limitations of light microscopy including matrix interference. Gravimetric reduction and correlative analyses are recommended for all non-friable, organically bound materials. This method has a reporting limit of 1% or greater. Visual estimation contains an inherent range of uncertainty. This report must not be reproduced except in full with the approval of the lab, and must not be used to claim NVLAP or other gov't agency endorsement.

Client Sample No.	SLI Sample/ Layer ID	Sample Identification/ Layer Name	PLM Analysis Results	
			Asbestos Fibers	Other Materials
040512-WP- 34	31418851	S Side Administration Offices		
Layer 1:	Mastic Black, Bituminous		None Detected	100% NON FIBROUS MATERIAL
040512-WP- 35	31418852	S Side Administration Offices		
Layer 1:	Shingle Black, Bituminous		None Detected	10% MINERAL/GLASS WOOL 90% NON FIBROUS MATERIAL
040512-WP- 36	31418853	S Side Administration Offices		
Layer 1:	Shingle Black, Bituminous		None Detected	10% MINERAL/GLASS WOOL 90% NON FIBROUS MATERIAL

Fatima Eltayyar

Analyst: **FATIMA ELTAYYAR**

Halal Osman

Reviewed By: **HALA A. OSMAN, Analyst**

Total Number of Pages in Report: 6

Results relate only to samples as received by the laboratory.

Visit www.slabinc.com for current certifications.

Samples analyzed by the EPA Test Method are subject to the limitations of light microscopy including matrix interference. Gravimetric reduction and correlative analyses are recommended for all non-friable, organically bound materials. This method has a reporting limit of 1% or greater. Visual estimation contains an inherent range of uncertainty. This report must not be reproduced except in full with the approval of the lab, and must not be used to claim NVLAP or other gov't agency endorsement.



**Phoenix
Enviro**
4020 SHIPYARD BLVD.
WILMINGTON, NC 28403

CHAIN OF CUSTODY

1301-12-700



V : \ 878 \ 878369

LABORATORY TEST REQUEST

CONTACT: Warren Plautz	PHONE: (910) 397-0370	FAX: (910) 313-6094	DATE SHIPPED: 4/6/2012
EMAIL: mstewart@phoenixenvirocorp.com			
PEC Job #: 21-12-078-AB-Pb-I	CLIENT'S JOB NAME: MCAS Cherry Point - Building 131		
SAMPLE TYPE: Asbestos Bulk (PLM)	NUMBER OF SAMPLES: 36	TURN AROUND TIME SPECIFIED: ___ 6 Hr ___ <input checked="" type="checkbox"/> 24 Hr ___ 48 Hr ___ 3 Day ___ 5 Day	
SPECIAL INSTRUCTIONS: Stop at first positive for each homogeneous area (HGA). List positive stops on analysis form. Separate all layers prior to analysis. Separate layers of wallboard/joint compound. If joint compound is 1% or greater, composite sample and re-analyze. Please email results.			

Sample #	Sample Area	Sample Date	HGA	Lab Analysis Requested
040512-WP-01	Large diameter steam pipe TSI within the basement pipe chase in the south side mechanical room	04/05/12	1	PLM See Special Instructions
040512-WP-02	Large diameter steam pipe TSI within the basement pipe chase in the south side mechanical room	04/05/12	1	PLM See Special Instructions
040512-WP-03	Small diameter steam pipe TSI within the basement pipe chase in the south side mechanical room	04/05/12	2	PLM See Special Instructions
040512-WP-04	Small diameter steam pipe TSI within the basement pipe chase in the south side mechanical room	04/05/12	2	PLM See Special Instructions
040512-WP-05	Gray rigid HVAC duct mastic within the south side mechanical room	04/05/12	3	PLM See Special Instructions
040512-WP-06	Gray rigid HVAC duct mastic within the south side mechanical room	04/05/12	3	PLM See Special Instructions
040512-WP-07	White pipe flange mastic within the south side mechanical room	04/05/12	4	PLM See Special Instructions
040512-WP-08	White pipe flange mastic near the entrance to the south side mechanical room	04/05/12	4	PLM See Special Instructions
040512-WP-09	Cloth pipe TSI wrap near the entrance to the south side mechanical room	04/05/12	5	PLM See Special Instructions
040512-WP-10	Cloth pipe TSI wrap near the entrance to the south side mechanical room	04/05/12	5	PLM See Special Instructions
040512-WP-11	Mud elbow TSI near the entrance to the south side mechanical room	04/05/12	6	PLM See Special Instructions
040512-WP-12	Mud elbow TSI near the entrance to the south side mechanical room	04/05/12	6	PLM See Special Instructions
040512-WP-13	Cloth rigid HVAC duct wrap within the south side administration offices	04/05/12	7	PLM See Special Instructions
040512-WP-14	Cloth rigid HVAC duct wrap within the south side administration offices	04/05/12	7	PLM See Special Instructions
040512-WP-15	White mastic and cloth pipe TSI wrap with the south side administration offices	04/05/12	8	PLM See Special Instructions

CHAIN OF CUSTODY RECORD

DATE	CONDITION OF SAMPLE	SAMPLES RECEIVED BY	SAMPLES RELEASED BY
4/6/2012	SEALED/GOOD	SIGNATURE <i>L. Robert</i>	SIGNATURE <i>Warren Plautz</i>
2.		SIGNATURE (SAMPLE ADMIN.) <i>4/9/12</i>	SIGNATURE (SAMPLE ADMIN.)
3.		SIGNATURE (LAB) <i>SCG</i>	SIGNATURE (LAB)

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**Phoenix
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4020 SHIPYARD BLVD.
WILMINGTON, NC 28403

CHAIN OF CUSTODY

LABORATORY TEST REQUEST

CONTACT: Warren Plautz	PHONE: (910) 397-0370 FAX: (910) 313-6094	DATE SHIPPED: 4/6/2012
	EMAIL: mstewart@phoenixenvirocorp.com	
PEC Job #: 21-12-078-AB-Pb-I	CLIENT'S JOB NAME: MCAS Cherry Point - Building 131	
SAMPLE TYPE: Asbestos Bulk (PLM)	NUMBER OF SAMPLES: 36	TURN AROUND TIME SPECIFIED: ___ 6 Hr ___ <input checked="" type="checkbox"/> 24 Hr ___ 48 Hr ___ 3 Day ___ 5 Day
SPECIAL INSTRUCTIONS: Stop at first positive for each homogeneous area (HGA). List positive stops on analysis form. Separate all layers prior to analysis. Separate layers of wallboard/joint compound. If joint compound is 1% or greater, composite sample and re-analyze. Please email results.		

Sample #	Sample Area	Sample Date	HGA	Lab Analysis Requested
040512-WP-16	White mastic and cloth pipe TSI wrap with the south side administration offices	04/05/12	8	PLM See Special Instructions
040512-WP-17	2'x2' white ceiling tile within the south side administration offices	04/05/12	9	PLM See Special Instructions
040512-WP-18	2'x2' white ceiling tile within the south side administration offices	04/05/12	9	PLM See Special Instructions
040512-WP-19	Drywall/joint compound within the south side administration offices	04/05/12	10	PLM See Special Instructions
040512-WP-20	Drywall/joint compound within the south side administration offices	04/05/12	10	PLM See Special Instructions
040512-WP-21	White to black 2nd layer window caulk on the exterior of the south side administration offices	04/05/12	11	PLM See Special Instructions
040512-WP-22	White to black 2nd layer window caulk on the exterior of the south side administration offices	04/05/12	11	PLM See Special Instructions
040512-WP-23	White window caulk on the exterior of the south side administration offices	04/05/12	12	PLM See Special Instructions
040512-WP-24	White window caulk on the exterior of the south side administration offices	04/05/12	12	PLM See Special Instructions
040512-WP-25	Black window glaze on the exterior of the south side administration offices	04/05/12	13	PLM See Special Instructions
040512-WP-26	Black window glaze on the exterior of the south side administration offices	04/05/12	13	PLM See Special Instructions
040512-WP-27	Cloth window stripping on the exterior of the south side administration offices	04/05/12	14	PLM See Special Instructions
040512-WP-28	Cloth window stripping on the exterior of the south side administration offices	04/05/12	14	PLM See Special Instructions
040512-WP-29	Exterior white to gray HVAC vent mastic near the south side administration offices	04/05/12	15	PLM See Special Instructions
040512-WP-30	Exterior white to gray HVAC vent mastic near the south side administration offices	04/05/12	15	PLM See Special Instructions

CHAIN OF CUSTODY RECORD

DATE	CONDITION OF SAMPLE	SAMPLES RECEIVED BY	SAMPLES RELEASED BY
4/6/2012	SEALED/GOOD	SIGNATURE <i>[Signature]</i> 4/6/12	SIGNATURE <i>Warren Plautz</i>
2.		SIGNATURE (SAMPLE ADMIN.) <i>[Signature]</i>	SIGNATURE (SAMPLE ADMIN.)
3.		SIGNATURE (LAB) <i>[Signature]</i>	SIGNATURE (LAB)

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5



CHAIN OF CUSTODY

1301-12-700

LABORATORY TEST REQUEST

CONTACT: Warren Plautz		PHONE: (910) 397-0370	FAX: (910) 313-6094	DATE SHIPPED: 4/6/2012
PEC Job #: 21-12-078-AB-Pb-I		EMAIL: mstewart@phoenixenvirocorp.com		
CLIENT'S JOB NAME: MCAS Cherry Point - Building 131				
SAMPLE TYPE: Asbestos Bulk (PLM)	NUMBER OF SAMPLES: 36	TURN AROUND TIME SPECIFIED: <input type="checkbox"/> 6 Hr <input checked="" type="checkbox"/> 24 Hr <input type="checkbox"/> 48 Hr <input type="checkbox"/> 3 Day <input type="checkbox"/> 5 Day		
SPECIAL INSTRUCTIONS: Stop at first positive for each homogeneous area (HGA). List positive stops on analysis form. Separate all layers prior to analysis. Separate layers of wallboard/joint compound. If joint compound is 1% or greater, composite sample and re-analyze. Please email results.				

Sample #	Sample Area	Sample Date	HGA	Lab Analysis Requested
040512-WP-31	Exterior gray vent hood mastic near the south side administration offices	04/05/12	16	PLM See Special Instructions
040512-WP-32	Exterior gray vent hood mastic near the south side administration offices	04/05/12	16	PLM See Special Instructions
040512-WP-33	Exterior black pipe/flashing mastic near the south side administration offices	04/05/12	17	PLM See Special Instructions
040512-WP-34	Exterior black pipe/flashing mastic near the south side administration offices	04/05/12	17	PLM See Special Instructions
040512-WP-35	Rolled shingle roof material near the south side administration offices	04/05/12	18	PLM See Special Instructions
040512-WP-36	Rolled shingle roof material near the south side administration offices	04/05/12	18	PLM See Special Instructions

CHAIN OF CUSTODY RECORD

DATE	CONDITION OF SAMPLE	SAMPLES RECEIVED BY	SAMPLES RELEASED BY
4/6/2012	SEALED/GOOD	SIGNATURE <i>[Signature]</i>	SIGNATURE <i>[Signature]</i>
2.		SIGNATURE (SAMPLE ADMIN.) 9:05	SIGNATURE (SAMPLE ADMIN.)
3.		SIGNATURE (LAB) <i>[Signature]</i>	SIGNATURE (LAB)

1-X 796 SD

SCHNEIDER LABORATORIES GLOBAL

INCORPORATED

2512 W. Cary Street • Richmond, Virginia • 23220-5117
804-353-6778 • 800-785-LABS (5227) • (FAX) 804-359-1475

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AIHA/ELLAP 100527, ISO/IEC 17025, NVLAP 101150-0, VELAP 460135, NYELAP/NELAC 11413

LABORATORY ANALYSIS REPORT

Lead Analysis based on EPA 7000B Method

Using SLI P26 A14

ACCOUNT #: 1301-12-761
CLIENT: PHOENIX ENVIROCORP
ADDRESS: 4020 SHIPYARD BLVD
WILMINGTON, NC 28403-6153

DATE RECEIVED: 4/9/2012
DATE ANALYZED: 4/9/2012
DATE REPORTED: 4/9/2012

PROJECT NAME: MCAS Cherry Point

JOB LOCATION: Building 131

PROJECT NO.: 21-12-078-AB-Pb-I

PO NO.:

Sample Type: PAINT

SLI Sample No.	Client Sample No.	Collection Date	Sample Description	Sample Wt (mg)	Total Lead (µg)*	Lead Conc (% by wt)	Lead Conc PPM
31418868	040512-WP-37	4/5/2012	HVAC Duct S Sd Mech. Rm	369	40.9	0.011	111
31418869	040512-WP-38	4/5/2012	Pipe System S Sd Mech. R	321	< 10.0	< 0.003	< 31
31418870	040512-WP-39	4/5/2012	Con. Pump Mech. Rm	120	22.9	0.019	191
			<i>Sample weight below SLI SOP guidelines.</i>				
31418871	040512-WP-40	4/5/2012	Pump S Sd Mech. Rm	165	10.4	0.006	63
			<i>Sample weight below SLI SOP guidelines.</i>				
31418872	040512-WP-41	4/5/2012	Yellow Tank S Sd Mech. R	337	245.7	0.073	729
31418873	040512-WP-42	4/5/2012	Gas Tank S Sd Mech Rm	198	< 10.0	< 0.005	< 51
			<i>Sample weight below SLI SOP guidelines.</i>				
31418874	040512-WP-43	4/5/2012	Elec. S Sd Admin. Office	261	46.3	0.018	177
31418875	040512-WP-44	4/5/2012	Cloth Pipe S Sd Admin Offi	318	19.3	0.006	61
31418876	040512-WP-45	4/5/2012	Wall Paint Admin. Office	377	33.7	0.009	89
31418877	040512-WP-46	4/5/2012	Int Win S Sd Admin. Office	328	8,436.5	2.572	25,721
31418878	040512-WP-47	4/5/2012	Ext Win S Sd Admin. Office	326	30,503.5	9.357	93,569

Analysis Run ID: 49782

Analyst: Derek L. Jackson

Total Number of Pages in Report: 1

Results relate only to samples as received by the laboratory.


Reviewed By **Alisar Daou, Data Management**
Visit www.slabin.com for current certifications.

*Minimum Reporting Limit: 10.0 µg. Lead Based Paint contains 0.5% lead by weight per Federal statute. The OSHA Lead in Construction Standard, 29 CFR 1926.62, is invoked if any lead is present in the sample. Lead-free paint is defined as <0.009% by weight (CPSC). *Data precision justifies 2 significant figures. All internal QC parameters were met. Unusual sample conditions, if any, are described.*



**Phoenix
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4020 SHIPYARD BLVD.
WILMINGTON, NC 28403

CHAIN OF CUSTODY

LABORATORY TEST REQUEST

CONTACT: Warren Plautz	PHONE: (910) 397-0370	FAX: (910) 313-6094	DATE SHIPPED: 4/6/2012
PEC JOB #: 21-12-078-AB-Pb-I		CLIENT'S JOB NAME/#: MCAS Cherry Point - Building 131	
SAMPLE TYPE: Lead Paint Chip (Bulk)	NUMBER OF SAMPLES: 11	TURN AROUND TIME SPECIFIED: ____ 2hr ____ 6hr <input checked="" type="checkbox"/> 24hr ____ 48hr ____ 3 Day	
SPECIAL INSTRUCTIONS: REPORT RESULTS IN % BY WEIGHT. PLEASE EMAIL RESULTS TO ABOVE LISTED ADDRESS.			

SAMPLE #	SAMPLE AREA	SUBSTRATE	COLOR	CONDITION	SAMPLE DATE	LAB ANALYSIS REQUESTED
040512-WP-37	Rigid HVAC duct paint within the south side mechanical room	Metal	Off-white	Good	4/5/2012	AAS
040512-WP-38	Pipe system within the south side mechanical room	Metal	White	Fair	4/5/2012	AAS
040512-WP-39	Condensate pump within the south side mechanical room	Metal	Red	Fair	4/5/2012	AAS
040512-WP-40	Suction pump within the south side mechanical room	Metal	Blue	Poor	4/5/2012	AAS
040512-WP-41	Yellow tank within the south side mechanical room	Metal	Yellow	Fair	4/5/2012	AAS
040512-WP-42	Non-flammable gas tank within the south side mechanical room	Metal	Greenish/gray	Good	4/5/2012	AAS
040512-WP-43	Electrical conduit south side administration offices	Metal	Off-white	Fair	4/5/2012	AAS
040512-WP-44	Cloth pipe system within the south side administration offices	Cloth	Off-white	Poor	4/5/2012	AAS
040512-WP-45	Wall paint within the south side administration offices	Drywall	Off-white	Fair	4/5/2012	AAS
040512-WP-46	Interior white paint encompassing windows within south side administration offices	Metal	White	Fair	4/5/2012	AAS
040512-WP-47	Exterior window paint outside the south side administration offices	Metal	Gray	Fair	4/5/2012	AAS

WorkOrderKey

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CHAIN OF CUSTODY RECORD

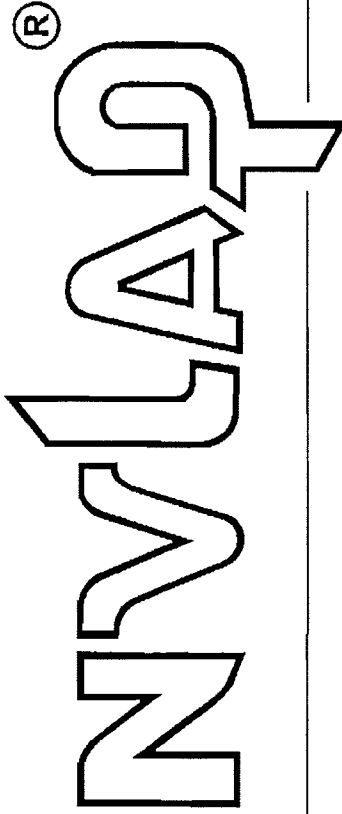
DATE	CONDITION OF SAMPLE	SAMPLES RECEIVED BY	SAMPLES RELEASED BY
4/6/2012		SIGNATURE <i>[Signature]</i> 4/9/12 9:55	SIGNATURE <i>Warren Plautz</i>
		SIGNATURE (LAB) <i>SLQ</i>	SIGNATURE (LAB)

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S

United States Department of Commerce
National Institute of Standards and Technology



Certificate of Accreditation to ISO/IEC 17025:2005

NVLAP LAB CODE: 101150-0

Schneider Laboratories Global, Inc.
Richmond, VA

is accredited by the National Voluntary Laboratory Accreditation Program for specific services,
listed on the Scope of Accreditation, for:

BULK ASBESTOS FIBER ANALYSIS

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005.
This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).

2011-04-01 through 2012-03-31

Effective dates



Sally A. Bruce
For the National Institute of Standards and Technology



**National Voluntary
Laboratory Accreditation Program**



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

Schneider Laboratories Global, Inc.
2512 W. Cary Street
Richmond, VA 23220-5117
Mr. Raja Abouzaki, PhD
Phone: 804-353-6778 Fax: 804-359-1138
E-Mail: RAbouzaki@slabinc.com
URL: <http://www.slabinc.com>

BULK ASBESTOS FIBER ANALYSIS (PLM)

NVLAP LAB CODE 101150-0

NVLAP Code Designation / Description

18/A01 EPA-600/M4-82-020: Interim Method for the Determination of Asbestos in Bulk Insulation Samples

2011-04-01 through 2012-03-31

Effective dates

For the National Institute of Standards and Technology



AIHA

Laboratory Accreditation Programs, LLC

AIHA Laboratory Accreditation Programs, LLC

acknowledges that

Schneider Laboratories, Inc.

2512 West Cary Street, Richmond, VA 23220-5117

Laboratory ID: 100527

along with all premises from which key activities are performed, as listed above, has fulfilled the requirements of the AIHA Laboratory Accreditation Programs (AIHA-LAP), LLC accreditation to the ISO/IEC 17025:2005 international standard, *General Requirements for the Competence of Testing and Calibration Laboratories* in the following:

LABORATORY ACCREDITATION PROGRAMS

- INDUSTRIAL HYGIENE Accreditation Expires: 04/01/2013
- ENVIRONMENTAL LEAD Accreditation Expires: 04/01/2013
- ENVIRONMENTAL MICROBIOLOGY Accreditation Expires:
- FOOD Accreditation Expires:

Specific Field(s) of Testing (FoT)/Method(s) within each Accreditation Program for which the above named laboratory maintains accreditation is outlined on the attached **Scope of Accreditation**. Continued accreditation is contingent upon successful on-going compliance with ISO/IEC 17025:2005 and AIHA-LAP, LLC requirements. This certificate is not valid without the attached **Scope of Accreditation**. Please review the AIHA-LAP, LLC website (www.aihaaccreditedlabs.org) for the most current Scope.

Christine Powell

Christine Powell

Chairperson, Analytical Accreditation Board

Revision 10: 01/13/2011

Cheryl O. Morton

Cheryl O. Morton

Director, AIHA Laboratory Accreditation Programs, LLC

Date Issued: 04/01/2011



AIHA Laboratory Accreditation Programs, LLC SCOPE OF ACCREDITATION

Schneider Laboratories, Inc.
2512 West Cary Street, Richmond, VA 23220-5117

Laboratory ID: 100527
Issue Date: 04/01/2011

The laboratory is approved for those specific field(s) of testing/methods listed in the table below. Clients are urged to verify the laboratory's current accreditation status for the particular field(s) of testing/Methods, since these can change due to proficiency status, suspension and/or revocation. A complete listing of currently accredited Environmental Lead laboratories is available on the AIHA-LAP, LLC website at: <http://www.aihaaccreditedlabs.org>

The EPA recognizes the AIHA-LAP, LLC ELLAP program as meeting the requirements of the National Lead Laboratory Accreditation Program (NLLAP) established under Title X of the Residential Lead-Based Paint Hazard Reduction Act of 1992 and includes paint, soil and dust wipe analysis. Air analysis is not included as part of the NLLAP.

Environmental Lead Laboratory Accreditation Program (ELLAP)

Initial Accreditation Date: 05/06/1994

Field of Testing (FoT)	Method	Method Description <i>(for internal methods only)</i>
Airborne Dust	EPA SW-846 3050B	
	NIOSH 7082	
	NIOSH 7300	
Paint	EPA SW-846 3050B	
	EPA SW-846 6010C	
	EPA SW-846 7000B	
Settled Dust by Wipe	EPA SW-846 3050B	
	EPA SW-846 6010C	
	EPA SW-846 7000B	
Soil	EPA SW-846 3050B	
	EPA SW-846 6010C	
	EPA SW-846 7000B	

The laboratory participates in the following AIHA-LAP, LLC-approved proficiency testing programs:

- √ Paint
- √ Soil
- √ Settled Dust by Wipe
- √ Airborne Dust



North Carolina Department of Health and Human Services
Division of Public Health · Epidemiology Section
Occupational and Environmental Epidemiology Branch
1912 Mail Service Center · Raleigh, North Carolina 27699-1912
Tel 919-707-5950 · Fax 919-870-4808

Beverly Eaves Perdue, Governor
Lanier M. Cansler, Secretary

Jeffrey P. Engel, M.D.
State Health Director

August 1, 2011

Warren L Plautz
202 Nantucket Ct
Wilmington, NC 28412

Dear Mr. Plautz:

Based upon the review of your accreditation application, the Health Hazards Control Unit (HHCU) has determined that you have fulfilled the requirements and are eligible for asbestos accreditation as a(n) INSPECTOR. Your assigned North Carolina accreditation number is 11888, which is reflected on your enclosed North Carolina Accreditation card. Please be sure to take this card with you to any asbestos work site where you are employed. The State requires that all persons conducting asbestos abatement or asbestos management activities be accredited and have their identification card on site.

Your North Carolina Inspector accreditation will expire on JULY 31, 2012. It is NOT the policy of the HHCU to issue renewal notices. If you wish to continue working as a(n) Inspector after this expiration date, you must successfully complete the required training and submit a completed application to this office prior to July 31, 2012. If you should continue to perform asbestos management activities as a(n) Inspector without a valid North Carolina accreditation, you will be in violation of State regulations and may be cited for noncompliance.

Sincerely,

Marita E Cheek
Accreditation/Certification Secretary
Health Hazards Control Unit

Enclosure



North Carolina Public Health
Working for a healthier and safer North Carolina
Everywhere. Everyday. Everybody.



Location: 5505 Six Forks Road, 2nd Floor, Room D-1 · Raleigh, N.C. 27609

SECTION 02 41 00

DEMOLITION
05/10

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-CONDITIONING, HEATING AND REFRIGERATION INSTITUTE (AHRI)

AHRI Guideline K (2009) Guideline for Containers for Recovered Non-Flammable Fluorocarbon Refrigerants

AMERICAN SOCIETY OF SAFETY ENGINEERS (ASSE/SAFE)

ASSE/SAFE A10.6 (2006) Safety Requirements for Demolition Operations

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1 (2008; Errata 1-2010; Changes 1-3 2010; Changes 4-6 2011) Safety and Health Requirements Manual

U.S. DEFENSE LOGISTICS AGENCY (DLA)

DLA 4145.25 (June 2000) Storage and Handling of Liquefied and Gaseous Compressed Gases and Their Full and Empty Cylinders

U.S. DEPARTMENT OF DEFENSE (DOD)

DOD 4000.25-1-M (2006) MILSTRIP - Military Standard Requisitioning and Issue Procedures

MIL-STD-129 (2007; Rev P; Change 4 2007) Military Marking for Shipment and Storage

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

40 CFR 61 National Emission Standards for Hazardous Air Pollutants

40 CFR 82 Protection of Stratospheric Ozone

49 CFR 173.301 Shipment of Compressed Gases in Cylinders and Spherical Pressure Vessels

1.2 PROJECT DESCRIPTION

1.2.1 Demolition/Deconstruction Plan

Prepare a Demolition Plan and submit proposed demolition, and removal procedures for approval before work is started.. Include in the plan procedures for careful removal and disposition of materials specified to be salvaged, coordination with other work in progress a detailed description of methods and equipment to be used for each operation and of the sequence of operations. Identify components and materials to be salvaged for reuse or recycling with reference to paragraph Existing Facilities to be Removed. Append tracking forms for all removed materials indicating type, quantities, condition, destination, and end use. Coordinate with Waste Management Plan. Include statements affirming Contractor inspection of the existing roof deck and its suitability to perform as a safe working platform or if inspection reveals a safety hazard to workers, state provisions for securing the safety of the workers throughout the performance of the work. Provide procedures for safe conduct of the work in accordance with EM 385-1-1. Plan shall be approved by Contracting Officer prior to work beginning.

1.2.2 General Requirements

Do not begin demolition or deconstruction until authorization is received from the Contracting Officer. The work of this section is to be performed in a manner that maximizes salvage and recycling of materials. Remove rubbish and debris from the project site; do not allow accumulations inside or outside the building or on airfield pavements. The work includes demolition, salvage of identified items and materials, and removal of resulting rubbish and debris. Remove rubbish and debris from Government property daily, unless otherwise directed. Store materials that cannot be removed daily in areas specified by the Contracting Officer. In the interest of occupational safety and health, perform the work in accordance with EM 385-1-1, Section 23, Demolition, and other applicable Sections.

1.3 ITEMS TO REMAIN IN PLACE

Take necessary precautions to avoid damage to existing items to remain in place, to be reused, or to remain the property of the Government. Repair or replace damaged items as approved by the Contracting Officer. Coordinate the work of this section with all other work indicated. Construct and maintain shoring, bracing, and supports as required. Ensure that structural elements are not overloaded. Increase structural supports or add new supports as may be required as a result of any cutting, removal, deconstruction, or demolition work performed under this contract. Do not overload structural elements and pavements to remain. Provide new supports and reinforcement for existing construction weakened by demolition, deconstruction, or removal work. Repairs, reinforcement, or structural replacement require approval by the Contracting Officer prior to performing such work.

1.3.1 Existing Construction Limits and Protection

Do not disturb existing construction beyond the extent indicated or necessary for installation of new construction. Provide temporary shoring and bracing for support of building components to prevent settlement or other movement. Provide protective measures to control accumulation and migration of dust and dirt in all work areas. Remove dust, dirt, and debris from work areas daily.

1.3.2 Weather Protection

For portions of the building to remain, protect building interior and materials and equipment from the weather at all times. Where removal of existing roofing is necessary to accomplish work, have materials and workmen ready to provide adequate and temporary covering of exposed areas.

1.3.3 Utility Service

Maintain existing utilities indicated to stay in service and protect against damage during demolition and deconstruction operations. Prior to start of work, the Government will disconnect and seal utilities serving each area of alteration or removal upon written request from the Contractor.

1.3.4 Facilities

Protect electrical and mechanical services and utilities. Where removal of existing utilities and pavement is specified or indicated, provide approved barricades, temporary covering of exposed areas, and temporary services or connections for electrical and mechanical utilities. Floors, roofs, walls, columns, pilasters, and other structural components that are designed and constructed to stand without lateral support or shoring, and are determined to be in stable condition, must remain standing without additional bracing, shoring, or lateral support until demolished or deconstructed, unless directed otherwise by the Contracting Officer. Ensure that no elements determined to be unstable are left unsupported and place and secure bracing, shoring, or lateral supports as may be required as a result of any cutting, removal, deconstruction, or demolition work performed under this contract.

1.4 BURNING

The use of burning at the project site for the disposal of refuse and debris will not be permitted. Where burning is permitted, adhere to federal, state, and local regulations.

1.5 AVAILABILITY OF WORK AREAS

Areas in which the work is to be accomplished will be available in accordance with the Phasing Plan.

1.6 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for A/E approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Existing Conditions

SD-07 Certificates

Demolition Plan

Notification

SD-11 Closeout Submittals

Receipts

1.7 QUALITY ASSURANCE

Submit timely notification of demolition and renovation projects to Federal, State, regional, and local authorities in accordance with 40 CFR 61, Subpart M. Notify the Regional Office of the United States Environmental Protection Agency (USEPA), State's environmental protection agency, local air pollution control district/agency and the Contracting Officer in writing 10 working days prior to the commencement of work in accordance with 40 CFR 61, Subpart M. Comply with federal, state, and local hauling and disposal regulations. In addition to the requirements of the "Contract Clauses," conform to the safety requirements contained in ASSE/SAFE A10.6. Comply with the Environmental Protection Agency requirements specified. Use of explosives will not be permitted.

1.7.1 Dust and Debris Control

Prevent the spread of dust and debris to occupied portions of the building and on airfield pavements and avoid the creation of a nuisance or hazard in the surrounding area. Do not use water if it results in hazardous or objectionable conditions such as, but not limited to, ice, flooding, or pollution. Vacuum and dust the work area daily. Sweep pavements as often as necessary to control the spread of debris that may result in foreign object damage potential to aircraft.

1.8 PROTECTION

1.8.1 Traffic Control Signs

a. Where pedestrian and driver safety is endangered in the area of removal work, use traffic barricades with flashing lights. Anchor barricades in a manner to prevent displacement by wind, jet or prop blast. Notify the Contracting Officer prior to beginning such work.

1.8.2 Protection of Personnel

Before, during and after the demolition work continuously evaluate the condition of the structure being demolished and take immediate action to protect all personnel working in and around the project site. No area, section, or component of floors, roofs, walls, columns, pilasters, or other structural element will be allowed to be left standing without sufficient bracing, shoring, or lateral support to prevent collapse or failure while workmen remove debris or perform other work in the immediate area.

1.9 FOREIGN OBJECT DAMAGE (FOD)

Aircraft and aircraft engines are subject to FOD from debris and waste material lying on airfield pavements. Remove all such materials that may appear on operational aircraft pavements due to the Contractor's operations. If necessary, the Contracting Officer may require the Contractor to install a temporary barricade at the Contractor's expense to control the spread of FOD potential debris. The barricade shall include a fence covered with a fabric designed to stop the spread of debris. Anchor the fence and fabric to prevent displacement by winds or jet/prop blasts. Remove barricade when no longer required.

1.10 RELOCATIONS

Perform the removal and reinstallation of relocated items as indicated with workmen skilled in the trades involved. Repair or replace items to be relocated which are damaged by the Contractor with new undamaged items as approved by the Contracting Officer.

1.11 EXISTING CONDITIONS

Before beginning any demolition or deconstruction work, survey the site and examine the drawings and specifications to determine the extent of the work. Record existing conditions in the presence of the Contracting Officer showing the condition of structures and other facilities adjacent to areas of alteration or removal. Photographs sized 4 inch will be acceptable as a record of existing conditions. Include in the record the elevation of the top of foundation walls, finish floor elevations, possible conflicting electrical conduits, plumbing lines, alarms systems, the location and extent of existing cracks and other damage and description of surface conditions that exist prior to before starting work. It is the Contractor's responsibility to verify and document all required outages which will be required during the course of work, and to note these outages on the record document. Submit survey results.

PART 2 PRODUCTS

PART 3 EXECUTION

3.1 EXISTING FACILITIES TO BE REMOVED

Inspect and evaluate existing structures onsite for reuse. Existing construction scheduled to be removed for reuse shall be disassembled. Dismantled and removed materials are to be separated, set aside, and prepared as specified, and stored or delivered to a collection point for reuse, remanufacture, recycling, or other disposal, as specified. Materials shall be designated for reuse onsite whenever possible.

3.1.1 Utilities and Related Equipment

3.1.1.1 General Requirements

Do not interrupt existing utilities serving occupied or used facilities, except when authorized in writing by the Contracting Officer. Do not interrupt existing utilities serving facilities occupied and used by the Government except when approved in writing and then only after temporary utility services have been approved and provided. Do not begin demolition or deconstruction work until all utility disconnections have been made. Shut off and cap utilities for future use, as indicated.

3.1.2 Roofing

Remove existing roof system and associated components in their entirety down to existing roof deck. Remove roofing system and insulation without damaging the roof deck. Sequence work to minimize building exposure between demolition or deconstruction and new roof materials installation.

3.1.2.1 Temporary Roofing

Install temporary roofing and flashing as necessary to maintain a watertight condition throughout the course of the work. Remove temporary

work prior to installation of permanent roof system materials unless approved otherwise by the Contracting Officer.

3.1.2.2 Reroofing

When removing the existing roofing system from the roof deck, remove only as much roofing as can be recovered by the end of the work day, unless approved otherwise by the Contracting Officer. Do not attempt to open the roof covering system in threatening weather. Reseal all openings prior to suspension of work the same day.

3.1.3 Structural Steel

Dismantle structural steel at field connections and in a manner that will prevent bending or damage. Salvage for recycle structural steel, steel joists, girders, angles, plates, columns and shapes. Do not use flame-cutting torches. Transport steel joists and girders as whole units and not dismantled. Transport structural steel shapes to a designated recycling facility, stacked according to size, type of member and length, and stored off the ground, protected from the weather.

3.1.4 Miscellaneous Metal

Salvage shop-fabricated items such as access doors and frames, steel gratings, metal ladders, wire mesh partitions, metal railings, metal windows and similar items as whole units. Salvage light-gage and cold-formed metal framing, such as steel studs, steel trusses, metal gutters, roofing and siding, metal toilet partitions, toilet accessories and similar items. Scrap metal shall become the Contractor's property. Recycle scrap metal as part of demolition and deconstruction operations. Provide separate containers to collect scrap metal and transport to a scrap metal collection or recycling facility, in accordance with the Waste Management Plan.

3.1.5 Acoustic Ceiling Tile

Remove, neatly stack, and recycle acoustic ceiling tiles. Recycling may be available with manufacturer. Otherwise, priority shall be given to a local recycling organization.

3.1.6 Patching

Where removals leave holes and damaged surfaces exposed in the finished work, patch and repair these holes and damaged surfaces to match adjacent finished surfaces, using on-site materials when available. Where new work is to be applied to existing surfaces, perform removals and patching in a manner to produce surfaces suitable for receiving new work. Finished surfaces of patched area shall be flush with the adjacent existing surface and shall match the existing adjacent surface as closely as possible as to texture and finish. Patching shall be as specified and indicated, and shall include:

- a. Concrete and Masonry: Completely fill holes and depressions, left as a result of removals in existing masonry walls to remain, with an approved masonry patching material, applied in accordance with the manufacturer's printed instructions.
- b. Where existing partitions have been removed leaving damaged or missing resilient tile flooring, patch to match the existing floor

tile.

- c. Patch acoustic lay-in ceiling where partitions have been removed. The transition between the different ceiling heights shall be effected by continuing the higher ceiling level over to the first runner on the lower ceiling and closing the vertical opening with a painted sheet metal strip.

3.1.7 Air Conditioning Equipment

Remove air conditioning, refrigeration, and other equipment containing refrigerants without releasing chlorofluorocarbon refrigerants to the atmosphere in accordance with the Clean Air Act Amendment of 1990. Recover all refrigerants prior to removing air conditioning, refrigeration, and other equipment containing refrigerants and dispose of in accordance with the paragraph entitled "Disposal of Ozone Depleting Substance (ODS)."

3.1.8 Cylinders and Canisters

Remove all fire suppression system cylinders and canisters and dispose of in accordance with the paragraph entitled "Disposal of Ozone Depleting Substance (ODS)."

3.1.9 Mechanical Equipment and Fixtures

Disconnect mechanical hardware at the nearest connection to existing services to remain, unless otherwise noted. Disconnect mechanical equipment and fixtures at fittings. Remove service valves attached to the unit. Salvage each item of equipment and fixtures as a whole unit; listed, indexed, tagged, and stored. Salvage each unit with its normal operating auxiliary equipment. Transport salvaged equipment and fixtures, including motors and machines, to a designated storage area as directed by the Contracting Officer. Do not remove equipment until approved. Do not offer low-efficiency equipment for reuse. All mechanical equipment and fixtures shall be disposed of by the Contractor.

3.1.9.1 Preparation for Storage

Remove water, dirt, dust, and foreign matter from units; tanks, piping and fixtures shall be drained; interiors, if previously used to store flammable, explosive, or other dangerous liquids, shall be steam cleaned. Seal openings with caps, plates, or plugs. Secure motors attached by flexible connections to the unit. Change lubricating systems with the proper oil or grease.

3.1.9.2 Piping

Disconnect piping at unions, flanges and valves, and fittings as required to reduce the pipe into straight lengths for practical storage. Store salvaged piping according to size and type. If the piping that remains can become pressurized due to upstream valve failure, end caps, blind flanges, or other types of plugs or fittings with a pressure gage and bleed valve shall be attached to the open end of the pipe to ensure positive leak control. Carefully dismantle piping that previously contained gas, gasoline, oil, or other dangerous fluids, with precautions taken to prevent injury to persons and property. Store piping outdoors until all fumes and residues are removed. Box prefabricated supports, hangers, plates, valves, and specialty items according to size and type. Wrap sprinkler heads individually in plastic bags before boxing. Classify piping not designated

for salvage, or not reusable, as scrap metal. All mechanical piping and fittings shall be disposed of by the Contractor.

3.1.9.3 Ducts

Classify removed duct work as scrap metal.

3.1.9.4 Fixtures, Motors and Machines

Remove and salvage fixtures, motors and machines associated with plumbing, heating, air conditioning, refrigeration, and other mechanical system installations. Salvage, box and store auxiliary units and accessories with the main motor and machines. Tag salvaged items for identification, storage, and protection from damage. Classify broken, damaged, or otherwise unserviceable units and not caused to be broken, damaged, or otherwise unserviceable as debris to be disposed of by the Contractor. All fixtures, motors and machines shall be disposed of by the Contractor.

3.1.10 Electrical Equipment and Fixtures

Salvage motors, motor controllers, and operating and control equipment that are attached to the driven equipment. Salvage wiring systems and components. Box loose items and tag for identification. Disconnect primary, secondary, control, communication, and signal circuits at the point of attachment to their distribution system. All electrical equipment and fixtures shall be disposed of by the Contractor.

3.1.10.1 Fixtures

Remove and salvage electrical fixtures. Salvage unprotected glassware from the fixture and salvage separately. Salvage incandescent, mercury-vapor, and fluorescent lamps and fluorescent ballasts manufactured prior to 1978, boxed and tagged for identification, and protected from breakage. All electrical equipment and fixtures shall be disposed of by the Contractor.

3.1.10.2 Electrical Devices

Remove and salvage switches, switchgear, transformers, conductors including wire and nonmetallic sheathed and flexible armored cable, regulators, meters, instruments, plates, circuit breakers, panelboards, outlet boxes, and similar items. Box and tag these items for identification according to type and size.

3.1.10.3 Wiring Ducts or Troughs

Remove and salvage wiring ducts or troughs. Dismantle plug-in ducts and wiring troughs into unit lengths. Remove plug-in or disconnecting devices from the busway and store separately.

3.1.10.4 Conduit and Miscellaneous Items

Salvage conduit except where embedded in concrete or masonry. Consider corroded, bent, or damaged conduit as scrap metal. Sort straight and undamaged lengths of conduit according to size and type. Classify supports, knobs, tubes, cleats, and straps as debris to be removed and disposed.

3.1.11 Items With Unique/Regulated Disposal Requirements

Remove and dispose of items with unique or regulated disposal requirements in the manner dictated by law or in the most environmentally responsible manner.

3.2 DISPOSITION OF MATERIAL

3.2.1 Title to Materials

Except for salvaged items specified in related Sections, and for materials or equipment scheduled for salvage, all materials and equipment removed and not reused or salvaged, shall become the property of the Contractor and shall be removed from Government property. Title to materials resulting from demolition and deconstruction, and materials and equipment to be removed, is vested in the Contractor upon approval by the Contracting Officer of the Contractor's demolition, deconstruction, and removal procedures, and authorization by the Contracting Officer to begin demolition and deconstruction. The Government will not be responsible for the condition or loss of, or damage to, such property after contract award. Showing for sale or selling materials and equipment on site is prohibited.

3.2.2 Reuse of Materials and Equipment

Remove and store materials and equipment indicated to be reused or relocated to prevent damage, and reinstall as the work progresses.

3.2.3 Salvaged Materials and Equipment

Remove materials and equipment that are in the Demolition Plan and specified to be removed by the Contractor and that are to remain the property of the Government, and deliver to a storage site. All demolished materials shall be disposed of by the Contractor.

- a. Salvage items and material to the maximum extent possible.
- b. Store all materials salvaged for the Contractor as approved by the Contracting Officer and remove from Government property before completion of the contract. On site sales of salvaged material is prohibited.
- c. Remove salvaged items to remain the property of the Government in a manner to prevent damage, and packed or crated to protect the items from damage while in storage or during shipment. Items damaged during removal or storage must be repaired or replaced to match existing items. Properly identify the contents of containers.
- d. Remove and capture all Class I ODS refrigerants in accordance with the Clean Air Act Amendment of 1990, and turn in to the Navy as directed by the Commanding Officer.

3.2.4 Disposal of Ozone Depleting Substance (ODS)

Class I and Class II ODS are defined in Section, 602(a) and (b), of The Clean Air Act. Prevent discharge of Class I and Class II ODS to the atmosphere. Place recovered ODS in cylinders meeting AHRI Guideline K suitable for the type ODS (filled to no more than 80 percent capacity) and provide appropriate labeling. Recovered ODS shall be removed from

Government property and disposed of in accordance with 40 CFR 82. Products, equipment and appliances containing ODS in a sealed, self-contained system (e.g. residential refrigerators and window air conditioners) shall be disposed of in accordance with 40 CFR 82. Submit Receipts or bills of lading, as specified. Submit a shipping receipt or bill of lading for all containers of ozone depleting substance (ODS) shipped to the Defense Depot, Richmond, Virginia.

3.2.4.1 Special Instructions

No more than one type of ODS is permitted in each container. A warning/hazardous label shall be applied to the containers in accordance with Department of Transportation regulations. All cylinders including but not limited to fire extinguishers, spheres, or canisters containing an ODS shall have a tag with the following information:

- a. Activity name and unit identification code
- b. Activity point of contact and phone number
- c. Type of ODS and pounds of ODS contained
- d. Date of shipment
- e. Naval stock number (for information, call (804) 279-4525).

3.2.5 Transportation Guidance

Ship all ODS containers in accordance with MIL-STD-129, DLA 4145.25 (also referenced one of the following: Army Regulation 700-68, Naval Supply Instruction 4440.128C, Marine Corps Order 10330.2C, and Air Force Regulation 67-12), 49 CFR 173.301, and DOD 4000.25-1-M.

3.3 CLEANUP

Remove debris and rubbish from basement and similar excavations. Remove and transport the debris in a manner that prevents spillage on streets or adjacent areas. Apply local regulations regarding hauling and disposal.

3.4 DISPOSAL OF REMOVED MATERIALS

3.4.1 Regulation of Removed Materials

Dispose of debris, rubbish, scrap, and other nonsalvageable materials resulting from removal operations with all applicable federal, state and local regulations as contractually specified in the Waste Management Plan. Storage of removed materials on the project site is prohibited.

3.4.2 Burning on Government Property

Burning of materials removed from demolished and deconstructed structures will not be permitted on Government property.

3.4.3 Removal to Spoil Areas on Government Property

Transport noncombustible materials removed from demolition and deconstruction structures to designated spoil areas on Government property.

3.4.4 Removal from Government Property

Transport waste materials removed from demolished and deconstructed structures, except waste soil, from Government property for legal disposal. Dispose of waste soil as directed.

3.5 REUSE OF SALVAGED ITEMS

Recondition salvaged materials and equipment designated for reuse before installation. Replace items damaged during removal and salvage operations or restore them as necessary to usable condition.

-- End of Section --

SECTION 02 83 13.00 20

LEAD IN CONSTRUCTION

08/11

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 INDUSTRIAL HYGIENE ASSOCIATION (AIHA)

AIHA Z88.6 (2006) Respiratory Protection - Respirator Use-Physical Qualifications for Personnel

STATE OF VIRGINIA ADMINISTRATIVE CODE (VAC)

18 VAC 15-30 Title 18, Agency 15, Chapter 30: Virginia Lead-Based Paint Activities Regulations

U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT (HUD)

HUD 6780 (1995; Errata Aug 1996; Rev Ch. 7 - 1997) Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing

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

29 CFR 1910.134 Respiratory Protection

29 CFR 1926.21 Safety Training and Education

29 CFR 1926.33 Access to Employee Exposure and Medical Records

29 CFR 1926.55 Gases, Vapors, Fumes, Dusts, and Mists

29 CFR 1926.59 Hazard Communication

29 CFR 1926.62 Lead

29 CFR 1926.65 Hazardous Waste Operations and Emergency Response

40 CFR 260 Hazardous Waste Management System: General

40 CFR 261 Identification and Listing of Hazardous Waste

40 CFR 262 Standards Applicable to Generators of Hazardous Waste

40 CFR 263 Standards Applicable to Transporters of Hazardous Waste

40 CFR 264	Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 265	Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 268	Land Disposal Restrictions
40 CFR 745	Lead-Based Paint Poisoning Prevention in Certain Residential Structures
49 CFR 172	Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements
49 CFR 178	Specifications for Packagings

UNDERWRITERS LABORATORIES (UL)

UL 586	(2009) Standard for High-Efficiency Particulate, Air Filter Units
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1.2 DEFINITIONS

1.2.1 Action Level

Employee exposure, without regard to use of respirators, to an airborne concentration of lead of 30 micrograms per cubic meter of air averaged over an 8 hour period.

1.2.2 Area Sampling

Sampling of lead concentrations within the lead control area and inside the physical boundaries which is representative of the airborne lead concentrations but is not collected in the breathing zone of personnel (approximately 5 to 6 feet above the floor).

1.2.3 Competent Person (CP)

As used in this section, refers to a person employed by the Contractor who is trained in the recognition and control of lead hazards in accordance with current federal, State, and local regulations and has the authority to take prompt corrective actions to control the lead hazard. A Certified Industrial Hygienist (CIH) certified by the American Board of Industrial Hygiene or a Certified Safety Professional (CSP) certified by the Board of Certified Safety Professionals is the best choice.

1.2.4 Contaminated Room

Refers to a room for removal of contaminated personal protective equipment (PPE).

1.2.5 Decontamination Shower Facility

That facility that encompasses a clean clothing storage room, and a contaminated clothing storage and disposal rooms, with a shower facility in

between.

1.2.6 High Efficiency Particulate Arrestor (HEPA) Filter Equipment

HEPA filtered vacuuming equipment with a UL 586 filter system capable of collecting and retaining lead-contaminated particulate. A high efficiency particulate filter demonstrates at least 99.97 percent efficiency against 0.3 micron or larger size particles.

1.2.7 Lead

Metallic lead, inorganic lead compounds, and organic lead soaps. Excludes other forms of organic lead compounds.

1.2.8 Lead Control Area

A system of control methods to prevent the spread of lead dust, paint chips or debris to adjacent areas that may include temporary containment, floor or ground cover protection, physical boundaries, and warning signs to prevent unauthorized entry of personnel. HEPA filtered local exhaust equipment may be used as engineering controls to further reduce personnel exposures or building/outdoor environmental contamination.

1.2.9 Lead Permissible Exposure Limit (PEL)

Fifty micrograms per cubic meter of air as an 8 hour time weighted average as determined by 29 CFR 1926.62. If an employee is exposed for more than eight hours in a work day, the PEL shall be determined by the following formula:

$$\text{PEL (micrograms/cubic meter of air)} = 400/\text{No. hrs worked per day}$$

1.2.10 Material Containing Lead/Paint with Lead (MCL/PWL)

Any material, including paint, which contains lead as determined by the testing laboratory using a valid test method. The requirements of this section does not apply if no detectable levels of lead are found using a quantitative method for analyzing paint or MCL using laboratory instruments with specified limits of detection (usually 0.01 percent). An X-Ray Fluorescence (XRF) instrument is not considered a valid test method.

1.2.11 Personal Sampling

Sampling of airborne lead concentrations within the breathing zone of an employee to determine the 8 hour time weighted average concentration in accordance with 29 CFR 1926.62. Samples shall be representative of the employees' work tasks. Breathing zone shall be considered an area within a hemisphere, forward of the shoulders, with a radius of 6 to 9 inches and centered at the nose or mouth of an employee.

1.2.12 Physical Boundary

Area physically roped or partitioned off around lead control area to limit unauthorized entry of personnel.

1.3 DESCRIPTION

1.3.1 Description of Work

Construction activities impacting PWL or material containing lead which are covered by this specification include the demolition and/or removal of material containing lead in intact condition, located on the First, Mezzanine and Roof Floors for all off-white painted HVAC ductwork, red painted condensate pump system, blue painted suction pump system, yellow painted tanks, off-white painted electrical conduit system, off-white painted cloth pipe systems, off-white painted walls and interior windows and gray painted exterior windows and as indicated on the drawings.

1.3.2 Coordination with Other Work

The contractor shall coordinate with work being performed in adjacent areas. Coordination procedures shall be explained in the Plan and shall describe how the Contractor will prevent lead exposure to other contractors and/or Government personnel performing work unrelated to lead activities.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for A/E approval. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Occupational and Environmental Assessment Data Report (if objective data is used to justify excluding the initial occupational exposure assessment); G

Lead Compliance Plan including CP approval (signature, date, and certification number); G

Competent Person qualifications; G

Training Certification of workers and supervisors; G

lead waste management plan; G

written evidence that TSD is approved for lead disposal; G

Certification of Medical Examinations; G

SD-06 Test Reports

sampling results; G

Occupational and Environmental Assessment Data Report; G

SD-07 Certificates

Testing laboratory qualifications; G

Occupant Notification; G

Third party consultant qualifications; G

Clearance Certification; G

SD-11 Closeout Submittals

Completed and signed hazardous waste manifest from treatment or disposal facility; G

Waste turn-in documents or weight tickets for non-hazardous wastes that are disposed of at sanitary or construction and demolition landfills; G

1.5 QUALITY ASSURANCE

1.5.1 Qualifications

1.5.1.1 Competent Person (CP)

Submit name, address, and telephone number of the CP selected to perform responsibilities specified in paragraph entitled "Competent Person (CP) Responsibilities." Provide documented construction project-related experience with implementation of OSHA's Lead in Construction standard (29 CFR 1926.62) which shows ability to assess occupational and environmental exposure to lead, experience with the use of respirators, personal protective equipment and other exposure reduction methods to protect employee health. Submit proper documentation that the CP is trained and certified in accordance with federal, State (18 VAC 15-30) and local laws. The competent person shall be a licensed lead-based paint abatement Supervisor/Project Designer in the State of North Carolina.

1.5.1.2 Training Certification

Submit a certificate for each worker and supervisor, signed and dated by the accredited training provider, stating that the employee has received the required lead training specified in 29 CFR 1926.62(1) and is certified to perform or supervise deleading, lead removal or demolition activities in the state of North Carolina.

1.5.1.3 Testing Laboratory

Submit the name, address, and telephone number of the testing laboratory selected to perform the air and wipe analysis, testing, and reporting of airborne concentrations of lead. Use a laboratory participating in the EPA National Lead Laboratory Accreditation Program (NLLAP) by being accredited by either the American Association for Laboratory Accreditation (A2LA) or the American Industrial Hygiene Association (AIHA) and that is successfully participating in the Environmental Lead Proficiency Analytical Testing (ELPAT) program to perform sample analysis. Laboratories selected to perform blood lead analysis shall be OSHA approved.

1.5.1.4 Third Party Consultant Qualifications

Submit the name, address and telephone number of the third party consultant selected to perform the wipe sampling for determining concentrations of lead in dust. Submit proper documentation that the consultant is trained and certified as an inspector technician or inspector/risk assessor by the USEPA authorized State (or local) certification and accreditation program.

1.5.2 Requirements

1.5.2.1 Competent Person (CP) Responsibilities

- a. Verify training meets all federal, State, and local requirements.
- b. Review and approve Lead Compliance Plan for conformance to the applicable referenced standards.
- c. Continuously inspect PWL or MCL work for conformance with the approved plan.
- d. Perform (or oversee performance of) air sampling. Recommend upgrades or downgrades (whichever is appropriate based on exposure) on the use of PPE (respirators included) and engineering controls.
- e. Ensure work is performed in strict accordance with specifications at all times.
- f. Control work to prevent hazardous exposure to human beings and to the environment at all times.
- g. Supervise final cleaning of the lead control area, take clearance wipe samples if necessary; review clearance sample results and make recommendations for further cleaning.
- h. Certify the conditions of the work as called for elsewhere in this specification.

1.5.2.2 Lead Compliance Plan

Submit a detailed job-specific plan of the work procedures to be used in the disturbance of PWL or MCL. The plan shall include a sketch showing the location, size, and details of lead control areas, critical barriers, physical boundaries, location and details of decontamination facilities, viewing ports, and mechanical ventilation system. Include a description of equipment and materials, work practices, controls and job responsibilities for each activity from which lead is emitted. Include in the plan, eating, drinking, smoking, hygiene facilities and sanitary procedures, interface of trades, sequencing of lead related work, collected waste water and dust containing lead and debris, air sampling, respirators, personal protective equipment, and a detailed description of the method of containment of the operation to ensure that lead is not released outside of the lead control area. Include site preparation, cleanup and clearance procedures. Include occupational and environmental sampling, training and strategy, sampling and analysis strategy and methodology, frequency of sampling, duration of sampling, and qualifications of sampling personnel in the air sampling portion of the plan. Include a description of arrangements made among contractors on multicontractor worksites to inform affected employees and to clarify responsibilities to control exposures.

The plan shall be developed by a certified planner/project designer in the State of North Carolina.

In occupied buildings, the plan shall also include an occupant protection program that describes the measures that will be taken during the work to notify and protect the building occupants.

1.5.2.3 Occupational and Environmental Assessment Data Report

If initial monitoring is necessary, submit occupational and environmental sampling results to the Contracting Officer within three working days of collection, signed by the testing laboratory employee performing the analysis, the employee that performed the sampling, and the CP.

In order to reduce the full implementation of 29 CFR 1926.62, the Contractor shall provide documentation. Submit a report that supports the determination to reduce full implementation of the requirements of 29 CFR 1926.62 and supporting the Lead Compliance Plan.

- a. The initial monitoring shall represent each job classification, or if working conditions are similar to previous jobs by the same employer, provide previously collected exposure data that can be used to estimate worker exposures per 29 CFR 1926.62. The data shall represent the worker's regular daily exposure to lead for stated work.
- b. Submit worker exposure data gathered during the task based trigger operations of 29 CFR 1926.62 with a complete process description. This includes manual demolition, manual scraping, manual sanding, heat gun, power tool cleaning, rivet busting, cleanup of dry expendable abrasives, abrasive blast enclosure removal, abrasive blasting, welding, cutting and torch burning where lead containing coatings are present.
- c. The initial assessment shall determine the requirement for further monitoring and the need to fully implement the control and protective requirements including the lead compliance plan per 29 CFR 1926.62.

1.5.2.4 Medical Examinations

Initial medical surveillance as required by 29 CFR 1926.62 shall be made available to all employees exposed to lead at any time (1 day) above the action level. Full medical surveillance shall be made available to all employees on an annual basis who are or may be exposed to lead in excess of the action level for more than 30 days a year or as required by 29 CFR 1926.62. Adequate records shall show that employees meet the medical surveillance requirements of 29 CFR 1926.33, 29 CFR 1926.62 and 29 CFR 1910.134. Provide medical surveillance to all personnel exposed to lead as indicated in 29 CFR 1926.62. Maintain complete and accurate medical records of employees for the duration of employment plus 30 years.

1.5.2.5 Training

Train each employee performing work that disturbs lead, who performs MCL/PWL disposal, and air sampling operations prior to the time of initial job assignment and annually thereafter, in accordance with 29 CFR 1926.21, 29 CFR 1926.62, and State North Carolina and local regulations where appropriate.

1.5.2.6 Respiratory Protection Program

- a. Provide each employee required to wear a respirator a respirator fit test at the time of initial fitting and at least annually thereafter as required by 29 CFR 1926.62.
- b. Establish and implement a respiratory protection program as required by

AIHA Z88.6, 29 CFR 1910.134, 29 CFR 1926.62, and 29 CFR 1926.55.

1.5.2.7 Hazard Communication Program

Establish and implement a Hazard Communication Program as required by 29 CFR 1926.59.

1.5.2.8 Lead Waste Management

The Lead Waste Management Plan shall comply with applicable requirements of federal, State, and local hazardous waste regulations. and address:

- a. Identification and classification of wastes associated with the work.
- b. Estimated quantities of wastes to be generated and disposed of.
- c. Names and qualifications of each contractor that will be transporting, storing, treating, and disposing of the wastes. Include the facility location and a 24-hour point of contact. Furnish two copies of USEPA local hazardous waste permits.
- d. Names and qualifications (experience and training) of personnel who will be working on-site with hazardous wastes.
- e. List of waste handling equipment to be used in performing the work, to include cleaning, volume reduction, and transport equipment.
- f. Spill prevention, containment, and cleanup contingency measures including a health and safety plan to be implemented in accordance with 29 CFR 1926.65.
- g. Work plan and schedule for waste containment, removal and disposal. Proper containment of the waste includes using acceptable waste containers (e.g., 55-gallon drums) as well as proper marking/labeling of the containers. Wastes shall be cleaned up and containerized daily.
- h. Include any process that may alter or treat waste rendering a hazardous waste non hazardous.
- i. Unit cost for hazardous waste disposal according to this plan.

1.5.2.9 Environmental, Safety and Health Compliance

In addition to the detailed requirements of this specification, comply with laws, ordinances, rules, and regulations of federal, State, and local authorities regarding lead. Comply with the applicable requirements of the current issue of 29 CFR 1926.62. Submit matters regarding interpretation of standards to the Contracting Officer for resolution before starting work. Where specification requirements and the referenced documents vary, the most stringent requirement shall apply. The following local and State laws, ordinances, criteria, rules and regulations regarding removing, handling, storing, transporting, and disposing of lead-contaminated materials apply:

- a. 29 CFR 1926.57, 29 CFR 1926.59, 29 CFR 1926.62 and 29 CFR 1910.134
- b. 40 CFR 258 and 40 CFR 261
- c. Certification in the state of North Carolina is required.

1.5.3 Pre-Construction Conference

Along with the CP, meet with the Contracting Officer to discuss in detail the Lead Waste Management Plan and the Lead Compliance Plan, including procedures and precautions for the work.

1.6 EQUIPMENT

1.6.1 Respirators

Furnish appropriate respirators approved by the National Institute for Occupational Safety and Health (NIOSH), Department of Health and Human Services, for use in atmospheres containing lead dust, fume and mist. Respirators shall comply with the requirements of 29 CFR 1926.62.

1.6.2 Special Protective Clothing

Furnish personnel who will be exposed to lead-contaminated dust with proper disposable protective whole body clothing, head covering, gloves, eye, and foot coverings as required by 29 CFR 1926.62. Furnish proper disposable plastic or rubber gloves to protect hands. Reduce the level of protection only after obtaining approval from the CP.

1.6.3 Rental Equipment Notification

If rental equipment is to be used during PWL or MCL handling and disposal, notify the rental agency in writing concerning the intended use of the equipment.

1.6.4 Vacuum Filters

UL 586 labeled HEPA filters.

1.6.5 Equipment for Government Personnel

Furnish the Contracting Officer with two complete sets of personal protective equipment (PPE) daily, as required herein, for entry into and inspection of the lead removal work within the lead controlled area. Personal protective equipment shall include disposable whole body covering, including appropriate foot, head, eye, and hand protection. PPE shall remain the property of the Contractor. The Government will provide respiratory protection for the Contracting Officer.

1.7 PROJECT/SITE CONDITIONS

1.7.1 Protection of Existing Work to Remain

Perform work without damage or contamination of adjacent areas. Where existing work is damaged or contaminated, restore work to its original condition or better as determined by the Contracting Officer.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 Protection

3.1.1.1 Notification

- a. Notify the Contracting Officer 20 days prior to the start of any lead work.
- b. Occupant Notification

3.1.1.2 Lead Control Area

- a. Physical Boundary - Provide physical boundaries around the lead control area by roping off the area designated in the work plan or providing curtains, portable partitions or other enclosures to ensure that lead will not escape outside of the lead control area.
- b. Warning Signs - Provide warning signs at approaches to lead control areas. Locate signs at such a distance that personnel may read the sign and take the necessary precautions before entering the area. Signs shall comply with the requirements of 29 CFR 1926.62.

3.1.1.3 Furnishings

Furniture and equipment will remain in the building. Protect and cover furnishings or remove furnishings from the work area and store in a location approved by the Contracting Officer.

3.1.1.4 Heating, Ventilating and Air Conditioning (HVAC) Systems

Shut down, lock out, and isolate HVAC systems that supply, exhaust, or pass through the lead control areas. Seal intake and exhaust vents in the lead control area with 6 mil plastic sheet and tape. Seal seams in HVAC components that pass through the lead control area. Provide temporary HVAC system for areas in which HVAC has been shut down outside the lead control area.

3.1.1.5 Decontamination Shower Facility

Provide clean and contaminated change rooms and shower facilities in accordance with this specification and 29 CFR 1926.62.

3.1.1.6 Eye Wash Station

Where eyes may be exposed to injurious corrosive materials, suitable facilities for quick drenching or flushing of the eyes shall be provided within the work area.

3.1.1.7 Mechanical Ventilation System

- a. To the extent feasible, use local exhaust ventilation or other collection systems, approved by the CP. Local exhaust ventilation systems shall be evaluated and maintained in accordance with 29 CFR 1926.62.

- b. Vent local exhaust outside the building and away from building ventilation intakes or ensure system is connected to HEPA filters.
- c. Use locally exhausted, power actuated tools or manual hand tools.

3.1.1.8 Personnel Protection

Personnel shall wear and use protective clothing and equipment as specified herein. Eating, smoking, or drinking or application of cosmetics is not permitted in the lead control area. No one will be permitted in the lead control area unless they have been appropriately trained and provided with protective equipment.

3.2 ERECTION

3.2.1 Lead Control Area Requirements

Establish a lead control area by completely establishing barriers and physical boundaries around the area or structure where PWL or MCL removal operations will be performed.

Full containment - Contain removal operations by the use of critical barriers and HEPA filtered exhaust . For containment areas larger than 1,000 square feet install a minimum of two 18 inch square viewing ports. Locate ports to provide a view of the required work from the exterior of the enclosed contaminated area. Glaze ports with laminated safety glass.

3.3 APPLICATION

3.3.1 Lead Work

Perform lead work in accordance with approved Lead Compliance Plan. Use procedures and equipment required to limit occupational exposure and environmental contamination with lead when the work is performed in accordance with 29 CFR 1926.62 or 40 CFR 745, and as specified herein. Dispose of all PWL or MCL and associated waste in compliance with federal, State, and local requirements.

3.3.2 Paint with Lead or Material Containing Lead Removal

Manual or power sanding or grinding of lead surfaces or materials is not permitted unless tools are equipped with HEPA attachments or wet methods. The dry sanding or grinding of surfaces that contain lead is prohibited. Provide methodology for removing lead in the Lead Compliance Plan. Select lead removal processes to minimize contamination of work areas outside the control area with lead-contaminated dust or other lead-contaminated debris or waste and to ensure that unprotected personnel are not exposed to hazardous concentrations of lead. Describe this removal process in the Lead Compliance Plan.

3.3.2.1 Paint with Lead or Material Containing Lead - Indoor Removal

Perform manual or mechanical removal in the lead control areas using enclosures, barriers or containments and powered locally exhausted tools. Collect residue debris for disposal in accordance with federal, State, and local requirements.

3.3.2.2 Paint with Lead or Material Containing Lead - Outdoor Removal

Perform outdoor removal as indicated in federal, State, and local regulations and in the Lead Compliance Plan. The worksite preparation (barriers or containments) shall be job dependent and presented in the Lead Compliance Plan.

3.3.3 Personnel Exiting Procedures

Whenever personnel exit the lead-controlled area, they shall perform the following procedures and shall not leave the work place wearing any clothing or equipment worn in the control area:

- a. Vacuum all clothing before entering the contaminated change room.
- b. Remove protective clothing in the contaminated change room, and place them in an approved impermeable disposal bag.
- c. Shower.
- d. Wash hands and face at the site, don appropriate disposable or uncontaminated reusable clothing, move to an appropriate shower facility, shower.
- e. Change to clean clothes prior to leaving the clean clothes storage area.

3.4 FIELD QUALITY CONTROL

3.4.1 Tests

3.4.1.1 Air and Wipe Sampling

Conduct sampling for lead in accordance with 29 CFR 1926.62 and as specified herein. Air and wipe sampling shall be directed or performed by the CP.

- a. The CP shall be on the job site directing the air and wipe sampling and inspecting the PWL or MCL removal work to ensure that the requirements of the contract have been satisfied during the entire PWL or MCL operation.
- b. Collect personal air samples on employees who are anticipated to have the greatest risk of exposure as determined by the CP. In addition, collect air samples on at least twenty-five percent of the work crew or a minimum of two employees, whichever is greater, during each work shift.
- c. Submit results of air samples, signed by the CP, within 72 hours after the air samples are taken.
- d. Conduct area air sampling for two (2) shifts for each lead abatement procedure (i.e. whole component removal, lead paint scraping, demolition of components containing lead based paint) in areas immediately adjacent to the lead control areas. Area air sampling shall not proceed until all prep work is complete and actual lead abatement activities are taking place. If analysis of area air sampling for both shifts reveals lead concentrations below 30 micrograms per cubic meter of air, area air sampling may cease for that procedure provided methods of removal and training of personnel conducting lead abatement

activities remain consistent with those utilized during area air sampling procedures. If 30 micrograms per cubic meter of air is reached or exceeded, stop work, correct the condition(s) causing the increased levels and notify the Contracting Officer immediately. Determine what condition(s) caused the elevated levels and change work methods as needed and as approved by the CP and the Contracting Officer. In addition, two (2) additional shifts of area air monitoring shall be conducted adjacent to the areas where elevated levels were found with area air sampling ceasing when analysis of the samples for both shifts reveals lead concentrations below 30 micrograms per cubic meter of air.

- e. Before any work begins, a third party consultant shall collect and analyze baseline wipe samples in accordance with methods defined by federal, State, and local standards inside and outside of the physical boundary to assess the degree of dust contamination in the facility prior to lead disturbance or removal.
- f. Surface Wipe Samples - Collect surface wipe samples on floors at a location no greater than 10 feet outside the lead control area at a frequency of once per day while lead removal work is conducted in occupied buildings. Surface wipe results shall meet criteria in paragraph "Clearance Certification."

3.4.1.2 Sampling After Removal

After the visual inspection, collect wipe samples according to the HUD protocol contained in HUD 6780 to determine the lead content of settled dust in micrograms per square meter foot of surface area .

3.5 CLEANING AND DISPOSAL

3.5.1 Cleanup

Maintain surfaces of the lead control area free of accumulations of dust and debris. Restrict the spread of dust and debris; keep waste from being distributed over the work area. Do not dry sweep or use pressurized air to clean up the area. At the end of each shift and when the lead operation has been completed, clean the controlled area of visible contamination by vacuuming with a HEPA filtered vacuum cleaner, wet mopping the area and wet wiping the area as indicated by the Lead Compliance Plan. Reclean areas showing dust or debris. After visible dust and debris is removed, wet wipe and HEPA vacuum all surfaces in the controlled area. If adjacent areas become contaminated at any time during the work, clean, visually inspect, and then wipe sample all contaminated areas. The CP shall then certify in writing that the area has been cleaned of lead contamination before clearance testing.

3.5.1.1 Clearance Certification

The CP shall certify in writing that air samples collected outside the lead control area during paint removal operations are less than 30 micrograms per cubic meter of air; the respiratory protection used for the employees was adequate; the work procedures were performed in accordance with 29 CFR 1926.62; and that there were no visible accumulations of material and dust containing lead left in the work site. Do not remove the lead control area or roped off boundary and warning signs prior to the Contracting Officer's acknowledgement of receipt of the CP certification.

The third party consultant shall certify surface wipe sample results collected inside and outside the work area are less than 40 micrograms per square foot on floors, less than 250 micrograms per square foot on interior window sills and less than 400 micrograms per square foot on window troughs.

3.5.2 Disposal

- a. All material, whether hazardous or non-hazardous shall be disposed in accordance with all laws and provisions and all federal, State or local regulations. Ensure all waste is properly characterized. The result of each waste characterization (TCLP for RCRA materials) will dictate disposal requirements.
- b. Contractor is responsible for segregation of waste. Collect lead-contaminated waste, scrap, debris, bags, containers, equipment, and lead-contaminated clothing that may produce airborne concentrations of lead particles. Label the containers in accordance with 29 CFR 1926.62 and 40 CFR 261.
- c. Dispose of lead-contaminated material classified as hazardous waste at an EPA or State approved hazardous waste treatment, storage, or disposal facility off Government property.
- d. Store waste materials in U.S. Department of Transportation (49 CFR 178) approved 55 gallon drums. Properly label each drum to identify the type of waste (49 CFR 172) and the date the drum was filled. For hazardous waste, the collection drum requires marking/labeling in accordance with 40 CFR 262 during the accumulation/collection timeframe. The Contracting Officer or an authorized representative will assign an area for interim storage of waste-containing drums. Do not store hazardous waste drums in interim storage longer than 90 calendar days from the date affixed to each drum.
- e. Handle, store, transport, and dispose lead or lead-contaminated waste in accordance with 40 CFR 260, 40 CFR 261, 40 CFR 262, 40 CFR 263, 40 CFR 264, and 40 CFR 265. Comply with land disposal restriction notification requirements as required by 40 CFR 268.

3.5.2.1 Disposal Documentation

Submit written evidence to demonstrate the hazardous waste treatment, storage, or disposal facility (TSD) is approved for lead disposal by the EPA, State or local regulatory agencies. Submit one copy of the completed hazardous waste manifest, signed and dated by the initial transporter in accordance with 40 CFR 262. Contractor shall provide a certificate that the waste was accepted by the disposal facility. Provide turn-in documents or weight tickets for non-hazardous waste disposal.

3.5.2.2 Payment for Hazardous Waste

Payment for disposal of hazardous and non-hazardous waste will not be made until a signed copy of the manifest from the treatment or disposal facility certifying the amount of lead-containing materials or non-hazardous waste delivered is returned and a copy is furnished to the Government.

-- End of Section --

SECTION 02 84 16

HANDLING OF LIGHTING BALLASTS AND LAMPS CONTAINING PCBs AND MERCURY
04/06

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. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.1000	Air Contaminants
40 CFR 260	Hazardous Waste Management System: General
40 CFR 261	Identification and Listing of Hazardous Waste
40 CFR 262	Standards Applicable to Generators of Hazardous Waste
40 CFR 263	Standards Applicable to Transporters of Hazardous Waste
40 CFR 265	Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 268	Land Disposal Restrictions
40 CFR 270	EPA Administered Permit Programs: The Hazardous Waste Permit Program
40 CFR 273	Standards For Universal Waste Management
40 CFR 761	Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions
49 CFR 178	Specifications for Packagings

1.2 REQUIREMENTS

Removal and disposal of PCB containing lighting ballasts and associated mercury-containing lamps. Contractor may encounter leaking PCB ballasts.

1.3 DEFINITIONS

1.3.1 Certified Industrial Hygienist (CIH)

A industrial hygienist hired by the contractor shall be certified by the American Board of Industrial Hygiene.

1.3.2 Leak

Leak or leaking means any instance in which a PCB article, PCB container, or PCB equipment has any PCBs on any portion of its external surface.

1.3.3 Lamps

Lamp, also referred to as "universal waste lamp", is defined as the bulb or tube portion of an electric lighting device. A lamp is specifically designed to produce radiant energy, most often in the ultraviolet, visible, and infra-red regions of the electromagnetic spectrum. Examples of common universal waste electric lamps include, but are not limited to, fluorescent, high intensity discharge, neon, mercury vapor, high pressure sodium, and metal halide lamps.

1.3.4 Polychlorinated Biphenyls (PCBs)

PCBs as used in this specification shall mean the same as PCBs, PCB containing lighting ballast, and PCB container, as defined in 40 CFR 761, Section 3, Definitions.

1.3.5 Spill

Spill means both intentional and unintentional spills, leaks, and other uncontrolled discharges when the release results in any quantity of PCBs running off or about to run off the external surface of the equipment or other PCB source, as well as the contamination resulting from those releases.

1.3.6 Universal Waste

Universal Waste means any of the following hazardous wastes that are managed under the universal waste requirements 40 CFR 273:

- (1) Batteries as described in Sec. 273.2 of this chapter;
- (2) Pesticides as described in Sec. 273.3 of this chapter;
- (3) Thermostats as described in Sec. 273.4 of this chapter; and
- (4) Lamps as described in Sec. 273.5 of this chapter.

1.4 QUALITY ASSURANCE

1.4.1 Regulatory Requirements

Perform PCB related work in accordance with 40 CFR 761.

1.4.2 Training

Certified industrial hygienist (CIH) shall instruct and certify the training of all persons involved in the removal of PCB containing lighting ballasts and mercury-containing lamps. The instruction shall include: The dangers of PCB and mercury exposure, decontamination, safe work practices, and applicable OSHA and EPA regulations. The CIH shall review and approve the PCB and Mercury-Containing Lamp Removal Work Plans.

1.4.3 Regulation Documents

Maintain at all times one copy each at the office and one copy each in view at the job site of 29 CFR 1910.1000, 40 CFR 260, 40 CFR 261, 40 CFR 262, 40 CFR 263, 40 CFR 265, 40 CFR 268, 40 CFR 270, 40 CFR 273 a and of the Contractor removal work plan and disposal plan for PCB and for associated

mercury-containing lamps.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation; Architect-Engineer approval is required for submittals with a "A" designation; submittals not having a "G" or "A" designation are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-07 Certificates

Qualifications of CIH

Training Certification

PCB and Lamp Removal Work Plan

PCB and Lamp Disposal Plan

SD-11 Closeout Submittals

Transporter certification of notification to EPA of their PCB waste activities and EPA ID numbers

Certification of Decontamination

Certificate of Disposal and/or recycling. Submit to the Government before application for payment within 30 days of the date that the disposal of the PCB and mercury-containing lamp waste identified on the manifest was completed.

DD Form 1348-1

1.6 ENVIRONMENTAL REQUIREMENTS

Use special clothing:

- a. Disposable gloves (polyethylene)
- b. Eye protection
- c. PPE as required by CIH

1.7 SCHEDULING

Notify the Contracting Officer 20 days prior to the start of PCB and mercury-containing lamp removal work.

1.8 QUALITY ASSURANCE

1.8.1 Qualifications of CIH

Submit the name, address, and telephone number of the Industrial Hygienist selected to perform the duties in paragraph entitled "Certified Industrial Hygienist." Submit training certification that the Industrial Hygienist is certified, including certification number and date of certification or re certification.

1.8.2 PCB and Lamp Removal Work Plan

Submit a job-specific plan within 20 calendar days after award of contract of the work procedures to be used in the removal, packaging, and storage of PCB-containing lighting ballasts and associated mercury-containing lamps. Include in the plan: Requirements for Personal Protective Equipment (PPE), spill cleanup procedures and equipment, eating, smoking and restroom procedures. The plan shall be approved and signed by the Certified Industrial Hygienist. Obtain approval of the plan by the Contracting Officer prior to the start of PCB and/or lamp removal work.

1.8.3 PCB and Lamp Disposal Plan

Submit a PCB and lamp Disposal Plan with 45 calendar days after award of contract. The PCB and Lamp Disposal Plan shall comply with applicable requirements of federal, state, and local PCB and Universal waste regulations and address:

- a. Estimated quantities of wastes to be generated, disposed of, and recycled.
- b. Names and qualifications of each Contractor that will be transporting, storing, treating, and disposing of the wastes. Include the facility location. Furnish two copies of EPA and state PCB and mercury-containing lamp waste permit applications and EPA identification numbers, as required.
- c. Names and qualifications (experience and training) of personnel who will be working on-site with PCB and mercury-containing lamp wastes.
- d. Spill prevention, containment, and cleanup contingency measures to be implemented.
- e. Work plan and schedule for PCB and mercury-containing lamp waste removal, containment, storage, transportation, disposal and or recycling. Wastes shall be cleaned up and containerize daily.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 WORK PROCEDURE

Furnish labor, materials, services, and equipment necessary for the removal of PCB containing lighting ballasts, associated mercury-containing fluorescent lamps, in accordance with local, state, or federal regulations. Do not expose PCBs to open flames or other high temperature sources since toxic decomposition by-products may be produced. Do not break mercury containing fluorescent lamps or high intensity discharge lamps.

3.1.1 Work Operations

Ensure that work operations or processes involving PCB or PCB-contaminated materials are conducted in accordance with 40 CFR 761, 40 CFR 262 40 CFR 263, and the applicable requirements of this section, including but not limited to:

- a. Obtaining suitable PCB and mercury-containing lamp storage sites.
- b. Notifying Contracting Officer prior to commencing the operation.
- c. Reporting leaks and spills to the Contracting Officer.
- d. Cleaning up spills.
- e. Inspecting PCB and PCB-contaminated items and waste containers for leaks and forwarding copies of inspection reports to the Contracting Officer.
- f. Maintaining inspection, inventory and spill records.

3.2 PCB SPILL CLEANUP REQUIREMENTS

3.2.1 PCB Spills

Immediately report to the Contracting Officer any PCB spills.

3.2.2 PCB Spill Control Area

Rope off an area around the edges of a PCB leak or spill and post a "PCB Spill Authorized Personnel Only" caution sign. Immediately transfer leaking items to a drip pan or other container.

3.2.3 PCB Spill Cleanup

40 CFR 761, subpart G. Initiate cleanup of spills as soon as possible, but no later than 24 hours of its discovery. Mop up the liquid with rags or other conventional absorbent. The spent absorbent shall be properly contained and disposed of as solid PCB waste.

3.2.4 Records and Certification

Document the cleanup with records of decontamination in accordance with 40 CFR 761, Section 125, Requirements for PCB Spill Cleanup. Provide test results of cleanup and certification of decontamination.

3.3 REMOVAL

3.3.1 Ballasts

As ballast are removed from the lighting fixture, inspect label on ballast. Ballasts without a "No PCB" label shall be assumed to contain PCBs and containerized and disposed of as required under paragraphs STORAGE FOR DISPOSAL and DISPOSAL. If there are less than 1600 "No PCB" labeled lighting ballasts dispose of them as normal demolition debris.

3.3.2 Lighting Lamps

Remove lighting tubes/lamps from the lighting fixture and carefully place (unbroken) into appropriate containers (original transport boxes or equivalent). In the event of a lighting tube/lamp breaking, sweep and place waste in double plastic taped bags and dispose of as universal waste as specified herein.

3.4 STORAGE FOR DISPOSAL

3.4.1 Storage Containers for PCBs

49 CFR 178. Store PCB in containers approved by DOT for PCB.

3.4.2 Storage Containers for lamps

Store mercury containing lamps in appropriate DOT containers. The boxes shall be stored and labeled for transport in accordance with 40 CFR 273.

3.4.3 Labeling of Waste Containers

Label with the following:

- a. Date the item was placed in storage and the name of the cognizant activity/building.
- b. "Caution Contains PCB," conforming to 40 CFR 761, CFR Subpart C. Affix labels to PCB waste containers.
- c. Label mercury-containing lamp waste in accordance with 40 CFR 273. Affix labels to all lighting waste containers.

3.5 DISPOSAL

Dispose of off Government property in accordance with EPA, DOT, and local regulations at a permitted site.

3.5.1 Identification Number

Federal regulations 40 CFR 761, and 40 CFR 263 require that generators, transporters, commercial storers, and disposers of PCB waste possess U.S. EPA identification numbers. The contractor shall verify that the activity has a U.S. EPA generator identification number for use on the Uniform Hazardous Waste manifest. If not, the contractor shall advise the activity that it must file and obtain an I.D. number with EPA prior to commencement of removal work. For mercury containing lamp removal, Federal regulations 40 CFR 273 require that large quantity handlers of Universal waste (LQHUW) must provide notification of universal waste management to the appropriate EPA Region (or state director in authorized states), obtain an EPA identification number, and retain for three years records of off-site shipments of universal waste. The contractor shall verify that the activity has a U.S. EPA generator identification number for use on the Universal Waste manifest. If not, the contractor shall advise the activity that it must file and obtain an I.D. number with EPA prior to commencement of removal work.

3.5.2 Transporter Certification

Comply with disposal and transportation requirements outlined in 40 CFR 761 and 40 CFR 263. Before transporting the PCB waste, sign and date the manifest acknowledging acceptance of the PCB waste from the Government. Return a signed copy to the Government before leaving the job site. Ensure that the manifest accompanies the PCB waste at all times. Submit transporter certification of notification to EPA of their PCB waste activities (EPA Form 7710-53).

3.5.2.1 Certificate of Disposal and/or Recycling

40 CFR 761. Certificate for the PCBs and PCB items disposed shall include:

- a. The identity of the disposal and or recycling facility, by name, address, and EPA identification number.
- b. The identity of the PCB waste affected by the Certificate of Disposal including reference to the manifest number for the shipment.
- c. A statement certifying the fact of disposal and or recycling of the identified PCB waste, including the date(s) of disposal, and identifying the disposal process used.
- d. A certification as defined in 40 CFR 761.

3.5.3 Disposal by the Government 3.5.3.1 DD Form 1348-1

Prepare DD Form 1348-1 Turn-in Document (TID), which will accompany the PCB to the storage site. Ensure that a responsible person from the activity that owns the PCB signs the DD Form 1348-1.

-- End of Section --

SECTION 05 12 00

STRUCTURAL STEEL

11/11

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 INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 201	(2006) AISC Certification Program for Structural Steel Fabricators
AISC 303	(2010) Code of Standard Practice for Steel Buildings and Bridges
AISC 325	(2011) Steel Construction Manual
AISC 326	(2009) Detailing for Steel Construction
AISC 341	(2010) Seismic Provisions for Structural Steel Buildings
AISC 360	(2010) Specification for Structural Steel Buildings
AISC 810	(1997) Design Guide 10: Erection Bracing of Low-Rise Structural Steel Buildings

AMERICAN WELDING SOCIETY (AWS)

AWS A2.4	(2012) Standard Symbols for Welding, Brazing and Nondestructive Examination
AWS D1.1/D1.1M	(2010; Errata 2010) Structural Welding Code - Steel

ASME INTERNATIONAL (ASME)

ASME B46.1	(2009) Surface Texture, Surface Roughness, Waviness and Lay
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ASTM INTERNATIONAL (ASTM)

ASTM A307	(2010) Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
ASTM A325	(2010) Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM A490	(2011) Standard Specification for

Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength

- ASTM A500/A500M (2010a) Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
- ASTM A53/A53M (2010) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
- ASTM A563 (2007a) Standard Specification for Carbon and Alloy Steel Nuts
- ASTM A6/A6M (2011) Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling
- ASTM A992/A992M (2011) Standard Specification for Structural Steel Shapes
- ASTM F436 (2011) Hardened Steel Washers
- ASTM F844 (2007a) Washers, Steel, Plain (Flat), Unhardened for General Use

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

- SSPC PA 1 (2000; E 2004) Shop, Field, and Maintenance Painting of Steel
- SSPC PS 13.01 (1982; E 2004) Epoxy Polyamide Painting System
- SSPC Paint 25 (1997; E 2004) Zinc Oxide, Alkyd, Linseed Oil Primer for Use Over Hand Cleaned Steel, Type I and Type II
- SSPC SP 3 (1982; E 2004) Power Tool Cleaning
- SSPC SP 6/NACE No.3 (2007) Commercial Blast Cleaning

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

- 29 CFR 1926.756 Steel Erection; Beams and Columns

1.2 SYSTEM DESCRIPTION

Provide the structural steel system, including shop primer, complete and ready for use. Structural steel systems including design, materials, installation, workmanship, fabrication, assembly, erection, inspection, quality control, and testing shall be provided in accordance with AISC 360 and AISC 341 except as modified in this contract.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for A/E approval. Submit the

following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Erection Plan, including description of temporary supports

Fabrication drawings including description of connections

SD-03 Product Data

Shop primer

Welding electrodes and rods

SD-06 Test Reports

Supply the certified manufacturer's mill reports which clearly show the applicable ASTM mechanical and chemical requirements together with the actual test results for the supplied fasteners.

SD-07 Certificates

Steel

Bolts, nuts, and washers

AISC Quality Certification

Overhead, top running crane rail beam

Welding procedures and qualifications

1.4 AISC QUALITY CERTIFICATION

Work shall be fabricated in an AISC certified Category Std fabrication plant.

1.5 QUALITY ASSURANCE

1.5.1 Drawing Requirements

Submit fabrication drawings for approval prior to fabrication. Prepare in accordance with AISC 326 and AISC 325. Fabrication drawings shall not be reproductions of contract drawings. Include complete information for the fabrication and erection of the structure's components, including the location, type, and size of bolts, welds, member sizes and lengths, connection details, blocks, copes, and cuts. Double connections that require an erection seat to comply with OSHA 29 CFR 1926.756(c)(1) shall be shown on the shop drawings, reviewed and approved by the structural engineer of record. Use AWS A2.4 standard welding symbols. Member substitutions of details shown on the contract drawings shall be clearly highlighted on the fabrication drawings. Explain the reasons for any deviations from the contract drawings.

1.5.2 Certifications

1.5.2.1 Erection Plan

Submit for record purposes. Indicate the sequence of erection, temporary

shoring and bracing.

1.5.2.2 Welding Procedures and Qualifications

Prior to welding, submit certification for each welder stating the type of welding and positions qualified for, the code and procedure qualified under, date qualified, and the firm and individual certifying the qualification tests. If the qualification date of the welding operator is more than one-year old, the welding operator's qualification certificate shall be accompanied by a current certificate by the welder attesting to the fact that he has been engaged in welding since the date of certification, with no break in welding service greater than 6 months.

Conform to all requirements specified in AWS D1.1/D1.1M.

PART 2 PRODUCTS

2.1 STEEL

2.1.1 Structural Shapes for Use in Building Framing

Wide flange shapes, ASTM A992/A992M.

2.1.2 Structural Steel Tubing

ASTM A500/A500M, Grade B.

2.1.3 Steel Pipe

ASTM A53/A53M, Type E or S, Grade B, weight class as indicated.

2.2 BOLTS, NUTS, AND WASHERS

Provide the following unless indicated otherwise.

2.2.1 Structural Steel

2.2.1.1 Bolts

ASTM A325, Type 1. The bolt heads and the nuts of the supplied fasteners must be marked with the manufacturer's identification mark, the strength grade and type specified by ASTM specifications.

2.2.1.2 Nuts

ASTM A563, Grade and Style for applicable ASTM bolt standard recommended.

2.2.1.3 Washers

ASTM F844 washers for ASTM A307 bolts, and ASTM F436 washers for ASTM A325 and ASTM A490 bolts.

2.3 STRUCTURAL STEEL ACCESSORIES

2.3.1 Welding Electrodes and Rods

AWS D1.1/D1.1M.

2.4 SHOP PRIMER

SSPC Paint 25, (alkyd primer) or SSPC PS 13.01 epoxy-polyamide, green primer (Form 150) type 1, except provide a Class B coating in accordance with AISC 325 for slip critical joints. Primer shall conform to Federal, State, and local VOC regulations. If flash rusting occurs, re-clean the surface prior to application of primer.

2.5 FABRICATION

2.5.1 Markings

Prior to erection, members shall be identified by a painted erection mark. Connecting parts assembled in the shop for reaming holes in field connections shall be match marked with scratch and notch marks. Do not locate erection markings on areas to be welded. Do not locate match markings in areas that will decrease member strength or cause stress concentrations.

2.5.2 Shop Primer

Shop prime structural steel, except as modified herein, in accordance with SSPC PA 1. Do not prime steel surfaces embedded in concrete, galvanized surfaces, surfaces to receive epoxy coatings, or surfaces within 0.5 inch of the toe of the welds prior to welding (except surfaces on which metal decking is to be welded). Slip critical surfaces shall be primed with a Class B coating. Prior to assembly, prime surfaces which will be concealed or inaccessible after assembly. Do not apply primer in foggy or rainy weather; when the ambient temperature is below 45 degrees F or over 95 degrees F; or when the primer may be exposed to temperatures below 40 degrees F within 48 hours after application, unless approved otherwise by the Contracting Officer.

2.5.2.1 Cleaning

SSPC SP 6/NACE No.3, except steel exposed in spaces above ceilings, attic spaces, furred spaces, and chases that will be hidden to view in finished construction may be cleaned to SSPC SP 3 when recommended by the shop primer manufacturer. Maintain steel surfaces free from rust, dirt, oil, grease, and other contaminants through final assembly.

2.5.2.2 Primer

Apply primer to a minimum dry film thickness of 2.0 mil except provide the Class B coating for slip critical joints in accordance with the coating manufacturer's recommendations. Repair damaged primed surfaces with an additional coat of primer.

2.5.3 Epoxy Coated Surfaces

Surfaces to receive epoxy coatings shall be cleaned and prepared in accordance with the manufacturer's recommendations.

PART 3 EXECUTION

3.1 FABRICATION

Fabrication shall be in accordance with the applicable provisions of AISC 325. Fabrication and assembly shall be done in the shop to the

greatest extent possible. The fabricating plant shall be certified under the AISC 201 for Category Conventional Steel Building structural steelwork.

Compression joints depending on contact bearing shall have a surface roughness not in excess of 500 micro inch as determined by ASME B46.1, and ends shall be square within the tolerances for milled ends specified in ASTM A6/A6M.

Structural steelwork, except surfaces of steel to be encased in concrete, surfaces to be field welded, surfaces to be fireproofed, and contact surfaces of friction-type high-strength bolted connections shall be prepared for painting in accordance with endorsement "P" of AISC 201 and primed with the specified paint.

Shop splices of members between field splices will be permitted only where indicated on the Contract Drawings. Splices not indicated require the approval of the Contracting Officer.

3.2 ERECTION

- a. Erection of structural steel, except as indicated in item b. below, shall be in accordance with the applicable provisions of AISC 325. Erection plan shall be reviewed, stamped and sealed by a licensed structural engineer.
- b. For low-rise structural steel buildings (60 feet tall or less and a maximum of 2 stories), the erection plan shall conform to AISC 303 and the structure shall be erected in accordance with AISC 810.

Provide for drainage in structural steel. After final positioning of steel members, provide full bearing under base plates and bearing plates using nonshrink grout. Place nonshrink grout in accordance with the manufacturer's instructions.

3.2.1 STORAGE

Material shall be stored out of contact with the ground in such manner and location as will minimize deterioration.

3.3 CONNECTIONS

Except as modified in this section, connections not detailed shall be designed in accordance with AISC 360. Build connections into existing work. Do not tighten anchor bolts set in concrete with impact torque wrenches. Punch, subpunch and ream, or drill bolt holes perpendicular to the surface of the member. Holes shall not be cut or enlarged by burning. Bolts, nuts, and washers shall be clean of dirt and rust, and lubricated immediately prior to installation.

3.3.1 Bolts

Bolts shall be tightened to a "snug tight" fit. "Snug tight" is the tightness that exists when plies in a joint are in firm contact. If firm contact of joint plies cannot be obtained with a few impacts of an impact wrench, or the full effort of a man using a spud wrench, contact the Contracting Officer for further instructions.

3.4 GAS CUTTING

Use of gas-cutting torch in the field for correcting fabrication errors will not be permitted on any major member in the structural framing. Use of a gas cutting torch will be permitted on minor members not under stress only after approval has been obtained from the Contracting Officer.

3.5 WELDING

AWS D1.1/D1.1M Provide AWS D1.1/D1.1M qualified welders, welding operators, and tackers.

The Contractor shall develop and submit the Welding Procedure Specifications (WPS) for all welding, including welding done using prequalified procedures. Prequalified procedures may be submitted for information only; however, procedures that are not prequalified shall be submitted for approval.

3.6 SHOP PRIMER REPAIR

Repair shop primer in accordance with the paint manufacturer's recommendation for surfaces damaged by handling, transporting, cutting, welding, or bolting.

3.6.1 Field Priming

Field priming of steel exposed to the weather, or located in building areas without HVAC for control of relative humidity. After erection, the field bolt heads and nuts, field welds, and any abrasions in the shop coat shall be cleaned and primed with paint of the same quality as that used for the shop coat.

3.7 FIELD QUALITY CONTROL

Perform field tests, and provide labor, equipment, and incidentals required for testing. The Contracting Officer shall be notified in writing of defective welds, bolts, nuts, and washers within 7 working days of the date of weld inspection.

3.7.1 Welds

3.7.1.1 Visual Inspection

AWS D1.1/D1.1M. Furnish the services of AWS-certified welding inspectors for fabrication and erection inspection and testing and verification inspections. Welding inspectors shall visually inspect and mark welds, including fillet weld end returns.

The Contractor shall inspect proper preparation, size, gaging location, and acceptability of welds; identification marking; operation and current characteristics of welding sets in use.

3.7.1.2 Nondestructive Testing

AWS D1.1/D1.1M. Test locations shall be selected by the Contracting Officer. If more than 20 percent of welds made by a welder contain defects identified by testing, then all welds made by that welder shall be tested by radiographic or ultrasonic testing, as approved by the Contracting Officer. When all welds made by an individual welder are required to be

tested, magnetic particle testing shall be used only in areas inaccessible to either radiographic or ultrasonic testing. Retest defective areas after repair.

3.7.2 High-Strength Bolts

3.7.2.1 Inspection

Inspection procedures shall be in accordance with AISC 360. Confirm and report to the Contracting Officer that the materials meet the project specification and that they are properly stored. Confirm that the faying surfaces have been properly prepared before the connections are assembled. Observe the specified job site testing and calibration, and confirm that the procedure to be used provides the required tension. Monitor the work to ensure the testing procedures are routinely followed on joints that are specified to be fully tensioned.

3.7.2.2 Testing

The Government has the option to perform nondestructive tests on 5 percent of the installed bolts to verify compliance with pre-load bolt tension requirements. The nondestructive testing will be done in-place using an ultrasonic measuring device or any other device capable of determining in-place pre-load bolt tension. The test locations shall be selected by the Contracting Officer. If more than 10 percent of the bolts tested contain defects identified by testing, then all bolts used from the batch from which the tested bolts were taken, shall be tested. Retest new bolts after installation.

3.8 SPECIAL INSPECTION AND TESTING FOR SEISMIC-RESISTING SYSTEMS

Special inspections and testing for seismic-resisting systems and components shall be done in accordance with Section 01 45 35 SPECIAL INSPECTION FOR SEISMIC-RESISTING SYSTEMS.

-- End of Section --

SECTION 05 30 00

STEEL DECKS

11/11

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 IRON AND STEEL INSTITUTE (AISI)

AISI D100 (1991; R 2008) Cold-Formed Steel Design Manual

AISI SG03-3 (2002; Suppl 2001-2004; R 2008) Cold-Formed Steel Design Manual Set

ASTM INTERNATIONAL (ASTM)

ASTM A1008/A1008M (2011) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardened

ASTM A653/A653M (2011) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM A780/A780M (2009) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings

ASTM A792/A792M (2010) Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process

FM GLOBAL (FM)

FM DS 1-28 (2002) Design Wind Loads

STEEL DECK INSTITUTE (SDI)

SDI 31 (2007) Design Manual for Composite Decks, Form Decks, and Roof Decks

SDI MOC2 (2006) Manual of Construction with Steel Deck

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-301-01 (2010; Change 3) Structural Engineering

UNDERWRITERS LABORATORIES (UL)

- UL 209 (2011) Cellular Metal Floor Raceways and Fittings
- UL 580 (2006; Reprint Jul 2009) Tests for Uplift Resistance of Roof Assemblies

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for A/E approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

- Metal Floor Deck Units
- Cant Strips
- Ridge and Valley Plates
- Metal Closure Strips

SD-03 Product Data

- Accessories
- Deck Units
- Galvanizing Repair Paint
- Joint Sealant Material

SD-05 Design Data

- Deck Units
- Submit manufacturer's design calculations, or applicable published literature for the structural properties of the proposed deck units.

SD-07 Certificates

- Wind Storm Resistance

1.3 QUALITY ASSURANCE

1.3.1 Deck Units

Furnish deck units and accessory products from a manufacturer regularly engaged in manufacture of steel decking. Provide manufacturer's certificates attesting that the decking material meets the specified requirements.

1.3.2 Regulatory Requirements

1.3.2.1 Wind Storm Resistance

Provide roof construction assembly capable of withstanding an uplift pressure of 60 pounds per square foot when tested in accordance with the uplift pressure test described in the FM DS 1-28 or as described in UL 580 and in general compliance with UFC 3-301-01.

1.3.3 Fabrication Drawings

Show type and location of units, location and sequence of connections, bearing on supports, methods of anchoring, attachment of accessories, adjusting plate details, size and location of holes to be cut and reinforcement to be provided, the manufacturer's erection instructions and other pertinent details.

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver deck units to the site in a dry and undamaged condition. Store and handle steel deck in a manner to protect it from corrosion, deformation, and other types of damage. Do not use decking for storage or as working platform until units have been fastened into position. Exercise care not to damage material or overload decking during construction. The maximum uniform distributed storage load must not exceed the design live load. Stack decking on platforms or pallets and cover with weathertight ventilated covering. Elevate one end during storage to provide drainage. Maintain deck finish at all times to prevent formation of rust. Repair deck finish using touch-up paint. Replace damaged material.

1.5 DESIGN REQUIREMENTS FOR ROOF DECKS

1.5.1 Properties of Sections

Properties of metal roof deck sections must comply with engineering design width as limited by the provisions of AISI D100.

1.5.2 Allowable Loads

Indicate total uniform dead and live load for detailing purposes.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Steel Sheet

Flat rolled carbon steel sheets of structural quality, thickness not less than 0.028 inch before coating, meeting the requirements of AISI SG03-3, except as modified herein.

2.1.2 Steel Coating

ASTM A653/A653M designation G90 galvanized, or ASTM A792/A792M designation AZ55, aluminum-zinc alloy. Apply coating to both sides of sheet. Conform to UL 209 for coating on decking provided as wire raceways.

2.1.3 Joint Sealant Material for Roof Decks

Provide a nonskinning, gun-grade, bulk compound material as recommended by the manufacturer.

2.1.4 Galvanizing Repair Paint for Roof Decks

Provide a high zinc-dust content paint for regalvanizing welds in galvanized steel and shall conform to ASTM A780/A780M.

2.2 ACCESSORIES

Provide accessories of same material as deck, unless specified otherwise. Provide manufacturer's standard type accessories, as specified.

2.2.1 Adjusting Plates

Provide adjusting plates, or segments of deck units, of same thickness and configuration as deck units in locations too narrow to accommodate full size units. Provide factory cut plates of predetermined size where possible.

2.2.2 Mechanical Fasteners

Provide mechanical fasteners, such as powder actuated or pneumatically driven fasteners, for anchoring the deck to structural supports and adjoining units that are designed to meet the loads indicated. Provide positive locking-type fasteners listed by the Steel Deck Institute and ICC-ES, as approved by the Contracting Officer.

2.2.3 Miscellaneous Accessories

Furnish the manufacturer's standard accessories to complete the deck installation. Furnish metal accessories of the same material as the deck and with the minimum design thickness as follows: saddles, 0.0474 inch welding washers, 0.0598 inch cant strip, 0.0295 inch other metal accessories, 0.0358 inch unless otherwise indicated. Accessories must include but not be limited to saddles, welding washers, fasteners, cant strips, butt cover plates, underlapping sleeves, and ridge and valley plates.

2.3 FABRICATION

2.3.1 Roof Deck

Conform to ASTM A792/A792M or ASTM A1008/A1008M for deck used in conjunction with insulation and built-up roofing. Fabricate roof deck units of 0.0295 inch design thickness or thicker steel.

PART 3 EXECUTION

3.1 EXAMINATION

Prior to installation of decking units and accessories, examine worksite to verify that as-built structure will permit installation of decking system without modification.

3.2 INSTALLATION

Install steel deck units in accordance with SDI 31 approved shop drawings.

Place units on structural supports, properly adjusted, leveled, and aligned at right angles to supports before permanently securing in place. Damaged deck and accessories including material which is permanently stained or contaminated, deformed, or with burned holes shall not be installed. Extend deck units over three or more supports unless absolutely impractical. Report inaccuracies in alignment or leveling to the Contracting Officer and make necessary corrections before permanently anchoring deck units. Locate deck ends over supports only. Do not use unanchored deck units as a work or storage platform. Permanently anchor units placed by the end of each working day. Do not support suspended ceilings, light fixtures, ducts, utilities, or other loads by steel deck unless indicated. Distribute loads by appropriate means to prevent damage.

3.2.1 Attachment

Immediately after placement and alignment, and after correcting inaccuracies, permanently fasten steel deck units to structural supports as indicated on the design drawings and in accordance with manufacturer's recommended procedure and SDI 31. Clamp or weight deck units to provide firm contact between deck units and structural supports while performing fastening. Attachment of adjacent deck units by button-punching is prohibited.

3.2.1.1 Fastening

Anchor deck to structural supports and adjoining units with mechanical fasteners as listed by the Steel Deck Institute, ICC-ES, the fastener and steel deck manufacturers, and approved by the Contracting Officer. Drive pneumatically fasteners with a low-velocity fastening tool and comply with the manufacturer's recommendations.

3.2.2 Deck Damage

SDI MOC2, for repair of deck damage.

3.2.3 Accessory Installation

3.2.3.1 Adjusting Plates

Provide in locations too narrow to accommodate full-size deck units and install as shown on shop drawings.

3.3 JOINT SEALING FOR ROOF DECKS

Seal sidelaps and endlaps with manufacturer's recommended joint sealing material. Shop or field apply the material. Before applying the sealing material, completely remove dust, dirt, moisture, and other foreign material from the surfaces to which the sealing material is to be applied. Apply sealing material in strict accordance with the sealing material manufacturer's printed instructions.

3.4 ROOF INSULATION SUPPORT FOR ROOF DECKS

Provide metal closure strips for support of roof insulation where rib openings in top surface of metal roof decking occur adjacent to edges and openings. Weld metal closure strips in position.

3.5 CLEANING AND PROTECTION FOR ROOF DECKS

Upon completion of the deck, sweep surfaces clean and prepare for installation of the roofing.

-- End of Section --

SECTION 05 51 00

METAL STAIRS

02/12

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 INSTITUTE OF STEEL CONSTRUCTION (AISC)

ANSI/AISC 360 (2010) Specification for Structural Steel Buildings

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2010; Errata 2010) Structural Welding Code - Steel

ASME INTERNATIONAL (ASME)

ASME B18.21.1 (2009) Washers: Helical Spring-Lock, Tooth Lock, and Plain Washers (Inch Series)

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M (2009) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A153/A153M (2009) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

ASTM A283/A283M (2003; R 2007) Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates

ASTM A29/A29M (2011a) Standard Specification for Steel Bars, Carbon and Alloy, Hot-Wrought General Requirements for

ASTM A307 (2010) Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength

ASTM A36/A36M (2008) Standard Specification for Carbon Structural Steel

ASTM A500/A500M (2010a) Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

- ASTM A53/A53M (2010) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
- ASTM A6/A6M (2011) Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling
- ASTM A653/A653M (2011) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

- NAAMM MBG 531 (2009) Metal Bar Grating Manual

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for A/E approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

- Iron and Steel Hardware
- Steel Shapes, Plates, Bars and Strips
- Metal Stair System

SD-03 Product Data

- Structural Steel Plates, Shapes, and Bars
- Structural Steel Tubing
- Protective Coating
- Steel Pan Stairs
- Steel Stairs

SD-07 Certificates

- Welder Qualification

SD-08 Manufacturer's Instructions

- Structural Steel Plates, Shapes, and Bars
- Structural Steel Tubing
- Protective Coating

1.3 QUALIFICATIONS FOR WELDING WORK

Certify welder qualification by tests in accordance with AWS D1.1/D1.1M, or under an equivalent approved qualification test. In addition, perform

tests on test pieces in positions and with clearances equivalent to those actually encountered. If a test weld fails to meet requirements, ensure that an immediate retest of two test welds and each test weld is made and passes. Failure in the immediate retest requires that the welder be retested after further practice or training and a complete set of test welds made.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

Submit complete and detailed fabrication drawings for all iron and steel hardware, and for all steel shapes, plates, bars and strips used in accordance with the design specifications referenced in this section.

Pre-assemble items in the shop to the greatest extent possible. Disassemble units only to the extent necessary for shipping and handling. Clearly mark units for reassembly and coordinated installation.

For the fabrication of work exposed to view, use only materials that are smooth and free of surface blemishes, including pitting, seam marks, roller marks, rolled trade names, and roughness. Remove blemishes by grinding, or by welding and grinding, prior to cleaning, treating, and application of surface finishes, including zinc coatings.

2.2 STRUCTURAL STEEL PLATES, SHAPES AND BARS

Structural-size shapes and plates, conforming to ASTM A36/A36M, unless otherwise noted, except bent or cold-formed plates.

Steel plates - bent or cold-formed, conforming to ASTM A283/A283M, Grade C.

Steel bars and bar-size shapes, conforming to ASTM A36/A36M, unless otherwise noted for steel bars and bar-size shapes.

2.3 STRUCTURAL STEEL TUBING

Structural steel tubing, hot-formed, welded or seamless, conforming to ASTM A500/A500M, Grade B, unless otherwise noted.

2.4 STEEL PIPE

Steel pipe conforming to ASTM A53/A53M, type as selected, Grade B; primed finish, unless galvanizing is required; standard weight (Schedule 40).

2.5 FASTENERS

Galvanized zinc-coated fasteners in accordance with ASTM A153/A153M and used for exterior applications or where built into exterior walls or floor systems. Select fasteners for the type, grade, and class required for the installation of steel stair items.

Standard/regular hexagon-head bolts and nuts be conforming to ASTM A307, Grade A.

Plain washers, round, general-assembly-grade, carbon steel conforming to ASME B18.21.1.

Lockwashers helical spring, carbon steel conforming to.

2.6 GENERAL FABRICATION

Prepare and submit metal stair system shop drawings with detailed plans and elevations at not less than 1 inch to 1 foot with details of sections and connections at not less than 3 inches to 1 foot. Also detail placement drawings, diagrams, templates for installation of anchorage, including but not limited to, anchor bolts, and miscellaneous metal items having integral anchorage devices.

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

Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges. Ease exposed edges to a radius of approximately 1/32 inch, and bend metal corners to the smallest radius possible without causing grain separation or otherwise impairing the work.

Continuously weld corners and seams in accordance with the recommendations of AWS D1.1/D1.1M. Grind smooth exposed welds and flush to match and blend with adjoining surfaces.

Form exposed connections with hairline joints that are flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of the type indicated or, if not indicated, use Phillips flathead (countersunk) screws or bolts.

Provide and coordinate anchorage of the type indicated with the supporting structure. Fabricate anchoring devices, space as indicated and required to provide adequate support for the intended use of the work.

Use hot-rolled steel bars for work fabricated from bar stock unless work is indicated or specified as fabricated from cold-finished or cold-rolled stock.

2.7 PROTECTIVE COATING

Hot dip galvanize steelwork as indicated in accordance with ASTM A123/A123M. Touch up abraded surfaces and cut ends of galvanized members with zinc-dust, zinc-oxide primer, or an approved galvanizing repair compound.

2.8 STEEL PAN STAIRS

2.8.1 Stair Framing

Fabricate stringers of structural steel channels, or plates, or a combination thereof as indicated. Provide closures for exposed ends of strings.

Construct platforms of structural steel channel headers and miscellaneous framing members as indicated. Bolt headers to stringers and newels and framing members to stringers and headers.

2.8.2 Floor Grating Treads And Platforms

Provide floor grating treads and platforms conforming to ASTM A6/A6M, ASTM A29/A29M and NAAMM MBG 531, "Metal Bar Grating Manual." Provide pattern, spacing, and bar sizes as indicated:

- a. Galvanized finish conforming to ASTM A123/A123M.

Fabricate grating treads with steel plate nosing on one edge and with steel angle or steel plate carrier at each end for string connections. Secure treads to strings with bolts.

Fabricate grating platforms with nosing that matches on grating treads at landings. Provide toe-plates at open-sided edges of floor grating to platform framing members.

2.8.3 Safety Treads

Plank grating ASTM A653/A653M, G-90

2.8.4 Steel Stairs

Provide steel stairs complete with stringers, grating treads, landings, columns, handrails, and necessary bolts and other fastenings. Hot-dip galvanize steel stairs and accessories.

2.8.4.1 Design Loads

Design stairs to sustain a live load of not less than 100 pounds per square foot, or a concentrated load of 300 pounds applied where it is most critical. Conform to ANSI/AISC 360 with the design and fabrication of steel stairs, other than a commercial product.

2.8.4.2 Materials

Provide steel stairs of welded construction except that bolts may be used where welding is not practicable. Screw or screw-type connections are not permitted.

- a. Structural Steel: ASTM A36/A36M.
- b. Gratings for Treads and Landings: Plank grating; ASTM A653/A653M, G-90 for steel. Provide gratings with nonslip nosings.
- c. Support steel grating on angle cleats welded to stringers or treads with integral cleats, welded or bolted to the stringer. Close exposed ends. For exterior stairs, form all exposed joints to exclude water.
- d. Before fabrication, obtain necessary field measurements and verify drawing dimensions.
- e. Clean metal surfaces free from mill scale, flake rust and rust pitting prior to shop finishing. Weld permanent connections. Finish welds flush and smooth on surfaces that will be exposed after installation.

PART 3 EXECUTION

3.1 STEEL STAIRS

Provide anchor bolts, grating fasteners, washers, and all parts or devices necessary for proper installation. Provide lock washers under nuts.

3.2 FIELD WELDING

Execute procedures of manual shielded metal arc welding, appearance and quality of welds made, and methods used in correcting welding work in compliance with AWS D1.1/D1.1M.

-- End of Section --

SECTION 05 52 00

METAL RAILINGS

02/11

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 WELDING SOCIETY (AWS)

AWS D1.1/D1.1M (2010; Errata 2010) Structural Welding Code - Steel

ASME INTERNATIONAL (ASME)

ASME B18.2.1 (2010) Square and Hex Bolts and Screws (Inch Series)

ASME B18.21.1 (2009) Washers: Helical Spring-Lock, Tooth Lock, and Plain Washers (Inch Series)

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M (2009) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A153/A153M (2009) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware

ASTM A283/A283M (2003; R 2007) Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates

ASTM A307 (2010) Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength

ASTM A36/A36M (2008) Standard Specification for Carbon Structural Steel

ASTM A500/A500M (2010a) Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

ASTM A53/A53M (2010) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM AMP 521

(2001) Pipe Railing Manual

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for A/E approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Fabrication Drawings

Iron and Steel Hardware

Steel Shapes, Plates, Bars and Strips

SD-03 Product Data

Structural Steel Plates, Shapes, and Bars

Structural Steel Tubing

Protective Coating

Steel Railings and Handrails

Anchorage and Fastening Systems

SD-07 Certificates

Welder Qualification

SD-08 Manufacturer's Instructions

Installation Instructions

1.3 QUALITY ASSURANCE

1.3.1 Welder Qualification

Submit certified welder qualification by tests in accordance with AWS D1.1/D1.1M, or under an equivalent approved qualification test. In addition be performed on test pieces in positions and with clearances equivalent to those actually encountered. If a test weld fails to meet requirements, make an immediate retest of two test welds and each test weld must pass. Failure in the immediate retest will require that the welder be retested after further practice or training and make a complete set of test welds.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

Provide complete, detailed fabrication and installation drawings for all iron and steel hardware, and for all steel shapes, plates, bars and strips used in accordance with the design specifications referenced in this section.

Pre-assemble items in the shop to the greatest extent possible. Disassemble units only to the extent necessary for shipping and handling. Clearly mark units for reassembly and coordinated installation.

For the fabrication of work exposed to view, use only materials that are smooth and free of surface blemishes, including pitting, seam marks, roller marks, rolled trade names, and roughness. Remove blemishes by grinding, or by welding and grinding, prior to cleaning, treating, and application of surface finishes, including zinc coatings.

2.2 GENERAL FABRICATION

Provide railings and handrails detail plans and elevations at not less than 1 inch to 1 foot. Provide details of sections and connections at not less than 3 inches to 1 foot. Also detail setting drawings, diagrams, templates for installation of anchorages, including concrete inserts, anchor bolts, and miscellaneous metal items having integral anchors.

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

Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges. Ensure all exposed edges are eased to a radius of approximately 1/32 inch. Bend metal corners to the smallest radius possible without causing grain separation or otherwise impairing the work.

Weld corners and seams continuously and in accordance with the recommendations of AWS D1.1/D1.1M. Grind exposed welds smooth and flush to match and blend with adjoining surfaces.

Form exposed connections with hairline joints that are flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of the type indicated or, if not indicated, use Phillips flathead (countersunk) screws or bolts.

Provide anchorage of the type indicated and coordinated with the supporting structure. Fabricate anchoring devices and space as indicated and as required to provide adequate support for the intended use of the work.

2.3 STRUCTURAL STEEL PLATES, SHAPES AND BARS

Provide structural-size shapes and plates, except plates to be bent or cold-formed, conforming to ASTM A36/A36M, unless otherwise noted.

Provide steel plates, to be bent or cold-formed, conforming to ASTM A283/A283M, Grade C.

Provide steel bars and bar-size shapes conforming to ASTM A36/A36M, unless otherwise noted.

2.4 STRUCTURAL STEEL TUBING

Provide structural steel tubing, hot-formed, welded or seamless, conforming to ASTM A500/A500M, Grade B, unless otherwise noted.

2.5 STEEL PIPE

Provide pipe conforming to ASTM A53/A53M, type as selected, Grade B; primed finish, unless galvanizing is required; standard weight (Schedule 40).

2.6 FASTENERS

Provide galvanized zinc-coated fasteners in accordance with ASTM A153/A153M used for exterior applications or where built into exterior walls or floor systems. Select fasteners for the type, grade, and class required for the installation of steel stair items.

Provide standard hexagon-head bolts, conforming to ASTM A307, Grade A.

Provide plain round, general-assembly-grade, carbon steel washers conforming to ASME B18.21.1.

Provide helical spring, carbon steel lockwashers conforming to ASME B18.2.1.

2.7 PROTECTIVE COATING

Provide hot dipped galvanized steelwork as indicated in accordance with ASTM A123/A123M. Touch up abraded surfaces and cut ends of galvanized members with zinc-dust, zinc-oxide primer, or an approved galvanizing repair compound.

2.8 STEEL RAILINGS AND HANDRAILS

Design handrails to resist a concentrated load of 250 lbs in any direction at any point of the top of the rail or 20 lbs per foot applied horizontally to top of the rail, whichever is more severe. NAAMM AMP 521, provide the same size rail and post.

2.8.1 Steel Handrails

Provide steel handrails, including inserts in concrete, steel pipe conforming to ASTM A53/A53M or structural tubing conforming to ASTM A500/A500M, Grade A or B of equivalent strength. Provide steel railings of 1 1/2 inches nominal size, hot-dip galvanized .

- a. Fabrication: Joint posts, rail, and corners by one of the following methods:

(1) Flush-type rail fittings of commercial standard, welded and ground smooth with railing splice locks secured with 3/8 inch hexagonal-recessed-head setscrews.

(2) Mitered and welded joints made by fitting post to top rail and intermediate rail to post, mitering corners, groove welding joints, and grinding smooth. Butt railing splices and reinforce them by a tight fitting interior sleeve not less than 6 inches long.

(3) Railings may be bent at corners in lieu of jointing, provided bends are made in suitable jigs and the pipe is not crushed.

PART 3 EXECUTION

3.1 INSTALLATION INSTRUCTIONS

Submit manufacturer's installation instructions for the following products to be used in the fabrication of steel stair railing :

- a. Structural steel plates, shapes, and bars
- b. Structural steel tubing
- c. Protective coating
- d. Steel railings and handrails
- e. Anchorage and fastening systems

Provide complete, detailed fabrication and installation drawings for all iron and steel hardware, and for all steel shapes, plates, bars and strips used in accordance with the design specifications referenced in this section.

3.2 PREPARATION

Adjust stair railings and handrails prior to securing in place to ensure proper matching at butting joints and correct alignment throughout their length. Space posts not more than 8 feet on center. Plumb posts in each direction. Secure posts and rail ends to building construction as follows:

Anchor posts to steel with steel oval flanges, angle type or floor type as required by conditions, welded to posts and bolted to the steel supporting members.

Anchor rail ends to steel with steel oval or round flanges welded to tail ends and bolted to the structural steel members.

3.3 STEEL HANDRAIL

Install by means of base plates bolted to stringers or structural steel frame work.

3.4 FIELD WELDING

Ensure procedures of manual shielded metal arc welding, appearance and quality of welds made, and methods used in correcting welding work comply with AWS D1.1/D1.1M.

-- End of Section --

SECTION 06 10 00

ROUGH CARPENTRY

02/12

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 FOREST & PAPER ASSOCIATION (AF&PA)

- AF&PA T10 (2001) Wood Frame Construction Manual for One- and Two-Family Dwellings
- AF&PA T101 (2005) National Design Specification (NDS) for Wood Construction

AMERICAN WOOD PROTECTION ASSOCIATION (AWPA)

- AWPA BOOK (2009) AWPA Book of Standards
- AWPA P5 (2009) Standard for Waterborne Preservatives

ASME INTERNATIONAL (ASME)

- ASME B18.2.1 (2010) Square and Hex Bolts and Screws (Inch Series)
- ASME B18.2.2 (2010) Standard for Square and Hex Nuts
- ASME B18.5.2.1M (2006; R 2011) Metric Round Head Short Square Neck Bolts
- ASME B18.5.2.2M (1982; R 2010) Metric Round Head Square Neck Bolts
- ASME B18.6.1 (1981; R 2008) Wood Screws (Inch Series)

ASTM INTERNATIONAL (ASTM)

- ASTM A153/A153M (2009) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
- ASTM A307 (2010) Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
- ASTM F 547 (2006) Nails for Use with Wood and Wood-Base Materials

FM GLOBAL (FM)

FM 4435 (2004) Roof Perimeter Flashing

INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC (2009; Errata First Printing)
International Building Code

NATIONAL HARDWOOD LUMBER ASSOCIATION (NHLA)

NHLA Rules (2007) Rules for the Measurement &
Inspection of Hardwood & Cypress

NORTHEASTERN LUMBER MANUFACTURERS ASSOCIATION (NELMA)

NELMA Grading Rules (2006) Standard Grading Rules for
Northeastern Lumber

REDWOOD INSPECTION SERVICE (RIS) OF THE CALIFORNIA REDWOOD
ASSOCIATION (CRA)

RIS Grade Use (1998) Redwood Lumber Grades and Uses

SOUTHERN CYPRESS MANUFACTURERS ASSOCIATION (SCMA)

SCMA Spec (1986; Supple. No. 1, Aug 1993) Standard
Specifications for Grades of Southern
Cypress

SOUTHERN PINE INSPECTION BUREAU (SPIB)

SPIB 1003 (2002) Standard Grading Rules for Southern
Pine Lumber

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-1923 (Rev A; Notice 2) Shield, Expansion (Lag,
Machine and Externally Threaded Wedge Bolt
Anchors)

CID A-A-1924 (Rev A; Notice 2) Shield, Expansion (Self
Drilling Tubular Expansion Shell Bolt
Anchors)

CID A-A-1925 (Rev A; Notice 2) Shield Expansion (Nail
Anchors)

WEST COAST LUMBER INSPECTION BUREAU (WCLIB)

WCLIB 17 (2000) Standard Grading Rules

WESTERN WOOD PRODUCTS ASSOCIATION (WWPA)

WWPA G-5 (1998) Western Lumber Grading Rules

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation;

submittals not having a "G" designation are for Contractor A/E approval. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Nailers and Nailing Strips

Drawings of field erection details, including materials and methods of fastening nailers in conformance with Factory Mutual wind uplift rated systems specified in other Sections of these specifications.

SD-07 Certificates

Preservative treatment

1.3 DELIVERY AND STORAGE

Deliver materials to the site in an undamaged condition. Store, protect, handle, and install prefabricated structural elements in accordance with manufacturer's instructions and as specified. Store materials off the ground to provide proper ventilation, with drainage to avoid standing water, and protection against ground moisture and dampness. Store materials with a moisture barrier at both the ground level and as a cover forming a well ventilated enclosure. Remove defective and damaged materials and provide new materials. Store separated reusable wood waste convenient to cutting station and area of work.

1.4 PRESERVATIVE TREATMENT

Treat wood products with waterborne wood preservatives conforming to AWPA P5. Pressure treatment of wood products shall conform to the requirements of AWPA BOOK Use Category System Standards U1 and T1. Pressure-treated wood products shall not contain arsenic, chromium, or other agents classified as carcinogenic, probably carcinogenic, or possibly carcinogenic to humans (compounds in Groups 1, 2A, or 2B) by the International Agency for Research on Cancer (IARC), Lyon, France. Pressure-treated wood products shall not exceed the limits of the U.S. EPA's Toxic Characteristic Leaching Procedure (TCLP), and shall not be classified as hazardous waste. Submit certification from treating plant stating chemicals and process used and net amount of preservatives retained are in conformance with specified standards.

- a. 0.25 pcf intended for above ground use.

PART 2 PRODUCTS

2.1 LUMBER

2.1.1 Framing Lumber

Framing lumber such as nailing strips, and nailers shall be one of the species listed in the table below. Minimum grade of species shall be as listed.

<u>Table of Grades for Framing and Board Lumber</u>			
<u>Grading Rules</u>	<u>Species</u>	<u>Framing</u>	<u>Board Lumber</u>
WWPA G-5 standard grading rules	Aspen, Douglas Fir-Larch, Douglas Fir South, Engelmann Spruce-Lodgepole Pine, Engelmann Spruce, Hem-Fir, Idaho White Pine, Lodgepole Pine, Mountain Hemlock, Mountain Hemlock-Hem-Fir, Ponderosa Pine-Sugar Pine, Ponderosa Pine-Lodgepole Pine, Subalpine Fir, White Woods, Western Woods, Western Cedars, Western Hemlock	All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 10 feet and shorter)	All Species: No. 3 Common
WCLIB 17 standard grading rules	Douglas Fir-Larch, Hem-Fir, Mountain Hemlock, Sitka Spruce, Western Cedars, Western Hemlock	All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 10 feet and shorter)	All Species: Standard

<u>Table of Grades for Framing and Board Lumber</u>			
<u>Grading Rules</u>	<u>Species</u>	<u>Framing</u>	<u>Board Lumber</u>
SPIB 1003 standard grading rules	Southern Pine	All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 10 feet and shorter)	No. 2 Boards
SCMA Spec standard specifications	Cypress	No. 2 Common	No. 2 Common
NELMA Grading Rules standard grading rules	Balsam Fir, Eastern Hemlock-Tamarack, Eastern Spruce, Eastern White Pine, Northern Pine, Northern Pine-Cedar	All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 10 feet and shorter)	All Species: No. 3 Common except Standard for Eastern White and Northern Pine
RIS Grade Use standard specifications	Redwood	All Species: Standard Light Framing or No. 3 Structural Light Framing (Stud Grade for 2x4 nominal size, 10 feet and shorter)	Construction Heart

<u>Table of Grades for Framing and Board Lumber</u>			
<u>Grading Rules</u>	<u>Species</u>	<u>Framing</u>	<u>Board Lumber</u>
NHLA Rules rules for the measurement and inspection of hardwood and cypress lumber	Cypress	No. 2 Dimension	No. 2 Common

2.2 ROUGH HARDWARE

Unless otherwise indicated or specified, rough hardware shall be of the type and size necessary for the project requirements. Sizes, types, and spacing of fastenings of manufactured building materials shall be as recommended by the product manufacturer unless otherwise indicated or specified. Rough hardware exposed to the weather or embedded in or in contact with preservative treated wood, exterior masonry, or concrete walls or slabs shall be hot-dip zinc-coated in accordance with ASTM A153/A153M.

2.2.1 Bolts, Nuts, Studs, and Rivets

ASME B18.2.1, ASME B18.5.2.1M, ASME B18.5.2.2M and ASME B18.2.2.

2.2.2 Anchor Bolts

ASTM A307, size as indicated, complete with nuts and washers.

2.2.3 Expansion Shields

CID A-A-1923, CID A-A-1924, and CID A-A-1925. Except as shown otherwise, maximum size of devices shall be 3/8 inch.

2.2.4 Lag Screws and Lag Bolts

ASME B18.2.1.

2.2.5 Wood Screws

ASME B18.6.1.

2.2.6 Nails

ASTM F 547, size and type best suited for purpose. For sheathing and subflooring, length of nails shall be sufficient to extend 1 inch into supports. In general, 8-penny or larger nails shall be used for nailing through 1 inch thick lumber and for toe nailing 2 inch thick lumber; 16-penny or larger nails shall be used for nailing through 2 inch thick lumber. Nails used with treated lumber and sheathing shall be hot-dipped galvanized in accordance with ASTM A153/A153M. Nailing shall be in accordance with the recommended nailing schedule contained in AF&PA T10. Where detailed nailing requirements are not specified, nail size and spacing shall be sufficient to develop an adequate strength for the connection. The connection's strength shall be verified against the nail

capacity tables in AF&PA T101. Reasonable judgment backed by experience shall ensure that the designed connection will not cause the wood to split. If a load situation exceeds a reasonable limit for nails, a specialized connector shall be used.

PART 3 EXECUTION

3.1 INSTALLATION

Conform to AF&PA T10 and install in accordance with the National Association of Home Builders (NAHB) Advanced Framing Techniques: Optimum Value Engineering, unless otherwise indicated or specified. Select lumber sizes to minimize waste. Fit framing lumber and other rough carpentry, set accurately to the required lines and levels, and secure in place in a rigid manner. Do not splice framing members between bearing points. Provide adequate support as appropriate to the application, climate, and modulus of elasticity of the product. Reinforce all members damaged by such cutting or boring by means of specially formed and approved sheet metal or bar steel shapes, or remove and provide new, as approved. Provide as necessary for the proper completion of the work all framing members not indicated or specified. Spiking and nailing not indicated or specified otherwise shall be in accordance with the Nailing Schedule contained in ICC IBC; perform bolting in an approved manner. Spikes, nails, and bolts shall be drawn up tight.

3.2 MISCELLANEOUS

3.2.1 Wood Roof Nailers, Edge Strips, Crickets, Curbs, and Cants

Provide sizes and configurations indicated or specified and anchored securely to continuous construction.

3.2.1.1 Roof Nailing Strips

Provide roof nailing strips for roof decks as indicated and specified herein. Apply nailing strips in straight parallel rows in the direction and spacing indicated. Strips shall be surface applied.

- a. Surface-Applied Nailers: Shall be 3 inches wide and of thickness to finish flush with the top of the insulation. Anchor strips securely to the roof deck with powder actuated fastening devices or expansion shields and bolts, spaced not more than 24 inches o.c. On decks with slopes of one inch or more, provide surface applied wood nailers for securing insulation.

3.2.1.2 Roof Edge Strips and Nailers

Provide at perimeter of roof, around openings through roof, and where roofs abut walls, curbs, and other vertical surfaces. Except where indicated otherwise, nailers shall be 6 inches wide and the same thickness as the insulation. Anchor nailers securely to underlying construction. Anchor perimeter nailers in accordance with FM 4435.

3.2.1.3 Curbs

Provide curbs as indicated, specified, or necessary.

-- End of Section --

SECTION 07 22 00

ROOF AND DECK INSULATION

08/11

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 C1177/C1177M	(2008) Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing
ASTM C1289	(2011) Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
ASTM E84	(2012) Standard Test Method for Surface Burning Characteristics of Building Materials

FM GLOBAL (FM)

FM 4470	(2010) Single-Ply, Polymer-Modified Bitumen Sheet, Built-up Roof (BUR), and Liquid Applied Roof Assemblies for Use in Class 1 and Noncombustible Roof Deck Construction
FM APP GUIDE	(updated on-line) Approval Guide http://www.approvalguide.com/
FM P9513	(2002) Specialist Data Book Set for Roofing Contractors; contains 1-22 (2001), 1-28 (2002), 1-29 (2002), 1-28R/1-29R (1998), 1-30 (2000), 1-31 (2000), 1-32 (2000), 1-33 (2000), 1-34 (2001), 1-49 (2000), 1-52 (2000), 1-54 (2001)

UNDERWRITERS LABORATORIES (UL)

UL Bld Mat Dir	(2011) Building Materials Directory
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1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for A/E approval. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Wood nailers

Show location and spacing of wood nailers that are required for securing insulation . Show a complete description of the procedures for the installation of each phase of the system indicating the type of materials, thicknesses, identity codes, sequence of laying insulation, special methods for cutting and fitting of insulation, and special precautions. The drawings shall be based on field measurements.

SD-03 Product Data

Fasteners Asphalt

Insulation

SD-06 Test Reports

Flame spread and smoke developed ratings

Submit in accordance with ASTM E84.

SD-07 Certificates

Installer qualifications

SD-08 Manufacturer's Instructions

Nails and fasteners

Roof insulation, including field of roof and perimeter attachment requirements.

1.3 MANUFACTURER'S CERTIFICATE

Submit certificate from the insulation manufacturer attesting that the installer has the proper qualifications for installing tapered roof insulation systems.

Certificate attesting that the expanded perlite or polyisocyanurate insulation contains recovered material and showing estimated percent of recovered material. Certificates of compliance for felt materials.

1.4 QUALITY ASSURANCE

1.4.1 Insulation on Combustible and Steel Decks

Roof insulation shall have a flame spread rating not greater than 75 and a smoke developed rating not greater than 150, exclusive of covering, when tested in accordance with ASTM E84. Insulation bearing the UL label and listed in the UL Bld Mat Dir as meeting the flame spread and smoke developed ratings will be accepted in lieu of copies of test reports. Compliance with flame spread and smoke developed ratings will not be required when insulation has been tested as part of a roof construction assembly of the type used for this project and the construction is listed as fire-classified in the UL Bld Mat Dir or listed as Class I roof deck construction in the FM APP GUIDE. Insulation tested as part of a roof construction assembly shall bear UL or FM labels attesting to the ratings specified herein.

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Delivery

Deliver materials to site in manufacturer's unopened and undamaged standard commercial containers bearing the following legible information:

- a. Name of manufacturer;
- b. Brand designation;
- c. Specification number, type, and class, as applicable, where materials are covered by a referenced specification; and

Deliver materials in sufficient quantity to allow continuity of the work.

1.5.2 Storage and Handling

Store and handle materials in a manner to protect from damage, exposure to open flame or other ignition sources, and from wetting, condensation or moisture absorption. Store in an enclosed building or trailer that provides a dry, adequately ventilated environment. Store felt rolls on ends. For the 24 hours immediately before application of felts, store felts in an area maintained at a temperature no lower than 50 degrees F above grade and having ventilation around all sides. Replace damaged material with new material.

1.6 ENVIRONMENTAL CONDITIONS

Do not install roof insulation during inclement weather or when air temperature is below 40 degrees F and interior humidity is 45 percent or greater, or when there is visible ice, frost, or moisture on the roof deck.

PART 2 PRODUCTS

2.1 INSULATION

2.1.1 Insulation Types

Roof insulation shall be one or an assembly of a maximum of three of the following materials and compatible with attachment methods for the specified insulation and roof membrane:

- a. Polyisocyanurate Board: ASTM C1289 Type II, fibrous felt or glass mat membrane both sides, except minimum compressive strength shall be 20 pounds per square inch (psi).

2.1.2 Insulation Thickness

As necessary to provide a thermal resistance (R value) of shown on drawings. Thickness shall be based on the "R" value for aged insulation. Insulation over steel decks shall satisfy both specified R value and minimum thickness for width of rib opening recommended in insulation manufacturer's published literature.

2.2 PROTECTION BOARD

For use as a thermal barrier (underlayment), fire barrier (overlayment), or protection board for hot-mopped, torched-down, or adhesively-applied

roofing membrane over roof insulation.

2.2.1 Glass Mat Gypsum Roof Board

ASTM C1177/C1177M, 0 Flame Spread and 0 Smoke Developed when tested in accordance with ASTM E84, 500 psi, Class A, non-combustible, 1/2 inch thick, 4 by 8 feet board size.

2.3 SHEATHING PAPER FOR WOOD DECKS

Rosin-sized building paper or unsaturated felt weighing not less than 5 pounds per 100 square feet.

2.4 FASTENERS

Flush-driven through flat round or hexagonal steel or plastic plates. Steel plates shall be zinc-coated, flat round not less than 1 3/8 inch diameter or hexagonal not less than 28 gage. Plastic plates shall be high-density, molded thermoplastic with smooth top surface, reinforcing ribs and not less than 3 inches in diameter. Fastener head shall recess fully into the plastic plate after it is driven. Plates shall be formed to prevent dishing. Do not use bell-or cup-shaped plates. Fasteners shall conform to insulation manufacturer's recommendations except that holding power, when driven, shall be not less than 120 pounds each in steel deck. Fasteners for steel decks shall conform to FM APP GUIDE for Class I roof deck construction, and shall be spaced to withstand an uplift pressure of 60 pounds per square foot.

2.4.1 Fasteners for Wood Decks

One-piece composite screws long enough to penetrate into wood decks approximately 1/2 inch but not protrude through underside of decking.

2.4.2 Fasteners for Steel Decks

Approved hardened penetrating fasteners or screws conforming to FM 4470 and listed in FM APP GUIDE for Class I roof deck construction. Quantity and placement to withstand a minimum uplift pressure of 90 psf conforming to FM APP GUIDE.

2.5 WOOD NAILERS

Pressure-preservative-treated as specified in Section 06 10 00 ROUGH CARPENTRY.

PART 3 EXECUTION

3.1 EXAMINATION AND PREPARATION

3.1.1 Surface Inspection

Surfaces shall be clean, smooth, and dry. Check roof deck surfaces for defects before starting work.

The Contracting Officer will inspect and approve the surfaces immediately before starting installation. Prior to installing insulation, perform the

following:

- a. Examine wood decks to ascertain that deck boards have been properly nailed and that exposed nail heads have been set.
- b. Examine steel decks to ensure that panels are properly secured to structural members and to each other and that surfaces of top flanges are flat or slightly convex.

3.1.2 Surface Preparation

Correct defects and inaccuracies in roof deck surface to eliminate poor drainage and hollow or low spots and perform the following:

- a. Install wood nailers the same thickness as insulation at eaves, edges, curbs, walls, and roof openings for securing gravel stops, gutters, and flashing flanges. On decks with slopes of one inch per foot or more, install wood nailers perpendicular to slope for securing insulation and for backnailing of roofing felts. Space nailers in accordance with approved shop drawings.
- b. Fill or cover cracks or knot holes larger than 1/2 inch in diameter in wood decks as necessary to form an unyielding surface.
- c. Cover wood decks with a layer of rosin-sized building paper or unsaturated felt. Lap sides and ends not less than 3 inches. Nail sufficiently to prevent tearing or buckling during installation.
- d. Cover steel decks with a layer of insulation board of sufficient thickness to span the width of a deck rib opening, and conforming to fire safety requirements. Secure with piercing or self-drilling, self-tapping fasteners of quantity and placement conforming to FM APP GUIDE. Insulation joints parallel to ribs of deck shall occur on solid bearing surfaces only, not over open ribs.

3.2 INSULATION INSTALLATION

Apply insulation in two layers with staggered joints when total required thickness of insulation exceeds 1/2 inch. Lay insulation so that continuous longitudinal joints are perpendicular to direction of roofing, as specified in Section 07 52 00, "modified bituminous membrane roofing", and end joints of each course are staggered with those of adjoining courses. When using multiple layers of insulation, joints of each succeeding layer shall be parallel and offset in both directions with respect to layer below. Keep insulation 1/2 inch clear of vertical surfaces penetrating and projecting from roof surface.

3.2.1 Installation Using Only Mechanical Fasteners

Secure total thickness of insulation with penetrating type fasteners.

3.2.2 Special Precautions for Installation of Foam Insulation

3.2.2.1 Polyisocyanurate Insulation

Where polyisocyanurate foam board insulation is provided, install 1/2 inch glass mat gypsum roof board over top surface of foam board insulation. Stagger joints of insulation with respect to foam board insulation below.

3.3 PROTECTION

3.3.1 Protection of Applied Insulation

Completely cover each day's installation of insulation with the finished roofing specified in Section 07 52 00 on same day. Do not permit phased construction. Protect open spaces between insulation and parapets or other walls and spaces at curbs until permanent roofing and flashing are applied. Do not permit storing, walking, wheeling, or trucking directly on insulation or on roofed surfaces. Provide smooth, clean board or plank walkways, runways, and platforms near supports, as necessary, to distribute weight to conform to a 20 psf live load limit. Exposed edges of the insulation shall be protected by cutoffs at the end of each work day or whenever precipitation is imminent. Cutoffs shall be 2 layers of bituminous-saturated felt set in plastic bituminous cement or single ply set in roof cement. Fill all profile voids in cut-offs to prevent entrapping of moisture into the area below the membrane. Cutoffs shall be removed when work is resumed.

3.3.2 Damaged Work and Materials

Restore work and materials that become damaged during construction to original condition or replace with new materials.

3.4 INSPECTION

The Contractor shall establish and maintain an inspection procedure to assure compliance of the installed roof insulation with the contract requirements. Any work found not to be in compliance with the contract shall be promptly removed and replaced or corrected in an approved manner. Quality control shall include, but not be limited to, the following:

- a. Observation of environmental conditions; number and skill level of insulation workers; start and end time of work.
- b. Verification of certification, listing or label compliance with FM P9513.
- c. Verification of proper storage and handling of insulation and vapor retarder materials before, during, and after installation.
- d. Inspection of mechanical fasteners; type, number, length, and spacing.
- e. Coordination with other materials, cants, sleepers, and nailing strips.
- f. Inspection of insulation joint orientation and laps between layers, joint width and bearing of edges of insulation on deck.
- g. Installation of cutoffs and proper joining of work on subsequent days.
- h. Continuation of complete roofing system installation to cover insulation installed same day.

-- End of Section --

SECTION 07 52 00

MODIFIED BITUMINOUS MEMBRANE ROOFING
11/08

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 NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI/SPRI ES-1 (2003) Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7 (2010; Change 2010; Change 2011; Errata 2011; Change 2011) Minimum Design Loads for Buildings and Other Structures

AMERICAN SOCIETY OF SAFETY ENGINEERS (ASSE/SAFE)

ASSE/SAFE A10.24 (2006) Roofing - Safety Requirements of Low-Sloped Roofs

ASPHALT ROOFING MANUFACTURER'S ASSOCIATION (ARMA)

ARMA 410BUR88 (2001) Manual of Roof Maintenance and Repair

ARMA 460LSR97 (2002) NRCA/MRCA Repair Manual for Low Slope Membrane Roof Systems

ARMA PMBRG98 (1998) Quality Control Guideline for the Application of Polymer Modified Bitumen Roofing

ASTM INTERNATIONAL (ASTM)

ASTM C1289 (2011) Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board

ASTM D4073 (2006) Standard Test Method for Tensile-Tear Strength of Bituminous Roofing Membranes

ASTM D41/D41M (2011) Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing

ASTM D4586 (2007) Asphalt Roof Cement, Asbestos-Free

ASTM E108 (2011) Fire Tests of Roof Coverings

FM GLOBAL (FM)

- FM 4470 (2010) Single-Ply, Polymer-Modified Bitumen Sheet, Built-up Roof (BUR), and Liquid Applied Roof Assemblies for Use in Class 1 and Noncombustible Roof Deck Construction
- FM APP GUIDE (updated on-line) Approval Guide <http://www.approvalguide.com/>

NATIONAL ROOFING CONTRACTORS ASSOCIATION (NRCA)

- NRCA Details (2003) NRCA Roof Perimeter Flashing Systems Construction Details for Class 1 Roof Construction
- NRCA RoofMan (2012) The NRCA Roofing Manual

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

- SMACNA 1793 (2003) Architectural Sheet Metal Manual, 6th Edition

UNDERWRITERS LABORATORIES (UL)

- UL 790 (2004; Reprint Oct 2008) Standard Test Methods for Fire Tests of Roof Coverings
- UL RMSD (2011) Roofing Materials and Systems Directory

1.2 DESCRIPTION OF ROOF MEMBRANE SYSTEM

Minimum two-ply SBS modified bitumen roof membrane consisting of modified bitumen base sheet and cap sheet. Modified bitumen roof membrane base sheet shall be mechanically attached in the side cap. Cap sheet shall be cold-applied adhesive..

All work must follow the NRCA RoofMan guidelines and standards stated within this Section.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for A/E approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Roof plan drawing depicting wind loads and boundaries of enhanced perimeter and corner attachments of roof system components, as applicable

SD-03 Product Data

Modified Bitumen Sheets

Cold-Applied Membrane Adhesive

Fiberglass Felt

Primer

Modified Bitumen Roof Cement

Pre-Manufactured Accessories

Fasteners And Plates

Sample Warranty certificate

Submit all data required by Section 07 22 00 ROOF AND DECK INSULATION, together with requirements of this section. Include in data written acceptance by the roof membrane manufacturer of the products and accessories provided. Products must be as listed in the applicable wind uplift and fire rating classification listings, unless approved otherwise by the Contracting Officer.

SD-05 Design Data

Wind Uplift Calculations

Provide Engineering calculations validating the wind resistance per ASCE 7, ASTM D4073, and ANSI/SPRI ES-1 of non-rated roof system.

SD-07 Certificates

Provide evidence that products used within this specification are manufactured in the United States.

Qualification of Manufacturer

Certify that the manufacturer of the modified bitumen membrane meets requirements specified under paragraph entitled "Qualification of Manufacturer."

Qualification of Applicator

Certify that the applicator meets requirements specified under paragraph entitled "Qualification of Applicator."

Bill of Lading

Submit bill of lading when labels of asphalt containers do not bear the flash point (FP), finished blowing temperature (FBT), and equiviscous temperature (EVT).

Wind Uplift Resistance classification, as applicable

Fire Resistance classification

Submit the roof system assembly wind uplift and fire rating classification listings.

SD-08 Manufacturer's Instructions

Modified Bitumen Membrane Application

Flashing

Cold Adhesive Applied Modified Bitumen Membrane

Base Sheet attachment, including pattern and frequency of mechanical attachments required in field of roof, corners, and perimeters to provide for the specified wind resistance.

Primer

Fasteners

Coating Application

Cold Weather Installation

Include detailed application instructions and standard manufacturer drawings altered as required by these specifications. Explicitly identify in writing, differences between manufacturer's instructions and the specified requirements.

SD-11 Closeout Submittals

Warranty

Information Card

Instructions To Government Personnel

Include copies of Material Safety Data Sheets for maintenance/repair materials.

Submit 20 year "No-Dollar-Limit" warranty for labor and materials.

1.4 QUALITY ASSURANCE

1.4.1 Qualification of Manufacturer

Modified bitumen sheet roofing system manufacturer must have a minimum of 5 years experience in manufacturing modified bitumen roofing products.

1.4.2 Qualification of Applicator

Roofing system applicator must be approved, authorized, or licensed in writing by the modified bitumen sheet roofing system manufacturer and have a minimum of 3 years experience as an approved, authorized, or licensed applicator with that manufacturer and be approved at a level capable of providing the specified warranty. The applicator must supply the names, locations and client contact information of five projects of similar size and scope that the applicator has constructed using the manufacturer's roofing products submitted for this project within the previous three years.

1.4.3 Fire Resistance

Complete roof covering assembly must:

- a. Be Class A rated in accordance with ASTM E108, FM 4470, or UL 790; and
- b. Be listed as part of Fire-Classified roof deck construction in UL RMSD, or Class I roof deck construction in FM APP GUIDE.

FM or UL approved components of the roof covering assembly must bear the appropriate FM or UL label.

1.4.4 Wind Uplift Resistance

Complete roof covering assembly, including insulation, must be rated Class 1-120 in accordance with FM APP GUIDE and ASTM D4073 capable of withstanding an uplift pressure of 60 psf. Non-rated systems must not be installed, except as approved by the Contracting Officer. Provide wind load calculations and submit engineering calculations with substantiating data to validate wind resistance of any non-rated roof system. Base all Wind uplift calculations on a design wind speed of 130 mph in accordance with ASCE 7, ASTM D4073, or applicable building code requirements.

1.4.5 Preroofing Conference

After approval of submittals and before performing roofing and insulation system installation work, hold a preroofing conference to review the following:

- a. Drawings, including Roof Plan, specifications and submittals related to the roof work

Field inspection and verification of all existing conditions, including all fire safety issues, existing structure, and existing materials, including concealed combustibles, which may require additional protection during installation.
- b. Roof system components installation
- c. Procedure for the roof manufacturer's technical representative's onsite inspection and acceptance of the roof structure, and roofing substrate, the name of the manufacturer's technical representatives, the frequency of the onsite visits, distribution of copies of the inspection reports from the manufacturer's technical representatives to roof manufacturer
- d. Contractor's plan for coordination of the work of the various trades involved in providing the roofing system and other components secured to the roofing
- e. Quality control, (ARMA PMBRG98) plan for the roof system installation
- f. Safety requirements

Coordinate preroofing conference scheduling with the Contracting Officer. The conference must be attended by the Contractor, the Contracting Officer's designated personnel, and personnel directly responsible for the installation of roofing and insulation, flashing and sheet metal work, electrical work, other trades interfacing with the roof work, designated safety personnel trained to enforce and comply with ASSE/SAFE A10.24, and representative of the roofing materials manufacturer. Before beginning roofing work, provide a copy of meeting notes and action items to all attending parties. Note action items requiring resolution prior to start

of roof work.

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Delivery

Deliver materials in manufacturers' original unopened containers and rolls with labels intact and legible. Mark and remove wet or damaged materials from the site. Where materials are covered by a referenced specification, the container must bear the specification number, type, and class, as applicable. Deliver materials in sufficient quantity to allow work to proceed without interruption.

1.5.2 Storage

Protect materials against moisture absorption and contamination or other damage. Avoid crushing or crinkling of roll materials. Store roll materials on end on clean raised platforms or pallets one level high in dry locations with adequate ventilation, such as an enclosed building or closed trailer. Do not store roll materials in buildings under construction until concrete, mortar, and plaster work is finished and dry. Maintain roll materials at temperatures above 50 degrees F for 24 hours immediately before application. Do not store materials outdoors unless approved by the Contracting Officer. Completely cover felts stored outdoors, on and off roof, with waterproof canvas protective covering. Do not use polyethylene sheet as a covering. Tie covering securely to pallets to make completely weatherproof. Provide sufficient ventilation to prevent condensation. Do not store more materials on roof than can be installed the same day and remove unused materials at end of each days work. Distribute materials temporarily stored on roof to stay within live load limits of the roof construction.

Immediately remove wet, contaminated or otherwise damaged or unsuitable materials from the site. Damaged materials may be marked by the Contracting Officer.

1.5.3 Handling

Prevent damage to edges and ends of roll materials. Do not install damaged materials in the work. Select and operate material handling equipment to prevent damage to materials or applied roofing.

1.6 ENVIRONMENTAL REQUIREMENTS

Do not install roofing system when air temperature is below 40 degrees F, during any form of precipitation, including fog, or when there is ice, frost, moisture, or any other visible dampness on the roof deck. Follow manufacturer's printed instructions for Cold Weather Installation.

1.7 SEQUENCING

Coordinate the work with other trades to ensure that components which are to be secured to or stripped into the roofing system are available and that permanent flashing and counter flashing, per NRCA Details, and are installed as the work progresses. Ensure temporary protection measures are in place to preclude moisture intrusion or damage to installed materials. Application of roofing must immediately follow application of insulation as a continuous operation. Coordinate roofing operations with insulation work so that all roof insulation applied each day is covered with roof membrane

installation the same day.

1.8 WARRANTY

Provide roof system material and workmanship warranties meeting specified requirements. Provide revision or amendment to standard membrane manufacturer warranty as required to comply with the specified requirements.

1.8.1 Roof Membrane Manufacturer Warranty

Furnish the roof membrane manufacturer's 20-year no dollar limit roof system materials and installation workmanship warranty, including flashing, insulation in compliance with ASTM C1289, and accessories necessary for a watertight roof system construction. Provide warranty directly to the Government and commence warranty effective date at time of Government's acceptance of the roof work. The warranty must state that:

- a. If within the warranty period the roof system, as installed for its intended use in the normal climatic and environmental conditions of the facility, becomes non-watertight, shows evidence of moisture intrusion within the assembly, blisters, splits, tears, delaminates, separates at the seams, or shows evidence of excessive weathering due to defective materials or installation workmanship, the repair or replacement of the defective and damaged materials of the roof system assembly and correction of defective workmanship are the responsibility of the roof membrane manufacturer. All costs associated with the repair or replacement work are the responsibility of the roof membrane manufacturer.
- b. When the manufacturer or his approved applicator fail to perform the repairs within 72 hours of notification, emergency temporary repairs performed by others does not void the warranty.
- c. Damage to the roofing system caused by 3-second wind gust having a velocity of 130 mph or less is covered by the warranty.

1.8.2 Roofing System Installer Warranty

The roof system installer must warrant for a period of not less than two years that the roof system, as installed, is free from defects in installation workmanship, to include the roof membrane, flashing, insulation, accessories, attachments, and sheet metal installation integral to a complete watertight roof system assembly. Make warranty directly to the Government. Correction of defective workmanship and replacement of damaged or affected materials are the responsibility of the roof system installer. All costs associated with the repair or replacement work are the responsibility of the installer.

1.8.3 Continuance of Warranty

Repair or replacement work, ARMA 410BUR88, ARMA 460LSR97 that becomes necessary within the warranty period must be approved, as required, and accomplished in a manner so as to restore the integrity of the roof system assembly and validity of the roof membrane manufacturer warranty for the remainder of the manufacturer warranty period.

1.9 CONFORMANCE AND COMPATIBILITY

The entire roofing and flashing system must be in accordance with specified

and indicated requirements, including fire and wind resistance (ANSI/SPRI ES-1) requirements. Work not specifically addressed and any deviation from specified requirements must be in general accordance with recommendations of the NRCA Roofing and Waterproofing Manual, membrane manufacturer published recommendations and details, and compatible with surrounding components and construction. Submit any deviation from specified or indicated requirements to the Contracting Officer for approval prior to installation.

PART 2 PRODUCTS

2.1 MODIFIED BITUMEN SHEETS AND FIBERGLASS FELT MATERIALS

Furnish a combination of specified materials that comprise the modified bitumen manufacturer's standard system of the number and type of plies specified. Materials provided must be suitable for the service and climatic conditions of the installation. Modified bitumen sheets must be watertight and visually free of pinholes, particles of foreign matter, non-dispersed raw material, factory splices, or other conditions that might affect serviceability. Polymer modifier must comply with ARMA PMBRG98 and be uniformly dispersed throughout the sheet. Edges of sheet must be straight and flat.

- a. SBS Base Sheet: ASTM D6164, Type II, Grade S, minimum 160 mils thick.
- b. SBS Cap Sheet: ASTM D6164; Type II, Grade G, minimum 160 thick at selvage edge, and as required to provide specified fire safety rating.

2.2 BASE FLASHING MEMBRANE

Membrane manufacturer's standard, minimum two-ply modified bitumen membrane flashing system compatible with the roof membrane specified and as recommended in membrane manufacturer's published literature. Flashing membranes must meet or exceed the properties of the material standards specified for the modified bitumen base and cap sheet, except that flashing membrane thickness must be as recommended by the membrane manufacturer.

When flashing heights do not meet manufacturer's minimum requirements, utilize manufacturer's recommended liquid applied flashing system.

2.3 COLD-APPLIED MEMBRANE ADHESIVE

Membrane manufacturer's recommended low volatile organic compound (VOC) cold process adhesive for application of the membrane plies.

2.4 MEMBRANE SURFACING

Provide modified bitumen roof membrane cap sheet with factory-applied granule surfacing of light color as selected from membrane manufacturer's standard colors. Provide modified bitumen membrane manufacturer's recommended field-applied protective reflective coating of white color meeting a minimum 78 SRI. Two coats at a coverage rate of 1.5 gal/sq as indicated on drawing. Apply coating no sooner than 30 days after installation of cap sheets.

2.5 PRIMER

ASTM D41/D41M, or other primer compatible with the application and as approved in writing by the modified bitumen membrane manufacturer.

2.6 MODIFIED BITUMEN ROOF CEMENT

ASTM D4586, Type II for vertical surfaces, Type I for horizontal surfaces, compatible with the modified bitumen roof membrane and as recommended by the modified bitumen membrane manufacturer.

2.7 FASTENERS AND PLATES

Provide coated, corrosion-resistant fasteners as recommended by the modified bitumen sheet manufacturer's printed instructions and meeting the requirements of FM 4470 and FM APP GUIDE for Class I roof deck construction and the wind uplift resistance specified. For fastening of membrane or felts to wood materials, provide fasteners driven through 1 inch diameter metal discs, or one piece composite fasteners with heads not less than 1 inch in diameter or 1 inch square with rounded or 45 degree tapered corners.

2.7.1 Masonry or Concrete Walls and Vertical Surfaces

Use hardened steel nails or screws with flat heads, diamond shaped points, and mechanically deformed shanks not less than 1 inch long for securing felts, modified bitumen sheets, metal items, and accessories to masonry or concrete walls and vertical surfaces. Use power-driven fasteners only when approved in writing by the Contracting Officer.

2.7.2 Metal Plates

Provide flat corrosion-resistant round stress plates as recommended by the modified bitumen sheet manufacturer's printed instructions and meeting the requirements of FM 4470; not less than 2 inch in diameter. Form discs to prevent dishing or cupping.

2.8 PRE-MANUFACTURED ACCESSORIES

Pre-manufactured accessories must be manufacturer's standard for intended purpose, compatible with the membrane roof system and approved for use by the modified bitumen membrane manufacturer.

2.9 WALKPADS

Roof walkpads must be polyester reinforced, granule-surfaced modified bitumen membrane material, minimum 200 mils thick, compatible with the modified bitumen sheet roofing and as recommended by the modified bitumen sheet roofing manufacturer. Panels must not exceed 4 foot in length. Other walkpad materials require approval of the Contracting Officer prior to installation. Walkpad surface color shall contrast with the cap sheet color.

2.10 ROOF INSULATION BELOW MODIFIED BITUMEN MEMBRANE SYSTEM

Insulation must be compatible with the roof membrane, approved by the membrane manufacturer and meeting all the requirements of as specified in Section 07 22 00 ROOF AND DECK INSULATION.

PART 3 EXECUTION

3.1 EXAMINATION

Ensure that the following conditions exist prior to application of the

roofing materials:

- a. Curbs, perimeter walls, roof penetrating components, and equipment supports are in place.
- b. Surfaces are rigid, clean, dry, smooth, and free from cracks, holes, and sharp changes in elevation. Joints in the substrate are sealed to prevent dripping of bitumen into building or down exterior walls.
- c. The plane of the substrate does not vary more than 1/4 inch within an area 10 by 10 foot when checked with a 10 foot straight edge placed anywhere on the substrate.
- d. Substrate is sloped as indicated to provide positive drainage.
- e. Walls and vertical surfaces are constructed to receive counter flashing, and will permit mechanical fastening of the base flashing materials.
- f. Treated wood nailers are in place on non-nailable surfaces, to permit nailing of base flashing at minimum height of 8 inch above finished roofing surface.
- g. Protect all combustible materials and surfaces which may contain concealed combustible or flammable materials. All fire extinguishing equipment has been placed as specified.
- h. Treated wood nailers are fastened in place openings, and intersections with vertical surfaces for securing of membrane, edging strips, attachment flanges of sheet metal, and roof fixtures. Surface-applied nailers are the same thickness as the roof insulation.
- i. Exposed nail heads in wood substrates are properly set. Warped and split boards have been replaced. There are no cracks or end joints 1/4 inch in width or greater. Knot holes are covered with sheet metal and nailed in place. Wood decks are covered with rosin paper or unsaturated felt prior to base sheet or roof membrane application.
- j. Insulation boards are installed smoothly and evenly, and are not broken, cracked, or curled. There are no gaps in insulation board joints exceeding 1/4 inch in width. Insulation is being roofed over on the same day the insulation is installed.

3.2 PREPARATION

3.2.1 Protection of Property

3.2.1.1 Protective Coverings

Install protective coverings at paving and building walls adjacent to hoists prior to starting the work. Lap protective coverings not less than 6 inch, secure against wind, and vent to prevent collection of moisture on covered surfaces. Keep protective coverings in place for the duration of the roofing work.

3.2.2 Equipment

3.2.2.1 Mechanical Application Devices

Mount mechanical application devices on pneumatic-tired wheels. Use devices designed and maintained to operate without damaging the insulation, roofing membrane, or structural components.

3.2.2.2 Electric-Heated Equipment

Provide adequate electrical service as required by manufacturer of electrical equipment to ensure against damage to equipment and property and to ensure proper application of roofing materials.

3.2.3 Priming of Surfaces

Prime all surfaces to be in contact with adhered membrane materials. Apply primer at the rate of 0.75 gallon per 100 sq. ft. or as recommended by modified bitumen sheet manufacturer's printed instructions to promote adhesion of membrane materials. Allow primer to dry prior to application of membrane materials to primed surface. Avoid flammable primer material conditions in torch applied membrane applications.

3.2.3.1 Priming of Concrete and Masonry Surfaces

After surface dryness requirements have been met, coat concrete and masonry surfaces which are to receive membrane materials uniformly with primer.

3.2.3.2 Priming of Metal Surfaces

Prime flanges of metal components to be embedded into the roof system prior to setting in bituminous materials or stripping into roofing system.

3.2.4 Membrane Preparation

Unroll modified bitumen membrane materials and allow to relax a minimum of 30 minutes prior to installation. In cold weather, adhere to membrane manufacturer's additional recommendations for pre-installation membrane handling and preparation. Inspect for damage, pinholes, particles of foreign matter, non-dispersed raw material, factory splices, or other conditions that might affect serviceability. Edges of seams must be straight and flat so that they may be seamed to one another without forming fish mouths or wrinkles. Discard damaged or defective materials.

3.2.5 Substrate Preparation

Apply membrane to clean, dry surfaces only. Don not apply membrane to surfaces that have been wet by rain or frozen precipitation within the previous 12 hours. Provide cleaning and artificial drying with heated blowers or torches as necessary to ensure clean, dry surface prior to membrane application.

3.3 APPLICATION

Apply roofing materials as specified herein unless approved otherwise by the Contracting Officer. Keep roofing materials dry before and during application. Complete application of roofing in a continuous operation. Begin and apply only as much roofing in one day as can be completed that same day. Maintain specified temperatures for asphalt. Provide temporary

roofing and flashing as specified herein prior to application of permanent roofing system.

3.3.1 Phased Membrane Construction

Phased application of membrane plies is prohibited unless otherwise approved by the Contracting Officer and supported by the membrane manufacturer's written application instructions. If cap sheet installation is delayed, thoroughly clean the applied membrane material surface and dry immediately prior to cap sheet installation. Priming of the applied membrane surface may be required at the discretion of the Contracting Officer prior to cap sheet installation.

3.3.2 Temporary Roofing and Flashing

Provide watertight temporary roofing and flashing where considerable work by other trades, such as installing cooling towers, pipes, ducts, is to be performed on the roof or where construction scheduling or weather conditions require protection of the building's interior before permanent roofing system can be installed. Do not install temporary roofing over permanently installed insulation. Provide rigid pads for traffic over temporary roofing.

3.3.2.1 Removal

Completely remove temporary roofing and flashing before continuing with application of the permanent roofing system.

3.3.3 Application Method

3.3.3.1 Cold Adhesive Applied Modified Bitumen Membrane

Apply cold adhesive with airless sprayer or 1/4 inch saw-toothed rubber squeegee to prepared surfaces in accordance with membrane manufacturer's application instructions. Fully cover substrate with adhesive. Roll or lay membrane in adhesive in accordance with manufacturer's recommendations and within the time limitations of adhesive application. Broom the membrane to ensure full contact with adhesive. Seal laps with adhesive or by heat fusing with torch or hot air welder as required by membrane manufacturer. Minimize traffic on installed membrane during the adhesive cure and set time.

3.3.4 Modified Bitumen Membrane Application

Ensure proper sheet alignment prior to installation. Apply membrane layers perpendicular to slope of roof in shingle fashion to shed water, including application on areas of tapered insulation that change slope direction. Bucking or backwater laps are prohibited. Mechanically fasten in the side lap directly to the wood and metal deck. Quantity, size and spacing of fasteners shall be as required to meet the design wind loads. Provide minimum 3 inch side laps and minimum 6 inch end laps and as otherwise required by membrane manufacturer. Stagger end laps minimum 36 inch. Offset side laps between membrane layers a minimum of 12 inch. Offset end laps between membrane layers a minimum of 36 inch. Install all membrane layers the same workday, unless supported otherwise by roof membrane manufacturer application instructions and approved by the Contracting Officer. Provide tight smooth laminations of each membrane layer without wrinkles, ridges, buckles, kinks, fishmouths, or voids. Ensure full membrane adhesion and full lap seals. Rework to seal any open laps prior

to application of subsequent membrane layers. The completed membrane application must be free of surface abrasions, air pockets, blisters, ridges, wrinkles, buckles, kinks, fishmouths, voids, or open seams.

3.3.4.1 Cap Sheet Installation

Underlying applied membrane must be inspected and repaired free of damage, holes, puncture, gouges, abrasions, and any other defects, and free of moisture, loose materials, debris, sediments, dust, and any other conditions required by the membrane manufacturer prior to cap sheet installation. Do not apply cap sheet if rain or frozen precipitation has occurred within the previous 24 hours. Align cap membrane and apply by the specified method with the proper side and end lap widths. Set cap sheet in cold applied adhesive as recommended by the modified bitumen membrane manufacturer. Cut at a 45 degree angle across selvage edge of cap membrane to be overlapped in end lap areas prior to applying overlapping cap membrane. Apply matching granules in any areas of adhesive bleed out while the adhesive is still tacky. Minimize traffic on newly installed cap sheet membrane.

3.3.5 Membrane Flashing

Apply two-ply modified bitumen strip flashing and sheet flashing in the angles formed where the roof deck abuts walls, curbs, ventilators, pipes, and other vertical surfaces, and where necessary to make the work watertight. Apply membrane flashing in accordance with the roof membrane manufacturers printed instructions and as specified. Cut at a 45 degree angle across terminating end lap area of cap membrane prior to applying adjacent overlapping cap membrane. Press flashing into place to ensure full adhesion and avoid bridging. Ensure full lap seal in all lap areas. Mechanically fasten top edge of modified bituminous base flashing (6 inches) on center through minimum 1 inch diameter tin caps with fasteners of sufficient length to embed minimum one inch into attachment substrate. Apply matching granules in any areas of adhesive bleed out while the adhesive is still tacky. Apply membrane liner over top of exposed nailers and blocking and to overlap top edge of base flashing installation at curbs, parapet walls, expansion joints and as otherwise indicated to serve as waterproof lining under sheet metal flashing components. Metal flashing per SMACNA 1793 guidelines and standards is specified under Section 07 60 00 FLASHING AND SHEET METAL. Do not set metal flashing in hot asphalt.

3.3.5.1 Membrane Strip Flashing

Set primed flanges of metal flashing in full bed of modified bituminous cement material and securely fasten through to attachment substrate. Strip-in with membrane flashing so that strip extends not less than 4 inch beyond outer edge of flange. Where multiple membrane stripping plies are installed, extend each additional stripping ply minimum 4 inch beyond edge of previous ply.

3.3.5.2 Set-On Accessories

Where pipe or conduit blocking, supports and similar roof accessories are set on the membrane, adhere walkpad material to bottom of accessories prior to setting on roofing membrane. Specific method of installing set-on accessories must permit normal movement due to expansion, contraction, vibration, and similar occurrences without damaging roofing membrane. Do not mechanically secure set-on accessories through roofing membrane into roof deck substrate.

3.3.6 Roof Walkpads

Install walkpads at roof access points and where otherwise indicated for traffic areas and for access to mechanical equipment, in accordance with the modified bitumen sheet roofing manufacturer's printed instructions. Provide minimum 6 inch separation between adjacent walkpads to accommodate drainage. Provide walkpad or an additional layer of cap sheet under precast concrete splash blocks to protect the roofing.

3.3.7 Concrete Splash Blocks

Reinstall concrete splash blocks where indicated . Set splash blocks on a layer of walkpad or cap sheet applied over the completed roof membrane.

3.3.8 Field Applied Surfacing

After completion of roof membrane and flashing installation, and correction of tears, gouges, and other deficiencies in the installed work, apply specified surfacing.

3.3.8.1 Coating Application

Apply surface coating materials to membrane and flashing in accordance with coating material manufacturer's recommendations.

3.3.9 Correction of Deficiencies

Where any form of deficiency is found, additional measures will be taken as deemed necessary by the Contracting Officer to determine the extent of the deficiency and corrective actions must be performed as directed by the Contracting Officer.

3.3.10 Clean Up

Remove debris, scraps, containers and other rubbish and trash resulting from installation of the roofing system from job site each day.

3.4 PROTECTION OF APPLIED ROOFING

At the end of the day's work and when precipitation is imminent, protect applied modified bitumen roofing system from water intrusion.

3.4.1 Water Cutoffs

Straighten insulation line using loose-laid cut insulation sheets and seal the terminated edge of modified bitumen roofing system in an effective manner. Seal off flutes in metal decking along the cutoff edge. Remove the water cut-offs to expose the insulation when resuming work, and remove the insulation sheets used for fill-in.

3.4.2 Temporary Flashing for Permanent Roofing

Provide temporary flashing at drains, curbs, walls and other penetrations and terminations of roofing sheets until permanent flashing can be applied. Remove temporary flashing before applying permanent flashing.

3.4.3 Temporary Walkways, Runways, and Platforms

Do not permit storing, walking, wheeling, and trucking directly on applied roofing materials. Provide temporary walkways, runways, and platforms of smooth clean boards, mats or planks as necessary to avoid damage to applied roofing materials, and to distribute weight to conform to live load limits of roof construction. Use rubber-tired equipment for roofing work.

3.5 FIELD QUALITY CONTROL

Perform field tests in the presence of the Contracting Officer. Notify the Contracting Officer one day before performing tests.

3.5.1 Construction Monitoring

During progress of the roof work, Contractor must make visual inspections as necessary to ensure compliance with specified parameters. Additionally, verify the following:

- a. Materials comply with the specified requirements.
- b. Materials are not installed in adverse weather conditions.

All materials are properly stored, handled and protected from moisture or other damages.
- c. Equipment is in working order. Metering devices are accurate.
- d. Substrates are in acceptable condition, in compliance with specification, prior to application of subsequent materials.

- (1) Nailers and blocking are provided where and as needed.

Insulation substrate is smooth, properly secured to its substrate, and without excessive gaps prior to membrane application.

- (2) The proper number, type, and spacing of fasteners are installed.

Membrane heating, hot mopping, or adhesive application is provided uniformly and as necessary to ensure full adhesion of roll materials. Asphalt is heated and applied within the specified temperature range.

The proper number and types of plies are installed, with the specified overlaps.

Applied membrane surface is inspected, cleaned, dry, and repaired as necessary prior to cap sheet installation.

- (3) Lap areas of all plies are completely sealed.

Membrane is fully adhered without ridges, wrinkles, kinks, fishmouths, or other voids or delaminations.

Installer adheres to specified and detailed application parameters.

Associated flashing and sheet metal are installed in a timely manner in accord with the specified requirements.

Temporary protection measures are in place at the end of each work shift.

3.5.1.1 Manufacturer's Inspection

Manufacturer's technical representative must visit the site a minimum of once per week during the installation for purposes of reviewing materials installation practices and adequacy of work in place. Follow-up inspections of previously noted deficiencies or application errors must be performed as requested by the Contracting Officer. After each inspection, submit a report, signed by the manufacturer's technical representative to the Contracting Officer within 3 working days. Note in the report overall quality of work, deficiencies and any other concerns, and recommended corrective action.

3.6 INSTRUCTIONS TO GOVERNMENT PERSONNEL

Furnish written and verbal instructions on proper maintenance procedures to designated Government personnel. Furnish instructions by a competent representative of the modified bitumen membrane manufacturer and include a minimum of 4 hours on maintenance and emergency repair of the membrane. Include a demonstration of membrane repair, and give sources of required special tools. Furnish information on safety requirements during maintenance and emergency repair operations.

3.7 INFORMATION CARD

For each roof, furnish a typewritten information card for facility Records and a card laminated in plastic and framed for interior display at roof access point, or a photoengraved 0.039 inch thick aluminum card for exterior display. Card must be 8 1/2 by 11 inch minimum. Information card must identify facility name and number; location; contract number; approximate roof area; detailed roof system description, including deck type, membrane, number of plies, method of application, manufacturer, insulation and cover board system and thickness; presence of tapered insulation for primary drainage, presence of vapor barrier material; date of completion; installing contractor identification and contact information; membrane manufacturer warranty expiration, warranty reference number, and contact information. The card must be a minimum size of 8 1/2 by 11 inch. Install card at roof top or access location as directed by the Contracting Officer and provide a paper copy to the Contracting Officer.

-- End of Section --

SECTION 07 60 00

FLASHING AND SHEET METAL

08/08

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 WELDING SOCIETY (AWS)

AWS D1.2/D1.2M (2008) Structural Welding Code - Aluminum

ASTM INTERNATIONAL (ASTM)

ASTM B209 (2010) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

ASTM D4586 (2007) Asphalt Roof Cement, Asbestos-Free

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

SMACNA 1793 (2003) Architectural Sheet Metal Manual, 6th Edition

1.2 GENERAL REQUIREMENTS

Finished sheet metalwork will form a weathertight construction without waves, warps, buckles, fastening stresses or distortion, which allows for expansion and contraction. Sheet metal mechanic is responsible for cutting, fitting, drilling, and other operations in connection with sheet metal required to accommodate the work of other trades. Coordinate installation of sheet metal items used in conjunction with roofing with roofing work to permit continuous roofing operations.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for A/E approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Gutters

Downspouts

Gravel stops and fascias

Base flashing

Counterflashing

Flashing at roof penetrations

Reglets

Copings

Drip edge

Indicate thicknesses, dimensions, fastenings and anchoring methods, expansion joints, and other provisions necessary for thermal expansion and contraction. Scaled manufacturer's catalog data may be submitted for factory fabricated items.

1.4 DELIVERY, HANDLING, AND STORAGE

Package and protect materials during shipment. Uncrate and inspect materials for damage, dampness, and wet-storage stains upon delivery to the job site. Remove from the site and replace damaged materials that cannot be restored to like-new condition. Handle sheet metal items to avoid damage to surfaces, edges, and ends. Store materials in dry, weather-tight, ventilated areas until immediately before installation.

PART 2 PRODUCTS

2.1 MATERIALS

Do not use lead, lead-coated metal, or galvanized steel. Use any metal listed by SMACNA Arch. Manual for a particular item, unless otherwise specified or indicated. Conform to the requirements specified and to the thicknesses and configurations established in SMACNA Arch. Manual for the materials. Different items need not be of the same metal, except that if copper is selected for any exposed item, all exposed items must be copper.

Furnish sheet metal items in 8 to 10 foot lengths. Single pieces less than 8 feet long may be used to connect to factory-fabricated inside and outside corners, and at ends of runs. Factory fabricate corner pieces with minimum 12 inch legs. Provide accessories and other items essential to complete the sheet metal installation. Provide accessories made of the same or compatible materials as the items to which they are applied. Fabricate sheet metal items of the materials specified below and to the gage, thickness, or weight shown in Table I at the end of this section. Provide sheet metal items with mill finish unless specified otherwise. Where more than one material is listed for a particular item in Table I, each is acceptable and may be used except as follows:

2.1.1 Exposed Sheet Metal Items

Must be of the same material. Consider the following as exposed sheet metal: gutters, including hangers; downspouts; gravel stops and fascias; cap, base, and eave flashings and related accessories.

2.1.2 Aluminum Alloy Sheet and Plate

ASTM B209 color to match existing form alloy, and temper appropriate for use.

2.1.2.1 Alclad

When fabricated of aluminum, fabricate the items Alclad 3003, Alclad 3004,

Alclad 3005, clad on one side unless otherwise indicated.

- a. Gutters, downspouts, and hangers
- b. Gravel stops and fascias
- c. Flashing

2.1.2.2 Finish

Exposed exterior sheet metal items of aluminum must have a baked-on, factory-applied color coating of polyvinylidene fluoride (PVF2) or other equivalent fluorocarbon coating applied after metal substrates have been cleaned and pretreated. Provide finish coating dry-film thickness of 0.8 to 1.3 mils and color to match existing.

2.1.3 Bituminous Plastic Cement

ASTM D4586, Type I.

2.1.4 Fasteners

Use the same metal or a metal compatible with the item fastened. Use stainless steel fasteners to fasten dissimilar materials.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Workmanship

Make lines and angles sharp and true. Free exposed surfaces from visible wave, warp, buckle, and tool marks. Fold back exposed edges neatly to form a 1/2 inch hem on the concealed side. Make sheet metal exposed to the weather watertight with provisions for expansion and contraction.

Make surfaces to receive sheet metal plumb and true, clean, even, smooth, dry, and free of defects and projections. For installation of items not shown in detail or not covered by specifications conform to the applicable requirements of SMACNA 1793, Architectural Sheet Metal Manual. Provide sheet metal flashing in the angles formed where roof decks abut walls, curbs, ventilators, pipes, or other vertical surfaces and wherever indicated and necessary to make the work watertight. Join sheet metal items together as shown in Table II.

3.1.2 Nailing

Confine nailing of sheet metal generally to sheet metal having a maximum width of 18 inch. Confine nailing of flashing to one edge only. Space nails evenly not over 3 inch on center and approximately 1/2 inch from edge unless otherwise specified or indicated. Face nailing will not be permitted. Where sheet metal is applied to other than wood surfaces, include in shop drawings, the locations for sleepers and nailing strips required to secure the work.

3.1.3 Cleats

Provide cleats for sheet metal 18 inch and over in width. Space cleats evenly not over 12 inch on center unless otherwise specified or indicated.

Unless otherwise specified, provide cleats of 2 inch wide by 3 inch long and of the same material and thickness as the sheet metal being installed. Secure one end of the cleat with two nails and the cleat folded back over the nailheads. Lock the other end into the seam. Where the fastening is to be made to concrete or masonry, use screws and drive in expansion shields set in concrete or masonry. Pretin cleats for soldered seams.

3.1.4 Bolts, Rivets, and Screws

Install bolts, rivets, and screws where indicated or required. Provide compatible washers where required to protect surface of sheet metal and to provide a watertight connection. Provide mechanically formed joints in aluminum sheets 0.040 inch or less in thickness.

3.1.5 Seams

Straight and uniform in width and height with no solder showing on the face.

3.1.5.1 Lap Seams

Finish soldered seams not less than one inch wide. Overlap seams not soldered, not less than 3 inch.

3.1.6 Soldering

Where soldering is specified, apply to copper, terne-coated stainless steel, zinc-coated steel, and stainless steel items. Pretin edges of sheet metal before soldering is begun. Seal the joints in aluminum sheets of 0.040 inch or less in thickness with specified sealants. Do not solder aluminum.

3.1.6.1 Edges

Scrape or wire-brush the edges of lead-coated material to be soldered to produce a bright surface. Flux brush the seams in before soldering. Treat with soldering acid flux the edges of stainless steel to be pretinned. Seal the joints in aluminum sheets of 0.040 inch or less in thickness with specified sealants. Do not solder aluminum.

3.1.7 Welding and Mechanical Fastening

Use welding for aluminum of thickness greater than 0.040 inch. Aluminum 0.040 inch or less in thickness must be butted and the space backed with formed flashing plate; or lock joined, mechanically fastened, and filled with sealant as recommended by the aluminum manufacturer.

3.1.7.1 Welding of Aluminum

Use welding of the inert gas, shield-arc type. For procedures, appearance and quality of welds, and the methods used in correcting welding work, conform to AWS D1.2/D1.2M.

3.1.7.2 Mechanical Fastening of Aluminum

Use No. 12, aluminum alloy, sheet metal screws or other suitable aluminum alloy or stainless steel fasteners. Drive fasteners in holes made with a No. 26 drill in securing side laps, end laps, and flashings. Space fasteners 12 inch maximum on center. Where end lap fasteners are required to improve closure, locate the end lap fasteners not more than 2 inch from

the end of the overlapping sheet.

3.1.8 Protection from Contact with Dissimilar Materials

3.1.8.1 Aluminum

Do not allow aluminum surfaces in direct contact with other metals except stainless steel, zinc, or zinc coating. Where aluminum contacts another metal, paint the dissimilar metal with a primer followed by two coats of aluminum paint. Where drainage from a dissimilar metal passes over aluminum, paint the dissimilar metal with a non-lead pigmented paint.

3.1.8.2 Metal Surfaces

Paint surfaces in contact with mortar, concrete, or other masonry materials with alkali-resistant coatings such as heavy-bodied bituminous paint.

3.1.8.3 Wood or Other Absorptive Materials

Paint surfaces that may become repeatedly wet and in contact with metal with two coats of aluminum paint or a coat of heavy-bodied bituminous paint.

3.1.9 Expansion and Contraction

Provide expansion and contraction joints at not more than 32 foot intervals for aluminum and at not more than 40 foot intervals for other metals. Provide an additional joint where the distance between the last expansion joint and the end of the continuous run is more than half the required interval. Space joints evenly. Join extruded aluminum gravel stops and fascias by expansion and contraction joints spaced not more than 12 feet apart.

3.1.10 Base Flashing

3.1.11 Counterflashing

Except where indicated or specified otherwise, insert counterflashing in reglets located from 9 to 10 inch above roof decks, extend down vertical surfaces over upturned vertical leg of base flashings not less than 3 inch. Fold the exposed edges of counterflashings 1/2 inch. Provide end laps in counterflashings not less than 3 inch and make it weathertight with plastic cement. Do not make lengths of metal counterflashings exceed 10 feet. Form the flashings to the required shapes before installation. Factory-form the corners not less than 12 inch from the angle. Secure the flashings in the reglets with lead wedges and space not more than 18 inch apart; on short runs, place wedges closer together. Fill caulked-type reglets or raked joints which receive counterflashing with caulking compound. Turn up the concealed edge of counterflashings built into masonry or concrete walls not less than 1/4 inch and extend not less than 2 inch into the walls. Install counterflashing to provide a spring action against base flashing. Where bituminous base flashings are provided, extend down the counter flashing as close as practicable to the top of the cant strip. Factory form counter flashing to provide spring action against the base flashing.

3.1.12 Metal Reglets

Provide factory fabricated caulked type or friction type reglets with a minimum opening of 1/4 inch and a depth of 1 1/4 inch, as approved.

3.1.12.1 Caulked Reglets

Provide with rounded edges and metal strap brackets or other anchors for securing to the concrete forms. Provide reglets with a core to protect them from injury during the installation. Provide built-up mitered corner pieces for internal and external angles. Wedge the flashing in the reglets with lead wedges every 18 inch, caulked full and solid with an approved compound.

3.1.12.2 Friction Reglets

Provide with flashing receiving slots not less than 5/8 inch deep, one inch jointing tongues, and upper and lower anchoring flanges installed at 24 inch maximum snaplock receiver. Insert the flashing the full depth of the slot and lock by indentations made with a dull-pointed tool, wedges, and filled with a sealant. For friction reglets, install flashing snaplock receivers at 24 inch on center maximum. When the flashing has been inserted the full depth, caulk the slot and lock with wedges and fill with sealant.

3.1.13 Gravel Stops and Fascias

Prefabricate in the shapes and sizes indicated and in lengths not less than 8 feet. Extend flange at least 4 inch onto roofing. Provide prefabricated, mitered corners internal and external corners. Install gravel stops and fascias after all plies of the roofing membrane have been applied, but before the flood coat of bitumen is applied. Prime roof flange of gravel stops and fascias on both sides with an asphalt primer. After primer has dried, set flange on roofing membrane and strip-in. Nail flange securely to wood nailer with large-head, barbed-shank roofing nails 1.5 inch long spaced not more than 3 inch on center, in two staggered rows.

3.1.13.1 Edge Strip

Hook the lower edge of fascias at least 3/4 inch over a continuous strip of the same material bent outward at an angle not more than 45 degrees to form a drip. Nail hook strip to a wood nailer at 6 inch maximum on center. Where fastening is made to concrete or masonry, use screws spaced 12 inch on center driven in expansion shields set in the concrete or masonry. Where horizontal wood nailers are slotted to provide for insulation venting, install strips to prevent obstruction of vent slots. Where necessary, install strips over 1/16 inch thick compatible spacer or washers.

3.1.13.2 Joints

Leave open the section ends of gravel stops and fascias 1/4 inch and backed with a formed flashing plate, mechanically fastened in place and lapping each section end a minimum of 4 inch set laps in plastic cement. Face nailing will not be permitted. Install prefabricated aluminum gravel stops and fascias in accordance with the manufacturer's printed instructions and details.

3.1.14 Metal Drip Edge

Provide a metal drip edge, designed to allow water run-off to drip free of underlying construction, at eaves and rakes prior to the application of roofing shingles. Apply directly on the wood deck at the eaves and over the underlay along the rakes. Extend back from the edge of the deck not more than 3 inch and secure with compatible nails spaced not more than 10

inch on center along upper edge.

3.1.15 Gutters

The hung type of shape indicated and supported on underside by brackets that permit free thermal movement of the gutter. Provide gutters in sizes indicated complete with mitered corners, end caps, outlets, brackets, and other accessories necessary for installation. Bead with hemmed edge or reinforce the outer edge of gutter with a stiffening bar not less than 3/4 by 3/16 inch of material compatible with gutter. Fabricate gutters in sections not less than 8 feet. Lap the sections a minimum of one inch in the direction of flow or provide with concealed splice plate 6 inch minimum. Join the gutters, other than aluminum, by riveted and soldered joints. Join aluminum gutters with riveted sealed joints. Provide expansion-type slip joints midway between outlets. Install gutters below slope line of the roof so that snow and ice can slide clear. Support gutters on by cleats spaced not less than 36 inch apart. Adjust gutters to slope uniformly to outlets, with high points occurring midway between outlets. Fabricate hangers and fastenings from metals.

3.1.16 Downspouts

Space supports for downspouts according to the manufacturer's recommendation for the masonry or steel substrate. Types, shapes and sizes are indicated. Provide complete including elbows and offsets. Provide downspouts in approximately 10 foot lengths. Provide end joints to telescope not less than 1/2 inch and lock longitudinal joints. Provide gutter outlets with wire ball strainers for each outlet. Provide strainers to fit tightly into outlets and be of the same material used for gutters. Keep downspouts not less than one inch away from walls. Fasten to the walls at top, bottom, and at an intermediate point not to exceed 5 feet on center with leader straps or concealed rack-and-pin type fasteners. Form straps and fasteners of metal compatible with the downspouts.

3.1.16.1 Terminations

Neatly fit into the drainage connection the downspouts terminating in drainage lines and fill the joints with a portland cement mortar cap sloped away from the downspout. Provide downspouts terminating in splash blocks with elbow-type fittings. Provide splash pans as specified.

3.1.17 Flashing at Roof Penetrations and Equipment Supports

Provide metal flashing for all pipes, ducts, and conduits projecting through the roof surface and for equipment supports, guy wire anchors, and similar items supported by or attached to the roof deck. Goose-necks, rainhoods, power roof ventilators.

3.1.18 Single Pipe Vents

See Table I, footnote (d). Set flange of sleeve in bituminous plastic cement and nail 3 inch on center. Bend the top of sleeve over and extend down into the vent pipe a minimum of 2 inch. For long runs or long rises above the deck, where it is impractical to cover the vent pipe with lead, use a two-piece formed metal housing. Set metal housing with a metal sleeve having a 4 inch roof flange in bituminous plastic cement and nailed 3 inch on center. Extend sleeve a minimum of 8 inch above the roof deck and lapped a minimum of 3 inch by a metal hood secured to the vent pipe by a draw band. Seal the area of hood in contact with vent pipe with an

approved sealant.

3.1.19 Copings

Provide coping using copper sheets 8 or 10 feet long joined by a 3/4 inch locked and soldered seam. Terminate outer edges in edge strips. Install with sealed lap joints as indicated.

3.2 CLEANING

Clean exposed sheet metal work at completion of installation. Remove grease and oil films, handling marks, contamination from steel wool, fittings and drilling debris, and scrub-clean. Free the exposed metal surfaces of dents, creases, waves, scratch marks, and solder or weld marks.

3.3 REPAIRS TO FINISH

Scratches, abrasions, and minor surface defects of finish may be repaired in accordance with the manufacturer's printed instructions and as approved. Repair damaged surfaces caused by scratches, blemishes, and variations of color and surface texture. Replace items which cannot be repaired.

3.4 FIELD QUALITY CONTROL

3.4.1 Procedure

TABLE I. SHEET METAL WEIGHTS, THICKNESSES, AND GAGES

	Aluminum, Inch
Downspouts and leaders.....	.032
Downspout clips and anchors.....	.040 clip .125 anchor
Downspout straps, 2-inch.....	.060
Flashings:	
Base.....	.040
Cap (Counter-flashing)	.032
Eave.....	-
Pipe vent sleeve(d)	
Coping.....	-
Gravel stops and fascias:	
Extrusions	.075
Sheets, smooth... ..	.050
Edge strip..... ..	.050
Gutters:	
Gutter section.... ..	.032
Continuous cleat.....	.032
Hangers, dimensions.....	1 inch by

TABLE I. SHEET METAL WEIGHTS, THICKNESSES, AND GAGES

	Aluminum, Inch
	.080 inch
Reglets (c).....	(c) -
(c) May be polyvinyl chloride.	
(d) 2.5 pound minimum lead sleeve with 4 inch flange. Where lead sleeve is impractical, refer to paragraph entitled "Single Pipe Vents" for optional material.	

TABLE II. SHEET METAL JOINTS
TYPE OF JOINT

Item Designation	Aluminum	Remarks
Flashings		
Base	One inch flat locked, soldered; sealed; 3 inch lap for expansion joint	Aluminum producer's recommended hard setting sealant for locked aluminum joints. Fill each metal expansion joint with a joint sealing compound compound.
Cap-in reglet	3 inch lap	Seal groove with joint sealing compound.
Reglets	- - -	Seal reglet groove with joint sealing compound.
Eave	One inch flat locked, locked, cleated one inch loose locked, sealed expansion joints, cleated	Same as base flashing.
Edge strip	Butt	- - -
Gravel		

TABLE II. SHEET METAL JOINTS
TYPE OF JOINT

Item Designation	Aluminum	Remarks
stops:		
Extrusions	Butt with 1/2 inch space	Use sheet flashing beneath and a cover plate.
Sheet, smooth	Butt with 1/4 inch space	Use sheet flashing backup plate.
Gutters	One inch flat locked, riveted, and sealed	Aluminum producers recommended hard setting sealant for locked aluminum joints.
(a)	Provide a 3 inch lap elastomeric flashing with manufacturer's recommended sealant.	
(b)	Seal polyvinyl chloride reglet with manufacturer's recommended sealant.	
-- End of Section --		

SECTION 07 84 00

FIRESTOPPING
05/10

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 E119	(2012) Standard Test Methods for Fire Tests of Building Construction and Materials
ASTM E1399	(1997; R 2009) Cyclic Movement and Measuring the Minimum and Maximum Joint Widths of Architectural Joint Systems
ASTM E1966	(2007; R 2011) Fire-Resistive Joint Systems
ASTM E2174	(2010ae1) Standard Practice for On-Site Inspection of Installed Fire Stops
ASTM E2307	(2010) Standard Test Method for Determining Fire Resistance of Perimeter Fire Barrier Systems Using Intermediate-Scale, Multi-story Test Apparatus
ASTM E2393	(2010a) Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers
ASTM E814	(2011a) Standard Test Method for Fire Tests of Through-Penetration Fire Stops
ASTM E84	(2012) Standard Test Method for Surface Burning Characteristics of Building Materials

FM GLOBAL (FM)

FM APP GUIDE	(updated on-line) Approval Guide http://www.approvalguide.com/
FM AS 4991	(2001) Approval of Firestop Contractors

UNDERWRITERS LABORATORIES (UL)

UL 1479	(2003; Reprint Mar 2010) Fire Tests of Through-Penetration Firestops
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UL 2079	(2004; Reprint Jun 2008) Tests for Fire Resistance of Building Joint Systems
UL 723	(2008; Reprint Sep 2010) Test for Surface Burning Characteristics of Building Materials
UL Fire Resistance	(2011) Fire Resistance Directory

1.2 SYSTEM DESCRIPTION

1.2.1 General

Furnish and install tested and listed firestopping systems, combination of materials, or devices to form an effective barrier against the spread of flame, smoke and gases, and maintain the integrity of fire resistance rated walls, partitions, floors, and ceiling-floor assemblies, including through-penetrations and construction joints and gaps.

- a. Through-penetrations include the annular space around pipes, tubes, conduit, wires, cables and vents.
- b. Construction joints include those used to accommodate expansion, contraction, wind, or seismic movement; firestopping material shall not interfere with the required movement of the joint.

Gaps requiring firestopping include gaps between the curtain wall and the floor slab and between the top of the fire-rated walls and the roof or floor deck above and at the intersection of shaft assemblies and adjoining fire resistance rated assemblies.

1.2.2 Sequencing

Coordinate the specified work with other trades. Apply firestopping materials, at penetrations of pipes and ducts, prior to insulating, unless insulation meets requirements specified for firestopping. Apply firestopping materials at building joints and construction gaps, prior to completion of enclosing walls or assemblies. Cast-in-place firestop devices shall be located and installed in place before concrete placement. Pipe, conduit or cable bundles shall be installed through cast-in-place device after concrete placement but before area is concealed or made inaccessible. Firestop material shall be inspected and approved prior to final completion and enclosing of any assemblies that may conceal installed firestop.

1.2.3 Submittals Requirements

- a. Submit detail drawings including manufacturer's descriptive data, typical details conforming to UL Fire Resistance or other details certified by another nationally recognized testing laboratory, installation instructions or UL listing details for a firestopping assembly in lieu of fire-test data or report. For those firestop applications for which no UL tested system is available through a manufacturer, a manufacturer's engineering judgment, derived from similar UL system designs or other tests, shall be submitted for review and approval prior to installation. Submittal shall indicate the firestopping material to be provided for each type of application. When more than a total of 5 penetrations and/or construction joints are to receive firestopping, provide drawings that indicate location, "F"

"T" and "L" ratings, and type of application.

b. Submit certificates attesting that firestopping material complies with the specified requirements. For all intumescent firestop materials used in through penetration systems, manufacturer shall provide certification from UL of passing the "Aging and Environmental Exposure Testing " portion of UL 1479.

c. Submit documentation of training and experience for Installer.

d. Submit manufacturer's representative certification stating that firestopping work has been inspected and found to be applied according to the manufacturer's recommendations and the specified requirements.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for A/E approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Firestopping Materials.

SD-07 Certificates

Manufacturer's Technical Representative
Firestopping Materials.
Installer Qualifications.
Inspection.

1.4 QUALITY ASSURANCE

1.4.1 Installer

Engage an experienced Installer who is:

- a. FM Research approved in accordance with FM AS 4991, operating as a UL Certified Firestop Contractor, or
- b. Certified, licensed, or otherwise qualified by the firestopping manufacturer as having the necessary staff, training, and a minimum of 3 years experience in the installation of manufacturer's products in accordance with specified requirements. A manufacturer's willingness to sell its firestopping products to the Contractor or to an installer engaged by the Contractor does not in itself confer installer qualifications on the buyer. The Installer shall have been trained by a direct representative of the manufacturer (not distributor or agent) in the proper selection and installation procedures. The installer shall obtain from the manufacturer written certification of training, and retain proof of certification for duration of firestop installation.

1.4.2 Manufacturer's Technical Representative

The manufacturer's technical representative shall be a direct representative of the manufacturer (not a distributor or an agent). Provide current documentation from the manufacturer that he or she is a direct representative of the manufacturer and is qualified to perform the specified inspections and certify the firestopping installation.

1.5 DELIVERY, STORAGE, AND HANDLING

Deliver materials in the original unopened packages or containers showing name of the manufacturer and the brand name. Store materials off the ground, protected from damage and exposure to elements. Remove damaged or deteriorated materials from the site.

PART 2 PRODUCTS

2.1 FIRESTOPPING MATERIALS

Provide firestopping materials, supplied from a single domestic manufacturer, consisting of commercially manufactured, asbestos-free, nontoxic, water-based, noncombustible products FM APP GUIDE approved, or UL listed, for use with applicable construction and penetrating items, complying with the following minimum requirements:

2.1.1 Fire Hazard Classification

Material shall have a flame spread of 25 or less, and a smoke developed rating of 50 or less, when tested in accordance with ASTM E84 or UL 723. Material shall be an approved firestopping material as listed in UL Fire Resistance or by a nationally recognized testing laboratory.

2.1.2 Toxicity

Material shall be nontoxic and carcinogen free to humans at all stages of application or during fire conditions and shall not contain hazardous chemicals or require harmful chemicals to clean material or equipment. Firestop material must be free from Ethylene Glycol, PCB, MEK, or other types of hazardous chemicals.

2.1.3 Fire Resistance Rating

Firestop systems shall be UL Fire Resistance listed or FM APP GUIDE approved with "F" rating at least equal to fire-rating of fire wall or floor in which penetrated openings are to be protected. Where required, firestop systems shall also have "T" rating at least equal to the fire-rated floor in which the openings are to be protected.

2.1.3.1 Through-Penetrations

Firestopping materials for through-penetrations, as described in paragraph SYSTEM DESCRIPTION, shall provide "F", "T" and "L" fire resistance ratings in accordance with ASTM E814 or UL 1479. Fire resistance ratings shall be as follows:

- a. Penetrations of Fire Resistance Rated Walls and Partitions: F Rating = Rating of wall or partition being penetrated.
- b. Penetrations of Fire Resistance Rated Floors, Floor-Ceiling Assemblies and the ceiling membrane of Roof-Ceiling Assemblies: F Rating = to match penetration rating T Rating = to match penetration rating. Where the penetrating item is outside of a wall cavity the F rating and T rating must be equal to the fire resistance rating of the floor penetrated.
- c. Penetrations of Fire and Smoke Resistance Rated Walls, Floors,

Floor-Ceiling Assemblies, and the ceiling membrane of Roof-Ceiling Assemblies: F Rating = to match penetration rating T Rating = to match penetration rating.

2.1.3.2 Construction Joints and Gaps

Fire resistance ratings of construction joints, as described in paragraph SYSTEM DESCRIPTION, and gaps such as those between floor slabs or roof decks and curtain walls shall be the same as the construction in which they occur. Construction joints and gaps shall be provided with firestopping materials and systems that have been tested in accordance with ASTM E119, ASTM E1966 or UL 2079 to meet the required fire resistance rating. Curtain wall joints shall be provided with firestopping materials and systems that have been tested in accordance with ASTM E2307 to meet the required fire resistance rating. Systems installed at construction joints shall meet the cycling requirements of ASTM E1399 or UL 2079. All joints at the intersection of the top of a fire resistance rated wall and the underside of a fire-rated floor, floor ceiling, or roof ceiling assembly shall provide a minimum class II movement capability.

2.1.4 Material Performance

All firestop materials are subject to these minimum standards of performance.

- a. Firestop material shall be capable of installation at temperatures of 35 to 120 degrees F.
- b. Material must be able to be frozen, thawed and still maintain manufacturer approval for installation.
- c. Firestop material must convey a manufacturer's written warranty guaranteeing the performance of the material for the sustainable lifetime of the structure.
- d. Material must maintain a shelf life of no less than two years from date of manufacturing.
- e. Acceptable firestop cast-in-place devices are factory assembled intumescent lined round or oval plastic cylinders capable of protecting plastic, metallic, cable, and blank openings through the cast-in-place device equal to the fire-resistance rating of the floor.

PART 3 EXECUTION

3.1 PREPARATION

Areas to receive firestopping shall be free of dirt, grease, oil, or loose materials which may affect the fitting or fire resistance of the firestopping system. For cast-in-place firestop devices, formwork or metal deck to receive device prior to concrete placement shall be sound and capable of supporting device. Prepare surfaces as recommended by the manufacturer.

3.2 INSTALLATION

Completely fill void spaces with firestopping material regardless of geometric configuration, subject to tolerance established by the manufacturer. Firestopping systems for filling floor voids 4 inches or

more in any direction shall be capable of supporting the same load as the floor is designed to support or shall be protected by a permanent barrier to prevent loading or traffic in the firestopped area. Install firestopping in accordance with manufacturer's written instructions. Provide tested and listed firestop systems in the following locations, except in floor slabs on grade:

- a. Penetrations of duct, conduit, tubing, cable and pipe through floors and through fire-resistance rated walls, partitions, and ceiling-floor assemblies.
- b. Penetrations of vertical shafts such as pipe chases, elevator shafts, and utility chutes.
- c. Gaps at the intersection of floor slabs and curtain walls, including inside of hollow curtain walls at the floor slab.
- d. Gaps at perimeter of fire-resistance rated walls and partitions, such as between the top of the walls and the bottom of roof decks.
- e. Construction joints in floors and fire rated walls and partitions.
- f. Other locations where required to maintain fire resistance rating of the construction.

3.2.1 Insulated Pipes and Ducts

Thermal insulation shall be cut and removed where pipes or ducts pass through firestopping, unless insulation meets requirements specified for firestopping. Replace thermal insulation with a material having equal thermal insulating and firestopping characteristics.

3.2.2 Fire Dampers

Install and firestop fire dampers in accordance with Section 23 00 00 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM. Firestop installed with fire damper must be tested and approved for use in fire damper system. Firestop installed with fire damper must be tested and approved for use in fire damper system.

3.2.3 Data and Communication Cabling

Cabling for data and communication applications shall be sealed with re-enterable firestopping products. Firestopping devices shall be pre-manufactured modular devices, containing built-in self-sealing intumescent inserts. Firestopping devices shall allow for cable moves, additions or changes without the need to remove or replace any firestop materials. Devices must be capable of maintaining the fire resistance rating of the penetrated membrane at 0% to 100% visual fill of penetrants; while maintaining "L" rating of <5 cfm/sf measured at ambient temperature and 400* F at 0% to 100% visual fill. Each device must be capable of retrofit applications and be available in square and round configurations, with single, double, triple and six-plex bracket systems provided. Firestop devices must also allow for plastic pipe, metallic pipe, and mixed multiple penetrations plastic, metallic, insulated metallic, and cable through a single device.

3.3 INSPECTION

3.3.1 General Requirements

For all projects, the firestopped areas shall not be covered or enclosed until inspection is complete and approved by the manufacturer's technical representative. The manufacturer's representative shall inspect the applications initially to ensure adequate preparations (clean surfaces suitable for application, etc.) and periodically during the work to assure that the completed work has been accomplished according to the manufacturer's written instructions and the specified requirements. Submit written reports indicating locations of and types of penetrations and types of firestopping used at each location; type shall be recorded by UL listed printed numbers.

3.3.2 Inspection Standards

Inspect all firestopping in accordance to ASTM standards for firestop inspection, and document inspection results to be submitted to GC, Architect and Owner.

- a. ASTM E2393
- b. ASTM E2174

-- End of Section --

SECTION 07 92 00

JOINT SEALANTS

01/07

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 C1330 (2002; R 2007) Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants

ASTM C920 (2011) Standard Specification for Elastomeric Joint Sealants

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for A/E approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Sealants

Primers

Bond breakers

Backstops

Manufacturer's descriptive data including storage requirements, shelf life, curing time, instructions for mixing and application, and primer data (if required). Provide a copy of the Material Safety Data Sheet for each solvent, primer or sealant material.

SD-07 Certificates

Sealant

Certificates of compliance stating that the materials conform to the specified requirements.

1.3 ENVIRONMENTAL CONDITIONS

Apply sealant when the ambient temperature is between 40 and 90 degrees F.

1.4 DELIVERY AND STORAGE

Deliver materials to the job site in unopened manufacturers' external shipping containers, with brand names, date of manufacture, color, and

material designation clearly marked thereon. Label elastomeric sealant containers to identify type, class, grade, and use. Carefully handle and store materials to prevent inclusion of foreign materials or subjection to sustained temperatures exceeding 90 degrees F or less than 0 degrees F.

1.5 QUALITY ASSURANCE

1.5.1 Compatibility with Substrate

Verify that each of the sealants are compatible for use with joint substrates.

1.5.2 Joint Tolerance

Provide joint tolerances in accordance with manufacturer's printed instructions.

1.6 SPECIAL WARRANTY

Guarantee sealant joint against failure of sealant and against water penetration through each sealed joint for five years.

PART 2 PRODUCTS

2.1 SEALANTS

Provide sealant that has been tested and found suitable for the substrates to which it will be applied.

2.1.1 Exterior Sealant

For joints in vertical surfaces, provide ASTM C920, Type S or M, Grade NS, Class 25, Use NT. For joints in horizontal surfaces, provide ASTM C920, Type S or M, Grade P, Class 25, Use T. Provide location(s) and color(s) of sealant as follows:

LOCATION	COLOR
a. Joints and recesses formed where frames and subsills of windows, doors, louvers, and vents adjoin masonry, concrete, or metal frames. Use sealant at both exterior and interior surfaces of exterior wall penetrations.	Match adjacent surface color
b. Voids where items pass through exterior walls.	Match adjacent surface color
c. Metal reglets, where flashing is inserted into masonry joints, and where flashing is penetrated by coping dowels.	Match adjacent surface color
d. Metal-to-metal joints where sealant is indicated or specified.	Match adjacent surface color
e. Joints between ends of gravel stops, fascias, copings, and adjacent walls.	Match adjacent surface color

2.2 PRIMERS

Provide a nonstaining, quick-drying type and consistency recommended by the sealant manufacturer for the particular application.

2.3 BOND BREAKERS

Provide the type and consistency recommended by the sealant manufacturer to prevent adhesion of the sealant to backing or to bottom of the joint.

2.4 BACKSTOPS

Provide glass fiber roving or neoprene, butyl, polyurethane, or polyethylene foams free from oil or other staining elements as recommended by sealant manufacturer. Provide 25 to 33 percent oversized backing for closed cell and 40 to 50 percent oversized backing for open cell material, unless otherwise indicated. Make backstop material compatible with sealant. Do not use oakum and other types of absorptive materials as backstops.

2.4.1 POLYETHYLENE FOAM

Conform to ASTM C1330 Type C, closed-cell foam, round cross section.

2.5 CLEANING SOLVENTS

Provide type(s) recommended by the sealant manufacturer except for aluminum and bronze surfaces that will be in contact with sealant.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

Clean surfaces from dirt frost, moisture, grease, oil, wax, lacquer, paint, or other foreign matter that would tend to destroy or impair adhesion. Remove oil and grease with solvent. Surfaces must be wiped dry with clean cloths. When resealing an existing joint, remove existing caulk or sealant prior to applying new sealant. For surface types not listed below, contact sealant manufacturer for specific recommendations.

3.1.1 Steel Surfaces

Remove loose mill scale by sandblasting or, if sandblasting is impractical or would damage finish work, scraping and wire brushing. Remove protective coatings by sandblasting or using a residue-free solvent.

3.1.2 Aluminum or Bronze Surfaces

Remove temporary protective coatings from surfaces that will be in contact with sealant. When masking tape is used as a protective coating, remove tape and any residual adhesive just prior to sealant application. For removing protective coatings and final cleaning, use nonstaining solvents recommended by the manufacturer of the item(s) containing aluminum or bronze surfaces.

3.1.3 Concrete and Masonry Surfaces

Where surfaces have been treated with curing compounds, oil, or other such materials, remove materials by sandblasting or wire brushing. Remove

laitance, efflorescence and loose mortar from the joint cavity.

3.2 SEALANT PREPARATION

Do not add liquids, solvents, or powders to the sealant. Mix multicomponent elastomeric sealants in accordance with manufacturer's instructions.

3.3 APPLICATION

3.3.1 Joint Width-To-Depth Ratios

a. Acceptable Ratios:

<u>JOINT WIDTH</u>	<u>JOINT DEPTH</u>	
	Minimum	Maximum
For metal, glass, or other nonporous surfaces:		
1/4 inch (minimum)	1/4 inch	1/4 inch
over 1/4 inch	1/2 of width	Equal to width

b. Unacceptable Ratios: Where joints of acceptable width-to-depth ratios have not been provided, clean out joints to acceptable depths and grind or cut to acceptable widths without damage to the adjoining work. Grinding is not required on metal surfaces.

3.3.2 Masking Tape

Place masking tape on the finish surface on one or both sides of a joint cavity to protect adjacent finish surfaces from primer or sealant smears. Remove masking tape within 10 minutes after joint has been filled and tooled.

3.3.3 Backstops

Install backstops dry and free of tears or holes. Tightly pack the back or bottom of joint cavities with backstop material to provide a joint of the depth specified. Install backstops in the following locations:

- a. Where indicated.
- b. Where backstop is not indicated but joint cavities exceed the acceptable maximum depths specified in paragraph entitled, "Joint Width-to-Depth Ratios".

3.3.4 Primer

Immediately prior to application of the sealant, clean out loose particles from joints. Where recommended by sealant manufacturer, apply primer to joints in concrete masonry units, wood, and other porous surfaces in accordance with sealant manufacturer's instructions. Do not apply primer to exposed finish surfaces.

3.3.5 Bond Breaker

Provide bond breakers to the back or bottom of joint cavities, as recommended by the sealant manufacturer for each type of joint and sealant used, to prevent sealant from adhering to these surfaces. Carefully apply the bond breaker to avoid contamination of adjoining surfaces or breaking bond with surfaces other than those covered by the bond breaker.

3.3.6 Sealants

Provide a sealant compatible with the material(s) to which it is applied. Do not use a sealant that has exceeded shelf life or has jelled and can not be discharged in a continuous flow from the gun. Apply the sealant in accordance with the manufacturer's printed instructions with a gun having a nozzle that fits the joint width. Force sealant into joints to fill the joints solidly without air pockets. Tool sealant after application to ensure adhesion. Make sealant uniformly smooth and free of wrinkles. Upon completion of sealant application, roughen partially filled or unfilled joints, apply sealant, and tool smooth as specified. Apply sealer over the sealant when and as specified by the sealant manufacturer.

3.4 PROTECTION AND CLEANING

3.4.1 Protection

Protect areas adjacent to joints from sealant smears. Masking tape may be used for this purpose if removed 5 to 10 minutes after the joint is filled.

3.4.2 Final Cleaning

Upon completion of sealant application, remove remaining smears and stains and leave the work in a clean and neat condition.

- a. Masonry and Other Porous Surfaces: Immediately scrape off fresh sealant that has been smeared on masonry and rub clean with a solvent as recommended by the sealant manufacturer. Allow excess sealant to cure for 24 hour then remove by wire brushing or sanding.
- b. Metal and Other Non-Porous Surfaces: Remove excess sealant with a solvent-moistened cloth.

-- End of Section --

SECTION 08 51 13

ALUMINUM WINDOWS
05/11

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.

ALUMINUM ASSOCIATION (AA)

AA DAF45 (2003; Reaffirmed 2009) Designation System for Aluminum Finishes

AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 1503 (2009) Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections

AAMA 611 (1998; R 2004) Voluntary Specification for Anodized Architectural Aluminum

AAMA/WDMA/CSA 101/I.S.2/A440 (2008; Update 1 2008; Update 2 2008; Update 3 2009) North American Fenestration Standard/Specification for Windows, Doors, and Skylights

ASTM INTERNATIONAL (ASTM)

ASTM D1972 (1997; R 2005) Standard Practice for Generic Marking of Plastic Products

NATIONAL FENESTRATION RATING COUNCIL (NFRC)

NFRC 100 (2010) Procedure for Determining Fenestration Product U-Factors

NFRC 200 (2010) Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence

1.2 CERTIFICATION

Each prime window unit must bear the AAMA Label warranting that the product complies with AAMA/WDMA/CSA 101/I.S.2/A440. Certified test reports attesting that the prime window units meet the requirements of AAMA/WDMA/CSA 101/I.S.2/A440, including test size, will be acceptable in lieu of product labeling.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for A/E approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Windows

Fabrication Drawings

SD-03 Product Data

Windows

Fasteners

Window performance

Thermal-Barrier Windows

Mullions

Accessories

Thermal performance

Submit documentation for Energy Star qualifications.

SD-06 Test Reports

Minimum condensation resistance factor

SD-10 Operation and Maintenance Data

Windows, Data Package 1

Submit in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

Plastic Identification

When not labeled, identify types in Operation and Maintenance Manual.

1.4 QUALITY ASSURANCE

1.4.1 Shop Drawing Requirements

Provide drawings that indicate elevations of windows, full-size sections, thickness and gages of metal, fastenings, proposed method of anchoring, size and spacing of anchors, details of construction, method of glazing, mullion details, material and method of attaching subframes, installation details, and other related items.

1.4.2 Test Report Requirements

Submit test reports for each type of window attesting that identical

windows have been tested and meet the requirements specified herein for conformance to AAMA/WDMA/CSA 101/I.S.2/A440 including test size, minimum condensation resistance factor (CRF).

1.5 DELIVERY AND STORAGE

Deliver windows to project site in an undamaged condition. Use care in handling and hoisting windows during transportation and at the jobsite. Store windows and components out of contact with the ground, under a weathertight covering, so as to prevent bending, warping, or otherwise damaging the windows. Repair damaged windows to an "as new" condition as approved. If windows can not be repaired, provide a new unit.

1.6 PROTECTION

Protect finished surfaces during shipping and handling using the manufacturer's standard method. Do not apply coatings or lacquers to surfaces to which calking and glazing compounds must adhere.

1.7 SUSTAINABLE DESIGN REQUIREMENTS

1.7.1 Plastic Identification

Verify that plastic products to be incorporated into the project are labeled in accordance with ASTM D1972. Where products are not labeled, provide product data indicating polymeric information in the Operation and Maintenance Manual.

- a. Type 1: Polyethylene Terephthalate (PET, PETE).
- b. Type 2: High Density Polyethylene (HDPE).
- c. Type 3: Vinyl (Polyvinyl Chloride or PVC).
- d. Type 4: Low Density Polyethylene (LDPE).
- e. Type 5: Polypropylene (PP).
- f. Type 6: Polystyrene (PS).
- g. Type 7: Other. Use of this code indicates that the package in question is made with a resin other than the six listed above, or is made of more than one resin listed above, and used in a multi-layer combination.

1.8 FIELD MEASUREMENTS

Take field measurements prior to preparation of the drawings and fabrication.

1.9 PERFORMANCE REQUIREMENTS

1.9.1 Wind Loading Design Pressure

Design window components, including mullions, and anchors, to withstand a wind-loading design pressure of at least 45 pounds per square foot (psf).

1.9.2 Tests

Test windows proposed for use in accordance with AAMA/WDMA/CSA 101/I.S.2/A440 for the particular type and quality window specified.

Perform tests by a nationally recognized independent testing laboratory equipped and capable of performing the required tests. Submit the results of the tests as certified laboratory reports required herein.

Minimum design load for a uniform-load structural test must be 50 psf.

1.10 DRAWINGS

Submit the Fabrication Drawings for aluminum window units showing complete window assembly including subframe assembly details.

1.11 WINDOW PERFORMANCE

Aluminum windows must meet the following performance requirements. Perform testing requirements by an independent testing laboratory or agency.

1.11.1 Structural Performance

Structural test pressures on window units must be for positive load (inward) and negative load (outward). After testing, there will be no glass breakage, permanent damage to fasteners, hardware parts, support arms or actuating mechanisms or any other damage which could cause window to be inoperable. There must be no permanent deformation of any main frame, sash or ventilator member in excess of the requirements established by AAMA/WDMA/CSA 101/I.S.2/A440 for the window types and classification specified in this section.

1.11.2 Air Infiltration

Air infiltration must not exceed the amount established by AAMA/WDMA/CSA 101/I.S.2/A440 for each window type.

1.11.3 Water Penetration

Water penetration must not exceed the amount established by AAMA/WDMA/CSA 101/I.S.2/A440 for each window type.

1.11.4 Thermal Performance

Non-residential aluminum windows (including frames and glass) shall be certified by the National Fenestration Rating Council with a whole-window Solar Heat Gain Coefficient (SHGC) maximum of 0.30 determined according to NFRC 200 procedures and a U-factor maximum of 0.35 Btu/hr-ft²-F in accordance with NFRC 100.

1.11.5 Sound Attenuation

The window unit must have a minimum STC of 34 with the window glazed with 1/2 inch air space between two pieces of 1/4 inch thick glass when tested in accordance with AAMA/WDMA/CSA 101/I.S.2/A440 acoustical performance (optional).

1.12 QUALIFICATION

Window manufacturer must specialize in designing and manufacturing the type of aluminum windows specified in this section, and have a minimum of 5 years of documented successful experience. Manufacturer must have the facilities capable of meeting contract requirements, single-source responsibility and warranty.

1.13 WARRANTY

Provide Manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period.

PART 2 PRODUCTS

2.1 WINDOWS

Provide prime windows that comply with AAMA/WDMA/CSA 101/I.S.2/A440 and the requirements specified herein. In addition to compliance with AAMA/WDMA/CSA 101/I.S.2/A440, window framing members for each individual light of glass must not deflect to the extent that deflection perpendicular to the glass light exceeds $L/175$ of the glass edge length when subjected to uniform loads at specified design pressures. Provide Structural calculations for deflection to substantiate compliance with deflection requirements. Provide windows of types, performance classes, performance grades, combinations, and sizes indicated or specified. Design windows to accommodate hardware, glass, weatherstripping, screens, and accessories to be furnished. Each window must be a complete factory assembled unit with or without glass installed. Dimensions shown are minimum. Provide windows with insulating glass and thermal break necessary to achieve a minimum Condensation Resistance Factor (CRF) of 51 when tested in accordance with AAMA 1503.

2.1.1 Fixed Windows (F)

Type F-CW30.

2.1.2 Glass and Glazing

Materials are specified in Section 08 81 00 GLAZING.

2.1.3 Calking and Sealing

Are specified in Section 07 92 00 JOINT SEALANTS.

2.1.4 Weatherstripping

AAMA/WDMA/CSA 101/I.S.2/A440.

2.2 FABRICATION

Fabrication of window units must comply with AAMA/WDMA/CSA 101/I.S.2/A440.

2.2.1 Provisions for Glazing

Design windows and rabbets suitable for glass thickness shown or specified. Design sash for double glazing and for securing glass with glazing channels, or glazing compound.

2.2.2 Fasteners

Use fasteners as standard with the window manufacturer for windows, trim, and accessories. Self-tapping sheet-metal screws are not acceptable for material more than 1/16 inch thick.

2.2.3 Combination Windows

Windows used in combination must be the same class and grade and will be factory assembled. Where factory assembly of individual windows into larger units is limited by transportation considerations, prefabricate, match mark, transport, and field assemble.

2.2.4 Mullions

Provide mullions with a thermal break. Secure mullions to adjoining construction and window units in such a manner as to permit expansion and contraction and to form a weathertight joint. Provide mullion covers on the interior and exterior to completely close exposed joints and recesses between window units and to present a neat appearance.

2.2.5 Accessories

Provide windows complete with necessary hardware, fastenings, clips, fins, anchors, glazing beads, and other appurtenances necessary for complete installation and proper operation. Furnish extruded aluminum subframe receptors and subsill with each window unit.

2.2.5.1 Fasteners

Provide concealed anchors of the type recommended by the window manufacturer for the specific type of construction. Anchors and fasteners must be compatible with the window and the adjoining construction. Provide a minimum of three anchors for each jamb located approximately 6 inches from each end and at midpoint.

2.2.5.2 Window Anchors

Anchoring devices for installing windows must be made of aluminum, cadmium-plated steel, stainless steel, or zinc-plated steel conforming to AAMA/WDMA/CSA 101/I.S.2/A440.

2.2.6 Finishes

Exposed aluminum surfaces must be factory finished with an anodic coating. All windows will have the same finish.

2.2.6.1 Anodic Coating

Clean exposed aluminum surfaces and provide an anodized finish conforming to AA DAF45 and AAMA 611. Finish must be:

- a. Architectural Class II (0.4 mil to 0.7 mil), designation AA-M10-C22-A31, clear (natural) anodized.

2.3 THERMAL-BARRIER WINDOWS

Provide thermal-barrier windows, complete with accessories and fittings, where indicated.

Specify material and construction except as follows:

- a. Aluminum alloy must be 6063-T6.
- b. Frame construction must be factory-assembled and factory-sealed inner

and outer aluminum completely separated from metal-to-metal contact. Join assembly by a continuous, concealed, low conductance divider housed in an interlocking extrusion of the inner frame. Metal fasteners, straps, or anchors will not bridge the connection between the inner and outer frame.

2.4 MULLIONS

Provide mullions between multiple-window units where indicated.

Mullions and mullion covers must be the profile indicated, reinforced as required for the specified wind loading, and securely anchored to the adjoining construction. Mullion extrusion will include serrations or pockets to receive weatherstripping, sealant, or tape at the point of contact with each window flange.

Mullion assembly must include aluminum window clamps or brackets screwed or bolted to the mullion and the mullion cover.

Mullion cover must be screw-fastened to the mullion unless otherwise indicated.

Mullion reinforcing members shall be fabricated of the materials specified in AAMA/WDMA/CSA 101/I.S.2/A440 and meet the specified design loading.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Method of Installation

Install in accordance with the window manufacturer's printed instructions and details. Build in windows as the work progresses or install without forcing into prepared window openings. Set windows at proper elevation, location, and reveal; plumb, square, level, and in alignment; and brace, strut, and stay properly to prevent distortion and misalignment. Bed screws or bolts in sill members, joints at mullions, contacts of windows with sills, built-in fins, and subframes in mastic sealant of a type recommended by the window manufacturer. Install and caulk windows in a manner that will prevent entrance of water and wind.

3.1.2 Dissimilar Materials

Where aluminum surfaces are in contact with, or fastened to masonry, concrete, wood, or dissimilar metals, except stainless steel or zinc, protect the aluminum surface from dissimilar materials as recommended in the Appendix to AAMA/WDMA/CSA 101/I.S.2/A440. Do not coat surfaces in contact with sealants after installation with any type of protective material.

3.1.3 Anchors and Fastenings

Make provision for securing units to each other, to masonry, and to other adjoining construction. Windows installed in masonry walls must have head and jamb members designed to recess into masonry wall not less than 7/16 inch.

3.1.4 Adjustments After Installation

After installation of windows and completion of glazing and field painting,

verify that products are properly installed, connected, and adjusted.

3.2 CLEANING

Clean interior and exterior surfaces of window units of mortar, plaster, paint spattering spots, and other foreign matter to present a neat appearance, to prevent fouling of weathering surfaces and weather-stripping, and to prevent interference with the operation of hardware. Replace all stained, discolored, or abraded windows that cannot be restored to their original condition with new windows.

-- End of Section --

SECTION 08 62 50

TUBULAR DAYLIGHTING DEVICE

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 A 463/A 463M	(2010) Standard Specification for Steel Sheet, Aluminum-Coated, by the Hot-Dip Process
ASTM A 653/A 653M	(2011) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM D 1929	(2011) Standard Test Method for Determining Ignition Temperature of Plastics
ASTM D 635	(2010) Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position
ASTM E 1886	(2005) Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials
ASTM E 1996	(2009) Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricane
ASTM E 283	(2004) Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
ASTM E 308	(2008) Computing the Colors of Objects by Using the CIE System
ASTM E 330	(2002; R 2010) Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference

ASTM E 547 (2009) Test Method for Water Penetration of Exterior Windows, Skylights, Doors and Curtain walls by Cyclic Air Pressure Difference; 2000

ASTM E 84 (2011b) Standard Test Method for Surface Burning Characteristics of Building Materials

INTERNATIONAL CODE COUNCIL (ICC)

ICC AC-16 (2008) Acceptance Criteria for Plastic Skylights

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for A/E approval. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Tubular Daylighting Devices

Submit shop drawings showing layout, profiles and product components, including anchorage, flashings and accessories.

SD-03 Product Data

Tubular Daylighting Devices

Manufacturer's data sheets on each product to be used, including operation instructions and recommendations; storage and handling requirements and recommendations and installation methods.

SD-06 Test Reports

Tubular Daylighting Devices

Independent testing agency or evaluation service reports verifying compliance with specified performance requirements.

1.3 PERFORMANCE REQUIREMENTS

Completed tubular daylighting device assemblies shall be capable of meeting the following performance requirements:

- a. Air Infiltration Test: Air infiltration will not exceed 0.30 cfm/sf aperture with a pressure delta of 1.57 psf across the tube when tested in accordance with ASTM E 283.
- b. Water Resistance Test: No uncontrolled water leakage at 10.5 psf pressure differential with water rate of 5 gallons/hour/sf when tested in accordance with ASTM E 547.
- c. Uniform Load Test: No breakage, permanent damage to fasteners, hardware parts, or damage to make daylighting system inoperable or cause excessive permanent deflection of any section when tested at

a Positive Load of 150 psf or Negative Load of 70 psf. All units shall be tested with a safety factor of (3) for positive pressure and (2) for negative pressure, acting normal to plane of roof in accordance with ASTM E 330.

- d. Hurricane Resistance: Meets ASTM E 1886 and ASTM E 1996 for missile and cyclic pressure differential testing.
- e. Fire Testing: When used with the Dome Edge Protection Band, all domes meet fire rating requirements as described in the 2006 International Building Code. Self-Ignition Temperature greater than 650 degrees F per ASTM D 1929. Smoke Density Rating no greater than 450 per ASTM E 84 in way intended for use. Classification C. Rate of Burn and/or Extent Maximum Burning Rate: 2.5 inches/min Classification CC-2 per ASTM D 635. Rate of Burn and/or Extent - Maximum Burn Extent: 1 inch Classification CC-1 per ASTM D 635.

1.4 QUALITY ASSURANCE

Manufacturer Qualifications: Engaged in manufacture of tubular daylighting devices for minimum 15 years.

1.5 DELIVERY, STORAGE AND HANDLING

Store products in manufacturer's unopened packaging until ready for installation. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.6 PROJECT CONDITIONS

Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.7 WARRANTY

Daylighting Device: Manufacturer's standard warranty for 10 years.

PART 2 PRODUCTS

2.1 TUBULAR DAYLIGHTING DEVICES

2.1.1 General

Transparent roof-mounted skylight dome and self-flashing curb, reflective tube, and ceiling level diffuser assembly, transferring sunlight to interior spaces; complying with ICC AC-16.

2.1.2 Open Ceiling Daylighting System - 21 Inch

Roof Dome Assembly: Transparent, UV and impact resistant dome with flashing base supporting dome and top of tube. Outer Dome Glazing, Type DA, 0.125 inch minimum thickness injection molded acrylic classified as CC2 material; UV inhibiting (100 percent UV C, 100 percent UV B and 98.5 percent UV A), impact modified acrylic blend. Inner Dome Glazing, Type DPI, 0.115 inch minimum thickness polycarbonate classified as CC1 material.

2.1.3 Light Tracker Reflector

Made of aluminum sheet, 0.015 inch thickness, positioned in the dome to capture low angle sunlight.

2.1.4 Roof Flashing Base

One piece, seamless, leak-proof flashing functioning as base support for dome and top of tube. Sheet steel, corrosion resistant conforming to ASTM A 653/A 653M or ASTM A 463/A 463M, 0.028 inch thick. Base Style, Type F8, Self mounted, 8 inches high.

2.1.5 Flashing Insulator

Type FI, Thermal isolation material for use under flashing.

2.1.6 Dome Edge Protection Band

For fire rated roofs with 8 inch high turret. Galvanized steel. Nominal thickness of 0.039 inch.

2.1.7 Roof Flashing Turret Extensions

Provide manufacturer's standard extensions for applications as requiring Type T48: Additional lengths of 48 inches extension.

2.1.8 Tube Ring

Attached to top of base section; 0.090 inch nominal thickness injection molded high impact PVC; to prevent thermal bridging between base flashing and tubing and channel condensed moisture out of tubing.

2.1.9 Tube Ring Seal

Attached to the base of the dome ring; butyl glazing rope 0.24 inch diameter; to minimize air infiltration.

2.1.10 Dome Seal

Adhesive backed weatherstrip, 0.63 inch tall by 0.28 inch wide.

2.1.11 Reflective Tubes

Aluminum sheet, 0.018 inch thickness. Interior Finish: Spectralight Infinity high reflectance specular finish on exposed reflective surface. Specular reflectance for visible spectrum (400 nm to 760 nm) greater than 99 percent. Total solar spectrum reflectance (400 nm to 2500 nm) less than 80.2 percent. Color: a* and b* (defined by CIE L*a*b* color model) shall not exceed plus 2 or be less than minus 2 as determined in accordance to ASTM E 308. Reflective extension tube, Type EXX, Notched for Open Ceiling diffuser attachment, 24 inches or 48 inches long

2.1.12 Diffuser Assemblies

For tubes not penetrating ceilings (open ceiling) 21 inch diffuser attached directly to bottom of tube. Lens Type L1 OptiView Fresnel lens design to maximize light output and diffusion. Visible Light Transmission shall be greater than 90 percent at 0.022 inch thick. Classified as CC2. Diffuser

Seal: Open cell foam, acrylic adhesive backed, 0.75 in wide by 0.125 in thick to minimize condensation and bug, dirt and air infiltration per ASTM E 283. Diffuser Trim Ring: Injection molded acrylic. Nominal wall thickness 0.172 inches.

2.1.13 Accessories

Wire Suspension Kit, Type E, Use the wire suspension kit when additional bracing to the structure is required.

2.2 ACCESSORIES

2.2.1 Fasteners

Same material as metals being fastened, non-magnetic steel, non-corrosive metal of type recommended by manufacturer, or injection molded nylon.

2.2.2 Suspension Wire

Steel, annealed, galvanized finish, size and type for application and ceiling system requirement.

2.2.3 Sealant

Polyurethane or copolymer based elastomeric sealant as provided or recommended by manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

Do not begin installation until substrates have been properly prepared. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

Clean surfaces thoroughly prior to installation. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

Install in accordance with manufacturer's printed instructions. After installation of first unit, field test to determine adequacy of installation. Conduct water test in presence of Owner, Architect, or Contractor, or their designated representative. Correct if needed before proceeding with installation of subsequent units.

3.4 PROTECTION

Protect installed products until completion of project. Touch-up, repair or replace damaged products before Substantial Completion.

-- End of Section --

SECTION 08 81 00

GLAZING

08/11

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 C1036	(2011) Standard Specification for Flat Glass
ASTM C920	(2011) Standard Specification for Elastomeric Joint Sealants
ASTM D2287	(2011) Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds
ASTM E413	(2010) Rating Sound Insulation
ASTM E90	(2009) Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements

GLASS ASSOCIATION OF NORTH AMERICA (GANA)

GANA Glazing Manual	(2004) Glazing Manual
GANA Sealant Manual	(2008) Sealant Manual

INSULATING GLASS MANUFACTURERS ALLIANCE (IGMA)

IGMA TB-3001	(1990) Guidelines for Sloped Glazing
IGMA TM-3000	(1997) Glazing Guidelines for Sealed Insulating Glass Units
IGMA TR-1200	(1983) Commercial Insulating Glass Dimensional Tolerances

NATIONAL FENESTRATION RATING COUNCIL (NFRC)

NFRC 100	(2010) Procedure for Determining Fenestration Product U-Factors
NFRC 200	(2010) Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

Energy Star (1992; R 2006) Energy Star Energy Efficiency Labeling System

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

16 CFR 1201 Safety Standard for Architectural Glazing Materials

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for A/E approval. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Installation

Drawings showing complete details of the proposed setting methods, mullion details, edge blocking, size of openings, frame details, materials, and types and thickness of glass.

Drawings showing complete details of the proposed setting methods, mullion details, edge blocking, size of openings, frame details, materials, and types and thickness of glass.

SD-03 Product Data

Insulating Glass

Documentation for Energy Star qualifications.

Glazing Accessories

Manufacturer's descriptive product data, handling and storage recommendations, installation instructions, and cleaning instructions.

SD-04 Samples

Insulating Glass

Sealant

Two 8 by 10 inch samples of each of the following: insulating glass units.

Three samples of each indicated material. Samples of plastic sheets shall be minimum 5 by 7 inches.

SD-07 Certificates

Insulating Glass

Certificates stating that the glass meets the specified requirements. Labels or manufacturers marking affixed to the

glass will be accepted in lieu of certificates.

Glazing Accessories

Certificates from the manufacturer attesting that the units meet the luminous and solar radiant transmission requirements for heat absorbing glass.

SD-08 Manufacturer's Instructions

Setting and sealing materials

Glass setting

Submit glass manufacturer's recommendations for setting and sealing materials and for installation of each type of glazing material specified.

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver products to the site in unopened containers, labeled plainly with manufacturers' names and brands. Store glass and setting materials in safe, enclosed dry locations and do not unpack until needed for installation. Handle and install materials in a manner that will protect them from damage.

1.4 ENVIRONMENTAL REQUIREMENTS

Do not start glazing work until the outdoor temperature is above 40 degrees F and rising, unless procedures recommended by the glass manufacturer and approved by the Contracting Officer are made to warm the glass and rabbet surfaces. Provide ventilation to prevent condensation of moisture on glazing work during installation. Do not perform glazing work during damp or rainy weather.

1.5 WARRANTY

1.5.1 Warranty for Insulating Glass Units

Warranty insulating glass units against development of material obstruction to vision (such as dust, fogging, or film formation on the inner glass surfaces) caused by failure of the hermetic seal, other than through glass breakage, for a 10-year period following acceptance of the work. Provide new units for any units failing to comply with terms of this warranty within 45 working days after receipt of notice from the Government.

PART 2 PRODUCTS

2.1 GLASS

ASTM C1036, unless specified otherwise. In doors and sidelights, provide safety glazing material conforming to 16 CFR 1201.

2.1.1 Clear Glass

Type I, Class 1 (clear), Quality q5 (B). Provide for glazing openings not indicated or specified otherwise. Use double-strength sheet glass or 1/8 inch float glass for openings up to and including 15 square feet, 3/16 inch for glazing openings over 15 square feet but not over 30 square feet, and

1/4 inch for glazing openings over 30 square feet but not over 45 square feet.

2.1.2 Annealed Glass

Annealed glass shall be Type I transparent flat type, Class 1 - tinted, Quality q3 - glazing select, 44 percent light transmittance, 52 percent shading coefficient, conforming to ASTM C1036. Color shall be bronze.

2.2 INSULATING GLASS UNITS

Two panes of glass separated by a dehydrated 1/2 inch airspace, filled with argon and hermetically sealed. Non-residential glazed systems (including frames and glass) shall be certified by the National Fenestration Rating Council with a whole-window Solar Heat Gain Coefficient (SHGC) maximum of 0.30 determined according to NFRC 200 procedures and a U-factor maximum of 0.35 in accordance with NFRC 100. Glazing shall meet or exceed a luminous efficacy of 1.0. Glazed panels shall be rated for not less than 35 Sound Transmission Class (STC) when tested for laboratory sound transmission loss according to ASTM E90 and determined by ASTM E413. Dimensional tolerances shall be as specified in IGMA TR-1200. Spacer shall be black, roll-formed, thermally broken aluminum, with bent or tightly welded or keyed and sealed joints to completely seal the spacer periphery and eliminate moisture and hydrocarbon vapor transmission into airspace through the corners. Primary seal shall be compressed polyisobutylene and the secondary seal shall be a specially formulated silicone.

Two panes of glass separated by a dehydrated airspace and hermetically sealed. Dimensional tolerances shall be as specified in IGMA TR-1200. Spacer shall be roll-formed, with bent or tightly welded or keyed and sealed joints to completely seal the spacer periphery and eliminate moisture and hydrocarbon vapor transmission into airspace through the corners. Primary seal shall be compressed polyisobutylene and the secondary seal shall be a specially formulated silicone.

2.2.1 Low Emissivity Insulating Glass

Interior and exterior glass panes for Low-E insulating units shall be Type I annealed flat glass, Class 2-tinted with anti-reflective low-emissivity coating on No. 2 surface (inside surface of exterior pane), Quality q3 - glazing select, conforming to ASTM C1036. Glass performance shall be U value maximum of 0.35, Solar Heat Gain Coefficient (SHGC) maximum of 0.30. Color shall be bronze.

2.3 SETTING AND SEALING MATERIALS

Provide as specified in the GANA Glazing Manual, IGMA TM-3000, IGMA TB-3001, and manufacturer's recommendations, unless specified otherwise herein. Do not use metal sash putty, nonskinning compounds, nonresilient preformed sealers, or impregnated preformed gaskets. Materials exposed to view and unpainted shall be gray or neutral color.

2.3.1 Sealants

Provide elastomeric sealants.

2.3.1.1 Elastomeric Sealant

ASTM C920, Type S, Grade NS, Class 12.5, Use G. Use for channel or stop

glazing metal sash. Sealant shall be chemically compatible with setting blocks, edge blocks, and sealing tapes, with sealants used in manufacture of insulating glass units . Color of sealant shall be white.

2.3.2 Joint Backer

Joint backer shall have a diameter size at least 25 percent larger than joint width; type and material as recommended in writing by glass and sealant manufacturer.

2.3.3 Sealing Tapes

Preformed, semisolid, PVC-based material of proper size and compressibility for the particular condition, complying with ASTM D2287. Use only where glazing rabbet is designed for tape and tape is recommended by the glass or sealant manufacturer. Provide spacer shims for use with compressible tapes. Tapes shall be chemically compatible with the product being set.

2.3.4 Glazing Gaskets

2.3.4.1 Aluminum Framing Glazing Gaskets

Glazing gaskets for aluminum framing shall be permanent, elastic, non-shrinking, non-migrating, watertight and weathertight.

2.3.5 Accessories

Provide as required for a complete installation, including glazing points, clips, shims, angles, beads, and spacer strips. Provide noncorroding metal accessories. Provide primer-sealers and cleaners as recommended by the glass and sealant manufacturers.

PART 3 EXECUTION

3.1 PREPARATION

Preparation, unless otherwise specified or approved, shall conform to applicable recommendations in the GANA Glazing Manual, GANA Sealant Manual, IGMA TB-3001, IGMA TM-3000, and manufacturer's recommendations. Determine the sizes to provide the required edge clearances by measuring the actual opening to receive the glass. Grind smooth in the shop glass edges that will be exposed in finish work. Leave labels in place until the installation is approved, except remove applied labels on heat-absorbing glass and on insulating glass units as soon as glass is installed. Securely fix movable items or keep in a closed and locked position until glazing compound has thoroughly set.

3.2 GLASS SETTING

Shop glaze or field glaze items to be glazed using glass of the quality and thickness specified or indicated. Glazing, unless otherwise specified or approved, shall conform to applicable recommendations in the GANA Glazing Manual, GANA Sealant Manual, IGMA TB-3001, IGMA TM-3000, and manufacturer's recommendations. Aluminum windows, wood doors, and wood windows may be glazed in conformance with one of the glazing methods described in the standards under which they are produced, except that face puttying with no bedding will not be permitted. Handle and install glazing materials in accordance with manufacturer's instructions. Use beads or stops which are furnished with items to be glazed to secure the glass in

place. Verify products are properly installed, connected, and adjusted.

3.2.1 Insulating Glass Units

Do not grind, nip, or cut edges or corners of units after the units have left the factory. Springing, forcing, or twisting of units during setting will not be permitted. Handle units so as not to strike frames or other objects. Installation shall conform to applicable recommendations of IGMA TB-3001 and IGMA TM-3000.

3.3 CLEANING

Clean glass surfaces and remove labels, paint spots, putty, and other defacement as required to prevent staining. Glass shall be clean at the time the work is accepted.

3.4 PROTECTION

Glass work shall be protected immediately after installation. Glazed openings shall be identified with suitable warning tapes, cloth or paper flags, attached with non-staining adhesives. Reflective glass shall be protected with a protective material to eliminate any contamination of the reflective coating. Protective material shall be placed far enough away from the coated glass to allow air to circulate to reduce heat buildup and moisture accumulation on the glass. Upon removal, separate protective materials for reuse or recycling. Glass units which are broken, chipped, cracked, abraded, or otherwise damaged during construction activities shall be removed and replaced with new units.

-- End of Section --

SECTION 09 51 00

ACOUSTICAL CEILINGS
08/10

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 A489	(2004e1) Standard Specification for Carbon Steel Lifting Eyes
ASTM A641/A641M	(2009a) Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
ASTM C635/C635M	(2007) Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings
ASTM C636/C636M	(2008) Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels
ASTM E1264	(2008e1) Acoustical Ceiling Products
ASTM E795	(2005) Mounting Test Specimens During Sound Absorption Tests

1.2 SYSTEM DESCRIPTION

Provide sound controlling units mechanically mounted on a ceiling suspension system for acoustical treatment. The unit size, texture, finish, and color must be as specified. The location and extent of acoustical treatment shall be as shown on the approved detail drawings. Submit drawings showing suspension system, method of anchoring and fastening, details, and reflected ceiling plan. Coordinate with paragraph RECLAMATION PROCEDURES for reclamation of mineral fiber acoustical ceiling panels to be removed from the job site.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for A/E approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Approved Detail Drawings

SD-03 Product Data

Acoustical Ceiling Systems
Certification

SD-04 Samples

Acoustical Units
Acoustic Ceiling Tiles

SD-07 Certificates

Acoustical Units
Acoustic Ceiling Tiles

1.4 DELIVERY, STORAGE. AND HANDLING

Deliver materials to the site in the manufacturer's original unopened containers with brand name and type clearly marked. Carefully handle and store materials in dry, watertight enclosures. Immediately before installation, store acoustical units for not less than 24 hours at the same temperature and relative humidity as the space where they will be installed in order to assure proper temperature and moisture acclimation.

1.5 ENVIRONMENTAL REQUIREMENTS

Maintain a uniform temperature of not less than 60 degrees F nor more than 85 degrees F and a relative humidity of not more than 70 percent for 24 hours before, during, and 24 hours after installation of acoustical units.

1.6 SCHEDULING

Complete and dry interior finish work such as plastering, concrete and terrazzo work before ceiling installation. Complete mechanical, electrical, and other work above the ceiling line; install and start operating heating, ventilating, and air conditioning systems in order to maintain temperature and humidity requirements.

1.7 WARRANTY

Provide manufacturer's standard performance guarantees or warranties that extend beyond a one year period. Include an agreement to repair or replace acoustical panels that fail within the warranty period in the standard performance guarantee or warranty. Failures include, but are not limited to, sagging and warping of panels; rusting and manufacturers defects of grid system.

1.8 EXTRA MATERIALS

Furnish spare tiles, from the same lot as those installed, of each color at the rate of 5 tiles for each 1000 tiles installed.

PART 2 PRODUCTS

2.1 ACOUSTICAL UNITS

Comply with EPA requirements. Submit one sample of each type of acoustical unit and each type of suspension grid tee section showing texture, finish, and color. Conform acoustical units to ASTM E1264, Class A.

2.1.1 Units for Exposed-Grid System

- a. Type: III (non-asbestos mineral fiber with painted finish).
- b. Flame Spread: Class A, 25 or less
- c. Pattern: D.
- d. Minimum NRC: 0.75 in open office areas; 0.60 in conference rooms, executive offices, teleconferencing rooms, and other rooms as designated; 0.50 in all other rooms and areas when tested on mounting Type E-400 of ASTM E795.
- e. Minimum Light Reflectance Coefficient: LR-1, 0.75 or greater.
- f. Nominal size: 24 by 24 inch.
- g. Edge detail: Square.
- h. Finish: Factory-applied standard finish.
- i. Minimum CAC: 40.

2.1.2 Humidity Resistant Composition Units

- a. Type: Ceiling panel have a non-combustible 1/2" gypsum core.. Provide panels that do not sag or warp under conditions of heat, high humidity or chemical fumes.
- b. Flame Spread: Class: A, 25 or less.
- c. Finish: 2 mil white stipple vinyl laminate.
- d. Minimum NRC: Minimum 0.50 when tested on Mounting Type E-400 of ASTM E795.
- e. Minimum Light Reflectance Coefficient: LR-1, 0.75 or greater.
- f. Nominal Size: 24 by 24 inch.
- g. Edge Detail: Square.

2.2 SUSPENSION SYSTEM

Provide standard exposed-grid standard width flange suspension system conforming to ASTM C635/C635M for intermediate-duty systems . Provide surfaces exposed to view of aluminum or steel with a factory-applied white baked-enamel finish . Provide wall molding having a flange of not less than 15/16 inch . Provide standard overlapped corners. Suspended ceiling framing system must have the capability to support the finished ceiling, light fixtures, air diffusers, and accessories, as shown. Provide a suspension system with a maximum deflection of 1/360 of the span length.

2.3 HANGERS

Provide hangers and attachment capable of supporting a minimum 300 pound ultimate vertical load without failure of supporting material or attachment.

2.3.1 Wires

Conform wires to ASTM A641/A641M, Class 1, 0.11 inch in diameter.

2.3.2 Eyebolts

Provide eyebolts of weldless, forged-carbon-steel, with a straight-shank in accordance with ASTM A489. Eyebolt size must be a minimum 1/4 inch, zinc coated.

2.4 FINISHES

Use manufacturer's standard textures, patterns and finishes as specified for acoustical units and suspension system members. Treat ceiling suspension system components to inhibit corrosion.

2.5 COLORS AND PATTERNS

Use colors and patterns for acoustical units and suspension system components.

PART 3 EXECUTION

3.1 INSTALLATION

Examine surfaces to receive directly attached acoustical units for unevenness, irregularities, and dampness that would affect quality and execution of the work. Rid areas, where acoustical units will be cemented, of oils, form residue, or other materials that reduce bonding capabilities of the adhesive. Complete and dry interior finish work such as plastering, concrete, and terrazzo work before installation. Complete and approve mechanical, electrical, and other work above the ceiling line prior to the start of acoustical ceiling installation. Provide acoustical work complete with necessary fastenings, clips, and other accessories required for a complete installation. Do not expose mechanical fastenings in the finished work. Lay out hangers for each individual room or space. Provide hangers to support framing around beams, ducts, columns, grilles, and other penetrations through ceilings. Keep main runners and carrying channels clear of abutting walls and partitions. Provide at least two main runners for each ceiling span. Wherever required to bypass an object with the hanger wires, install a subsuspension system so that all hanger wires will be plumb.

3.1.1 Suspension System

Install suspension system in accordance with ASTM C636/C636M and as specified herein. Do not suspend hanger wires or other loads from underside of steel decking.

3.1.1.1 Plumb Hangers

Install hangers plumb and not pressing against insulation covering ducts and pipes. Where lighting fixtures are supported from the suspended ceiling system, provide hangers at a minimum of four hangers per fixture and located not more than 6 inch from each corner of each fixture.

3.1.2 Wall Molding

Provide wall molding where ceilings abut vertical surfaces. Miter corners

where wall moldings intersect or install corner caps. Secure wall molding not more than 3 inch from ends of each length and not more than 16 inch on centers between end fastenings. Provide wall molding springs at each acoustical unit in semi-exposed or concealed systems.

3.1.3 Acoustical Units

Install acoustical units in accordance with the approved installation instructions of the manufacturer. Ensure that edges of acoustical units are in close contact with metal supports, with each other, and in true alignment. Arrange acoustical units so that units less than one-half width are minimized. Hold units in exposed-grid system in place with manufacturer's standard hold-down clips, if units weigh less than 1 psf or if required for fire resistance rating.

3.1.4 Caulking

Seal all joints around pipes, ducts or electrical outlets penetrating the ceiling. Apply a continuous ribbon of acoustical sealant on vertical web of wall or edge moldings.

3.2 CLEANING

Following installation, clean dirty or discolored surfaces of acoustical units and leave them free from defects. Remove units that are damaged or improperly installed and provide new units as directed.

-- End of Section --

SECTION 09 90 00

PAINTS AND COATINGS

05/11

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 CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH)

ACGIH 0100 (2001; Supplements 2002-2008)
Documentation of the Threshold Limit
Values and Biological Exposure Indices

ASTM INTERNATIONAL (ASTM)

ASTM D235 (2002; R 2007) Mineral Spirits (Petroleum
Spirits) (Hydrocarbon Dry Cleaning Solvent)

ASTM D4214 (2007) Standard Test Method for Evaluating
the Degree of Chalking of Exterior Paint
Films

ASTM D523 (2008) Standard Test Method for Specular
Gloss

MASTER PAINTERS INSTITUTE (MPI)

MPI 107 (Oct 2009) Rust Inhibitive Primer
(Water-Based)

MPI 163 (Oct 2009) Exterior W.B. Light Industrial
Coating, Semi-Gloss, MPI Gloss Level 5

MPI 79 (Oct 2009) Alkyd Anti-Corrosive Metal
Primer

SCIENTIFIC CERTIFICATION SYSTEMS (SCS)

SCS SP-01 (2000) Environmentally Preferable Product
Specification for Architectural and
Anti-Corrosive Paints

THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC PA 1 (2000; E 2004) Shop, Field, and
Maintenance Painting of Steel

SSPC PA Guide 3 (1982; E 1995) A Guide to Safety in Paint
Application

SSPC SP 1 (1982; E 2004) Solvent Cleaning

SSPC SP 10/NACE No. 2	(2007) Near-White Blast Cleaning
SSPC SP 12/NACE No.5	(2002) Surface Preparation and Cleaning of Metals by Waterjetting Prior to Recoating
SSPC SP 2	(1982; E 2004) Hand Tool Cleaning
SSPC SP 3	(1982; E 2004) Power Tool Cleaning
SSPC SP 6/NACE No.3	(2007) Commercial Blast Cleaning
SSPC SP 7/NACE No.4	(2007) Brush-Off Blast Cleaning
SSPC VIS 1	(2002; e 2004) Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning
SSPC VIS 3	(2004) Guide and Reference Photographs for Steel Surfaces Prepared by Hand and Power Tool Cleaning
SSPC VIS 4/NACE VIS 7	(1998; E 2000; E 2004) Guide and Reference Photographs for Steel Surfaces Prepared by Waterjetting

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2008; Errata 1-2010; Changes 1-3 2010; Changes 4-6 2011) Safety and Health Requirements Manual
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U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.1000	Air Contaminants
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1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for A/E approval. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

The current MPI, "Approved Product List" which lists paint by brand, label, product name and product code as of the date of contract award, will be used to determine compliance with the submittal requirements of this specification. The Contractor may choose to use a subsequent MPI "Approved Product List", however, only one list may be used for the entire contract and each coating system is to be from a single manufacturer. All coats on a particular substrate must be from a single manufacturer. No variation from the MPI Approved Products List is acceptable.

Samples of specified materials may be taken and tested for compliance with specification requirements.

In keeping with the intent of Executive Order 13101, "Greening the Government through Waste Prevention, Recycling, and Federal Acquisition", products certified by SCS as meeting SCS SP-01 shall be given preferential consideration over registered products. Products that are registered shall be given preferential consideration over products not carrying any EPP

designation.

SD-03 Product Data

Certification

Materials;

Manufacturer's Technical Data Sheets

SD-04 Samples

Color

Submit manufacturer's samples of paint colors. Cross reference color samples to color scheme as indicated.

1.3 REGULATORY REQUIREMENTS

1.3.1 Environmental Protection

In addition to requirements specified elsewhere for environmental protection, provide coating materials that conform to the restrictions of the local Air Pollution Control District and regional jurisdiction. Notify Contracting Officer of any paint specified herein which fails to conform.

1.3.2 Lead Content

Do not use coatings having a lead content over 0.06 percent by weight of nonvolatile content.

1.3.3 Chromate Content

Do not use coatings containing zinc-chromate or strontium-chromate.

1.3.4 Asbestos Content

Materials shall not contain asbestos.

1.3.5 Mercury Content

Materials shall not contain mercury or mercury compounds.

1.3.6 Silica

Abrasive blast media shall not contain free crystalline silica.

1.3.7 Human Carcinogens

Materials shall not contain ACGIH 0100 confirmed human carcinogens (A1) or suspected human carcinogens (A2).

1.4 PACKAGING, LABELING, AND STORAGE

Paints shall be in sealed containers that legibly show the contract specification number, designation name, formula or specification number, batch number, color, quantity, date of manufacture, manufacturer's formulation number, manufacturer's directions including any warnings and

special precautions, and name and address of manufacturer. Pigmented paints shall be furnished in containers not larger than 5 gallons. Paints and thinners shall be stored in accordance with the manufacturer's written directions, and as a minimum, stored off the ground, under cover, with sufficient ventilation to prevent the buildup of flammable vapors, and at temperatures between 40 to 95 degrees F. Do not store paint, polyurethane, varnish, or wood stain products with materials that have a high capacity to adsorb VOC emissions, . Do not store paint, polyurethane, varnish, or wood stain products in occupied spaces.

1.5 SAFETY AND HEALTH

Apply coating materials using safety methods and equipment in accordance with the following:

Work shall comply with applicable Federal, State, and local laws and regulations, and with the ACCIDENT PREVENTION PLAN, including the Activity Hazard Analysis as specified in Section 01 35 26 GOVERNMENT SAFETY REQUIREMENTS and in Appendix A of EM 385-1-1. The Activity Hazard Analysis shall include analyses of the potential impact of painting operations on painting personnel and on others involved in and adjacent to the work zone.

1.5.1 Safety Methods Used During Coating Application

Comply with the requirements of SSPC PA Guide 3.

1.5.2 Toxic Materials

To protect personnel from overexposure to toxic materials, conform to the most stringent guidance of:

- a. The applicable manufacturer's Material Safety Data Sheets (MSDS) or local regulation.
- b. 29 CFR 1910.1000.
- c. ACGIH 0100, threshold limit values.

1.6 ENVIRONMENTAL CONDITIONS

Comply, at minimum, with manufacturer recommendations for space ventilation during and after installation.

1.6.1 Coatings

Do not apply coating when air or substrate conditions are:

- a. Less than 5 degrees F above dew point;
- b. Below 50 degrees F or over 95 degrees F, unless specifically pre-approved by the Contracting Officer and the product manufacturer. Under no circumstances shall application conditions exceed manufacturer recommendations.

1.7 LOCATION AND SURFACE TYPE TO BE PAINTED

1.7.1 Painting Included

Where a space or surface is indicated to be painted, include the following

unless indicated otherwise.

- a. Surfaces behind portable objects and surface mounted articles readily detachable by removal of fasteners, such as screws and bolts.
- b. Existing coated surfaces that are damaged during performance of the work.

1.7.1.1 Exterior Painting

Includes , existing coated surfaces, of the building and appurtenances. Also included are existing coated surfaces made bare by cleaning operations.

1.7.2 Painting Excluded

Do not paint the following unless indicated otherwise.

- a. Surfaces concealed and made inaccessible by panelboards, fixed ductwork, machinery, and equipment fixed in place.
- b. Surfaces in concealed spaces. Concealed spaces are defined as enclosed spaces above suspended ceilings, furred spaces, attic spaces, crawl spaces, elevator shafts and chases.
- c. Steel to be embedded in concrete.
- d. Copper, stainless steel, aluminum, brass, and lead except existing coated surfaces.
- e. Hardware, fittings, and other factory finished items.

1.7.3 Definitions and Abbreviations

1.7.3.1 Qualification Testing

Qualification testing is the performance of all test requirements listed in the product specification. This testing is accomplished by MPI to qualify each product for the MPI Approved Product List, and may also be accomplished by Contractor's third party testing lab if an alternative to Batch Quality Conformance Testing by MPI is desired.

1.7.3.2 Batch Quality Conformance Testing

Batch quality conformance testing determines that the product provided is the same as the product qualified to the appropriate product specification. This testing shall only be accomplished by MPI testing lab.

1.7.3.3 Coating

A film or thin layer applied to a base material called a substrate. A coating may be a metal, alloy, paint, or solid/liquid suspensions on various substrates (metals, plastics, wood, paper, leather, cloth, etc.). They may be applied by electrolysis, vapor deposition, vacuum, or mechanical means such as brushing, spraying, calendaring, and roller coating. A coating may be applied for aesthetic or protective purposes or both. The term "coating" as used herein includes emulsions, enamels, stains, varnishes, sealers, epoxies, and other coatings, whether used as primer, intermediate, or finish coat. The terms paint and coating are used interchangeably.

1.7.3.4 DFT or dft

Dry film thickness, the film thickness of the fully cured, dry paint or coating.

1.7.3.5 DSD

Degree of Surface Degradation, the MPI system of defining degree of surface degradation. Five (5) levels are generically defined under the Assessment sections in the MPI Maintenance Repainting Manual.

1.7.3.6 EPP

Environmentally Preferred Products, a standard for determining environmental preferability in support of Executive Order 13101.

1.7.3.7 EXT

MPI short term designation for an exterior coating system.

1.7.3.8 INT

MPI short term designation for an interior coating system.

1.7.3.9 micron / microns

The metric measurement for 0.001 mm or one/one-thousandth of a millimeter.

1.7.3.10 mil / mils

The English measurement for 0.001 in or one/one-thousandth of an inch, equal to 25.4 microns or 0.0254 mm.

1.7.3.11 mm

The metric measurement for millimeter, 0.001 meter or one/one-thousandth of a meter.

1.7.3.12 MPI Gloss Levels

MPI system of defining gloss. Seven (7) gloss levels (G1 to G7) are generically defined under the Evaluation sections of the MPI Manuals. Traditionally, Flat refers to G1/G2, Eggshell refers to G3, Semigloss refers to G5, and Gloss refers to G6.

Gloss levels are defined by MPI as follows:

<u>Gloss Level</u>	<u>Description</u>	<u>Units at 60 degrees</u>	<u>Units at 85 degrees</u>
G1	Matte or Flat	0 to 5	10 max
G2	Velvet	0 to 10	10 to 35
G3	Eggshell	10 to 25	10 to 35

<u>Gloss Level</u>	<u>Description</u>	<u>Units at 60 degrees</u>	<u>Units at 85 degrees</u>
G4	Satin	20 to 35	35 min
G5	Semi-Gloss	35 to 70	
G6	Gloss	70 to 85	
G7	High Gloss		

Gloss is tested in accordance with ASTM D523. Historically, the Government has used Flat (G1 / G2), Eggshell (G3), Semi-Gloss (G5), and Gloss (G6).

1.7.3.13 MPI System Number

The MPI coating system number in each Division found in either the MPI Architectural Painting Specification Manual or the Maintenance Repainting Manual and defined as an exterior (EXT/REX) or interior system (INT/RIN). The Division number follows the CSI Master Format.

1.7.3.14 Paint

See Coating definition.

1.7.3.15 REX

MPI short term designation for an exterior coating system used in repainting projects or over existing coating systems.

1.7.3.16 RIN

MPI short term designation for an interior coating system used in repainting projects or over existing coating systems.

PART 2 PRODUCTS

2.1 MATERIALS

PART 3 EXECUTION

3.1 PROTECTION OF AREAS AND SPACES NOT TO BE PAINTED

Prior to surface preparation and coating applications, remove, mask, or otherwise protect, hardware, hardware accessories, machined surfaces, radiator covers, plates, lighting fixtures, public and private property, and other such items not to be coated that are in contact with surfaces to be coated. Following completion of painting, workmen skilled in the trades involved shall reinstall removed items. Restore surfaces contaminated by coating materials, to original condition and repair damaged items.

3.2 SURFACE PREPARATION

Remove dirt, splinters, loose particles, grease, oil, disintegrated coatings, and other foreign matter and substances deleterious to coating performance as specified for each substrate before application of paint or surface treatments. Oil and grease shall be removed prior to mechanical cleaning. Cleaning shall be programmed so that dust and other contaminants

will not fall on wet, newly painted surfaces. Exposed ferrous metals such as nail heads on or in contact with surfaces to be painted with water-thinned paints, shall be spot-primed with a suitable corrosion-inhibitive primer capable of preventing flash rusting and compatible with the coating specified for the adjacent areas.

3.2.1 Additional Requirements for Preparation of Surfaces With Existing Coatings

Before application of coatings, perform the following on surfaces covered by soundly-adhered coatings, defined as those which cannot be removed with a putty knife:

- a. Test existing finishes for lead before sanding, scraping, or removing. If lead is present, refer to paragraph Toxic Materials.
- b. Wipe previously painted surfaces to receive solvent-based coatings, except stucco and similarly rough surfaces clean with a clean, dry cloth saturated with mineral spirits, ASTM D235. Allow surface to dry. Wiping shall immediately precede the application of the first coat of any coating, unless specified otherwise.
- c. Sand existing glossy surfaces to be painted to reduce gloss. Brush, and wipe clean with a damp cloth to remove dust.
- d. The requirements specified are minimum. Comply also with the application instructions of the paint manufacturer.
- e. Previously painted surfaces specified to be repainted and/or damaged during construction shall be thoroughly cleaned of all grease, dirt, dust or other foreign matter.
- f. Blistering, cracking, flaking and peeling or other deteriorated coatings shall be removed.
- g. Chalk shall be removed so that when tested in accordance with ASTM D4214, the chalk resistance rating is no less than 8.
- h. Slick surfaces shall be roughened. Damaged areas such as, but not limited to, nail holes, cracks, chips, and spalls shall be repaired with suitable material to match adjacent undamaged areas.
- i. Edges of chipped paint shall be feather edged and sanded smooth.
- j. Rusty metal surfaces shall be cleaned as per SSPC requirements. Solvent, mechanical, or chemical cleaning methods shall be used to provide surfaces suitable for painting.
- k. New, proposed coatings shall be compatible with existing coatings.

3.2.2 Removal of Existing Coatings

Remove existing coatings from the following surfaces:

- a. Surfaces containing large areas of minor defects;
- b. Surfaces containing more than 20 percent peeling area; and
- c. Surfaces designated by the Contracting Officer, such as surfaces where

rust shows through existing coatings.

3.2.3 Substrate Repair

- a. Repair substrate surface damaged during coating removal;
- b. Sand edges of adjacent soundly-adhered existing coatings so they are tapered as smooth as practical to areas involved with coating removal; and
- c. Clean and prime the substrate as specified.

3.3 PREPARATION OF METAL SURFACES

3.3.1 Existing and New Ferrous Surfaces

- a. Ferrous Surfaces including Shop-coated Surfaces and Small Areas That Contain Rust, Mill Scale and Other Foreign Substances: Solvent clean or detergent wash in accordance with SSPC SP 1 to remove oil and grease. Where shop coat is missing or damaged, clean according to SSPC SP 2, , , or . Brush-off blast remaining surface in accordance with SSPC SP 7/NACE No.4; Shop-coated ferrous surfaces shall be protected from corrosion by treating and touching up corroded areas immediately upon detection.

3.3.2 Final Ferrous Surface Condition:

For tool cleaned surfaces, the requirements are stated in SSPC SP 2 and SSPC SP 3. As a visual reference, cleaned surfaces shall be similar to photographs in SSPC VIS 3.

For abrasive blast cleaned surfaces, the requirements are stated in SSPC SP 7/NACE No.4, SSPC SP 6/NACE No.3, and SSPC SP 10/NACE No. 2. As a visual reference, cleaned surfaces shall be similar to photographs in SSPC VIS 1.

For waterjet cleaned surfaces, the requirements are stated in SSPC SP 12/NACE No.5. As a visual reference, cleaned surfaces shall be similar to photographs in SSPC VIS 4/NACE VIS 7.

3.4 APPLICATION

3.4.1 Coating Application

Painting practices shall comply with applicable federal, state and local laws enacted to insure compliance with Federal Clean Air Standards. Apply coating materials in accordance with SSPC PA 1. SSPC PA 1 methods are applicable to all substrates, except as modified herein.

At the time of application, paint shall show no signs of deterioration. Uniform suspension of pigments shall be maintained during application.

Unless otherwise specified or recommended by the paint manufacturer, paint may be applied by brush, roller, or spray. Use trigger operated spray nozzles for water hoses. Rollers for applying paints and enamels shall be of a type designed for the coating to be applied and the surface to be coated. Wear protective clothing and respirators when applying oil-based paints or using spray equipment with any paints.

Paints, except water-thinned types, shall be applied only to surfaces that are completely free of moisture as determined by sight or touch.

Thoroughly work coating materials into joints, crevices, and open spaces. Special attention shall be given to insure that all edges, corners, crevices, welds, and rivets receive a film thickness equal to that of adjacent painted surfaces.

Each coat of paint shall be applied so dry film shall be of uniform thickness and free from runs, drops, ridges, waves, pinholes or other voids, laps, brush marks, and variations in color, texture, and finish. Hiding shall be complete.

Touch up damaged coatings before applying subsequent coats. Interior areas shall be broom clean and dust free before and during the application of coating material.

- a. **Drying Time:** Allow time between coats, as recommended by the coating manufacturer, to permit thorough drying, but not to present topcoat adhesion problems. Provide each coat in specified condition to receive next coat.
- b. **Primers, and Intermediate Coats:** Do not allow primers or intermediate coats to dry more than 30 days, or longer than recommended by manufacturer, before applying subsequent coats. Follow manufacturer's recommendations for surface preparation if primers or intermediate coats are allowed to dry longer than recommended by manufacturers of subsequent coatings. Each coat shall cover surface of preceding coat or surface completely, and there shall be a visually perceptible difference in shades of successive coats.
- c. **Finished Surfaces:** Provide finished surfaces free from runs, drops, ridges, waves, laps, brush marks, and variations in colors.

3.4.2 Coating Systems

- a. **Systems by Substrates:** Apply coatings that conform to the respective specifications listed in the following Tables:

Table	
<u>EXTERIOR</u>	
Division 5.	Exterior Metal, Ferrous and Non-Ferrous Paint Table

- b. **Minimum Dry Film Thickness (DFT):** Apply paints, primers, varnishes, enamels, undercoats, and other coatings to a minimum dry film thickness of 1.5 mil each coat unless specified otherwise in the Tables. Coating thickness where specified, refers to the minimum dry film thickness.
- c. **Coatings for Surfaces Not Specified Otherwise:** Coat surfaces which have not been specified, the same as surfaces having similar conditions of exposure.
- d. **Existing Surfaces Damaged During Performance of the Work, Including New Patches In Existing Surfaces:** Coat surfaces with the following:

- (1) One coat of primer.
- (2) One coat of undercoat or intermediate coat.
- (3) One topcoat to match adjacent surfaces.

e. Existing Coated Surfaces To Be Painted: Apply coatings conforming to the respective specifications listed in the Tables herein, except that pretreatments, sealers and fillers need not be provided on surfaces where existing coatings are soundly adhered and in good condition. Do not omit undercoats or primers.

3.5 COATING SYSTEMS FOR METAL

Apply coatings of Tables in Division 5 for Exterior and Interior.

- a. Apply specified ferrous metal primer on the same day that surface is cleaned, to surfaces that meet all specified surface preparation requirements at time of application.
- b. Inaccessible Surfaces: Prior to erection, use one coat of specified primer on metal surfaces that will be inaccessible after erection.
- c. Shop-primed Surfaces: Touch up exposed substrates and damaged coatings to protect from rusting prior to applying field primer.
- d. Surface Previously Coated with Epoxy or Urethane: Apply MPI 101, 1.5 mils DFT immediately prior to application of epoxy or urethane coatings.
- e. Pipes and Tubing: The semitransparent film applied to some pipes and tubing at the mill is not to be considered a shop coat, but shall be overcoated with the specified ferrous-metal primer prior to application of finish coats.
- f. Exposed Nails, Screws, Fasteners, and Miscellaneous Ferrous Surfaces. On surfaces to be coated with water thinned coatings, spot prime exposed nails and other ferrous metal with latex primer MPI 107.

3.6 INSPECTION AND ACCEPTANCE

In addition to meeting previously specified requirements, demonstrate mobility of moving components, including swinging and sliding doors, cabinets, and windows with operable sash, for inspection by the Contracting Officer. Perform this demonstration after appropriate curing and drying times of coatings have elapsed and prior to invoicing for final payment.

3.7 PAINT TABLES

All DFT's are minimum values..

3.7.1 EXTERIOR PAINT TABLES

DIVISION 5: EXTERIOR METAL, FERROUS AND NON-FERROUS PAINT TABLE
<u>STEEL / FERROUS SURFACES</u>

DIVISION 5: EXTERIOR METAL, FERROUS AND NON-FERROUS PAINT TABLE		
A. Existing steel that has been spot-blasted to SSPC SP 6/NACE No.3:		
1. Surface previously coated with alkyd or latex:		
Waterborne Light Industrial Coatin		
MPI REX 5.1C-G5 (Semigloss)		
Spot Primer: MPI 79	Intermediate: MPI 163	Topcoat: MPI 163
System DFT: 5 mils		

-- End of Section --

SECTION 23 00 00

AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEMS
08/10

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	(2008) 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 260	(2001) Sound Rating of Ducted Air Moving and Conditioning Equipment
AHRI 410	(2001; Addendum 1-2002; Addendum 2-2005) Forced-Circulation Air-Cooling and Air-Heating Coils
AHRI 430	(2009) Central-Station Air-Handling Units
AHRI 880	(2008) Performance Rating of Air Terminals
AHRI 885	(2008) Procedure for Estimating Occupied Space Sound Levels in the Application of Air Terminals and Air Outlets
AHRI Guideline D	(1996) Application and Installation of Central Station Air-Handling Units

AMERICAN BEARING MANUFACTURERS ASSOCIATION (ABMA)

ABMA 11	(1990) Load Ratings and Fatigue Life for Roller Bearings
ABMA 9	(1990; R 2008) Load Ratings and Fatigue Life for Ball Bearings

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

- ASHRAE 52.2 (2010; Errata 2010) Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size
- ASHRAE 62.1 (2010; Errata 2011) Ventilation for Acceptable Indoor Air Quality
- ASHRAE 68 (1997) Laboratory Method of Testing to Determine the Sound Power In a Duct
- ASHRAE 70 (2006) Method of Testing for Rating the Performance of Air Outlets and Inlets

ASME INTERNATIONAL (ASME)

- ASME A13.1 (2007) Scheme for the Identification of Piping Systems

ASTM INTERNATIONAL (ASTM)

- ASTM A 123/A 123M (2009) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
- ASTM A 167 (1999; R 2009) Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
- ASTM A 53/A 53M (2010) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
- ASTM A 924/A 924M (2010) Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
- ASTM B 117 (2009) Standing Practice for Operating Salt Spray (Fog) Apparatus
- ASTM B 766 (1986; R 2008) Standard Specification for Electrodeposited Coatings of Cadmium
- ASTM C 1071 (2005e1) Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material)
- ASTM C 553 (2008) Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
- ASTM C 916 (1985; R 2007) Standard Specification for Adhesives for Duct Thermal Insulation
- ASTM D 1654 (2008) Evaluation of Painted or Coated Specimens Subjected to Corrosive

Environments

- ASTM D 3359 (2009e2) Measuring Adhesion by Tape Test
- ASTM D 520 (2000; R 2011) Zinc Dust Pigment
- ASTM E 2016 (2006) Standard Specification for Industrial Woven Wire Cloth
- ASTM E 84 (2011b) Standard Test Method for Surface Burning Characteristics of Building Materials

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

- 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

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

- NFPA 90A (2012) Standard for the Installation of Air Conditioning and Ventilating Systems

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

- SMACNA 1966 (2005) HVAC Duct Construction Standards Metal and Flexible, 3rd Edition

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

- 40 CFR 82 Protection of Stratospheric Ozone

UNDERWRITERS LABORATORIES (UL)

- UL 181 (2005; Reprint Oct 2008) Factory-Made Air Ducts and Air Connectors
- UL 214 (1997; Rev thru Aug 2001) Tests for Flame-Propagation of Fabrics and Films
- UL 586 (2009) Standard for High-Efficiency Particulate, Air Filter Units
- UL 6 (2007; reprint Nov 2010) Electrical Rigid Metal Conduit-Steel
- UL 705 (2004; Reprint Oct 2009) Standard for Power Ventilators
- UL 723 (2008; Reprint Sep 2010) Test for Surface Burning Characteristics of Building

Materials

- UL 900 (2004; Reprint Nov 2009) Standard for Air Filter Units
- UL Bld Mat Dir (2011) Building Materials Directory
- UL Electrical Constructn (2009) Electrical Construction Equipment 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

The number of charts and diagrams shall be equal to or greater than the number of mechanical equipment rooms. Where more than one chart or diagram per space is required, mount these in edge pivoted, swinging leaf, extruded aluminum frame holders which open to 170 degrees.

1.2.1.1 Charts

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.

1.2.1.2 Diagrams

Submit proposed diagrams, at least 2 weeks prior to start of related testing. provide neat mechanical drawings provided with extruded aluminum frame under 1/8-inch glass or laminated plastic, system diagrams that show the layout of equipment, piping, and ductwork, and typed condensed operation manuals explaining preventative maintenance procedures, methods of checking the system for normal, safe operation, and procedures for safely starting and stopping the system. After approval, post these items where directed.

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:

<u>SERVICE</u>	<u>LABEL AND TAG DESIGNATION</u>
Air handling unit Number	RTU-1 and AHU-1
Exhaust Fan Number	EF-1
VAV Box Number	VAV-1

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

1/2 inch
3/4 inch
1-1/4 inch

1.2.3 Color Coding

Color coding of all piping systems shall be in accordance with ASME A13.1.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for A/E approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Detail Drawings

SD-03 Product Data

Insulated Nonmetallic Flexible Duct Runouts
Duct Connectors
Duct Access Doors
Manual Balancing Dampers
Sound Attenuation Equipment
Acoustical Duct Liner
Diffusers; G
Registers and Grilles
Centrifugal Type Power Roof Ventilators
Air Handling Units
Variable Volume, Single Duct Terminal Units
Test Procedures
Diagrams

SD-06 Test Reports

Performance Tests
Damper Acceptance Test

SD-07 Certificates

Bolts

SD-08 Manufacturer's Instructions

Manufacturer's Installation Instructions
Operation and Maintenance Training

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals
Manual Balancing Dampers
Centrifugal Type Power Roof Ventilators

Air Handling Units
Variable Volume, Single Duct Terminal Units
Reheat 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. All coils shall pass ASTM B117-90 3000 hour salt spray resistant test. 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. Provide written certification from the bolt manufacturer that the bolts furnished comply with the requirements of this specification. Include illustrations of product markings, and the number of each type of bolt to be furnished in the certification.

1.4.2 Asbestos Prohibition

Do not use asbestos and asbestos-containing products.

1.4.3 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.

1.4.4 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.

1.4.5 Test Procedures

Submit proposed test procedures and test schedules for the ductwork leak test, and performance tests of systems, at least 2 weeks prior to the start of related testing.

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

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.

2.2 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.

2.3 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. The requirements for operating platforms are specified in Section 05 12 00 STRUCTURAL STEEL.

2.4 ELECTRICAL WORK

- a. Mechanical contractor is responsible for all motor starters. Provide motors, controllers, integral disconnects, contactors, and controls with their respective pieces of equipment, except controllers indicated as part of motor control centers. Provide electrical equipment,

including motors and wiring, as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. 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.
- e. Where variable-speed motors are indicated, solid-state variable-speed controllers are allowed to accomplish the same function. Provide variable frequency drives for motors as specified in Section 23 09 23.13 20 DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC.

2.5 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.

2.6 PAINTING

Paint equipment units in accordance with approved equipment manufacturer's standards unless specified otherwise. Field retouch only if approved. Otherwise, return equipment to the factory for refinishing.

2.7 INDOOR AIR QUALITY

Provide equipment and components that comply with the requirements of ASHRAE 62.1 unless more stringent requirements are specified herein.

2.8 DUCT SYSTEMS

2.8.1 Metal Ductwork

Provide metal ductwork construction, including all fittings and components, that complies with SMACNA 1966, as supplemented and modified by this

specification .

- a. Ductwork shall be constructed meeting the requirements for the duct system static pressure specified in APPENDIX D of Section 23 05 93 TESTING, ADJUSTING AND BALANCING FOR HVAC.
- b. Provide radius type elbows with a centerline radius of 1.5 times the width or diameter of the duct where space permits. Otherwise, elbows having a minimum radius equal to the width or diameter of the duct or square elbows with factory fabricated turning vanes are allowed.
- c. Provide ductwork that meets the requirements of Seal Class A. Provide ductwork in VAV systems upstream of the VAV boxes that meets the requirements of Seal Class A.
- d. Provide sealants that conform to fire hazard classification specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS and are suitable for the range of air distribution and ambient temperatures to which it is exposed. Do not use pressure sensitive tape as a sealant.
- e. Make spiral lock seam duct, and flat oval with duct sealant and lock with not less than 3 equally spaced drive screws or other approved methods indicated in SMACNA 1966. Apply the sealant to the exposed male part of the fitting collar so that the sealer is on the inside of the joint and fully protected by the metal of the duct fitting. Apply one brush coat of the sealant over the outside of the joint to at least 2 inch band width covering all screw heads and joint gap. Dents in the male portion of the slip fitting collar are not acceptable. Fabricate outdoor air intake ducts and plenums with watertight soldered or brazed joints and seams.

2.8.1.1 Insulated Nonmetallic Flexible Duct Runouts

Use flexible duct runouts only where indicated. Runout length is indicated on the drawings, and is not to exceed 5 feet. Provide runouts that are preinsulated, factory fabricated, and that comply with NFPA 90A and UL 181. Provide ducts designed for working pressures of two inches water gauge positive and 1.5 inches water gauge negative. Provide either field or factory applied vapor barrier. Provide not less than 20 ounce glass fabric duct connectors coated on both sides with neoprene. Where coil induction or high velocity units are supplied with vertical air inlets, use a streamlined, vaned and mitered elbow transition piece for connection to the flexible duct or hose. Provide a die-stamped elbow and not a flexible connector as the last elbow to these units other than the vertical air inlet type. Insulated flexible connectors are allowed as runouts. Provide insulated material and vapor barrier that conform to the requirements of Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS. Do not expose the insulation material surface to the air stream.

2.8.1.2 General Service Duct Connectors

Provide a flexible duct connector approximately 6 inches in width where sheet metal connections are made to fans or where ducts of dissimilar metals are connected. For round/oval ducts, secure the flexible material by stainless steel or zinc-coated, iron clinch-type draw bands. For rectangular ducts, install the flexible material locked to metal collars using normal duct construction methods. Provide a composite connector system that complies with UL 214 and is classified as "flame-retarded fabrics" in UL Bld Mat Dir.

2.8.2 Duct Access Doors

Provide hinged access doors conforming to SMACNA 1966 in ductwork and plenums where indicated and at all air flow measuring primaries, automatic dampers, fire dampers, coils, thermostats, and other apparatus requiring service and inspection in the duct system. Provide access doors upstream and downstream of air flow measuring primaries and heating and cooling coils. Provide doors that are a minimum 15 by 18 inches, unless otherwise shown. Where duct size does not accommodate this size door, make the doors as large as practicable. Equip doors 24 by 24 inches or larger with fasteners operable from inside and outside the duct. Use insulated type doors in insulated ducts.

2.8.3 Manual Balancing Dampers

a. Furnish manual balancing dampers with accessible operating mechanisms. Use chromium plated operators (with all exposed edges rounded) in finished portions of the building. Provide manual volume control dampers that are operated by locking-type quadrant operators.

b. Unless otherwise indicated, provide opposed blade type multileaf dampers with maximum blade width of 12 inches. Provide access doors or panels for all concealed damper operators and locking setscrews. Provide access doors or panels in hard ceilings, partitions and walls for access to all concealed damper operators and damper locking setscrews. Coordinate location of doors or panels with other affected contractors.

c. Provide stand-off mounting brackets, bases, or adapters not less than the thickness of the insulation when the locking-type quadrant operators for dampers are installed on ducts to be thermally insulated, to provide clearance between the duct surface and the operator. Stand-off mounting items shall be integral with the operator or standard accessory of the damper manufacturer.

2.8.4 Automatic Balancing Dampers

Provide dampers as specified in paragraph SUPPLEMENTAL COMPONENTS/SERVICES, subparagraph CONTROLS.

2.8.5 Sound Attenuation Equipment

a. For acoustical duct liner: Use fibrous glass designed or flexible elastomeric duct liner for lining ductwork and conforming to the requirements of ASTM C 1071, Type I and II. Provide uniform density, graduated density, or dual density liner composition, as standard with the manufacturer. Provide not less than 1 inch thick coated lining. Where acoustical duct liner is used, provide the thermal equivalent of the insulation specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS for liner or combination of liner and insulation applied to the exterior of the ductwork. Increase duct sizes shown to compensate for the thickness of the lining used. In lieu of sheet metal duct with field-applied acoustical lining, provide acoustically equivalent lengths of fibrous glass duct, elastomeric duct liner or factory fabricated double-walled internally insulated duct with perforated liner.

2.8.6 Diffusers, Registers, and Grilles

Provide factory-fabricated units of aluminum that distribute the specified quantity of air evenly over space intended without causing noticeable drafts, air movement faster than 50 fpm in occupied zone, or dead spots anywhere in the conditioned area. Provide outlets for diffusion, spread, throw, and noise level as required for specified performance. Certify performance according to ASHRAE 70. Provide sound rated and certified inlets and outlets according to ASHRAE 70. Provide sound power level as indicated. Provide diffusers and registers with volume damper with accessible operator, unless otherwise indicated; or if standard with the manufacturer, an automatically controlled device is acceptable. Provide opposed blade type volume dampers for all diffusers and registers, except linear slot diffusers. Provide linear slot diffusers with round or elliptical balancing dampers. Where the inlet and outlet openings are located less than 7 feet above the floor, protect them by a grille or screen according to NFPA 90A.

2.8.6.1 Diffusers

Provide diffuser types indicated. Furnish ceiling mounted units with anti-smudge devices, unless the diffuser unit minimizes ceiling smudging through design features. Provide diffusers with air deflectors of the type indicated. Provide air handling troffers or combination light and ceiling diffusers conforming to the requirements of UL Electrical Constructn for the interchangeable use as cooled or heated air supply diffusers or return air units. Install ceiling mounted units with rims tight against ceiling. Provide sponge rubber gaskets between ceiling and surface mounted diffusers for air leakage control. Provide suitable trim for flush mounted diffusers. For connecting the duct to diffuser, provide duct collar that is airtight and does not interfere with volume controller. Provide return or exhaust units that are similar to supply diffusers.

2.8.6.2 Perforated Plate Diffusers

Provide adjustable one-way, two-way, three-way, or four-way air pattern controls as indicated. Provide diffuser faceplates that do not sag or deflect when operating under design conditions.

2.8.6.3 Registers and Grilles

2.8.6.4 Registers

Double-deflection supply registers. Provide manufacturer-furnished volume dampers. Provide volume dampers of the group-operated, opposed-blade type and key adjustable by inserting key through face of register. Operating mechanism shall not project through any part of the register face. Automatic volume control devices are acceptable. Provide exhaust and return registers as specified for supply registers, except provide exhaust and return registers that have a single set of nondirectional face bars or vanes having the same appearance as the supply registers.

2.8.7 Bird Screens and Frames

Provide bird screens that conform to ASTM E 2016, No. 2 mesh, aluminum or stainless steel. Provide "medium-light" rated aluminum screens. Provide "light" rated stainless steel screens. Provide removable type frames fabricated from either stainless steel or extruded aluminum.

2.9 AIR SYSTEMS EQUIPMENT

2.9.1 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.

2.9.1.1 Centrifugal Type Power Roof Ventilators

Provide direct or V-belt driven centrifugal type fans with backward inclined, non-overloading wheel. Provide hinged or removable and weatherproof motor compartment housing, constructed of heavy gauge aluminum. Provide fans with birdscreen, disconnect switch, gravity dampers, roof curb,. Provide dripproof type motor enclosure. Provide centrifugal type kitchen exhaust fans according to UL 705, fitted with V-belt drive, round hood, and windband upblast discharge configuration, integral residue trough and collection device, with motor and power transmission components located in outside positively air ventilated compartment. Use only lubricated bearings.

2.9.2 Coils

Provide fin-and-tube type coils constructed of seamless copper tubes and aluminum or copper fins mechanically bonded or soldered to the tubes. Provide copper tube wall thickness that is a minimum of 0.016 inches.. Provide aluminum fins that are 0.0055inch minimum thickness. 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.

2.9.2.1 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 cast iron, welded steel or copper. Furnish each coil with a plugged vent and drain connection extending through the unit casing. Provide removable water coils with drain pans.

2.9.2.2 Corrosion Protection for Coastal Installations

Provide either phenolic, vinyl or epoxy/electrodeposition coating for all roof top units (RTU-1, RTU-2, RTU-3, and RTU-4) and air handling units (AHU-1 and AHU-2). All coils shall pass ASTM B117-90 3000 hour salt spray resistant test. Note that all roof top air handling units and air handling units indicated coil capacity with the corrosion protection installed on the coil.

2.9.3 Air Filters

List air filters according to requirements of UL 900, except list high efficiency particulate air filters of 99.97 percent efficiency by the DOP Test method under the Label Service to meet the requirements of UL 586.

2.9.3.1 Replaceable Media Filters

Provide the dry-mediaviscous adhesive type replaceable media filters, of the size required to suit the application. Provide filtering media that is not less than 2 inches thick fibrous glass media pad supported by a structural wire grid or woven wire mesh. Enclose pad in a holding frame of not less than 16 gauge galvanized steel, equipped with quick-opening mechanism for changing filter media. Base the air flow capacity of the filter on net filter face velocity not exceeding 300 fpm, with initial resistance of 0.13 inches water gauge. Provide MERV that is not less than 8 when tested according to ASHRAE 52.2.

2.9.3.2 Holding Frames

Fabricate frames from not lighter than 16 gauge sheet steel with rust-inhibitor coating. Equip each holding frame with suitable filter holding devices. Provide gasketed holding frame seats. Make all joints airtight.

2.9.3.3 Filter Gauges

Provide dial type filter gauges, diaphragm actuated draft for all filter stations, including those filters which are furnished as integral parts of factory fabricated air handling units. Gauges shall be at least 3-7/8 inches in diameter, with white dials with black figures, and graduations with a minimum range of 1 inch of water beyond the specified final resistance for the filter bank on which each gauge is applied. Provide each gauge with a screw operated zero adjustment and two static pressure taps with integral compression fittings, two molded plastic vent valves, two 5 foot minimum lengths of 1/4 inch diameter aluminum tubing, and all hardware and accessories for gauge mounting.

2.10 AIR HANDLING UNITS

2.10.1 Factory-Fabricated Air Handling Units

Provide single-zone draw-through type units as indicated. Units shall include fans, coils, airtight insulated casing, prefilters, secondary filter sections, diffuser sections where indicated, adjustable V-belt drives, belt guards for externally mounted motors, access sections where indicated, mixing box combination sectional filter-mixing box, pan vibration-isolators, and appurtenances required for specified operation. Provide vibration isolators as indicated. Physical dimensions of each air handling unit shall be suitable to fit space allotted to the unit with the capacity indicated. Provide air handling unit that is rated in accordance with AHRI 430 and AHRI certified for cooling. Furnish piping vestibules for RTU-1, RTU-2, RTU-3, and RTU-4.

2.10.1.1 Casings

Provide the following:

- a. Casing sections 2 inch double wall type as indicated, constructed of a minimum 18 gauge galvanized steel, or 18 gauge corrosion-resisting sheet steel conforming to ASTM A 167, Type 304. Inner casing of double-wall units that are a minimum 20 gauge solid galvanized steel or corrosion-resisting sheet steel conforming to ASTM A 167, Type 304. Design and construct casing with an integral insulated structural galvanized steel frame such that exterior panels are non-load bearing.
- b. Individually removable exterior panels with standard tools. Removal shall not affect the structural integrity of the unit. Furnish casings with access sections, according to paragraph AIR HANDLING UNITS, inspection doors, and access doors, all capable of opening a minimum of 90 degrees, as indicated.
- c. Insulated, fully gasketed, double-wall type inspection and access doors, of a minimum 18 gauge outer and 20 gauge inner panels made of either galvanized steel or corrosion-resisting sheet steel conforming to ASTM A 167, Type 304. Doors shall be rigid and provided with heavy duty hinges and latches. Inspection doors shall be a minimum 12 inches wide by 12 inches high. Access doors shall be a minimum 24 inches wide, the full height of the unit casing or a minimum of 6 foot, whichever is less.
- d. Double-wall insulated type drain pan (thickness equal to exterior casing) constructed of 16 gauge corrosion resisting sheet steel conforming to ASTM A 167, Type 304, conforming to ASHRAE 62.1. Construct drain pans water tight, treated to prevent corrosion, and designed for positive condensate drainage. When 2 or more cooling coils are used, with one stacked above the other, condensate from the upper coils shall not flow across the face of lower coils. Provide intermediate drain pans or condensate collection channels and downspouts, as required to carry condensate to the unit drain pan out of the air stream and without moisture carryover. Construct drain pan to allow for easy visual inspection, including underneath the coil without removal of the coil and to allow complete and easy physical cleaning of the pan underneath the coil without removal of the coil. Coils shall be individually removable from the casing.
- e. Casing insulation that conforms to NFPA 90A. Single-wall casing

sections handling conditioned air shall be insulated with not less than 1 inch thick, 1-1/2 pound density coated fibrous glass material having a thermal conductivity not greater than 0.23 Btu/hr-sf-F. Double-wall casing sections handling conditioned air shall be insulated with not less than 2 inches of the same insulation specified for single-wall casings. Foil-faced insulation is not an acceptable substitute for use with double wall casing. Double wall insulation shall be completely sealed by inner and outer panels.

- f. Factory applied fibrous glass insulation that conforms to ASTM C 1071, except that the minimum thickness and density requirements do not apply, and that meets the requirements of NFPA 90A. Make air handling unit casing insulation uniform over the entire casing. Foil-faced insulation is not an acceptable substitute for use on double-wall access doors and inspections doors and casing sections.
- g. Duct liner material, coating, and adhesive that conforms to fire-hazard requirements specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS. Protect exposed insulation edges and joints where insulation panels are butted with a metal nosing strip or coat to meet erosion resistance requirements of ASTM C 1071.
- h. Alatched and hinged inspection door, in the fan and coil sections. .

2.10.1.2 Heating and Cooling Coils

Provide coils as specified in paragraph AIR SYSTEMS EQUIPMENT.

2.10.1.3 Air Filters

Provide air filters as specified in paragraph AIR SYSTEMS EQUIPMENT for types and thickness indicated.

2.10.1.4 Fans

Provide the following:

- a. Fans that are double-inlet, centrifugal type with each fan in a separate scroll. Dynamically balance fans and shafts prior to installation into air handling unit, then after it has been installed in the air handling unit, statically and dynamically balance the entire fan assembly. Mount fans on steel shafts, accurately ground and finished.
- b. Fan bearings that are sealed against dust and dirt and are precision self-aligning ball or roller type, with L50 rated bearing life at not less than 200,000 hours as defined by ABMA 9 and ABMA 11. Bearings shall be permanently lubricated or lubricated type with lubrication fittings readily accessible at the drive side of the unit. Support bearings by structural shapes, or die formed sheet structural members, or support plates securely attached to the unit casing. Do not fasten bearings directly to the unit sheet metal casing. Furnish fans and scrolls with coating indicated.
- c. Fans that are driven by a unit-mounted, or a floor-mounted motor connected to fans by V-belt drive complete with belt guard for externally mounted motors. Furnish belt guards that are the three-sided enclosed type with solid or expanded metal face. Belt drives shall be designed for not less than a 1.3 service factor based

on motor nameplate rating.

- d. Motor sheaves that are variable pitch for 25 hp and below and fixed pitch above 25 hp as defined by AHRI Guideline D. Where fixed sheaves are required, the use of variable pitch sheaves is allowed during air balance, but replace them with an appropriate fixed sheave after air balance is completed. Select variable pitch sheaves to drive the fan at a speed that produces the specified capacity when set at the approximate midpoint of the sheave adjustment. Furnish motors for V-belt drives with adjustable bases, and with open enclosures.
- e. Motor starters of magnetic, across-the-line, reduced-voltage-start, type with weather-resistant enclosure for AHU-1 and AHU-2. Select unit fan or fans to produce the required capacity at the fan static pressure with sound power level as indicated. Obtain the sound power level values according to AMCA 300, ASHRAE 68, or AHRI 260.

2.10.1.5 Access Sections and Filter/Mixing Boxes

Provide access sections where indicated and furnish with access doors as shown. Construct access sections and filter/mixing boxes in a manner identical to the remainder of the unit casing and equip with access doors. Design mixing boxes to minimize air stratification and to promote thorough mixing of the air streams.

2.11 TERMINAL UNITS

2.11.1 Variable Air Volume (VAV) Terminal Units

- a. Provide VAV units that are the type, size, and capacity shown, mounted in the ceiling or wall cavity, plus units that are suitable for single duct system applications. Provide actuators and controls as specified in paragraph SUPPLEMENTAL COMPONENTS/SERVICES, subparagraph CONTROLS. For each VAV terminal unit, provide a temperature sensor in the unit discharge ductwork.
- b. Provide unit enclosures that are constructed of galvanized steel not lighter than 22 gauge or aluminum sheet not lighter than 18 gauge. Provide single or multiple discharge outlets as required. Units with flow limiters are not acceptable. Provide unit air volume that is factory preset and readily field adjustable without special tools. Provide reheat coils as indicated.
- c. Attach a flow chart to each unit. Base acoustic performance of the terminal units upon units tested according to AHRI 880 with the calculations prepared in accordance with AHRI 885. Provide sound power level as indicated. Show discharge sound power for minimum and 1-1/2 inches water gauge inlet static pressure. Provide acoustical lining according to NFPA 90A.

2.11.1.1 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.

2.11.1.2 Reheat Units

- a. Hot Water Coils: Provide fin-and-tube type hot-water coils constructed of seamless copper tubes and copper or aluminum fins mechanically bonded or soldered to the tubes. Provide headers that are constructed of cast iron, welded steel or copper. Provide casing and tube support sheets that are 16 gauge, galvanized steel, formed to provide structural strength. Provide tubes that are correctly circuited for proper water velocity without excessive pressure drop and are drainable where required or indicated. At the factory, test each coil at not less than 250 psi air pressure and provide coils suitable for 200 psi working pressure. Install drainable coils in the air handling units with a pitch of not less than 1/8 inch per foot of tube length toward the drain end. Coils shall conform to the provisions of AHRI 410.

2.12 FACTORY PAINTING

Factory paint new equipment, which are not of galvanized construction. Paint with a corrosion resisting paint finish according to ASTM A 123/A 123M or ASTM A 924/A 924M. Clean, phosphatize and coat internal and external ferrous metal surfaces with a paint finish which has been tested according to ASTM B 117, ASTM D 1654, and ASTM D 3359. Submit evidence of satisfactory paint performance for a minimum of 125 hours for units to be installed indoors and 3000 hours for units to be installed outdoors. Provide rating of failure at the scribe mark that is not less than 6, average creepage not greater than 1/8 inch. Provide rating of the inscribed area that is not less than 10, no failure. On units constructed of galvanized steel that have been welded, provide a final shop docket of zinc-rich protective paint on exterior surfaces of welds or welds that have burned through from the interior according to ASTM D 520 Type I.

Factory painting that has been damaged prior to acceptance by the Contracting Officer shall be field painted in compliance with the requirements of paragraph FIELD PAINTING OF MECHANICAL EQUIPMENT.

2.13 SUPPLEMENTAL COMPONENTS/SERVICES

2.13.1 Chilled Water Piping

The requirements for chilled water piping and accessories are specified in Section 23 64 26 CHILLED WATER PIPING SYSTEMS.

2.13.2 Water or Steam Heating System Accessories

The requirements for water or steam heating accessories such as expansion tanks and steam traps are specified in Section 23 21 13.00 20 LOW TEMPERATURE WATER (LTW) HEATING SYSTEM.

2.13.3 Condensate Drain Lines

Provide and install condensate drainage for each item of equipment that generates condensate.

2.13.4 Insulation

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

2.13.5 Controls

The requirements for controls are specified in Section 23 05 93 TESTING, ADJUSTING, AND BALANCING OF HVAC SYSTEMS 23 09 23.13 22 BACnet DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC.

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 Condensate Drain Lines

Provide water seals in the condensate drain from all units. Provide a depth of each seal of 2 inches plus the number of inches, measured in water gauge, of the total static pressure rating of the unit to which the drain is connected. Provide water seals that are constructed of 2 tees and an appropriate U-bend with the open end of each tee plugged. Provide pipe cap or plug cleanouts where indicated. Connect drains indicated to connect to the sanitary waste system using an indirect waste fitting. Insulate air conditioner drain lines as specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

3.2.2 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.

3.2.3 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. Provide access panels as specified in Section 05 12 00 STRUCTURAL STEEL.

3.2.4 Flexible Duct

Install pre-insulated flexible duct in accordance with the latest printed instructions of the manufacturer to ensure a vapor tight joint. Provide hangers, when required to suspend the duct, of the type recommended by the duct manufacturer and set at the intervals recommended.

3.2.5 Metal Ductwork

Install according to SMACNA 1966 unless otherwise indicated. Install duct supports for sheet metal ductwork according to SMACNA 1966, unless otherwise specified. Do not use friction beam clamps indicated in SMACNA 1966. Anchor risers on high velocity ducts in the center of the vertical run to allow ends of riser to move due to thermal expansion. Erect supports on the risers that allow free vertical movement of the duct. Attach supports only to structural framing members and concrete slabs. Do not anchor supports to metal decking unless a means is provided and approved for preventing the anchor from puncturing the metal decking. Where supports are required between structural framing members, provide suitable intermediate metal framing. Where C-clamps are used, provide retainer clips.

3.2.6 Acoustical Duct Lining

Apply lining in cut-to-size pieces attached to the interior of the duct with nonflammable fire resistant adhesive conforming to ASTM C 916, Type I, NFPA 90A, UL 723, and ASTM E 84. Provide top and bottom pieces that lap the side pieces and are secured with welded pins, adhered clips of metal, nylon, or high impact plastic, and speed washers or welding cup-head pins installed according to SMACNA 1966. Provide welded pins, cup-head pins, or adhered clips that do not distort the duct, burn through, nor mar the finish or the surface of the duct. Make pins and washers flush with the surfaces of the duct liner and seal all breaks and punctures of the duct liner coating with the nonflammable, fire resistant adhesive. Coat exposed edges of the liner at the duct ends and at other joints where the lining is subject to erosion with a heavy brush coat of the nonflammable, fire resistant adhesive, to prevent delamination of glass fibers. Apply duct liner to flat sheet metal prior to forming duct through the sheet metal brake. Additionally secure lining at the top and bottom surfaces of the duct by welded pins or adhered clips as specified for cut-to-size pieces. Other methods indicated in SMACNA 1966 to obtain proper installation of

duct liners in sheet metal ducts, including adhesives and fasteners, are acceptable.

3.2.7 Dust Control

To prevent the accumulation of dust, debris and foreign material during construction, perform temporary dust control protection. Protect the distribution system (supply and return) with temporary seal-offs at all inlets and outlets at the end of each day's work. Keep temporary protection in place until system is ready for startup.

3.2.8 Insulation

Provide thickness and application of insulation materials for ductwork, piping, and equipment according to Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS. Externally insulate outdoor air intake ducts and plenums up to the point where the outdoor air reaches the conditioning unit or up to the point where the outdoor air mixes with the outside air stream.

3.2.9 Duct Test Holes

Provide holes with closures or threaded holes with plugs in ducts and plenums as indicated or where necessary for the use of pitot tube in balancing the air system. Plug insulated duct at the duct surface, patched over with insulation and then marked to indicate location of test hole if needed for future use.

3.2.10 Power Roof Ventilator Mounting

Provide foamed 1/2 inch thick, closed-cell, flexible elastomer insulation to cover width of roof curb mounting flange. Where wood nailers are used, predrill holes for fasteners.

3.2.11 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 28 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. Insulation: Provide duct insulation in accordance with Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS continuous through sleeves and prepared openings except firewall penetrations. Terminate duct insulation at fire dampers and flexible connections. For duct handling air at or below 60 degrees F, provide insulation continuous over the damper collar and retaining angle of fire dampers, which are exposed to unconditioned air.
- d. 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.
- e. Firestopping: Where ducts pass through fire-rated walls, fire

partitions, and fire rated chase walls, seal the penetration with fire stopping materials.

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 DUCTWORK LEAK TESTS

The requirements for ductwork leak tests are specified in Section 23 05 93 TESTING, ADJUSTING AND BALANCING FOR HVAC.

3.10 DAMPER ACCEPTANCE TEST

Submit the proposed schedule, at least 2 weeks prior to the start of test. Operate all fire dampers and smoke dampers under normal operating conditions, prior to the occupancy of a building to determine that they function properly. Test each fire damper equipped with fusible link by having the fusible link cut in place. Test dynamic fire dampers with the air handling and distribution system running. Reset all fire dampers with the fusible links replaced after acceptance testing. To ensure optimum operation and performance, install the damper so it is square and free from racking.

3.11 TESTING, ADJUSTING, AND BALANCING

The requirements for testing, adjusting, and balancing are specified in Section 23 05 93 TESTING, ADJUSTING AND BALANCING FOR HVAC. Begin testing, adjusting, and balancing only when the air supply and distribution, including controls, has been completed, with the exception of performance tests.

3.12 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 14 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.

Submit test reports for the ductwork leak test, and performance tests in booklet form, upon completion of testing. Document phases of tests performed including initial test summary, repairs/adjustments made, and final test results in the reports.

3.13 CLEANING AND ADJUSTING

Provide a temporary bypass for water coils to prevent flushing water from passing through coils. Inside of air terminal units, thoroughly clean ducts, plenums, and casing of debris and blow free of small particles of rubbish and dust and then vacuum clean before installing outlet faces. Wipe equipment clean, with no traces of oil, dust, dirt, or paint spots. Provide temporary filters prior to startup of all fans that are operated during construction, and install new filters after all construction dirt has been removed from the building, and the ducts, plenums, casings, and other items specified have been vacuum cleaned. Maintain system in this clean condition until final acceptance. Properly lubricate bearings with oil or grease as recommended by the manufacturer. Tighten belts to proper tension. Adjust control valves and other miscellaneous equipment requiring adjustment to setting indicated or directed. Adjust fans to the speed indicated by the manufacturer to meet specified conditions. Maintain all equipment installed under the contract until close out documentation is received, the project is completed and the building has been documented as beneficially occupied.

3.14 OPERATION AND MAINTENANCE

3.14.1 Operation and Maintenance Manuals

Submit six manuals at least 2 weeks prior to field training. Submit data complying with the requirements specified in Section 01 78 23 OPERATION AND MAINTENANCE DATA. Submit Data Package 3 for the items/units listed under SD-10 Operation and Maintenance Data

3.14.2 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. Submit the proposed On-site Training schedule concurrently with the Operation and Maintenance Manuals and at least 14 days prior to conducting the training course.

-- End of Section --

SECTION 23 03 00.00 20

BASIC MECHANICAL MATERIALS AND METHODS

08/10

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 B117 (2009) Standing Practice for Operating Salt Spray (Fog) Apparatus

1.2 RELATED REQUIREMENTS

This section applies to all sections of Divisions: 21, FIRE SUPPRESSION; 22, PLUMBING; and 23, HEATING, VENTILATING, AND AIR CONDITIONING of this project specification, unless specified otherwise in the individual section.

1.3 QUALITY ASSURANCE

1.3.1 Material and Equipment Qualifications

Provide materials and equipment that are standard products of manufacturers regularly engaged in the manufacture of such products, which are of a similar material, design and workmanship. Standard products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year use shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2 year period.

1.3.2 Alternative Qualifications

Products having less than a two-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturer's factory or laboratory tests, can be shown.

1.3.3 Service Support

The equipment items shall be supported by service organizations. Submit a certified list of qualified permanent service organizations for support of the equipment which includes their addresses and qualifications. These service organizations shall be reasonably convenient to the equipment installation and able to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

1.3.4 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.

1.3.5 Modification of References

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.

1.3.5.1 Definitions

For the International Code Council (ICC) Codes referenced in the contract documents, advisory provisions shall be considered mandatory, the word "should" shall be interpreted as "shall." Reference to the "code official" shall be interpreted to mean the "Contracting Officer." For Navy owned property, references to the "owner" shall be interpreted to mean the "Contracting Officer." For leased facilities, references to the "owner" shall be interpreted to mean the "lessor." References to the "permit holder" shall be interpreted to mean the "Contractor."

1.3.5.2 Administrative Interpretations

For ICC Codes referenced in the contract documents, the provisions of Chapter 1, "Administrator," do not apply. These administrative requirements are covered by the applicable Federal Acquisition Regulations (FAR) included in this contract and by the authority granted to the Officer in Charge of Construction to administer the construction of this project. References in the ICC Codes to sections of Chapter 1, shall be applied appropriately by the Contracting Officer as authorized by his administrative cognizance and the FAR.

1.4 DELIVERY, STORAGE, AND HANDLING

Handle, store, and protect equipment and materials to prevent damage before and during installation in accordance with the manufacturer's recommendations, and as approved by the Contracting Officer. Replace damaged or defective items.

1.5 ELECTRICAL REQUIREMENTS

Furnish motors, controllers, disconnects and contactors with their respective pieces of equipment. Motors, controllers, disconnects and contactors shall conform to and have electrical connections provided under Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Furnish internal wiring for components of packaged equipment as an integral part of the equipment. Extended voltage range motors will not be permitted. Controllers and contactors shall have a maximum of 120 volt control circuits, and shall have auxiliary contacts for use with the controls furnished. When motors and equipment furnished are larger than sizes indicated, the cost of additional electrical service and related work shall be included under the section that specified that motor or equipment. Power wiring and conduit for field installed equipment shall be provided under and conform to the requirements of Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

1.6 INSTRUCTION TO GOVERNMENT PERSONNEL

When specified in other sections, furnish the services of competent instructors to give full instruction to the designated Government personnel

in the adjustment, operation, and maintenance, including pertinent safety requirements, of the specified equipment or system. 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. When more than 4 man-days of instruction are specified, use approximately half of the time for classroom instruction. Use other time for instruction with the equipment or system.

When significant changes or modifications in the equipment or system are made under the terms of the contract, provide additional instruction to acquaint the operating personnel with the changes or modifications.

1.7 ACCESSIBILITY

Install all work so that parts requiring periodic inspection, operation, maintenance, and repair are readily accessible. Install concealed valves, expansion joints, controls, dampers, and equipment requiring access, in locations freely accessible through access doors.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 PAINTING OF NEW EQUIPMENT

New equipment painting shall be factory applied or shop applied, and shall be as specified herein, and provided under each individual section.

3.1.1 Factory Painting Systems

Manufacturer's standard factory painting systems may be provided subject to certification that the factory painting system applied will withstand 125 hours in a salt-spray fog test, except that equipment located outdoors shall withstand 500 hours in a salt-spray fog test. Salt-spray fog test shall be in accordance with ASTM B117, and for that test the acceptance criteria shall be as follows: immediately after completion of the test, the paint shall show no signs of blistering, wrinkling, or cracking, and no loss of adhesion; and the specimen shall show no signs of rust creepage beyond 0.125 inch on either side of the scratch mark.

The film thickness of the factory painting system applied on the equipment shall not be less than the film thickness used on the test specimen. If manufacturer's standard factory painting system is being proposed for use on surfaces subject to temperatures above 120 degrees F, the factory painting system shall be designed for the temperature service.

3.1.2 Shop Painting Systems for Metal Surfaces

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 metal surfaces

subject to temperatures in excess of 120 degrees F shall be cleaned to bare metal.

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. Color of finish coat shall be aluminum or light gray.

- a. Temperatures Less Than 120 Degrees F: Immediately after cleaning, the metal surfaces subject to temperatures less than 120 degrees F shall receive 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 1 mil; and two coats of enamel applied to a minimum dry film thickness of 1 mil per coat.
- b. Temperatures Between 120 and 400 Degrees F: Metal surfaces subject to temperatures between 120 and 400 degrees F shall receive two coats of 400 degrees F heat-resisting enamel applied to a total minimum thickness of 2 mils.
- c. Temperatures Greater Than 400 Degrees F: Metal surfaces subject to temperatures greater than 400 degrees F shall receive two coats of 600 degrees F heat-resisting paint applied to a total minimum dry film thickness of 2 mils.

-- End of Section --

SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING FOR HVAC

08/09

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 203 (1990) Field Performance Measurements of Fan Systems

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

ASHRAE 62.1 (2010; Errata 2011) Ventilation for Acceptable Indoor Air Quality

ASSOCIATED AIR BALANCE COUNCIL (AABC)

AABC MN-1 (2002; 6th ed) 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 AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA 1143 (1985) HVAC Air Duct Leakage Test Manual, 1st Edition

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

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

1.2 DEFINITIONS

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

- c. DALT: Duct air leakage test
- d. DALT'd: Duct air leakage tested
- e. HVAC: Heating, ventilating, and air conditioning; or heating, ventilating, and cooling.
- f. NEBB: National Environmental Balancing Bureau
- g. Out-of-tolerance data: Pertains only to field acceptance testing of Final DALT or TAB report. When applied to DALT work, this phase means "a leakage rate measured during DALT field acceptance testing which exceeds the leakage rate allowed by Appendix D REQUIREMENTS FOR DUCT AIR LEAK TESTING." 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."
- h. 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.
- i. 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.
- j. 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.
- k. Sound measurements terminology: Defined in AABC MN-1, NEBB MASV, or SMACNA 1858 (TABB).
- l. TAB: Testing, adjusting, and balancing (of HVAC systems).
- m. TAB'd: HVAC Testing/Adjusting/Balancing procedures performed.
- n. TAB Agency: TAB Firm
- o. TAB team field leader: TAB team field leader
- p. TAB team supervisor: TAB team engineer.
- q. TAB team technicians: TAB team assistants.
- r. 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 Term	NEBB Term	TABB Term
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 duct air leakage testing (DALT) and testing, adjusting, and balancing (TAB) of new heating, ventilating, and cooling (HVAC) air and water distribution systems including ducts, and piping which are located within, on, under, between, and adjacent to buildings.

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 DALT and TAB of the indicated existing systems and equipment and submit the specified DALT and TAB reports for approval. Conduct DALT testing in compliance with the requirements specified in SMACNA 1143, except as supplemented and modified by this section. Conduct DALT and TAB work in accordance with the requirements of this section. The limits of DALT testing include ductwork connections on the supply side to RTU-1, RTU-2, RTU-3, and RTU-4 to the inlet side of the VAV boxes. Supply ductwork downstream of the VAV boxes, return, and exhaust ductwork do not require DALT testing. DALT testing is not required on ductwork associated with AHU-1 and AHU-2.

1.3.1 Air Distribution Systems

Test, adjust, and balance systems (TAB) in compliance with this section. Obtain Contracting Officer's written approval before applying insulation to exterior of air distribution systems as specified under Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

1.3.2 Water Distribution Systems

TAB system 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.

1.3.3 Related Requirements

Requirements for price breakdown of HVAC TAB work are specified in Section 01 20 00.00 20 PRICE AND PAYMENT PROCEDURES.

Requirements for construction scheduling related to HVAC TAB work are specified in Section 01 32 17.00 20 NETWORK ANALYSIS SCHEDULES (NAS).

Submit three 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.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for A/E approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

TAB Firm

Designation of TAB team assistants;

Designation of TAB team engineer;

Designation of TAB team field leader;

SD-02 Shop Drawings

TAB Schematic Drawings and Report Forms;

SD-03 Product Data

TAB Procedures;

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

Calibration;

SD-06 Test Reports

DALT and TAB Work Execution Schedule;
 DALT and TAB Procedures Summary;
 Design review report;
 Pre-Final DALT report;
 Final DALT report;
 DALT and TAB Submittal and Work Schedule;
 TAB report for Season 1;
 TAB report for Season 2;

SD-07 Certificates

Independent TAB agency and personnel qualifications;
 Advance notice of Pre-Final DALT field work;
 Completed Pre-Final DALT Work Checklist;
 Advance Notice of Season 1 TAB Field Work;
 Completed Season 1 Pre-TAB Work Checklist
 Advance Notice of Season 2 TAB Field Work;
 Completed Season 2 Pre-TAB Work Checklist
 Pre-Field DALT Preliminary Notification;
 Pre-Field TAB Engineering Report;
 Prerequisite HVAC Work Check Out List For Season 1;
 Prerequisite HVAC Work Check Out List For Season 2;

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.

1.6 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.

1.7 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, building systems commissioning, and 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.

1.8 SEQUENCING AND SCHEDULING

1.8.1 DALT and 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

1.8.2 DALT and 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.

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

Pre-Field DALT Preliminary Notification: On completion of the duct installation for each system, notify the Contracting Officer in writing within 5 days after completion.

Ductwork Selected for DALT: Within 7 calendar days of Pre-Field DALT Preliminary Notification, the COTR will select which of the project ductwork must be DALT'd.

DALT Field Work: Within 48 hours of COTR's selection, complete DALT field work on selected.

Submit Pre-final DALT Report: Within one working day after completion of DALT field work, submit Pre-final DALT Report. Separate Pre-final DALT reports may be submitted to allow phased testing from system to system.

DALT Work Field Check: Upon approval of the Pre-final DALT Report, schedule the COTR's DALT field check work with the Contracting Officer.

Submit Final DALT Report: Within 15 calendar days after completion of successful DALT Work Field Check, submit Season 1 TAB report.

Pre-Field TAB Engineering Report: Within 8 calendar days after approval of the TAB agency Personnel Qualifications, submit the Pre-Field TAB Engineering Report.

Prerequisite HVAC Work Check Out List For Season 1 and Advance Notice of Season 1 TAB Field Work: At a minimum of 8 calendar days prior to CCD, submit Season 1 prerequisite HVAC work check out list certified as complete, and submit advance notice of commencement of Season 1 TAB field work.

Season 1 TAB Field Work: At a minimum of 90 calendar days prior to CCD, and when the ambient temperature is within Season 1 limits, accomplish Season 1 TAB field work.

Submit Season 1 TAB Report: Within 15 calendar days after completion of Season 1 TAB field work, submit Season 1 TAB report.

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

Complete Season 1 TAB Work: Prior to CCD, complete all TAB work except Season 2 TAB work.

Prerequisite HVAC Work Check Out List For Season 2 and Advance Notice of Season 2 TAB Field Work: Within 150 calendar days after date of the commencement of the Season 1 TAB field work, submit the Season 2 prerequisite HVAC work check out list certified as complete and submit advance notice of commencement of Season 2 TAB field work.

Season 2 TAB Field Work: Within 180 calendar days after date of commencement of the Season 1 TAB field work and when the ambient temperature is within Season 2 limits, accomplish Season 2 TAB field work.

Submit Season 2 TAB Report: Within 15 calendar days after completion of Season 2 TAB field work, submit Season 2 TAB report.

Season 2 TAB Field Check: 30 calendar days after the Season 2 TAB report is approved by the Contracting Officer, conduct Season 2 field check.

Complete Season 2 TAB Work: Within 15 calendar days after the completion of Season 2 TAB field data check, complete all TAB work.

1.8.2.1 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.

1.8.2.2 Pre-Field DALT Preliminary Notification

Notification: On completion of the installation of each duct system

indicated to be DALT'd, notify the Contracting Officer in writing within 7 calendar days after completion.

1.8.2.3 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) Air System Diagrams: Use the contract drawings and duct fabrication drawings if available to provide air system diagrams in the report showing the location of all terminal outlet supply, return, exhaust and transfer registers, grilles and diffusers. Use a key numbering system on the diagrams which identifies each outlet contained in the outlet airflow report sheets. Show intended locations of all traverses and static pressure readings.
- (3) 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.

1.9 SUBCONTRACTOR SPECIAL REQUIREMENTS

Perform all work in this section in accordance with the paragraph entitled "Subcontractor Special Requirements" in Section 01 30 00 ADMINISTRATIVE REQUIREMENTS, stating that all contract requirements of this section must be accomplished directly by a first tier subcontractor. No work may be performed by a second tier subcontractor.

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 DALT PROCEDURES

3.2.1 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.

3.2.2 Advance Notice of Pre-Final DALT Field Work

On completion of the installation of each duct system indicated to be DALT'd, notify the Contracting Officer in writing prior to the COTR's duct selection field visit.

3.2.3 Ductwork To Be DALT'd

From the discharge of RTU-1, RTU-2, RTU-3, and RTU-4 to the inlet ductwork of the VAV boxes only.

3.2.4 DALT Testing

Perform DALT on the HVAC duct sections of each system as indicated. Use the duct class, seal class, leakage class and the leak test pressure data indicated on the drawings, to comply with the procedures specified in SMACNA 1143.

In spite of specifications of SMACNA 1143 to the contrary, DALT ductwork of construction class of 3-inch water gauge static pressure and below if indicated to be DALT'd. Complete DALT work within 48 hours after the particular ductwork was selected for DALT. Separately conduct DALT work for large duct systems to enable the DALT work to be completed in 48 hours.

3.2.5 Pre-final DALT Report

After completion of the DALT work, prepare a Pre-final DALT Report meeting the additional requirements specified in Appendix B REPORTS - DALT and TAB. Data required by those data report forms shall be furnished by the

TAB team. Prepare the report neatly and legibly; the Pre-final DALT report shall provide the basis for the Final DALT Report.

TAB supervisor shall review, approve and sign the Pre-Final DALT Report and submit this report within one day of completion of DALT field work. Verbally notify the COTR that the field check of the Pre-Final DALT Report data can commence.

3.2.6 Quality Assurance - COTR DALT Field Acceptance Testing

In the presence of the COTR and TAB team field leader, verify for accuracy Pre-final DALT Report data selected by the COTR. For each duct system, this acceptance testing shall be conducted on a maximum of 50 percent of the duct sections DALT'd.

Further, if any data on the Pre-final DALT report form for a given duct section is out-of-tolerance, then field acceptance testing shall be conducted on data for one additional duct section, preferably in the same duct system, in the presence of the COTR.

3.2.7 Additional COTR Field Acceptance Testing

If any of the duct sections checked for a given system are determined to have a leakage rate measured that exceeds the leakage rate allowed by SMACNA Leak Test Manual for an indicated duct construction class and sealant class, terminate data checking for that section. The associated Pre-final DALT Report data for the given duct system will be disapproved. Make the necessary corrections and prepare a revised Pre-final DALT Report. Reschedule a field check of the revised report data with the COTR.

3.2.8 Certified Final DALT Report

On successful completion of all field checks of the Pre-Final DALT Report data for all systems, the TAB Supervisor shall assemble, review, approve, sign and submit the Final DALT Report in compliance with Appendix B REPORTS - DALT and TAB to the Contracting Officer for approval.

3.2.9 Prerequisite for TAB Field Work

Do not commence TAB field work prior to the completion and approval, for all systems, of the Final DALT Report.

3.3 TAB PROCEDURES

3.3.1 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 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. The only water flow and air flow reporting which can be deferred until the Season 2 is that data which would be affected in terms of accuracy due to outside ambient conditions.

3.3.2 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.

3.3.3 TAB Air Distribution Systems

3.3.3.1 Units With Coils

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

- a. For 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."

Do not determine entering and leaving wet and dry bulb temperatures by single point measurement, but by 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.).

3.3.3.2 Rooftop Air Conditioning

Rooftop air conditioning systems including fans, coils, ducts, plenums, and air distribution devices for supply air, return air, and outside air.

3.3.3.3 Exhaust Fans

Exhaust fan systems including fans, ducts, plenums, grilles, and hoods for exhaust air.

3.3.4 TAB Water Distribution Systems

3.3.4.1 Chilled Water

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

3.3.4.2 Heating Hot Water

Heating hot water systems including boilers, hot water converters (e.g., heat exchangers), pumps, coils, system balancing valves and flow measuring devices.

3.3.5 TAB Work on Performance Tests With Seasonal Limitations

3.3.5.1 Performance Tests

Accomplish proportionate balancing TAB work on the air distribution systems and water distribution systems, in other words, accomplish adjusting and balancing of the air flows and water flows, any time during the duration of this contract, subject to the limitations specified elsewhere in this section. However, accomplish, within the following seasonal limitations, TAB work on HVAC systems which directly transfer thermal energy.

3.3.5.2 Season Of Maximum Load

Visit the contract site for at least two TAB work sessions for TAB field measurements. Visit the contract site during the season of maximum heating load and visit the contract site during the season of maximum cooling load, the goal being to TAB the operational performance of the heating systems and cooling systems under their respective maximum outdoor environment-caused loading. During the seasonal limitations, TAB the operational performance of the heating systems and cooling systems.

3.3.5.3 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.

3.3.5.4 Sound Measurements

Comply with paragraph entitled "Sound Measurement Work," specifically, the requirement that a room must be operating in its noisiest mode at the time of sound measurements in the room. The maximum noise level measurements could depend on seasonally related heat or cooling transfer equipment.

3.3.6 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.

3.3.7 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.

3.3.8 TAB Reports

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

3.3.9 Quality Assurance - COTR TAB Field Acceptance Testing

3.3.9.1 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, sound level readings) 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: All boilers, and air handling units (rooftop).

Group 2: 25 percent of the VAV terminal boxes and associated diffusers and registers.

Group 4: 25 percent of the return grilles, return registers, exhaust grilles and exhaust registers.

Group 5: 25 percent of the supply fans, exhaust fans, and 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.

3.3.9.2 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.

3.3.9.3 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.

3.4 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.

3.5 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.

3.6 APPENDICES

Appendix A WORK DESCRIPTIONS OF PARTICIPANTS
Appendix B REPORTS - DALT and TAB
Appendix C DALT AND TAB SUBMITTAL AND WORK SCHEDULE
Appendix D REQUIREMENTS FOR DUCT AIR LEAK TESTING

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 "DALT and TAB Schedule" are met.
 - c. Coordinate Support: Provide and coordinate support personnel required by the TAB Firm in order to accomplish the DALT and 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.
 - d. 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.
 - e. 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.
 - f. Prior to the TAB field team's arrival, ensure completion of the applicable inspections and work items listed in the TAB team supervisor's DALT and 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
 - h. Insulation work: Ensure that no insulation is shall not be installed on ducts to be DALT'd until DALT work on the subject ducts is complete.

Ensure the duct and piping systems are properly insulated and vapor sealed upon the successful completion and acceptance of the DALT and TAB work.

2. TAB Team Supervisor

- a. Overall management: Supervise and manage the overall TAB team work effort, including preliminary and technical DALT and TAB procedures and TAB team field work.
- b. Schedule: Ensure the requirements specified under the paragraph "DALT and TAB Schedule" are met.
- c. Submittals: Provide the submittals specified herein.
- d. 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.
- e. 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 DALT or 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.

- f. Advance Notice: Monitor the completion of the duct system installations and provide the Advance Notice for Pre-Final DALT field work as specified herein.
- g. Technical Assistance: Provide technical assistance to the DALT and TAB field work.
- h. 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.
- i. 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 - DALT and 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. DALT and 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. DALT and TAB Procedures Summary

Submit a detailed narrative describing all aspects of the DALT and TAB field work to be performed. Clearly distinguish between DALT information and TAB information. 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 DALT and 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 DALT field work can be performed. The Contractor must complete, submit, and receive approval of the Completed Pre-Final DALT Work Checklist before DALT field work can be accomplished.
- g. A thorough checklist of the work items and inspections that need to be accomplished before the Season 1 TAB field work can be performed. The Contractor must complete, submit, and receive approval of the Completed Season 1 Pre-TAB Work Checklist before the Season 1 TAB field work can be accomplished.
- h. A thorough checklist of the work items and inspections that need to be

accomplished before the Season 2 TAB field work can be performed. The Contractor must complete, submit, and receive approval of the Completed Season 2 Pre-TAB Work Checklist before the Season 2 TAB field work can be accomplished.

- i. 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. Pre-Final DALT Report for COTR DALT Field Checks

Report the data for the Pre-Final DALT Report meeting the following requirements:

- a. Submit a copy of the approved DALT and TAB Procedures Summary: Provide notations describing how actual field procedures differed from the procedures listed.
- b. Report format: Submit a comprehensive report for the DALT field work data using data presentation forms equivalent to the "Air Duct Leakage Test Summary Report Forms" located in the SMACNA 1143. In addition, submit in the report, a marked duct shop drawing which identifies each section of duct tested with assigned node numbers for each section. Node numbers shall be included in the completed report forms to identify each duct section.
- c. Calculations: Include a copy of all calculations prepared in determining the duct surface area of each duct test section. Include in the DALT reports copy(s) of the calibration curve for each of the DALT test orifices used for testing.
- d. Instruments: List the types of instruments actually used to measure the data. Include in the listing each instrument's unique identification number, calibration date, and calibration expiration date. Instruments are to be calibrated within one year of the date of use in the field; instrument calibration is to be traceable to the measuring standards of the National Institute of Standards and Technology.

- e. TAB Supervisor Approval: Include on the submitted report the typed name of the TAB supervisor and the dated signature of the TAB supervisor.

5. Final DALT Report

On successful completion of all COTR field checks of the Pre-final DALT Report data for all systems, the TABS Supervisor shall assemble, review, sign and submit the Final DALT Report to the Contracting Officer for approval.

6. TAB Reports: Submit TAB Report for Season 1 and TAB Report for Season 2 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:

Room 120, 175, 213, and 234.

- (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 Season I TAB Report Season I and Season 2 TAB Report.
- d. Air System Diagrams: Provided updated diagrams with final installed locations of all terminals and devices, any numbering changes, and actual test locations.
- e. Air Static Pressure Profiles: Report static pressure profiles for air

duct systems including: RTU-1, RTU-2, RTU-3, RTU-4, AHU-1, and AHU-2. Report static pressure data for all supply, return, relief, exhaust and outside air ducts for the systems listed. The static pressure report data shall include, in addition to AABC or NEBB or TABB required data, the following:

- (1) Report supply fan, return fan, relief fan, and exhaust fan inlet and discharge static pressures.
- (2) Report static pressure drop across chilled water coils, DX coils, hot water coils, steam coils, electric resistance heating coils and heat reclaim devices installed in unit cabinetry or the system ductwork.
- (3) Report static pressure drop across outside air, return air, and supply air automatic control dampers, both proportional and two-position, installed in unit cabinetry.
- (4) Report static pressure drop across air filters, acoustic silencers, moisture eliminators, air flow straighteners, air flow measuring stations or other pressure drop producing specialty items installed in unit cabinetry, or in the system ductwork. Examples of these specialty items are smoke detectors, white sound generators, RF shielding, wave guides, security bars, blast valves, small pipes passing through ductwork, and duct mounted humidifiers.

Do not report static pressure drop across duct fittings provided for the sole purpose of conveying air, such as elbows, transitions, offsets, plenums, manual dampers, and branch takes-offs.

- (5) Report static pressure drop across outside air and relief/exhaust air louvers.
 - (6) Report static pressure readings of supply air, return air, exhaust/relief air, and outside air in duct at the point where these ducts connect to each air moving unit.
- f. Duct Transverses: Report duct traverses for main and branch main supply, return exhaust ducts. This shall include all ducts, including those which lack 7 1/2 duct diameters upstream and 2 1/2 duct diameters downstream of straight duct unobstructed by duct fittings/offsets/elbows. The TAB Agency shall evaluate and report findings on the duct traverses taken. Evaluate the suitability of the duct traverse measurement based on satisfying the qualifications for a pitot traverse plane as defined by AMCA 203, "Field Measurements", Section 8, paragraph 8.3, "Location of Traverse Plane".
- g. 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.

- h. 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.

- i. 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.
- j. 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."

Appendix C

DALT AND TAB SUBMITTAL AND WORK SCHEDULE

Perform the following items of work in the order listed adhering to the dates schedule specified below. Include the major items listed in this schedule in the project network analysis schedule required by Section 01 32 17.00 20 NETWORK ANALYSIS SCHEDULES (NAS).

Submit TAB Agency and TAB Personnel Qualifications: Within 42 calendar days after date of contract award.

Submit the DALT and TAB Work Execution Schedule: within 14 days after receipt of the TAB agency and TAB personnel qualifications approval. Revise and re-submit this schedule 28 days prior to commencement of DALT work and 28 days prior to the commencement of TAB Season 1 work and TAB Season 2 work.

Submit the DALT and TAB Work Procedures Summary: within 14 days after receipt of the initial approved DALT and TAB Work Execution Schedule.

Submit Design Review Report: Within 56 calendar days after the receipt of the approved initial DALT and TAB Work Execution Schedule.

Advance Notice of Pre-Final DALT Field Work: After the completed installation of the HVAC duct system to be DALT'd, submit to the Contracting Officer an Advance Notice of Pre-Final DALT Field Work accompanied by the completed Pre-Final DALT Work Checklist checklist for the subject duct system.

Ductwork Selected for DALT: The ductwork sections to be DALT'd are indicated on drawing sheet M-601 - Schedules.

DALT Field Work: Within 48 hours of COTR's selection, complete DALT field work on indicated ductwork.

Submit Pre-Final DALT Report: Within two working days after completion of DALT field work, submit Pre-final DALT Report. Separate Pre-final DALT reports may be submitted to allow phased testing from system to system.

Quality Assurance - COTR DALT Field Checks: Upon approval of the Pre-final DALT Report, the COTR's DALT field check work shall be scheduled with the Contracting Officer.

Submit Final DALT Report: Within 14 calendar days after completion of successful DALT Work Field Check, submit Season 1 TAB report.

Advance Notice of Season 1 TAB Field Work: At a minimum of 14 calendar days prior to Season 1 TAB Field Work, submit advance notice of TAB field work accompanied by completed Season 1 Pre-TAB Work Checklist.

Season 1 TAB Field Work: At a minimum of 84 calendar days prior to CCD, and when the ambient temperature is within Season 1 limits, accomplish Season 1 TAB field work.

Submit Season 1 TAB Report: Within 14 calendar days after completion of Season 1 TAB field work, submit initial Season 1 TAB report.

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

Complete Season 1 TAB Work: Prior to CCD, complete all TAB work except Season 2 TAB work and submit final.

Receive the approved TAB report: Within 21 calendar days, receive the report from Contracting Officer approved TAB report.

Advance Notice of Season 2 TAB Field Work: At a minimum of 126 calendar days after CCD, submit advance notice of Season 2 TAB field work accompanied by completed Season 2 Pre-TAB Work Checklist.

Season 2 TAB Field Work: Within 14 calendar days after date of advance notice of Season 2 TAB field work and when the ambient temperature is within Season 2 limits, accomplish Season 2 TAB field work.

Submit Season 2 TAB Report: Within 14 calendar days after completion of Season 2 TAB field work, submit Season 2 TAB report.

Season 2 Quality Assurance - COTR TAB Field Checks: 28 calendar days after the Season 2 TAB report is approved by the Contracting Officer, conduct Season 2 field check.

Complete Season 2 TAB Work: Within 14 calendar days after the completion of Season 2 TAB field data check, complete all TAB work.

Receive the approved TAB report: Within calendar 21 days, receive the report from Contracting Officer.

Appendix D

REQUIREMENTS FOR DUCT AIR LEAK TESTING

	SYSTEMS			
	RTU-1			
	RTU-2			
	RTU-3			
	RTU-4			
Duct System Static Pressure in inches W.C.				
for Supply	3			
for Return	1			
System Oval/Round Duct and Rectangular Duct SMACNA Seal Class				
for Supply	A	A	A	A
for Return	A	A	A	A
for Exhaust	A	A	A	A
System Oval/Round Duct SMACNA Leak Class				
for Supply	3			
for Return	6			
Duct Test Pressure in inches W.C.				
for Supply	3			
for Return	1			

NOTE:

-- End of Section --

SECTION 23 07 00

THERMAL INSULATION FOR MECHANICAL SYSTEMS
08/10

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 (2010) Energy Standard for Buildings
Except Low-Rise Residential Buildings

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 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 1534 (2007e1) Standard Specification for
Flexible Polymeric Foam Sheet Insulation
Used as a Thermal and Sound Absorbing
Liner for Duct Systems

ASTM C 195 (2007) 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 (2007e1) 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 612 (2010) Mineral Fiber Block and Board Thermal Insulation
- ASTM C 647 (2008) Properties and Tests of Mastics and Coating Finishes for Thermal Insulation
- 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 (2010) Standard Specification for Elastomeric Joint Sealants
- ASTM C 921 (2010) 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 (2010) Tensile Properties of Thin Plastic Sheeting
- ASTM E 2231 (2009) Specimen Preparation and Mounting of Pipe and Duct Insulation Materials to Assess Surface Burning Characteristics
- ASTM E 84 (2011b) 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) Pipe Hangers and Supports - Selection and Application (ANSI Approved American National Standard)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

- NFPA 90A (2012) Standard for the Installation of

Air Conditioning and Ventilating Systems

NFPA 90B (2012) Standard for the Installation of Warm Air Heating and Air Conditioning Systems

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-A-24179 (1969; Rev A; Am 2 1980; Notice 1 1987) Adhesive, Flexible Unicellular-Plastic Thermal Insulation

MIL-A-3316 (1987; Rev C; Am 2 1990) Adhesives, Fire-Resistant, Thermal Insulation

UNDERWRITERS LABORATORIES (UL)

UL 723 (2008; Reprint Sep 2010) 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. Field applied insulation materials required for use on Government-furnished items as listed in the SPECIAL CONTRACT REQUIREMENTS shall be furnished and installed by the Contractor.

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 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

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for A/E approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

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

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 copywritten, 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.

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. The instructions must be copywritten, have an identifying or publication number, and shall have been published prior to the issuance date of this solicitation.

1.4 QUALITY ASSURANCE

1.4.1 Installer Qualification

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 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. Insulation shall be CFC and HCFC free.

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. Calcium silicate shall not be used on chilled or cold water systems. Materials shall be asbestos free and conform to the following: Flexible Elastomeric: Closed-cell, foam- or expanded-rubber materials containing anti-microbial additive. Comply with ASTM C 534/C 534M, Type I, Grade 1, for tubular materials and Type II, Grade 1, for sheet materials. Provide product recognized under Underwriters Laboratories "UL 94 - Plastic Component Classification" and listed in Factory Mutual "FM Approval Guide."

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 red 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. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179, Type II, Class I. Provide product recognized under Underwriters Laboratories "UL 94 - Plastic Component Classification" and listed in Factory Mutual "FM Approval Guide."

2.2.3 Caulking

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

2.2.4 Corner Angles

2.2.4.1 General

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.

2.2.4.2 Fittings

Fabricated Fittings are the prefabricated fittings for flexible elastomeric pipe insulation systems. Together with the flexible elastomeric tubes, they provide complete system integrity for retarding heat gain and controlling condensation drip from chilled-water and refrigeration systems. Flexible elastomeric, fabricated fittings provide thermal protection (0.25 k) and condensation resistance (0.05 Water Vapor Transmission factor).

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. Elastomeric Foam Tape: Black vapor-retarder foam tape with acrylic adhesive containing an anti-microbial additive.

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.

2.2.9 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 plies 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. Flexible Elastomeric exterior foam with factory applied UV Jacket. Construction of laminate designed to provide UV resistance, high puncture, tear resistance and excellent WVT.

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 302, 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. . Comply with EPA requirements in accordance with Section 01 62 35 RECYCLED / RECOVERED MATERIALS. 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.

2.3.2 Aboveground Hot Pipeline (Above 60 deg. F)

Insulation for outdoor, indoor, exposed or concealed applications shall meet the following requirements. Supply the insulation with manufacturer's recommended factory-applied jacket/vapor barrier.

- a. Mineral Fiber: ASTM C 547, Types I, II or III, supply the insulation with manufacturer's recommended factory-applied jacket.

2.4 DUCT INSULATION SYSTEMS

2.4.1 Duct Insulation

Provide factory-applied cellular glass polyisocyanurate or phenolic foam/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.

2.4.2 Acoustical Duct Lining

2.4.2.1 General

For ductwork indicated or specified in Section 23 00 00 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM to be acoustically lined, provide external insulation in accordance with this specification section and in addition to the acoustical duct lining. Do not use acoustical lining in place of duct wrap or rigid board insulation (insulation on the exterior of the duct).

2.4.2.2 Duct Liner

Flexible Elastomeric Acoustical and Conformable Duct Liner: Materials:

Flexible Elastomeric Thermal, Acoustical and Conformable Insulation Compliance with ASTM C 534/C 534M Grade 1, Type II or ASTM C 1534 and NFPA 90A or NFPA 90B. Acoustical duct lining shall only be used for air transfer ducts.

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 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.

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 Painting and Finishing

Painting shall be as specified in Section 09 90 00 PAINTS AND COATINGS.

3.1.4 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 220 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.

3.1.5 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.

3.1.6 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

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.

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, prefabricated insulation pipe hangers, 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, 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. Other areas that specifically require protection to the 6 foot level are located in the mechanical room.

3.2.1.6 Pipe Insulation Material and Thickness

TABLE 1
Insulation Material For Piping (°F)

Service	Material	Spec-Type-Class	Vapor Retard/ Vapor Barr'r Required
Chilled Water (Supply & Return, Dual Temperature Piping, 40°F nominal)	Cellular Glass	ASTM C 552 II 2	No
Heating Hot Water Supply & Return, Heated Oil (Max 250°F)	Mineral Fiber	ASTM C 547 I 1	No
ASTM C 552 Refrigerant Suction Piping (35°F nominal)	Flex Elast Cell'r	ASTM C 534/C 534M I	No
Steam and	Mineral Fiber	ASTM C 547 I 1	No

TABLE 1
Insulation Material For Piping (°F)

Service	Material	Spec-Type-Class	Vapor Retard/ Vapor Barr'r Required
Condensate Return (201 to 250°F)			
A/C condensate Drain Located Inside Bldg.	Cellular Glass	ASTM C 552 II 2	No

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	1.5	1.5	1.5	2	
Heating Hot Water Supply & Return, Heated Oil (Max. 250°F)	Mineral Fiber	1.5	1.5	2	2	2	
Refrigerant Piping	Flex Elas Cell'r	0.5	0.5	0.5	0.5	0.5	
A/C condensate Drain Located Inside Bldg.	Cellular Glass	1.5	1.5	1.5	1.5	1.5	
Medium Temp- erature Hot Water and Steam (251°F to 350°F)	Mineral Fiber	1.5	3	3	4	4	
High Temperature Water (351o to 400°F) and Steam (351°F to 500°F)	Mineral Fiber	2.5	3	3	4	4	

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

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. Make-up water.
- b. Refrigerant suction lines.
- 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. Other areas that specifically require protection to the 6 ft level are piping located in the mechanical room.

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.

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.

3.2.3 Aboveground Hot Pipelines

3.2.3.1 General Requirements

All hot pipe lines above 60 degrees F, except those piping listed in subparagraph Pipe Insulation in PART 3 as to be omitted, shall be insulated in accordance with Table 2. This includes but is not limited to the following:

- a. Steam.
- b. Condensate
- c. Hot water heating.

Insulation shall be covered, in accordance with manufacturer's recommendations, with a factory applied Type I jacket or field applied aluminum where required or seal welded PVC.

3.2.3.2 Insulation for Fittings and Accessories

a. General. 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. Insulation shall be marked showing the location of unions, strainers, check valves and other components that would otherwise be hidden from view by the insulation.

b. Precut or Preformed. Precut or preformed insulation shall be placed around all fittings and accessories. Insulation shall be the same insulation as the pipe insulation, including same density, thickness,

and thermal conductivity.

c. Rigid Preformed. 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".

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 aluminum jacket or PVC 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 Aluminum 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

Except for oven hood exhaust duct insulation, corner angles shall be installed on external corners of insulation on ductwork in exposed finished spaces before covering with jacket. Duct insulation shall be omitted on exposed supply and return ducts in air conditioned spaces where the difference between supply air temperature and room air temperature is less

than 15 degrees F unless otherwise shown. Air conditioned spaces shall be defined as those spaces directly supplied with cooled conditioned air (or provided with a cooling device such as a fan-coil unit) and heated conditioned air (or provided with a heating device such as a unit heater, radiator or convector).

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
Fresh Air Intake Ducts	1.5
Warm Air Ducts	2.0
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. Flexible run-outs (field-insulated).
- d. Fresh 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.

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. Flexible run-outs (field insulated).
- d. Fresh air intake ducts.

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 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.

3.4 EQUIPMENT INSULATION SYSTEMS INSTALLATION

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. ASME stamps.
- b. Manufacturer's nameplates.
- c. 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. Cold and chilled water pumps.
 - c. Air handling equipment parts that are not factory insulated.
 - d. 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

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. 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.

3.4.3 Insulation for Hot Equipment

Insulation shall be furnished on equipment handling media above 60 degrees F including the following:

- a. Heat exchangers.
- b. Pumps handling media above 130 degrees F.
- c. Air separation tanks.
- d. Surge tanks.
- e. Flash tanks.
- f. Condensate receivers.

3.4.3.1 Insulation

Insulation shall be suitable for the temperature encountered. Shell and tube-type heat exchangers shall be insulated for the temperature of the shell medium.

Insulation thickness for hot equipment shall be determined using Table 6:

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

TABLE 6
 Insulation Thickness for Hot Equipment (Inches and °F)

Equipment handling media to indicated pressure
 or temperature limit:

15 psig	RMF	2.0 inches
or	FMF	2.0 inches
250 F		

3.4.3.2 Insulation of Pumps

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. Bottom and sides shall be banded to form a rigid housing that does not rest on the pump. Joints between top cover and sides shall fit tightly. The top cover shall have a joint forming a female shiplap joint on the side pieces and a male joint on the top cover, making the top cover removable. Two coats of Class I adhesive shall be applied over insulation, including removable sections, with a layer of glass cloth embedded between the coats. 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. The total dry thickness of the finish shall be 1/16 inch. Caulking shall be applied to parting line of the removable sections and penetrations.

3.4.3.3 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.

-- End of Section --

SECTION 23 09 23.13 20

DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC

06/12

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.

AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL (AMCA)

AMCA 500-D (1998) Laboratory Methods of Testing
Dampers for Rating

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI/ATA 878.1 (1999) ARCNET - Local Area Network: Token
Ring

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

ASHRAE 135 (2008; Addenda J,L,Q,R,S,V 2009; Errata 1
& 2 2009:INT 1 & 2 2009) BACnet-A Data
Communication Protocol for Building
Automation and Control Networks

ASME INTERNATIONAL (ASME)

ASME B16.34 (2009; Supp 2010) Valves - Flanged,
Threaded and Welding End

ASME B16.5 (2009) Pipe Flanges and Flanged Fittings:
NPS 1/2 Through NPS 24 Metric/Inch Standard

ASME B31.1 (2010) Power Piping

ASTM INTERNATIONAL (ASTM)

ASTM A 126 (2004) Standard Specification for Gray
Iron Castings for Valves, Flanges, and
Pipe Fittings

ASTM B 117 (2009) Standing Practice for Operating
Salt Spray (Fog) Apparatus

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.41.1 (2002; R 2008) Guide on the Surges
Environment in Low-Voltage (1000 V and
Less) AC Power Circuits

IEEE C62.41.2 (2002) Recommended Practice on

Characterization of Surges in Low-Voltage
(1000 V and Less) AC Power Circuits

IEEE C62.45 (2002; R 2008) Surge Testing for Equipment
Connected to Low-Voltage (1000v and
less)AC Power Circuits

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO/IEC 8802 (2000) Telecommunications and Information
Exchange Between Systems

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2011; TIA 11-1; Errata 2011) National
Electrical Code

NFPA 72 (2010; TIA 10-4) National Fire Alarm and
Signaling Code

NFPA 90A (2012) Standard for the Installation of
Air Conditioning and Ventilating Systems

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

SMACNA 1966 (2005) HVAC Duct Construction Standards
Metal and Flexible, 3rd Edition

UNDERWRITERS LABORATORIES (UL)

UL 1449 (2006; Rev thru Sep 2009) Surge Protective
Devices

UL 506 (2000; Rev thru May 2006) Standard for
Specialty Transformers

UL 508A (2001; Rev thru Sep 2009) Standard for
Industrial Control Panels

UL 916 (2007) Energy Management Equipment

1.2 DEFINITIONS

1.2.1 ANSI/ASHRAE Standard 135

ANSI/ASHRAE Standard 135: BACnet - A Data Communication Protocol for
Building Automation and Control Networks, referred to as "BACnet". ASHRAE
developed BACnet to provide a method for diverse building automation
devices to communicate and share data over a network.

1.2.2 ARCNET

ANSI/ATA 878.1 - Attached Resource Computer Network. ARCNET is a
deterministic LAN technology; meaning it's possible to determine the
maximum delay before a device is able to transmit a message.

1.2.3 BACnet

Building Automation and Control Network; the common name for the communication standard ASHRAE 135. The standard defines methods and protocol for cooperating building automation devices to communicate over a variety of LAN technologies.

1.2.4 BACnet/IP

An extension of BACnet, Annex J, defines this mechanism using a reserved UDP socket to transmit BACnet messages over IP networks. A BACnet/IP network is a collection of one or more IP subnetworks that share the same BACnet network number. See also "BACnet Broadcast Management Device".

1.2.5 BACnet Internetwork

Two or more BACnet networks, possibly using different LAN technologies, connected with routers. In a BACnet internetwork, there exists only one message path between devices.

1.2.6 BACnet Network

One or more BACnet segments that have the same network address and are interconnected by bridges at the physical and data link layers.

1.2.7 BACnet Segment

One or more physical segments of BACnet devices on a BACnet network, connected at the physical layer by repeaters.

1.2.8 BBMD

BACnet Broadcast Management Device (BBMD). A communications device, typically combined with a BACnet router. A BBMD forwards BACnet broadcast messages to BACnet/IP devices and other BBMDs connected to the same BACnet/IP network. Every IP subnetwork that is part of a BACnet/IP network must have only one BBMD. See also "BACnet/IP".

1.2.9 BAS

Building Automation Systems, including DDC (Direct Digital Controls) used for facility automation and energy management.

1.2.10 BAS Owner

The regional or local user responsible for managing all aspects of the BAS operation, including: network connections, workstation management, submittal review, technical support, control parameters, and daily operation. The BAS Owner for this project is D. Craig Bruns. Point of contact is (252) 466-2112.

1.2.11 BIBBs

BACnet Interoperability Building Blocks. A collection of BACnet services used to describe supported tasks. BIBBs are often described in terms of "A" (client) and "B" (server) devices. The "A" device uses data provided by the "B" device, or requests an action from the "B" device.

1.2.12 BI

BACnet International, formerly two organizations: the BACnet Manufacturers Association (BMA) and the BACnet Interest Group - North America (BIG-NA).

1.2.13 BI/BTL

BACnet International/BACnet Testing Laboratories (Formerly BMA/BTL). The organization responsible for testing products for compliance with the BACnet standard, operated under the direction of BACnet International.

1.2.14 Bridge

Network hardware that connects two or more network (or BACnet internetwork) segments at the physical and data link layers. A bridge may also filter messages.

1.2.15 Broadcast

A message sent to all devices on a network segment.

1.2.16 Device

Any control system component, usually a digital controller, that contains a BACnet Device Object and uses BACnet to communicate with other devices. See also "Digital Controller".

1.2.17 Device Object

Every BACnet device requires one Device Object, whose properties represent the network visible properties of that device. Every Device Object requires a unique Object Identifier number on the BACnet internetwork. This number is often referred to as the device instance.

1.2.18 Device Profile

A collection of BIBBs determining minimum BACnet capabilities of a device, defined in ASHRAE Standard 135-2004, Annex L. Standard device profiles include BACnet Operator Workstations (B-OWS), BACnet Building Controllers (B-BC), BACnet Advanced Application Controllers (B-AAC), BACnet Application Specific Controllers (B-ASC), BACnet Smart Actuator (B-SA), and BACnet Smart Sensor (B-SS). Each device used in new construction is required to have a PICS statement listing BIBBs supported.

1.2.19 Digital Controller

An electronic controller, usually with internal programming logic and digital and analog input/output capability, which performs control functions. In most cases, synonymous with a BACnet device described in this specification. See also "Device".

1.2.20 Direct Digital Control (DDC)

Digital controllers performing control logic. Usually the controller directly senses physical values, makes control decisions with internal programs, and outputs control signals to directly operate switches, valves, dampers, and motor controllers.

1.2.21 DDC System

A network of digital controllers, communication architecture, and user interfaces. A DDC system may include programming, sensors, actuators, switches, relays, factory controls, operator workstations, and various other devices, components, and attributes.

1.2.22 Ethernet

A family of local-area-network technologies providing high-speed networking features over various media.

1.2.23 Firmware

Software programmed into read only memory (ROM), flash memory, electrically erasable programmable read only memory (EEPROM), or erasable programmable read only memory (EPROM) chips.

1.2.24 Gateway

Communication hardware connecting two or more different protocols, similar to human language translators. The Gateway translates one protocol into equivalent concepts for the other protocol. In BACnet applications, a gateway has BACnet on one side and non-BACnet (usually proprietary) protocols on the other side.

1.2.25 Half Router

A device that participates as one partner in a BACnet point-to-point (PTP) connection. Two half-routers in an active PTP connection combine to form a single router.

1.2.26 Hub

A common connection point for devices on a network.

1.2.27 Internet Protocol (IP, TCP/IP, UDP/IP)

A communication method, the most common use is the World Wide Web. At the lowest level, it is based on Internet Protocol (IP), a method for conveying and routing packets of information over various LAN media. Two common protocols using IP are User Datagram Protocol (UDP) and Transmission Control Protocol (TCP). UDP conveys information to well-known "sockets" without confirmation of receipt. TCP establishes "sessions", which have end-to-end confirmation and guaranteed sequence of delivery.

1.2.28 Input/Output (I/O)

Physical inputs and outputs to and from a device, although the term sometimes describes software, or "virtual" I/O. See also "Points".

1.2.29 I/O Expansion Unit

An I/O expansion unit provides additional point capacity to a digital controller.

1.2.30 IP subnet

Internet protocol (IP) identifies individual devices with a 32-bit number

divided into four groups from 0 to 255. Devices are often grouped and share some portion of this number. For example, one device has IP address 209.185.47.68 and another device has IP address 209.185.47.82. These two devices share Class C subnet 209.185.47.00

1.2.31 Local-Area Network (LAN)

A communication network that spans a limited geographic area and uses the same basic communication technology throughout.

1.2.32 LonTalk

ANSI/EIA 709. A communication protocol developed by Echelon Corp. LonTalk is an optional physical and data link layer for BACnet.

1.2.33 MAC Address

Media Access Control address. The physical node address that identifies a device on a Local Area Network.

1.2.34 Master-Slave/Token-Passing (MS/TP)

ISO/IEC 8802 (Part 3). One of the LAN options for BACnet. MSTP uses twisted-pair wiring for relatively low speed and low cost communication (up to 4,000 ft at 76.8K bps).

1.2.35 Native BACnet Device

A device that uses BACnet as its primary, if not only, method of communication with other BACnet devices without intermediary gateways. A system that uses native BACnet devices at all levels is a native BACnet system.

1.2.36 Network

Communication technology for data communications. BACnet approved network types are BACnet over Internet Protocol (IP), Point to Point (PTP) Ethernet, ARCNET, MS/TP, and LonTalk®.

1.2.37 Network Number

A site-specific number assigned to each network segment to identify for routing. This network number must be unique throughout the BACnet internetwork.

1.2.38 Object

The concept of organizing BACnet information into standard components with various associated properties. Examples include analog input objects and binary output objects.

1.2.39 Object Identifier

An object property used to identify the object, including object type and instance. Object Identifiers must be unique within a device.

1.2.40 Object Properties

Attributes of an object. Examples include present value and high limit

properties of an analog input object. Properties are defined in ASHRAE 135; some are optional and some are required. Objects are controlled by reading from and writing to object properties.

1.2.41 Peer-to-Peer

Peer-to-peer refers to devices where any device can initiate and respond to communication with other devices.

1.2.42 Performance Verification Test (PVT)

The procedure for determining if the installed BAS meets design criteria prior to final acceptance. The PVT is performed after installation, testing, and balancing of mechanical systems. Typically the PVT is performed by the Contractor in the presence of the Government.

1.2.43 PID

Proportional, integral, and derivative control; three parameters used to control modulating equipment to maintain a setpoint. Derivative control is often not required for HVAC systems (leaving "PI" control).

1.2.44 PICS

Protocol Implementation Conformance Statement (PICS), describing the BACnet capabilities of a device. See BACnet, Annex A for the standard format and content of a PICS statement.

1.2.45 Points

Physical and virtual inputs and outputs. See also "Input/Output".

1.2.46 PTP

Point-to-Point protocol connects individual BACnet devices or networks using serial connections like modem-to-modem links.

1.2.47 Repeater

A network component that connects two or more physical segments at the physical layer.

1.2.48 Router

A BACnet router is a component that joins together two or more networks using different LAN technologies. Examples include joining a BACnet Ethernet LAN to a BACnet MS/TP LAN.

1.2.49 Stand-Alone Control

Refers to devices performing equipment-specific and small system control without communication to other devices or computers for physical I/O, excluding outside air and other common shared conditions. Devices are located near controlled equipment, with physical input and output points limited to 64 or less per device, except for complex individual equipment or systems. Failure of any single device will not cause other network devices to fail. BACnet "Smart" actuators (B-SA profile) and sensors (B-SS profile) communicating on a network with a parent device are exempt from stand-alone requirements.

1.3 SUBCONTRACTOR SPECIAL REQUIREMENTS

Perform all work in this section in accordance with the paragraph entitled "Subcontractor Special Requirements" in Section 01 30 00 ADMINISTRATIVE REQUIREMENTS. The paragraph specifies that all contract requirements of this section shall be accomplished directly by a first tier subcontractor. No work required shall be accomplished by a second tier subcontractor.

1.4 BACnet DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC DESCRIPTION

Provide a BACnet compliant DDC systems including associated equipment and accessories. Manufacturer's products, including design materials, fabrication, assembly, erection, examination, inspections, and testing shall be in accordance with ASME B31.1 and NFPA 70, except as modified herein or indicated otherwise. The new DDC system shall interface and communicate with the existing Energy Management and Control System (EMCS) central server at MCAS Cherry Point, Building 87 utilizing the existing EMCS Ethernet network.

Building 131 currently has a NEC (Site Building Controller) located in Room 182. Replace the current NEC with a new DDC control panel in the same location. Return the existing NEC to the government.

1.4.1 Design Requirements

1.4.1.1 Control System Drawings Title Sheet

Provide a title sheet for the control system drawing set. Include the project title, project location, contract number, the controls contractor preparing the drawings, an index of the control drawings in the set, and a legend of the symbols and abbreviations used throughout the control system drawings.

1.4.1.2 List of I/O Points

Also known as a Point Schedule, provide for each input and output point physically connected to a digital controller: point name, point description, point type (Analog Output (AO), Analog Input (AI), Binary Output (BO), Binary Input (BI)), point sensor range, point actuator range, point address, BACnet object, associated BIBBS (where applicable), and point connection terminal number. Typical schedules for multiple identical equipment are allowed unless otherwise requested in design or contract criteria.

1.4.1.3 Control System Components List

Provide a complete list of control system components installed on this project. Include for each controller and device: control system schematic name, control system schematic designation, device description, manufacturer, and manufacturer part number. For sensors, include point name, sensor range, and operating limits. For valves, include body style, Cv, design flow rate, pressure drop, valve characteristic (linear or equal percentage), and pipe connection size. For actuators, include point name, spring or non-spring return, modulating or two-position action, normal (power fail) position, nominal control signal operating range (0-10 volts DC or 4-20 milliamps), and operating limits.

1.4.1.4 Control System Schematics

Provide control system schematics. Typical schematics for multiple identical equipment are allowed unless otherwise requested in design or contract criteria. Include the following:

- a. Location of each input and output device
- b. Flow diagram for each piece of HVAC equipment
- c. Name or symbol for each control system component, such as V-1 for a valve
- d. Setpoints, with differential or proportional band values
- e. Written sequence of operation for the HVAC equipment
- f. Valve and Damper Schedules, with normal (power fail) position

1.4.1.5 HVAC Equipment Electrical Ladder Diagrams

Provide HVAC equipment electrical ladder diagrams. Indicate required electrical interlocks.

1.4.1.6 Component Wiring Diagrams

Provide a wiring diagram for each type of input device and output device. Indicate how each device is wired and powered; showing typical connections at the digital controller and power supply. Show for all field connected devices such as control relays, motor starters, actuators, sensors, and transmitters.

1.4.1.7 Terminal Strip Diagrams

Provide a diagram of each terminal strip. Indicate the terminal strip location, termination numbers, and associated point names.

1.4.1.8 Communication Architecture Schematic

Provide a schematic showing the project's entire communication network, including addressing used for LANs, LAN devices including media converters, switches, routers and bridges, gateways, controllers, workstations, and field interface devices. If applicable, show connection to existing networks. Show bus routing and component locations on a separate floor plan.

1.5 SUBMITTALS

Submit detailed and annotated manufacturer's data, drawings, and specification sheets for each item listed, that clearly show compliance with the project specifications.

Submit the following according to 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Include the following in the project's control system drawing set:

Control system drawings title sheet

List of I/O Points

Control System Components List

Control system schematics

HVAC Equipment Electrical Ladder diagrams

Component wiring diagrams

Terminal strip diagrams

Communication architecture schematic

SD-03 Product Data

Direct Digital Controllers

Include BACnet PICS for each controller/device type, including smart sensors (B-SS) and smart actuators (B-SA).

BACnet Gateways

Include BACnet and workstation display information; bi-directional communication ability; compliance with interoperability schedule; expansion capacity; handling of alarms, events, scheduling and trend data; and single device capability (not depending on multiple devices for exchanging information from either side of the gateway).

BACnet Protocol Analyzer

Include capability to store and report data traffic on BACnet networks, measure bandwidth usage, filter information, and identify BACnet devices.

DDC Software

Sensors and Input Hardware

Output Hardware

Surge and transient protection

Indicators

Duct smoke detectors

SD-05 Design Data

Performance Verification Testing Plan

Pre-Performance Verification Testing Checklist

SD-06 Test Reports

Performance Verification Testing Report

SD-07 Certificates

Contractor's Qualifications

SD-09 Manufacturer's Field Reports

Pre-PVT Checklist

SD-10 Operation and Maintenance Data

Comply with requirements for data packages in Section 01 78 23 OPERATION AND MAINTENANCE DATA, except as supplemented and modified in this specification.

BACnet Direct Digital Control Systems, Data Package 4

SD-11 Closeout Submittals

Training documentation

1.6 QUALITY ASSURANCE

1.6.1 Standard Products

Provide material and equipment that are standard manufacturer's products currently in production and supported by a local service organization.

1.6.2 Delivery, Storage, and Handling

Handle, store, and protect equipment and materials to prevent damage before and during installation according to manufacturer's recommendations, and as approved by the Contracting Officer. Replace damaged or defective items.

1.6.3 Operating Environment

Protect components from humidity and temperature variation, dust, and contaminants. If components are stored before installation, keep them within the manufacturer's limits.

1.6.4 Finish of New Equipment

New equipment finishing shall be factory provided. Manufacturer's standard factory finishing shall be proven to withstand 125 hours in a salt-spray fog test. Equipment located outdoors shall be proven to withstand 500 hours in a salt-spray fog test.

Salt-spray fog test shall be according to ASTM B 117, with acceptance criteria as follows: immediately after completion of the test, the finish shall show no signs of degradation or loss of adhesion beyond 0.125 inch on either side of the scratch mark.

1.6.5 Verification of Dimensions

The contractor shall verify all dimensions in the field, and advise the Contracting Officer of any discrepancy before performing work.

1.6.6 Contractor's Qualifications

Submit documentation certifying the controls Contractor performing the work

has completed at least three DDC systems installations of a similar design to this project, and programmed similar sequences of operation for at least two years. Personnel performing work on the EMCS server must have training and experience working with Johnson Controls Incorporation (JCI) Metasys Extended Architecture (MESA) software and be approved for access by the EMCS system administrator.

1.6.7 Modification of References

The advisory provisions in ASME B31.1 and NFPA 70 are mandatory. Substitute "shall" for "should" wherever it appears and interpret all references to the "authority having jurisdiction" and "owner" to mean the Contracting Officer.

1.6.8 Project Sequence

The control system work for this project shall proceed in the following order:

- a. Submit and receive approval on the Shop Drawings, Product Data, and Certificates specified under the paragraph entitled "SUBMITTALS."
- b. Perform the control system installation work, including all field check-outs and tuning.
- c. Provide support to TAB personnel as specified under the paragraph "TEST AND BALANCE SUPPORT."
- d. Submit and receive approval of the Controls System Operators Manual specified under the paragraph "CONTROLS SYSTEM OPERATORS MANUALS."
- e. Submit and receive approval of the Performance Verification Testing Plan and the Pre-PVT Checklist specified under the paragraph "PERFORMANCE VERIFICATION TESTING."
- f. Perform the Performance Verification Testing.
- g. Submit and receive approval on the PVT Report.
- h. Submit and receive approval on the Training Documentation specified under the paragraph "INSTRUCTION TO GOVERNMENT PERSONNEL". Submit at least 30 days before training.
- i. Deliver the final Controls System Operators Manuals.
- j. Conduct the Phase I Training and VFD on-site/hands-on training.
- k. Conduct the Phase II Training.
- l. Submit and receive approval of Closeout Submittals.

PART 2 PRODUCTS

2.1 DDC SYSTEM

- a. Provide new DDC systems including associated equipment, accessories and communication media. Manufacturer's products, including design materials, fabrication, assembly, erection, examination, inspections, and testing shall be in accordance with

ASME B31.1 and NFPA 70, except as modified herein or indicated otherwise. The new DDC system shall interface and communicate with the existing Energy Management and Control System (EMCS) at MCAS Cherry Point, Building 87. The new DDC system shall use Cherry Point's Point Naming Nomenclature and Graphical Standards attached at the end of this section. The new DDC system via the supervisory building controller shall be capable of upload/download from the central server at Building 87. All DDC points whether physical or pseudo, shall be exposed as BACnet objects and accessible by the Metasys server in Building 87 for purposes of monitoring status, controlling operation, or modifying values. The new DDC system shall have the capability of managing its loads using the existing EMCS Johnson Control load management programming.

- b. The Energy Management and Control System (EMCS) at MCAS Cherry Point is an enterprise system that actively receives energy and building condition information from multiple sources and provides load shedding, electric metering, alarming, trending, scheduling, set point adjusting, device communications status of all SBC and TCU for maintenance personnel. The existing EMCS system is Johnson Controls and incorporates the Metasys System that communicates over the Ethernet communications network to the supervisory building controllers. The existing EMCS central server is located at Building 87.
- c. If applicable, provide a supervisory building controller (SBC) for the new DDC system. Provide all necessary hardware, drivers, software, material, and equipment, which shall allow communication between the SBC and the existing EMCS system via the UMAC Ethernet network. The SBC shall act as the interface between the existing EMCS system and the new DDC system. The SBC shall perform closed-loop, modulating control of building equipment, provide all programming and communication with the DDC system such that it shall maintain stable temperature control and all other conditions as indicated. The end-to-end accuracy of the system, including temperature sensor error, wiring error, A/D conversion, and display, shall be 1 degree F or less.
- d. Provide a complete fully BACnet Open Protocol compatible Direct Digital Control (DDC) system. The system shall have stand-alone digital controllers that are connected to the SBC. All BACnet devices shall be BACnet Testing Laboratories (BTL) certified and listed. The DDC system shall be capable of controlling and monitoring all spaces and all HVAC systems. The manufacturer's control system shall have a successful, proven, in use history of at least 2 years. The DDC control system object configuration and communication - shall be totally native BACnet Open protocol with no other programming language protocol, interface, or gateways utilized, except as required by the Project documents.
- e. The contractor shall update the existing Johnson Controls server, ADX-1, located in Building 87 to incorporate and integrate the new DDC system. The update requirements include, but are not limited to the EMCS server database, graphics for the new DDC system and any other affected graphics, and programming of all load management functions.

The contractor shall fully test and verify all levels of control and

communication of all the DDC system controllers from the existing Johnson Controls ECMS server in Building 87. The contractor shall also test and verify all levels of control and communication of the new DDC system.

2.1.1.1 Direct Digital Controllers

All new direct digital controllers shall be native BACnet and UL 916 rated.

2.1.1.1.1 I/O Point Limitation

The total number of I/O hardware points used by a single stand-alone digital controller, including I/O expansion units, shall not exceed 64, except for complex individual equipment or systems. Place I/O expansion units in the same cabinet as the digital controller.

2.1.1.1.2 Environmental Limits

Controllers shall be suitable for, or placed in protective enclosures suitable for the environment (temperature, humidity, dust, and vibration) where they are located.

2.1.1.1.3 Stand-Alone Control

Provide stand-alone digital controllers.

2.1.1.1.4 Internal Clock

Provide internal clocks for all BACnet Building Controllers (B-BC) and BACnet Advanced Application Controllers (B-AAC) using BACnet time synchronization services. Automatically synchronize system clocks daily from an operator-designated controller. The system shall automatically adjust for daylight saving time.

2.1.1.1.5 Memory

Provide sufficient memory for each controller to support the required control, communication, trends, alarms, and messages. Protect programs residing in memory with EEPROM, flash memory, or by an uninterruptible power source (battery or uninterruptible power supply). The backup power source shall have capacity to maintain the memory during a 72-hour continuous power outage. Rechargeable power sources shall be constantly charged while the controller is operating under normal line power. Batteries shall be replaceable without soldering. Trend and alarm history collected during normal operation shall not be lost during power outages less than 72 hours long.

2.1.1.1.6 Immunity to Power Fluctuations

Controllers shall operate at 90 percent to 110 percent nominal voltage rating.

2.1.1.1.7 Transformer

The controller power supply shall be fused or current limiting and rated at 125 percent power consumption.

2.1.1.8 Wiring Terminations

Use screw terminal wiring terminations for all field-installed controllers. Provide field-removable modular terminal strip or a termination card connected by a ribbon cable for all controllers other than terminal units.

2.1.1.9 Input and Output Interface

Provide hard-wired input and output interface for all controllers as follows:

- a. Protection: Shorting an input or output point to itself, to another point, or to ground shall cause no controller damage. Input or output point contact with sources up to 24 volts AC or DC for any duration shall cause no controller damage.
- b. Binary Inputs: Binary inputs shall have a toggle switch and monitor on and off contacts from a "dry" remote device without external power, and external 5-24 VDC voltage inputs.
- c. Pulse Accumulation Inputs: Pulse accumulation inputs shall conform to binary input requirements and accumulate pulses at a resolution suitable to the application.
- d. Analog Inputs: Analog inputs shall monitor low-voltage (0-10 VDC), current (4-20 mA), or resistance (thermistor or RTD) signals.
- e. Binary Outputs: Binary outputs shall have a toggle switch and send a pulsed 24 VDC low-voltage signal for modulation control, or provide a maintained open-closed position for on-off control. For HVAC equipment and plant controllers, provide for manual overrides, either with three-position (on-off-auto) override switches and status lights, or with an adjacent operator display and interface. Where appropriate, provide a method to select normally open or normally closed operation.
- f. Analog Outputs: Analog outputs shall send modulating 0-10 VDC or 4-20 mA signals to control output devices.
- g. Tri-State Outputs: Tri-State outputs shall provide three-point floating control of terminal unit electronic actuators.

2.1.1.10 BACnet Gateways

Provide BACnet communication ports, whenever available as a plant equipment OEM standard option, for DDC integration via a single communication cable. Typical BACnet controlled plant equipment includes, but is not limited to, boilers, chillers, and variable frequency motor drives.

Provide gateways to connect BACnet to legacy systems, existing non-BACnet devices, and existing non-BACnet DDC controlled plant equipment, only when specifically requested and approved by the Government, and shown on the Government approved BACnet Communication Architecture Schematic. Provide with each gateway an interoperability schedule, showing each point or event on the legacy side that the BACnet "client" will read, and each parameter that the BACnet network will write to. Describe this interoperability in terms of BACnet services, or Interoperability Building Blocks (BIBBS), defined in ASHRAE 135 Annex K. Provide two-year minimum warranty for each

gateway, including parts and labor.

The following minimum capabilities are required:

- a. Gateways shall be able to read and view all readable object properties listed in the interoperability schedule on the non-BACnet network to the BACnet network and vice versa where applicable.
- b. Gateways shall be able to write to all writeable object properties listed in the interoperability schedule on the non-BACnet network from the BACnet network and vice versa where applicable.
- c. Gateways shall provide single-pass (only one protocol to BACnet without intermediary protocols) translation from the non-BACnet protocol to BACnet and vice versa.
- d. Gateways shall meet the requirements of Data Sharing Read Property (DS-RP-B), Data Sharing Write Property (DS-WP-B), Device Management Dynamic Device Binding-B (DM-DDB-B), and Device Management Communication Control (DM-DCC-B) BIBBs, in accordance with ASHRAE 135.
- e. Gateways shall include all hardware, software, software licenses, and configuration tools for operator-to-gateway communications. Provide backup programming and parameters on CD media and the ability to modify, download, backup, and restore gateway configuration.

2.1.1.11 Digital Controller Cabinet

Provide each digital controller in a factory fabricated cabinet enclosure. Cabinets located indoors shall protect against dust and have a minimum NEMA 1 rating, except where indicated otherwise. Cabinets located outdoors or in damp environments shall protect against all outdoor conditions and have a minimum NEMA 4 rating. Outdoor control panels and controllers must be able to withstand extreme ambient conditions, without malfunction or failure, whether or not the controlled equipment is running. If necessary, provide a thermostatically controlled panel heater in freezing locations, and an internal ventilating fan in locations exposed to direct sunlight. Cabinets shall have a hinged lockable door and an offset removable metal back plate, except controllers integral with terminal units, like those mounted on VAV boxes. Provide like-keyed locks for all hinged panels provided and a set of two keys at each panel, with one key inserted in the lock.

2.1.1.12 Main Power Switch and Receptacle

Provide each control cabinet with a main external power on/off switch located inside the cabinet. Also provide each cabinet with a separate 120 VAC duplex receptacle.

2.1.2 DDC System Integration and Monitoring

- a. A workstation shall not be provided unless other wise noted.
- b. All interface to the DDC system shall be provided through the existing EMCS server at Building 87. The workstation via the EMCS server at Building 87 shall be capable of monitoring, troubleshooting, and making adjustments to the program or operating parameters of all DDC controllers, including TCU's. The

workstation shall also be capable of remotely programming of all controllers, including TCU's. The contractor shall provide a temporary workstation for system interface and start-up until the connection to the EMCS server at Building 87 is completed, tested, and verified.

- c. DDC system shall routinely operate continuously without connection to the workstation. Information at the workstation is not required for day to day operations of the direct digital controllers.

2.1.2.1 Software

The EMCS server (ADX-1) uses Johnson Controls Incorporation (JCI) Metasys Extended Architecture (MESA) software. Modify and update the existing EMCS server at Building 87 as necessary for proper interface with the new DDC system. The MESA software shall be configured to operate according to the DDC system manufacturer's specifications. Software shall be installed in the supervisory building controller (SBC) that permits monitoring and troubleshooting of the DDC system using the ADX-1 server. The ADX-1 in conjunction with the SBC software shall permit modification of controller parameters and control for all controllers, both high level and low level application specific. Operations shall be menu selected. Menu selections shall be made with a mouse.

- a. Menu System: Menu system shall allow an operator to select a particular function or access a particular screen through successive menu penetration or icon selection.
- b. Controller Parameter Modification: The ADX-1 software shall be an interface for performance specified in paragraph entitled "Parameter Modification" and available through a workstation logged into the ADX-1 server. Parameter modification shall require only that an operator "fill in the blank" for a parameter on a screen requesting the information in plain language. Parameter modifications shall download to the appropriate controllers at the operator request.

2.1.2.2 Graphic-Based Software

Update the existing graphics located on the ADX-1 server in Building 87 to incorporate and integrate the new DDC system. Create new graphics as required for the new DDC controllers. Graphic-based software shall provide graphical location of the building on the map, the building floor plan, the building mechanical systems, and the DDC system. The current value and point name of every I/O point shall be shown on at least one graphic and in its appropriate physical location relative to building and mechanical systems.

- a. Graphic shall closely follow the style of the control drawings in representing mechanical systems, sensors, controlled devices and point names.
- b. Graphic Title: Graphics shall have an identifying title visible when the graphic is viewed.
- c. Dynamic Update: When the ADX-1 server is on-line with the control system, point data shall update dynamically on the graphic images.

- d. Graphic Penetration: Provide graphic penetration using buttons to select graphics with more detail or to select different equipment.
- e. Graphic Types: Graphic-based software shall have graphics of the building exterior, building section, floor plans, and mechanical systems. At a minimum, provide the following graphics:
 - (1) Building Exterior Graphic: Show exterior architecture, major landmarks, and building number.
 - (2) Building Section Graphic: Show floors in section graphic with appropriate floor name on each floor.
 - (3) Floor Plan Graphics: Provide a single graphic for each floor, unless the graphic will contain more information than can reasonably be shown on a single graphic. Each heating or cooling zone within a floor plan shall have a zone name and its current temperature displayed within the zone outline. Show each controlled variable in the zone. Provide visual warning for each point in alarm. Show existing and new bus routings on floor plan as physically installed in the building.
 - (4) Mechanical System Graphics: Provide two-dimensional drawings to symbolize mechanical equipment; do not use line drawings. Show controlled or sensed mechanical equipment. Each graphic shall consist of a single mechanical system; examples are a graphic for an air handling unit, a graphic for a VAV box, a graphic for a heating water system and a graphic for a chiller system. Place point name and point value adjacent to sensor or controlled device. Provide visual warning of each point in alarm. Point values shall update dynamically on the graphic.

2.1.3 DDC Software

2.1.3.1 Programming

Provide programming to execute the sequence of operation indicated. Provide all programming and tools to configure and program all controllers. Provide programming routines in simple, easy-to-follow logic with detailed text comments describing what the logic does and how it corresponds to the project's written sequence of operation.

- a. Graphic-based programming shall use a library of function blocks made from pre-programmed code designed for BAS control. Function blocks shall be assembled with interconnecting lines, depicting the control sequence in a flowchart. If providing a computer with device programming tools as part of the project, graphic programs shall be viewable in real time showing present values and logical results from each function block.
- b. Menu-based programming shall be done by entering parameters, definitions, conditions, requirements, and constraints.
- c. For line-by-line and text-based programming, declare variable types (local, global, real, integer, etc.) at the beginning of the program. Use descriptive comments frequently to describe the programming.
- d. If providing a computer with device programming tools as part of the project, provide a means for detecting program errors and testing software strategies with a simulation tool. Simulation may be inherent

within the programming software suite, or provided by physical controllers mounted in a NEMA 1 test enclosure. The test enclosure shall contain one dedicated controller of each type provided under this contract, complete with power supply and relevant accessories.

2.1.3.2 Parameter Modification

All writeable object properties, and all other programming parameters needed to comply with the project specification shall be adjustable for devices at any network level, including those accessible with web-browser communication, and regardless of programming methods used to create the applications.

2.1.3.3 Short Cycling Prevention

Provide setpoint differentials and minimum on/off times to prevent equipment short cycling.

2.1.3.4 Equipment Status Delay

Provide an adjustable delay from when equipment is commanded on or off and when the control program looks to the status input for confirmation.

2.1.3.5 Run Time Accumulation

Use the Elapsed Time Property to provide re-settable run time accumulation for each Binary Output Object connected to mechanical loads greater than 1 HP, electrical loads greater than 10 KW, or wherever else specified.

2.1.3.6 Timed Local Override

Provide an adjustable override time for each push of a timed local override button.

2.1.3.7 Time Synchronization

Provide time synchronization, including adjustments for leap years, daylight saving time, and operator time adjustments.

2.1.3.8 Scheduling

Provide operating schedules as indicated, with equipment assigned to groups. Changing the schedule of a group shall change the operating schedule of all equipment in the group. Groups shall be capable of operator creation, modification, and deletion. Provide capability to view and modify schedules in a seven-day week format. Provide capability to enter holiday and override schedules one full year at a time.

2.1.3.9 Object Property Override

Allow writeable object property values to accept overrides to any valid value. Where specified or required for the sequence of control, the Out_Of_Service property of Objects shall be modifiable using BACnet's write property service. When documented, exceptions to these requirement are allowed for life, machine, and process safeties.

2.1.3.10 Alarms and Events

Alarms and events shall be capable of having programmed time delays and

high-low limits. When a computer workstation or web server is connected to the BACnet internetwork, alarms/events shall report to the computer, printer, e-mail, as defined by an authorized operator. Otherwise alarms/events shall be stored within a device on the BACnet network until connected to a user interface device and retrieved. Provide alarms/events in agreement with the point schedule, sequence of operation, and the BAS Owner. At a minimum, provide programming to initiate alarms/events any time a piece of equipment fails to operate, a control point is outside normal range or condition shown on schedules, communication to a device is lost, a device has failed, or a controller has lost its memory.

2.1.3.11 Trending

Provide trend services on the supervisory building controller capable of trending all object present values set points, and other parameters indicated for trending on project schedules. Trends may be associated into groups, and a trend report may be set up for each group. Trends are stored within a device on the BACnet network, with operator selectable trend intervals from 10 seconds up to 60 minutes and/or change of value set points. The minimum number of consecutive trend values stored at one time shall be 100 per variable. When trend memory is full, it shall be selectable to stop trending or overwrite the oldest data. Upon reaching 3/4 of the device buffer limit (via Notification_Threshold property), by operator request, or by time schedule for archiving. Archived and real-time trend data shall be available for viewing numerically and graphically for at the EMCS server and connected notebook computers.

2.1.3.12 Device Diagnostics

Each controller shall have diagnostic LEDs for power, communication, and device fault condition. The DDC system shall recognize and report a non-responsive controller.

2.1.3.13 Power Loss

Upon restoration of power, the DDC system shall perform an orderly restart and restoration of control.

2.1.4 BACnet Protocol Analyzer

Provide a BACnet protocol analyzer and required cables and fittings for connection to the BACnet network. The analyzer shall include the following minimum capabilities:

- a. Capture and store to a file data traffic on all network levels.
- b. Measure bandwidth usage.
- c. Filtering options with ability to ignore select traffic.

2.2 SENSORS AND INPUT HARDWARE

Coordinate sensor types with the BAS Owner to keep them consistent with existing installations.

2.2.1 Field-Installed Temperature Sensors

Where feasible, provide the same sensor type throughout the project. Avoid using transmitters unless absolutely necessary.

2.2.1.1 Thermistors

Precision thermistors may be used in applications below 200 degrees F. Sensor accuracy over the application range shall be 0.36 degree F or less between 32 to 150 degrees F. Stability error of the thermistor over five years shall not exceed 0.25 degrees F cumulative. A/D conversion resolution error shall be kept to 0.1 degrees F. Total error for a thermistor circuit shall not exceed 0.5 degrees F.

2.2.1.2 Resistance Temperature Detectors (RTDs)

Provide RTD sensors with platinum elements compatible with the digital controllers. Encapsulate sensors in epoxy, series 300 stainless steel, anodized aluminum, or copper. Temperature sensor accuracy shall be 0.1 percent (1 ohm) of expected ohms (1000 ohms) at 32 degrees F. Temperature sensor stability error over five years shall not exceed 0.25 degrees F cumulative. Direct connection of RTDs to digital controllers without transmitters is preferred. When RTDs are connected directly, lead resistance error shall be less than 0.25 degrees F. The total error for a RTD circuit shall not exceed 0.5 degrees F.

2.2.1.3 Temperature Sensor Details

- a. Room Type: Provide the sensing element components within a decorative protective cover suitable for surrounding decor. Provide room temperature sensors with timed override button, setpoint adjustment lever, digital temperature display.
- b. Duct Probe Type: Ensure the probe is long enough to properly sense the air stream temperature.
- c. Duct Averaging Type: Continuous averaging sensors shall be one foot in length for each 4 square feet of duct cross-sectional area, and a minimum length of 6 feet.
- d. Pipe Immersion Type: Provide minimum three-inch immersion. Provide each sensor with a corresponding pipe-mounted sensor well, unless indicated otherwise. Sensor wells shall be stainless steel when used in steel piping, and brass when used in copper piping. Provide the sensor well with a heat-sensitive transfer agent between the sensor and the well interior.
- e. Outside Air Type: Provide the sensing element on the building's north side with a protective weather shade that positions the sensor approximately 3 inches off the wall surface, does not inhibit free air flow across the sensing element, and protects the sensor from snow, ice, and rain.

2.2.2 Transmitters

Provide transmitters with 4 to 20 mA or 0 to 10 VDC linear output scaled to the sensed input. Transmitters shall be matched to the respective sensor, factory calibrated, and sealed. Size transmitters for an output near 50 percent of its full-scale range at normal operating conditions. The total transmitter error shall not exceed 0.1 percent at any point across the measured span. Supply voltage shall be 12 to 24 volts AC or DC. Transmitters shall have non-interactive offset and span adjustments. For temperature sensing, transmitter drift shall not exceed 0.03 degrees F a

year.

2.2.2.1 Relative Humidity Transmitters

Provide transmitters with an accuracy equal to plus or minus 3 percent from 0 to 90 percent scale, and less than one percent drift per year. Sensing elements shall be the polymer type.

2.2.2.2 Pressure Transmitters

Provide transmitters integral with the pressure transducer.

2.2.3 Current Transducers

Provide current transducers to monitor motor amperage, unless current switches are shown on design drawings or point tables.

2.2.4 Pneumatic to Electric Transducers

Pneumatic to electronic transducers shall convert a 0 to 20 psig signal to a proportional 4 to 20 mA or 0 to 10 VDC signal (operator scaleable). Supply voltage shall be 24 VDC. Accuracy and linearity shall be 1.0 percent or better.

2.2.5 Air Quality Sensors

Provide power supply for each sensor.

2.2.5.1 CO2 Sensors

Provide photo-acoustic type CO2 sensors with integral transducers and linear output. The devices shall read CO2 concentrations between 0 and 2000 ppm with full scale accuracy of at least plus or minus 100 ppm.

2.2.5.2 Air Quality Sensors

Provide full spectrum air quality sensors using a hot wire element based on the Taguchi principle. The sensor shall monitor a wide range of gaseous volatile organic components common in indoor air contaminants like paint fumes, solvents, cigarette smoke, and vehicle exhaust. The sensor shall automatically compensate for temperature and humidity, have span and calibration potentiometers, operate on 24 VDC power with output of 0-10 VDC, and have a service rating of 32 to 140 degrees F and 5 to 95 percent relative humidity.

2.2.6 Input Switches

2.2.6.1 Timed Local Overrides

Provide buttons or switches to override the DDC occupancy schedule programming for each major building zone during unoccupied periods, and to return HVAC equipment to the occupied mode. This requirement is waived for zones clearly intended for 24 hour continuous operation.

2.2.7 Freeze Protection Thermostats

Provide special purpose thermostats with flexible capillary elements 20 feet minimum length for coil face areas up to 40 square feet. Provide longer elements for larger coils at 1-foot of element for every 4 square

feet of coil face area, or provide additional thermostats. Provide switch contacts rated for the respective motor starter's control circuit voltage. Include auxiliary contacts for the switch's status condition. A freezing condition at any 18-inch increment along the sensing element's length shall activate the switch. The thermostat shall be equipped with a manual push-button reset switch so that when tripped, the thermostat requires manual resetting before the HVAC equipment can restart.

2.2.8 Air Flow Measurement Stations

Air flow measurement stations shall have an array of velocity sensing elements and straightening vanes inside a flanged sheet metal casing. The velocity sensing elements shall be the RTD or thermistor type, traversing the ducted air in at least two directions. The air flow pressure drop across the station shall not exceed 0.08 inch water gage at a velocity of 2,000 fpm. The station shall be suitable for air flows up to 5,000 fpm, and a temperature range of 40 to 120 degrees F. The station's measurement accuracy over the range of 125 to 2,500 fpm shall be plus or minus 3 percent of the measured velocity. Station transmitters shall provide a linear, temperature-compensated 4 to 20 mA or 0 to 10 VDC output. The output shall be capable of being accurately converted to a corresponding air flow rate in cubic feet per minute. Transmitters shall be a 2-wire, loop powered device. The output error of the transmitter shall not exceed 0.5 percent of the measurement.

2.2.9 Energy Metering

2.2.9.1 Steam Meters

Steam meters shall be the vortex type, with pressure compensation, a minimum turndown ratio of 10 to 1, and an output signal compatible with the DDC system. See Section 23 22 26.00 20 STEAM SYSTEM AND TERMINAL UNITS for more information.

2.3 OUTPUT HARDWARE

2.3.1 Control Dampers

Provide factory manufactured galvanized steel dampers where indicated. Control dampers shall comply with SMACNA 1966 except as modified or supplemented by this specification. Published damper leakage rates and respective pressure drops shall have been verified by tests in compliance with AMCA 500-D requirements.

Provide damper assembly frames constructed of 0.064 inch minimum thickness galvanized steel channels with mitered and welded corners. Damper axles shall be 0.5 inches minimum diameter plated steel rods supported in the damper frame by stainless steel or bronze bearings. Blades mounted vertically shall be supported by thrust bearings.

Dampers shall be rated for not less than 2000 fpm air velocity. The pressure drop through each damper when full-open shall not exceed 0.04 inches water gage at 1000 fpm face velocity. Damper assemblies in ductwork subject to above 3-inch water gauge static air pressure shall be constructed to meet SMACNA Seal Class "A" construction requirements.

Provide the damper operating linkages outside of the air stream, including crank arms, connecting rods, and other hardware that transmits motion from the damper actuators to the dampers, shall be adjustable. Additionally, operating linkages shall be designed and constructed to have a 2 to 1

safety factor when loaded with the maximum required damper operating force. Linkages shall be brass, bronze, galvanized steel, or stainless steel.

Provide access doors or panels in hard ceilings and walls for access to all concealed damper operators and damper locking setscrews.

For field-installed control dampers, a single damper section shall have blades no longer than 48 inches and no higher than 72 inches. The maximum damper blade width shall be 12 inches. Larger sized dampers shall be built using a combination of sections.

Frames shall be at least 2 inches wide. Flat blades shall have edges folded for rigidity. Blades shall be provided with compressible gasket seals along the full length of the blades to prevent air leakage when closed.

The damper frames shall be provided with jamb seals to minimize air leakage. Seals shall be suitable for an operating temperature range of minus 40 degrees F to 200 degrees F.

The leakage rate of each damper when full-closed shall be no more than 4 cfm per sq. foot of damper face area at 1.0 inches water gage static pressure.

2.3.2 Control Valves

2.3.2.1 Valve Assembly

Valve bodies shall be designed for 125 psig minimum working pressure or 150 percent of the operating pressure, whichever is greater. Valve stems shall be Type 316 stainless steel. Valve leakage ratings shall be 0.01 percent of rated Cv value. Class 125 copper alloy valve bodies and Class 150 steel or stainless steel valves shall meet the requirements of ASME B16.5. Cast iron valve components shall meet the requirements of ASTM A 126 Class B or C.

2.3.2.2 Butterfly Valves

Butterfly valves shall be the threaded lug type suitable for dead-end service and for modulation to the fully-closed position, with stainless steel shafts supported by bearings, non-corrosive discs geometrically interlocked with or bolted to the shaft (no pins), and EPDM seats suitable for temperatures from minus 20 degrees F to plus 250 degrees F. Valves shall have a means of manual operation independent of the actuator.

2.3.2.3 Two-Way Valves

Two-way modulating valves shall have an equal percentage characteristic.

2.3.2.4 Three-Way Valves

Three-way valves shall have an equal percentage characteristic.

2.3.2.5 Valves for Chilled Water, Condenser Water, and Glycol Fluid Service

- a. Bodies for valves 1-1/2 inches and smaller shall be brass or bronze, with threaded or union ends. Bodies for valves from 2 inches to 3 inches inclusive shall be of brass, bronze, or iron. Bodies for 2 inch valves shall have threaded connections. Bodies for valves from 2-1/2 to 3 inches shall have flanged connections.

- b. Internal valve trim shall be brass or bronze, except that valve stems shall be stainless steel.
- c. Unless indicated otherwise, provide modulating valves sized for 2 psi minimum and 4 psi maximum differential across the valve at the design flow rate.
- d. Valves 4 inches and larger shall be butterfly valves, unless indicated otherwise.

2.3.2.6 Valves for Hot Water Service

Valves for hot water service below 250 Degrees F:

- a. Bodies for valves 1-1/2 inches and smaller shall be brass or bronze, with threaded or union ends. Bodies for valves from 2 inches to 3 inches inclusive shall be of brass, bronze, or iron. Bodies for 2 inch valves shall have threaded connections. Bodies for valves from 2-1/2 to 3 inches shall have flanged connections.
- b. Internal trim (including seats, seat rings, modulation plugs, valve stems, and springs) of valves controlling water above 210 degrees F shall be Type 316 stainless steel.
- c. Internal trim for valves controlling water 210 degrees F or less shall be brass or bronze. Valve stems shall be Type 316 stainless steel.
- d. Non-metallic parts of hot water control valves shall be suitable for a minimum continuous operating temperature of 250 degrees F or 50 degrees F above the system design temperature, whichever is higher.
- e. Unless indicated otherwise, provide modulating valves sized for 2 psi minimum and 4 psi maximum differential across the valve at the design flow rate.
- f. Valves 4 inches and larger shall be butterfly valves, unless indicated otherwise.

2.3.2.7 Valves for High Temperature Hot Water Service

Valves for hot water service 250 Degrees F above:

- a. Valve bodies shall conform to ASME B16.34 Class 300. Valve and actuator combination shall be normally closed. Bodies shall be carbon steel, globe type with welded ends on valves 1 inch and larger. Valves smaller than 1 inch shall have socket-weld ends. Packing shall be virgin polytetrafluoroethylene (PTFE).
- b. Internal valve trim shall be Type 316 stainless steel.
- c. Unless indicated otherwise, provide modulating valves sized for 2 psi minimum and 4 psi maximum differential across the valve at the design flow rate.

2.3.2.8 Valves for Steam Service

The entire body for valves 1-1/2 inches and smaller shall be brass or bronze, with threaded or union ends. Bodies for valves from 2 to 3 inches

inclusive shall be of brass, bronze, or carbon steel. Bodies for valves 4 inches and larger shall be carbon steel. Bodies for 2 inch valves shall have threaded connections. Bodies for valves 2-1/2 inches and larger shall have flanged connections. Steam valves shall be sized for 150 psig inlet steam pressure with a maximum 13 psi differential through the valve at rated flow, except where indicated otherwise. Internal valve trim shall be Type 316 stainless steel.

2.3.3 Actuators

Provide direct-drive electric actuators for all control applications, except where indicated otherwise.

2.3.3.1 Electric Actuators

Each actuator shall deliver the torque required for continuous uniform motion and shall have internal end switches to limit the travel, or be capable of withstanding continuous stalling without damage. Actuators shall function properly within 85 to 110 percent of rated line voltage. Provide actuators with hardened steel running shafts and gears of steel or copper alloy. Fiber or reinforced nylon gears may be used for torques less than 16 inch-pounds. Provide two-position actuators of single direction, spring return, or reversing type. Provide modulating actuators capable of stopping at any point in the cycle, and starting in either direction from any point. Actuators shall be equipped with a switch for reversing direction, and a button to disengage the clutch to allow manual adjustments. Provide the actuator with a hand crank for manual adjustments, as applicable. Thermal type actuators may only be used on terminal fan coil units, terminal VAV units, convectors, and unit heaters. Spring return actuators shall be provided on all control dampers and all control valves except terminal fan coil units, terminal VAV units, convectors, and unit heaters; unless indicated otherwise. Each actuator shall have distinct markings indicating the full-open and full-closed position, and the points in-between.

2.3.4 Output Switches

2.3.4.1 Control Relays

Field installed and DDC panel relays shall be double pole, double throw, UL listed, with contacts rated for the intended application, indicator light, and dust proof enclosure. The indicator light shall be lit when the coil is energized and off when coil is not energized. Relays shall be the socket type, plug into a fixed base, and replaceable without tools or removing wiring. Encapsulated "PAM" type relays may be used for terminal control applications.

2.4 ELECTRICAL POWER AND DISTRIBUTION

2.4.1 Transformers

Transformers shall conform to UL 506. For control power other than terminal level equipment, provide a fuse or circuit breaker on the secondary side of each transformer.

2.4.2 Surge and Transient Protection

Provide each digital controller with surge and transient power protection. Surge and transient protection shall consist of the following devices,

installed externally to the controllers.

2.4.2.1 Power Line Surge Protection

Provide surge suppressors on the incoming power at each controller or grouped terminal controllers. Surge suppressors shall be rated in accordance with UL 1449, have a fault indicating light, and conform to the following:

- a. The device shall be a transient voltage surge suppressor, hard-wire type individual equipment protector for 120 VAC/1 phase/2 wire plus ground.
- b. The device shall react within 5 nanoseconds and automatically reset.
- c. The voltage protection threshold, line to neutral, shall be no more than 211 volts.
- d. The device shall have an independent secondary stage equal to or greater than the primary stage joule rating.
- e. The primary suppression system components shall be pure silicon avalanche diodes.
- f. The secondary suppression system components shall be silicon avalanche diodes or metal oxide varistors.
- g. The device shall have an indication light to indicate the protection components are functioning.
- h. All system functions of the transient suppression system shall be individually fused and not short circuit the AC power line at any time.
- i. The device shall have an EMI/RFI noise filter with a minimum attenuation of 13 dB at 10 kHz to 300 MHz.
- j. The device shall comply with IEEE C62.41.1 and IEEE C62.41.2, Class "B" requirements and be tested according to IEEE C62.45.
- k. The device shall be capable of operating between minus 20 degrees F and plus 122 degrees F.

2.4.2.2 Telephone and Communication Line Surge Protection

Provide surge and transient protection for DDC controllers and DDC network related devices connected to phone and network communication lines, in accordance with the following:

- a. The device shall provide continuous, non-interrupting protection, and shall automatically reset after safely eliminating transient surges.
- b. The protection shall react within 5 nanoseconds using only solid-state silicon avalanche technology.
- c. The device shall be installed at the distance recommended by its manufacturer.

2.4.2.3 Controller Input/Output Protection

Provide controller inputs and outputs with surge protection via optical isolation, metal oxide varistors (MOV), or silicon avalanche devices. Fuses are not permitted for surge protection.

2.4.3 Wiring

Provide complete electrical wiring for the DDC System, including wiring to transformer primaries. Unless indicated otherwise, provide all normally visible or otherwise exposed wiring in conduit. Where conduit is required, control circuit wiring shall not run in the same conduit as power wiring over 100 volts. Circuits operating at more than 100 volts shall be in accordance with Section 26 20 00, INTERIOR DISTRIBUTION SYSTEM. Run all circuits over 100 volts in conduit, metallic tubing, covered metal raceways, or armored cable. Use plenum-rated cable for circuits under 100 volts in enclosed spaces. Examples of these spaces include HVAC plenums, within walls, above suspended ceilings, in attics, and within ductwork.

2.4.3.1 Power Wiring

The following requirements are for field-installed wiring:

- a. Wiring for 24 V circuits shall be insulated copper 18 AWG minimum and rated for 300 VAC service.
- b. Wiring for 120 V circuits shall be insulated copper 14 AWG minimum and rated for 600 VAC service.

2.4.3.2 Analog Signal Wiring

Field-installed analog signal wiring shall be 18 AWG single or multiple twisted pair. Each cable shall be 100 percent shielded and have a 20 AWG drain wire. Each wire shall have insulation rated for 300 VAC service. Cables shall have an overall aluminum-polyester or tinned-copper cable-shield tape.

2.5 FIRE PROTECTION DEVICES

2.5.1 Duct Smoke Detectors

Provide duct smoke detectors in HVAC ducts in accordance with NFPA 72 and NFPA 90A, except as indicated otherwise. Provide UL listed or FM approved detectors, designed specifically for duct installation.

Provide ionization or photoelectric type detectors. Detectors shall detect both visible and invisible particles of combustion, and shall not be susceptible to undesired operation by changes to relative humidity. Provide each detector with an approved duct housing mounted exterior to the duct, and an integral perforated sampling tube extending across the width of the duct. The detector housing shall have indicator lamps that light when the detector is powered and when the detector is activated. Each detector shall have an integral test port, test switch and or, remote keyed test device. Connect new detectors to the building's new existing fire alarm control panel. Provide control and power modules required for the operation of the detectors in their own new control unit or integral with the existing fire alarm panel. A ground fault, break, or open condition in the electrical circuitry to any detector or its control or power unit shall cause activation of a trouble signal at the building fire

alarm panel. Electrical supervision of wiring used exclusively for air-handling unit shutdown is not required, provided a break in the wiring would cause shutdown of the associated unit. Equipment and devices shall be compatible and operable in all respects with, and shall in no way impair the reliability or operational functions of, the new existing fire alarm system. The building's existing fire alarm control panel was manufactured by METASYS Notifier IFC3030. Provide descriptive zone labels at the existing fire alarm panel indicating which new air-handling unit detectors they serve and their location. Label zones modified in order to accomplish the work.

2.6 INDICATORS

2.6.1 Thermometers

Provide bi-metal type thermometers at locations shown. Thermometers shall have either 9 inch long scales or 3.5 inch diameter dials, with insertion, immersion, or averaging elements. Provide matching thermowells for pipe-mounted installations. Select scale ranges suitable for the intended service, with the normal operating temperature near the scale's midpoint. The thermometer's accuracy shall be plus or minus 2 percent of the scale range.

PART 3 EXECUTION

3.1 INSTALLATION

Perform the installation under the supervision of competent technicians regularly employed in the installation of DDC systems.

3.1.1 BACnet Naming and Addressing

Coordinate with the BAS Owner and provide unique naming and addressing for BACnet networks and devices using the attached Point Naming Convention.

a. MAC Address

Every BACnet device shall have an assigned and documented MAC Address unique to its network. For Ethernet networks, document the MAC Address assigned at its creation. For ARCNET or MS/TP, assign from 00 to 64.

b. Network Numbering

Assign unique numbers to each new network installed on the BACnet internetwork. Provide ability for changing the network number; either by device switches, network computer, or field operator interface. The BACnet internetwork (all possible connected networks) can contain up to 65,534 possible unique networks.

c. Device Object Identifier Property Number

Assign unique Device "Object_Identifier" property numbers or device instances for each device on the BACnet internetwork. Provide for future modification of the device instance number; either by device switches, network computer, or field interface. BACnet allows up to 4,194,302 possible unique devices per internetwork.

d. Device Object Name Property Text

The Device Object Name property field shall support 32 minimum printable characters. Assign unique Device "Object_Name" property names with plain-English descriptive names for each device. For example, the Device Object Name that for the device controlling the chiller plant at Building 3408 would be:

Device Object_Name = CW System B3408

A Device Object Name for a VAV box controller might be:

Device Object_Name = VAV BOX25

e. Object Name Property Text (Other than Device Objects)

The Object Name property field shall support 32 minimum printable characters. Assign Object Name properties with plain-English names descriptive of the application. Examples include "Zone 1 Temperature" and "Fan Start/Stop".

f. Object Identifier Property Number (Other than Device Objects)

Assign Object Identifier property numbers according to design drawings or tables if provided. If not provided, Object Identifier property numbers may be assigned at the Contractor's discretion but must be approved by the Government. In this case they must be documented and unique for like object types within the device.

3.1.2 Minimum BACnet Object Requirements

a. Use of Standard BACnet Objects

For the following points and parameters, use standard BACnet objects, where all relevant object properties can be read using BACnet's Read Property Service, and all relevant object properties can be modified using BACnet's Write Property Service:
all device physical inputs and outputs, all set points, all PID tuning parameters, all calculated pressures, flow rates, and consumption values, all alarms, all trends, all schedules, and all equipment and lighting circuit operating status.

b. BACnet Object Description Property

The Object Description property shall support 32 minimum printable characters. For each object, complete the description property field using a brief, narrative, plain English description specific to the object and project application. For example: "HW Pump 1 Proof." Document compliance, length restrictions, and whether the description is writeable in the device PICS.

c. Analog Input, Output, and Value Objects

Support and provide Description and/or Device_Type text strings matching signal type and engineering units shown on the points list.

d. Binary Input, Output, and Value Objects

Support and provide Inactive_Text and Active_Text property descriptions matching conditions shown on the points list.

e. Calendar Object

For devices with scheduling capability, provide at least one Calendar Object with ten-entry capacity. All operators may view Calendar Objects; authorized operators may make modifications from a workstation. Enable the writeable Date List property and support all calendar entry data types.

f. Schedule Object

Use Schedule Objects for all building system scheduling. All operators may view schedule entries; authorized operators may modify schedules from a workstation.

g. Loop Object or Equal

Use Loop Objects or equivalent BACnet objects in each applicable field device for PID control. Regardless of program method or object used, allow authorized operators to adjust the Update Interval, Setpoint, Proportional Constant, Integral Constant, and Derivative Constant using BACnet read/write services.

3.1.3 Minimum BACnet Service Requirements

a. Command Priorities

Use commandable BACnet objects to control machinery and systems, providing the priority levels listed below. If the sequence of operation requires a different priority, obtain approval from the Contracting Officer.

<u>Priority Level</u>	<u>Application</u>
1	Manual-Life Safety
2	Automatic-Life Safety
3	(User Defined)
4	(User Defined)
5	Critical Equipment Control
6	Minimum On/Off
7	(User Defined)
8	Manual Operator
9	(User Defined)
10	(User Defined)
11	Load Shedding
12	(User Defined)
13	(User Defined)
14	(User Defined)
15	(User Defined)
16	(User Defined)

b. Alarming

- (1) Alarm Priorities - Coordinate alarm and event notification with the BAS Owner.
- (2) Notification Class - Enable writeable Priority, Ack Required, and Recipient List properties of Notification Class objects.
- (3) Event Notification Message Texts - Use condition specific narrative text and numerical references for alarm and event

notification.

c. Updating Displayed Property Values

Allow workstations to display property values at discrete polled intervals, or based on receipt of confirmed and unconfirmed Change of Value notifications. The COV increment shall be adjustable by an operator using BACnet services, and polled intervals shall be adjustable at the operator workstation.

3.1.4 Local Area Networks

Obtain Government approval before connecting new networks with existing networks. Network numbers and device instance numbers shall remain unique when joining networks. Do not change existing network addressing without Government approval. See also "BACnet Naming and Addressing".

3.1.5 BACnet Routers, Bridges, and Switches

Provide the quantity of BACnet routers, bridges, and switches necessary for communications shown on the BACnet Communication Architecture schematic. Provide BACnet routers with BACnet Broadcast Message Device (BBMD) capability on each BACnet internetwork communicating across an IP network. Configure each BACnet device and bridge, router, or switch to communicate on its network segment.

3.1.6 Wiring Criteria

- a. Run circuits operating at more than 100 volts in rigid or flexible conduit, metallic tubing, covered metal raceways, or armored cable.
- b. Do not run binary control circuit wiring in the same conduit as power wiring over 100 volts. Where analog signal wiring requires conduit, do not run in the same conduit with AC power circuits or control circuits operating at more than 100 volts.
- c. Provide circuit and wiring protection required by NFPA 70.
- d. Run all wiring located inside mechanical rooms in conduit.
- e. Do not bury aluminum-sheathed cable or aluminum conduit in concrete.
- f. Input/output identification: Permanently label each field-installed wire, cable, and pneumatic tube at each end with descriptive text using a commercial wire marking system that fully encircles the wire, cable, or tube. Locate the markers within 2 inches of each termination. Match the names and I/O number to the project's point list. Similarly label all power wiring serving control devices, including the word "power" in the label. Number each pneumatic tube every six feet. Label all terminal blocks with alpha/numeric labels. All wiring and the wiring methods shall be in accordance with UL 508A.
- g. For controller power, provide new 120 VAC circuits, with ground. Provide each circuit with a dedicated breaker, and run wiring in its own conduit, separate from any control wiring. Connect the controller's ground wire to the electrical panel ground; conduit grounds are not acceptable.
- h. Surge Protection: Install surge protection according to manufacturer's

instructions. Multiple controllers fed from a common power supply may be protected by a common surge protector, properly sized for the total connected devices.

- i. Grounding: Ground controllers and cabinets to a good earth ground as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Conduit grounding is not acceptable; all grounding shall have a direct path to the building earth ground. Ground sensor drain wire shields at the controller end.
- j. The Contractor shall be responsible for correcting all associated ground loop problems.
- k. Run wiring in panel enclosures in covered wire track.

3.1.7 Accessibility

Install all equipment so that parts requiring periodic inspection, operation, maintenance, and repair are readily accessible. Install digital controllers, data ports, and concealed actuators, valves, dampers, and like equipment in locations freely accessible through access doors.

3.1.8 Digital Controllers

- a. Install as stand alone control devices (see definitions).
- b. Locate control cabinets at the locations shown on the drawings. If not shown on the drawings, install in the most accessible space, close to the controlled equipment.

3.1.9 Hand-Off-Auto Switches

Wire safety controls such as smoke detectors and freeze protection thermostats to protect the equipment during both hand and auto operation.

3.1.10 Temperature Sensors

Install temperature sensors in locations that are accessible and provide a good representation of sensed media. Installations in dead spaces are not acceptable. Calibrate sensors according to manufacturer's instructions. Do not use sensors designed for one application in a different application.

3.1.10.1 Room Temperature Sensors

Mount the sensors on interior walls to sense the average room temperature at the locations indicated. Avoid locations near heat sources such as copy machines or locations by supply air outlet drafts. Mount the center of the sensor 5 feet above the finished floor.

3.1.10.2 Duct Temperature Sensors

- a. Probe Type: Provide a gasket between the sensor housing and the duct wall. Seal the duct penetration air tight. Seal the duct insulation penetration vapor tight.
- b. Averaging Type (and coil freeze protection thermostats): Weave the capillary tube sensing element in a serpentine fashion perpendicular to the flow, across the duct or air handler cross-section, using durable non-metal supports. Prevent contact between the capillary and the duct

or air handler internals. Provide a duct access door at the sensor location. The access door shall be hinged on the side, factory insulated, have cam type locks, and be as large as the duct will permit, maximum 18 by 18 inches. For sensors inside air handlers, the sensors shall be fully accessible through the air handler's access doors without removing any of the air handler's internals.

3.1.10.3 Immersion Temperature Sensors

Provide thermowells for sensors measuring piping, tank, or pressure vessel temperatures. Locate wells to sense continuous flow conditions. Do not install wells using extension couplings. Where piping diameters are smaller than the length of the wells, provide wells in piping at elbows to sense flow across entire area of well. Wells shall not restrict flow area to less than 70 percent of pipe area. Increase piping size as required to avoid restriction. Provide thermal conductivity material within the well to fully coat the inserted sensor.

3.1.11 Energy Meters

Locate energy meters as indicated. Connect each meter output to the DDC system, to measure both instantaneous and accumulated energy usage.

3.1.12 Damper Actuators

Where possible, mount actuators outside the air stream in accessible areas.

3.1.13 Thermometers and Gages

Mount devices to allow reading while standing on the floor or ground, as applicable.

3.1.14 Pressure Sensors

Locate pressure sensors as indicated.

3.1.15 Component Identification Labeling

Using an electronic hand-held label maker with white tape and bold black block lettering, provide an identification label on the exterior of each new control panel, control device, actuator, and sensor. Also provide labels on the exterior of each new control actuator indicating the (full) open and (full) closed positions. For labels located outdoors, use exterior grade label tape, and provide labels on both the inside and outside of the panel door or device cover. Acceptable alternatives are white plastic labels with engraved bold black block lettering permanently attached to the control panel, control device, actuator, and sensor. Have the labels and wording approved by the BAS Owner prior to installation.

3.2 TEST AND BALANCE SUPPORT

The controls contractor shall coordinate with and provide on-site support to the test and balance (TAB) personnel specified under Section 23 05 93 TESTING, ADJUSTING AND BALANCING. This support shall include:

- a. On-site operation and manipulation of control systems during the testing and balancing.
- b. Control setpoint adjustments for balancing all relevant mechanical

systems, including VAV boxes.

- c. Tuning control loops with setpoints and adjustments determined by TAB personnel.

3.3 PERFORMANCE VERIFICATION TESTING (PVT)

3.3.1 General

The PVT shall demonstrate compliance of the control system work with the contract requirements. The PVT shall be performed by the Contractor and witnessed and approved by the Government. If the project is phased, provide separate testing for each phase. A Pre-PVT meeting to review the Pre-PVT Checklist is required to coordinate all aspects of the PVT and shall include the Contractor's QA representative, the Contractor's PVT administrator, the Contracting Officer's representative, and the BAS Owner.

3.3.2 Performance Verification Testing Plan

Submit a detailed PVT Plan of the proposed testing for Government approval. Develop the PVT Plan specifically for the control system in this contract. The PVT Plan shall be a clear list of test items arranged in a logical sequence. Include the intended test procedure, the expected response, and the pass/fail criteria for every component tested.

The plan shall clearly describe how each item is tested, indicate where assisting personnel are required (like the mechanical contractor), and include what procedures are used to simulate conditions. Include a separate column for each checked item and extra space for comments. Where sequences of operations are checked, insert each corresponding routine from the project's sequence of operation. For each test area, include signature and date lines for the Contractor's PVT administrator, the Contractor's QA representative, the Contracting Officer's representative, and the BAS Owner to acknowledge successful completion. The BAS Owner can provide sample PVT forms and procedures upon request.

3.3.3 PVT Sample Size

Test all central plant equipment and primary air handling unit controllers unless otherwise directed. Twenty percent sample testing is allowed for identical controllers typical of terminal control like VAV boxes and fan coil units. The Government may require testing of like controllers beyond a statistical sample if sample controllers require retesting or do not have consistent results.

The Government may witness all testing, or random samples of PVT items. When only random samples are witnessed, the Government may choose which ones.

3.3.4 Pre-Performance Verification Testing Checklist

Submit the following as a list with items checked off once verified. Provide a detailed explanation for any items that are not completed or verified.

- a. Verify all required mechanical installation work is successfully completed, and all HVAC equipment is working correctly (or will be by the time the PVT is conducted).

- b. Verify HVAC motors operate below full-load amperage ratings.
- c. Verify all required control system components, wiring, and accessories are installed.
- d. Verify the installed control system architecture matches approved drawings.
- e. Verify all control circuits operate at the proper voltage and are free from grounds or faults.
- f. Verify all required surge protection is installed.
- g. Verify the A/C Power Table specified in "CONTROLS SYSTEM OPERATORS MANUALS" is accurate.
- h. Verify all DDC network communications function properly, including uploading and downloading programming changes.
- i. Using the BACnet protocol analyzer (if provided or required in this specification), verify communications are error free.
- j. Verify each digital controller's programming is backed up.
- k. Verify all wiring, components, and panels are properly labeled.
- l. Verify all required points are programmed into devices.
- m. Verify all TAB work affecting controls is complete.
- n. Verify all valve and actuator zero and span adjustments are set properly.
- o. Verify all sensor readings are accurate and calibrated.
- p. Verify each control valve and actuator goes to normal position upon loss of power.
- q. Verify all control loops are tuned for smooth and stable operation. View trend data where applicable.
- r. Verify each controller works properly in stand-alone mode.
- s. Verify all safety controls and devices function properly, including freeze protection and interfaces with building fire alarm systems.
- t. Verify all electrical interlocks work properly.
- u. Verify all workstations, notebooks and maintenance personnel interface tools are delivered, all system and database software is installed, and graphic pages are created for each workstation and notebook.
- v. Verify the as-built (shop) control drawings are completed.

3.3.5 Conducting Performance Verification Testing

- a. Conduct Government-witnessed PVT after approval of the PVT Plan and the completed Pre-PVT Checklist. Notify the Contracting Officer of the planned PVT at least 15 days prior to testing. Provide an estimated

time table required to perform the testing. Furnish personnel, equipment, instrumentation, and supplies necessary to perform all aspects of the PVT. Ensure that testing personnel are regularly employed in the testing and calibration of DDC systems. Using the project's as-built control system (shop) drawings, the project's mechanical design drawings, the approved Pre-PVT Checklist, and the approved PVT Plan, conduct the PVT.

- b. During testing, identify any items that do not meet the contract requirements and if time permits, conduct immediate repairs and re-test. Otherwise, deficiencies shall be investigated, corrected, and re-tested later. Document each deficiency and corrective action taken.
- c. If re-testing is required, follow the procedures for the initial PVT. The Government may require re-testing of any control system components affected by the original failed test.

3.3.6 Controller Capability and Labeling

Test the following for each controller:

- a. Memory: Demonstrate that programmed data, parameters, and trend/ alarm history collected during normal operation is not lost during power failure.
- b. Direct Connect Interface: Demonstrate the ability to connect directly to each type of digital controller with a portable electronic device like a notebook computer or PDA. Show that maintenance personnel interface tools perform as specified in the manufacturer's technical literature.
- c. Stand Alone Ability: Demonstrate controllers provide stable and reliable stand-alone operation using default values or other method for values normally read over the network.
- d. Wiring and AC Power: Demonstrate the ability to disconnect any controller safely from its power source using the AC Power Table. Demonstrate the ability to match wiring labels easily with the control drawings. Demonstrate the ability to locate a controller's location using the BACnet Communication Architecture Schematic and floor plans.
- e. Nameplates and Tags: Show the nameplates and tags are accurate and permanently attached to control panel doors, devices, sensors, and actuators.

3.3.7 Workstation and Software Operation

For every user workstation or notebook provided:

- a. Show points lists agree with naming conventions.
- b. Show that graphics are complete.
- c. Show the UPS operates as specified.

3.3.8 BACnet Communications and Interoperability Areas

Demonstrate proper interoperability of data sharing, alarm and event management, trending, scheduling, and device and network management. If

available or required in this specification, use a BACnet protocol analyzer to assist with identifying devices, viewing network traffic, and verifying interoperability. These requirements must be met even if there is only one manufacturer of equipment installed. Testing includes the following:

- a. Data Presentation: On each BACnet Operator Workstation, demonstrate graphic display capabilities.
- b. Reading of Any Property: Demonstrate the ability to read and display any used readable object property of any device on the network.
- c. Setpoint and Parameter Modifications: Show the ability to modify all setpoints and tuning parameters in the sequence of control or listed on project schedules. Modifications are made with BACnet messages and write services initiated by an operator using workstation graphics, or by completing a field in a menu with instructional text.
- d. Peer-to-Peer Data Exchange: Show all BACnet devices are installed and configured to perform BACnet read/write services directly (without the need for operator or workstation intervention), to implement the project sequence of operation, and to share global data.
- e. Alarm and Event Management: Show that alarms/events are installed and prioritized according to the BAS Owner. Demonstrate time delays and other logic is set up to avoid nuisance tripping, e.g., no status alarms during unoccupied times or high supply air during cold morning start-up. Show that operators with sufficient privilege can read and write alarm/event parameters for all standard BACnet event types. Show that operators with sufficient privilege can change routing (BACnet notification classes) for each alarm/event including the destination, priority, day of week, time of day, and the type of transition involved (TO-OFF NORMAL, TO-NORMAL, etc.).
- f. Schedule Lists: Show that schedules are configured for start/stop, mode change, occupant overrides, and night setback as defined in the sequence of operations.
- g. Schedule Display and Modification: Show the ability to display any schedule with start and stop times for the calendar year. Show that all calendar entries and schedules are modifiable from any connected workstation by an operator with sufficient privilege.
- h. Archival Storage of Data: Show that data archiving is handled by the operator workstation/server, and local trend archiving and display is accomplished with BACnet Trend Log objects.
- i. Modification of Trend Log Object Parameters: Show that an operator with sufficient privilege can change the logged data points, sampling rate, and trend duration.
- j. Device and Network Management: Show the following capabilities:
 - (1) Display of Device Status Information
 - (2) Display of BACnet Object Information
 - (3) Silencing Devices that are Transmitting Erroneous Data
 - (4) Time Synchronization

(5) Remote Device Reinitialization

(6) Backup and Restore Device Programming and Master Database(s)

(7) Configuration Management of Half-Routers, Routers and BBMDs

3.3.9 Execution of Sequence of Operation

Demonstrate that the HVAC system operates properly through the complete sequence of operation. Use read/write property services to globally read and modify parameters over the internetwork.

3.3.10 Control Loop Stability and Accuracy

For all control loops tested, give the Government trend graphs of the control variable over time, demonstrating that the control loop responds to a 20 percent sudden change of the control variable set point without excessive overshoot and undershoot. If the process does not allow a 20 percent set point change, use the largest change possible. Show that once the new set point is reached, it is stable and maintained. Control loop trend data shall be in real-time with the time between data points 30 seconds or less.

3.3.11 Performance Verification Testing Report

Upon successful completion of the PVT, submit a PVT Report to the Government and prior to the Government taking use and possession of the facility. Do not submit the report until all problems are corrected and successfully re-tested. The report shall include the annotated PVT Plan used during the PVT. Where problems were identified, explain each problem and the corrective action taken. Include a written certification that the installation and testing of the control system is complete and meets all of the contract's requirements.

3.4 TRAINING REQUIREMENTS

Provide a qualified instructor (or instructors) with two years minimum field experience with the installation and programming of similar BACnet DDC systems. Orient training to the specific systems installed. Coordinate training times with the Contracting Officer and BAS Owner after receiving approval of the training course documentation. Training shall take place at the job site and/or a nearby Government-furnished location. A training day shall occur during normal working hours, last no longer than 8 hours and include a one-hour break for lunch and two additional 15-minute breaks. The project's approved Controls System Operators Manual shall be used as the training text. The Contractor shall ensure the manuals are submitted, approved, and available to hand out to the trainees before the start of training.

3.4.1 Training Documentation

Submit training documentation for review 30 days minimum before training. Documentation shall include an agenda for each training day, objectives, a synopsis of each lesson, and the instructor's background and qualifications. The training documentation can be submitted at the same time as the project's Controls System Operators Manual.

3.4.2 Training

The training shall be divided into 2 separate sessions, with each session lasting one day and be conducted at the DDC system workstation, at a notebook computer connected to the DDC system in the field, and at other site locations as necessary. One training session should focus on the mechanical equipment involved and the DDC system operations. The other session shall focus on the DDC software design, configuration and maintenance. Upon completion of the training, each trainee should fully understand the project's DDC system operation. The training sessions shall include, but not limited to the following:

- a. A walk-through tour of the mechanical system and the installed DDC components (controllers, valves, dampers, surge protection, switches, thermostats, sensors, etc.)
- b. A discussion of the components and functions at each DDC panel
- c. Logging-in and navigating at each operator interface type
- d. Using each operator interface to find, read, and write to specific controllers and objects
- e. Modifying and downloading control program changes
- f. Modifying setpoints
- g. Creating, editing, and viewing trends
- h. Creating, editing, and viewing alarms
- i. Creating, editing, and viewing operating schedules and schedule objects
- j. Backing-up and restoring programming and data bases
- k. Modifying graphic text, backgrounds, dynamic data displays, and links to other graphics
- l. Creating new graphics and adding new dynamic data displays and links
- m. Alarm and Event management
- n. Adding and removing network devices

Point Naming Convention

Format - Supervisory Controller/Bus . Application Specific Controller .
 Point Type
 (Spaces added for clarity separating parts for the 'Fully
 Qualified Reference')

Example - adx-1:NAE-0298-1/N2-1.011047UN.ZN-T

Supervisory Controller Server: **NAE-XXXX-X**
 Example - adx-1: **NAE-0298-1**

ASC Controllers (Bus & Identifier are created when insert field device
 and can't be changed later)

Bus Bus type - Bus # Example: adx-1:NAE-0298-1/**N2-1**
 N2-1 or N2-2
 FC-1 or FC-2 for BacNet
 (BacNet over IP may be limited by the controllers when added)

Identifier (Item reference) Server: *NAE name/bus.XXX N2 address
 controller type*

Example - adx-1: *NAE-0298-1/N2-1.011047UN*

ASC controller Name 4 digit bldg #.011XXXYY Where X=N2 address & Y
 in type identifier

Use **011** for bus #1 and **012** for bus #2

Example - **0298.011047UN** (bldg 298 bus #1 N2 address 047 UNT)

Note: (use **FE** for FEC controllers.)

Points (Insert field point) **See separate list for point type
 nomenclatures.**

Identifier (Item reference) Server: *NAE name/bus.N2 address &
 controller type.point type*
 (Identifier are created when inserting
 a field device and can't be changed
 later)

(Shows up with mouse over on graphics.)

Example - adx-1: *NAE-0298-1/N2-1.011047UN.ZN-T*

Point Name **bldg#.controller name.point type** (Shows up as Item in
 event viewer)

Example - **0298.AHU-8.ZN-T**

Description **Description of point**

Examples - Zone Temp , Sup Fan Status, Hot Water Pump Status

EMCS Graphic Conventions

Any deviations from these conventions shall be approved in advance.

All graphics: All new graphics should match the appearance of existing graphics.

Sample of current graphics will be made available.

Background images are Visio 2003 SVGZ files.

Data values should be shown as black text in a white box and a black border.

Text should be black with a transparent background with no border. Some graphics use blue text for contrast for special items such as names of devices.

Buttons to select other graphics are gray with white text in a vertical column on the right side of the page.

Attention should be given to the general alignment and centering of objects.

- Floor Plans**
- should come from CAD drawings if available.
 - Display against a light pale yellow background.
 - Show Temperature sensors on the floor plan in their true location and source reference
 - Zone temp backgrounds should turn red when in alarm state.
 - Show all communication equipment locations and bus routing.
 - Show location of all controllers and their status.
 - Include a legend as appropriate.

- Systems**
- Information such as set points, modes & other data not specifically shown as a point on the system graphic should be in a gray framed box in the bottom left portion of the page. This box should include outside air temp and humidity for all systems.
 - The status of dynamic values such as running, alarm, etc should be indicated both with text and color or moving dynamic symbols. Color preferences used:

Alarms: Normal- green or white for temperature background, Alarm - red

Run status: On/running - green,
Off/stopped - red for moving symbols/
white for text backgrounds.

Load Shed: Shedding - Red, Not Shedding - white

(See Table 1 below for RGB color specifications)

- All system graphics should include a framed boxed in the lower right corner showing controller and load shedding status.
- Include a legend as appropriate.

Table 1: Common Colors Used In Graphics

Use	Description	RGB Color
Floor Plan Background	Pale Yellow	255,255,153
Main Background on most graphics	Violet	146,132,255
Gray Background for framed boxes	Gray	193,193,193
Alternant Gray (System gray preference)	Lighter Gray	204,204,204
Run status Off, Alarm Condition, Load	RED	255 , 0 , 0
Run Status On, Normal condition, Com. Ok	Green	0 , 255 , 0

Modify any existing graphic or add to an existing common graphic if affected by the project.

Existing common graphics include but not limited to:

Station map showing building location with a link to the buildings floor plan.

Load shedding status.

Network communications page for NAEs, etc.

Power meter summary pages.

Special pages for Well and Lift Station data.

-- End of Section --

SECTION 23 21 13.00 20

LOW TEMPERATURE WATER (LTW) HEATING SYSTEM

04/06

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 SANITARY ENGINEERING (ASSE)

- ASSE 1003 (2009) Performance Requirements for Water Pressure Reducing Valves for Domestic Water Distribution Systems - (ANSI approved 2010)
- ASSE 1017 (2009) Performance Requirements for Temperature Actuated Mixing Valves for Hot Water Distribution Systems - (ANSI approved 2010)

AMERICAN WELDING SOCIETY (AWS)

- AWS Z49.1 (2005) Safety in Welding and Cutting and Allied Processes

ASME INTERNATIONAL (ASME)

- ASME B1.1 (2003; R 2008) Unified Inch Screw Threads (UN and UNR Thread Form)
- ASME B1.20.1 (1983; R 2006) Pipe Threads, General Purpose (Inch)
- ASME B16.1 (2010) Gray Iron Threaded Fittings; Classes 25, 125 and 250
- ASME B16.11 (2009) Forged Fittings, Socket-Welding and Threaded
- ASME B16.18 (2001; R 2005) Cast Copper Alloy Solder Joint Pressure Fittings
- ASME B16.21 (2011) Nonmetallic Flat Gaskets for Pipe Flanges
- ASME B16.22 (2001; R 2010) Standard for Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
- ASME B16.24 (2006) Cast Copper Alloy Pipe Flanges and Flanged Fittings: Classes 150, 300, 600, 900, 1500, and 2500

ASME B16.3	(2010) Malleable Iron Threaded Fittings, Classes 150 and 300
ASME B16.34	(2009; Supp 2010) Valves - Flanged, Threaded and Welding End
ASME B16.39	(2009) Standard for Malleable Iron Threaded Pipe Unions; Classes 150, 250, and 300
ASME B16.5	(2009) Pipe Flanges and Flanged Fittings: NPS 1/2 Through NPS 24 Metric/Inch Standard
ASME B16.9	(2007) Standard for Factory-Made Wrought Steel Butt welding Fittings
ASME B18.2.2	(2010) Standard for Square and Hex Nuts
ASME B31.9	(2011) Building Services Piping
ASME B40.100	(2005) Pressure Gauges and Gauge Attachments
ASME BPVC SEC VIII D1	(2007; Addenda 2008; Addenda 2009) BPVC Section VIII-Rules for Construction of Pressure Vessels Division 1

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M	(2009) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A194/A194M	(2010a) Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure or High-Temperature Service, or Both
ASTM A307	(2010) Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
ASTM A53/A53M	(2010) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM B32	(2008) Standard Specification for Solder Metal
ASTM B88	(2009) Standard Specification for Seamless Copper Water Tube

COPPER DEVELOPMENT ASSOCIATION (CDA)

CDA A4015	(1994; R 1995) Copper Tube Handbook
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MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS
INDUSTRY (MSS)

MSS SP-110 (2010) Ball Valves Threaded,
Socket-Welding, Solder Joint, Grooved and
Flared Ends

MSS SP-58 (2009) Pipe Hangers and Supports -
Materials, Design and Manufacture,
Selection, Application, and Installation

MSS SP-67 (2002a) Butterfly Valves

MSS SP-69 (2003) Pipe Hangers and Supports -
Selection and Application (ANSI Approved
American National Standard)

MSS SP-70 (2006) Gray Iron Gate Valves, Flanged and
Threaded Ends

MSS SP-72 (2010) Ball Valves with Flanged or
Butt-Welding Ends for General Service

MSS SP-80 (2008) Bronze Gate, Globe, Angle and Check
Valves

MSS SP-85 (2002) Gray Iron Globe & Angle Valves
Flanged and Threaded Ends

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1 (2009) Motors and Generators

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

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

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-V-12003 (Rev F; Am 1; CANC Notice 1) Valves,
Plug, Cast-Iron or Steel, Manually
Operated

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-1689 (Rev B) Tape, Pressure-Sensitive Adhesive,
(Plastic Film)

CID A-A-50560 (Basic) Pumps, Centrifugal, Water
Circulating, Electric-Motor-Driven

CID A-A-59617 (Basic) Unions, Brass or Bronze, Threaded
Pipe Connections and Solder-Joint Tube
Connections

FS WW-S-2739 (Basic; Notice 1) Strainers, Sediment:
Pipeline, Water, Air, Gas, Oil, or Steam

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

29 CFR 1910.144 Safety Color Code for Marking Physical Hazards

29 CFR 1910.219 Mechanical Power Transmission Apparatus

1.2 RELATED REQUIREMENTS

Section 23 03 00.00 20 BASIC MECHANICAL MATERIALS AND METHODS applies to this section with additions and modifications specified herein.

1.3 SYSTEM DESCRIPTION

Except as specified otherwise, equipment and piping components shall be suitable for use in low temperature water heating system. Except as modified herein, the pressure temperature limitations shall be as specified in the referenced standards and specifications. Pressures in this specification are pressures in pounds per square inch above atmospheric pressure, and temperatures are in degrees Fahrenheit (F).

1.3.1 Hot Water Heating System

Submit plan, elevations, dimensions, capacities, and ratings. Include the following:

- a. Unit heaters
- b. Pumps
- c. Valves
- d. Expansion tanks
- e. Air separating tank

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for A/E approval. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Hot water heating system

SD-03 Product Data

Pumps;

Include pump speed and characteristic curve for performance of impeller selected for each pump. Curves shall indicate capacity vs head, efficiency, and brake power for full range, from shut-off to free delivery.

Expansion tanks

Ultrasonic Flowmeter

External air separation tanks

Hot water heating pipe

SD-06 Test Reports

Hydrostatic test of piping system

SD-07 Certificates

Report of prior installations

Welding procedures

Welder's qualifications

1.5 QUALITY ASSURANCE

1.5.1 Standard Commercial Product for Terminal Units

Terminal units provided shall comply with features called out in this specification and shall be the manufacturer's standard commercial product. Additional or better features which are not prohibited by this specification but which are a part of the manufacturer's standard commercial product, shall be included in the terminal units being furnished. A standard commercial product is a product which has been sold or is currently being offered for sale, on the commercial market through advertisements or manufacturer's catalogs, or brochures. Provide Institute of Boiler and Radiator Manufacturer (IBR) or Steel Boiler Institute (SBI) rating for required capacity.

1.5.2 Welding

1.5.2.1 Report of Prior Installations

Submit a Certificate of Full Approval or a current Certificate of Approval for each design, size, and make of backflow preventer being provided for the project. Certificate shall be from the Foundation for Cross-Connection Control and Hydraulic Research, University of Southern California, and shall attest that this design, size, and make of backflow preventer has satisfactorily passed the complete sequence of performance testing and evaluation for the respective level of approval. A Certificate of Provisional Approval is not acceptable in lieu of the above.

1.5.2.2 Welding Procedures

Before performing welding, submit three copies of welding procedure specification for all metals to be used in the work, together with proof of welder's qualification as outlines in ASME B31.9.

1.5.2.3 Welder's Qualifications

Before welder or operator performs welding, submit three copies of Welder's Performance Qualification Record in conformance with ASME B31.9 showing that the welder was tested under the approved procedure specification submitted by the Contractor. In addition, submit each welder's assigned number, letter, or symbol used to identify the work of the welder.

1.5.2.4 Identification of Welder's Work

Ensure that each welder's assigned number, letter or symbol is affixed immediately upon completion of the weld. To welders making defective welds after passing a qualification test, give a requalification test. Upon failing to pass the test, do not permit welder to work in this contract.

1.5.2.5 Previous Qualifications

Welding procedures, welders, and welding operators previously qualified by test may be accepted for this contract without requalification subject to the approval and provided that all the conditions specified in ASME B31.9 are met before a procedure can be used.

1.5.3 Brazing and Soldering

1.5.3.1 Brazing Procedure

ASME B31.9. Brazing procedure for joints shall be as outlined in CDA A4015.

1.5.3.2 Soldering, Soldering Preparation, and Procedures for Joints

ASME B31.9 and as outlined in CDA A4015.

1.6 SAFETY STANDARDS

1.6.1 Welding

Safety in welding and cutting of pipe shall conform to AWS Z49.1.

1.6.2 Guards

Couplings, motor shafts, gears and other moving parts shall be guarded, in accordance with OSHA 29 CFR 1910.219. Guards shall be cast iron or expanded metal. Guard parts shall be rigid and removable without disassembling the guarded unit.

PART 2 PRODUCTS

2.1 PIPE AND FITTINGS

2.1.1 Hot Water Heating Pipe (Supply and Return)

ASTM A53/A53M electric resistance welded or seamless Schedule 40 steel pipe or ASTM B88 Type L hard drawn Copper tubing.

2.1.2 Fittings

Provide fittings compatible with the pipe being provided and shall conform to the following requirements.

2.1.2.1 Steel or Malleable Iron Pipe

Sizes 1/8 to 2 inches. ASME B16.11 steel socket welding or screwed type or ASME B16.3 for screwed type malleable iron fittings.

2.1.2.2 Steel, Cast Iron, or Bronze

Sizes 2 1/2 inches and above. Steel fitting butt welding type ASME B16.9 or ASME B16.5 flanged type. Cast iron fittings flanged type ASME B16.1. Bronze fittings up to 8 inch size flanged type ASME B16.24.

2.1.2.3 Fittings for Copper Tubing

ASME B16.18 cast bronze solder joint type or ASME B16.22 wrought copper solder joint type. Fittings may be flared or compression joint type.

2.1.3 Unions

2.1.3.1 Steel Pipe

Provide ASME B16.39, malleable iron unions, threaded connections.

2.1.3.2 Copper Tubing

Provide CID A-A-59617, bronze unions, solder joint end.

2.1.3.3 Dielectric Union

Provide insulated union with galvanized steel female pipe-threaded end and a copper solder joint end conforming with ASME B16.39, Class 1, dimensional, strength and pressure requirements. Union shall have a water-impervious insulation barrier capable of limiting galvanic current to one percent of the short-circuit current in a corresponding bimetallic joint. When dry, insulation barrier shall be able to withstand a 600-volt breakdown test.

2.1.4 Flanges

Remove raised faces when used with flanges having a flat face.

2.1.4.1 Steel Flanges

ASME B16.5 forged steel, welding type.

2.1.4.2 Cast Iron Screwed Flanges

ASME B16.1.

2.1.4.3 Bronze Screwed Flanges

ASME B16.24.

2.1.5 Drains and Overflows

2.1.5.1 Steel Pipe

ASTM A53/A53M, Electric resistance welded Schedule 40, Malleable iron or forged steel fittings, screwed or welded joints.

2.1.5.2 Copper Tubing

ASTM B88, Type L hard drawn, cast brass or wrought copper fittings, Grade Sb5 solder joints.

2.1.6 Valves

Valves shall have rising stems and shall open when turned counterclockwise.

2.1.6.1 Gate Valves

- a. Bronze Gate Valves: MSS SP-80, 2 inches and smaller, wedge disc, inside screw type not less than Class 150. Use solder joint ends with copper tubing.
- b. Steel Gate Valves: ASME B16.34, provide with open stem and yoke type with solid wedge or flexible wedge disc and heat and corrosion-resistant steel trim.
- c. Cast Iron Gate Valves: MSS SP-70, 2 1/2 inches and larger, open stem and yoke type with bronze trim.

2.1.6.2 Globe and Angle Valves

- a. Bronze Globe and Angle Valves: MSS SP-80, 2 inches and smaller, Class 200, except use Class 150 with solder ends for copper tubing. Valves shall have renewable seat and discs except solder end valves which shall have integral seats.
- b. Steel Globe and Angle Valves: ASME B16.34, provide with heat and corrosion-resistant trim.
- c. Cast Iron Globe and Angle Valves: MSS SP-85, 2 1/2 inches and larger, with bronze trim, tapped drains and brass plug.

2.1.6.3 Check Valves

- a. Bronze Check Valves: MSS SP-80, 2 inches and smaller, regrinding swing check type, Class 200.
- b. Steel Swing Check Valves: ASME B16.34 regrinding swing check type, Class 200.
 - (1) Swing check valves shall have bolted caps.
 - (2) Steel Lift check valves 2 inches and smaller shall have bolted caps. Lift check valves 2 1/2 inches and larger shall have pressure seal caps.
- c. Cast Iron Check Valves: ASME B16.34, 2 1/2 inches and larger, bronze trim, non-slam, eccentric disc type for centrifugal pump discharge service.

2.1.6.4 Temperature Regulating Valves

Provide ASSE 1017 copper alloy body with adjustable range thermostat.

2.1.6.5 Water Pressure-Reducing Valves

ASSE 1003.

2.1.6.6 Plug Valves

MIL-V-12003, except that a replaceable valve seat will not be required.

Type I - lubricated, tapered plug or Type II - non-lubricated, lift-plug valves.

2.1.6.7 Ball Valves

Flanged or butt-welding ends ball valve shall conform to MSS SP-72, bronze . Threaded, socket-welding, solder joint, and flared ends shall conform to MSS SP-110.

2.1.6.8 Flow Control Balancing Valves

Copper alloy or cast iron body, copper alloy or stainless internal working parts, and integral pointer that indicates the degree of valve opening. Valves shall be suitable for 125 psig at 190 degrees F hot water. Valve shall function as a service valve when in fully closed position. Valve body shall have factory-installed tappings for differential pressure meter connections for verification of pressure differential across valve orifice. Meter connections shall have positive check valves or shutoff valves. Each valve shall have metal tag showing the gallons per minute flow for each differential pressure reading.

2.1.6.9 Butterfly Valves

Conform with MSS SP-67, Type I - Tight shut off valve, and flanged valve ends. Valve body material shall be cast iron, steel, or bronze and shall be bubble tight for shutoff at 150 psig. Flanged and flangeless type valves shall have Type 300 series corrosion resistant steel stems and corrosion resistant or bronze discs with molded elastomer disc seals. Flow conditions shall be for the regulation from maximum flow to complete shutoff by way of throttling effect. Valves shall be provided in closed system. Valves smaller than 8 inches shall have throttling handles. Valves 8 inches and larger shall have totally enclosed manual gear operators with adjustable balance return stops and indicators. Valves shall have a minimum of 7 locking positions and shall be suitable for water temperatures up to 200 degrees F.

2.1.6.10 Butterfly Valves 2 Inches and Smaller

Valves shall be one-piece and three-piece design with male or female threaded or soldered end connections and shall be bubble tight for shutoff at 150 psig. Stem and disc assembly shall be of 300 series corrosion resistant steel. Disc seal assembly shall be of 300 series corrosion resistant steel. Disc seal shall be suitable for the liquid being used in the system in which the valve is to be installed. Valves shall be suitable for water temperature up to 200 degrees F and shall be capable of operating at the rated pressure of 150 psig. Valves shall be designed for throttling service use by valve lever and indicator adjustment.

2.1.6.11 Relief Valves

Bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labelled.

2.1.6.12 Balancing Valves

Balancing valves shall be calibrated bronze body balancing valves with integral ball valve and venturi or valve orifice and valve body pressure taps for flow measurement based on differential pressure readings. Valve pressure taps and meter connections shall have seals and built-in check

valves with threaded connections for a portable meter. Meter shall be provided by the same manufacturer and be capable of reading system pressures and shall meet the requirements of the paragraph entitled "Flow Measuring Equipment." Valves shall have internal seals to prevent leakage around rotating element and be suitable for full shut-off rated pressure. Valves shall have an operator with integral pointer and memory stop. Balancing valves shall be selected for the required flows as indicated on the plans.

2.1.7 End Connections

2.1.7.1 Flexible Connectors

Provide flexible pipe connectors on piping connected to equipment. Flexible section shall consist of rubber, tetrafluoroethylene resin, corrosion-resistant steel, bronze, monel, or galvanized steel. Material provided and configuration shall be suitable for pressure, and circulating medium. Flexible section shall have threaded, welding, soldering, flanged or socket-weld ends and shall be suitable for service intended. Flexible section may be reinforced with metal retaining rings, with built-in braided wire reinforcement and restriction bolts or with wire braid cover suitable for service intended.

2.1.7.2 Steel Piping

Screwed or socket welded for 2 inches and smaller and flanged or butt welded for 2 1/2 inches and larger.

- a. Screwed Joints With Taper Threads: ASME B1.20.1.
- b. Flanged Joints: Bolting and gaskets shall be as follows:
 - (1) Bolting: Bolt and stud material ASTM A307, Grade B, and nut material ASTM A194/A194M, Grade 2. Bolt, stud, and nut dimensions ASME B18.2.2 threads ASME B1.1 coarse type with Class 2A fit for bolts and studs, and Class 2B fit for nuts. Bolts or bolt studs shall extend completely through the nuts and may have reduced shanks of a diameter not less than the diameter at root of threads. Carbon steel bolts shall have American Standard regular square or heavy hexagon heads and shall have American Standard heavy semifinished hexagonal nuts conforming to ASME B18.2.2.
 - (2) Gaskets: ASME B16.21, Nonasbestos compressed material 1/16 inch thickness full face or self-centering flat ring type and suitable for pressure and temperature of the piping system.
- c. Butt Weld Joints: ASME B31.9. Backing rings shall conform to ASME B31.9. Ferrous rings shall not exceed 0.05 percent sulfur; for alloy pipe, backing rings shall be of material compatible with the chemical composition of the parts to be welded and preferably of the same composition. Provide continuous machined or split band backing rings.
- d. Socket Weld Joints: ASME B31.9.

2.1.7.3 Joints for Copper Tubing

- a. Solder conforming to ASTM B32 alloy grade Sb5 or Sn96. Solder and flux shall be lead free (less than 0.2 percent of lead).

- b. Copper Tube Extracted Joint: An extracted mechanical tee joint may be made in copper tube. Make joint with an appropriate tool by drilling a pilot hole and drawing out the tube surface to form a collar having a minimum height of three times the thickness of the tube wall. To prevent the branch tube from being inserted beyond the depth of the extracted joint, provide dimpled depth stops. Notch the branch tube for proper penetration into fitting to assure a free flow joint. Braze extracted joints using a copper phosphorous classification brazing filler metal. Soldered joints shall not be permitted.

2.1.8 Instrumentation

2.1.8.1 Pressure and Vacuum Gauges

Provide ASME B40.100 with restrictor.

2.1.8.2 Indicating Thermometers

Thermometers shall be dial type with an adjustable angle suitable for the service. Provide thermowell sized for each thermometer in accordance with the thermowell specification. Fluid-filled thermometers (mercury is not acceptable) shall have a nominal scale diameter of 5 inches. Construction shall be stainless-steel case with molded glass cover, stainless-steel stem and bulb. Stem shall be straight, length as required to fit well. Bimetal thermometers shall have a scale diameter of 3 1/2 inches. Case shall be hermetic. Case and stem shall be constructed of stainless steel. Bimetal stem shall be straight and of a length as required to fit the well.

2.1.8.3 Pressure/Temperature Test Ports

Pressure/Temperature Test Ports shall have brass body and EPDM and/or Neoprene valve seals. Ports shall be rated for service between 35 and 275 degrees F and up to 500 psig. Ports shall be provided in lengths appropriate for the insulation thickness specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS and installed to allow a minimum of 12 inches of access for probe insertion. Provide with screw-on cap attached with a strap or chain to prevent loss when removed. Ports shall be 1/4 inch NPT and accept 1/8 inch diameter probes.

2.1.9 Miscellaneous Pipeline Components

2.1.9.1 Air Vent

Provide float type air vent in hydronic systems. Vent shall be constructed of brass or semi-steel body, copper float, and stainless steel valve and valve seat. Design air vent to suit system operating temperature and pressure. Provide isolating valve to permit service without draining the system. Pipe discharge of vent to a drain.

2.1.9.2 Strainers

Strainers for classes 125 and 250 piping in IPS 1/2 to 8 inches, inclusive, FS WW-S-2739 and locate as indicated.

2.1.9.3 Hangers and Supports

Design and fabrication of pipe hangers, supports, and welding attachments shall conform to MSS SP-58 and ASME B31.9. Hanger types and supports for

bare and covered pipe shall conform to MSS SP-69 for the temperature range.

2.1.9.4 Pipe Sleeves

Sleeves in masonry and concrete walls, floors, and roof slabs shall be ASTM A53/A53M, Schedule 40 or Standard Weight, hot-dip galvanized steel ductile-iron or cast-iron pipe. Sleeves in partitions shall be zinc-coated sheet steel having a nominal weight of not less than 0.906 pound per square foot.

2.1.9.5 Escutcheon Plates

Provide one piece or split hinge metal plates for piping passing through floors, walls, and ceilings in exposed spaces. Provide polished stainless steel plates or chromium-plated finish on copper alloy plates in finished spaces and paint finish on metal plates in unfinished spaces.

2.2 CENTRAL MECHANICAL EQUIPMENT

2.2.1 Converters

See Section 23 22 26.00 20 STEAM SYSTEM AND TERMINAL UNITS.

2.3 PIPING SYSTEM EQUIPMENT

2.3.1 Pumps

Provide hot water circulating pumps, CID A-A-50560, Service A. Pump casing and flange shall be made of close-grained cast iron. Shaft shall be carbon or alloy steel with lubricated bearings and impeller shall be bronze. Select pumps so that the operating point on selected impeller-curve will lie at or to the left of shutoff side of, and not more than 5 percent below, point of maximum efficiency for impeller. Provide motors of opensplash proof type conforming to NEMA MG 1 and suitable for electrical characteristic as indicated. Hot water pump shall have a variable frequency drive. For more information, see Section 26 29 23 VARIABLE FREQUENCY DRIVES SYSTEMS UNDER 600 VOLTS..

2.3.2 Expansion Tanks

Provide welded steel, constructed and tested hydrostatically in accordance with ASME BPVC SEC VIII D1. Tank shall be equipped with all necessary fittings. The tank and fittings shall be pressure rated at least equal to the test pressure of the total system. Zinc coat the tank inside and out after fabrication by the hot dip process ASTM A123/A123M.

2.3.3 External Air Separation Tanks

Provide tank constructed of steel, designed for not less than 75 psig, and constructed and tested in accordance with the requirements of ASME BPVC SEC VIII D1. Provide tangential inlet and outlet connections, flanged for sizes 2 1/2 inches and larger. Each unit shall have an internal design suitable for creating the required vortex and subsequent air separation. Provide with automatic air release device and galvanized steel strainer. Provide a blow down connection with a gate valve and piped to nearest floor drain.

2.3.4 Ultrasonic Flowmeter

Provide clamp-on non-intrusive Ultrasonic Flowmeter for hot water distribution system. Provide wall mount NEMA 4X enclosure in mechanical room. Accuracy shall be 1%, +/- 0.5 for velocities greater than 1 feet per second. Repeatability shall be +/- 0.15% at 1 feet per second. The number of analog inputs / outputs shall be 4. Ultrasonic flow meter shall communicate and be compatible to DDC system. Wall mount shall have LCD display with backlight and keypad.

2.4 TERMINAL UNITS

2.4.1 Unit Heaters

Provide hot water unit heaters as specified in Section 23 82 00.00 20 TERMINAL HEATING AND COOLING UNITS.

2.5 ELECTRICAL EQUIPMENT

Provide complete with motors, motor starters, thermal overload protection, and controls. Equipment and wiring shall be in accordance with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

2.6 CONTROLS

Provide controls as specified in Section 23 09 23.13 20 DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC.

2.7 INSULATION

Provide shop and field applied insulation as specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

2.8 ASBESTOS PROHIBITION

Asbestos and asbestos containing products are prohibited.

PART 3 EXECUTION

3.1 PREPARATION

Provide storage for equipment and material at the project site. All parts shall be readily accessible for inspection, repair, and renewal. Protect material and equipment from the weather.

3.2 INSTALLATION

Piping fabrication, assembly, welding, soldering, and brazing shall conform to ASME B31.9. Piping shall follow the general arrangement shown. Route piping and equipment within buildings out of the way of lighting fixtures and doors, windows, and other openings. Run overhead piping in buildings in inconspicuous positions. Provide adequate clearances from walls, ceilings, and floors to permit welding of joints and application of insulation. Make provision for expansion and contraction of pipe lines. Make changes in size of water lines with reducing fittings. Do not bury, conceal, or insulate until piping has been inspected, tested, and approved. Do not run piping concealed in walls, partitions, underground, or under the floor except as otherwise indicated. Where pipe passes through building structure, locate pipe joints and expansion joints where

they may be inspected. Provide flanged joints where necessary for normal maintenance and where required to match valves and equipment. Furnish gaskets, packing, and thread compounds suitable for the service. Provide long radius ells where possible to reduce pressure drops. Pipe bends in lieu of welding fittings may be used where space permits. Pipe bends shall have a uniform radius of at least five times the pipe diameter and shall be free from appreciable flattening, wrinkling, or thinning of the pipe. Do not use mitering of pipe to form elbows, notching straight runs to form full sized tees, or any similar construction. Make branch connections over 2 inches with welding tees except factory made forged welding branch outlets or nozzles having integral reinforcements conforming to ASME B31.9 may be used, provided the nominal diameter of the branch is at least one pipe size less than the nominal diameter of the run. Branch connections 2 inches and under can be threaded or welded. Run vertical piping plumb and straight and parallel to walls. Provide sleeves for lines passing through building structure. Provide a fire seal where pipes pass through fire wall, fire partitions, fire rated pipe chase walls, or floors above grade. Install piping connected to equipment with flexibility for thermal stresses and for vibration, and support and anchor so that strain from weight and thermal movement of piping is not imposed on the equipment.

3.2.1 Hangers and Supports

Unless otherwise indicated, horizontal and vertical piping attachments shall conform to MSS SP-58. Band and secure insulation protection shields without damaging pipe insulation. Continuous inserts and expansion bolts may be used.

3.2.2 Grading of Pipe Lines

Unless otherwise indicated, install horizontal lines of hot water piping to grade down in the direction of flow with a pitch of not less than one inch in 30 feet, except in loop mains and main headers where the flow may be in either direction.

3.2.3 Pipe Sleeves

Provide sleeves where pipes and tubing pass through masonry or concrete walls, floors, roof, and partitions. Annular space between pipe, tubing, or insulation and the sleeve shall not be less than 1/4 inch. Hold sleeves securely in proper position and location before and during construction. Sleeves shall be of sufficient length to pass through entire thickness of walls, partitions, or slabs. Sleeves in floor slabs shall extend 2 inches above finished floor. Firmly pack space between pipe or tubing and sleeve with oakum and caulk on both ends of the sleeve with plastic waterproof cement which will dry to a firm but pliable mass, or provide a mechanically adjustable segmented elastomeric seal. Seal both ends of penetrations through fire walls and fire floors to maintain fire resistive integrity with UL listed fill, void, or cavity material.

3.2.4 Flashing for Buildings

Provide flashing where pipes pass through building roofs, and make outside walls tight and waterproof.

3.2.5 Unions and Flanges

Provide unions and flanges to permit easy disconnection of piping and apparatus. Each connection having a screwed-end valve shall have a union.

Place unions and flanges no farther apart than 100 feet. Install unions downstream of valves and at equipment or apparatus connections. Provide unions on piping under 2 inches in diameter, and provide flanges on piping 2 inches and over in diameter. Provide dielectric unions or flanges between ferrous and non-ferrous piping, equipment, and fittings; except that bronze valves and fittings may be used without dielectric couplings for ferrous-to-ferrous or non-ferrous-to-non-ferrous connections.

3.2.6 Connections for Future Equipment

Locate capped or plugged outlets for connections to future equipment as indicated.

3.2.7 Changes in Pipe Size

Provide reducing fittings for changes in pipe size; reducing bushings are not permitted. In horizontal lines, provide eccentric reducing fittings to maintain the top of the lines in the same plane.

3.2.8 Cleaning of Pipe

Thoroughly clean each section of pipe, fittings, and valves free of foreign matter before erection. Prior to erection, hold each piece of pipe in an inclined position and tap along its full length to loosen sand, mill scale and other foreign matter. For pipe 2 inches and larger, draw wire brush, of a diameter larger than that of the inside of the pipe, several times through the entire length of pipe. Before making final connections to apparatus, wash out interior of piping thoroughly with water. Plug or cap open ends of mains during shutdown periods. Do not leave lines open where foreign matter might enter the pipe.

3.2.9 Valves

Install valves in conformance with ASME B31.9. Provide gate valves unless otherwise directed. Install valves with stems horizontal or above. Locate or equip stop valves to permit operation from floor level, or provide with safe access in the form of walkways or ladders. Install valves in positions accessible for operation and repair.

3.2.9.1 Globe Valves

Install globe valves so that the pressure is below the disk and the stem horizontal.

3.2.9.2 Radiators Valves

Provide radiator valves on water inlet and balancing valves on water outlet of terminal heating units such as radiation, unit heaters, and fan coil unit.

3.2.9.3 Relief Valves

Provide valves on pressure tanks, low pressure side of reducing valves, heat exchangers, and expansion tanks. Select system relief valve so that capacity is greater than make-up pressure reducing valve capacity. Select equipment relief valve capacity to exceed rating of connected equipment. Pipe relief valve outlet to the nearest floor drain.

3.2.10 Pressure Gage

Provide a shut-off valve or pet cock between pressure gages and the line.

3.2.11 Thermometers

Provide thermometers and thermal sensing elements of control valves with a separable socket. Install separable sockets in pipe lines in such a manner to sense the temperature of flowing the fluid and minimize obstruction to flow.

3.2.12 Strainers

Provide strainers, with meshes suitable for the services, where indicated, or where dirt might interfere with the proper operation of valve parts, orifices, or moving parts of equipment.

3.2.13 Pumps

Select pumps for specified fluid temperatures, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve. Support piping adjacent to pump such that no weight is carried on pump casings. Install close coupled and base mounted pumps on concrete base, with anchor bolts, set and level, and grout in place and provide supports under elbows on pump suction and discharge line sizes 4 inches and over. Lubricate pump before start-up.

3.2.14 Equipment Foundations

Locate equipment foundations as shown on the drawings. Size, weight, and design shall preclude shifting of equipment under operating conditions. Foundations shall meet the requirements of the equipment manufacturer.

3.2.15 Equipment Installation

Install equipment in accordance with installation instructions of the manufacturers. Grout equipment mounted on concrete foundations before installing piping. Install piping in such a manner as not to place a strain on the equipment. Do not bolt flanged joints tight unless they match. Grade, anchor, guide, and support piping without low pockets.

3.2.16 Cleaning of Systems

As installation of the various system components is completed, fill, start, and vent prior to cleaning. Place terminal control valves in open position. Add cleaner to closed system at concentration as recommended by manufacturer. Apply heat while circulating, slowly raising temperature to 160 degrees F and maintain for 12 hours minimum. Remove heat and circulate to 100 degrees F or less; drain systems as quickly as possible and refill with clean water. Circulate for 6 hours at design temperatures, then drain. Refill with clean water and repeat until system cleaner is removed. Use neutralizer agents on recommendation of system cleaner supplier and approval of Contracting Officer. Remove, clean, and replace strainer screens. Inspect, remove sludge, and flush low points with clean water after cleaning process is completed. Include disassembly of components as required. Preliminary or final tests are not permitted until cleaning is approved.

3.2.17 Painting of Piping and Equipment

Provide in accordance with Section 09 90 00 PAINTS AND COATINGS.

3.2.18 Identification of Piping

Identify piping in accordance with OSHA 29 CFR 1910.144, except that labels or tapes may be used in lieu of painting or stenciling. Spacing of identification marking on runs shall not exceed 50 feet. Materials for labels and tapes shall conform to CID A-A-1689, and shall be general purpose type and color class. Painting and stenciling shall conform to Section 09 90 00 PAINTS AND COATINGS.

3.3 FIELD QUALITY CONTROL

Perform inspections and tests as specified herein to demonstrate that piping and equipment, as installed, is in compliance with contract requirements. Start up and operate the system. During this time, periodically clean the various strainers until no further accumulation of foreign material occurs. Exercise care so that minimum loss of water occurs when strainers are cleaned. Adjust safety and automatic control instruments to place them in proper operation and sequence.

3.3.1 Hydrostatic Test of Piping System

Test piping system hydrostatically using water not exceeding 100 degrees F. Conduct tests in accordance with the requirements of ASME B31.9 and as follows. Test piping system after all lines have been cleaned and before applying insulation covering. Remove or valve off from the system, gages, and other apparatus which may be damaged by the test before the tests are made. Install calibrated test pressure gage in the system to observe any loss in pressure. Maintain test pressure for a sufficient length of time to enable an inspection of each joint and connection. Perform tests after installation and prior to acceptance. Notify the Contracting Officer in writing 5 days prior to the time scheduled for the tests.

3.4 TESTING, ADJUSTING, AND BALANCING

Except as specified herein, perform in accordance with SMACNA 1780, Chapter VIII "Hydronic System TAB Procedures," drawings and specifications; prepare complete report of final test results. Test, adjust, and balance the hydronic system in accordance with Section 23 05 93 TESTING, ADJUSTING AND BALANCING FOR HVAC.

3.4.1 Markings of Settings

Following final acceptance of the balancing report, the settings of all valves, splitters, dampers, and other adjustment devices shall be permanently marked so that adjustment can be restored if disturbed at anytime.

-- End of Section --

SECTION 23 22 26.00 20

STEAM SYSTEM AND TERMINAL UNITS

02/10

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 WELDING SOCIETY (AWS)

AWS Z49.1 (2005) Safety in Welding and Cutting and Allied Processes

ASME INTERNATIONAL (ASME)

ASME A13.1 (2007) Scheme for the Identification of Piping Systems

ASME B1.1 (2003; R 2008) Unified Inch Screw Threads (UN and UNR Thread Form)

ASME B1.20.1 (1983; R 2006) Pipe Threads, General Purpose (Inch)

ASME B16.11 (2009) Forged Fittings, Socket-Welding and Threaded

ASME B16.18 (2001; R 2005) Cast Copper Alloy Solder Joint Pressure Fittings

ASME B16.20 (2007) Metallic Gaskets for Pipe Flanges - Ring-Joint, Spiral Wound, and Jacketed

ASME B16.21 (2011) Nonmetallic Flat Gaskets for Pipe Flanges

ASME B16.22 (2001; R 2010) Standard for Wrought Copper and Copper Alloy Solder Joint Pressure Fittings

ASME B16.24 (2006) Cast Copper Alloy Pipe Flanges and Flanged Fittings: Classes 150, 300, 600, 900, 1500, and 2500

ASME B16.3 (2010) Malleable Iron Threaded Fittings, Classes 150 and 300

ASME B16.34 (2009; Supp 2010) Valves - Flanged, Threaded and Welding End

ASME B16.39 (2009) Standard for Malleable Iron Threaded Pipe Unions; Classes 150, 250, and 300

ASME B16.5	(2009) Pipe Flanges and Flanged Fittings: NPS 1/2 Through NPS 24 Metric/Inch Standard
ASME B16.9	(2007) Standard for Factory-Made Wrought Steel Buttwelding Fittings
ASME B18.2.1	(2010) Square and Hex Bolts and Screws (Inch Series)
ASME B18.2.2	(2010) Standard for Square and Hex Nuts
ASME B31.1	(2010) Power Piping
ASME B40.100	(2005) Pressure Gauges and Gauge Attachments
ASME BPVC	(2010) Boiler and Pressure Vessels Code
ASME BPVC SEC IX	(2010) BPVC Section IX-Welding and Brazing Qualifications
ASME BPVC SEC VIII D1	(2007; Addenda 2008; Addenda 2009) BPVC Section VIII-Rules for Construction of Pressure Vessels Division 1

ASTM INTERNATIONAL (ASTM)

ASTM A106/A106M	(2010) Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service
ASTM A194/A194M	(2010a) Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure or High-Temperature Service, or Both
ASTM A307	(2010) Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
ASTM A53/A53M	(2010) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM B32	(2008) Standard Specification for Solder Metal
ASTM B88	(2009) Standard Specification for Seamless Copper Water Tube

COPPER DEVELOPMENT ASSOCIATION (CDA)

CDA A4015	(1994; R 1995) Copper Tube Handbook
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MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS
INDUSTRY (MSS)

MSS SP-45	(2003; R 2008) Bypass and Drain Connections
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MSS SP-58 (2009) Pipe Hangers and Supports -
Materials, Design and Manufacture,
Selection, Application, and Installation

MSS SP-69 (2003) Pipe Hangers and Supports -
Selection and Application (ANSI Approved
American National Standard)

MSS SP-80 (2008) Bronze Gate, Globe, Angle and Check
Valves

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-V-18436 (1987; Rev F) Valves, Check, Bronze, Cast
Iron, and Steel Body

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-1689 (Rev B) Tape, Pressure-Sensitive Adhesive,
(Plastic Film)

CID A-A-50494 (Basic; Notice 1) Exhaust Head, Steam

CID A-A-50558 (Basic; Notice 1) Valves, Pressure
Regulating, Steam

CID A-A-50568 (Basic; Notice 1) Gages, Liquid Level
Measuring, Tank

CID A-A-59617 (Basic) Unions, Brass or Bronze, Threaded
Pipe Connections and Solder-Joint Tube
Connections

CID A-A-60001 (Basic) Traps, Steam

FS F-P-2908 (Basic; Notice 1) pumping Units,
Condensate, Return; and Boiler Feed Package

FS F-V-2906 (Basic) Valves, Air Venting, Steam

FS QQ-B-654 (Rev A; Notice 1) Brazing Alloys, Silver

FS WW-H-191 (Rev E; Notice 2) Heater, Fluid,
Industrial (Instantaneous, Steam, Water
Converter Type)

FS WW-S-2739 (Basic; Notice 1) Strainers, Sediment:
Pipeline, Water, Air, Gas, Oil, or Steam

1.2 GENERAL REQUIREMENTS

Section 23 03 00.00 20 BASIC MECHANICAL MATERIALS AND METHODS, applies to this section, with the additions and modifications specified herein. This section includes steam and condensate piping, convertors, condensate return units, used for heating within the building. Steam boilers, feedwater treatment equipment, process steam terminal units, boiler feed piping, and blow-off piping are not covered in this section.

1.2.1 Classes and Maximum Working Pressures

Equipment, piping, and piping components shall be suitable for use under the maximum working pressure indicated. Except as modified herein, the pressure temperature limitations shall be as specified in the referenced standards and specifications.

1.2.2 Standard Commercial Product

The terminal units provided shall, as a minimum, comply with the features specified herein and shall be the manufacturer's standard commercial product. Additional or better features which are not specifically prohibited herein but which are a part of the manufacturer's standard commercial product, shall be included in the terminal units being furnished. A standard commercial product is a product which has been sold or is currently being offered for sale, on the commercial market through advertisements or manufacturer's catalogs or brochures. Provide Institute of Boiler and Radiator Manufacturer (IBR) or Steel Boiler Institute (SBI) rating for required capacity.

1.2.3 Welding Safety

AWS Z49.1.

1.2.4 Definitions

1.2.4.1 High Pressure Piping System

A system whose pressure is greater than 15 psig and shall conform to ASME B31.1.

1.2.4.2 Low Pressure Piping System

A system whose pressure is 15 psig or less.

1.2.4.3 Terminal Unit

An enclosed unit that provides heated air from a steam coil and includes natural convection units, radiation, and forced air units.

1.2.4.4 Piping and Piping System

Includes pipe, tubing, flanges, bolting, gaskets, valves, safety valves, fittings, and pressure containing parts of other piping components, hangers, supports, guides, expansion joints, anchors, and other equipment items necessary to prevent overstressing the pressure containing parts.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for A/E approval. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Convertors

Condensate return pumping units

Valves

Steam meters

Traps

Strainers

Flash Tanks

Instrumentation

SD-06 Test Reports

Steam piping tests

Copper tubing test

Valves tests

Instrumentation tests

Pipe and pipe system

Convertors tests

Condensate return pumping units tests

Submit reports of tests required by the reference specification and standards.

SD-07 Certificates

Welding procedure

Welder's Performance Qualification Record

List of welders and welder's symbols

SD-08 Manufacturer's Instructions

Convertors

Condensate return pumping units

Include manufacturer's recommendations for equipment foundations.

1.4 QUALITY ASSURANCE

1.4.1 Welding Procedure

Submit welding procedure specification for metals included in the work, together with proof of the procedure's qualifications as outlined in ASME B31.1.

1.4.2 Welder's Performance Qualification Record

Submit to the Contracting Officer the Welder's Performance Qualification

Record in conformance with ASME B31.1 for each welder, showing that the welder was tested under the approved procedure specification submitted by the Contractor. In addition, the Contractor shall submit list of welders and welder's symbols, assigned number, or letter which shall be used to identify the work of the welder which shall be affixed immediately upon completion of the weld. Welders making defective welds after passing a qualification test shall be required to take a requalification test. Welders failing the requalification tests will not be permitted to work under this contract.

1.4.3 Previous Qualifications

Welding procedures, welders, and welding operators previously qualified by test may be accepted for this contract without requalification subject to approval if the conditions specified in ASME B31.1 are met before a procedure can be used.

PART 2 PRODUCTS

2.1 PIPE AND PIPE SYSTEM

2.1.1 High Pressure Steam Piping System (Over 15 psig)

ASME B31.1 for a steam working pressure of 125 psig and a temperature of 353 degrees F, a condensate pressure of 15 psig, and a temperature of 212 degrees F.

2.1.1.1 High Pressure Steam Piping

ASTM A106/A106M or ASTM A53/A53M, Grade B, Schedule 40, black steel, electric-resistance welded. Use ASTM A53/A53M pipe for bending.

2.1.2 Low Pressure Steam Piping System

ASME B31.1 for a steam working pressure of 15 psig or less, a condensate pressure of 15 psig, and a temperature of 212 degrees F.

2.1.2.1 Low Pressure Steam Piping

- a. Steel Piping: ASTM A53/A53M, Schedule 40, black, electric-resistance welded. Use ASTM A53/A53M pipe for bending.
- b. Copper Tubing: ASTM B88, Type K.

2.1.3 Condensate Return Piping (100 psig or Less)

2.1.3.1 Steel Piping

ASTM A106/A106M or ASTM A53/A53M, Grade B, Schedule 80, black, electric-resistance welded.

2.1.3.2 Copper Tubing (15 psig or Less)

ASTM B88, Type K.

2.1.4 Fittings

Provide fittings compatible in all respects (material, size, pressure, and temperature limitations) with the pipe being used and within any further

limitations of ASME B31.1.

2.1.4.1 Fittings for Steel Pipe

a. Sizes 1/8 to 2 inches:

(1) Steel Fittings: ASME B16.11, socket welding or threaded. Where pressure exceeds 15 psig, provide socket-welding type only.

(2) Malleable Iron Fittings: ASME B16.3, threaded.

b. Sizes 2 1/2 inches and larger:

(1) Steel Fittings: ASME B16.9, buttwelding or ASME B16.5, flanged.

(2) Bronze Fittings: ASME B16.24, flanged. Sizes larger than 8 inches are not permitted.

2.1.4.2 Fittings for Copper Tubing

ASME B16.18, cast copper alloy or ASME B16.22, wrought copper, solder joint type. Flared or compression joint type fittings for tube sizes not exceeding 2 inches outside diameter (O.D.) may be provided as permitted in ASME B31.1.

2.1.5 Unions

2.1.5.1 Unions for Steel Pipe

ASME B16.39, threaded.

2.1.5.2 Unions for Copper Tubing

CID A-A-59617, solder joint end type.

2.1.6 Flanges

Remove the raised faces on flanges when used with flanges having a flat face.

2.1.6.1 Steel Flanges

ASME B16.5, forged steel, welding type.

2.1.6.2 Bronze Flanges

ASME B16.24, threaded.

2.1.7 Valves

Shall conform to the following paragraphs. End connections shall conform to paragraph entitled "End Connections."

2.1.7.1 Gate Valves

- a. Bronze Gate Valves: MSS SP-80, Type 1 (solid wedge, non-rising stem) or Type 2 (solid wedge, inside screw, rising stem), 3 inches and smaller, threaded or solder joint ends, and not less than Class 150.

- b. Steel Gate Valves: ASME B16.34. Provide outside screw and yoke type with solid wedge or flexible wedge disc, and with trim suitable for the service temperature and pressure.

2.1.7.2 Globe and Angle Valves

- a. Bronze Globe and Angle Valves: MSS SP-80, Type 1 (metal disc, integral seat) or Type 3 (metal disc, renewable seat), 3 inches and smaller, threaded or solder joint ends, Class 200 except that Class 150 with solder joint ends may be used for copper tubing. Valves shall have renewable seats and discs, except solder joint end valves which shall have integral seats.
- b. Steel Globe and Angle Valves: ASME B16.34, with trim suitable for the service temperature and pressure.

2.1.7.3 Check Valves

- a. Bronze Check Valves: MSS SP-80, Type 3 (swing check, metal disc to metal seat), 3 inches and smaller, threaded or solder joint ends, Class 200, regrinding type.
- b. Steel Check Valves: MIL-V-18436, with trim suitable for the service temperature and pressure.
 - (1) Swing Check Valves: Shall have bolted caps.
 - (2) Lift Check Valves: Shall have threaded or bolted caps.

2.1.7.4 Steam Pressure Reducing Valves

CID A-A-50558, Type External Piloted, Class 300, Construction Ductile Iron, Regulation Accuracy + / - 1%, cast iron prohibited.

2.1.7.5 Air Vent Valves

FS F-V-2906, with vacuum holding device, pressure rated for the intended service, and with a capacity based on manufacturer's standard for the connection size, cast iron prohibited.

2.1.7.6 Safety Valves

MIL-V-18436, Type 1, Class 300, Lift lever, and sized in accordance with ASME BPVC. Set point shall be as indicated, cast iron prohibited. All piping downstream of steam safety valves shall be vented to the outdoors.

2.1.8 End Connections

2.1.8.1 Steel Piping

Sizes 2 inches and smaller threaded or socket welded; sizes 2 1/2 inches and larger flanged or butt welded.

- a. Threaded Joints: ASME B1.20.1.
- b. Flanged Joints: Flanges shall conform to paragraph entitled "Flanges." Bolting and gaskets shall be as follows:
 - (1) Bolting: Material used for bolts and studs shall conform to

ASTM A307, Grade B; and material for nuts shall conform to ASTM A194/A194M, Grade 2. Dimensions of bolts, studs, and nuts shall conform to ASME B18.2.1 and ASME B18.2.2 with threads conforming to ASME B1.1 coarse type, with Class 2A fit for bolts and studs, and Class 2B fit for nuts. Bolts or bolt-studs shall extend completely through the nuts and may have reduced shanks of a diameter not less than the diameter at root of threads. Carbon steel bolts shall have American Standard regular square or heavy hexagon heads and shall have American Standard heavy semifinished hexagonal nuts, conforming to ASME B18.2.1 and ASME B18.2.2.

(2) Gaskets: Gaskets shall be as follows:

<u>Working Conditions</u>	<u>Material</u>
Saturation	
125 psig 353 degrees F	Composition or Copper

Gaskets shall be as thin as the finish of surfaces will permit. Metal or metal-jacketed non-asbestos gaskets shall be used with small male and female or small tongue-and-groove flanges or flanged fittings; they may be used with steel flanges with lapped, large male and female, large tongue-and-groove, or raised faces. Full faced gaskets shall be used with flat-faced bronze flanges. Lapped steel flanges, or raised-face steel flanges shall have ring gaskets with an outside diameter extending to the inside of the bolt holes. Widths of gaskets for small male and female and for tongue-and-groove joints shall be equal to the widths of the male face or tongue. Gaskets shall have an inside diameter equal to or larger than the port openings. Rings for ring joints shall be in accordance with dimensions in ASME B16.20, suitable for the service conditions encountered, and shall be softer than the flanges. Dimensions for non-metallic gaskets shall be in accordance with ASME B16.21.

- c. Butt Weld Joints: ASME B31.1. The use of backing rings shall conform to ASME B31.1. Ferrous rings shall be of good weldable quality and shall not exceed 0.05 percent sulfur; for alloy pipe, backing rings shall be of material compatible with the chemical composition of the parts to be welded and preferably of the same composition. Backing rings shall be continuous machined or split band type.
- d. Socket Weld Joints: ASME B31.1.

2.1.8.2 Joints for Copper Tubing

- a. Solder Joints: ASTM B32, alloy grade Sb5 solder for steam pressure 15 psig or less.
- b. Brazed Joints: FS QQ-B-654 for steam pressure 120 psig or less.

2.1.9 Instrumentation

2.1.9.1 Pressure and Vacuum Gages

ASME B40.100 with restrictor, locate as indicated. Provide scale range for intended service. Scale range not to exceed two times (2X) the indicated pressure of piping.

2.1.9.2 Tank Gages

CID A-A-50568, locate as indicated.

2.1.9.3 Indicating Thermometers

Thermometers shall be dial type with an adjustable angle suitable for the service. Provide thermowell sized for each thermometer in accordance with the thermowell specification. Fluid-filled thermometers (mercury is not acceptable) shall have a nominal scale diameter of 5 inches. Construction shall be stainless-steel case with molded glass cover, stainless-steel stem, and bulb. Stem shall be straight, length as required to fit well. Bimetal thermometers shall have a scale diameter of 3 1/2 inches. Case shall be hermetic. Case and stem shall be constructed of stainless steel. Bimetal stem shall be straight and of a length as required to fit the well.

2.1.10 Miscellaneous Pipeline Components

2.1.10.1 Steam Meters

a. Vortex Steam Meter

1. Provide vortex type designed for mounting directly in the steam line.
2. The meter shall be self-contained and self-operating requiring no mercury, pressure piping, compressed air, or electrical connections except for operation of accessory contacts where required or desired. Stuffing box shall not be allowed. Provide with replacable sensor that is isolated from the process.
3. Materials of construction shall be stainless steel and nickel alloy with 250 pounds flanged ends for pressures up to 250 psig and temperatures up to 450 degrees F.. Wear parts shall be of monel or stainless steel with graphite top bearing and jewelled bottom bearing.
4. Meter shall be direct reading in pounds of steam over a 10 to 1 range, with continuous overload capability up to 150 percent of rated capacity and temporary overload capability up to 200 percent of rated capacity.
5. Accuracy shall be within plus or minus 2 percent of actual flow over the entire 10 to 1 range at flow rates and pressures within the limits set forth in the capacity tables.
6. Meter counter shall be equipped with electric contactor to operate a remote totalizer, or for providing impulses for interfacing with an energy monitoring system. Provide proportional integral derivative function block for pressure compensated steam flow.

2.1.10.2 Air Traps

CID A-A-60001 for float-operated steam traps (non-thermostatic), except that the valve mechanism shall be inverted so as to be closed, not opened, by rising water. Arrange float-controlled valves to close promptly when water enters the traps. Locate traps as indicated.

2.1.10.3 Steam Traps

CID A-A-60001, Type Cast Iron Body, Style, float and thermostatic steam traps. Provide traps with separate strainers and locate as indicated.

2.1.10.4 Strainers

FS WW-S-2739, Style Y (Y pattern) for Class 125 and 250 piping in sizes 1/2 to 8 inches, inclusive, locate as indicated, cast iron prohibited.

2.1.10.5 Exhaust Heads

CID A-A-50494, for atmospheric discharge of exhaust steam.

2.1.10.6 Hangers, Supports, Spacing Requirements, and Attachments

MSS SP-58 and ASME B31.1 for materials, design, and manufacture. MSS SP-69 for selection and application.

2.1.10.7 Flash Tanks

Construct of steel for a minimum working pressure of 125 psig. Provide the tank with a vent and valved drain. Vent piping shall be routed outdoors and not terminate inside the mechanical room.

2.2 CONVERTORS

FS WW-H-191, steam to hot water convertors, with capacity as indicated for the design conditions. Design convertor for support by system piping and mounted on skid, and provide air and steam trap.

2.3 CONDENSATE RETURN UNITS

2.3.1 Condensate Return Pumping Units

FS F-P-2908, with horizontal, cylindrical, stand-mounted receiver, and a single steam pressure powered pump unit, with capacity as indicated.

PART 3 EXECUTION

3.1 INSTALLATION

Work material and equipment into a complete, convenient, and economical system or systems; and provide apparatus, parts, materials, and accessories which are necessary to accomplish this result.

3.1.1 Piping

Fabricate, assemble, weld, solder, braze, and install piping and pipe system in accordance with ASME B31.1 and as further qualified herein. Piping shall follow the general arrangement shown. Cut piping accurately to measurements established, for the work shown, by the Contractor, and work into place without springing or forcing, except where cold-springing is indicated. Locate piping and equipment within buildings entirely out of the way of lighting fixtures, conduit, and doors, windows, and other openings. Run overhead piping in buildings in the most inconspicuous positions. Provide adequate clearances from walls, ceilings, and floors to permit the welding of joints; at least 6 inches for pipe sizes 4 inches and smaller, 10 inches for pipe sizes larger than 4 inches, and in corners

provide sufficient clearance to permit the welder to work between the pipe and one wall. Make provision for expansion and contraction of pipe lines. Do not bury, conceal, or insulate piping until it has been inspected, tested, and approved. Do not conceal piping in walls, partitions, underground, or under the floor except as indicated. Where pipe passes through building structure, do not conceal pipe joints, but locate where they may be readily inspected and not weaken building structure. Run insulated pipe as shown and as required with sufficient clearance to permit application of insulation. Use flanged joints only where necessary for normal maintenance and where required to match valves and equipment. Gaskets, packing, and thread compounds shall be suitable for the service. Apply joint compound or tape on male thread only. Use long radius ells wherever possible to reduce pressure drops. Pipe bends may be used in lieu of welding fittings where space permits. Pipe bends shall have a uniform radius of at least five times the pipe diameter and shall be free from any appreciable flattening, wrinkling, or thinning of the pipe. Mitering of pipe to form elbows, notching straight runs to form full sized tees, or any similar construction shall not be used. Make branch connections with welding tees except factory made forged welding branch outlets or nozzles having integral reinforcements conforming to ASME B31.1 may be used, provided the nominal diameter of the branch is at least one pipe size less than the nominal diameter of the run. Run piping as indicated, and avoid interference with other piping, conduit, or equipment. Run vertical piping plumb and straight and parallel to walls, except where specifically shown otherwise. Do not trap lines, except where indicated. Use reducing fittings for changes in pipe sizes. The use of bushings is prohibited. In horizontal lines 2 1/2 inches and larger, use reducing fittings of the eccentric type to maintain the bottom of the lines in the same plane for steam lines and to maintain the top of the lines in the same plane for condensate lines except where a trap or pocket would result. Provide suitable size sleeves for lines passing through building structure. Install piping connected to equipment to provide flexibility for thermal stresses and for vibration. Support and anchor pipe so that strain from weight and thermal movement of piping is not imposed on the equipment. Thoroughly clean each section of pipe, fittings, and valves of foreign matter before erection. Before placing in position, clean the inside of black steel pipe by rapping along its full length to loosen sand, mill scale, and other foreign matter; pipe 2 inches and larger shall have a wire brush of a diameter larger than that of the inside of the pipe drawn through its entire length several times. Before final connections are made to the apparatus, thoroughly wash out the piping interior with water. Blow out steam piping with high-pressure steam, if available, or compressed air, removing rust, oil, chips, sand, and other material. Plug or cap open ends of mains during shutdown periods. Do not leave lines open at any place where any foreign matter might accidentally enter pipe.

3.1.1.1 Welding

- a. Welding of Piping: Welding of joints in piping, butt welds, fillet welds, bends, loops, offsets, and preparation and cleaning of pipe shall be in accordance with ASME B31.1. Welds shall be visually examined and meet acceptance standards indicated in Chapter VI of ASME B31.1.
- b. Quality of Welds: Quality of welds, correction of defects, stress relieving, and preheating shall be in accordance with ASME B31.1.
- c. Arc Welding and Gas Welding: In accordance with ASME BPVC SEC IX.

3.1.1.2 Brazing and Soldering

- a. Brazing and soldering procedure qualification shall conform to ASME B31.1. Brazing procedure for joints shall be as outlined in the CDA A4015.
- b. Soldering, soldering preparation, and procedures for joints shall be in accordance with ASME B31.1 and as outlined in the CDA A4015.
- c. Copper Tube Extracted Joint: An extracted mechanical tee joint may be made in copper tube. Make joint with an appropriate tool by drilling a pilot hole and drawing out the tube surface to form a collar having a minimum height of three times the thickness of the tube wall. To prevent the branch tube from being inserted beyond the depth of the extracted joint, provide dimpled depth stops. Notch the branch tube for proper penetration into fitting to ensure a free flow joint. Braze extracted joints using a copper phosphorous classification brazing filler metal. Soldered joints shall not be permitted.

3.1.1.3 Hangers and Supports

Unless otherwise indicated, horizontal and vertical piping attachments shall conform to MSS SP-58. Continuous inserts and expansion bolts may be used.

3.1.1.4 Grading and Venting of Pipe Lines

Unless otherwise indicated, install horizontal lines of steam and return piping to grade down in the direction of flow with a pitch of not less than one inch in 30 feet, except in loop mains and main headers where the flow may be in either direction. When counterflow of condensate within the steam pipe occurs in a portion of a pipeline, pitch up in the direction of steam flow a minimum of 6 inches per 100 feet and increase pipe diameters by one standard pipe size. Steam mains pitched away from the boiler shall contain drip connection and air vent valves at the extreme end. Air vents shall be provided at the highest point of any vertical riser. Drip connections shall not be interconnected above the water line of the boiler.

3.1.1.5 Pipe Sleeves

Provide pipe sleeves where pipes and tubing pass through masonry or concrete walls, floors, roofs, and partitions. Use Schedule 40 galvanized steel pipe sleeves in outside walls below and above grade, in floor, and in roof slabs. Sleeves in partitions shall be zinc-coated sheet steel having a weight of not less than 0.907 psf. Space between pipe, tubing, or insulation and the sleeve shall be not less than 1 inch. Hold sleeves securely in proper position and location before and during construction. Sleeves shall be of sufficient length to pass through entire thickness of walls, partitions, or slabs. Sleeves in floor slabs shall extend 2 inches above the finished floor. Pack space between the pipe or tubing and the sleeve firmly with oakum and caulk both ends of the sleeve with elastic cement. Furnish sleeves in waterproofed construction with flanges and clamping rings.

3.1.1.6 Floor, Wall, and Ceiling Plates

Secure plates to the pipe with enough clearance for thermal expansion of pipe. Use chromium-plated steel or nickel-plated cast iron plates on pipes passing through floors and partitions of toilet rooms and where indicated;

use painted cast iron, malleable iron, or steel for all other plates.

3.1.1.7 Flashing for Buildings

Provide tight waterproof flashing where pipes pass through building roofs and outside walls.

3.1.1.8 Unions and Flanges

Provide unions and flanges where necessary to permit easy disconnection of piping and apparatus, and as indicated. Provide a union for each threaded end valve. Place unions or flanges no farther apart than 100 feet. Use unions on piping smaller than 2 inches in diameter, and use flanges on piping 2 inches and larger in diameter. Provide dielectric unions or flanges between ferrous and non-ferrous piping, equipment, and fittings; except that bronze valves and fittings may be used without dielectric couplings for ferrous-to-ferrous or non-ferrous to non-ferrous connections. Dielectric fittings shall utilize a non-metallic filler which will prevent current flow. The spacer shall be suitable for the pressure and temperature of the service. The fittings shall otherwise conform to the requirements of paragraph entitled "Fittings."

3.1.1.9 Traps and Connections

Traps shall be of the type and capacity for the service and shall be properly supported and connected. Except for thermostatic traps in pipe coils, radiators, and convectors, install traps with a dirt pocket and strainer between it and the piping or apparatus it drains. When necessary to maintain in continuous service apparatus or piping which is to be drained, provide a three-valve bypass so that the trap may be removed and repaired and condensate may drain through the throttled bypass valve. Provide a check valve on the discharge side of the trap whenever the trap is installed for lift or operating against a back pressure, or discharges into a common return line. When a thermodynamic trap is used, a check valve is not required or recommended. Provide test connections on the discharge side of the high and medium pressure traps when they are specifically required. The test connection shall include a 1/2 inch globe valve with uncapped nipple.

3.1.1.10 Connections for Future Equipment

Locate capped or plugged outlets for connections to future equipment as indicated.

3.1.2 Valves

3.1.2.1 General

Install valves in conformance with ASME B31.1, ASME BPVC SEC VIII D1, and as required herein, at the locations indicated and elsewhere as required for the proper functioning of the system. Use gate valves unless otherwise directed. Install stop valves in the supply lines equipped or located so as to permit operation from floor level, or provided with safe access in the form of walkways or ladders. Install valves in positions accessible for operation and repair. Provide gate valves 8 inches and larger with globe-valved bypass in accordance with MSS SP-45.

3.1.2.2 Globe Valves

Install globe valves so that the pressure shall be below the disk. Install globe valves with the stems horizontal on steam and exhaust lines.

3.1.2.3 Steam Pressure-Reducing Valves

Provide the steam line entering each pressure-reducing valve with a strainer. Provide each pressure-reducing valve unit with two cutout valves and with a globe or angle bypass valve and bypass piping. Provide each pressure-reducing valve unit with an indicating steam gage to show the reduced pressure, and a safety valve on the low pressure side with sufficient capacity to relieve the high pressure steam.

3.1.2.4 Safety Valves

Provide with drip pan elbows.

3.1.3 Pressure Gages

Install a shutoff valve or petcock between each pressure gage and the line, and gages on steam lines shall have a syphon installed ahead of the gage.

3.1.4 Thermometers

Provide thermometers and thermal sensing elements of control valves with a separable socket. Install separable sockets in pipe lines in such a manner to sense the temperature of the flowing fluid and minimize obstruction to flow.

3.1.5 Strainers

Provide strainers with meshes suitable for the services where indicated, and where dirt might interfere with the proper operation of valve parts, orifices, and moving parts of equipment.

3.1.6 Equipment Foundations

Design equipment foundations of sufficient size and weight to provide isolation and to preclude shifting of equipment under operating conditions. Foundations shall meet the requirements of the equipment manufacturer. When required by the Contracting Officer, the equipment manufacturer's approval of the foundation design and construction for the equipment involved shall be obtained.

3.1.7 Equipment Installation

Install equipment as specified and in accordance with the manufacturer's installation instructions. Grout equipment mounted on concrete foundations before piping is installed. Install piping in such a manner as not to place a strain on any of the equipment. Do not bolt flanged joints tight unless they match. Adequately extend expansion bends before installation. Grade, anchor, guide, and support piping without low pockets.

3.1.8 Cleaning of System

As installations of the various system components are completed, clean before final closing. Remove foreign matter from equipment and surrounding areas. Preliminary or final tests shall not be performed until the

cleaning is approved.

3.1.9 Cleaning and Painting of Piping and Equipment

Clean and paint piping and equipment in accordance with Section 09 90 00 PAINTS AND COATINGS.

3.1.10 Identification of Piping

Labels for pipes 3/4 inch diameter and larger shall bear printed legends to identify contents of pipes and arrows to shown direction of flow. Labels shall have color coded background to signify levels of hazard in accordance with ASME A13.1. Legends and type and size of characters shall also conform as ASME A13.1. Make labels of plastic sheet CID A-A-1689 with pressure sensitivity suitable for the intended applications, or they may be premolded of plastic to fit over pipe. For pipe smaller than 3/4 inch diameter, provide brass identification tags 1 1/2 inches in diameter with legends in depressed black filled characters.

3.2 FIELD TESTS AND INSPECTIONS

Field inspections, tests, and trial operations specified in this section shall be performed by the Contractor. The Contractor shall provide gas, oil, labor, equipment, and incidentals required for testing, except that in accordance with Division 1 the Government will provide water or electric power required for tests. The Contractor shall give the Contracting Officer 15 days' advance written notice of the dates and times scheduled for tests and trial operations.

3.2.1 Field Inspections

Inspect piping system prior to initial operation, for conformance to drawings, specifications, and ASME B31.1. Equipment, material, or work rejected because of defects or non-conformance with drawings, specifications, and ASME B31.1 shall be replaced or corrected by the Contractor, as directed by the Contracting Officer.

3.2.2 Field Tests

Conduct the following tests after completion of the piping installation and prior to initial operation.

3.2.2.1 Piping System

Test piping system hydrostatically using water not exceeding 100 degrees F. Conduct tests in accordance with the requirements of ASME B31.1 and as follows. Test the piping system after the lines have been cleaned as herein specified and before any insulation covering has been applied. Test piping system at 1 1/2 times the system pressure or 50 psig whichever is greater. Before performing tests, remove or valve off from the system, gages, traps, and other apparatus which may be damaged by the test pressure. Install a calibrated test pressure gage in the system to observe any loss in pressure. Maintain the required test pressure for a sufficient length of time to enable an inspection to be made of joints and connections. Perform tests after installation and prior to acceptance.

3.2.2.2 Start-Up and Operational Test

Start-up the system and initially operate with components operating. During

the test, periodically clean the various strainers until no further accumulation of foreign material occurs. Exercise care so that minimum loss of steam occur when strainers are cleaned. Adjust safety and automatic control instruments as necessary to place them in proper operation and sequence.

3.2.2.3 Extent of Field Tests

After installation and before acceptance, subject the work of this section to necessary field tests, including those herein specified, and in Section 23 05 93 TESTING, ADJUSTING AND BALANCING.

-- End of Section --

SECTION 23 64 10

WATER CHILLERS, VAPOR COMPRESSION TYPE

08/08

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-CONDITIONING, HEATING AND REFRIGERATION INSTITUTE (AHRI)

AHRI 550/590 (2003) Performance Rating of Water-Chilling Packages Using the Vapor Compression Cycle

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

ANSI/ASHRAE 15 & 34 (2010; Addenda a, b, c, d, e, f, g, h, and i) ANSI/ASHRAE Standard 15-Safety Standard for Refrigeration Systems and ANSI/ASHRAE Standard 34-Designation and Safety Classification of Refrigerants

AMERICAN WELDING SOCIETY (AWS)

AWS Z49.1 (2005) Safety in Welding and Cutting and Allied Processes

ASTM INTERNATIONAL (ASTM)

ASTM A307 (2010) Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength

ASTM B117 (2009) Standing Practice for Operating Salt Spray (Fog) Apparatus

ASTM D 520 (2000; R 2011) Zinc Dust Pigment

ASTM E 84 (2011b) Standard Test Method for Surface Burning Characteristics of Building Materials

ASTM F 104 (2011) Standard Classification System for Nonmetallic Gasket Materials

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

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

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for A/E approval. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Water Chiller

Manufacturer's standard catalog data, at least highlighted to show material, size, options, performance charts and curves, etc. in adequate detail to demonstrate compliance with contract requirements. Data shall include manufacturer's recommended installation instructions and procedures. Data shall be adequate to demonstrate compliance with contract requirements as specified within the paragraphs:

- a. Water Chiller
- b. Chiller Components
- c. Accessories

If vibration isolation is specified for a unit, vibration isolator literature shall be included containing catalog cuts and certification that the isolation characteristics of the isolators provided meet the manufacturer's recommendations.

Posted Instructions

Posted instructions, including equipment layout, wiring and control diagrams, piping, valves and control sequences, and typed condensed operation instructions. The condensed operation instructions shall include preventative maintenance procedures, methods of checking the system for normal and safe operation, and procedures for safely starting and stopping the system. The posted instructions shall be framed under glass or laminated plastic and be posted where indicated by the Contracting Officer.

Verification of Dimensions

A letter including the date the site was visited, conformation of existing conditions, and any discrepancies found.

Manufacturer's Multi-Year Compressor Warranty

Manufacturer's 5 year warranty for compressor(s) in air-cooled water chillers as specified.

System Performance Tests

A schedule, at least 2 weeks prior to the start of related testing, for the system performance tests. The schedules shall identify the proposed date, time, and location for each test.

Demonstrations

A schedule, at least 2 weeks prior to the date of the proposed training course, which identifies the date, time, and location for the training.

Water Chiller - field acceptance test plan

SD-06 Test Reports

Field Acceptance Testing

Water Chiller - field acceptance test report

System Performance Tests

Six copies of the report shall be provided in bound 8 1/2 by 11 inch booklets.

SD-07 Certificates

Refrigeration System

Where the system, components, or equipment are specified to comply with requirements of AGA, NFPA, ARI, ASHRAE, ASME, or UL, 1 copy of proof of such compliance shall be provided. The label or listing of the specified agency shall be acceptable evidence. In lieu of the label or listing, a written certificate from an approved, nationally recognized testing organization equipped to perform such services, stating that the items have been tested and conform to the requirements and testing methods of the specified agency may be submitted. When performance requirements of this project's drawings and specifications vary from standard ARI rating conditions, computer printouts, catalog, or other application data certified by ARI or a nationally recognized laboratory as described above shall be included. If ARI does not have a current certification program that encompasses such application data, the manufacturer may self certify that his application data complies with project performance requirements in accordance with the specified test standards.

SD-08 Manufacturer's Instructions

Water Chiller - Installation Instruction

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals

Six complete copies of an operation manual in bound 8 1/2 by 11 inch booklets listing step-by-step procedures required for system startup, operation, abnormal shutdown, emergency shutdown, and normal shutdown at least 4 weeks prior to the first training course. The booklets shall include the manufacturer's name, model number, and parts list. The manuals shall include the manufacturer's name, model number, service manual, and a brief description of all equipment and their basic operating features. Six complete copies of maintenance manual in bound 8 1/2 by 11 inch booklets listing routine maintenance procedures, possible breakdowns and repairs, and a trouble shooting guide. The manuals shall include piping and equipment layouts and simplified wiring

and control diagrams of the system as installed.

1.3 SAFETY REQUIREMENTS

Exposed moving parts, parts that produce high operating temperature, parts which may be electrically energized, and parts that may be a hazard to operating personnel shall be insulated, fully enclosed, guarded, or fitted with other types of safety devices. Safety devices shall be installed so that proper operation of equipment is not impaired. Welding and cutting safety requirements shall be in accordance with AWS Z49.1.

1.4 DELIVERY, STORAGE, AND HANDLING

Stored items shall be protected from the weather, humidity and temperature variations, dirt and dust, or other contaminants. Proper protection and care of all material both before and during installation shall be the Contractor's responsibility. Any materials found to be damaged shall be replaced at the Contractor's expense. During installation, piping and similar openings shall be capped to keep out dirt and other foreign matter.

1.5 PROJECT REQUIREMENTS

1.5.1 Verification of Dimensions

The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and advise the Contracting Officer of any discrepancy before performing any work.

1.6 Warranty

In addition to the warranty requirements specification in Division 00, Contract Requirements, the following major components of the chiller shall be covered by a warranty of a duration period of five years: compressor, and labor.

1.7 MANUFACTURER'S MULTI-YEAR COMPRESSOR WARRANTY

The Contractor shall provide a 5 year parts and labor (includes refrigerant) manufacturer's warranty on the chiller compressor(s). This warranty shall be directly from the chiller manufacturer to the Government and shall be in addition to the standard one-year warranty of construction. The manufacturer's warranty shall provide for the repair or replacement of the chiller compressor(s) that become inoperative as a result of defects in material or workmanship within 5 years after the date of final acceptance. When the manufacturer determines that a compressor requires replacement, the manufacturer shall furnish new compressor(s) at no additional cost to the Government. Upon notification that a chiller compressor has failed under the terms of the warranty, the manufacturer shall respond in no more than 24 hours. Response shall mean having a manufacturer-qualified technician onsite to evaluate the extent of the needed repairs. The warranty period shall begin on the same date as final acceptance and shall continue for the full product warranty period.

1.7.1 Equipment Warranty Tags

At the time of installation, each item of manufacturer's multi-year warranted equipment shall be tagged with a durable, oil- and water-resistant tag, suitable for interior and exterior locations, resistant to solvents, abrasion, and fading due to sunlight. The tag shall

be attached with copper wire or a permanent, pressure-sensitive, adhesive backing. The tag shall be installed in an easily noticed location attached to the warranted equipment. The tag for this equipment shall be similar to the following in format, and shall contain all of the listed information:

MANUFACTURER'S MULTI-YEAR WARRANTY EQUIPMENT TAG

Equipment/Product Covered: _____

Manufacturer: _____ Model No.: _____ Serial No.: _____

Warranty Period: From _____ to _____

Contract No.: _____

Warranty Contact: _____

Name: _____

Address: _____

Telephone: _____

STATION PERSONNEL SHALL PERFORM PREVENTIVE
MAINTENANCE AND OPERATIONAL MAINTENANCE

PART 2 PRODUCTS

2.1 STANDARD COMMERCIAL PRODUCTS

Materials and equipment shall be standard Commercial cataloged products of a manufacturer regularly engaged in the manufacturing of such products, which are of a similar material, design and workmanship.

These products shall have a two year record of satisfactory field service prior to bid opening. the two year record of service shall include applications of equipment and materials under similar circumstances and of similar size.

Products having less than a two year record of satisfactory field service shall be acceptable if a certified record of satisfactory field service for not less than 6000 hours can be shown. The 6000 hour service record shall not include any manufacturer's prototype or factory testing.

Satisfactory field service shall have been completed by a product that has been, and presently is being sold or offered for sale on the commercial market through the following copyrighted means: advertisements, manufacturer's catalogs, or brochures.

2.2 MANUFACTURER'S STANDARD NAMEPLATES

Nameplates are required on major components if the manufacturer needs to provide specific engineering and manufacturing information pertaining to the particular component. Should replacement of this component be required, nameplate information will insure correct operation of the unit after replacement of this component.

2.3 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 electrical equipment, including motors and wiring, as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Manual or automatic control and protective or signal devices required for controls and devices specified, but not shown, shall be provided. For packaged equipment, the manufacturer shall provide controllers including 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.
- 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 11.
- d. Provide motors in accordance with NEMA MG 11 and of sufficient size to drive the load at the specified capacity without exceeding the nameplate rating of the motor. Motors shall be rated for continuous duty with the enclosure specified. Motor duty requirements shall allow for maximum frequency start-stop operation and minimum encountered interval between start and stop. Motor torque shall be 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. Motor bearings shall be fitted with grease supply fittings and grease relief to outside of the enclosure.
- e. Provide inverter duty premium efficiency motors for use with variable frequency drives.
- f. Provide variable frequency drives for motors as specified in Section 26 29 23 VARIABLE FREQUENCY DRIVE SYSTEMS UNDER 600 VOLTS

2.4 SELF-CONTAINED WATER CHILLERS, VAPOR COMPRESSION TYPE

Unless necessary for delivery purposes, units shall be assembled, leak-tested, charged (refrigerant and oil), and adjusted at the factory. In lieu of delivery constraints, a chiller may be assembled, leak-tested, charged (refrigerant and oil), and adjusted at the job site by a factory representative. Unit components delivered separately shall be sealed and charged with a nitrogen holding charge. Parts weighing 50 pounds or more which must be removed for inspection, cleaning, or repair, such as motors, gear boxes, cylinder heads, casing tops, condenser, and cooler heads, shall have lifting eyes or lugs. Chiller shall be provided with a single point wiring connection for incoming power supply. Chiller's condenser and water cooler shall be provided with flanged connections.

2.4.1 Variable Speed Centrifugal Type

Chiller shall be constructed and rated in accordance with AHRI 550/590. Chiller shall conform to ANSI/ASHRAE 15 & 34. As a minimum, chiller shall include the following components as defined in paragraph CHILLER COMPONENTS.

- a. Refrigerant
- b. Structural base
- c. Chiller refrigerant circuit
- d. Controls package
- e. Turbocor TM oil-free centrifugal compressors

- f. Compressor driver, electric motor
- g. Compressor driver connection
- h. Water cooler (evaporator)
- i. Air-cooled condenser coil

2.5 CHILLER COMPONENTS

2.5.1 Refrigerant

Refrigerants shall be one of the fluorocarbon gases. Refrigerants shall have number designations and safety classifications in accordance with ANSI/ASHRAE 15 & 34. The ODP shall be in accordance with the "Montreal Protocol On Substances That Deplete The Ozone Layer," September 1987, as amended through 2000, sponsored by the United Nations Environment Programme.

2.5.2 Structural Base

Chiller and individual chiller components shall be provided with a factory-mounted structural steel base (welded or bolted) or support legs. Chiller and individual chiller components shall be isolated from the building structure by means of molded neoprene isolation pads.

2.5.3 Chiller Refrigerant Circuit

Chiller refrigerant circuit shall be completely piped and factory leak tested. For multicompressor units, not less than 2 independent refrigerant circuits shall be provided. Circuit shall include as a minimum a combination sight glass and moisture indicator, liquid-line solenoid valve for reciprocating, an electronic or thermostatic expansion valve with external equalizer, charging ports, compressor service valves for field-serviceable compressors, and superheat adjustment.

2.5.4 Controls Package

Chiller shall be provided with a complete factory-mounted, prewired electric or microprocessor based operating and safety control system. Controls package shall contain as a minimum a digital display or acceptable gauges, an on-auto-off switch, variable frequency drives, disconnect switches, power wiring, and control wiring. Controls package shall provide operating controls, monitoring capabilities, programmable setpoints, safety controls, and EMCS interfaces as defined below.

2.5.4.1 Operating Controls

Chiller shall be provided with the following adjustable operating controls as a minimum.

- a. Leaving chilled water temperature control
- b. Adjustable timer or automated controls to prevent a compressor from short cycling
- c. Automatic lead/lag controls (adjustable) for multi-compressor units
- d. Load limiting

- e. System capacity control to adjust the unit capacity in accordance with the system load and the programmable setpoints. Controls shall automatically re-cycle the chiller on power interruption.
- f. Startup and head pressure controls to allow system operation at all ambient temperatures down to 32 degrees F
- g. Fan sequencing for air-cooled condenser

2.5.4.2 Monitoring Capabilities

During normal operations, the control system shall be capable of monitoring and displaying the following operating parameters. Access and operation of display shall not require opening or removing any panels or doors.

- a. Entering and leaving chilled water temperatures
- b. Self diagnostic
- c. Operation status
- d. Operating hours
- e. Number of starts
- f. Compressor status (on or off)
- g. Refrigerant discharge and suction pressures
- h. Oil pressure

2.5.4.3 Programmable Setpoints

The control system shall be capable of being reprogrammed directly at the unit. No parameters shall be capable of being changed without first entering a security access code. The programmable setpoints shall include the following as a minimum.

- a. Leaving Chilled Water Temperature

2.5.4.4 Safety Controls with Manual Reset

Chiller shall be provided with the following safety controls which automatically shutdown the chiller and which require manual reset.

- a. Low chilled water temperature protection
- b. High condenser refrigerant discharge pressure protection
- c. Low evaporator pressure protection
- d. Chilled water flow detection
- e. High motor winding temperature protection

2.5.4.5 Safety Controls with Automatic Reset

Chiller shall be provided with the following safety controls which automatically shutdown the chiller and which provide automatic reset.

- a. Over/under voltage protection
- b. Chilled water flow interlock

2.5.4.6 Remote Alarm

During the initiation of a safety shutdown, a chiller's control system shall be capable of activating a remote alarm bell. In coordination with the chiller, the Contractor shall provide an alarm circuit (including transformer if applicable) and a minimum 4 inch diameter alarm bell. Alarm circuit shall activate bell in the event of machine shutdown due to the chiller's monitoring of safety controls. The alarm bell shall not sound for a chiller that uses low-pressure cutout as an operating control.

2.5.4.7 Energy Management Control System (EMCS) Interface

The control system shall be capable of communicating all data to a remote integrated DDC processor through a single shielded cable. The data shall include as a minimum all system operating conditions, capacity controls, and safety shutdown conditions. The control system shall also be capable of receiving at a minimum the following operating commands.

- a. Remote Unit Start/Stop

2.5.5 Compressor(s)

2.5.5.1 Centrifugal Compressor(s)

Compressors shall be of semi-hermetic centrifugal design and operate oil-free with two stages of compression, magnetic bearings, movable inlet guide vanes and integrated variable frequency drive system.

- a. Compressor shall automatically be positioned and controlled inlet guide vanes shall operate with compressor speed controls. The compressor shall be capable of coming to a controlled stop in the event of a power failure. The unit shall be capable of initializing an automatic restart in the case of power failure. Each compressor shall have integrated microprocessor control capable of capacity and safety control.
- b. Casing of cast iron, aluminum, or steel plate with split sections gasketed and bolted or clamped together.
- c. No oil is required for this system..
- d. Shaft shall be constructed of high strength alloy.
- e. Impellers shall be aluminum. Bearing shall be digitally controlled magnetic type.

2.5.6 Compressor Driver, Electric Motor

Provide variable speed drives, wiring, etc. shall be in accordance with paragraph ELECTRICAL WORK. Permanent-magnet, synchronous hermetically sealed motor of sufficient size to effectively provide compressor horsepower requirements.

2.5.7 Water Cooler (Evaporator)

Cooler shall be of the shell-and-coil or shell-and-tube type design. Condenser's refrigerant side shall be designed and factory pressure tested to comply with ANSI/ASHRAE 15 & 34. Condenser's water side shall be designed and factory pressure tested for not less than 145 psi. Cooler shell shall be constructed of seamless or welded steel. Coil bundles shall be totally removable and arranged to drain completely. Tubes shall be seamless copper, plain, integrally finned with smooth bore or integrally finned with enhanced bore. Each tube shall be individually replaceable. Tubes shall be installed into carbon mild steel tube sheets by rolling. Tube baffles shall be properly spaced to provide adequate tube support and cross flow. Performance shall be based on a water velocity not less than 3 fps nor more than 12 fps and a fouling factor of 0.00025 h(ft²)(degrees F)/Btu. Minimum evaporator exiting water temperature shall be 38°F. Minimum entering condenser air temperature shall be 32°F. Minimum inlet condenser air to outlet chilled water difference shall be 12°F.

2.5.8 Air-Cooled Condenser Coil

Condenser coil shall be of the extended-surface fin-and-tube type and shall be constructed of seamless copper or tubes with compatible aluminum fins. Fins shall be soldered or mechanically bonded to the tubes and installed in a metal casing. Coils shall be circuited and sized for a minimum of 5 degrees F subcooling and full pumpdown capacity. Coil shall be factory leak and pressure tested after assembly in accordance with ANSI/ASHRAE 15 & 34. Coil shall be entirely coated with the manufacturer's standard epoxy or vinyl coating.

The fans shall be balanced dynamically and statically and direct drive. Also, the blades shall be corrosion resistant designed for low noise, full airfoil cross section, providing vertical air discharge from extended orifices. The guards shall be constructed of heavy duty 14 gauge steel and painted. Provide ECM motors with variable frequency drives for condenser fans.

2.6 ACCESSORIES

2.6.1 Gaskets

Gaskets shall conform to ASTM F 104 - classification for compressed sheet with nitrile binder and acrylic fibers for maximum 700 degrees F service.

2.6.2 Bolts and Nuts

Bolts and nuts, except as required for piping applications, shall be in accordance with ASTM A307. The bolt head shall be marked to identify the manufacturer and the standard with which the bolt complies in accordance with ASTM A307.

2.7 FABRICATION

2.7.1 Factory Coating

Unless otherwise specified, equipment and component items, when fabricated from ferrous metal, shall be factory finished with the manufacturer's standard finish, except that items located outside of buildings shall have weather resistant finishes that will withstand 3000 minimum hours exposure

to the salt spray test specified in ASTM B117 using a 5 percent sodium chloride solution. Immediately after completion of the test, the specimen shall show no signs of blistering, wrinkling, cracking, or loss of adhesion and no sign of rust creepage beyond 1/8 inch on either side of the scratch mark. Cut edges of galvanized surfaces where hot-dip galvanized sheet steel is used shall be coated with a zinc-rich coating conforming to ASTM D 520, Type I.

2.7.2 Factory Applied Insulation

Chiller shall be provided with factory installed insulation on surfaces subject to sweating including the water cooler, suction line piping, economizer, and cooling lines. Insulation on heads of coolers may be field applied, however it shall be installed to provide easy removal and replacement of heads without damage to the insulation. Where motors are the gas-cooled type, factory installed insulation shall be provided on the cold-gas inlet connection to the motor per manufacturer's standard practice. Factory insulated items installed outdoors are not required to be fire-rated. As a minimum, factory insulated items installed indoors shall have a flame spread index no higher than 75 and a smoke developed index no higher than 150. Factory insulated items (no jacket) installed indoors and which are located in air plenums, in ceiling spaces, and in attic spaces shall have a flame spread index no higher than 25 and a smoke developed index no higher than 50. Flame spread and smoke developed indexes shall be determined by ASTM E 84. Insulation shall be tested in the same density and installed thickness as the material to be used in the actual construction. Material supplied by a manufacturer with a jacket shall be tested as a composite material. Jackets, facings, and adhesives shall have a flame spread index no higher than 25 and a smoke developed index no higher than 50 when tested in accordance with ASTM E 84.

2.8 SUPPLEMENTAL COMPONENTS/SERVICES

2.8.1 Chilled and Condenser Water Piping and Accessories

Chilled and condenser water piping and accessories shall be provided and installed in accordance with Section 23 64 26 CHILLED, WATER PIPING SYSTEMS.

2.8.2 Temperature Controls

Chiller control packages shall be fully coordinated with and integrated into the temperature control system specified in Section 23 09 23.13 20 DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC.

PART 3 EXECUTION

3.1 INSTALLATION

Installation of water chiller systems including materials, installation, workmanship, fabrication, assembly, erection, examination, inspection, and testing shall be in accordance with the manufacturer's written installation instructions, including the following:

1. Water chiller - installation instructions

3.1.1 Refrigeration System

3.1.1.1 Equipment

Refrigeration equipment and the installation thereof shall conform to ANSI/ASHRAE 15 & 34. Necessary supports shall be provided for all equipment, appurtenances, and pipe as required, including frames or supports for compressors, pumps, cooling towers, condensers, water coolers, and similar items. Compressors shall be isolated from the building structure. If mechanical vibration isolators are not provided, vibration absorbing foundations shall be provided. Each foundation shall include isolation units consisting of machine and floor or foundation fastenings, together with intermediate isolation material. Other floor-mounted equipment shall be set on not less than a 6 inch concrete pad doweled in place. Concrete foundations for floor mounted pumps shall have a mass equivalent to three times the weight of the components, pump, base plate, and motor to be supported. In lieu of concrete pad foundation, concrete pedestal block with isolators placed between the pedestal block and the floor may be provided. Concrete pedestal block shall be of mass not less than three times the combined pump, motor, and base weights. Isolators shall be selected and sized based on load-bearing requirements and the lowest frequency of vibration to be isolated. Lines connected to pumps mounted on pedestal blocks shall be provided with flexible connectors. Foundation drawings, bolt-setting information, and foundation bolts shall be furnished prior to concrete foundation construction for all equipment indicated or required to have concrete foundations. Equipment shall be properly leveled, aligned, and secured in place in accordance with manufacturer's instructions.

3.1.1.2 Field Refrigerant Charging

- a. Initial Charge: Upon completion of all the refrigerant pipe tests, the vacuum on the system shall be broken by adding the required charge of dry refrigerant for which the system is designed, in accordance with the manufacturer's recommendations. Contractor shall provide the complete charge of refrigerant in accordance with manufacturer's recommendations. Upon satisfactory completion of the system performance tests, any refrigerant that has been lost from the system shall be replaced. After the system is fully operational, service valve seal caps and blanks over gauge points shall be installed and tightened.
- b. Refrigerant Leakage: If a refrigerant leak is discovered after the system has been charged, the leaking portion of the system shall immediately be isolated from the remainder of the system and the refrigerant shall be pumped into the system receiver or other suitable container. The refrigerant shall not be discharged into the atmosphere.
- c. Contractor's Responsibility: The Contractor shall, at all times during the installation and testing of the refrigeration system, take steps to prevent the release of refrigerants into the atmosphere. The steps shall include, but not be limited to, procedures which will minimize the release of refrigerants to the atmosphere and the use of refrigerant recovery devices to remove refrigerant from the system and store the refrigerant for reuse or reclaim. At no time shall more than 3 ounces of refrigerant be released to the atmosphere in any one occurrence. Any system leaks within the first year shall be repaired in accordance with the specified requirements including material, labor, and refrigerant if the leak is the result of defective

equipment, material, or installation.

3.1.2 Field Applied Insulation

Field installed insulation shall be as specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS, except as defined differently herein.

3.1.3 Field Painting

Painting required for surfaces not otherwise specified, and finish painting of items only primed at the factory are specified in Section 09 90 00 PAINTS AND COATINGS.

3.2 MANUFACTURER'S FIELD SERVICE

The services of a factory-trained representative shall be provided for days. The representative shall advise on the following:

a. Hermetic machines:

- (1) Testing hermetic water-chilling unit under pressure for refrigerant leaks; evacuation and dehydration of machine to an absolute pressure of not over 300 microns.
- (2) Charging the machine with refrigerant.
- (3) Starting the machine.

3.3 CLEANING AND ADJUSTING

Equipment shall be wiped clean, with all traces of oil, dust, dirt, or paint spots removed. Temporary filters shall be provided for all fans that are operated during construction, and new filters shall be installed after all construction dirt has been removed from the building. System shall be maintained in this clean condition until final acceptance. Bearings shall be properly lubricated with oil or grease as recommended by the manufacturer. Belts shall be tightened to proper tension. Control valves and other miscellaneous equipment requiring adjustment shall be adjusted to setting indicated or directed. Fans shall be adjusted to the speed indicated by the manufacturer to meet specified conditions. At least one week before the official equipment warranty start date, all condenser coils on air-cooled water chillers and split-system water chillers shall be cleaned in accordance with the chiller manufacturer's instructions. This work covers two coil cleanings. The condenser coils shall be cleaned with an approved coil cleaner by a service technician, factory trained by the chiller manufacturer. The condenser coil cleaner shall not have any detrimental affect on the materials or protective coatings on the condenser coils. Testing, adjusting, and balancing shall be as specified in Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC.

3.4 FIELD ACCEPTANCE TESTING

3.4.1 Test Plans

a. Manufacturer's Test Plans: Within 120 calendar days after contract award, submit the following plans:

- (1) Water chiller - field acceptance test plan

Field acceptance test plans shall be developed by the absorption chiller manufacturer detailing recommended field test procedures for that particular type and size of equipment. Field acceptance test plans developed by the installing Contractor, or the equipment sales agency furnishing the equipment, will not be acceptable.

The Contracting Officer will review and approve the field acceptance test plan for each of the listed equipment prior to commencement of field testing of the equipment. The approved field acceptance tests of the absorption chiller and subsequent test reporting.

- b. Coordinated testing: Indicate in each field acceptance test plan when work required by this section requires coordination with test work required by other specification sections. Furnish test procedures for the simultaneous or integrated testing of tower system controls which interlock and interface with controls factory prewired or external controls for the equipment provided under Section 23 09 23.13 20, DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC.
- c. Prerequisite testing: Absorption chillers for which performance testing is dependent upon the completion of the work covered by Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC must have that work completed as a prerequisite to testing work under this section. Indicate in each field acceptance test plan when such prerequisite work is required.
- d. Test procedure: Indicate in each field acceptance test plan each equipment manufacturers published installation, start-up, and field acceptance test procedures. Include in each test plan a detailed step-by-step procedure for testing automatic controls provided by the manufacturer.

Each test plan shall include the required test reporting forms to be completed by the Contractor's testing representatives. Procedures shall be structured to test the controls through all modes of control to confirm that the controls are performing with the intended sequence of control.

Controller shall be verified to be properly calibrated and have the proper set point to provide stable control of their respective equipment.

- e. Performance variables: Each test plan shall list performance variables that are required to be measured or tested as part of the field test.

Include in the listed variables performance requirements indicated on the equipment schedules on the design drawings. Chiller manufacturer shall furnish with each test procedure a description of acceptable results that have been verified.

Chiller manufacturer shall identify the acceptable limits or tolerance within which each tested performance variable shall acceptably operate.

- f. Job specific: Each test plan shall be job specific and shall address the particular cooling towers and particular conditions which exist in

this contract. Generic or general preprinted test procedures are not acceptable.

- g. Specialized components: Each test plan shall include procedures for field testing and field adjusting specialized components, such as hot gas bypass control valves, or pressure valves.

3.4.2 Testing

- a. Each water chiller system shall be field acceptance tested in compliance with its approved field acceptance test plan and the resulting following field acceptance test report submitted for approval:
 - 1. Water chiller - field acceptance test report
- b. Manufacturer's recommended testing: Conduct the manufacturer's recommended field testing in compliance with the approved test plan. Furnish a factory trained field representative authorized by and to represent the equipment manufacturer at the complete execution of the field acceptance testing.
- c. Operational test: Conduct a continuous 24 hour operational test for each item of equipment. Equipment shutdown before the test period is completed shall result in the test period being started again and run for the required duration. For the duration of the test period, compile an operational log of each item of equipment. Log required entries every two hours. Use the test report forms for logging the operational variables.
- d. Notice of tests: Conduct the manufacturer's recommended tests and the operational tests; record the required data using the approved reporting forms. Notify the Contracting Officer in writing at least 15 calendar days prior to the testing. Within 30 calendar days after acceptable completion of testing, submit each test report for review and approval.
- e. Report forms: Type data entries and writing on the test report forms. Completed test report forms for each item of equipment shall be reviewed, approved, and signed by the Contractor's test director. The manufacturer's field test representative shall review, approve, and sign the report of the manufacturer's recommended test. Signatures shall be accompanied by the person's name typed.
- f. Deficiency resolution: The test requirements acceptably met; deficiencies identified during the tests shall be corrected in compliance with the manufacturer's recommendations and corrections retested in order to verify compliance.

3.5 SYSTEM PERFORMANCE TESTS

3.5.1 General Requirements

Before each refrigeration system is accepted, tests to demonstrate the general operating characteristics of all equipment shall be conducted by a registered professional engineer or an approved manufacturer's start-up representative experienced in system start-up and testing, at such times as directed. Tests shall cover a period of not less than 48 hours for each system and shall demonstrate that the entire system is functioning in accordance with the drawings and specifications. Corrections and

adjustments shall be made as necessary and tests shall be re-conducted to demonstrate that the entire system is functioning as specified. Prior to acceptance, service valve seal caps and blanks over gauge points shall be installed and tightened. Any refrigerant lost during the system startup shall be replaced. If tests do not demonstrate satisfactory system performance, deficiencies shall be corrected and the system shall be retested. Tests shall be conducted in the presence of the Contracting Officer. Water and electricity required for the tests will be furnished by the Government. Any material, equipment, instruments, and personnel required for the test shall be provided by the Contractor. Field tests shall be coordinated with Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC.

3.5.2 Test Report

The report shall document compliance with the specified performance criteria upon completion and testing of the system. The report shall indicate the number of days covered by the tests and any conclusions as to the adequacy of the system. The report shall also include the following information and shall be taken at least three different times at outside dry-bulb temperatures that are at least 5 degrees F apart:

- a. Date and outside weather conditions.
- b. The load on the system based on the following:
 - (1) The refrigerant used in the system.
 - (2) Condensing temperature and pressure.
 - (3) Suction temperature and pressure.
 - (4) Running current, voltage and proper phase sequence for each phase of all motors.
 - (5) The actual on-site setting of all operating and safety controls.
 - (6) Chilled water pressure, flow and temperature in and out of the chiller.

3.6 DEMONSTRATIONS

Contractor shall conduct a training course for the operating staff as designated by the Contracting Officer. The training period shall consist of a total 40 hours of normal working time and start after the system is functionally completed but prior to final acceptance tests. The field posted instructions shall cover all of the items contained in the approved operation and maintenance manuals as well as demonstrations of routine maintenance operations.

-- End of Section --

SECTION 23 64 26

CHILLED WATER PIPING SYSTEMS

08/09

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 NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z21.22/CSA 4.4 (1999; Addenda A 2000, Addenda B 2001; R 2004) Relief Valves for Hot Water Supply Systems

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1003 (2009) Performance Requirements for Water Pressure Reducing Valves for Domestic Water Distribution Systems - (ANSI approved 2010)

ASSE 1017 (2009) Performance Requirements for Temperature Actuated Mixing Valves for Hot Water Distribution Systems - (ANSI approved 2010)

AMERICAN WELDING SOCIETY (AWS)

AWS A5.8/A5.8M (2004) Specification for Filler Metals for Brazing and Braze Welding

AWS BRH (2007; 5th Ed) Brazing Handbook

AWS D1.1/D1.1M (2010; Errata 2010) Structural Welding Code - Steel

AWS Z49.1 (2005) Safety in Welding and Cutting and Allied Processes

ASME INTERNATIONAL (ASME)

ASME B1.20.1 (1983; R 2006) Pipe Threads, General Purpose (Inch)

ASME B16.1 (2010) Gray Iron Threaded Fittings; Classes 25, 125 and 250

ASME B16.11 (2009) Forged Fittings, Socket-Welding and Threaded

ASME B16.18 (2001; R 2005) Cast Copper Alloy Solder Joint Pressure Fittings

ASME B16.21	(2011) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.22	(2001; R 2010) Standard for Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B16.26	(2006) Standard for Cast Copper Alloy Fittings for Flared Copper Tubes
ASME B16.3	(2010) Malleable Iron Threaded Fittings, Classes 150 and 300
ASME B16.39	(2009) Standard for Malleable Iron Threaded Pipe Unions; Classes 150, 250, and 300
ASME B16.9	(2007) Standard for Factory-Made Wrought Steel Buttwelding Fittings
ASME B31.9	(2011) Building Services Piping
ASME B40.100	(2005) Pressure Gauges and Gauge Attachments

ASTM INTERNATIONAL (ASTM)

ASTM A53/A53M	(2010) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A653/A653M	(2011) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A733	(2003; R 2009e1) Standard Specification for Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples
ASTM B117	(2009) Standard Practice for Operating Salt Spray (Fog) Apparatus
ASTM B32	(2008) Standard Specification for Solder Metal
ASTM B42	(2010) Standard Specification for Seamless Copper Pipe, Standard Sizes
ASTM B62	(2009) Standard Specification for Composition Bronze or Ounce Metal Castings
ASTM B75	(2002; R 2010) Standard Specification for Seamless Copper Tube
ASTM B813	(2010) Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube

- ASTM B88 (2009) Standard Specification for Seamless Copper Water Tube
- ASTM D 3308 (2006) PTFE Resin Skived Tape
- ASTM D 520 (2000; R 2011) Zinc Dust Pigment
- ASTM E 84 (2011b) Standard Test Method for Surface Burning Characteristics of Building Materials
- ASTM F 1199 (1988; R 2010) Cast (All Temperatures and Pressures) and Welded Pipe Line Strainers (150 psig and 150 degrees F Maximum)

HYDRAULIC INSTITUTE (HI)

- HI 1.1-1.2 (2008) Rotodynamic (Centrifugal) Pump for Nomenclature and Definitions

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

- MSS SP-110 (2010) Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends
- MSS SP-25 (2008) Standard Marking System for Valves, Fittings, Flanges and Unions
- MSS SP-58 (2009) Pipe Hangers and Supports - Materials, Design and Manufacture, Selection, Application, and Installation
- MSS SP-67 (2002a) Butterfly Valves
- MSS SP-69 (2003) Pipe Hangers and Supports - Selection and Application (ANSI Approved American National Standard)
- MSS SP-70 (2006) Gray Iron Gate Valves, Flanged and Threaded Ends
- MSS SP-71 (2005) Gray Iron Swing Check Valves, Flanged and Threaded Ends
- MSS SP-72 (2010) Ball Valves with Flanged or Butt-Welding Ends for General Service
- MSS SP-78 (2005a) Cast Iron Plug Valves, Flanged and Threaded Ends
- MSS SP-80 (2008) Bronze Gate, Globe, Angle and Check Valves
- MSS SP-85 (2002) Gray Iron Globe & Angle Valves Flanged and Threaded Ends

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

- NEMA 250 (2008) Enclosures for Electrical Equipment (1000 Volts Maximum)
- NEMA MG 1 (2009) Motors and Generators
- NEMA MG 11 (1977; R 2007) Energy Management Guide for Selection and Use of Single Phase Motors

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

- NFPA 90A (2012) Standard for the Installation of Air Conditioning and Ventilating Systems

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

- CID A-A-50541 (Basic; Notice 2) Valves, Tank Float, Angle and Globe Pattern (Inch-Pound

1.2 SYSTEM DESCRIPTION

Provide the water systems having the minimum service (design) temperature-pressure rating indicated. Provision of the piping systems, including materials, installation, workmanship, fabrication, assembly, erection, examination, inspection, and testing shall be in accordance with the required and advisory provisions of ASME B31.9 except as modified or supplemented by this specification section or design drawings. This specification section covers the water systems piping which is located within, on, and adjacent to building(s) within the building(s) 5 foot line.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for A/E approval. Submit the following submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

- Calibrated Balancing Valves
- Pump Discharge Valve
- Water Temperature Mixing Valve
- Water Temperature Regulating Valves
- Water Pressure Reducing Valve
- Pressure Relief Valve
- Combination Pressure and Temperature Relief Valves
- Pumps
- Combination Strainer and Pump Suction Diffuser
- Expansion Tanks

Air Separator Tanks

Ultrasonic flow meter

SD-06 Test Reports

Piping welds NDE report

Pressure tests reports

Report shall be provided in bound 8-1/2 by 11 inch booklets. In the reports, document all phases of the tests performed. Include initial test summaries, all repairs/adjustments made, and the final test results.

SD-07 Certificates

Employer's Record Documents (For Welding)

Welding Procedures and Qualifications

Certificates shall be submitted showing conformance with the referenced standards contained in this section.

SD-10 Operation and Maintenance Data

Requirements for data packages are specified Section 01 78 23 OPERATION AND MAINTENANCE DATA, except as supplemented and modified by this specification section.

Submit spare parts data for each different item of equipment specified, with operation and maintenance data packages. Include a complete list of parts and supplies, with current unit prices and source of supply, a recommended spare parts list for 1 year of operation, and a list of the parts recommended by the manufacturer to be replaced on a routine basis.

Submit a list of qualified permanent service organizations with operation and maintenance data packages. Include service organization addresses and service area or expertise. The service organizations shall be reasonably convenient to the equipment installation and be able to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

Calibrated Balancing Valves, Data Package 3

Pump Discharge Valve, Data Package 2

Water Temperature Mixing Valve, Data Package 3

Water Pressure Reducing Valve, Data Package 3

Pressure Relief Valve, Data Package 2

Combination Pressure and Temperature Relief Valves, Data Package 2

Pumps, Data Package 3

Combination Strainer and Pump Suction Diffuser, Data Package 2

Expansion Tanks, Data Package 2

Air Separator Tanks, Data Package 2

1.4 MODIFICATIONS TO REFERENCES

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.

1.4.1 Definitions

For the International Code Council (ICC) Codes referenced in the contract documents, advisory provisions shall be considered mandatory, the word "should" shall be interpreted as "shall." Reference to the "code official" shall be interpreted to mean the "Contracting Officer." For Navy owned property, references to the "owner" shall be interpreted to mean the "Contracting Officer." For leased facilities, references to the "owner" shall be interpreted to mean the "lessor." References to the "permit holder" shall be interpreted to mean the "Contractor."

1.4.2 Administrative Interpretations

For ICC Codes referenced in the contract documents, the provisions of Chapter 1, "Administrator," do not apply. These administrative requirements are covered by the applicable Federal Acquisition Regulations (FAR) included in this contract and by the authority granted to the Officer in Charge of Construction to administer the construction of this project. References in the ICC Codes to sections of Chapter 1, shall be applied appropriately by the Contracting Officer as authorized by his administrative cognizance and the FAR.

1.5 SAFETY REQUIREMENTS

Exposed moving parts, parts that produce high operating temperature, parts which may be electrically energized, and parts that may be a hazard to operating personnel shall be insulated, fully enclosed, guarded, or fitted with other types of safety devices. Safety devices shall be installed so that proper operation of equipment is not impaired.

1.6 DELIVERY, STORAGE, AND HANDLING

Protect stored items from the weather, humidity and temperature variations, dirt and dust, or other contaminants. Proper protection and care of all material both before and during installation shall be the Contractor's responsibility. Any materials found to be damaged shall be replaced at the Contractor's expense. During installation, cap piping and similar openings to keep out dirt and other foreign matter. Any porous materials found to be contaminated with mold or mildew will be replaced at the Contractor's expense. Non-porous materials found to be contaminated with mold or mildew will be disinfected and cleaned prior to installation.

1.7 PROJECT/SITE CONDITIONS

1.7.1 Verification of Dimensions

The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and advise the Contracting Officer of any discrepancy before performing any work.

1.7.2 Drawings

Because of the small scale of the drawings, it is not possible to indicate all offsets, fittings, and accessories that may be required. The Contractor shall carefully investigate the plumbing, fire protection, electrical, structural and finish conditions that would affect the work to be performed and shall arrange such work accordingly, furnishing required offsets, fittings, and accessories to meet such conditions.

1.7.3 Accessibility

Install all work so that parts requiring periodic inspection, operation, maintenance, and repair are readily accessible. Install concealed valves, expansion joints, controls, dampers, and equipment requiring access, in locations freely accessible through access doors.

PART 2 PRODUCTS

2.1 STANDARD COMMERCIAL PRODUCTS

Materials and equipment shall be standard products of a manufacturer regularly engaged in the manufacturing of such products, which are of a similar material, design and workmanship. The standard products shall have been in satisfactory commercial or industrial use for 2 years prior to bid opening.

The two year use shall include applications of equipment and materials under similar circumstances and of similar size. The 2 years experience shall be satisfactorily completed by a product which has been sold or is offered for sale on the commercial market through advertisements, manufacturer's catalogs, or brochures.

Products having less than a 2 year field service record shall be 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. System components shall be environmentally suitable for the indicated locations.

The equipment items shall be supported by service organizations. These service organizations shall be reasonably convenient to the equipment installation and able to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

2.2 STEEL PIPING

Water piping shall be steel pipe or copper tubing. Provide steel piping with a ANSI/ASME Class 125 service rating, which for 150 degrees F, the pressure rating is 175 psig.

2.2.1 Pipe

Steel pipe, conform to ASTM A53/A53M, Schedule 40, Type E or S, Grades A or B. Do not use Type F pipe.

2.2.2 Fittings and End Connections (Joints)

Piping and fittings 1 inch and smaller shall have threaded connections. Piping and fittings larger than 1 inch and smaller than 3 inches shall have either threaded, or welded connections. Piping and fittings 3 inches and larger shall have welded, or flanged connections. The manufacturer of each fitting shall be permanently identified on the body of the fitting in accordance with MSS SP-25.

2.2.2.1 Threaded Connections

Use threaded valves and pipe connections conforming to ASME B1.20.1. Use threaded fitting conforming to ASME B16.3. Use threaded unions conforming to ASME B16.39. Use threaded pipe nipples conforming to ASTM A733.

2.2.2.2 Flanged Connections

Flanges shall conform to ASME B16.1, Class 150. Gaskets shall be nonasbestos compressed material in accordance with ASME B16.21, 1/16 inch thickness, full face or self-centering flat ring type. These gaskets shall contain aramid fibers bonded with styrene butadiene rubber (SBR) or nitrile butadiene rubber (NBR). Bolts, nuts, and bolt patterns shall conform to ASME B16.1.

2.2.2.3 Welded Connections

Welded valves and pipe connections (both butt-welds and socket-welds types) shall conform to ASME B31.9. Butt-welded fittings shall conform to ASME B16.9. Socket-welded fittings shall conform to ASME B16.11. Welded fittings shall be identified with the appropriate grade and marking symbol.

2.2.2.4 Dielectric Waterways and Flanges

Provide dielectric waterways with a water impervious insulation barrier capable of limiting galvanic current to 1 percent of short circuit current in a corresponding bimetallic joint. When dry, insulation barrier shall be able to withstand a 600-volt breakdown test. Provide dielectric waterways constructed of galvanized steel and have threaded end connections to match connecting piping. Dielectric waterways shall be suitable for the required operating pressures and temperatures. Provide dielectric flanges with the same pressure ratings as standard flanges and provide complete electrical isolation between connecting pipe and/or equipment as described herein for dielectric waterways.

2.3 COPPER TUBING

Provide copper tubing and fittings with a ANSI/ASME Class 125 service rating, which for 150 degrees F., the pressure rating is 175 psig.

2.3.1 Tube

Use copper tube conforming to ASTM B88, Type L or M for aboveground tubing, and Type K for buried tubing.

2.3.2 Fittings and End Connections (Solder and Flared Joints)

Wrought copper and bronze solder joint pressure fittings, including unions and flanges, shall conform to ASME B16.22 and ASTM B75. Provide adapters as required. Cast copper alloy solder-joint pressure fittings, including unions and flanges, shall conform to ASME B16.18. Cast copper alloy fittings for flared copper tube shall conform to ASME B16.26 and ASTM B62. ASTM B42 copper pipe nipples with threaded end connections shall conform to ASTM B42.

Copper tubing of sizes larger than 4 inches shall have brazed joints. Brass or bronze adapters for brazed tubing may be used for connecting tubing to flanges and to threaded ends of valves and equipment.

Extracted brazed tee joints may be used if produced with an acceptable tool and installed in accordance with tool manufacturer's written procedures.

2.3.3 Solder

Provide solder in conformance with ASTM B32, grade Sb5, tin-antimony alloy. Solder flux shall be liquid or paste form, non-corrosive and conform to ASTM B813.

2.3.4 Brazing Filler Metal

Filler metal shall conform to AWS A5.8/A5.8M, Type BAg-5 with AWS Type 3 flux, except Type BCuP-5 or BCuP-6 may be used for brazing copper-to-copper joints.

2.4 VALVES

Provide valves with a ANSI/ASME Class 125 service rating, which for 150 degrees F, the pressure rating is 175 psig.

2.4.1 Gate Valve

Gate valves 2-1/2 inches and smaller shall conform to MSS SP-80 Class 125 and shall be bronze with wedge disc, rising stem and threaded, soldered, or flanged ends. Gate valves 3 inches and larger shall conform to MSS SP-70, Class 125, cast iron with bronze trim, outside screw and yoke, and flanged or threaded ends.

2.4.2 Globe and Angle Valve

Globe and angle valves 2-1/2 inches and smaller shall conform to MSS SP-80, Class 125. Globe and angle valves 3 inches and larger shall conform to MSS SP-85, Class 125.

2.4.3 Check Valve

Check valves 2-1/2 inches and smaller shall conform to MSS SP-80. Check valves 3 inches and larger shall conform to MSS SP-71, Class 125.

2.4.4 Butterfly Valve

Butterfly valves shall conform to MSS SP-67, Type 1 and shall be either the wafer or lug type. Valves smaller than 8 inches shall have throttling handles with a minimum of seven locking positions. Valves 8 inches and larger shall have totally enclosed manual gear operators with adjustable

balance return stops and position indicators.

2.4.5 Plug Valve

Plug valves 2 inches and larger shall conform to MSS SP-78, have flanged or threaded ends, and have cast iron bodies with bronze trim. Valves 2 inches and smaller shall be bronze with NPT connections for black steel pipe and brazed connections for copper tubing. Valve shall be lubricated, non-lubricated, or tetrafluoroethylene resin-coated type. Valve shall be resilient, double seated, trunnion mounted with tapered lift plug capable of 2-way shutoff. Valve shall operate from fully open to fully closed by rotation of the handwheel to lift and turn the plug. Valve shall have weatherproof operators with mechanical position indicators. Valves 8 inches or larger shall be provided with manual gear operators with position indicators.

2.4.6 Ball Valve

Full port design. Ball valves 1/2 inch and larger shall conform to MSS SP-72 or MSS SP-110 and shall be cast iron or bronze with threaded, soldered, or flanged ends. Valves 8 inches or larger shall be provided with manual gear operators with position indicators. Ball valves may be provided in lieu of gate valves.

2.4.7 Square Head Cocks

Provide copper alloy or cast-iron body with copper alloy plugs, suitable for 125 psig water working pressure.

2.4.8 Calibrated Balancing Valves

Copper alloy or cast iron body, copper alloy or stainless internal working parts. Provide valve calibrated so that flow can be determined when the temperature and pressure differential across valve is known. Valve shall have an integral pointer which registers the degree of valve opening. Valve shall function as a service valve when in fully closed position. Valve shall be constructed with internal seals to prevent leakage and shall be supplied with preformed insulation.

Provide valve bodies with tapped openings and pipe extensions with positive shutoff valves outside of pipe insulation. The pipe extensions shall be provided with quick connecting hose fittings for a portable differential pressure meter connections to verify the pressure differential. Provide metal tag on each valve showing the gallons per minute flow for each differential pressure reading.

2.4.9 Pump Discharge Valve

Valve shall perform the functions of a nonslam check valve, a manual balancing valve, and a shutoff. Valve shall be of cast iron or ductile iron construction with bronze and/or stainless steel accessories. Provide an integral pointer on the valve which registers the degree of valve opening. Flow through the valve shall be manually adjustable from bubble tight shutoff to full flow. Valves smaller than 2 inches shall have NPT connections. Valves 2 inches and larger shall have flanged end connections. Valve design shall allow the back seat for the stem to be replaced in the field under full line pressure.

2.4.10 Water Temperature Mixing Valve

Valve, ASSE 1017 for water service.

2.4.11 Water Temperature Regulating Valves

Provide copper alloy body, direct acting, pilot operated, for the intended service.

2.4.12 Water Pressure Reducing Valve

Valve, ASSE 1003 for water service, copper alloy body, automatic re-seating, with test lever.

2.4.13 Pressure Relief Valve

Valve shall prevent excessive pressure in the piping system when the piping system reaches its maximum heat buildup. Valve, ANSI Z21.22/CSA 4.4 and shall have cast iron bodies with corrosion resistant internal working parts. The discharge pipe from the relief valve shall be the size of the valve outlet unless otherwise indicated.

2.4.14 Combination Pressure and Temperature Relief Valves

ANSI Z21.22/CSA 4.4, copper alloy body, automatic re-seating, test lever, and discharge capacity based on AGA temperature steam rating.

2.4.15 Float Valve

Valve, CID A-A-50541, Style A (angle pattern) or Style B (globe pattern). Where float rods are extended for tank applications, extension shall be properly supported and guided to avoid bending of float rod or stressing of valve pilot linkage.

2.4.16 Drain Valves

Valves, MSS SP-80 gate valves. Valve shall be manually-operated, 3/4 inch pipe size and above with a threaded end connection. Provide valve with a water hose nipple adapter. Freeze-proof type valves shall be provided in installations exposed to freezing temperatures.

2.4.17 Air Venting Valves

Manually-operated general service type air venting valves, brass or bronze valves that are furnished with threaded plugs or caps. Air venting valves on water coils shall have not less than 1/8 inch threaded end connections. Air venting valves on water mains shall have not less than 3/4 inch threaded end connections. Air venting valves on all other applications shall have not less than 1/2 inch threaded end connections.

2.4.18 Vacuum Relief Valves

ANSI Z21.22/CSA 4.4

2.5 PIPING ACCESSORIES

2.5.1 Strainer

Strainer, ASTM F 1199, except as modified and supplemented in this

specification. Strainer shall be the cleanable, basket or "Y" type, the same size as the pipeline. Strainer bodies shall be fabricated of cast iron with bottoms drilled, and tapped. Provide blowoff outlet with pipe nipple, gate valve, and discharge pipe nipple. The bodies shall have arrows clearly cast on the sides indicating the direction of flow.

Provide strainer with removable cover and sediment screen. The screen shall be made of minimum 22 gauge brass sheet, monel, or corrosion-resistant steel, with small perforations numbering not less than 400 per square inch to provide a net free area through the basket of at least 3.30 times that of the entering pipe. The flow shall be into the screen and out through the perforations.

2.5.2 Cyclonic Separator

Metal- bodied, with removal capability of removing solids 45 microns/325 mesh in size and heavier than 1.20 specific gravity, maximum pressure drop of 5 psid, with cleanout connection.

2.5.3 Combination Strainer and Pump Suction Diffuser

Angle type body with removable strainer basket and internal straightening vanes, a suction pipe support, and a blowdown outlet and plug. Strainer shall be in accordance with ASTM F 1199, except as modified and supplemented by this specification. Unit body shall have arrows clearly cast on the sides indicating the direction of flow.

Strainer screen shall be made of minimum 22 gauge brass sheet, monel, or corrosion-resistant steel, with small perforations numbering not less than 400 per square inch to provide a net free area through the basket of at least 3.30 times that of the entering pipe. Flow shall be into the screen and out through the perforations. Provide an auxiliary disposable fine mesh strainer which shall be removed 30 days after start-up. Provide warning tag for operator indicating scheduled date for removal.

Casing shall have connection sizes to match pump suction and pipe sizes, and be provided with adjustable support foot or support foot boss to relieve piping strains at pump suction. Provide unit casing with blowdown port and plug. Provide a magnetic insert to remove debris from system.

2.5.4 Flexible Pipe Connectors

Provide flexible bronze or stainless steel piping connectors with single braid. Equip flanged assemblies with limit bolts to restrict maximum travel to the manufacturer's standard limits. Unless otherwise indicated, the length of the flexible connectors shall be as recommended by the manufacturer for the service intended. Internal sleeves or liners, compatible with circulating medium, shall be provided when recommended by the manufacturer. Provide covers to protect the bellows where indicated.

2.5.5 Pressure and Vacuum Gauges

Gauges, ASME B40.100 with throttling type needle valve or a pulsation dampener and shut-off valve. Provide gauges with 4.5 inch dial, brass or aluminum case, bronze tube, and siphon. Gauge shall have a minimum of with a range from 0 psig to approximately 1.5 times the maximum system working pressure. Each gauge range shall be selected so that at normal operating pressure, the needle is within the middle-third of the range.

2.5.6 Temperature Gauges

Temperature gauges, shall be the industrial duty type and be provided for the required temperature range. Provide gauges with fixed thread connection, dial face gasketed within the case; and an accuracy within 2 percent of scale range. Gauges shall have Fahrenheit scale in 2 degree graduations scale (black numbers) on a white face. The pointer shall be adjustable. Rigid stem type temperature gauges shall be provided in thermal wells located within 5 feet of the finished floor. Universal adjustable angle type or remote element type temperature gauges shall be provided in thermal wells located 5 to 7 feet above the finished floor or in locations indicated. Remote element type temperature gauges shall be provided in thermal wells located 7 feet above the finished floor or in locations indicated.

2.5.6.1 Stem Cased-Glass

Stem cased-glass case shall be polished stainless steel or cast aluminum, 9 inches long, with clear acrylic lens, and non-mercury filled glass tube with indicating-fluid column.

2.5.6.2 Bimetallic Dial

Bimetallic dial type case shall be not less than 3-1/2 inches, stainless steel, and shall be hermetically sealed with clear acrylic lens. Bimetallic element shall be silicone dampened and unit fitted with external calibrator adjustment.

2.5.6.3 Liquid-, Solid-, and Vapor-Filled Dial

Liquid-, solid-, and vapor-filled dial type cases shall be not less than 3-1/2 inches, stainless steel or cast aluminum with clear acrylic lens. Fill shall be nonmercury, suitable for encountered cross-ambients, and connecting capillary tubing shall be double-braided bronze.

2.5.6.4 Thermal Well

Thermal well shall be identical size, 1/2 or 3/4 inch NPT connection, brass or stainless steel. Where test wells are indicated, provide captive plug-fitted type 1/2 inch NPT connection suitable for use with either engraved stem or standard separable socket thermometer or thermostat. Mercury shall not be used in thermometers. Extended neck thermal wells shall be of sufficient length to clear insulation thickness by 1 inch.

2.5.7 Pipe Hangers, Inserts, and Supports

Pipe hangers, inserts, guides, and supports: to MSS SP-58 and MSS SP-69.

2.5.8 Escutcheons

Provide one piece or split hinge metal plates for piping entering floors, walls, and ceilings in exposed spaces. Secure plates in place by internal spring tension or set screws. Provide polished stainless steel plates or chromium-plated finish on copper alloy plates in finished spaces. Provide paint finish on metal plates in unfinished spaces.

2.6 PUMPS

Pumps shall be the electrically driven, non-overloading, centrifugal type

which conform to HI 1.1-1.2. Pumps shall be selected at or within 5 percent of peak efficiency. Pump curve shall rise continuously from maximum capacity to shutoff. Pump motor shall conform to NEMA MG 1, be open splash-proof, and have sufficient horsepower for the service required. Pump motor shall have the required capacity to prevent overloading with pump operating at any point on its characteristic curve. Pump speed shall not exceed 3,600 rpm, except where the pump head is less than 60 feet of water, the pump speed shall not exceed 1,750 rpm. Pump motor shall be equipped with an across-the-line magnetic controller in a NEMA 250, Type 1 enclosure with "START-STOP" switch in the cover.

2.6.1 Construction

Each pump casing shall be designed to withstand the discharge head specified plus the static head on system plus 50 percent of the total, but not less than 125 psig. Pump casing and bearing housing shall be close grained cast iron. High points in the casing shall be provided with manual air vents; low points shall be provided with drain plugs. Provide threaded suction and discharge pressure gage tapping with square-head plugs.

Impeller shall be statically and dynamically balanced. Impeller, impeller wearing rings, glands, casing wear rings, and shaft sleeve shall be bronze. Shaft shall be carbon or alloy steel, turned and ground. Bearings shall be ball-bearings, roller-bearings, or oil-lubricated bronze-sleeve type bearings, and be efficiently sealed or isolated to prevent loss of oil or entrance of dirt or water.

Pump and motor shall be mounted on a common cast iron base having lipped edges and tapped drainage openings or structural steel base with lipped edges or drain pan and tapped drainage openings. Pump shall be provided with steel shaft coupling guard. Base-mounted pump, coupling guard, and motor shall each be bolted to a fabricated steel base which shall have bolt holes for securing base to supporting surface. Close-coupled pump shall be provided with integrally cast or fabricated steel feet with bolt holes for securing feet to supporting surface. Close-coupled pumps shall be provided with drip pockets and tapped openings. Pump shall be accessible for servicing without disturbing piping connections. Shaft seals shall be mechanical-seals or stuffing-box type.

2.6.2 Mechanical Shaft Seals

Seals shall be single, inside mounted, end-face-elastomer bellows type with stainless steel spring, brass or stainless steel seal head, carbon rotating face, and tungsten carbide or ceramic sealing face. Glands shall be bronze and of the water-flush design to provide lubrication flush across the face of the seal. Bypass line from pump discharge to flush connection in gland shall be provided, with filter or cyclone particle separator in line.

2.6.3 Stuffing-Box Type Seals

Stuffing box shall include minimum 4 rows of square, impregnated TFE (Teflon) or graphite cord packing and a bronze split-lantern ring. Packing gland shall be bronze interlocking split type.

2.7 EXPANSION TANKS

Tank shall be welded steel, constructed for, and tested to pressure-temperature rating of 125 psi at 150 degrees F. Provide tanks precharged to the minimum operating pressure. Tank shall have a

replaceable polypropylene or butyl lined diaphragm which keeps the air charge separated from the water; shall be the captive air type.

Tanks shall accommodate expanded water of the system generated within the normal operating temperature range, limiting this pressure increase at all components in the system to the maximum allowable pressure at those components. Each tank air chamber shall be fitted with a drain, fill, an air charging valve, and system connections. Tank shall be supported by steel legs or bases for vertical installation or steel saddles for horizontal installations. The only air in the system shall be the permanent sealed-in air cushion contained within the expansion tank.

2.8 AIR SEPARATOR TANKS

External air separation tank shall have an internal design constructed of stainless steel and suitable for creating the required vortex and subsequent air separation. Tank shall be steel, constructed for, and tested to pressure-temperature rating of 125 psi at 150 degrees F. Tank shall have tangential inlets and outlets connections, threaded for 2 inches and smaller and flanged for sizes 2-1/2 inches and larger. Air released from a tank shall be to the atmosphere. Tank shall be provided with a blow-down connection.

Design to separate air from water and to direct released air to automatic air vent. Unit shall be of one piece cast-iron construction with internal baffles and two air chambers at top of unit; one air chamber shall have outlet to expansion tank and other air chamber shall be provided with automatic air release device. Tank shall be steel, constructed for, and tested to a ANSI Class 125 pressure-temperature rating.

2.9 ULTRASONIC FLOW METER

Provide clamp-on non-intrusive Ultrasonic Flowmeter for the chilled water distribution system. Provide wall mount NEMA 4X enclosure in mechanical room. Accuracy shall be 1%, +/- 0.5 for velocities greater than 1 feet per second. Repeatability shall be +/- 0.15% at 1 feet per second. The number of analog inputs / outputs shall be 4. Ultrasonic flow meter shall communicate and be compatible to DDC system. Wall mount shall have LCD display with backlight and keypad.

2.10 ELECTRICAL WORK

Provide motors, controllers, integral disconnects, contactors, and controls with their respective pieces of equipment, except controllers indicated as part of motor control centers. Provide electrical equipment, including motors and wiring, as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. 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, shall be provided. For packaged equipment, the manufacturer shall provide controllers including the required monitors and timed restart.

Provide high efficiency type, single-phase, fractional-horsepower alternating-current motors, including motors that are part of a system, in accordance with NEMA MG 11.

Provide polyphase, squirrel-cage medium induction motors, including motors that are part of a system, that meet the efficiency ratings for premium efficiency motors in accordance with NEMA MG 1. 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.

Motors shall be rated for continuous duty with the enclosure specified. Motor duty requirements shall allow for maximum frequency start-stop operation and minimum encountered interval between start and stop. Motor torque shall be 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. Motor bearings shall be fitted with grease supply fittings and grease relief to outside of the enclosure.

2.11 PAINTING OF NEW EQUIPMENT

New equipment painting shall be factory applied or shop applied, and shall be as specified herein, and provided under each individual section.

2.11.1 Factory Painting Systems

Manufacturer's standard factory painting systems may be provided. The factory painting system applied will withstand 125 hours in a salt-spray fog test, except that equipment located outdoors shall withstand 500 hours in a salt-spray fog test.

Salt-spray fog test shall be in accordance with ASTM B117, and for that test, the acceptance criteria shall be as follows: immediately after completion of the test, the paint shall show no signs of blistering, wrinkling, or cracking, and no loss of 0.125 inch on either side of the scratch mark. The film thickness of the factory painting system applied on the equipment shall not be less than the film thickness used on the test specimen.

If manufacturer's standard factory painting system is being proposed for use on surfaces subject to temperatures above 120 degrees F, the factory painting system shall be designed for the temperature service.

2.11.2 Shop Painting Systems for Metal Surfaces

Clean, retreat, 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 metal surfaces subject to temperatures in excess of 120 degrees F shall be cleaned to bare metal.

Where hot-dip galvanized steel has been cut, resulting surfaces with no galvanizing shall be coated with a zinc-rich coating conforming to ASTM D 520, Type I.

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. Color of finish coat shall be aluminum or light gray.

- a. Temperatures Less Than 120 Degrees F: Immediately after cleaning, the metal surfaces subject to temperatures less than 120 degrees F shall receive 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.

- b. Temperatures Between 120 and 400 degrees F: Metal surfaces subject to temperatures between 120 and 400 degrees F shall receive two coats of 400 degrees F heat-resisting enamel applied to a total minimum thickness of 2 mils.
- c. Temperatures Greater Than 400 degrees F: Metal surfaces subject to temperatures greater than 400 degrees F shall receive two coats of 600 degrees F heat-resisting paint applied to a total minimum dry film thickness of 2 mils.

2.12 FACTORY APPLIED INSULATION

Factory insulated items installed outdoors are not required to be fire-rated. As a minimum, factory insulated items installed indoors shall have a flame spread index no higher than 75 and a smoke developed index no higher than 150. Factory insulated items (no jacket) installed indoors and which are located in air plenums, in ceiling spaces, and in attic spaces shall have a flame spread index no higher than 25 and a smoke developed index no higher than 50. Flame spread and smoke developed indexes shall be determined by ASTM E 84.

Insulation shall be tested in the same density and installed thickness as the material to be used in the actual construction. Material supplied by a manufacturer with a jacket shall be tested as a composite material. Jackets, facings, and adhesives shall have a flame spread index no higher than 25 and a smoke developed index no higher than 50 when tested in accordance with ASTM E 84.

2.13 NAMEPLATES

Major equipment including pumps, pump motors, expansion tanks, and air separator tanks shall have the manufacturer's name, type or style, model or serial number on a plate secured to the item of equipment. The nameplate of the distributing agent will not be acceptable. Plates shall be durable and legible throughout equipment life and made of stainless steel. Plates shall be fixed in prominent locations with nonferrous screws or bolts.

2.14 RELATED COMPONENTS/SERVICES

2.14.1 Drain and Make-Up Water Piping

Make up water shall be connected to existing back flow preventor located in the mechanical room.

2.14.2 Field Applied Insulation

Requirements for field applied insulation is specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

2.14.3 Field Applied Insulation

Requirements for field installed insulation is specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS, except as supplemented and modified by this specification section.

2.14.4 Field Painting

Requirements for painting of surfaces not otherwise specified, and finish painting of items only primed at the factory, are specified in Section 09 90 00 PAINTS AND COATINGS.

2.14.4.1 Color Coding

Requirements for color coding for piping identification are specified in Section 09 90 00 PAINTS AND COATINGS.

PART 3 EXECUTION

3.1 INSTALLATION

Cut pipe accurately to measurements established at the jobsite, and work into place without springing or forcing, completely clearing all windows, doors, and other openings. Cutting or other weakening of the building structure to facilitate piping installation is not permitted without written approval. Cut pipe or tubing square, remove burrs by reaming, and fashion to permit free expansion and contraction without causing damage to the building structure, pipe, joints, or hangers.

Notify the Contracting Officer in writing at least 15 calendar days prior to the date the connections are required. Obtain approval before interrupting service. Furnish materials required to make connections into existing systems and perform excavating, backfilling, compacting, and other incidental labor as required. Furnish labor and tools for making actual connections to existing systems.

3.1.1 Welding

Provide welding work specified this section for piping systems in conformance with ASME B31.9, as modified and supplemented by this specification section and the accompanying drawings. The welding work includes: qualification of welding procedures, welders, welding operators, brazers, brazing operators, and nondestructive examination personnel; maintenance of welding records, and examination methods for welds.

3.1.1.1 Employer's Record Documents (For Welding)

Submit for review and approval the following documentation. This documentation and the subject qualifications shall be in compliance with ASME B31.9.

- a. List of qualified welding procedures that is proposed to be used to provide the work specified in this specification section.
- b. List of qualified welders, brazers, welding operators, and brazing operators that are proposed to be used to provide the work specified in this specification section.
- c. List of qualified weld examination personnel that are proposed to be used to provide the work specified in this specification section.

3.1.1.2 Welding Procedures and Qualifications

- a. Specifications and Test Results: Submit copies of the welding procedures specifications and procedure qualification test results for

each type of welding required. Approval of any procedure does not relieve the Contractor of the responsibility for producing acceptable welds. Submit this information on the forms printed in ASME BPVC SEC IX or their equivalent.

- b. Certification: Before assigning welders or welding operators to the work, submit a list of qualified welders, together with data and certification that each individual is performance qualified as specified. Do not start welding work prior to submitting welder, and welding operator qualifications. The certification shall state the type of welding and positions for which each is qualified, the code and procedure under which each is qualified, date qualified, and the firm and individual certifying the qualification tests.

3.1.1.3 Examination of Piping Welds

Conduct non-destructive examinations (NDE) on piping welds and brazing and verify the work meets the acceptance criteria specified in ASME B31.9. NDE on piping welds covered by ASME B31.9 is visual inspection only. Submit a piping welds NDE report meeting the requirements specified in ASME B31.9.

3.1.1.4 Welding Safety

Welding and cutting safety requirements shall be in accordance with AWS Z49.1.

3.1.2 Directional Changes

Make changes in direction with fittings, except that bending of pipe 4 inches and smaller is permitted, provided a pipe bender is used and wide weep bends are formed. Mitering or notching pipe or other similar construction to form elbows or tees is not permitted. The centerline radius of bends shall not be less than 6 diameters of the pipe. Bent pipe showing kinks, wrinkles, flattening, or other malformations is not acceptable.

3.1.3 Functional Requirements

Pitch horizontal supply mains down in the direction of flow as indicated. The grade shall not be less than 1 inch in 40 feet. Reducing fittings shall be used for changes in pipe sizes. Cap or plug open ends of pipelines and equipment during installation to keep dirt or other foreign materials out of the system.

Pipe not otherwise specified shall be uncoated. Connections to appliances shall be made with malleable iron unions for steel pipe 2-1/2 inches or less in diameter, and with flanges for pipe 3 inches and above in diameter. Connections between ferrous and copper piping shall be electrically isolated from each other with dielectric waterways or flanges.

Piping located in air plenums shall conform to NFPA 90A requirements. Pipe and fittings installed in inaccessible conduits or trenches under concrete floor slabs shall be welded. Equipment and piping arrangements shall fit into space allotted and allow adequate acceptable clearances for installation, replacement, entry, servicing, and maintenance. Electric isolation fittings shall be provided between dissimilar metals.

3.1.4 Fittings and End Connections

3.1.4.1 Threaded Connections

Threaded connections shall be made with tapered threads and made tight with PTFE tape complying with ASTM D 3308 or equivalent thread-joint compound applied to the male threads only. Not more than three threads shall show after the joint is made.

3.1.4.2 Brazed Connections

Brazing, AWS BRH, except as modified herein. During brazing, the pipe and fittings shall be filled with a pressure regulated inert gas, such as nitrogen, to prevent the formation of scale. Before brazing copper joints, both the outside of the tube and the inside of the fitting shall be cleaned with a wire fitting brush until the entire joint surface is bright and clean. Do not use brazing flux. Surplus brazing material shall be removed at all joints. Steel tubing joints shall be made in accordance with the manufacturer's recommendations. Piping shall be supported prior to brazing and not be sprung or forced.

3.1.4.3 Welded Connections

Branch connections shall be made with welding tees or forged welding branch outlets. Pipe shall be thoroughly cleaned of all scale and foreign matter before the piping is assembled. During welding, the pipe and fittings shall be filled with an inert gas, such as nitrogen, to prevent the formation of scale. Beveling, alignment, heat treatment, and inspection of weld shall conform to ASME B31.9. Weld defects shall be removed and rewelded at no additional cost to the Government. Electrodes shall be stored and dried in accordance with AWS D1.1/D1.1M or as recommended by the manufacturer. Electrodes that have been wetted or that have lost any of their coating shall not be used.

3.1.4.4 Flared Connections

When flared connections are used, a suitable lubricant shall be used between the back of the flare and the nut in order to avoid tearing the flare while tightening the nut.

3.1.4.5 Flanges and Unions

Except where copper tubing is used, union or flanged joints shall be provided in each line immediately preceding the connection to each piece of equipment or material requiring maintenance such as coils, pumps, control valves, and other similar items. Flanged joints shall be assembled square end tight with matched flanges, gaskets, and bolts. Gaskets shall be suitable for the intended application.

3.1.5 Valves

Isolation gate or ball valves shall be installed on each side of each piece of equipment, at the midpoint of all looped mains, and at any other points indicated or required for draining, isolating, or sectionalizing purpose. Isolation valves may be omitted where balancing cocks are installed to provide both balancing and isolation functions. Each valve except check valves shall be identified. Valves in horizontal lines shall be installed with stems horizontal or above.

3.1.6 Air Vents

Air vents shall be provided at all high points, on all water coils, and where indicated to ensure adequate venting of the piping system.

3.1.7 Drains

Drains shall be provided at all low points and where indicated to ensure complete drainage of the piping. Drains shall be accessible, and shall consist of nipples and caps or plugged tees unless otherwise indicated.

3.1.8 Flexible Pipe Connectors

Connectors shall be attached to components in strict accordance with the latest printed instructions of the manufacturer to ensure a vapor tight joint. Hangers, when required to suspend the connectors, shall be of the type recommended by the flexible pipe connector manufacturer and shall be provided at the intervals recommended.

3.1.9 Temperature Gauges

Temperature gauges shall be located on coolant supply and return piping at each heat exchanger, on condenser water piping entering and leaving a condenser, at each automatic temperature control device without an integral thermometer, and where indicated or required for proper operation of equipment. Thermal wells for insertion thermometers and thermostats shall extend beyond thermal insulation surface not less than 1 inch.

3.1.10 Pipe Hangers, Inserts, and Supports

Pipe hangers, inserts, and supports shall conform to MSS SP-58 and MSS SP-69, except as supplemented and modified in this specification section. Pipe hanger types 5, 12, and 26 shall not be used. Hangers used to support piping 2 inches and larger shall be fabricated to permit adequate adjustment after erection while still supporting the load. Piping subjected to vertical movement, when operating temperatures exceed ambient temperatures, shall be supported by variable spring hangers and supports or by constant support hangers.

3.1.10.1 Hangers

Type 3 shall not be used on insulated piping. Type 24 may be used only on trapeze hanger systems or on fabricated frames.

3.1.10.2 Inserts

Type 18 inserts shall be secured to concrete forms before concrete is placed. Continuous inserts which allow more adjustments may be used if they otherwise meet the requirements for Type 18 inserts.

3.1.10.3 C-Clamps

Type 19 and 23 C-clamps shall be torqued per MSS SP-69 and have both locknuts and retaining devices, furnished by the manufacturer. Field-fabricated C-clamp bodies or retaining devices are not acceptable.

3.1.10.4 Angle Attachments

Type 20 attachments used on angles and channels shall be furnished with an

added malleable-iron heel plate or adapter.

3.1.10.5 Saddles and Shields

Where Type 39 saddle or Type 40 shield are permitted for a particular pipe attachment application, the Type 39 saddle, connected to the pipe, shall be used on all pipe 4 inches and larger when the temperature of the medium is 60 degrees F or higher. Type 40 shields shall be used on all piping less than 4 inches and all piping 4 inches and larger carrying medium less than 60 degrees F. A high density insulation insert of cellular glass shall be used under the Type 40 shield for piping 2 inches and larger.

3.1.10.6 Horizontal Pipe Supports

Horizontal pipe supports shall be spaced as specified in MSS SP-69 and a support shall be installed not over 1 foot from the pipe fitting joint at each change in direction of the piping. Pipe supports shall be spaced not over 5 feet apart at valves. Pipe hanger loads suspended from steel joist with hanger loads between panel points in excess of 50 pounds shall have the excess hanger loads suspended from panel points.

3.1.10.7 Vertical Pipe Supports

Vertical pipe shall be supported at each floor, except at slab-on-grade, and at intervals of not more than 15 feet, not more than 8 feet from end of risers, and at vent terminations.

3.1.10.8 Pipe Guides

Type 35 guides using, steel, reinforced polytetrafluoroethylene (PTFE) or graphite slides shall be provided where required to allow longitudinal pipe movement. Lateral restraints shall be provided as required. Slide materials shall be suitable for the system operating temperatures, atmospheric conditions, and bearing loads encountered.

3.1.10.9 Steel Slides

Where steel slides do not require provisions for restraint of lateral movement, an alternate guide method may be used. On piping 4 inches and larger, a Type 39 saddle shall be used. On piping under 4 inches, a Type 40 protection shield may be attached to the pipe or insulation and freely rest on a steel slide plate.

3.1.10.10 Multiple Pipe Runs

In the support of multiple pipe runs on a common base member, a clip or clamp shall be used where each pipe crosses the base support member. Spacing of the base support members shall not exceed the hanger and support spacing required for an individual pipe in the multiple pipe run.

3.1.10.11 Structural Attachments

Attachment to building structure concrete and masonry shall be by cast-in concrete inserts, built-in anchors, or masonry anchor devices. Inserts and anchors shall be applied with a safety factor not less than 5. Supports shall not be attached to metal decking. Supports shall not be attached to the underside of concrete filled floors or concrete roof decks unless approved by the Contracting Officer. Masonry anchors for overhead applications shall be constructed of ferrous materials only. Structural

steel brackets required to support piping, headers, and equipment, but not shown, shall be provided under this section. Material used for support shall be as specified under Section 05 12 00 STRUCTURAL STEEL.

3.1.11 Pipe Alignment Guides

Pipe alignment guides shall be provided where indicated for expansion loops, offsets, and bends and as recommended by the manufacturer for expansion joints, not to exceed 5 feet on each side of each expansion joint, and in lines 4 inches or smaller not more than 2 feet on each side of the joint.

3.1.12 Pipe Anchors

Anchors shall be provided where indicated. Unless indicated otherwise, anchors shall comply with the requirements specified. Anchors shall consist of heavy steel collars with lugs and bolts for clamping and attaching anchor braces, unless otherwise indicated. Anchor braces shall be installed in the most effective manner to secure the desired results using turnbuckles where required.

Supports, anchors, or stays shall not be attached where they will injure the structure or adjacent construction during installation or by the weight of expansion of the pipeline. Where pipe and conduit penetrations of vapor barrier sealed surfaces occur, these items shall be anchored immediately adjacent to each penetrated surface, to provide essentially zero movement within penetration seal.

3.1.13 Building Surface Penetrations

Sleeves shall not be installed in structural members except where indicated or approved. Except as indicated otherwise piping sleeves shall comply with requirements specified. Sleeves in nonload bearing surfaces shall be galvanized sheet metal, conforming to ASTM A653/A653M, Coating Class G-90, 20 gauge. Sleeves in load bearing surfaces shall be uncoated carbon steel pipe, conforming to ASTM A53/A53M, Schedule 30. Sealants shall be applied to moisture and oil-free surfaces and elastomers to not less than 1/2 inch depth. Sleeves shall not be installed in structural members.

3.1.13.1 General Service Areas

Each sleeve shall extend through its respective wall, floor, or roof, and shall be cut flush with each surface. Pipes passing through concrete or masonry wall or concrete floors or roofs shall be provided with pipe sleeves fitted into place at the time of construction. Sleeves shall be of such size as to provide a minimum of 1/4 inch all-around clearance between bare pipe and sleeves or between jacketed-insulation and sleeves. Except in pipe chases or interior walls, the annular space between pipe and sleeve or between jacket over-insulation and sleeve shall be sealed in accordance with Section 07 92 00 JOINT SEALANTS.

3.1.13.2 Waterproof Penetrations

Pipes passing through roof or floor waterproofing membrane shall be installed through a .17 ounce copper sleeve, or a 0.032 inch thick aluminum sleeve, each within an integral skirt or flange.

Flashing sleeve shall be suitably formed, and skirt or flange shall extend not less than 8 inches from the pipe and be set over the roof or floor

membrane in a troweled coating of bituminous cement. The flashing sleeve shall extend up the pipe a minimum of 2 inches above the roof or floor penetration. The annular space between the flashing sleeve and the bare pipe or between the flashing sleeve and the metal-jacket-covered insulation shall be sealed as indicated. Penetrations shall be sealed by either one of the following methods.

- a. Waterproofing Clamping Flange: Pipes up to and including 10 inches in diameter passing through roof or floor waterproofing membrane may be installed through a cast iron sleeve with caulking recess, anchor lugs, flashing clamp device, and pressure ring with brass bolts. Waterproofing membrane shall be clamped into place and sealant shall be placed in the caulking recess.
- b. Modular Mechanical Type Sealing Assembly: In lieu of a waterproofing clamping flange, a modular mechanical type sealing assembly may be installed. Seals shall consist of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe/conduit and sleeve with corrosion protected carbon steel bolts, nuts, and pressure plates. Links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and each nut.

After the seal assembly is properly positioned in the sleeve, tightening of the bolt shall cause the rubber sealing elements to expand and provide a watertight seal between the pipe/conduit and the sleeve. Each seal assembly shall be sized as recommended by the manufacturer to fit the pipe/conduit and sleeve involved. The Contractor electing to use the modular mechanical type seals shall provide sleeves of the proper diameters.

3.1.13.3 Fire-Rated Penetrations

Penetration of fire-rated walls, partitions, and floors shall be sealed.

3.1.13.4 Escutcheons

Finished surfaces where exposed piping, bare or insulated, pass through floors, walls, or ceilings, except in boiler, utility, or equipment rooms, shall be provided with escutcheons. Where sleeves project slightly from floors, special deep-type escutcheons shall be used. Escutcheon shall be secured to pipe or pipe covering.

3.1.14 Access Panels

Access panels shall be provided where indicated for all concealed valves, vents, controls, and additionally for items requiring inspection or maintenance. Access panels shall be of sufficient size and located so that the concealed items may be serviced and maintained or completely removed and replaced.

3.2 ELECTRICAL INSTALLATION

Install electrical equipment in accordance with NFPA 70 and manufacturers instructions.

3.3 CLEANING AND ADJUSTING

Pipes shall be cleaned free of scale and thoroughly flushed of all foreign matter. A temporary bypass shall be provided for all water coils to prevent flushing water from passing through coils. Strainers and valves shall be thoroughly cleaned. Prior to testing and balancing, air shall be removed from all water systems by operating the air vents. Temporary measures, such as piping the overflow from vents to a collecting vessel shall be taken to avoid water damage during the venting process. Air vents shall be plugged or capped after the system has been vented. Control valves and other miscellaneous equipment requiring adjustment shall be adjusted to setting indicated or directed.

3.4 FIELD TESTS

Field tests shall be conducted in the presence of the QC Manager or his designated representative to verify systems compliance with specifications. Any material, equipment, instruments, and personnel required for the test shall be provided by the Contractor.

3.4.1 Equipment and Component Isolation

Prior to testing, equipment and components that cannot withstand the tests shall be properly isolated.

3.4.2 Pressure Tests

Each piping system shall be hydrostatically tested at a pressure not less than 188 psig for period of time sufficient to inspect every joint in the system and in no case less than 2 hours. Test pressure shall be monitored by a currently calibrated test pressure gauge. Leaks shall be repaired and piping retested until test requirements are met. No leakage or reduction in gage pressure shall be allowed.

Leaks shall be repaired by rewelding or replacing pipe or fittings. Caulking of joints will not be permitted. Concealed and insulated piping shall be tested in place before concealing.

Submit for approval pressure tests reports covering the above specified piping pressure tests; describe the systems tested, test results, defects found and repaired, and signature of the pressure tests' director. Obtain approval from the QC Manager before concealing piping or applying insulation to tested and accepted piping.

3.4.3 Related Field Inspections and Testing

3.4.3.1 Piping Welds

Examination of Piping Welds is specified in the paragraph above entitled "Examination of Piping Welds".

3.4.3.2 HVAC TAB

Requirements for testing, adjusting, and balancing (TAB) of HVAC water piping, and associated equipment is specified in Section 23 05 93 TESTING, ADJUSTING, AND BALANCING FOR HVAC. Coordinate with the TAB team, and provide support personnel and equipment as specified in Section 23 05 93 TESTING, ADJUSTING AND BALANCING FOR HVAC to assist TAB team to meet the TAB work requirements.

3.5 INSTRUCTION TO GOVERNMENT PERSONNEL

Furnish the services of competent instructors to give full instruction to the designated Government personnel in the adjustment, operation, and maintenance, including pertinent safety requirements, of the chilled water. Instructors shall be thoroughly familiar with all parts of the installation and shall be instructed in operating theory as well as practical operation and maintenance work. Submit a for approval. The lesson plan and instruction course shall be based on the approved operation and maintenance data and maintenance manuals.

Conduct a training course for the operating staff and maintenance staff selected by the Contracting Officer. Give the instruction 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 1 man-day. Use approximately half of the time for classroom instruction and the other time for instruction at the location of equipment or system.

When significant changes or modifications in the equipment or system are made under the terms of the contract, provide additional instruction to acquaint the operating personnel with the changes or modifications.

-- End of Section --

SECTION 23 81 00.00 20

UNITARY AIR CONDITIONING EQUIPMENT

11/09

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-CONDITIONING, HEATING AND REFRIGERATION INSTITUTE (AHRI)

AHRI DCUP (Online) Directory of Certified Unitary Products

ANSI/AHRI 210/240 (2008) Performance Rating of Unitary Air-Conditioning & Air-Source Heat Pump Equipment

ANSI/AHRI 340/360 (2007) Performance Rating of Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment

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

ANSI/ASHRAE 15 & 34 (2010; Addenda a, b, c, d, e, f, g, h, and i) ANSI/ASHRAE Standard 15-Safety Standard for Refrigeration Systems and ANSI/ASHRAE Standard 34-Designation and Safety Classification of Refrigerants

ASHRAE 52.2 (2010; Errata 2010) Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size

ASHRAE 55 (2010; INT 3 2010; Errata 1 2010; Errata 2 2011; Errata 3 2011; Errata 4 2011) Thermal Environmental Conditions for Human Occupancy

ASHRAE 62.1 (2010; Errata 2011) Ventilation for Acceptable Indoor Air Quality

AMERICAN WELDING SOCIETY (AWS)

AWS A5.8/A5.8M (2004) Specification for Filler Metals for Brazing and Braze Welding

ASME INTERNATIONAL (ASME)

ASME B16.22 (2001; R 2010) Standard for Wrought Copper and Copper Alloy Solder Joint Pressure Fittings

ASME B31.5 (2010) Refrigeration Piping and Heat Transfer Components

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M (2009) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM B117 (2009) Standing Practice for Operating Salt Spray (Fog) Apparatus

ASTM B280 (2008) Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service

ASTM B88 (2009) Standard Specification for Seamless Copper Water Tube

ASTM C534/C534M (2008) Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form

ASTM D 1654 (2008) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments

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

MSS SP-58 (2009) Pipe Hangers and Supports - Materials, Design and Manufacture, Selection, Application, and Installation

MSS SP-69 (2003) Pipe Hangers and Supports - Selection and Application (ANSI Approved American National Standard)

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 1 (2000; R 2005; R 2008) Standard for Industrial Control and Systems: General Requirements

NEMA ICS 2 (2000; R 2005; Errata 2008) Standard for Controllers, Contactors, and Overload Relays Rated 600 V

NEMA ICS 6 (1993; R 2006) Enclosures

NEMA MG 1 (2009) Motors and Generators

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS OO-A-373 (Rev D) Air Conditioners, Single Package Type

FS OO-A-374 (Rev C) Air Conditioners with Remote

Condensing Units or Remote Air-Cooled, and
Water-Cooled Condenser Units, Unitary

UNDERWRITERS LABORATORIES (UL)

- UL 109 (1997; Reprint May 2009) Tube Fittings for Flammable and Combustible Fluids, Refrigeration Service, and Marine Use
- UL 900 (2004; Reprint Nov 2009) Standard for Air Filter Units

1.2 RELATED REQUIREMENTS

Section 23 03 00.00 20 BASIC MECHANICAL MATERIALS AND METHODS, applies to this section with the additions and modifications specified herein.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for A/E approval. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

- Field-assembled refrigerant piping
- Control system wiring diagrams

SD-03 Product Data

- Air conditioners
- Filters
- Refrigerant piping and accessories
- Coatings for finned tube coils

SD-06 Test Reports

- Salt-spray tests
- Start-up and initial operational tests

SD-08 Manufacturer's Instructions

- Air conditioners
- Refrigerant piping and accessories

SD-10 Operation and Maintenance Data

- Air conditioners, Data Package 3

Submit in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

SD-11 Closeout Submittals

Posted operating instructions

1.4 QUALITY ASSURANCE

1.4.1 Modification of References

Accomplish work in accordance with the referenced publications, except as modified by this section. Consider the advisory or recommended provisions to be mandatory, as though the word "shall" had been substituted for the words "should" or "could" or "may," wherever they appear. Interpret reference to "the Authority having jurisdiction," "the Administrative Authority," "the Owner," or "the Design Engineer" to mean the Contracting Officer.

1.4.2 Detail Drawing

For refrigerant piping, submit piping, including pipe sizes. Submit control system wiring diagrams.

1.4.3 Safety

Design, manufacture, and installation of unitary air conditioning equipment shall conform to ANSI/ASHRAE 15 & 34.

1.4.4 Posted Operating Instructions

Submit posted operating instructions for each packaged air conditioning unit.

1.4.5 Sizing

Size equipment based on Design Manual CS from the Air Conditioning Contractors of America; do not oversize.

1.5 REFRIGERANTS

Refrigerants shall have an Ozone Depletion Factor (ODF) of 0.05 or less. The ODF shall be in accordance with the "Montreal Protocol On Substances That Deplete The Ozone Layer," September 1987, sponsored by the United Nations Environment Programme. CFCs shall not be permitted. Refrigerant shall be an approved alternative refrigerant per EPA's Significant New Alternative Policy (SNAP) listing.

1.6 ENVIRONMENTAL REQUIREMENTS

For proper Indoor Environmental Quality, maintain positive pressure within the building. Ventilation shall meet or exceed ASHRAE 62.1 and all published addenda. Meet or exceed filter media efficiency as tested in accordance with ASHRAE 52.2. Thermal comfort shall meet or exceed ASHRAE 55.

PART 2 PRODUCTS

2.1 AIR CONDITIONERS

2.1.1 Split-System Type

FS OO-A-374, except as modified herein; Provide wall mounted indoor unit..

Additional requirements for various system components are specified in this paragraph; however, basic requirements for the system and system components are contained in FS OO-A-374. Provide separate assemblies designed to be used together. Base ratings on the use of matched assemblies. Provide performance diagrams for units with capacities not certified by ARI to verify that components of the air conditioning system furnished will satisfy the capacity requirement specified or indicated. Unit shall have a minimum SEER16 when tested in accordance with ANSI/AHRI 210/240 or ANSI/AHRI 340/360 as applicable. List units with capacities smaller than 135,000 Btu/hr in the AHRI DCUP; in lieu of listing in the ARI Directory, a letter of certification from ARI that units have been certified and will be listed in the next Directory will be acceptable. Provide capacity, electrical characteristics and operating conditions as indicated.

Unit shall be "cooling only" and be used to condition the existng telecom room.

2.1.2 Wall mounted Single Zone Units

Provide single zone type units arranged to draw through coil sections. Provide wireless remote controller.

2.1.3 Compressors

For compressors over 20 tons, compressor speed shall not exceed 3450 rpm. For systems over 10 tons provide automatic capacity reduction of at least 50 percent of rated capacity. Capacity reduction may be accomplished by cylinder unloading, use of multi- or variable speed compressors, use of multiple, but not more than four compressors, or a combination of the two methods. Units with cylinder unloading shall start with capacity reduction devices in the unloaded position. Units with multiple compressors shall have means to sequence starting of compressors. Provide compressors with devices to prevent short cycling when shut down by safety controls. Device shall delay operation of compressor motor for at least 3 minutes but not more than 6 minutes. Provide a pumpdown cycle for units 20 tons and over. Provide reciprocating compressors with crankcase heaters in accordance with the manufacturer's recommendations. If compressors are paralleled, provide not less than two independent circuits.

2.1.4 Coils

On coils with all-aluminum construction, provide tubes of aluminum alloy 1100, 1200, or 3102; provide fins of aluminum alloy 7072; and provide tube sheets of aluminum alloy 7072 or 5052. Provide a separate air cooled condenser circuit for each compressor or parallel compressor installation. Provide a coating on condenser coils and fins as specified in the paragraph entitled "Coatings for Finned Tube Coils." Coils to be coated shall be part of manufacturer's standard product for capacities and ratings indicated and specified. Provide plate type fins.

2.1.5 Condenser Controls

Provide start-up and head pressure controls to allow for system operation at ambient temperatures down to 24 degrees F.

2.2 FILTERS

Provide filters to filter return air and locate inside air conditioners Provide cleanable (reusable) type. Filters shall conform to UL 900, Class

1 or Class 2.

2.3 COATINGS FOR FINNED TUBE COILS

Where stipulated in equipment specifications of this section, coat finned tube coils of the affected equipment as specified below. Apply coating at the premises of a company specializing in such work. Degrease and prepare for coating in accordance with the coating applicator's procedures for the type of metals involved. Completed coating shall show no evidence of softening, blistering, cracking, crazing, flaking, loss of adhesion, or "bridging" between the fins.

2.3.1 Phenolic Coating

Provide a resin base thermosetting phenolic coating. Apply coating by immersion dipping of the entire coil. Provide a minimum of two coats. Bake or heat dry coils following immersions. After final immersion and prior to final baking, spray entire coil with particular emphasis given to building up coating on sheared edges. Total dry film thickness shall be 2.5 to 3.0 mils.

2.4 MOTORS AND STARTERS

NEMA MG 1, NEMA ICS 1, and NEMA ICS 2. Variable speed. Motors less than 1 hp shall meet NEMA High Efficiency requirements. Motors 1 hp and larger shall meet NEMA Premium Efficiency requirements. Determine specific motor characteristics to ensure provision of correctly sized starters and overload heaters. Provide motors to operate at full capacity with a voltage variation of plus or minus 10 percent of the motor voltage rating. Motor size shall be sufficient for the duty to be performed and shall not exceed its full load nameplate current rating when driven equipment is operated at specified capacity under the most severe conditions likely to be encountered. When motor size provided differs from size indicated or specified, the Contractor shall make the necessary adjustments to the wiring, disconnect devices, and branch circuit protection to accommodate equipment actually provided. Provide reduced voltage type motor starters. Provide general-purpose type starter enclosures in accordance with NEMA ICS 6.

2.5 REFRIGERANT PIPING AND ACCESSORIES

Provide accessories as specified in FS OO-A-373 and this section. Provide suction line accumulators as recommended by equipment manufacturer's installation instructions. Provide a filter-drier in the liquid line.

2.5.1 Factory Charged Tubing

Provide extra soft, deoxidized, bright annealed copper tubing conforming to ASTM B280, factory dehydrated and furnished with a balanced charge of refrigerant recommended by manufacturer of equipment being connected. Factory insulate suction line tubing with 3/8 inch minimum thickness of closed cell, foamed plastic conforming to ASTM C534/C534M with a permeance rating not to exceed 1.0. Provide quick-connectors with caps or plugs to protect couplings. Include couplings for suction and liquid line connections of the indoor and outdoor sections.

2.5.2 Field-Assembled Refrigerant Piping

Material and dimensional requirements for field-assembled refrigerant

pipng, valves, fittings, and accessories shall conform to ANSI/ASHRAE 15 & 34 and ASME B31.5, except as herein specified. Factory clean, dehydrate, and seal piping before delivery to the project location. Provide seamless copper tubing, hard drawn, Type K or L, conforming to ASTM B88, except that tubing with outside diameters of 1/4 inch and 3/8 inch shall have nominal wall thickness of not less than 0.030 inch and 0.032 inch, respectively. Soft annealed copper tubing conforming to ASTM B280 may be used where flare connections to equipment are required only in nominal sizes less than one inch outside diameter.

2.5.3 Fittings

ASME B16.22 for solder-joint fittings. UL 109 for flared tube fittings.

2.5.4 Brazing Filler Material

AWS A5.8/A5.8M.

2.5.5 Pipe Hangers and Supports

MSS SP-69 and MSS SP-58, except as indicated otherwise.

2.5.6 Pipe Sleeves

Provide sleeves where piping passes through walls, floors, roofs, and partitions. Secure sleeves in proper position and location during construction. Provide sleeves of sufficient length to pass through entire thickness of walls, floors, roofs, and partitions. Provide not less than 0.25 inch space between exterior of piping or pipe insulation and interior of sleeve. Firmly pack space with insulation and caulk at both ends of the sleeve with plastic waterproof cement which will dry to a firm but pliable mass, or provide a segmented elastomeric seal.

2.5.6.1 Sleeves in Masonry and Concrete Walls, Floors, and Roofs

Provide Schedule 40 or Standard Weight zinc-coated steel pipe sleeves. Extend sleeves in floor slabs 3 inches above finished floor.

2.5.6.2 Sleeves in Partitions and Non-Masonry Structures

Provide zinc-coated steel sheet sleeves having a nominal weight of not less than 0.90 pound per square foot, in partitions and other than masonry and concrete walls, floors, and roofs.

2.6 FINISHES

Provide steel surfaces of equipment including packaged terminal units, heat pumps, and air conditioners, that do not have a zinc coating conforming to ASTM A123/A123M, or a duplex coating of zinc and paint, with a factory applied coating or paint system. Provide a coating or paint system on actual equipment identical to that on salt-spray test specimens with respect to materials, conditions of application, and dry-film thickness.

2.7 SOURCE QUALITY CONTROL

2.7.1 Salt-Spray Tests

Salt-spray test the factory-applied coating or paint system of equipment including packaged terminal units, heat pumps, and air conditioners in

accordance with ASTM B117. Conduct test for 3000 hours for equipment installed outdoors, or 125 hours for equipment installed indoors. Test specimens shall have a standard scribe mark as defined in ASTM D 1654. Upon completion of exposure, evaluate and rate the coating or paint system in accordance with procedures A and B of ASTM D 1654. Rating of failure at the scribe mark shall not be less than six, average creepage not greater than 1/8 inch. Rating of the unscribed area shall not be less than 10, no failure.

PART 3 EXECUTION

3.1 EQUIPMENT INSTALLATION

Install equipment and components in a manner to ensure proper and sequential operation of equipment and equipment controls. Install equipment not covered in this section, or in manufacturer's instructions, as recommended by manufacturer's representative. Provide proper foundations for mounting of equipment, accessories, appurtenances, piping and controls including, but not limited to, supports, vibration isolators, stands, guides, anchors, clamps and brackets. Foundations for equipment shall conform to equipment manufacturer's recommendation, unless otherwise indicated. Set anchor bolts and sleeves using templates. Provide anchor bolts of adequate length, and provide with welded-on plates on the head end embedded in the concrete. Level equipment bases, using jacks or steel wedges, and neatly grout-in with a nonshrinking type of grouting mortar. Locate equipment to allow working space for servicing including shaft removal, disassembling compressor cylinders and pistons, replacing or adjusting drives, motors, or shaft seals, access to water heads and valves of shell and tube equipment, tube cleaning or replacement, access to automatic controls, refrigerant charging, lubrication, oil draining and working clearance under overhead lines. Provide electric isolation between dissimilar metals for the purpose of minimizing galvanic corrosion.

3.1.1 Unitary Air Conditioning System

Install as indicated, in accordance with requirements of ANSI/ASHRAE 15 & 34, and the manufacturer's installation and operational instructions.

3.2 PIPING

Brazing, bending, forming and assembly of refrigerant piping shall conform to ASME B31.5.

3.2.1 Pipe Hangers and Supports

Design and fabrication of pipe hangers, supports, and welding attachments shall conform to MSS SP-58. Installation of hanger types and supports for bare and covered pipes shall conform to MSS SP-69 for the system temperature range. Unless otherwise indicated, horizontal and vertical piping attachments shall conform to MSS SP-58.

3.2.2 Refrigerant Piping

Cut pipe to measurements established at the site and work into place without springing or forcing. Install piping with sufficient flexibility to provide for expansion and contraction due to temperature fluctuation. Where pipe passes through building structure pipe joints shall not be concealed, but shall be located where they may be readily inspected. Install piping to be insulated with sufficient clearance to permit

application of insulation. Install piping as indicated and detailed, to avoid interference with other piping, conduit, or equipment. Except where specifically indicated otherwise, run piping plumb and straight and parallel to walls and ceilings. Trapping of lines will not be permitted except where indicated. Provide sleeves of suitable size for lines passing through building structure. Braze refrigerant piping with silver solder complying with AWS A5.8/A5.8M. Inside of tubing and fittings shall be free of flux. Clean parts to be jointed with emery cloth and keep hot until solder has penetrated full depth of fitting and extra flux has been expelled. Cool joints in air and remove flame marks and traces of flux. During brazing operation, prevent oxide film from forming on inside of tubing by slowly flowing dry nitrogen through tubing to expel air. Make provisions to automatically return oil on halocarbon systems. Installation of piping shall comply with ASME B31.5.

3.2.3 Returning Oil From Refrigerant System

Install refrigerant lines so that gas velocity in the evaporator suction line is sufficient to move oil along with gas to the compressor. Where equipment location requires vertical risers, line shall be sized to maintain sufficient velocity to lift oil at minimum system loading and corresponding reduction of gas volume. Install a double riser when excess velocity and pressure drop would result from full system loading. Larger riser shall have a trap, of minimum volume, obtained by use of 90- and 45-degree ells. Arrange small riser with inlet close to bottom of horizontal line, and connect to top of upper horizontal line. Do not install valves in risers.

3.2.4 Refrigerant Driers, Sight Glass Indicators, and Strainers

Provide refrigerant driers, sight glass liquid indicators, and strainers in refrigerant piping in accordance with FS OO-A-373 when not furnished by the manufacturer as part of the equipment. Install driers in liquid line with service valves and valved bypass line the same size as liquid line in which dryer is installed. Size of driers shall be determined by piping and installation of the unit on location. Install dryers of 50 cubic inches and larger vertically with the cover for removing cartridge at the bottom. Install moisture indicators in the liquid line downstream of the drier. Indicator connections shall be the same size as the liquid line in which it is installed.

3.3 ACCESS PANELS

Provide access panels for concealed valves, controls, dampers, and other fittings requiring inspection and maintenance.

3.4 AIR FILTERS

Allow access space for servicing filters. Install filters with suitable sealing to prevent bypassing of air.

3.5 FLASHING AND PITCH POCKETS

Provide flashing and pitch pockets for equipment supports and roof penetrations and flashing where piping or ductwork passes through exterior walls in accordance with Section 07 60 00 FLASHING AND SHEET METAL.

3.6 IDENTIFICATION TAGS AND PLATES

Provide equipment, gages, thermometers, valves, and controllers with tags numbered and stamped for their use. Provide plates and tags of brass or suitable nonferrous material, securely mounted or attached. Provide minimum letter and numeral size of 1/8 inch high.

3.7 FIELD QUALITY CONTROL

3.7.1 Leak Testing

Upon completion of installation of air conditioning equipment, test factory- and field-installed refrigerant piping with an electronic-type leak detector. Use same type of refrigerant to be provided in the system for leak testing. When nitrogen is used to boost system pressure for testing, ensure that it is eliminated from the system before charging. Minimum refrigerant leak field test pressure shall be as specified in ANSI/ASHRAE 15 & 34, except that test pressure shall not exceed 150 psig on hermetic compressors unless otherwise specified as a low side test pressure on the equipment nameplate. If leaks are detected at time of installation or during warranty period, remove the entire refrigerant charge from the system, correct leaks, and retest system.

3.7.2 Evacuation, Dehydration, and Charging

After field charged refrigerant system is found to be without leaks or after leaks have been repaired on field-charged and factory-charged systems, evacuate the system using a reliable gage and a vacuum pump capable of pulling a vacuum of at least one mm Hg absolute. Evacuate system in accordance with the triple-evacuation and blotter method or in accordance with equipment manufacturer's printed instructions and recharge system.

3.7.3 Start-Up and Initial Operational Tests

Test the air conditioning systems and systems components for proper operation. Adjust safety and automatic control instruments as necessary to ensure proper operation and sequence. Conduct operational tests for not less than 8 hours.

-- End of Section --

SECTION 23 82 00.00 20

TERMINAL HEATING AND COOLING UNITS

11/08

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 33 (2000) Method of Testing Forced Circulation Air Cooling and Air Heating Coils

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M (2009) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM B117 (2009) Standard Practice for Operating Salt Spray (Fog) Apparatus

ASTM D 1654 (2008) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 2 (2000; R 2005; Errata 2008) Standard for Controllers, Contactors, and Overload Relays Rated 600 V

NEMA ICS 6 (1993; R 2006) Enclosures

NEMA MG 1 (2009) Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 211 (2010) Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances

NFPA 54 (2009; TIA 10-3) National Fuel Gas Code

NFPA 70 (2011; TIA 11-1; Errata 2011) National Electrical Code

NFPA 90A (2012) Standard for the Installation of Air Conditioning and Ventilating Systems

NFPA 90B (2012) Standard for the Installation of Warm Air Heating and Air Conditioning

Systems

NFPA 91 (2010) Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists and Noncombustible Particulate Solids

1.2 RELATED REQUIREMENTS

Section 23 03 00.00 20 BASIC MECHANICAL MATERIALS AND METHODS, applies to this section with additions and modifications specified herein.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for A/E approval. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Unit heaters

SD-10 Operation and Maintenance Data

Unit heaters, Data Package 2

Submit in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

PART 2 PRODUCTS

2.1 UNIT HEATERS

Self-contained and factory assembled, propeller fan with capacities expressed as Btu per hour output and cubic foot-per-minute air delivery, operating conditions, and mounting arrangements as indicated. Average fan bearing life shall be minimum 200,000 hours at operating conditions. Provide fan motor with direct or belt drive. Construct fan-guard motor mount of steel wire. Equip each heater with individually adjustable package discharge louver. Louvers may be substituted by discharge cones or diffusers. Provide thermostats as indicated. Furnish circuit breaker disconnect switch.

2.1.1 Hot-Water Unit Heater

ASHRAE 33 tested for heating coils; UL listed for motor and controls.

2.1.1.1 Casing

Minimum 20 gage steel with removable access panels or means to remove, service, and maintain major components.

2.1.1.2 Coil

Fin-and-tube coil constructed of copper tubes and aluminum fins. Use maximum design pressure of hot water at minimum 150 psig and minimum 300 degrees F.

2.1.1.3 Controls

Automatic controls of on-off-auto as indicated.

2.2 FAN

Provide aluminum fans with ball or roller bearings for motors over 1/8 horsepower (hp) and sleeve bearings for motors 1/8 hp and under. Provide sleeve bearings with oil reservoir, if not permanently lubricated.

2.3 MOTOR AND STARTER

NEMA MG 1, and NEMA ICS 2, and NEMA ICS 6, respectively. Provide continuous-duty motor with built-in automatic reset thermal overload protection. For motor 1/2 hp and larger, use three-phase. Provide single-phase motor of permanent split capacitor or capacitor start. Limit motor speed at 1800 r/min. Wire motor to heater power supply source.

2.4 HOT WATER PIPING SYSTEM

Section 23 21 13.00 20 LOW TEMPERATURE WATER LTW HEATING SYSTEMS.

2.5 STEAM AND CONDENSATE PIPING SYSTEM

Section 23 22 26.00 20 STEAM SYSTEM AND TERMINAL UNITS.

2.6 SOURCE QUALITY CONTROL

Special protection is not required for equipment that has a zinc coating conforming to \&ASTM A123/A123M&\. Otherwise, protect affected equipment items by manufacturers' corrosion-inhibiting coating or paint system that has proved capable of withstanding salt-spray test in accordance with ASTM B117. Test indoor and outdoor equipment for 125 hours; test outdoor equipment used in a marine atmosphere for 500 hours. For each specimen, perform a scratch test as defined in ASTM D 1654.

PART 3 EXECUTION

3.1 INSTALLATION

Install equipment where indicated and as recommended by manufacturer's recommendations, NFPA 54, NFPA 90A, NFPA 90B, NFPA 91 and NFPA 211.

3.1.1 Suspensions of Equipment

Provide equipment supports including beam clamps, turnbuckles and twist links or weld-wire chains, wire ropes with rope clips and rope thimbles, threaded-eye rod hangers with lock nuts and heat-duct hangers, threaded-eye bolts with expansion screws, brackets, platform and mounting frame, and vibration isolators. Locate equipment in such a manner that working space is available for servicing, such as vacuum pump and burner removal, access to automatic controls, and lubrication. Provide electrical isolation of dissimilar metals. Clean interior of casings or cabinets before and after completion of installation.

3.1.2 Electrical Work

NFPA 70 and Division 16, "Electrical Work." When replacing original control wires, provide No. 16 AWG with minimum 105 degrees C insulation.

3.2 FIELD QUALITY CONTROL

Administer, schedule, and conduct specified tests. Furnish personnel, instruments and equipment for such tests. Correct defects and repeat the respective inspections and tests. Conduct inspections and testing in the presence of the Contracting Officer.

3.2.1 Test Instruments and Apparatus

Provide instruments and apparatus currently certified as being accurate to within one percent of their full scale. Use gages with a maximum scale between 1 1/2 and 2 times test pressure.

3.2.2 Field Inspection

Prior to initial operation, inspect equipment installation to ensure that indicated and specified requirements have been met.

-- End of Section --

SECTION 26 00 00.00 20

BASIC ELECTRICAL MATERIALS AND METHODS

07/06

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 100 (2000; Archived) The Authoritative Dictionary of IEEE Standards Terms

IEEE C2 (2007; Errata 06-1; TIA 07-1; TIA 07-2; TIA 07-3; Errata 07-2; TIA 08-4; TIA 08-5; TIA 08-6; TIA 08-7; TIA 08-8; TIA 08-9; TIA 08-10; TIA 08-11; TIA 09-12; TIA 09-13; TIA 09-14; Errata 09-3; TIA 09-15; TIA 09-16; TIA 10-17) National Electrical Safety Code

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250 (2008) Enclosures for Electrical Equipment (1000 Volts Maximum)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2011; TIA 11-1; Errata 2011) National Electrical Code

1.2 RELATED REQUIREMENTS

This section applies to certain sections of Division 02, EXISTING CONDITIONS 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. This section has been incorporated into, and thus, does not apply to, and is not referenced in the following sections.

Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM

Section 26 51 00 INTERIOR LIGHTING

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 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 ELECTRICAL CHARACTERISTICS

Electrical characteristics for this project shall be 12,470 kV primary, three phase, four wire, 60 Hz, and 480Y/277 and 208Y/120 volts secondary, three phase, four wire. Final connections to the power distribution system at the existing switchboard / panelboards shall be made by the Contractor as directed by the Contracting Officer.

1.5 ADDITIONAL SUBMITTALS INFORMATION

Submittals required in other sections that refer to this section must conform to the following additional requirements as applicable.

1.5.1 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.

1.5.2 Product Data (SD-03)

Submittal shall include performance and characteristic curves.

1.6 QUALITY ASSURANCE

1.6.1 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 unless more stringent requirements are specified or indicated.

1.6.2 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.

1.6.2.1 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.

1.6.2.2 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.

1.7 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.

1.8 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.

1.9 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.

1.10 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.

1.11 ELECTRICAL REQUIREMENTS

Electrical installations shall conform to IEEE C2, NFPA 70, and requirements specified herein.

1.12 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. Painting shall be as specified in the section specifying the associated electrical equipment.

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.

-- End of Section --

SECTION 26 20 00

INTERIOR DISTRIBUTION SYSTEM

08/08

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 B1	(2001; R 2007) Standard Specification for Hard-Drawn Copper Wire
ASTM B8	(2011) 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 100	(2000; Archived) The Authoritative Dictionary of IEEE Standards Terms
IEEE C2	(2007; Errata 06-1; TIA 07-1; TIA 07-2; TIA 07-3; Errata 07-2; TIA 08-4; TIA 08-5; TIA 08-6; TIA 08-7; TIA 08-8; TIA 08-9; TIA 08-10; TIA 08-11; TIA 09-12; TIA 09-13; TIA 09-14; Errata 09-3; TIA 09-15; TIA 09-16; TIA 10-17) National Electrical Safety Code

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI C80.1	(2005) American National Standard for Electrical Rigid Steel Conduit (ERSC)
ANSI C80.3	(2005) American National Standard for Electrical Metallic Tubing (EMT)
NEMA 250	(2008) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA FU 1	(2002; R 2007) Low Voltage Cartridge Fuses
NEMA ICS 6	(1993; R 2006) Enclosures
NEMA KS 1	(2001; R 2006) Enclosed and Miscellaneous Distribution Equipment Switches (600 V 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 WD 1 (1999; R 2005; R 2010) Standard for General Color Requirements for Wiring Devices

NEMA WD 6 (2002; R 2008) Wiring Devices Dimensions Specifications

NEMA Z535.4 (2007; Errata 2007) American National Standard for Product Safety Signs and Labels

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2011; TIA 11-1; Errata 2011) National Electrical Code

NFPA 70E (2009; Errata 09-1) Standard for Electrical Safety in the Workplace

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

29 CFR 1910.147 Control of Hazardous Energy (Lock Out/Tag Out)

UNDERWRITERS LABORATORIES (UL)

UL 1 (2005; Reprint Jul 2007) Standard for Flexible Metal Conduit

UL 1242 (2006; Reprint Jul 2007) Standard for Electrical Intermediate Metal Conduit -- Steel

UL 198M (2003; Reprint Oct 2007) Standard for Mine-Duty Fuses

UL 20 (2010) General-Use Snap Switches

UL 360 (2009; Reprint Jun 2009) Liquid-Tight Flexible Steel Conduit

UL 4248 (2007) UL Standard for Safety Fuseholders

UL 486A-486B (2003; Reprint Feb 2010) Wire Connectors

UL 486C (2004; Reprint Feb 2010) Splicing Wire Connectors

UL 489 (2009) Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker

Enclosures

UL 498	(2001; Reprint Apr 2010) Attachment Plugs and Receptacles
UL 50	(2007) Enclosures for Electrical Equipment, Non-environmental Considerations
UL 510	(2005; Reprint Apr 2008) Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape
UL 514A	(2004; Reprint Apr 2010) Metallic Outlet Boxes
UL 514B	(2004; Reprint Nov 2009) Conduit, Tubing and Cable Fittings
UL 514C	(1996; Reprint May 2011) Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers
UL 6	(2007; reprint Nov 2010) Electrical Rigid Metal Conduit-Steel
UL 67	(2009; Reprint Sep 2010) Standard for Panelboards
UL 797	(2007) Electrical Metallic Tubing -- Steel
UL 83	(2008) Thermoplastic-Insulated Wires and Cables
UL 869A	(2006) Reference Standard for Service Equipment
UL 943	(2006; Reprint May 2010) Ground-Fault Circuit-Interrupters
UL 984	(1996; Reprint Sep 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 100.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for A/E approval. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Panelboards

SD-03 Product Data

Receptacles

Circuit breakers

Switches

SD-06 Test Reports

600-volt wiring test

Grounding system test

Ground-fault receptacle test

SD-07 Certificates

Fuses

1.4 QUALITY ASSURANCE

1.4.1 Fuses

Submit coordination data as specified in paragraph, FUSES of this section.

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

ANSI C80.1, UL 6.

2.2.2 Intermediate Metal Conduit (IMC)

UL 1242, zinc-coated steel only.

2.2.3 Electrical, Zinc-Coated Steel Metallic Tubing (EMT)

UL 797, ANSI 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

Die cast compression type.

2.3 OUTLET BOXES AND COVERS

UL 514A, cadmium- or zinc-coated, if ferrous metal. UL 514C, if nonmetallic.

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.

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

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 B1, solid bare copper wire for sizes No. 8 AWG and smaller diameter; ASTM B8, 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.

2.7 SWITCHES

2.7.1 Toggle Switches

NEMA WD 1, UL 20, single pole, three-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. 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 or 3R, enclosure per NEMA ICS 6.

2.8 FUSES

NEMA FU 1. Provide complete set of fuses for each fusible switch. Time-current characteristics curves of fuses serving motors or connected in series with circuit breakers or other circuit protective devices shall be coordinated for proper operation. Submit coordination data for approval. 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. Associated fuseholders shall be Class R only.

2.9 RECEPTACLES

UL 498, hard use, heavy-duty, grounding-type. Ratings and configurations shall be as indicated. Bodies shall be of white 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 Weatherproof Receptacles

Provide in cast metal box with gasketed, weatherproof, cast-metal cover plate and gasketed cap over each receptacle opening. Provide caps with a spring-hinged flap. Receptacle shall be UL listed for use in "wet locations with plug in use."

2.9.2 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 PANELBOARDS

UL 67 and UL 50 having a short-circuit current rating as indicated. Panelboards for use as service disconnecting means shall additionally conform to UL 869A. Panelboards shall be circuit breaker-equipped. Design shall be such that individual breakers can be removed without disturbing adjacent units or without loosening or removing supplemental insulation supplied as means of obtaining clearances as required by UL. "Specific breaker placement" is required in panelboards to match the breaker placement indicated in the panelboard schedule on the drawings. Use of "Subfeed Breakers" is not acceptable unless specifically indicated otherwise. Main breaker shall be "separately" mounted "above" or "below" branch breakers. Where "space only" is indicated, make provisions for future installation of breakers. Directories shall indicate load served by each circuit in panelboard. Directories shall also indicate source of service to panelboard (e.g., Panel PA served from Panel MDP). Provide new directories for existing panels modified by this project. Type directories and mount in holder behind transparent protective covering. Panelboards shall be listed and labeled for their intended use. Panelboard shall have nameplates in accordance with paragraph FIELD FABRICATED NAMEPLATES.2.10.1 Enclosure

Enclosures shall meet the requirements of UL 50. All cabinets shall be fabricated from sheet steel of not less than No. 10 gauge if flush-mounted or mounted outdoors, and not less than No. 12 gauge if surface-mounted indoors, with full seam-welded box ends. Cabinets mounted outdoors or flush-mounted shall be hot-dipped galvanized after fabrication. Cabinets shall be painted in accordance with paragraph PAINTING. Front edges of cabinets shall be form-flanged or fitted with structural shapes welded or riveted to the sheet steel, for supporting the panelboard front. All

cabinets shall be so fabricated that no part of any surface on the finished cabinet shall deviate from a true plane by more than 1/8 inch. Holes shall be provided in the back of indoor surface-mounted cabinets, with outside spacers and inside stiffeners, for mounting the cabinets with a 1/2 inch clear space between the back of the cabinet and the wall surface. Flush doors shall be mounted on hinges that expose only the hinge roll to view when the door is closed. Each door shall be fitted with a combined catch and lock, except that doors over 24 inches long shall be provided with a three-point latch having a knob with a T-handle, and a cylinder lock. Two keys shall be provided with each lock, and all locks shall be keyed alike. Finished-head cap screws shall be provided for mounting the panelboard fronts on the cabinets.

2.10.2 Panelboard Buses

Support bus bars on bases independent of circuit breakers. Main buses and back pans shall be designed so that breakers may be changed without machining, drilling, or tapping. Provide isolated neutral bus in each panel for connection of circuit neutral conductors. Provide separate ground bus identified as equipment grounding bus per UL 67 for connecting grounding conductors; bond to steel cabinet.

2.10.2.1 Panelboard Neutrals for Non-Linear Loads

UL listed, and panelboard type shall have been specifically UL heat rise tested for use on non-linear loads. Panelboard shall be heat rise tested in accordance with UL 67, except with the neutral assembly installed and carrying 200 percent of the phase bus current during testing. Verification of the testing procedure shall be provided upon request. Two neutral assemblies paralleled together with cable is not acceptable. Nameplates for panelboard rated for use on non-linear loads shall be marked "SUITABLE FOR NON-LINEAR LOADS" and shall be in accordance with paragraph FIELD FABRICATED NAMEPLATES. Provide a neutral label with instructions for wiring the neutral of panelboards rated for use on non-linear loads.

2.10.3 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 are unacceptable.

2.10.3.1 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.

2.10.3.2 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 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.

2.11.1 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.

2.11.2 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.

2.11.3 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.

2.11.4 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, and motor control equipment forming part of motor control centers or switchgear assemblies, the conduit and wiring connecting such centers, assemblies, or other power sources to 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.

2.12 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."

2.13 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.

2.14 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. Provide red laminated plastic label with white center core for all Fire Protection equipment. 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.

2.15 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.

2.16 FIRESTOPPING MATERIALS

Provide firestopping around electrical penetrations.

2.17 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 Light 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 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. Shared neutral, or multi-wire branch circuits, are not permitted with arc-fault circuit interrupters. 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.

3.1.2 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.

3.1.2.1 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).

3.1.2.2 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).

3.1.2.3 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 watertight 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.

3.1.2.4 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.

3.1.2.5 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.

3.1.2.6 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.

3.1.3 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, when surface mounted on interior walls exposed up to 7 feet above floors and walkways, 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 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. Threaded studs driven in by powder charge and provided with lockwashers and nuts may be used in lieu of wood screws, expansion shields, or machine screws. 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 24 inches from box. When penetrating reinforced concrete members, avoid cutting reinforcing steel.

3.1.3.1 Boxes

Boxes for use with raceway systems shall be minimum 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 4 inches square, except that 4 by 2 inch boxes may be used where only one raceway enters outlet. Telecommunications outlets shall be a minimum of 4 inches square by 2 1/8 inches deep. Mount outlet boxes flush in finished walls.

3.1.3.2 Pull Boxes

Construct of at least minimum size required by NFPA 70 of code-gauge aluminum or galvanized sheet steel, and except where cast-metal boxes are required in locations specified herein. 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.

3.1.3.3 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.

3.1.4 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 18 inches above finished floor. Mount other devices as indicated. Measure mounting heights of wiring devices and outlets to center of device or outlet. Measure mounting heights of receptacle outlet boxes in the to the bottom of the outlet box.

3.1.5 Conductor Identification

Provide conductor identification within each enclosure where tap, splice, or termination is made. For conductors No. 6 AWG and smaller diameter, color coding shall be by factory-applied, color-impregnated insulation. For conductors No. 4 AWG and larger diameter, color coding shall be by plastic-coated, self-sticking markers; colored nylon cable ties and plates; or heat shrink-type sleeves. Identify control circuit terminations in accordance with Section 23 09 23.13 20, BACnet DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC.

3.1.6 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.

3.1.7 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.

3.1.8 Electrical Penetrations

Seal openings around electrical penetrations through fire resistance-rated walls, partitions, floors, or ceilings.

3.1.9 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.

3.1.10 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.

3.1.11 Repair of Existing Work

Repair of existing work, demolition, and modification of existing electrical distribution systems shall be performed as follows:

3.1.11.1 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.

3.1.11.2 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.

3.1.11.3 Removal of Existing Electrical Distribution System

Removal of existing electrical distribution system equipment shall include equipment's associated wiring, including conductors, cables, exposed conduit, surface metal raceways, boxes, and fittings, back to equipment's power source as indicated.

3.1.11.4 Continuation of Service

Maintain continuity of existing circuits of equipment to remain. Existing circuits of equipment shall remain energized. Circuits which are to remain but were disturbed during demolition shall have circuits wiring and power restored back to original condition.

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 existing 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 --

SECTION 26 29 23

VARIABLE FREQUENCY DRIVE SYSTEMS UNDER 600 VOLTS

04/06

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.

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

- IEEE 519 (1992; R 1993; Errata 2004) Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems
- IEEE C62.41.1 (2002; R 2008) Guide on the Surges Environment in Low-Voltage (1000 V and Less) AC Power Circuits
- IEEE C62.41.2 (2002) Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

- NEMA 250 (2008) Enclosures for Electrical Equipment (1000 Volts Maximum)
- NEMA ICS 1 (2000; R 2005; R 2008) Standard for Industrial Control and Systems: General Requirements
- NEMA ICS 3.1 (2009) Guide for the Application, Handling, Storage, Installation and Maintenance of Medium-Voltage AC Contactors, Controllers and Control Centers
- NEMA ICS 6 (1993; R 2006) Enclosures
- NEMA ICS 7 (2006) Adjustable-Speed Drives

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

- NFPA 70 (2011; TIA 11-1; Errata 2011) National Electrical Code

U.S. DEPARTMENT OF DEFENSE (DOD)

- MIL-STD-461 (2007; Rev F) Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment

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

47 CFR 15 Radio Frequency Devices

UNDERWRITERS LABORATORIES (UL)

UL 489 (2009) Molded-Case Circuit Breakers,
Molded-Case Switches, and Circuit-Breaker
EnclosuresUL 508C (2002; Reprint Nov 2010) Power Conversion
Equipment

1.2 RELATED REQUIREMENTS

Section 26 00 00.00 20 BASIC ELECTRICAL MATERIALS AND METHODS, and Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM apply to this section with additions and modifications specified herein.

1.3 SYSTEM DESCRIPTION

1.3.1 Performance Requirements

1.3.1.1 Electromagnetic Interference Suppression

Computing devices, as defined by 47 CFR 15, MIL-STD-461 rules and regulations, shall be certified to comply with the requirements for class A computing devices and labeled as set forth in part 15.

1.3.1.2 Electromechanical and Electrical Components

Electrical and electromechanical components of the Variable Frequency Drive (VFD) shall not cause electromagnetic interference to adjacent electrical or electromechanical equipment while in operation.

1.3.2 Electrical Requirements

1.3.2.1 Power Line Surge Protection

IEEE C62.41.1 and IEEE C62.41.2, IEEE 519 Control panel shall have surge protection, included within the panel to protect the unit from damaging transient voltage surges. Surge arrestor shall be mounted near the incoming power source and properly wired to all three phases and ground. Fuses shall not be used for surge protection.

1.3.2.2 Sensor and Control Wiring Surge Protection

I/O functions as specified shall be protected against surges induced on control and sensor wiring installed outdoors and as shown. The inputs and outputs shall be tested in both normal mode and common mode using the following two waveforms:

- a. A 10 microsecond by 1000 microsecond waveform with a peak voltage of 1500 volts and a peak current of 60 amperes.
- b. An 8 microsecond by 20 microsecond waveform with a peak voltage of 1000 volts and a peak current of 500 amperes.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for A/E approval. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

- Schematic diagrams

- Interconnecting diagrams

- Installation drawings

Submit drawings for government approval prior to equipment construction or integration. Modifications to original drawings made during installation shall be immediately recorded for inclusion into the as-built drawings.

SD-03 Product Data

- Variable frequency drives

- Wires and cables

- Equipment schedule

Include data indicating compatibility with motors being driven.

SD-06 Test Reports

- VFD Test

- Performance Verification Tests

- Endurance Test

SD-08 Manufacturer's Instructions

- Installation instructions

SD-09 Manufacturer's Field Reports

- VFD Factory Test Plan

- Factory test results

SD-10 Operation and Maintenance Data

- Variable frequency drives, Data Package 4

Submit in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA. Provide service and maintenance information including preventive maintenance, assembly, and disassembly procedures. Include electrical drawings from electrical general sections. Submit additional information necessary to provide complete operation, repair, and maintenance information, detailed to the smallest replaceable unit. Include copies of as-built

submittals. Provide routine preventative maintenance instructions, and equipment required. Provide instructions on how to modify program settings, and modify the control program. Provide instructions on drive adjustment, trouble-shooting, and configuration. Provide instructions on process tuning and system calibration.

1.5 QUALITY ASSURANCE

1.5.1 Schematic Diagrams

Show circuits and device elements for each replaceable module. Schematic diagrams of printed circuit boards are permitted to group functional assemblies as devices, provided that sufficient information is provided for government maintenance personnel to verify proper operation of the functional assemblies.

1.5.2 Interconnecting Diagrams

Show interconnections between equipment assemblies, and external interfaces, including power and signal conductors. Include for enclosures and external devices.

1.5.3 Installation Drawings

Show floor plan of each site, with V.F.D.'s and motors indicated. Indicate ventilation requirements, adequate clearances, and cable routes.

1.5.4 Equipment Schedule

Provide schedule of equipment supplied. Schedule shall provide a cross reference between manufacturer data and identifiers indicated in shop drawings. Schedule shall include the total quantity of each item of equipment supplied. For complete assemblies, such as VFD's, provide the serial numbers of each assembly, and a sub-schedule of components within the assembly. Provide recommended spare parts listing for each assembly or component.

1.5.5 Installation instructions

Provide installation instructions issued by the manufacturer of the equipment, including notes and recommendations, prior to shipment to the site. Provide operation instructions prior to acceptance testing.

1.5.6 Factory Test Results

Document test results and submit to government within 7 working days after completion of test.

1.6 DELIVERY AND STORAGE

Equipment delivered and placed in storage shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, or other contaminants.

1.7 WARRANTY

The complete system shall be warranted by the manufacturer for a period of one year, or the contracted period of any extended warrantee agreed upon by

the contractor and the Government, after successful completion of the acceptance test. Any component failing to perform its function as specified and documented shall be repaired or replaced by the contractor at no additional cost to the Government. Items repaired or replaced shall be warranted for an additional period of at least one year from the date that it becomes functional again, as specified in the FAR CLAUSE 52.246-21.

1.8 MAINTENANCE

1.8.1 Spare Parts

Manufacturers provide spare parts in accordance with recommended spare parts list.

1.8.2 Maintenance Support

During the warranty period, the Contractor shall provide on-site, on-call maintenance services by Contractor's personnel on the following basis: The service shall be on a per-call basis with 36 hour response. Contractor shall support the maintenance of all hardware and software of the system. Various personnel of different expertise shall be sent on-site depending on the nature of the maintenance service required. Costs shall include travel, local transportation, living expenses, and labor rates of the service personnel while responding to the service request. The provisions of this Section are not in lieu of, nor relieve the Contractor of, warranty responsibilities covered in this specification. Should the result of the service request be the uncovering of a system defect covered under the warranty provisions, all costs for the call, including the labor necessary to identify the defect, shall be borne by the Contractor.

PART 2 PRODUCTS

2.1 VARIABLE FREQUENCY DRIVES (VFD)

Provide frequency drive to control the speed of induction motor(s). The VFD shall include the following minimum functions, features and ratings.

- a. Input circuit breaker per UL 489 with a minimum of 10,000 amps symmetrical interrupting capacity and door interlocked external operator. Provide integral disconnect switch.
- b. A converter stage per UL 508C shall change fixed voltage, fixed frequency, ac line power to a fixed dc voltage. The converter shall utilize a full wave bridge design incorporating diode rectifiers. Silicon Controlled Rectifiers (SCR) are not acceptable. The converter shall be insensitive to three phase rotation of the ac line and shall not cause displacement power factor of less than .95 lagging under any speed and load condition.
- c. An inverter stage shall change fixed dc voltage to variable frequency, variable voltage, ac for application to a standard NEMA design B squirrel cage motor. The inverter shall be switched in a manner to produce a sine coded pulse width modulated (PWM) output waveform.
- d. The VFD shall be capable of supplying 120 percent of rated full load current for one minute at maximum ambient temperature.
- e. The VFD shall be designed to operate from a 208V or 460 volt, plus or minus 10 percent, three phase, 60 Hz supply, and control motors with a

corresponding voltage rating. Refer to mechanical sheets for schedules.

- f. Acceleration and deceleration time shall be independently adjustable from one second to 60 seconds.
- g. Adjustable full-time current limiting shall limit the current to a preset value which shall not exceed 120 percent of the controller rated current. The current limiting action shall maintain the V/Hz ratio constant so that variable torque can be maintained. Short time starting override shall allow starting current to reach 175 percent of controller rated current to maximum starting torque.
- h. The controllers shall be capable of producing an output frequency over the range of 3 Hz to 60 Hz (20 to one speed range), without low speed cogging. Over frequency protection shall be included such that a failure in the controller electronic circuitry shall not cause frequency to exceed 110 percent of the maximum controller output frequency selected.
- i. Minimum and maximum output frequency shall be adjustable over the following ranges: 1) Minimum frequency 3 Hz to 50 percent of maximum selected frequency; 2) Maximum frequency 40 Hz to 60 Hz.
- j. The controller efficiency at any speed shall not be less than 96 percent.
- k. The controllers shall be capable of being restarted into a motor coasting in the forward direction without tripping.
- l. Protection of power semiconductor components shall be accomplished without the use of fast acting semiconductor output fuses. Subjecting the controllers to any of the following conditions shall not result in component failure or the need for fuse replacement:
 - 1. Short circuit at controller output
 - 2. Ground fault at controller output
 - 3. Open circuit at controller output
 - 4. Input undervoltage
 - 5. Input overvoltage
 - 6. Loss of input phase
 - 7. AC line switching transients
 - 8. Instantaneous overload
 - 9. Sustained overload exceeding 115 percent of controller rated current
 - 10. Over temperature
 - 11. Phase reversal
- m. Solid state motor overload protection shall be included such that current exceeding an adjustable threshold shall activate a 60 second

timing circuit. Should current remain above the threshold continuously for the timing period, the controller will automatically shut down.

- n. A slip compensation circuit shall be included which will sense changing motor load conditions and adjust output frequency to provide speed regulation of NEMA B motors to within plus or minus 0.5 percent of maximum speed without the necessity of a tachometer generator.
- o. The VFD shall be factory set for manual restart after the first protective circuit trip for malfunction (overcurrent, undervoltage, overvoltage or overtemperature) or an interruption of power. The VFD shall be capable of being set for automatic restart after a selected time delay. If the drive faults again within a specified time period (adjustable 0-60 seconds), a manual restart will be required.
- p. The VFD shall include external fault reset capability. All the necessary logic to accept an external fault reset contact shall be included.
- q. Provide critical speed lockout circuitry to prevent operating at frequencies with critical harmonics that cause resonant vibrations. The VFD shall have a minimum of three user selectable bandwidths.
- r. Provide the following operator control and monitoring devices mounted on the front panel of the VFD:
 - 1. Manual speed potentiometer.
 - 2. Hand-Off-Auto (HOA) switch.
 - 3. Power on light.
 - 4. Drive run power light.
 - 5. Local display.
- s. Provide properly sized NEMA rated by-pass and isolation contactors to enable operation of motor in the event of VFD failure. Mechanical and electrical interlocks shall be installed between the by-pass and isolation contactors. Provide a selector switch and transfer delay timer.

2.2 ENCLOSURES

Provide equipment enclosures conforming to NEMA 250, NEMA ICS 7, NEMA ICS 6.

2.3 WIRES AND CABLES

All wires and cables shall conform to NEMA 250, NEMA ICS 7, NFPA 70.

2.4 NAMEPLATES

Nameplates external to NEMA enclosures shall conform with the requirements of Section 26 00 00.00 20 BASIC ELECTRICAL MATERIALS AND METHODS. Nameplates internal to enclosures shall be manufacturer's standard, with the exception that they must be permanent.

2.5 SOURCE QUALITY CONTROL

2.5.1 VFD Factory Test Plan

To ensure quality, each VFD shall be subject to a series of in-plant quality control inspections before approval for shipment from the manufacturer's facilities. Provide test plans and test reports.

PART 3 EXECUTION

3.1 INSTALLATION

Per NEMA ICS 3.1, install equipment in accordance with the approved manufacturer's printed installation drawings, instructions, wiring diagrams, and as indicated on project drawings and the approved shop drawings. A field representative of the drive manufacturer shall supervise the installation of all equipment, and wiring.

3.2 FIELD QUALITY CONTROL

Specified products shall be tested as a system for conformance to specification requirements prior to scheduling the acceptance tests. Contractor shall conduct performance verification tests in the presence of Government representative, observing and documenting complete compliance of the system to the specifications. Contractor shall submit a signed copy of the test results, certifying proper system operation before scheduling tests.

3.2.1 VFD Test

A proposed test plan shall be submitted to the contracting officer at least 28 calendar days prior to proposed testing for approval. The tests shall conform to NEMA ICS 1, NEMA ICS 7, and all manufacturer's safety regulations. The Government reserves the right to witness all tests and review any documentation. The contractor shall inform the Government at least 14 working days prior to the dates of testing. Contractor shall provide video tapes, if available, of all training provided to the Government for subsequent use in training new personnel. All training aids, texts, and expendable support material for a self-sufficient presentation shall be provided, the amount of which to be determined by the contracting officer.

3.2.2 Performance Verification Tests

"Performance Verification Test" plan shall provide the step by step procedure required to establish formal verification of the performance of the VFD. Compliance with the specification requirements shall be verified by inspections, review of critical data, demonstrations, and tests. The Government reserves the right to witness all tests, review data, and request other such additional inspections and repeat tests as necessary to ensure that the system and provided services conform to the stated requirements. The contractor shall inform the Government 14 calendar days prior to the date the test is to be conducted.

3.2.3 Endurance Test

Immediately upon completion of the performance verification test, the endurance test shall commence. The system shall be operated at varying rates for not less than 192 consecutive hours, at an average effectiveness

level of .9998, to demonstrate proper functioning of the complete PCS. Continue the test on a day-to-day basis until performance standard is met. During the endurance test, the contractor shall not be allowed in the building. The system shall respond as designed.

3.3 DEMONSTRATION

3.3.1 Training

Coordinate training requirements with the Contracting Officer.

3.3.1.1 Instructions to Government Personnel

Provide the services of competent instructors who will give full instruction to designated personnel in operation, maintenance, calibration, configuration, and programming of the complete control system. Orient the training specifically to the system installed. Instructors shall be thoroughly familiar with the subject matter they are to teach. The Government personnel designated to attend the training will have a high school education or equivalent. The number of training days of instruction furnished shall be as specified. A training day is defined as eight hours of instruction, including two 15-minute breaks and excluding lunch time; Monday through Friday. Provide a training manual for each student at each training phase which describes in detail the material included in each training program. Provide one additional copy for archiving. Provide equipment and materials required for classroom training. Provide a list of additional related courses, and offers, noting any courses recommended. List each training course individually by name, including duration, approximate cost per person, and location of course. Unused copies of training manuals shall be turned over to the Government at the end of last training session.

3.3.1.2 Operating Personnel Training Program

Provide one 2 hour training session at the site at a time and place mutually agreeable between the Contractor and the Government. Provide session to train 4 operation personnel in the functional operations of the system and the procedures that personnel will follow in system operation. This training shall include:

- a. System overview
- b. General theory of operation
- c. System operation
- d. Alarm formats
- e. Failure recovery procedures
- f. Troubleshooting

3.3.1.3 Engineering/Maintenance Personnel Training

Accomplish the training program as specified. Training shall be conducted on site at a location designated by the Government. Provide a one day training session to train 4 engineering personnel in the functional operations of the system. This training shall include:

- a. System overview
- b. General theory of operation
- c. System operation
- d. System configuration
- e. Alarm formats
- f. Failure recovery procedures
- g. Troubleshooting and repair
- h. Maintenance and calibration
- i. System programming and configuration

-- End of Section --

SECTION 26 51 00.00 20

HANGAR BAY LIGHTING

07/07

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.

GREEN SEAL (GS)

GC-12 (1997) Occupancy Sensors

ILLUMINATING ENGINEERING SOCIETY OF NORTH AMERICA (IESNA)

IESNA HB-9 (2000; Errata 2004; Errata 2005; Errata 2006) IES Lighting Handbook

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 100 (2000; Archived) The Authoritative Dictionary of IEEE Standards Terms

IEEE C2 (2012) National Electrical Safety Code

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250 (2008) Enclosures for Electrical Equipment (1000 Volts Maximum)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (2011; TIA 11-1; Errata 2011; TIA 11-2; TIA 11-3; TIA 11-4) National Electrical Code

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

Energy Star (1992; R 2006) Energy Star Energy Efficiency Labeling System

UNDERWRITERS LABORATORIES (UL)

UL 1598 (2008; Reprint Jan 2010) Luminaires

1.2 RELATED REQUIREMENTS

Materials not considered to be lighting equipment or lighting fixture accessories are specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Lighting fixtures and accessories mounted on exterior surfaces of buildings are specified in this section.

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 100.
- b. Average life is the time after which 50 percent will have failed and 50 percent will have survived under normal conditions.
- c. Total harmonic distortion (THD) is the root mean square (RMS) of all the harmonic components divided by the total fundamental current.

1.4 SYSTEM DESCRIPTION

1.4.1 Lighting Control System

Provide lighting control system as indicated. Lighting control equipment shall include, if indicated: control modules, power packs, dimming ballasts, occupancy sensors, and light level sensors.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

Data, drawings, and reports shall employ the terminology, classifications, and methods prescribed by the IESNA HB-9, as applicable, for the lighting system specified.

SD-03 Product Data

LED High Bay Lighting Fixtures; G

Occupancy sensors; G,

Energy Efficiency

SD-06 Test Reports

Operating test

Submit test results as stated in paragraph entitled "Field Quality Control."

SD-10 Operation and Maintenance Data

Lighting Control System, Data Package 5; G,

Submit operation and maintenance data in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA and as specified herein, showing all light fixtures, control modules, control zones, occupancy sensors, light level sensors, power packs, dimming ballasts, schematic diagrams and all interconnecting control wire, conduit, and associated hardware.

Operational Service

Submit documentation that includes contact information, summary of procedures, and the limitations and conditions applicable to the project. Indicate manufacturer's commitment to reclaim materials for recycling and/or reuse.

1.6 QUALITY ASSURANCE

1.6.1 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 unless more stringent requirements are specified or indicated.

1.6.2 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 this section.

1.6.2.1 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.

1.6.2.2 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.

1.6.2.3 Energy Efficiency

Comply with National Energy Policy Act and Energy Star requirements for lighting products. Submit documentation for Energy Star qualifications for equipment provided under this section. Submit data indicating lumens per watt efficiency and color rendition index of light source.

1.7 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.

1.8 OPERATIONAL SERVICE

Coordinate with manufacturer for maintenance agreement. Collect information from the manufacturer about maintenance agreement options, and submit to Contracting Officer. Services shall reclaim materials for recycling and/or reuse. Services shall not landfill or burn reclaimed materials. Indicate procedures for compliance with regulations governing disposal of mercury. When such a service is not available, local recyclers shall be sought after to reclaim the materials.

PART 2 PRODUCTS

2.1 LED HIGH BAY LIGHTING FIXTURES

Industrial LED High Bay with polyester corrosion resistant epoxy powder coating, ¾ threaded hub with sealed / potted power supply compartment, prewired 10ft power cord, prewired 10ft dimming cable.

17,000 lumen output fixture:

UL 1598A, NEMA 4X rating, with minimum 17,000 lumen output consuming no more than 172 watts, with circular photometric distribution, CCT of 4300K, min 72 CRI and operating temp of -40~65°C with an L70 25°C lifespan rating of 100,000 + hrs.

2.2 SUSPENDED FIXTURES

Provide hangers capable of supporting twice the combined weight of fixtures supported by hangers. Provide with swivel hangers to ensure a plumb installation. Hangers shall be cadmium-plated steel with a swivel-ball tapped for the conduit size indicated. Hangers shall allow fixtures to swing within an angle of 45 degrees. Brace pendants provided in shops or hangers to limit swinging. Multiple-unit row fixtures shall have a tubing or stem for wiring at one point and a tubing or rod suspension provided for each unit length of chassis, including one at each end. Rods shall be a minimum 0.18 inch diameter.

2.3 SWITCHES

2.4 OCCUPANCY SENSORS

UL listed. Comply with GC-12. Occupancy sensors and power packs shall be designed to operate on the voltage indicated. Sensors and power packs shall have circuitry that only allows load switching at or near zero current crossing of supply voltage. Occupancy sensor mounting as indicated. Sensor shall have an LED occupant detection indicator. Ceiling mounted sensors shall be white. Ceiling mounted sensors shall have 360 degree coverage unless otherwise indicated.

- a. Ultrasonic sensor shall be crystal controlled and shall not cause detection interference between adjacent sensors.
- b. Infrared sensors shall have a daylight filter. Sensor shall have a fresnel lens that is applicable to space to be controlled.
- c. Ultrasonic/Infrared Combination Sensor
- d. Microwave and audiophonic sensors.

Occupancy detection to turn lights on requires both ultrasonic and infrared sensor detection. Lights shall remain on if either the ultrasonic or infrared sensor detects movement. Infrared sensor shall have lens selected for indicated usage and daylight filter to prevent short wavelength infrared interference. Ultrasonic sensor frequency shall be crystal controlled.

2.5 EQUIPMENT IDENTIFICATION

2.5.1 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.

2.5.2 Labels

Provide labeled luminaires in accordance with UL 1598 requirements. All luminaires shall be clearly marked for operation of specific lamps and ballasts according to proper lamp type. The following lamp characteristics shall be noted in the format "Use Only _____":

- a. LED configuration and nominal wattage.
- b. Correlated color temperature (CCT) and color rendering index (CRI) for all luminaires.

All markings related to lamp type shall be clear and located to be readily visible to service personnel, but unseen from normal viewing angles when lamps are in place. Driver shall have clear markings indicating multi-level outputs and indicate proper terminals for the various outputs.

2.6 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 INSTALLATION

Electrical installations shall conform to IEEE C2, NFPA 70, and to the requirements specified herein.

3.1.1 Suspended Fixtures

Suspended fixtures shall be provided with 45 degree swivel hangers so that they hang plumb and shall be located with no obstructions within the 45 degree range in all directions. The stem, canopy and fixture shall be capable of 45 degree swing. Pendants, rods, or chains 4 feet or longer excluding fixture shall be braced to prevent swaying using three cables at 120 degree separation. Aligning splines shall be used on extruded aluminum fixtures to assure hairline joints. Steel fixtures shall be supported to prevent "oil-canning" effects. Fixture finishes shall be free of scratches, nicks, dents, and warps, and shall match the color and gloss specified. Pendants shall be finished to match fixtures. Aircraft cable shall be stainless steel. Canopies shall be finished to match the ceiling

and shall be low profile unless otherwise shown. Maximum distance between suspension points shall be 10 feet or as recommended by the manufacturer, whichever is less.

3.1.2 Dimming Power Supply

Integrated Power supply shall have 1KV line to line and 2KV line to ground internal surge protection, internal fusing, automatic thermal circuit protection over 65°C, Power Factor of .9, IEC 61000-3-2 compliant, THD less than 10%, and tested by approved lab to DOE IESNA LM-79. 100% to 10% variable dimming as per IEC 60929 (0-10V) compatible controls.

3.1.3 Photocell Switch Aiming

Aim switch according to manufacturer's recommendations.

3.1.4 Occupancy Sensor

Provide quantity of sensor units indicated as a minimum. Provide additional units to give full coverage over controlled area. Full coverage shall provide hand and arm motion detection for office and administration type areas and walking motion for industrial areas, warehouses, storage rooms and hallways. Locate the sensor(s) as indicated and in accordance with the manufacturer's recommendations to maximize energy savings and to avoid nuisance activation and deactivation due to sudden temperature or airflow changes and usage. Set sensor "on" duration to 15 minutes.

3.1.5 Light Level Sensor

Locate light level sensor as indicated and in accordance with the manufacturer's recommendations. Adjust sensor for 50 footcandles or for the indicated light level at the typical work plane for that area.

3.2 FIELD APPLIED PAINTING

Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria.

3.3 FIELD QUALITY CONTROL

Upon completion of installation, verify that equipment is properly installed, connected, and adjusted. Conduct an operating test to show that equipment operates in accordance with requirements of this section.

3.3.1 Electronic Dimming Ballast

Test for full range of dimming capability. Observe for visually detectable flicker over full dimming range.

3.3.2 Occupancy Sensor

Test sensors for proper operation. Observe for light control over entire area being covered.

-- End of Section --

SECTION 28 31 63.00 20

ANALOG/ADDRESSABLE INTERIOR FIRE ALARM SYSTEM
10/07

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.

FM GLOBAL (FM)

FM APP GUIDE (updated on-line) Approval Guide
<http://www.approvalguide.com/>

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 241 (2009) Standard for Safeguarding
Construction, Alteration, and Demolition
Operations

NFPA 72 (2010; TIA 10-4) National Fire Alarm and
Signaling Code

NFPA 90A (2012) Standard for the Installation of
Air Conditioning and Ventilating Systems

UNDERWRITERS LABORATORIES (UL)

UL 268 (2009) Smoke Detectors for Fire Alarm
Systems

UL Electrical Constructn (2009) Electrical Construction Equipment
Directory

UL Fire Prot Dir (2011) Fire Protection Equipment Directory

1.2 RELATED REQUIREMENTS

Section 26 00 00.00 20 BASIC ELECTRICAL MATERIALS AND METHODS, applies to this section, with the additions and modifications specified herein.

1.3 DESCRIPTION OF WORK

1.3.1 Scope

This work includes modifying the existing analog/addressable fire alarm system as described herein and on the contract drawings for Building 131. The system shall include wiring, raceways, pull boxes, outlet and mounting boxes, alarm and supervisory signal initiating devices, and other accessories and miscellaneous items required for a complete operating system even though each item is not specifically mentioned or described. Provide system complete and ready for operation. Equipment, materials, installation, workmanship, inspection, and testing shall be in strict accordance with the required and advisory provisions of NFPA 72 except as

modified herein. The system layout on the drawings show the intent of coverage and are shown in suggested locations. Final quantity, layout, and coordination is the responsibility of the Contractor.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for A/E approval. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

Provide six complete sets of submittals. Partial submittals will not be acceptable and will be returned without review. The Midlant Division , Naval Facilities Engineering Command, Fire Protection Engineer, will review and approve submittals.

SD-02 Shop Drawings

Provide point-to-point wiring diagrams showing the points of connection and terminals used for electrical field connections in the system, including interconnections between the equipment or systems which are supervised or controlled by the system. Diagrams shall show connections from field devices to the FACP, initiating circuits, switches, relays and terminals.

Provide plan view drawing showing device locations, junction boxes, other related equipment, conduit routing, wire counts, circuit identification in each conduit, and circuit layouts for all floors.

Provide a complete description of the system operation in matrix format on the drawings.

Duct detector signals shall be sent to the base receiving station.

Provide a complete list of device addresses and corresponding messages.

Include annotated catalog data, in table format on the drawings, showing manufacturer's name, model, voltage, and catalog numbers for equipment and components.

Provide complete riser diagrams indicating the wiring sequence of devices and their connections to the control equipment. Include a color code schedule for the wiring. Include floor plans showing the locations of devices and equipment.

Battery power calculations

Submit shop drawings not smaller than 24 by 36 inches. As a minimum, the shop drawing submittal shall include the items listed above.

SD-03 Product Data

Smoke sensors

Wiring and cable

Smoke sensor testing procedures

Submit data on proposed equipment, including, but not limited to the items listed above. Include UL or FM listing cards for equipment provided.

SD-06 Test Reports

Furnish preliminary test results to the Contracting Officer. Include the control panel and initiating and indicating devices, a unique identifier for each device with an indication of test results, and signature of the factory-trained technician of the control panel manufacturer and equipment installer. With reports on preliminary tests, include printer information.

SD-07 Certificates

Qualifications of installer

SD-10 Operation and Maintenance Data

INTERIOR FIRE ALARM SYSTEM, Data Package 5

Record drawing software

SD-11 Closeout Submittals

Prepare and submit to the Contracting Officer six sets of detailed as-built drawings. The drawings shall include complete wiring diagrams showing connections between devices and equipment, both factory and field wired. Include a riser diagram and drawings showing the as-built location of devices and equipment. The drawings shall show the system as installed, including deviations from both the project drawings and the approved shop drawings. The drawings shall be prepared on uniform sized mylar sheets not less than 30 by 42 inches with 8 by 4 inch title block similar to contract drawings. These drawings shall be submitted within 2 weeks after the final acceptance test of the system. At least one set of as-built (marked-up) drawings shall be provided at the time of, or prior to the final acceptance test.

Submit the installer's training history for the employees involved with this contract.

1.5 ADDITIONAL SUBMITTAL REQUIREMENTS

1.5.1 Battery Power Calculations

Verify that battery capacity exceeds supervisory and alarm power requirements.

- a. Provide complete battery calculations for both the alarm and supervisory power requirements. Ampere hour requirements for each system component shall be submitted with the calculations.

1.5.2 Qualifications of Installer

Design shall be by a National Institute for Certification in Engineering

Technologies (NICET) Level III or Level IV Technician. Installer shall have an office, which has been in existence for at least 3 years, within a 100 mile radius of the job site. Installation shall be accomplished by an electrical contractor with a minimum of 5 years' experience in the installation of fire alarm systems. The Contracting Officer may reject any proposed installer who cannot show evidence of such qualifications. The services of a technician provided by the control equipment manufacturer shall be provided to supervise installation, adjustments, and tests of the system. The Contractor shall furnish evidence that the fire alarm equipment supplier has an experienced and effective service organization which carries a stock of repair parts for the system to be furnished. The Contractor shall guarantee labor, materials, and equipment provided under this contract against defects for a period of one year after the date of final acceptance of this work by the Contracting Officer and the receipt of as-built drawings and schematics of all equipment. Prior to installation, submit data for approval by the Midlant Division, Naval Facilities Engineering Command, Fire Protection Engineer, showing that the Contractor has successfully installed addressable, analog intelligent interior fire alarm systems of the same type as specified herein, or that the Contractor has a firm contractual agreement with a subcontractor having such required experience. Include the names and locations of at least three installations where the Contractor, or the subcontractor referred to above, has installed such systems. Indicate the type and design of each system and certify that each system has performed satisfactorily in the manner intended for a period of not less than 18 months. Submit names and phone numbers of points of contact at each site.

1.5.3 Record Drawing Software

Furnish one compact disk (CD) containing CAD based drawings in DXF format of as-built drawings and schematics.

1.6 QUALITY ASSURANCE

Equipment and devices shall be compatible and operable with existing station fire alarm system and shall not impair reliability or operational functions of existing supervising station fire alarm system. Existing supervising station fire alarm system is Johnson Controls IFC2-640 System.

1.6.1 Regulatory Requirements

Devices and equipment for fire alarm service shall be listed by UL Fire Prot Dir or approved by FM APP GUIDE.

1.6.1.1 Requirements for Fire Protection Service

Equipment and material shall have been tested by UL and listed in UL Fire Prot Dir or approved by FM and listed in FM APP GUIDE. Where the terms "listed" or "approved" appear in this specification, they shall mean listed in UL Fire Prot Dir or FM APP GUIDE. The omission of these terms under the description of any item of equipment described shall not be construed as waiving this requirement.

1.6.1.2 Testing Services or Laboratories

Fire alarm and fire detection equipment shall be constructed in accordance with UL Fire Prot Dir, UL Electrical Constructn, or FM APP GUIDE.

1.6.2 Standard Products

Provide materials, equipment, and devices that have been tested by a nationally recognized testing laboratory, such as UL or FM, and listed or approved for fire protection service when so required by NFPA 72 or this specification. Select material from one manufacturer, where possible, and not a combination of manufacturers, for any particular classification of materials.

1.6.3 Modification of References

- a. In NFPA publications referred to herein, consider advisory provisions to be mandatory, as though the word "shall" had been substituted for "should" wherever it appears; interpret reference to "authority having jurisdiction" to mean the Midlant Division, Naval Facilities Engineering Command, Fire Protection Engineer.
- b. The recommended practices stated in the manufacturer's literature or documentation shall be considered as mandatory requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

Protect equipment delivered and placed in storage from the weather, humidity, and temperature variation, dirt and dust, and other contaminants.

1.8 SPARE PARTS AND TOOLS

1.8.1 Interchangeable Parts

Spare parts furnished shall be directly interchangeable with the corresponding components of the installed system. Spare parts shall be suitably packaged and identified by nameplate, tagging, or stamping. Spare parts shall be delivered to the Contracting Officer at the time of the final acceptance testing.

1.8.2 Spare Parts

Furnish the following spare parts and accessories:

- a. 2 smoke sensors and base of each type installed

PART 2 PRODUCTS

2.1 EXISTING FIRE ALARM EQUIPMENT

Existing fire alarm equipment shall be maintained fully operational until the new equipment has been tested and accepted by the Contracting Officer. As new equipment is installed, it shall be labeled "NOT IN SERVICE" until the new equipment is accepted. Once the new system is completed, tested, and accepted by the Government, it shall be placed in service and connected to the station fire alarm system. New equipment shall have tags removed and the existing equipment shall be tagged "NOT IN SERVICE" until removed from the building.

2.1.1 Equipment Removal

After acceptance of the new system by the Contracting Officer, existing equipment not connected to the new system shall be removed, unused exposed conduit shall be removed, and damaged surfaces shall be restored. The

material shall be removed from the site and disposed of by the Contractor.

2.1.2 Repair Service/Replacement Parts

Repair services and replacement parts for the system furnished under this contract shall be available for a period of 10 years after the date of final acceptance of this work by the Contracting Officer. On-site service during the guarantee period shall be provided within 24 hours after notification. All repairs shall be completed within 48 hours after notification.

2.1.3 Other Divisions To Be Coordinated With

Refer to the following sections for related work and coordination:

Section 23 00 00 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEMS.

2.1.4 Manufacturer Qualifications

Components shall be of current design and shall be in regular and recurrent production at the time of installation. Provide design, materials, and devices for a protected premises fire alarm system, complete, conforming to NFPA 72, except as otherwise or additionally specified herein.

2.2 INTERIOR FIRE ALARM SYSTEM DESIGN

2.2.1 Definitions

Wherever mentioned in this specification or on the drawings, the equipment, devices, and functions shall be defined as follows:

- a. Analog/Addressable System: A system in which multiple signals are transmitted via the same conduction path to a remote fire alarm control unit and fire alarm control panel, decoded and separated so that each signal will initiate the specified response.
- b. Hard Wired System: A system in which alarm and supervisory initiating devices are directly connected, through individual dedicated conductors, to a central control panel without the use of analog/addressable circuits or devices.
- c. Interface Device: An addressable device which interconnects hard wired systems or devices to an analog/addressable system.
- d. Fire Alarm Control Panel (FACP): A master control panel having the features of a fire alarm control unit and to which fire alarm control units are interconnected. .

2.2.2 System Operation

The system shall be a complete, supervised, noncoded, analog/addressable fire alarm system conforming to NFPA 72. The system shall have an interconnected riser loop or network having Style 6 supervision that shall not be located in the same room or shaft. The return portion of the loop shall be remote from the supply portion of the loop. Where the building has two stairs for egress from floors above grade, a single impairment cannot adversely affect more than one floor. Where three or more stairs are provided for egress from floors above grade, a single impairment cannot adversely affect more than 1/2 of any floor. The system shall operate in

the alarm mode upon actuation of any alarm initiating device. The system shall remain in the alarm mode until initiating device(s) are reset and the fire alarm control panel is manually reset and restored to normal. The system shall provide the following functions and operating features:

- a. The FACP and fire alarm control units, if used, shall provide power, annunciation, supervision, and control for the system.
- b. Provide Style B initiating device circuits for conductor lengths of 10 feet or less.
- c. Provide Style 4 signaling line circuits for each floor.
- d. Provide alarm verification capability for smoke sensors. Alarm verification shall initially be set for 30 seconds.
- e. Alarm functions shall override trouble or supervisory functions. Supervisory functions shall override trouble functions.
- f. The system shall be capable of being programmed from the panel's keyboard. Programmed information shall be stored in non-volatile memory.
- g. The system shall be capable of operating, supervising, and/or monitoring both addressable and non-addressable alarm and supervisory devices.
- h. There shall be no limit, other than maximum system capacity, as to the number of addressable devices which may be in alarm simultaneously.

2.2.3 Smoke Sensors

2.2.3.1 Photoelectric Smoke Sensors

Provide addressable photoelectric smoke sensors as follows:

- a. Provide analog/addressable photoelectric smoke sensors utilizing the photoelectric light scattering principle for operation in accordance with UL 268. Smoke sensors shall be listed for use with the fire alarm control panel.
- b. Provide self-restoring type sensors which do not require any readjustment after actuation at the FACP to restore them to normal operation. Sensors shall be UL listed as smoke-automatic fire sensors.
- c. Components shall be rust and corrosion resistant. Vibration shall have no effect on the sensor's operation. Protect the detection chamber with a fine mesh metallic screen which prevents the entrance of insects or airborne materials. The screen shall not inhibit the movement of smoke particles into the chamber.
- d. Provide twist lock bases for the sensors. The sensors shall maintain contact with their bases without the use of springs. Provide companion mounting base with screw terminals for each conductor. Terminate field wiring on the screw terminals. The sensor shall have a visual indicator to show actuation.
- e. The sensor address shall identify the particular unit, its location within the system, and its sensitivity setting. Sensors shall be of

the low voltage type rated for use on a 24 VDC system.

f. An operator at the control panel, having a proper access level, shall have the capability to manually access the following information for each initiating device.

- (1) Primary status
- (2) Device type
- (3) Present average value
- (4) Present sensitivity selected
- (5) Sensor range (normal, dirty, etc.)

2.2.3.2 Duct Smoke Sensors

Duct smoke sensors shall be analog/addressable photoelectric type as described in paragraph entitled "Photoelectric Smoke Sensors," and shall be provided in ductwork in accordance with NFPA 90A and in accordance with manufacturer's recommendations.

2.2.3.3 Smoke Sensor Testing

Smoke sensors shall be tested in accordance with manufacturer's recommended calibrated test method. Submit smoke sensor testing procedures for approval.

2.2.4 System Field Wiring

2.2.4.1 Wiring Within Cabinets, Enclosures, Boxes, Junction Boxes, and Fittings

Provide wiring installed in a neat and workmanlike manner and installed parallel with or at right angles to the sides and back of any box, enclosure, or cabinet. Conductors which are terminated, spliced, or otherwise interrupted in any enclosure, cabinet, mounting, or junction box shall be connected to terminal blocks. Mark each terminal in accordance with the wiring diagrams of the system. Make connections with approved pressure type terminal blocks, which are securely mounted. The use of wire nuts or similar devices shall be prohibited.

2.2.4.2 Alarm Wiring

Signaling line circuits and initiating device circuit field wiring shall be copper, No. 16 AWG size conductors at a minimum. Wire size shall be sufficient to prevent voltage drop problems. Circuits operating at 24 VDC shall not operate at less than 21.6 volts. Circuits operating at any other voltage shall not have a voltage drop exceeding 10 percent of nominal voltage. Power wiring, operating at 120 VAC minimum, shall be No. 12 AWG solid copper having similar insulation. Provide all wiring in rigid metal conduit or intermediate metal conduit. Electrical metallic tubing conduit is acceptable in dry locations not enclosed in concrete or where not subject to mechanical damage. Conceal conduit in finished areas of new construction and wherever practicable in existing construction. The use of flexible conduit not exceeding a 6 foot length shall be permitted in initiating device circuits. Run conduit or tubing concealed unless specifically shown otherwise on the drawings. Shielded wiring shall be utilized where recommended by the manufacturer. For shielded wiring, the shield shall be grounded at only one point, which shall be in or adjacent to the FACP. T-taps are permitted in Style 4 circuits with interconnections occurring on terminal strips. Color coding is required

for circuits and shall be maintained throughout the circuit.

2.2.4.3 Conductor Terminations

Labeling of conductors at terminal blocks in terminal cabinets, FACP, and remote fire alarm control units shall be provided at each conductor connection. Each conductor or cable shall have a shrink-wrap label to provide a unique and specific designation. Each terminal cabinet, FACP, and fire alarm control unit shall contain a laminated drawing which indicates each conductor, its label, circuit, and terminal. The laminated drawing shall be neat, using 12 point lettering minimum size, and mounted within each cabinet, panel, or unit so that it does not interfere with the wiring or terminals. Maintain existing color code scheme where connecting to existing equipment.

2.3 WIRING

Provide wiring materials under this section as specified in Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM with the additions and modifications specified herein.

PART 3 EXECUTION

3.1 INSTALLATION OF FIRE ALARM INITIATING AND INDICATING DEVICES

- a. Smoke and Heat Sensors: Locate sensors as required by NFPA 72 and their listings on a 4 inch mounting box. b. The modification of any fire alarm system and the procedures shall comply with the requirements of NFPA 241.

3.2 FIELD QUALITY CONTROL

3.2.1 Tests

- a. Megger Tests: After wiring has been installed, and prior to making any connections to panels or devices, wiring shall be megger tested for insulation resistance, grounds, and/or shorts. Conductors with 300 volt rated insulation shall be tested at a minimum of 250 VDC. Conductors with 600 volt rated insulation shall be tested at a minimum of 500 VDC. The tests shall be witnessed by the Contracting Officer and test results recorded for use at the final acceptance test.
- b. Loop Resistance Tests: Measure and record the resistance of each circuit with each pair of conductors in the circuit short-circuited at the farthest point from the circuit origin. The tests shall be witnessed by the Contracting Officer and test results recorded for use at the final acceptance test.
- c. Preliminary Testing: Conduct preliminary tests to ensure that devices and circuits are functioning properly. Tests shall meet the requirements of paragraph entitled "Minimum System Tests." After preliminary testing is complete, provide a letter certifying that the installation is complete and fully operable. The letter shall state that each initiating and indicating device was tested in place and functioned properly. The letter shall also state that panel functions were tested and operated properly. The letter shall include the names and titles of the witnesses to the preliminary tests. The Contractor and an authorized representative from each supplier of equipment shall be in attendance at the preliminary testing to make necessary

adjustments.

- d. Request for Formal Inspection and Tests: When tests have been completed and corrections made, submit a signed, dated certificate with a request for formal inspection and tests to the Contracting Officer.
- e. Final Testing: Notify the Contracting Officer in writing when the system is ready for final acceptance testing. Submit request for test at least 15 calendar days prior to the test date. A final acceptance test will not be scheduled until the operation and maintenance (O&M) manuals are furnished to the Contracting Officer and the following are provided at the job site:
 - (1) The systems manufacturer's technical representative
 - (2) Marked-up red line drawings of the system as actually installed
 - (3) Megger test results
 - (4) Loop resistance test results
 - (5) Complete program printout including input/output addresses

The final tests shall be witnessed by the Midlant Division, Naval Facilities Engineering Command, Fire Protection Engineer. At this time, any and all required tests shall be repeated at their discretion. Following acceptance of the system, as-built drawings and O&M manuals shall be delivered to the Contracting Officer for review and acceptance. In existing buildings, the transfer of devices from the existing system to the new system and the permission to begin demolition of the old fire alarm system will not be permitted until the as-built drawings and O&M manuals are received.

3.2.2 Minimum System Tests

Test the system in accordance with the procedures outlined in NFPA 72. The required tests are as follows:

- a. Verify the absence of unwanted voltages between circuit conductors and ground. The tests shall be accomplished at the preliminary test with results available at the final system test.
- b. Verify that the control unit is in the normal condition as detailed in the manufacturer's O&M manual.
- c. Test each new initiating device and circuit for proper operation and response at the control unit. Smoke sensors shall be tested in accordance with manufacturer's recommended calibrated test method. Testing of duct smoke detectors shall comply with the requirements of NFPA 72.
- d. Test the system for specified functions in accordance with the contract drawings and specifications and the manufacturer's O&M manual.
- e. Test both primary power and secondary power. Verify, by test, the secondary power system is capable of operating the system for the time period and in the manner specified.
- f. Determine that the system is operable under trouble conditions as

specified.

- g. Visually inspect wiring.
- h. Test the battery charger and batteries.
- i. Verify that software control and data files have been entered or programmed into the FACP. Hard copy records of the software shall be provided to the Contracting Officer.
- j. Verify that red-line drawings are accurate.
- k. Measure the current in circuits to ensure there is spare capacity for the circuits.
- l. Measure voltage readings for circuits to ensure that voltage drop is not excessive.
- m. Disconnect the verification feature for smoke sensors during tests to minimize the amount of smoke needed to activate the sensor. Testing of smoke sensors shall be conducted using real smoke. The use of canned smoke is prohibited.
- n. Measure the voltage drop at the most remote appliance on each notification appliance circuit.

3.3 INSTRUCTION OF GOVERNMENT EMPLOYEES

Equipment manufacturer shall provide 1 day on site Training shall allow for classroom instruction as well as individual hands on programming, troubleshooting and diagnostics exercises.

3.3.1 Instructor

Include in the project the services of an instructor, who shall have received specific training from the manufacturer for the training of other persons regarding the inspection, testing, and maintenance of the system provided. The instructor shall train the Government employees designated by the Contracting Officer, in the care, adjustment, maintenance, and operation of the fire alarm system.

3.3.2 Qualifications

Each instructor shall be thoroughly familiar with all parts of this installation. The instructor shall be trained in operating theory as well as in practical O&M work.

3.3.3 Required Instruction Time

Provide 16 hours of instruction after final acceptance of the system. The instruction shall be given during regular working hours on such dates and times as are selected by the Contracting Officer. The instruction may be divided into two or more periods at the discretion of the Contracting Officer. The training shall allow for rescheduling for unforeseen maintenance and/or fire department responses.

-- End of Section --