

SOLICITATION/CONTRACT/ORDER FOR COMMERCIAL ITEMS <i>OFFEROR TO COMPLETE BLOCKS 12, 17, 23, 24, AND 30</i>				1. REQUISITION NUMBER		PAGE 1 OF 54				
2. CONTRACT NO.		3. AWARD/EFFECTIVE DATE	4. ORDER NUMBER		5. SOLICITATION NUMBER N69450-16-R-3235		6. SOLICITATION ISSUE DATE 23-Jun-2016			
7. FOR SOLICITATION INFORMATION CALL:		a. NAME JOEL OVERSON			b. TELEPHONE NUMBER (No Collect Calls) 361-961-3397		8. OFFER DUE DATE/LOCAL TIME 05:00 PM 26 Jul 2016			
9. ISSUED BY NAVFAC SOUTHEAST PWD CORPUS CHRISTI 8851 OCEAN DRIVE, BLDG 19 CORPUS CHRISTI TX 78419-5021 TEL: FAX:		CODE	N69450		10. THIS ACQUISITION IS <input checked="" type="checkbox"/> UNRESTRICTED <input type="checkbox"/> SET ASIDE: % FOR <input type="checkbox"/> SB <input type="checkbox"/> HUBZONE SB <input type="checkbox"/> 8(A) <input type="checkbox"/> SVC-DISABLED VET-OWNED SB <input type="checkbox"/> EMERGING SB SIZE STD: NAICS:		11. DELIVERY FOR FOB DESTINATION UNLESS BLOCK IS MARKED <input type="checkbox"/> SEE SCHEDULE		12. DISCOUNT TERMS	
				<input type="checkbox"/> 13a. THIS CONTRACT IS A RATED ORDER UNDER DPAS (15 CFR 700)			13b. RATING			
							14. METHOD OF SOLICITATION <input type="checkbox"/> RFQ <input type="checkbox"/> IFB <input checked="" type="checkbox"/> RFP			
15. DELIVER TO PWD CORPUS CHRISTI INSPECTOR OF RECORD 8851 OCEAN DR, BLDG. 19 CORPUS CHRISTI TX 78419-5525 TEL: 361-961-3397 FAX:		CODE	N44215		16. ADMINISTERED BY			CODE		
17a. CONTRACTOR/OFFEROR		CODE			18a. PAYMENT WILL BE MADE BY		CODE			
TEL.		FACILITY CODE								
<input type="checkbox"/> 17b. CHECK IF REMITTANCE IS DIFFERENT AND PUT SUCH ADDRESS IN OFFER				18b. SUBMIT INVOICES TO ADDRESS SHOWN IN BLOCK 18a. UNLESS BLOCK BELOW IS CHECKED <input type="checkbox"/> SEE ADDENDUM						
19. ITEM NO.	20. SCHEDULE OF SUPPLIES/ SERVICES			21. QUANTITY	22. UNIT	23. UNIT PRICE	24. AMOUNT			
SEE SCHEDULE										
25. ACCOUNTING AND APPROPRIATION DATA					26. TOTAL AWARD AMOUNT (For Govt. Use Only)					
<input type="checkbox"/> 27a. SOLICITATION INCORPORATES BY REFERENCE FAR 52.212-1. 52.212-4. FAR 52.212-3. 52.212-5 ARE ATTACHED. ADDENDA <input type="checkbox"/> ARE <input type="checkbox"/> ARE NOT ATTACHED										
<input type="checkbox"/> 27b. CONTRACT/PURCHASE ORDER INCORPORATES BY REFERENCE FAR 52.212-4. FAR 52.212-5 IS ATTACHED. ADDENDA <input type="checkbox"/> ARE <input type="checkbox"/> ARE NOT ATTACHED										
28. CONTRACTOR IS REQUIRED TO SIGN THIS DOCUMENT AND RETURN <u>0</u> COPIES <input type="checkbox"/> TO ISSUING OFFICE. CONTRACTOR AGREES TO FURNISH AND DELIVER ALL ITEMS SET FORTH OR OTHERWISE IDENTIFIED ABOVE AND ON ANY ADDITIONAL SHEETS SUBJECT TO THE TERMS AND CONDITIONS SPECIFIED HEREIN.					29. AWARD OF CONTRACT: REFERENCE <input type="checkbox"/> OFFER DATED . YOUR OFFER ON SOLICITATION (BLOCK 5), INCLUDING ANY ADDITIONS OR CHANGES WHICH ARE SET FORTH HEREIN, IS ACCEPTED AS TO ITEMS:					
30a. SIGNATURE OF OFFEROR/CONTRACTOR				31a. UNITED STATES OF AMERICA (SIGNATURE OF CONTRACTING OFFICER)		31c. DATE SIGNED				
30b. NAME AND TITLE OF SIGNER (TYPE OR PRINT)		30c. DATE SIGNED		31b. NAME OF CONTRACTING OFFICER (TYPE OR PRINT)						
				TEL: EMAIL:						

**SOLICITATION/CONTRACT/ORDER FOR COMMERCIAL ITEMS
(CONTINUED)**

19. ITEM NO.	20. SCHEDULE OF SUPPLIES/ SERVICES	21. QUANTITY	22. UNIT	23. UNIT PRICE	24. AMOUNT
<p>SEE SCHEDULE</p>					

32a. QUANTITY IN COLUMN 21 HAS BEEN
 RECEIVED INSPECTED ACCEPTED, AND CONFORMS TO THE CONTRACT, EXCEPT AS NOTED: _____

32b. SIGNATURE OF AUTHORIZED GOVERNMENT REPRESENTATIVE	32c. DATE	32d. PRINTED NAME AND TITLE OF AUTHORIZED GOVERNMENT REPRESENTATIVE
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32e. MAILING ADDRESS OF AUTHORIZED GOVERNMENT REPRESENTATIVE	32f. TELEPHONE NUMBER OF AUTHORIZED GOVERNMENT REPRESENTATIVE
	32g. E-MAIL OF AUTHORIZED GOVERNMENT REPRESENTATIVE

33. SHIP NUMBER	34. VOUCHER NUMBER	35. AMOUNT VERIFIED CORRECT FOR	36. PAYMENT <input type="checkbox"/> COMPLETE <input type="checkbox"/> PARTIAL <input type="checkbox"/> FINAL	37. CHECK NUMBER
<input type="checkbox"/> PARTIAL <input type="checkbox"/> FINAL				

38. S/R ACCOUNT NUMBER	39. S/R VOUCHER NUMBER	40. PAID BY
------------------------	------------------------	-------------

41a. I CERTIFY THIS ACCOUNT IS CORRECT AND PROPER FOR PAYMENT	42a. RECEIVED BY (<i>Print</i>)		
41b. SIGNATURE AND TITLE OF CERTIFYING OFFICER	41c. DATE	42b. RECEIVED AT (<i>Location</i>)	
		42c. DATE REC'D (<i>YY/MM/DD</i>)	42d. TOTAL CONTAINERS

Section SF 1449 - CONTINUATION SHEET

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0001	REPLACE CHILLERS FFP REPLACE TWO CHILLERS AT BLDG 68 AT NAS CORPUS CHRISTI, TX. PERIOD OF PERFORMANCE WILL BE A TOTAL OF 270 CALENDAR DAYS. FOB: Destination	1	Job		

NET AMT

STATEMENT OF WORK**GENERAL INFORMATION:****Document Type: Combined Synopsis/Solicitation Notice****Solicitation Number: N69450-16-R-3235****Set Aside: 100% Total Small Business****NAICS Code: 238220, Size standard in Millions: \$15.0**

DESCRIPTION / SCOPE OF WORK: Contractor is to provide all Labor, Materials, equipment, Tools, Transportation and Management necessary to replace two chillers at Bldg 68 at NAS Corpus Christi, TX.

This request for proposal constitutes the only solicitation; no separate written solicitation will be issued.

BASIS FOR AWARD: AWARD WILL BE BASED ON LOWEST PRICE.**Target Price Range is between \$100,000 and \$250,000**

Anticipated award date: 10 days after close of solicitation

Quotes are to be received no later than 5:00 p.m. central standard time on 26 July 2016. Proposals should be emailed to joel.overson@navy.mil. Offerors shall include a completed copy of the provision at [52.212-3](#), Offeror Representations and Certifications -- Commercial Items, with its offer.Any changes to the solicitation or RFI's will be posted on FEDBIZOPS (www.fbo.gov) for the mutual benefit of all bidders.This is a combined synopsis/solicitation for commercial items prepared in accordance with the format in [Subpart 12.6](#), as supplemented with additional information included in this notice. This announcement constitutes the only solicitation; proposals are being requested and a written solicitation will not be issued.

The solicitation document and incorporated provisions and clauses are those in effect through Federal Acquisition Circular 205-88-1.

The following provisions or clauses apply to this acquisition:

[52.212-1](#), Instructions to Offerors -- Commercial

[52.212-2](#), Evaluation -- Commercial Items

[52.212-4](#), Contract Terms and Conditions -- Commercial Items

[52.212-5](#), Contract Terms and Conditions Required To Implement Statutes Or Executive Orders -- Commercial Items

ADDITIONAL INFORMATION:

Solicitation document shall be signed by bidders and all applicable Certifications and Representations shall be completed.

All payments are to be paid via the Internet through the Wide Area Work Flow (WAWF) system. WAWF may be accessed at <https://wawf.eb.mil>. WAWF training may be accessed online at <http://www.wawftraining.com>. Payment information may be accessed using the DFAS website at <https://www.dfas.mil>. Your purchase order/contract number or invoice will be required to inquire status of your payment.

Be advised that all interested parties must be registered in the System for Award Management (SAM) Database in order to receive payment for products/services rendered to the Government as the result of an award. If you are not registered you may request an application at (334) 206-7828 or through the SAM website at <https://sam.gov>.

Rapid Gate Information: The Navy has implemented a new security access program for the Corpus Christi and Kingsville Naval Air Stations. This program, called Rapid gate, will reduce expenses, reduce risk, and insure quicker access for people coming to the installation. You must either call 1-877-727-4342 or go online to <http://rapidgate.com>. Once the company is enrolled, your employees can register at the installation. If your company employees have been authorized the common access card (CAC), it is not necessary to enroll in the rapid gate program.

SITE VISIT INFORMATION:

1. One site visit will be held to ensure all potential offerors have uniform information in order to make an accurate proposal.
2. Site visit will be conducted on **5 JUL 2016 at 1000 a.m. central time at NAS Corpus Christi, TX**. All potential offerors are encouraged to attend the site visit to perform an inspection of the size and current layout.
3. Offerors are expected to satisfy themselves as to the general and local conditions that may affect the cost of the performance of the work to the extent that such information is reasonably obtainable. It is considered impractical to determine, without inspection, the exact nature of the work and site conditions under which the work is to be performed.

4. To attend please contact the Site Visit POC.

Site Visit POC:

ENS Natalie King

natalie.king@navy.mil

361-961-5175

Deadline for receipt of the base access form is one week prior to the site visit. It is the responsibility of the contractor to confirm this form is received. After submission of form should a person not be available to attend, send a cancellation email to the same POC.

5. Interested parties are advised to arrive by an hour early in order to receive security passes and clearance.

6. The contractor may require, and should have, their own ear plugs, safety glasses and safety shoes to have access to the work site.

STATEMENT OF WORK

REPLACE TWO 60-TON AIR COOLED CHILLERS, NAS CORPUS CHRISTI, TX

1. **GENERAL DESCRIPTION:** The Contractor shall provide all supervision, transportation, labor, materials, equipment and incidental work necessary to replace two 60 ton 460 volt 3 phase chillers. See paragraph 13 for detailed statement work.

2. **LOCATION:** The work is located at Building 68, N. A. S. Corpus Christi, Texas. See Attachment A for project location.

3. **PERIOD OF PERFORMANCE:** The period of performance is 270 calendar days. The period of performance starts when the contract/task order is awarded, and ends when the work is completed and accepted by the Government. The period of performance includes pre-construction submittals, material/equipment lead time, and all construction activities up to final acceptance. The period of performance is negotiable; hence, if the contractor believes a different/longer period of performance is needed, they should negotiate this with the Contract Specialist prior to task order/contract award.

4. **EXAMINATION OF SITE:** Bidders are expected to visit the site, take their own measurements, inspect carefully the work area and satisfy themselves as to the character and amount of work to be done.

5. **WORK RESTRICTIONS:** The following work restriction apply to this project:

5.1 **Schedule hours:** The work shall be so scheduled as to cause a minimum of interference to the normal operations of the tenants. Work shall be accomplished between the hours of 7:30 A.M. and 4:30 P.M., Monday through Friday. If the Contractor desires to work on Saturday, Sunday, holidays, or outside of the Station's regular hours, an application may be submitted to the Contracting Officer for approval.

5.2 **RAPID Gate:** All contractor and subcontractor personnel shall obtain a RAPID Gate pass to gain access to NAS Corpus Christi. Please allow three days for processing of all RAPID Gate applications. See <http://www.rapidgate.com> for additional information and costs. Costs incurred to obtain base access credentials are not directly reimbursable. No equitable adjustment in contract cost/price or schedule shall be allowed on account of the contractor participating in any program to obtain installation access.

5.3 Flight Line Pass: All contractor and subcontractor personnel working on airfield or flight line shall obtain flight a line pass. The flight line pass is offered at no costs to the contractor, but requires up to three days to process. Once the individual's application is processed, he/she shall proceed to the pass and tag office to have the flight line pass issued.

5.4 Airfield Vehicle Operators License: For projects located on the flight line or airfield, contractor or subcontractor personnel operating vehicles must also obtain one of two levels of licenses: (1) the Area 1 license (controlled movement areas), or (2) the Area 2 (aprons, non-runway/taxiway area). This license is required so ensure that all drivers are familiar with the airfield, its safety rules and radio protocols when operating vehicles where aircraft are present. The license must be obtained before the flight line pass. The license must be presented when obtaining the flight line pass in order to properly code the flight line pass to allow the driver to pass through the airfield access gate. Licenses are offered at no cost to the contractor.

5.4.1 Area 2 License - Area 2 includes all parking aprons, hangars, and associated facilities. To obtain an Area 2 license, vehicle operators must attend a one-hour class conducted on Tuesdays.

5.4.2 Area 1 License - Area 1 includes all runways, taxiways, and the perimeter road. To operate a vehicle in Area 1, the driver must attend an 8-hour class that is offered on Thursdays and continues into the next day(s). To obtain an Area 1 license, the operator must attend the class, pass a written test, and complete a day and night time practical test. An Area 1 license enables the driver the ability to drive on the entirety of the airfield, but the Area 2 license does not grant access to drive beyond the aprons.

5.5 Material deliveries: Material delivery trucks do not necessarily require RAPID Gate passes, flight line passes, or ramp passes. However, any material delivery driver that does not have a RAPID Gate pass must be escorted by Government personnel. To properly plan for Government escort availability, three (3) working days' notice is required for all material deliveries. Any material delivery driver that possesses a RAPID Gate pass does not require Government escort or advance notification unless the material is to be delivered on the flight line or airfield.

5.6 Time-Sensitive Material Deliveries: Time-sensitive material deliveries such as asphalt or concrete require pre-arrangement by NAS Security personnel to ensure expedited access at the entrance gate. Seven (7) calendar days' notice is required for time-sensitive material deliveries.

6. PROTECTION OF EXISTING WORK: Existing work to remain shall be protected from damage. Work damaged by the Contractor shall be repaired to original condition at no additional cost to the Government.

7. NAS FIRE REGULATIONS: "Hot work" permits are issued to the Contractor by the Fire Prevention Inspectors by calling 961-4151 or 961-4983. Permits are issued on a daily basis only and from start of work until finished. Permits are required for all "hot work" and before entering buildings. ("Hot work" includes all welding, cutting, soldering/brazing, blow torches, etc.)

8. SAFETY REQUIREMENTS:

8.1 Lock out/ Tag Out Policy

- a. Combination locks shall not be used for lockout;
- b. No two (2) lockout devices (locks) shall be keyed alike;
- c. No more than two (2) keys shall exist for any lock. The worker shall maintain one key, and the supervisor shall maintain the other in a location readily accessible in the event of an emergency;
- d. Both lockout and tag-out devices shall indicate the identifier of the employee applying the device(s). Tag-out devices shall include the cognizant shop (or code), the telephone number where the employee can be

reached during working hours, name of his/her supervisor, date the device was applied, and the machine, equipment, or system component that is de-energized.

9. **ASBESTOS AND LEAD:** There is no known asbestos containing material (ACM) and/or lead based paint on this project. If additional materials are encountered which may contain ACM and/or lead, **DO NOT TOUCH THE MATERIAL. IMMEDIATELY NOTIFY THE CONTRACTING OFFICER IN WRITING.** Within a reasonable time, the Government will perform tests to determine if asbestos or lead is present. If the materials are determined not to contain ACM or lead, the Contractor shall proceed without change. If it is determined that ACM and/lead are present and must be disturbed, the Contracting Officer may direct a change accordingly.

10. **WEIGHT HANDLING EQUIPMENT (WHE):** The provision of NAVFAC Publication P-307 apply to all civilian, military, and contractor personnel who operate weight handling equipment and use crane related rigging gear on board Naval Air Station Corpus Christi, Texas.

11. **EXCAVATIONS AND OUTAGES:** Any excavation greater than 6 inches below grade requires an excavation permit. Any utility or HVAC outage affecting inhabited work space, inhabited living space, or exit from an inhabited work space/living space requires an Outage Permit. For Excavation and Outage contact the government point of contact listed in paragraph 13.3.

12. **ATTACHMENTS:** The following sketches are a part of this specification and shall not be used for any purpose other than that contemplated by this contract:

Attachment	Title
A	Project Location
B	Solid Waste Report
C	PMI Equipment Inventory Card
D	Water Chillers, Vapor Compression Type
E	BACNet Controller

13. **SCOPE OF WORK:**

This scope of work is to replace two 60 ton 460 volt 3 phase condensing units at building 68 (Carrier Model # 30RBB0606—08-03 for both units). Currently the condensing units are experience corrosion issues and are beyond repair. These units shall be replaced with two new 60 ton 460 volt 3 phase condensing units to support the load of the building. These units are redundant and only one unit can be replaced at a time to ensure that no cooling is lost to the tower. The air handling unit is in good condition and is not to be replaced with the project. The new units must match and work with the air handling unit currently installed at the facility. The contract shall ensure the following:

- I. Ensure that units have been secured electrically and disconnect from electrical connections.
- II. Disconnect unit from chilled water lines. Demolish current units and dispose of units. The size of these units will require the use of weight handling equipment. The facility is also on the taxiway.
- III. Prep the site to receive the new units. If applicable install new mounting hardware or mounting apparatus. Unit must be mounted on level surface and secured.

- IV. Units must be spaced appropriately to allow adequate air flow between the units. This is determined by the manufacturer and is included in the installation manual provided for the unit select by the contractor. The contractor shall ensure that this distance is appropriate if it is different than the current mounting situation.
- V. Attachment D Water Chillers, Vapor Compression Type address all specifications required in selecting a water chilled vapor compression type unit. Contractor shall be required to follow specifications in Attachment D.
- VI. Units shall be reconnected to chilled water and electricity and start up testing will be required per manufacturer's recommendations and best practices.
- VII. Factory applied corrosion resistant coatings or materials must be provided for any exterior air-conditioning (including heating and ventilating) equipment and equipment handling outside air that is to be installed within 10 miles (16 km) of the ocean or other salt water body. This coating must meet ASTM B117 salt spray requirement for 3,000 hours.
- VIII. These systems typically have an onboard controls system. ASHRAE's BACnet® protocol is the preferred control system architecture for Navy & Marine Corp facilities. Facility HVAC control systems based on the BACnet® protocol must be designed and constructed in accordance with ANSI/ASHRAE Standard 135 and UFGS 23 09 23.13 20 which is included in Attachment E. Contractor is also required to make sure that controls installed with new unit is compatible with controls already installed on other systems in the building. Currently the facility has Siemens DDC controls installed. The contractor is required to provide training to government personnel on all control systems installed as well as equipment training.

13.1 The contractor shall conduct his own survey of the site to determine existing features, conditions, and measurements. The contractor shall report any discrepancy between the statement of work and existing conditions prior to the commencement of work.

13.2 The contractor shall coordinate with the FEAD Department approximately three working days in advance of start of work to let the occupant of the building know when the construction is to take place so that they may notify their personnel to remain clear of the jobsite and to not affect scheduled work hours.

13.3 All work under this Contract is to be accomplished with FEAD Department oversight. The contractor shall coordinate with the FEAD Point of Contact site visit access. The contractor shall give notice to the FEAD Point of Contact prior to accomplishment of any work. The Point of Contact will be appointed by the contracting officer at the time of contract award.

13.4 Keep the jobsite clean at all times, and remove all debris from the station.

13.5. All work shall be performed in compliance with the latest edition of UFC 3-410-01, ASHRAE 90.1 and 62.1. All products shall be installed according to manufacturer's recommendations.

13.6 Licensing Requirements: All work is to be accomplished with a licensed journeyman electrician that has met all current city & state certifications or license requirements to accomplish the specified work. HVAC technician must be certified to perform work on equipment of this size.

13.7 Submittals: Submittals shall be provided and approved prior to delivery to the job site. If submittals contain information for more than one product type, clearly indicate which product type is being submitted for approval. Provide submittals for the following materials to be furnished and delivered under this contract to the Contracting Officer for approval prior to installation:

1. Product data or product specification sheet.
2. Mechanical Placement drawing: showing demolition and new equipment placement
3. Lift plan for weight handling equipment

The approval or acceptance of submittals is not be construed as a complete check, and indicates only that the general method of construction, materials, detailing and other information are satisfactory. Approval or acceptance will not relieve the Contractor of the responsibility for any error which may exist, as the Contractor is responsible for dimensions, the design of adequate connections and details, and the satisfactory construction of all work.

14. PRODUCTS: Products shall be new, manufacturer's standard products, and commonly available from manufacturer's stock.

15. N/A

16. ORAL MODIFICATIONS: No oral statement of any person other than the Contracting Officer or his/her representative, as provided in the contract clause entitled "Changes" shall in any manner or degree modify or otherwise affect the terms of this contract.

17. CLEANUP: The premises shall be kept free at all times from the accumulation of waste material and/or rubbish resulting from the work. Combustibles shall be removed daily, and upon completion of the work, all debris, tools, and other surplus materials shall be removed and the premises left in approved condition.

18. ENVIRONMENTAL REQUIREMENTS: Take no action or inaction that exposes the Government to liability for non-compliance or other findings or damages, penalties or fines related thereto. In the event a regulatory agency assesses either a monetary or non-monetary fine or penalty for Contractor's noncompliance, the Contractor shall reimburse the Government for all associated cost. Remove all hazardous material and waste upon completion of the contract. Abandoned waste shall be managed as "unknown waste", and the contractor shall bear the cost of any analytical, disposal, or other costs incurred.

18.1 Regulated Waste: Regulated waste is defined as (1) hazardous waste as defined in EPA Regulations 40 CFR 261, (2) universal waste as defined in EPA Regulations 40 CFR 273, and (3) Class 1 industrial waste as defined in Texas Commission on Environmental Quality Regulations 30 Texas Administrative Code Parts 335 and 503. Manage all regulated waste and used oil in accordance with applicable federal, state, and local regulations, Navy and NASCC policies and instructions. All regulated waste shall be manifested through PWD Corpus Christi Environmental Division.

Before generating regulated waste obtain approval for storage from the Environmental Division. Application for approval shall include including location and type of storage (i.e. Satellite

Accumulation Point or <90-day Storage Area). Contractor shall provide immediate access to PWD Corpus Christi Environmental Division to inspection any locked units. Contractor shall inspect their regulated waste storage areas and provide weekly inspection reports to the Government POC.

PWD Corpus Christi Hazardous Waste Commodity Branch (HWCB) provides comprehensive regulated waste disposal services. If the contractor chooses to dispose of regulated waste through the HWCB, contractor shall establish a line of credit with the HWCB and provide required waste stream information **before generating any waste**. If contractor chooses not to dispose of regulated waste through the HWCB, the contractor shall provide funding to the HWCB for manifesting services. For FY 16 the rate is \$68 per manifest. The contact phone number for the HWCB is 361-961-3760. Contractor shall contact the HWCB before make any arrangements to remove regulated waste from the installation.

18.2 Solid Waste Disposal: All waste not covered under paragraph 18.1 must be tracked by NASCC whether directly disposed in a landfill or recycled. Contractor shall recycle waste to the greatest extent feasible. The solid waste tracking form is included in Attachment B. Contractor shall provide the filled out form to the Government POC at the close of the project.

19. PMI INVENTORY CARD: Contractor shall provide a completed PMI Equipment Inventory Card included as Attachment C for each piece of dynamic equipment containing a serial number. This requirement is in addition to any other operation and maintenance information required in the Submittals paragraph.

20. ACCEPTANCE: The work shall be accepted as a result of a final inspection conducted by a representative of the Facility Engineering and Acquisition Division, Public Works Department Corpus Christi.

21. WARRANTY: All workmanship and materials and/or equipment shall be warranted for a period of not less than one year under normal wear and tear or the normal standard warranty should it extend beyond one year.

*** END OF SPECIFICATIONS ***

INSPECTION AND ACCEPTANCE TERMS

Supplies/services will be inspected/accepted at:

CLIN	INSPECT AT	INSPECT BY	ACCEPT AT	ACCEPT BY
0001	Destination	Government	Destination	Government

DELIVERY INFORMATION

CLIN	DELIVERY DATE	QUANTITY	SHIP TO ADDRESS	UIC
0001	05-MAY-2017	1	PWD CORPUS CHRISTI INSPECTOR OF RECORD 8851 OCEAN DR, BLDG. 19 CORPUS CHRISTI TX 78419-5525 361-961-3397 FOB: Destination	N44215

CLAUSES INCORPORATED BY REFERENCE

52.209-7	Information Regarding Responsibility Matters	JUL 2013
52.209-12	Certification Regarding Tax Matters	FEB 2016
52.222-56	Certification Regarding Trafficking in Persons Compliance Plan.	MAR 2015
52.223-12	Refrigeration Equipment and Air Conditioners	MAY 1995
52.223-17	Affirmative Procurement of EPA-Designated Items in Service and Construction Contracts	MAY 2008
52.228-8	Liability and Insurance - Leased Motor Vehicles	MAY 1999
52.232-33	Payment by Electronic Funds Transfer--System for Award Management	JUL 2013
52.232-40	Providing Accelerated Payments to Small Business Subcontractors	DEC 2013
52.233-1	Disputes	MAY 2014
52.233-3	Protest After Award	AUG 1996
52.233-4	Applicable Law for Breach of Contract Claim	OCT 2004
252.211-7003	Item Unique Identification and Valuation	MAR 2016
252.232-7003	Electronic Submission of Payment Requests and Receiving Reports	JUN 2012
252.232-7010	Levies on Contract Payments	DEC 2006
252.243-7002	Requests for Equitable Adjustment	DEC 2012
252.246-7003	Notification of Potential Safety Issues	JUN 2013

CLAUSES INCORPORATED BY FULL TEXT

52.212-1 INSTRUCTIONS TO OFFERORS--COMMERCIAL ITEMS (OCT 2015)

(a) North American Industry Classification System (NAICS) code and small business size standard. The NAICS code and small business size standard for this acquisition appear in Block 10 of the solicitation cover sheet (SF 1449). However, the small business size standard for a concern which submits an offer in its own name, but which proposes to furnish an item which it did not itself manufacture, is 500 employees.

(b) Submission of offers. Submit signed and dated offers to the office specified in this solicitation at or before the exact time specified in this solicitation. Offers may be submitted on the SF 1449, letterhead stationery, or as otherwise specified in the solicitation. As a minimum, offers must show--

(1) The solicitation number;

- (2) The time specified in the solicitation for receipt of offers;
 - (3) The name, address, and telephone number of the offeror;
 - (4) A technical description of the items being offered in sufficient detail to evaluate compliance with the requirements in the solicitation. This may include product literature, or other documents, if necessary;
 - (5) Terms of any express warranty;
 - (6) Price and any discount terms;
 - (7) "Remit to" address, if different than mailing address;
 - (8) A completed copy of the representations and certifications at FAR 52.212-3 (see FAR 52.212-3(b) for those representations and certifications that the offeror shall complete electronically);
 - (9) Acknowledgment of Solicitation Amendments;
 - (10) Past performance information, when included as an evaluation factor, to include recent and relevant contracts for the same or similar items and other references (including contract numbers, points of contact with telephone numbers and other relevant information); and
 - (11) If the offer is not submitted on the SF 1449, include a statement specifying the extent of agreement with all terms, conditions, and provisions included in the solicitation. Offers that fail to furnish required representations or information, or reject the terms and conditions of the solicitation may be excluded from consideration.
- (c) Period for acceptance of offers. The offeror agrees to hold the prices in its offer firm for 30 calendar days from the date specified for receipt of offers, unless another time period is specified in an addendum to the solicitation.
- (d) Product samples. When required by the solicitation, product samples shall be submitted at or prior to the time specified for receipt of offers. Unless otherwise specified in this solicitation, these samples shall be submitted at no expense to the Government, and returned at the sender's request and expense, unless they are destroyed during preaward testing.
- (e) Multiple offers. Offerors are encouraged to submit multiple offers presenting alternative terms and conditions or commercial items for satisfying the requirements of this solicitation. Each offer submitted will be evaluated separately.
- (f) Late submissions, modifications, revisions, and withdrawals of offers:
- (1) Offerors are responsible for submitting offers, and any modifications, revisions, or withdrawals, so as to reach the Government office designated in the solicitation by the time specified in the solicitation. If no time is specified in the solicitation, the time for receipt is 4:30 p.m., local time, for the designated Government office on the date that offers or revisions are due.
 - (2)(i) Any offer, modification, revision, or withdrawal of an offer received at the Government office designated in the solicitation after the exact time specified for receipt of offers is "late" and will not be considered unless it is received before award is made, the Contracting Officer determines that accepting the late offer would not unduly delay the acquisition; and--
- (A) If it was transmitted through an electronic commerce method authorized by the solicitation, it was received at the initial point of entry to the Government infrastructure not later than 5:00 p.m. one working day prior to the date specified for receipt of offers; or

(B) There is acceptable evidence to establish that it was received at the Government installation designated for receipt of offers and was under the Government's control prior to the time set for receipt of offers; or

(C) If this solicitation is a request for proposals, it was the only proposal received.

(ii) However, a late modification of an otherwise successful offer, that makes its terms more favorable to the Government, will be considered at any time it is received and may be accepted.

(3) Acceptable evidence to establish the time of receipt at the Government installation includes the time/date stamp of that installation on the offer wrapper, other documentary evidence of receipt maintained by the installation, or oral testimony or statements of Government personnel.

(4) If an emergency or unanticipated event interrupts normal Government processes so that offers cannot be received at the Government office designated for receipt of offers by the exact time specified in the solicitation, and urgent Government requirements preclude amendment of the solicitation or other notice of an extension of the closing date, the time specified for receipt of offers will be deemed to be extended to the same time of day specified in the solicitation on the first work day on which normal Government processes resume.

(5) Offers may be withdrawn by written notice received at any time before the exact time set for receipt of offers. Oral offers in response to oral solicitations may be withdrawn orally. If the solicitation authorizes facsimile offers, offers may be withdrawn via facsimile received at any time before the exact time set for receipt of offers, subject to the conditions specified in the solicitation concerning facsimile offers. An offer may be withdrawn in person by an offeror or its authorized representative if, before the exact time set for receipt of offers, the identity of the person requesting withdrawal is established and the person signs a receipt for the offer.

(g) Contract award (not applicable to Invitation for Bids). The Government intends to evaluate offers and award a contract without discussions with offerors. Therefore, the offeror's initial offer should contain the offeror's best terms from a price and technical standpoint. However, the Government reserves the right to conduct discussions if later determined by the Contracting Officer to be necessary. The Government may reject any or all offers if such action is in the public interest; accept other than the lowest offer; and waive informalities and minor irregularities in offers received.

(h) Multiple awards. The Government may accept any item or group of items of an offer, unless the offeror qualifies the offer by specific limitations. Unless otherwise provided in the Schedule, offers may not be submitted for quantities less than those specified. The Government reserves the right to make an award on any item for a quantity less than the quantity offered, at the unit prices offered, unless the offeror specifies otherwise in the offer.

(i) Availability of requirements documents cited in the solicitation. (1)(i) The GSA Index of Federal Specifications, Standards and Commercial Item Descriptions, FPMR Part 101-29, and copies of specifications, standards, and commercial item descriptions cited in this solicitation may be obtained for a fee by submitting a request to--GSA Federal Supply Service Specifications Section, Suite 8100, 470 East L'Enfant Plaza, SW, Washington, DC 20407, Telephone (202) 619-8925, Facsimile (202) 619-8978.

(ii) If the General Services Administration, Department of Agriculture, or Department of Veterans Affairs issued this solicitation, a single copy of specifications, standards, and commercial item descriptions cited in this solicitation may be obtained free of charge by submitting a request to the addressee in paragraph (i)(1)(i) of this provision. Additional copies will be issued for a fee.

(2) Most unclassified Defense specifications and standards may be downloaded from the following ASSIST websites:

(i) ASSIST (<https://assist.dla.mil/online/start/>).

(ii) Quick Search (<http://quicksearch.dla.mil/>).

(iii) ASSISTdocs.com (<http://assistdocs.com>).

(3) Documents not available from ASSIST may be ordered from the Department of Defense Single Stock Point (DoDSSP) by--

(i) Using the ASSIST Shopping Wizard (<https://assist.dla.mil/wizard/index.cfm>);

(ii) Phoning the DoDSSP Customer Service Desk (215) 697-2179, Mon-Fri, 0730 to 1600 EST; or

(iii) Ordering from DoDSSP, Building 4, Section D, 700 Robbins Avenue, Philadelphia, PA 19111-5094, Telephone (215) 697-2667/2179, Facsimile (215) 697-1462.

(4) Nongovernment (voluntary) standards must be obtained from the organization responsible for their preparation, publication, or maintenance.

(j) Data Universal Numbering System (DUNS) Number. (Applies to all offers exceeding \$3,500, and offers of \$3,500 or less if the solicitation requires the Contractor to be registered in the System for Award Management (SAM) database. The offeror shall enter, in the block with its name and address on the cover page of its offer, the annotation "DUNS" or "DUNS +4" followed by the DUNS or DUNS +4 number that identifies the offeror's name and address. The DUNS +4 is the DUNS number plus a 4-character suffix that may be assigned at the discretion of the offeror to establish additional SAM records for identifying alternative Electronic Funds Transfer (EFT) accounts (see FAR Subpart 32.11) for the same concern. If the offeror does not have a DUNS number, it should contact Dun and Bradstreet directly to obtain one. An offeror within the United States may contact Dun and Bradstreet by calling 1-866-705-5711 or via the internet at <http://fedgov.dnb.com/webform>. An offeror located outside the United States must contact the local Dun and Bradstreet office for a DUNS number. The offeror should indicate that it is an offeror for a Government contract when contacting the local Dun and Bradstreet office.

(k) System for Award Management. Unless exempted by an addendum to this solicitation, by submission of an offer, the offeror acknowledges the requirement that a prospective awardee shall be registered in the SAM database prior to award, during performance and through final payment of any contract resulting from this solicitation. If the Offeror does not become registered in the SAM database in the time prescribed by the Contracting Officer, the Contracting Officer will proceed to award to the next otherwise successful registered Offeror. Offerors may obtain information on registration and annual confirmation requirements via the SAM database accessed through <https://www.acquisition.gov>.

(l) Debriefing. If a post-award debriefing is given to requesting offerors, the Government shall disclose the following information, if applicable:

(1) The agency's evaluation of the significant weak or deficient factors in the debriefed offeror's offer.

(2) The overall evaluated cost or price and technical rating of the successful and the debriefed offeror and past performance information on the debriefed offeror.

(3) The overall ranking of all offerors, when any ranking was developed by the agency during source selection.

(4) A summary of the rationale for award;

(5) For acquisitions of commercial items, the make and model of the item to be delivered by the successful offeror.

(6) Reasonable responses to relevant questions posed by the debriefed offeror as to whether source-selection procedures set forth in the solicitation, applicable regulations, and other applicable authorities were followed by the agency.

(End of provision)

52.212-2 EVALUATION--COMMERCIAL ITEMS (OCT 2014)

(a) The Government will award a contract resulting from this solicitation to the responsible offeror whose offer conforming to the solicitation will be most advantageous to the Government, price and other factors considered. The following factors shall be used to evaluate offers:

LOWEST PRICE ONLY

Technical and past performance, when combined, are NOT EVALUATED.

(b) Options. The Government will evaluate offers for award purposes by adding the total price for all options to the total price for the basic requirement. The Government may determine that an offer is unacceptable if the option prices are significantly unbalanced. Evaluation of options shall not obligate the Government to exercise the option(s).

(c) A written notice of award or acceptance of an offer, mailed or otherwise furnished to the successful offeror within the time for acceptance specified in the offer, shall result in a binding contract without further action by either party. Before the offer's specified expiration time, the Government may accept an offer (or part of an offer), whether or not there are negotiations after its receipt, unless a written notice of withdrawal is received before award.

(End of provision)

52.212-3 OFFEROR REPRESENTATIONS AND CERTIFICATIONS--COMMERCIAL ITEMS (APR 2016)

The Offeror shall complete only paragraph (b) of this provision if the Offeror has completed the annual representations and certification electronically via the System for Award Management (SAM) Web site accessed through <http://www.acquisition.gov>. If the Offeror has not completed the annual representations and certifications electronically, the Offeror shall complete only paragraphs (c) through (r) of this provision.

(a) Definitions. As used in this provision --

"Economically disadvantaged women-owned small business (EDWOSB) Concern" means a small business concern that is at least 51 percent directly and unconditionally owned by, and the management and daily business operations of which are controlled by, one or more women who are citizens of the United States and who are economically disadvantaged in accordance with 13 CFR part 127. It automatically qualifies as a women-owned small business eligible under the WOSB Program.

"Forced or indentured child labor" means all work or service-

(1) Exacted from any person under the age of 18 under the menace of any penalty for its nonperformance and for which the worker does not offer himself voluntarily; or

(2) Performed by any person under the age of 18 pursuant to a contract the enforcement of which can be accomplished by process or penalties.

Highest-level owner means the entity that owns or controls an immediate owner of the offeror, or that owns or controls one or more entities that control an immediate owner of the offeror. No entity

owns or exercises control of the highest level owner.

Immediate owner means an entity, other than the offeror, that has direct control of the offeror. Indicators of control include, but are not limited to, one or more of the following: Ownership or interlocking management, identity of interests among family members, shared facilities and equipment, and the common use of employees.

Inverted domestic corporation means a foreign incorporated entity that meets the definition of an inverted domestic corporation under 6 U.S.C. 395(b), applied in accordance with the rules and definitions of 6 U.S.C. 395(c).

Manufactured end product means any end product in product and service codes (PSCs) 1000-9999, except--

- (1) PSC 5510, Lumber and Related Basic Wood Materials;
- (2) Product or Service Group (PSG) 87, Agricultural Supplies;
- (3) PSG 88, Live Animals;
- (4) PSG 89, Subsistence;
- (5) PSC 9410, Crude Grades of Plant Materials;
- (6) PSC 9430, Miscellaneous Crude Animal Products, Inedible;
- (7) PSC 9440, Miscellaneous Crude Agricultural and Forestry Products;
- (8) PSC 9610, Ores;
- (9) PSC 9620, Minerals, Natural and Synthetic; and
- (10) PSC 9630, Additive Metal Materials.

Place of manufacture means the place where an end product is assembled out of components, or otherwise made or processed from raw materials into the finished product that is to be provided to the Government. If a product is disassembled and reassembled, the place of reassembly is not the place of manufacture.

Predecessor means an entity that is replaced by a successor and includes any predecessors of the predecessor.

Restricted business operations means business operations in Sudan that include power production activities, mineral extraction activities, oil-related activities, or the production of military equipment, as those terms are defined in the Sudan Accountability and Divestment Act of 2007 (Pub. L. 110-174). Restricted business operations do not include business operations that the person (as that term is defined in Section 2 of the Sudan Accountability and Divestment Act of 2007) conducting the business can demonstrate--

- (1) Are conducted under contract directly and exclusively with the regional government of southern Sudan;
- (2) Are conducted pursuant to specific authorization from the Office of Foreign Assets Control in the Department of the Treasury, or are expressly exempted under Federal law from the requirement to be conducted under such authorization;
- (3) Consist of providing goods or services to marginalized populations of Sudan;
- (4) Consist of providing goods or services to an internationally recognized peacekeeping force or humanitarian organization;

(5) Consist of providing goods or services that are used only to promote health or education; or

(6) Have been voluntarily suspended.

Sensitive technology--

(1) Means hardware, software, telecommunications equipment, or any other technology that is to be used specifically--

(i) To restrict the free flow of unbiased information in Iran; or

(ii) To disrupt, monitor, or otherwise restrict speech of the people of Iran; and

(2) Does not include information or informational materials the export of which the President does not have the authority to regulate or prohibit pursuant to section 203(b)(3) of the International Emergency Economic Powers Act (50 U.S.C. 1702(b)(3)).

Service-disabled veteran-owned small business concern--

(1) Means a small business concern--

(i) Not less than 51 percent of which is owned by one or more service-disabled veterans or, in the case of any publicly owned business, not less than 51 percent of the stock of which is owned by one or more service-disabled veterans; and

(ii) The management and daily business operations of which are controlled by one or more service-disabled veterans or, in the case of a service-disabled veteran with permanent and severe disability, the spouse or permanent caregiver of such veteran.

(2) Service-disabled veteran means a veteran, as defined in 38 U.S.C. 101(2), with a disability that is service-connected, as defined in 38 U.S.C. 101(16).

"Small business concern" means a concern, including its affiliates, that is independently owned and operated, not dominant in the field of operation in which it is bidding on Government contracts, and qualified as a small business under the criteria in 13 CFR Part 121 and size standards in this solicitation.

Small disadvantaged business concern, consistent with 13 CFR 124.1002, means a small business concern under the size standard applicable to the acquisition, that--

(1) Is at least 51 percent unconditionally and directly owned (as defined at 13 CFR 124.105) by--

(i) One or more socially disadvantaged (as defined at 13 CFR 124.103) and economically disadvantaged (as defined at 13 CFR 124.104) individuals who are citizens of the United States; and

(ii) Each individual claiming economic disadvantage has a net worth not exceeding \$750,000 after taking into account the applicable exclusions set forth at 13 CFR 124.104(c)(2); and

(2) The management and daily business operations of which are controlled (as defined at 13.CFR 124.106) by individuals, who meet the criteria in paragraphs (1)(i) and (ii) of this definition.

Subsidiary means an entity in which more than 50 percent of the entity is owned--

(1) Directly by a parent corporation; or

(2) Through another subsidiary of a parent corporation.

Successor means an entity that has replaced a predecessor by acquiring the assets and carrying out the affairs of the predecessor under a new name (often through acquisition or merger). The term “successor” does not include new offices/divisions of the same company or a company that only changes its name. The extent of the responsibility of the successor for the liabilities of the predecessor may vary, depending on State law and specific circumstances.

Veteran-owned small business concern means a small business concern--

(1) Not less than 51 percent of which is owned by one or more veterans (as defined at 38 U.S.C. 101(2)) or, in the case of any publicly owned business, not less than 51 percent of the stock of which is owned by one or more veterans; and

(2) The management and daily business operations of which are controlled by one or more veterans.

"Women-owned business concern" means a concern which is at least 51 percent owned by one or more women; or in the case of any publicly owned business, at least 51 percent of the stock of which is owned by one or more women; and whose management and daily business operations are controlled by one or more women.

"Women-owned small business concern" means a small business concern--

(1) That is at least 51 percent owned by one or more women or, in the case of any publicly owned business, at least 51 percent of its stock is owned by one or more women; or

(2) Whose management and daily business operations are controlled by one or more women.

Women-owned small business (WOSB) concern eligible under the WOSB Program (in accordance with 13 CFR part 127)", means a small business concern that is at least 51 percent directly and unconditionally owned by, and the management and daily business operations of which are controlled by, one or more women who are citizens of the United States.

(b) (1) Annual Representations and Certifications. Any changes provided by the offeror in paragraph (b)(2) of this provision do not automatically change the representations and certifications posted electronically on the SAM website.

(2) The offeror has completed the annual representations and certifications electronically via the SAM website accessed through <https://www.acquisition.gov>. After reviewing the SAM database information, the offeror verifies by submission of this offer that the representations and certifications currently posted electronically at FAR 52.212-3, Offeror Representations and Certifications--Commercial Items, have been entered or updated in the last 12 months, are current, accurate, complete, and applicable to this solicitation (including the business size standard applicable to the NAICS code referenced for this solicitation), as of the date of this offer and are incorporated in this offer by reference (see FAR 4.1201), except for paragraphs ____ .

[Offeror to identify the applicable paragraphs at (c) through (r) of this provision that the offeror has completed for the purposes of this solicitation only, if any.) These amended representation(s) and/or certification(s) are also incorporated in this offer and are current, accurate, and complete as of the date of this offer. Any changes provided by the offeror are applicable to this solicitation only, and do not result in an update to the representations and certifications posted electronically on ORCA.]

(c) Offerors must complete the following representations when the resulting contract will be performed in the United States or its outlying areas. Check all that apply.

- (1) Small business concern. The offeror represents as part of its offer that it (___) is, (___) is not a small business concern.
- (2) Veteran-owned small business concern. (Complete only if the offeror represented itself as a small business concern in paragraph (c)(1) of this provision.) The offeror represents as part of its offer that it (___) is, (___) is not a veteran-owned small business concern.
- (3) Service-disabled veteran-owned small business concern. (Complete only if the offeror represented itself as a veteran-owned small business concern in paragraph (c)(2) of this provision.) The offeror represents as part of its offer that it (___) is, (___) is not a service-disabled veteran-owned small business concern.
- (4) Small disadvantaged business concern. (Complete only if the offeror represented itself as a small business concern in paragraph (c)(1) of this provision.) The offeror represents that it (___) is, (___) is not a small disadvantaged business concern as defined in 13 CFR 124.1002.
- (5) Women-owned small business concern. (Complete only if the offeror represented itself as a small business concern in paragraph (c)(1) of this provision.) The offeror represents that it (___) is, (___) is not a women-owned small business concern.

Note to paragraphs (c)(8) and (9): Complete paragraphs (c)(8) and (c)(9) only if this solicitation is expected to exceed the simplified acquisition threshold.

- (6) WOSB concern eligible under the WOSB Program. [Complete only if the offeror represented itself as a women-owned small business concern in paragraph (c)(5) of this provision.] The offeror represents that--
- (i) It [___] is, [___] is not a WOSB concern eligible under the WOSB Program, has provided all the required documents to the WOSB Repository, and no change in circumstances or adverse decisions have been issued that affects its eligibility; and
- (ii) It [___] is, [___] is not a joint venture that complies with the requirements of 13 CFR part 127, and the representation in paragraph (c)(6)(i) of this provision is accurate for each WOSB concern eligible under the WOSB Program participating in the joint venture. [The offeror shall enter the name or names of the WOSB concern eligible under the WOSB Program and other small businesses that are participating in the joint venture: ___ .] Each WOSB concern eligible under the WOSB Program participating in the joint venture shall submit a separate signed copy of the WOSB representation.
- (7) Economically disadvantaged women-owned small business (EDWOSB) concern. [Complete only if the offeror represented itself as a WOSB concern eligible under the WOSB Program in (c)(6) of this provision.] The offeror represents that--
- (i) It [___] is, [___] is not an EDWOSB concern, has provided all the required documents to the WOSB Repository, and no change in circumstances or adverse decisions have been issued that affects its eligibility; and
- (ii) It [___] is, [___] is not a joint venture that complies with the requirements of 13 CFR part 127, and the representation in paragraph (c)(7)(i) of this provision is accurate for each EDWOSB concern participating in the joint venture. [The offeror shall enter the name or names of the EDWOSB concern and other small businesses that are participating in the joint venture: ___ -.] Each EDWOSB concern participating in the joint venture shall submit a separate signed copy of the EDWOSB representation.
- (8) Women-owned business concern (other than small business concern). (Complete only if the offeror is a women-owned business concern and did not represent itself as a small business concern in paragraph (c)(1) of this provision.) The offeror represents that it (___) is, a women-owned business concern.

(9) Tie bid priority for labor surplus area concerns. If this is an invitation for bid, small business offerors may identify the labor surplus areas in which costs to be incurred on account of manufacturing or production (by offeror or first-tier subcontractors) amount to more than 50 percent of the contract price:

—

(10) HUBZone small business concern. (Complete only if the offeror represented itself as a small business concern in paragraph (c)(1) of this provision.) The offeror represents, as part of its offer, that--

(i) It [___] is, [___] is not a HUBZone small business concern listed, on the date of this representation, on the List of Qualified HUBZone Small Business Concerns maintained by the Small Business Administration, and no material changes in ownership and control, principal office, or HUBZone employee percentage have occurred since it was certified in accordance with 13 CFR Part 126; and

(ii) It [___] is, [___] is not a HUBZone joint venture that complies with the requirements of 13 CFR Part 126, and the representation in paragraph (c)(10)(i) of this provision is accurate for each HUBZone small business concern participating in the HUBZone joint venture. [The offeror shall enter the names of each of the HUBZone small business concerns participating in the HUBZone joint venture: ___ .] Each HUBZone small business concern participating in the HUBZone joint venture shall submit a separate signed copy of the HUBZone representation.

(d) Certifications and representations required to implement provisions of Executive Order 11246--

(1) Previous Contracts and Compliance. The offeror represents that--

(i) It (___) has, (___) has not, participated in a previous contract or subcontract subject either to the Equal Opportunity clause of this solicitation, the and

(ii) It (___) has, (___) has not, filed all required compliance reports.

(2) Affirmative Action Compliance. The offeror represents that--

(i) It (___) has developed and has on file, (___) has not developed and does not have on file, at each establishment, affirmative action programs required by rules and regulations of the Secretary of Labor (41 CFR Subparts 60-1 and 60-2), or

(ii) It (___) has not previously had contracts subject to the written affirmative action programs requirement of the rules and regulations of the Secretary of Labor.

(e) Certification Regarding Payments to Influence Federal Transactions (31 U.S.C. 1352). (Applies only if the contract is expected to exceed \$150,000.) By submission of its offer, the offeror certifies to the best of its knowledge and belief that no Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress or an employee of a Member of Congress on his or her behalf in connection with the award of any resultant contract. If any registrants under the Lobbying Disclosure Act of 1995 have made a lobbying contact on behalf of the offeror with respect to this contract, the offeror shall complete and submit, with its offer, OMB Standard Form LLL, Disclosure of Lobbying Activities, to provide the name of the registrants. The offeror need not report regularly employed officers or employees of the offeror to whom payments of reasonable compensation were made.

(f) Buy American Certificate. (Applies only if the clause at Federal Acquisition Regulation (FAR) 52.225-1, Buy American --Supplies, is included in this solicitation.)

(1) The offeror certifies that each end product, except those listed in paragraph (f)(2) of this provision, is a domestic end product and that for other than COTS items, the offeror has considered components of unknown origin to have been mined, produced, or manufactured outside the United States. The offeror shall list as foreign end products those end products manufactured in the United States that do not qualify as domestic end products, i.e., an end product that is not a COTS item and does not meet the component test in paragraph (2) of the definition of "domestic end product." The terms "commercially available off-the-shelf (COTS) item," "component," "domestic end product," "end product," "foreign end product," and "United States" are defined in the clause of this solicitation entitled "Buy American--Supplies."

(2) Foreign End Products:

Line Item No.	Country of Origin
—	—
—	—
—	—

(List as necessary)

(3) The Government will evaluate offers in accordance with the policies and procedures of FAR Part 25.

(g)(1) Buy American--Free Trade Agreements--Israeli Trade Act Certificate. (Applies only if the clause at FAR 52.225-3, Buy American--Free Trade Agreements--Israeli Trade Act, is included in this solicitation.)

(i) The offeror certifies that each end product, except those listed in paragraph (g)(1)(ii) or (g)(1)(iii) of this provision, is a domestic end product and that for other than COTS items, the offeror has considered components of unknown origin to have been mined, produced, or manufactured outside the United States. The terms "Bahrainian, Moroccan, Omani, Panamanian, or Peruvian end product," "commercially available off-the-shelf (COTS) item," "component," "domestic end product," "end product," "foreign end product," "Free Trade Agreement country," "Free Trade Agreement country end product," "Israeli end product," and "United States" are defined in the clause of this solicitation entitled "Buy American--Free Trade Agreements--Israeli Trade Act."

(ii) The offeror certifies that the following supplies are Free Trade Agreement country end products (other than Bahrainian, Moroccan, Omani, Panamanian, or Peruvian end products) or Israeli end products as defined in the clause of this solicitation entitled "Buy American--Free Trade Agreements--Israeli Trade Act":

Free Trade Agreement Country End Products (Other than Bahrainian, Moroccan, Omani, Panamanian, or Peruvian End Products) or Israeli End Products:

Line Item No.	Country of Origin
—	—
—	—
—	—

[List as necessary]

(iii) The offeror shall list those supplies that are foreign end products (other than those listed in paragraph (g)(1)(ii) of this provision) as defined in the clause of this solicitation entitled "Buy American-Free Trade Agreements-Israeli Trade Act." The offeror shall list as other foreign end products those end products manufactured in the United States that do not qualify as domestic end products, i.e., an end product that is not a COTS item and does not meet the component test in paragraph (2) of the definition of "domestic end product."

Other Foreign End Products:

Line Item No.	Country of Origin
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[List as necessary]

(iv) The Government will evaluate offers in accordance with the policies and procedures of FAR Part 25. (2) *Buy American Act-Free Trade Agreements-Israeli Trade Act Certificate, Alternate I (Jan 2004)*. If Alternate I to the clause at FAR 52.225-3 is included in this solicitation, substitute the following paragraph (g)(1)(ii) for paragraph (g)(1)(ii) of the basic provision:

(g)(1)(ii) The offeror certifies that the following supplies are Canadian end products as defined in the clause of this solicitation entitled "Buy American -Free Trade Agreements-Israeli Trade Act":

Canadian End Products:

Line Item No.

[List as necessary]

(3) *Buy American-Free Trade Agreements-Israeli Trade Act Certificate, Alternate II (Jan 2004)*. If Alternate II to the clause at FAR 52.225-3 is included in this solicitation, substitute the following paragraph (g)(1)(ii) for paragraph (g)(1)(ii) of the basic provision:

(g)(1)(ii) The offeror certifies that the following supplies are Canadian end products or Israeli end products as defined in the clause of this solicitation entitled "Buy American-Free Trade Agreements-Israeli Trade Act":

Canadian or Israeli End Products:

Line Item No.	Country of Origin
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---	---

[List as necessary]

(4) Buy American--Free Trade Agreements--Israeli Trade Act Certificate, Alternate III. If Alternate III to the clause at FAR 52.225-3 is included in this solicitation, substitute the following paragraph (g)(1)(ii) for paragraph (g)(1)(ii) of the basic provision:

(g)(1)(ii) The offeror certifies that the following supplies are Free Trade Agreement country end products (other than Bahrainian, Korean, Moroccan, Omani, Panamanian, or Peruvian end products) or Israeli end products as defined in the clause of this solicitation entitled "Buy American --Free Trade Agreements--Israeli Trade Act":

Free Trade Agreement Country End Products (Other than Bahrainian, Korean, Moroccan, Omani, Panamanian, or Peruvian End Products) or Israeli End Products:

Line Item No.	Country of Origin
---	---
---	---
---	---

[List as necessary]

(5) Trade Agreements Certificate. (Applies only if the clause at FAR 52.225-5, Trade Agreements, is included in this solicitation.)

(i) The offeror certifies that each end product, except those listed in paragraph (g)(5)(ii) of this provision, is a U.S.-made or designated country end product, as defined in the clause of this solicitation entitled "Trade Agreements".

(ii) The offeror shall list as other end products those end products that are not U.S.-made or designated country end products.

Other End Products:

Line Item No.	Country of Origin
—	—
—	—
—	—

[List as necessary]

(iii) The Government will evaluate offers in accordance with the policies and procedures of FAR Part 25. For line items covered by the WTO GPA, the Government will evaluate offers of U.S.-made or designated country end products without regard to the restrictions of the Buy American statute. The Government will consider for award only offers of U.S.-made or designated country end products unless the Contracting Officer determines that there are no offers for such products or that the offers for such products are insufficient to fulfill the requirements of the solicitation.

(h) *Certification Regarding Responsibility Matters (Executive Order 12689)*. (Applies only if the contract value is expected to exceed the simplified acquisition threshold.) The offeror certifies, to the best of its knowledge and belief, that the offeror and/or any of its principals--

(1) [___] Are, [___] are not presently debarred, suspended, proposed for debarment, or declared ineligible for the award of contracts by any Federal agency;

(2) [___] Have, [___] have not, within a three-year period preceding this offer, been convicted of or had a civil judgment rendered against them for: commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a Federal, state or local government contract or subcontract; violation of Federal or state antitrust statutes relating to the submission of offers; or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, tax evasion, violating Federal criminal tax laws, or receiving stolen property; and

(3) [___] Are, [___] are not presently indicted for, or otherwise criminally or civilly charged by a Government entity with, commission of any of these offenses enumerated in paragraph (h)(2) of this clause; and

(4) [___] Have, [___] have not, within a three-year period preceding this offer, been notified of any delinquent Federal taxes in an amount that exceeds \$3,500 for which the liability remains unsatisfied.

(i) Taxes are considered delinquent if both of the following criteria apply:

(A) *The tax liability is finally determined.* The liability is finally determined if it has been assessed. A liability is not finally determined if there is a pending administrative or judicial challenge. In the case of a judicial challenge to the liability, the liability is not finally determined until all judicial appeal rights have been exhausted.

(B) *The taxpayer is delinquent in making payment.* A taxpayer is delinquent if the taxpayer has failed to pay the tax liability when full payment was due and required. A taxpayer is not delinquent in cases where enforced collection action is precluded.

(ii) Examples.

(A) The taxpayer has received a statutory notice of deficiency, under I.R.C. §6212, which entitles the taxpayer to seek Tax Court review of a proposed tax deficiency. This is not a delinquent tax because it is not a final tax liability. Should the taxpayer seek Tax Court review, this will not be a final tax liability until the taxpayer has exercised all judicial appeal rights.

(B) The IRS has filed a notice of Federal tax lien with respect to an assessed tax liability, and the taxpayer has been issued a notice under I.R.C. §6320 entitling the taxpayer to request a hearing with the IRS Office of Appeals Contesting the lien filing, and to further appeal to the Tax Court if the IRS determines to sustain the lien filing. In the course of the hearing, the taxpayer is entitled to contest the underlying tax liability because the taxpayer has had no prior opportunity to contest the liability. This is not a delinquent tax because it is not a final tax liability. Should the taxpayer seek tax court review, this will not be a final tax liability until the taxpayer has exercised all judicial appeal rights.

(C) The taxpayer has entered into an installment agreement pursuant to I.R.C. §6159. The taxpayer is making timely payments and is in full compliance with the agreement terms. The taxpayer is not delinquent because the taxpayer is not currently required to make full payment.

(D) The taxpayer has filed for bankruptcy protection. The taxpayer is not delinquent because enforced collection action is stayed under 11 U.S.C. §362 (the Bankruptcy Code).

(i) Certification Regarding Knowledge of Child Labor for *Listed End Products (Executive Order 13126)*. [*The Contracting Officer must list in paragraph (i)(1) any end products being acquired under this solicitation that are included in the List of Products Requiring Contractor Certification as to Forced or Indentured Child Labor, unless excluded at 22.1503(b).*]

(1) *Listed end products.*

Listed End Product	Listed Countries of Origin
—	—
—	—
—	—

(2) *Certification.* [*If the Contracting Officer has identified end products and countries of origin in paragraph (i)(1) of this provision, then the offeror must certify to either (i)(2)(i) or (i)(2)(ii) by checking the appropriate block.*]

[] (i) The offeror will not supply any end product listed in paragraph (i)(1) of this provision that was mined, produced, or manufactured in the corresponding country as listed for that product.

[] (ii) The offeror may supply an end product listed in paragraph (i)(1) of this provision that was mined, produced, or manufactured in the corresponding country as listed for that product. The offeror certifies that it has made a good faith effort to determine whether forced or indentured child labor was used to mine, produce, or

manufacture any such end product furnished under this contract. On the basis of those efforts, the offeror certifies that it is not aware of any such use of child labor.

(j) *Place of manufacture.* (Does not apply unless the solicitation is predominantly for the acquisition of manufactured end products.) For statistical purposes only, the offeror shall indicate whether the place of manufacture of the end products it expects to provide in response to this solicitation is predominantly—

(1) () In the United States (Check this box if the total anticipated price of offered end products manufactured in the United States exceeds the total anticipated price of offered end products manufactured outside the United States); or

(2) () Outside the United States.

(j) *Place of manufacture.* (Does not apply unless the solicitation is predominantly for the acquisition of manufactured end products.) For statistical purposes only, the offeror shall indicate whether the place of manufacture of the end products it expects to provide in response to this solicitation is predominantly--

(1) () In the United States (Check this box if the total anticipated price of offered end products manufactured in the United States exceeds the total anticipated price of offered end products manufactured outside the United States); or

(2) () Outside the United States.

(k) Certificates regarding exemptions from the application of the Service Contract Labor Standards. (Certification by the offeror as to its compliance with respect to the contract also constitutes its certification as to compliance by its subcontractor if it subcontracts out the exempt services.)

[*The contracting officer is to check a box to indicate if paragraph (k)(1) or (k)(2) applies.*]

[] (1) Maintenance, calibration, or repair of certain equipment as described in FAR 22.1003-4(c)(1). The offeror () does () does not certify that—

(i) The items of equipment to be serviced under this contract are used regularly for other than Governmental purposes and are sold or traded by the offeror (or subcontractor in the case of an exempt subcontract) in substantial quantities to the general public in the course of normal business operations;

(ii) The services will be furnished at prices which are, or are based on, established catalog or market prices (see FAR 22.1003-4(c)(2)(ii)) for the maintenance, calibration, or repair of such equipment; and

(iii) The compensation (wage and fringe benefits) plan for all service employees performing work under the contract will be the same as that used for these employees and equivalent employees servicing the same equipment of commercial customers.

[] (2) Certain services as described in FAR 22.1003-4(d)(1). The offeror () does () does not certify that—

(i) The services under the contract are offered and sold regularly to non-Governmental customers, and are provided by the offeror (or subcontractor in the case of an exempt subcontract) to the general public in substantial quantities in the course of normal business operations;

(ii) The contract services will be furnished at prices that are, or are based on, established catalog or market prices (see FAR 22.1003-4(d)(2)(iii));

(iii) Each service employee who will perform the services under the contract will spend only a small portion of his or her time (a monthly average of less than 20 percent of the available hours on an annualized basis, or less than 20 percent of available hours during the contract period if the contract period is less than a month) servicing the Government contract; and

(iv) The compensation (wage and fringe benefits) plan for all service employees performing work under the contract is the same as that used for these employees and equivalent employees servicing commercial customers.

(3) If paragraph (k)(1) or (k)(2) of this clause applies—

(i) If the offeror does not certify to the conditions in paragraph (k)(1) or (k)(2) and the Contracting Officer did not attach a Service Contract Labor Standards wage determination to the solicitation, the offeror shall notify the Contracting Officer as soon as possible; and

(ii) The Contracting Officer may not make an award to the offeror if the offeror fails to execute the certification in paragraph (k)(1) or (k)(2) of this clause or to contact the Contracting Officer as required in paragraph (k)(3)(i) of this clause.

(l) Taxpayer Identification Number (TIN) (26 U.S.C. 6109, 31 U.S.C. 7701). (Not applicable if the offeror is required to provide this information to the SAM database to be eligible for award.)

(1) All offerors must submit the information required in paragraphs (l)(3) through (l)(5) of this provision to comply with debt collection requirements of 31 U.S.C. 7701(c) and 3325(d), reporting requirements of 26 U.S.C. 6041, 6041A, and 6050M, and implementing regulations issued by the Internal Revenue Service (IRS).

(2) The TIN may be used by the Government to collect and report on any delinquent amounts arising out of the offeror's relationship with the Government (31 U.S.C. 7701(c)(3)). If the resulting contract is subject to the payment reporting requirements described in FAR 4.904, the TIN provided hereunder may be matched with IRS records to verify the accuracy of the offeror's TIN.

(3) Taxpayer Identification Number (TIN).

(___) TIN: -----.

(___) TIN has been applied for.

(___) TIN is not required because:

(___) Offeror is a nonresident alien, foreign corporation, or foreign partnership that does not have income effectively connected with the conduct of a trade or business in the United States and does not have an office or place of business or a fiscal paying agent in the United States;

(___) Offeror is an agency or instrumentality of a foreign government;

(___) Offeror is an agency or instrumentality of the Federal Government.

(4) Type of organization.

(___) Sole proprietorship;

(___) Partnership;

(___) Corporate entity (not tax-exempt);

(___) Corporate entity (tax-exempt);

(___) Government entity (Federal, State, or local);

(___) Foreign government;

(___) International organization per 26 CFR 1.6049-4;

(___) Other -----.

(5) Common parent.

(___) Offeror is not owned or controlled by a common parent;

(___) Name and TIN of common parent:

Name - ___ .

TIN - ___ .

(m) Restricted business operations in Sudan. By submission of its offer, the offeror certifies that the offeror does not conduct any restricted business operations in Sudan.

(n) Prohibition on Contracting with Inverted Domestic Corporations—

(1) Government agencies are not permitted to use appropriated (or otherwise made available) funds for contracts with either an inverted domestic corporation, or a subsidiary of an inverted domestic corporation, unless the exception at 9.108-2(b) applies or the requirement is waived in accordance with the procedures at 9.108-4.

(2) Representation. By submission of its offer, the offeror represents that--

(i) It is not an inverted domestic corporation; and

(ii) It is not a subsidiary of an inverted domestic corporation.

(o) Prohibition on contracting with entities engaging in certain activities or transactions relating to Iran.

(1) The offeror shall email questions concerning sensitive technology to the Department of State at CISADA106@state.gov.

(2) Representation. The Offeror represents that--

(i) It [___] is, [___] is not an inverted domestic corporation; and

(ii) It [] is, [] is not a subsidiary of an inverted domestic corporation.

(3) The representation and certification requirements of paragraph (o)(2) of this provision do not apply if—

(i) This solicitation includes a trade agreements certification (e.g., 52.212-3(g) or a comparable agency provision); and

(ii) The offeror has certified that all the offered products to be supplied are designated country end products.

(p) *Ownership or Control of Offeror.* (Applies in all solicitations when there is a requirement to be registered in SAM or a requirement to have a DUNS Number in the solicitation.

(1) The Offeror represents that it [] has or [] does not have an immediate owner. If the Offeror has more than one immediate owner (such as a joint venture), then the Offeror shall respond to paragraph (2) and if applicable, paragraph (3) of this provision for each participant in the joint venture.

(2) If the Offeror indicates “has” in paragraph (p)(1) of this provision, enter the following information:

Immediate owner CAGE code: _____

Immediate owner legal name: _____

(Do not use a “doing business as” name)

Is the immediate owner owned or controlled by another entity:

[] Yes or [] No.

(3) If the Offeror indicates “yes” in paragraph (p)(2) of this provision, indicating that the immediate owner is owned or controlled by another entity, then enter the following information:

Highest level owner CAGE code: _____

Highest level owner legal name: _____

(Do not use a “doing business as” name)

(q) *Representation by Corporations Regarding Delinquent Tax Liability or a Felony Conviction under any Federal Law.*

(1) As required by section 744 and 745 of Division E of the Consolidated and Further Continuing Appropriations Act, 2015 (Pub. L. 113-235), and similar provisions, if contained in subsequent appropriations acts, the Government will not enter into a contract with any corporation that—

(i) Has any unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability, where the awarding agency is aware of the unpaid tax liability, unless and agency has considered suspension or debarment of the corporation and made a determination that suspension or debarment is not necessary to protect the interests of the Government; or

(ii) Was convicted of a felony criminal violation under any Federal law within the preceding 24 months, where the awarding agency is aware of the conviction, unless an agency has considered suspension or debarment of the corporation and made a determination that this action is not necessary to protect the interests of the Government.

(2) The Offeror represents that--

(i) It is [____] is not [____] a corporation that has any unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability; and

(ii) It is [____] is not [____] a corporation that was convicted of a felony criminal violation under a Federal law within the preceding 24 months.

(r) Predecessor of Offeror. (Applies in all solicitations that include the provision at 52.204-16, Commercial and Government Entity Code Reporting.)

(1) The Offeror represents that it [____] is or [____] is not a successor to a predecessor that held a Federal contract or grant within the last three years.

(2) If the Offeror has indicated ``is" in paragraph (r)(1) of this provision, enter the following information for all predecessors that held a Federal contract or grant within the last three years (if more than one predecessor, list in reverse chronological order):

Predecessor CAGE code: ____ (or mark ``Unknown").

Predecessor legal name: ____.

(Do not use a ``doing business as" name).

(End of provision)

52.212-4 CONTRACT TERMS AND CONDITIONS-- COMMERCIAL ITEMS (MAY 2015)

(a) Inspection/Acceptance. The Contractor shall only tender for acceptance those items that conform to the requirements of this contract. The Government reserves the right to inspect or test any supplies or services that have been tendered for acceptance. The Government may require repair or replacement of nonconforming supplies or reperformance of nonconforming services at no increase in contract price. If repair/replacement or reperformance will not correct the defects or is not possible, the Government may seek an equitable price reduction or adequate consideration for acceptance of nonconforming supplies or services. The Government must exercise its post-acceptance rights (1) within a reasonable time after the defect was discovered or should have been discovered; and (2) before any substantial change occurs in the condition of the item, unless the change is due to the defect in the item.

(b) Assignment. The Contractor or its assignee may assign its rights to receive payment due as a result of performance of this contract to a bank, trust company, or other financing institution, including any Federal lending agency in accordance with the Assignment of Claims Act (31 U.S.C. 3727). However, when a third party makes payment (e.g., use of the Governmentwide commercial purchase card), the Contractor may not assign its rights to receive payment under this contract.

(c) Changes. Changes in the terms and conditions of this contract may be made only by written agreement of the parties.

(d) Disputes. This contract is subject to 41 U.S.C. chapter 71, Contract Disputes", as amended (41 U.S.C. 601-613). Failure of the parties to this contract to reach agreement on any request for equitable adjustment, claim, appeal or action arising under or relating to this contract shall be a dispute to be resolved in accordance with the clause at FAR 52.233-1, Disputes, which is incorporated herein by reference. The Contractor shall proceed diligently with performance of this contract, pending final resolution of any dispute arising under the contract.

(e) Definitions. The clause at FAR 52.202-1, Definitions, is incorporated herein by reference.

(f) Excusable delays. The Contractor shall be liable for default unless nonperformance is caused by an occurrence beyond the reasonable control of the Contractor and without its fault or negligence such as, acts of God or the public enemy, acts of the Government in either its sovereign or contractual capacity, fires, floods, epidemics, quarantine restrictions, strikes, unusually severe weather, and delays of common carriers. The Contractor shall notify the Contracting Officer in writing as soon as it is reasonably possible after the commencement or any excusable delay, setting forth the full particulars in connection therewith, shall remedy such occurrence with all reasonable dispatch and shall promptly give written notice to the Contracting Officer of the cessation of such occurrence.

(g) Invoice.

(1) The Contractor shall submit an original invoice and three copies (or electronic invoice, if authorized) to the address designated in the contract to receive invoices. An invoice must include--

(i) Name and address of the Contractor;

(ii) Invoice date and number;

(iii) Contract number, contract line item number and, if applicable, the order number;

(iv) Description, quantity, unit of measure, unit price and extended price of the items delivered;

(v) Shipping number and date of shipment, including the bill of lading number and weight of shipment if shipped on Government bill of lading;

(vi) Terms of any discount for prompt payment offered;

(vii) Name and address of official to whom payment is to be sent;

(viii) Name, title, and phone number of person to notify in event of defective invoice; and

(ix) Taxpayer Identification Number (TIN). The Contractor shall include its TIN on the invoice only if required elsewhere in this contract.

(x) Electronic funds transfer (EFT) banking information.

(A) The Contractor shall include EFT banking information on the invoice only if required elsewhere in this contract.

(B) If EFT banking information is not required to be on the invoice, in order for the invoice to be a proper invoice, the Contractor shall have submitted correct EFT banking information in accordance with the applicable solicitation provision, contract clause (e.g., 52.232-33, Payment by Electronic Funds Transfer—System for Award Management, or 52.232-34, Payment by Electronic

Funds Transfer--Other Than System for Award Management), or applicable agency procedures.

(C) EFT banking information is not required if the Government waived the requirement to pay by EFT.

(2) Invoices will be handled in accordance with the Prompt Payment Act (31 U.S.C. 3903) and Office of Management and Budget (OMB) prompt payment regulations at 5 CFR part 1315.

(h) Patent indemnity. The Contractor shall indemnify the Government and its officers, employees and agents against liability, including costs, for actual or alleged direct or contributory infringement of, or inducement to infringe, any United States or foreign patent, trademark or copyright, arising out of the performance of this contract, provided the Contractor is reasonably notified of such claims and proceedings.

(i) Payment.--

(1) Items accepted. Payment shall be made for items accepted by the Government that have been delivered to the delivery destinations set forth in this contract.

(2) Prompt payment. The Government will make payment in accordance with the Prompt Payment Act (31 U.S.C. 3903) and prompt payment regulations at 5 CFR part 1315.

(3) Electronic Funds Transfer (EFT). If the Government makes payment by EFT, see 52.212-5(b) for the appropriate EFT clause.

(4) Discount. In connection with any discount offered for early payment, time shall be computed from the date of the invoice. For the purpose of computing the discount earned, payment shall be considered to have been made on the date which appears on the payment check or the specified payment date if an electronic funds transfer payment is made.

(5) Overpayments. If the Contractor becomes aware of a duplicate contract financing or invoice payment or that the Government has otherwise overpaid on a contract financing or invoice payment, the Contractor shall--

(i) Remit the overpayment amount to the payment office cited in the contract along with a description of the overpayment including the--

(A) Circumstances of the overpayment (e.g., duplicate payment, erroneous payment, liquidation errors, date(s) of overpayment);

(B) Affected contract number and delivery order number, if applicable;

(C) Affected contract line item or subline item, if applicable; and

(D) Contractor point of contact.

(ii) Provide a copy of the remittance and supporting documentation to the Contracting Officer.

(6) Interest.

(i) All amounts that become payable by the Contractor to the Government under this contract shall bear simple interest from the date due until paid unless paid within 30 days of becoming due. The interest rate shall be the interest rate established by the Secretary of the Treasury as provided in 41 U.S.C. 7109, which is applicable to the period in which the amount becomes due, as provided in (i)(6)(v) of this clause, and then at the rate applicable for each six-month period as fixed by the Secretary until the amount is paid.

(ii) The Government may issue a demand for payment to the Contractor upon finding a debt is due under the contract.

(iii) Final decisions. The Contracting Officer will issue a final decision as required by 33.211 if--

(A) The Contracting Officer and the Contractor are unable to reach agreement on the existence or amount of a debt within 30 days;

(B) The Contractor fails to liquidate a debt previously demanded by the Contracting Officer within the timeline specified in the demand for payment unless the amounts were not repaid because the Contractor has requested an installment payment agreement; or

(C) The Contractor requests a deferment of collection on a debt previously demanded by the Contracting Officer (see 32.607-2).

(iv) If a demand for payment was previously issued for the debt, the demand for payment included in the final decision shall identify the same due date as the original demand for payment.

(v) Amounts shall be due at the earliest of the following dates:

(A) The date fixed under this contract.

(B) The date of the first written demand for payment, including any demand for payment resulting from a default termination.

(vi) The interest charge shall be computed for the actual number of calendar days involved beginning on the due date and ending on--

(A) The date on which the designated office receives payment from the Contractor;

(B) The date of issuance of a Government check to the Contractor from which an amount otherwise payable has been withheld as a credit against the contract debt; or

(C) The date on which an amount withheld and applied to the contract debt would otherwise have become payable to the Contractor.

(vii) The interest charge made under this clause may be reduced under the procedures prescribed in 32.608-2 of the Federal Acquisition Regulation in effect on the date of this contract.

(j) Risk of loss. Unless the contract specifically provides otherwise, risk of loss or damage to the supplies provided under this contract shall remain with the Contractor until, and shall pass to the Government upon:

(1) Delivery of the supplies to a carrier, if transportation is f.o.b. origin; or

(2) Delivery of the supplies to the Government at the destination specified in the contract, if transportation is f.o.b. destination.

(k) Taxes. The contract price includes all applicable Federal, State, and local taxes and duties.

(l) Termination for the Government's convenience. The Government reserves the right to terminate this contract, or any part hereof, for its sole convenience. In the event of such termination, the Contractor shall immediately stop all work hereunder and shall immediately cause any and all of its suppliers and subcontractors to cease work. Subject to the terms of this contract, the Contractor shall be paid a percentage of the contract price reflecting the percentage of the work performed prior to the notice of termination, plus reasonable charges the Contractor can demonstrate to

the satisfaction of the Government using its standard record keeping system, have resulted from the termination. The Contractor shall not be required to comply with the cost accounting standards or contract cost principles for this purpose. This paragraph does not give the Government any right to audit the Contractor's records. The Contractor shall not be paid for any work performed or costs incurred which reasonably could have been avoided.

(m) Termination for cause. The Government may terminate this contract, or any part hereof, for cause in the event of any default by the Contractor, or if the Contractor fails to comply with any contract terms and conditions, or fails to provide the Government, upon request, with adequate assurances of future performance. In the event of termination for cause, the Government shall not be liable to the Contractor for any amount for supplies or services not accepted, and the Contractor shall be liable to the Government for any and all rights and remedies provided by law. If it is determined that the Government improperly terminated this contract for default, such termination shall be deemed a termination for convenience.

(n) Title. Unless specified elsewhere in this contract, title to items furnished under this contract shall pass to the Government upon acceptance, regardless of when or where the Government takes physical possession.

(o) Warranty. The Contractor warrants and implies that the items delivered hereunder are merchantable and fit for use for the particular purpose described in this contract.

(p) Limitation of liability. Except as otherwise provided by an express warranty, the Contractor will not be liable to the Government for consequential damages resulting from any defect or deficiencies in accepted items.

(q) Other compliances. The Contractor shall comply with all applicable Federal, State and local laws, executive orders, rules and regulations applicable to its performance under this contract.

(r) Compliance with laws unique to Government contracts. The Contractor agrees to comply with 31 U.S.C. 1352 relating to limitations on the use of appropriated funds to influence certain Federal contracts; 18 U.S.C. 431 relating to officials not to benefit; 40 U.S.C. chapter 37, Contract Work Hours and Safety Standards; 41 U.S.C. chapter 87, Kickbacks; 41 U.S.C. 4712 and 10 U.S.C. 2409 relating to whistleblower protections; 49 U.S.C. 40118, Fly American; and 41 U.S.C. chapter 21 relating to procurement integrity.

(s) Order of precedence. Any inconsistencies in this solicitation or contract shall be resolved by giving precedence in the following order: (1) the schedule of supplies/services; (2) The Assignments, Disputes, Payments, Invoice, Other

Compliances, Compliance with Laws Unique to Government Contracts, and Unauthorized Obligations paragraphs of this clause; (3) the clause at 52.212-5; (4) addenda to this solicitation or contract, including any license agreements for computer software; (5) solicitation provisions if this is a solicitation; (6) other paragraphs of this clause; (7) the Standard Form 1449; (8) other documents, exhibits, and attachments; and (9) the specification.

(t) System for Award Management (SAM). (1) Unless exempted by an addendum to this contract, the Contractor is responsible during performance and through final payment of any contract for the accuracy and completeness of the data within the SAM database, and for any liability resulting from the Government's reliance on inaccurate or incomplete data. To remain registered in the SAM database after the initial registration, the Contractor is required to review and update on an annual basis from the date of initial registration or subsequent updates its information in the SAM database to ensure it is current, accurate and complete. Updating information in the SAM does not alter the terms and conditions of this contract and is not a substitute for a properly executed contractual document.

(2)(i) If a Contractor has legally changed its business name, "doing business as" name, or division name (whichever is shown on the contract), or has transferred the assets used in performing the contract, but has not completed the necessary requirements regarding novation and change-of-name agreements in FAR subpart 42.12, the Contractor shall provide the responsible Contracting Officer a minimum of one business day's written notification of its intention to (A) change the name in the SAM database; (B) comply with the requirements of subpart 42.12; and (C) agree in writing to the timeline and procedures specified by the responsible Contracting Officer. The Contractor must provide with the notification sufficient documentation to support the legally changed name.

(ii) If the Contractor fails to comply with the requirements of paragraph (t)(2)(i) of this clause, or fails to perform the agreement at paragraph (t)(2)(i)(C) of this clause, and, in the absence of a properly executed novation or change-of-name agreement, the SAM information that shows the Contractor to be other than the Contractor indicated in the contract will be considered to be incorrect information within the meaning of the "Suspension of Payment" paragraph of the electronic funds transfer (EFT) clause of this contract.

(3) The Contractor shall not change the name or address for EFT payments or manual payments, as appropriate, in the SAM record to reflect an assignee for the purpose of assignment of claims (see Subpart 32.8, Assignment of Claims). Assignees shall be separately registered in the SAM database. Information provided to the Contractor's SAM record that indicates payments, including those made by EFT, to an ultimate recipient other than that Contractor will be considered to be incorrect information within the meaning of the "Suspension of payment" paragraph of the EFT clause of this contract.

(4) Offerors and Contractors may obtain information on registration and annual confirmation requirements via SAM accessed through <https://www.acquisition.gov>.

(u) Unauthorized Obligations.

(1) Except as stated in paragraph (u)(2) of this clause, when any supply or service acquired under this contract is subject to any End User License Agreement (EULA), Terms of Service (TOS), or similar legal instrument or agreement, that includes any clause requiring the Government to indemnify the Contractor or any person or entity for damages, costs, fees, or any other loss or liability that would create an Anti-Deficiency Act violation (31 U.S.C. 1341), the following shall govern:

(i) Any such clause is unenforceable against the Government.

(ii) Neither the Government nor any Government authorized end user shall be deemed to have agreed to such clause by virtue of it appearing in the EULA, TOS, or similar legal instrument or agreement. If the EULA, TOS, or similar legal instrument or agreement is invoked through an "I agree" click box or other comparable mechanism (e.g., "click-wrap" or "browse-wrap" agreements), execution does not bind the Government or any Government authorized end user to such clause.

(iii) Any such clause is deemed to be stricken from the EULA, TOS, or similar legal instrument or agreement.

(2) Paragraph (u)(1) of this clause does not apply to indemnification by the Government that is expressly authorized by statute and specifically authorized under applicable agency regulations and procedures.

(v) Incorporation by reference. The Contractor's representations and certifications, including those completed electronically via the System for Award Management (SAM), are incorporated by reference into the contract.

(End of Clause)

52.212-5 CONTRACT TERMS AND CONDITIONS REQUIRED TO IMPLEMENT STATUTES OR EXECUTIVE ORDERS--COMMERCIAL ITEMS (MAR 2016)

(a) The Contractor shall comply with the following Federal Acquisition Regulation (FAR) clauses, which are incorporated in this contract by reference, to implement provisions of law or Executive orders applicable to acquisitions of commercial items:

(1) 52.209-10, Prohibition on Contracting with Inverted Domestic Corporations (Nov 2015).

(2) 52.233-3, Protest After Award (AUG 1996) (31 U.S.C. 3553).

(3) 52.233-4, Applicable Law for Breach of Contract Claim (OCT 2004) (Public Laws 108-77 and 108-78 (19 U.S.C. 3805 note)).

(b) The Contractor shall comply with the FAR clauses in this paragraph (b) that the Contracting Officer has indicated as being incorporated in this contract by reference to implement provisions of law or Executive orders applicable to acquisitions of commercial items: (Contracting Officer check as appropriate.)

___ (1) 52.203-6, Restrictions on Subcontractor Sales to the Government (Sept 2006), with Alternate I (Oct 1995) (41 U.S.C. 4704 and 10 U.S.C. 2402).

X (2) 52.203-13, Contractor Code of Business Ethics and Conduct (Oct 2015) (41 U.S.C. 3509).

X (3) 52.203-15, Whistleblower Protections under the American Recovery and Reinvestment Act of 2009 (June 2010) (Section 1553 of Pub. L. 111-5). (Applies to contracts funded by the American Recovery and Reinvestment Act of 2009.)

X (4) 52.204-10, Reporting Executive Compensation and First-Tier Subcontract Awards (Oct 2015) (Pub. L. 109-282) (31 U.S.C. 6101 note).

___ (5) [Reserved]

X (6) 52.204-14, Service Contract Reporting Requirements (JAN 2014) (Pub. L. 111-117, section 743 of Div. C).

___ (7) 52.204-15, Service Contract Reporting Requirements for Indefinite-Delivery Contracts (JAN 2014) (Pub. L. 111-117, section 743 of Div. C).

X (8) 52.209-6, Protecting the Government's Interest When Subcontracting with Contractors Debarred, Suspended, or Proposed for Debarment. (Oct 2015) (31 U.S.C. 6101 note).

X (9) 52.209-9, Updates of Publicly Available Information Regarding Responsibility Matters (July 2013) (41 U.S.C. 2313).

___ (10) [Reserved]

___ (11)(i) 52.219-3, Notice of HUBZone Set-Aside or Sole-Source Award (NOV 2011) (15 U.S.C. 657a).

___ (ii) Alternate I (NOV 2011) of 52.219-3.

___ (12) (i) 52.219-4, Notice of Price Evaluation Preference for HUBZone Small Business Concerns (OCT 2014) (if the offeror elects to waive the preference, it shall so indicate in its offer) (15 U.S.C. 657a).

___ (ii) Alternate I (JAN 2011) of 52.219-4.

___ (13) [Reserved]

X (14)(i) 52.219-6, Notice of Total Small Business Set-Aside (NOV 2011) (15 U.S.C. 644).

___ (ii) Alternate I (NOV 2011).

- ____ (iii) Alternate II (NOV 2011).
- ____ (15)(i) 52.219-7, Notice of Partial Small Business Set-Aside (June 2003) (15 U.S.C. 644).
- ____ (ii) Alternate I (Oct 1995) of 52.219-7.
- ____ (iii) Alternate II (Mar 2004) of 52.219-7.
- X (16) 52.219-8, Utilization of Small Business Concerns (OCT 2014) (15 U.S.C. 637(d)(2) and (3)).
- ____ (17)(i) 52.219-9, Small Business Subcontracting Plan (Oct 2015) (15 U.S.C. 637(d)(4)).
- ____ (ii) Alternate I (Oct 2001) of 52.219-9.
- ____ (iii) Alternate II (Oct 2001) of 52.219-9.
- ____ (iv) Alternate III (Oct 2015) of 52.219-9.
- ____ (18) 52.219-13, Notice of Set-Aside of Orders (NOV 2011) (15 U.S.C. 644(r)).
- ____ (19) 52.219-14, Limitations on Subcontracting (NOV 2011) (15 U.S.C. 637(a)(14)).
- ____ (20) 52.219-16, Liquidated Damages—Subcontracting Plan (Jan 1999) (15 U.S.C. 637(d)(4)(F)(i)).
- ____ (21) 52.219-27, Notice of Service-Disabled Veteran-Owned Small Business Set-Aside (NOV 2011) (15 U.S.C. 657f).
- X (22) 52.219-28, Post Award Small Business Program Rerepresentation (July 2013) (15 U.S.C. 632(a)(2)).
- ____ (23) 52.219-29, Notice of Set-Aside for, or Sole Source Award to, Economically Disadvantaged Women-Owned Small Business Concerns (Dec 2015) (15 U.S.C. 637(m)).
- ____ (24) 52.219-30, Notice of Set-Aside for, or Sole Source Award to, Women-Owned Small Business Concerns Eligible Under the Women-Owned Small Business Program (Dec 2015) (15 U.S.C. 637(m)).
- X (25) 52.222-3, Convict Labor (June 2003) (E.O. 11755).
- X(26) 52.222-19, Child Labor--Cooperation with Authorities and Remedies (FEB 2016) (E.O. 13126).
- X (27) 52.222-21, Prohibition of Segregated Facilities (Apr 2015).
- X (28) 52.222-26, Equal Opportunity (Apr 2015) (E.O. 11246).
- X (29) 52.222-35, Equal Opportunity for Veterans (Oct 2015) (38 U.S.C. 4212).
- X (30) 52.222-36, Equal Opportunity for Workers with Disabilities (July 2014) (29 U.S.C. 793).
- X (31) 52.222-37, Employment Reports on Veterans (FEB 2016) (38 U.S.C. 4212).
- X (32) 52.222-40, Notification of Employee Rights Under the National Labor Relations Act (Dec 2010) (E.O. 13496).
- X (33)(i) 52.222-50, Combating Trafficking in Persons (March 2, 2015) (22 U.S.C. chapter 78 and E.O. 13627).

____ (ii) Alternate I (March 2, 2015) of 52.222-50 (22 U.S.C. chapter 78 and E.O. 13627).

X (34) 52.222-54, Employment Eligibility Verification (Oct 2015). (E. O. 12989). (Not applicable to the acquisition of commercially available off-the-shelf items or certain other types of commercial items as prescribed in 22.1803.)

____ (35)(i) 52.223-9, Estimate of Percentage of Recovered Material Content for EPA-Designated Items (May 2008) (42 U.S.C. 6962(c)(3)(A)(ii)). (Not applicable to the acquisition of commercially available off-the-shelf items.)

____ (ii) Alternate I (May 2008) of 52.223-9 (42 U.S.C. 6962(i)(2)(C)). (Not applicable to the acquisition of commercially available off-the-shelf items.)

____ (36) (i) 52.223-13, Acquisition of EPEAT® Registered Imaging Equipment (Jun 2014) (E.O.s 13423 and 13514).

____ (ii) Alternate I (OCT 2015) of 52.223-13.

____ (37)(i) 52.223-14, Acquisition of EPEAT® Registered Televisions (Jun 2014) (E.O.s 13423 and 13514).

____ (ii) Alternate I (Jun 2014) of 52.223-14.

X (38) 52.223-15, Energy Efficiency in Energy-Consuming Products (Dec 2007) (42 U.S.C. 8259b).

____ (39)(i) 52.223-16, Acquisition of EPEAT[supreg]-Registered Personal Computer Products (OCT 2015) (E.O.s 13423 and 13514).

____ (ii) Alternate I (Jun 2014) of 52.223-16.

X (40) 52.223-18, Encouraging Contractor Policies to Ban Text Messaging While Driving (Aug 2011) (E.O. 13513).

X (41) 52.225-1, Buy American--Supplies (May 2014) (41 U.S.C. chapter 83).

X(42) (i) 52.225-3, Buy American--Free Trade Agreements--Israeli Trade Act (May 2014) (41 U.S.C. chapter 83, 19 U.S.C. 3301 note, 19 U.S.C. 2112 note, 19 U.S.C. 3805 note, 19 U.S.C. 4001 note, Pub. L. 103-182, 108-77, 108-78, 108-286, 108-302, 109-53, 109-169, 109-283, 110-138, 112-41, 112-42, and 112-43.

____ (ii) Alternate I (May 2014) of 52.225-3.

____ (iii) Alternate II (May 2014) of 52.225-3.

____ (iv) Alternate III (May 2014) of 52.225-3.

____ (43) 52.225-5, Trade Agreements (FEB 2016) (19 U.S.C. 2501, et seq., 19 U.S.C. 3301 note).

____ (44) 52.225-13, Restrictions on Certain Foreign Purchases (June 2008) (E.O.'s, proclamations, and statutes administered by the Office of Foreign Assets Control of the Department of the Treasury).

____ (45) 52.225-26, Contractors Performing Private Security Functions Outside the United States (Jul 2013) (Section 862, as amended, of the National Defense Authorization Act for Fiscal Year 2008; 10 U.S.C. 2302 Note).

____ (46) 52.226-4, Notice of Disaster or Emergency Area Set-Aside (Nov 2007) (42 U.S.C. 5150)

____ (47) 52.226-5, Restrictions on Subcontracting Outside Disaster or Emergency Area (Nov 2007) (42 U.S.C. 5150).

____ (48) 52.232-29, Terms for Financing of Purchases of Commercial Items (Feb 2002) (41 U.S.C. 4505, 10 U.S.C. 2307(f)).

____ (49) 52.232-30, Installment Payments for Commercial Items (Oct 1995) (41 U.S.C. 4505, 10 U.S.C. 2307(f)).

X (50) 52.232-33, Payment by Electronic Funds Transfer—System for Award Management (July 2013) (31 U.S.C. 3332).

____ (51) 52.232-34, Payment by Electronic Funds Transfer—Other than System for Award Management (July 2013) (31 U.S.C. 3332).

____ (52) 52.232-36, Payment by Third Party (MAY 2014) (31 U.S.C. 3332).

____ (53) 52.239-1, Privacy or Security Safeguards (Aug 1996) (5 U.S.C. 552a).

____ (54)(i) 52.247-64, Preference for Privately Owned U.S.-Flag Commercial Vessels (Feb 2006) (46 U.S.C. Appx. 1241(b) and 10 U.S.C. 2631).

____ (ii) Alternate I (Apr 2003) of 52.247-64.

(c) The Contractor shall comply with the FAR clauses in this paragraph (c), applicable to commercial services, that the Contracting Officer has indicated as being incorporated in this contract by reference to implement provisions of law or Executive orders applicable to acquisitions of commercial items: (Contracting Officer check as appropriate.)

____ (1) 52.222-17, Nondisplacement of Qualified Workers (May 2014) (E.O. 13495).

X (2) 52.222-41, Service Contract Labor Standards (MAY 2014) (41 U.S.C. chapter 67).

____ (3) 52.222-42, Statement of Equivalent Rates for Federal Hires (MAY 2014) (29 U.S.C. 206 and 41 U.S.C. chapter 67).

____ (4) 52.222-43, Fair Labor Standards Act and Service Contract Labor Standards--Price Adjustment (Multiple Year and Option Contracts) (MAY 2014) (29 U.S.C. 206 and 41 U.S.C. chapter 67).

X (5) 52.222-44, Fair Labor Standards Act and Service Contract Labor Standards--Price Adjustment (MAY 2014) (29 U.S.C. 206 and 41 U.S.C. chapter 67).

____ (6) 52.222-51, Exemption from Application of the Service Contract Labor Standards to Contracts for Maintenance, Calibration, or Repair of Certain Equipment--Requirements (MAY 2014) (41 U.S.C. chapter 67).

____ (7) 52.222-53, Exemption from Application of the Service Contract Labor Standards to Contracts for Certain Services--Requirements (MAY 2014) (41 U.S.C. chapter 67).

x(8) 52.222-55, Minimum Wages Under Executive Order 13658 (DEC 2015) (E.O. 13658).

____ (9) 52.226-6, Promoting Excess Food Donation to Nonprofit Organizations (MAY 2014) (42 U.S.C. 1792).

X (10) 52.237-11, Accepting and Dispensing of \$1 Coin (Sept 2008) (31 U.S.C. 5112(p)(1)).

(d) Comptroller General Examination of Record. The Contractor shall comply with the provisions of this paragraph (d) if this contract was awarded using other than sealed bid, is in excess of the simplified acquisition threshold, and does not contain the clause at 52.215-2, Audit and Records--Negotiation.

(1) The Comptroller General of the United States, or an authorized representative of the Comptroller General, shall have access to and right to examine any of the Contractor's directly pertinent records involving transactions related to this contract.

(2) The Contractor shall make available at its offices at all reasonable times the records, materials, and other evidence for examination, audit, or reproduction, until 3 years after final payment under this contract or for any shorter period specified in FAR Subpart 4.7, Contractor Records Retention, of the other clauses of this contract. If this contract is completely or partially terminated, the records relating to the work terminated shall be made available for 3 years after any resulting final termination settlement. Records relating to appeals under the disputes clause or to litigation or the settlement of claims arising under or relating to this contract shall be made available until such appeals, litigation, or claims are finally resolved.

(3) As used in this clause, records include books, documents, accounting procedures and practices, and other data, regardless of type and regardless of form. This does not require the Contractor to create or maintain any record that the Contractor does not maintain in the ordinary course of business or pursuant to a provision of law.

(e) (1) Notwithstanding the requirements of the clauses in paragraphs (a), (b), (c), and (d) of this clause, the Contractor is not required to flow down any FAR clause, other than those in this paragraph (e)(1) in a subcontract for commercial items. Unless otherwise indicated below, the extent of the flow down shall be as required by the clause—

(i) 52.203-13, Contractor Code of Business Ethics and Conduct (Oct 2015) (41 U.S.C. 3509).

(ii) 52.219-8, Utilization of Small Business Concerns (OCT 2014) (15 U.S.C. 637(d)(2) and (3)), in all subcontracts that offer further subcontracting opportunities. If the subcontract (except subcontracts to small business concerns) exceeds \$700,000 (\$1.5 million for construction of any public facility), the subcontractor must include 52.219-8 in lower tier subcontracts that offer subcontracting opportunities.

(iii) 52.222-17, Nondisplacement of Qualified Workers (MAY 2014) (E.O. 13495). Flow down required in accordance with paragraph (l) of FAR clause 52.222-17.

(iv) 52.222-21, Prohibition of Segregated Facilities (Apr 2015).

(v) 52.222-26, Equal Opportunity (APR 2015) (E.O. 11246).

(vi) 52.222-35, Equal Opportunity for Veterans (Oct 2015) (38 U.S.C. 4212).

(vii) 52.222-36, Equal Opportunity for Workers with Disabilities (Jul 2014) (29 U.S.C. 793).

(viii) 52.222-37, Employment Reports on Veterans (Feb 2016) (38 U.S.C. 4212).

(ix) 52.222-40, Notification of Employee Rights Under the National Labor Relations Act (Dec 2010) (E.O. 13496). Flow down required in accordance with paragraph (f) of FAR clause 52.222-40.

(x) 52.222-41, Service Contract Labor Standards (May 2014), (41 U.S.C. chapter 67).

(xi) X (A) 52.222-50, Combating Trafficking in Persons (March 2, 2015) (22 U.S.C. chapter 78 and E.O. 13627).

_____ (B) Alternate I (March 2, 2015) of 52.222-50 (22 U.S.C. chapter 78 and E.O. 13627).

(xii) 52.222-51, Exemption from Application of the Service Contract Labor Standards to Contracts for Maintenance, Calibration, or Repair of Certain Equipment--Requirements (May 2014) (41 U.S.C. chapter 67.)

(xiii) 52.222-53, Exemption from Application of the Service Contract Labor Standards to Contracts for Certain Services--Requirements (May 2014) (41 U.S.C. chapter 67)

(xiv) 52.222-54, Employment Eligibility Verification (Oct 2015) (E. O. 12989).

(xv) 52.222-55, Minimum Wages Under Executive Order 13658 (Dec 2015) (E.O. 13658).

(xvi) 52.225-26, Contractors Performing Private Security Functions Outside the United States (Jul 2013) (Section 862, as amended, of the National Defense Authorization Act for Fiscal Year 2008; 10 U.S.C. 2302 Note).

(xvii) 52.226-6, Promoting Excess Food Donation to Nonprofit Organizations. (May 2014) (42 U.S.C. 1792). Flow down required in accordance with paragraph (e) of FAR clause 52.226-6.

(xviii) 52.247-64, Preference for Privately-Owned U.S. Flag Commercial Vessels (Feb 2006) (46 U.S.C. Appx 1241(b) and 10 U.S.C. 2631). Flow down required in accordance with paragraph (d) of FAR clause 52.247-64.

(2) While not required, the Contractor may include in its subcontracts for commercial items a minimal number of additional clauses necessary to satisfy its contractual obligations.

(End of clause)

WAGE DETERMINATION

WD 05-2507 (Rev.-18) was first posted on www.wdol.gov on 01/05/2016

REGISTER OF WAGE DETERMINATIONS UNDER | U.S. DEPARTMENT OF LABOR
THE SERVICE CONTRACT ACT | EMPLOYMENT STANDARDS ADMINISTRATION
By direction of the Secretary of Labor | WAGE AND HOUR DIVISION
WASHINGTON D.C. 20210

| Wage Determination No.: 2005-2507
Daniel W. Simms Division of | Revision No.: 18
Director Wage Determinations| Date Of Revision: 12/29/2015

Note: Under Executive Order (EO) 13658, an hourly minimum wage of \$10.15 for calendar year 2016 applies to all contracts subject to the Service Contract Act for which the solicitation was issued on or after January 1, 2015. If this contract is covered by the EO, the contractor must pay all workers in any classification listed on this wage determination at least \$10.15 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in calendar year 2016. The EO minimum wage rate will be adjusted annually. Additional information on

contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

State: Texas

Area: Texas Counties of Aransas, Bee, Calhoun, Goliad, Jim Wells, Kleberg, Live Oak, Nueces, Refugio, San Patricio, Victoria

— **Fringe Benefits Required Follow the Occupational Listing**

OCCUPATION CODE - TITLE	FOOTNOTE	RATE
01000 - Administrative Support And Clerical Occupations		
01011 - Accounting Clerk I		12.96
01012 - Accounting Clerk II		14.55
01013 - Accounting Clerk III		16.27
01020 - Administrative Assistant		20.11
01040 - Court Reporter		16.11
01051 - Data Entry Operator I		10.21
01052 - Data Entry Operator II		12.12
01060 - Dispatcher, Motor Vehicle		15.58
01070 - Document Preparation Clerk		11.64
01090 - Duplicating Machine Operator		11.64
01111 - General Clerk I		11.40
01112 - General Clerk II		13.38
01113 - General Clerk III		15.06
01120 - Housing Referral Assistant		18.25
01141 - Messenger Courier		10.32
01191 - Order Clerk I		10.43
01192 - Order Clerk II		11.96
01261 - Personnel Assistant (Employment) I		15.03
01262 - Personnel Assistant (Employment) II		16.81
01263 - Personnel Assistant (Employment) III		18.75
01270 - Production Control Clerk		22.73
01280 - Receptionist		10.55
01290 - Rental Clerk		13.27
01300 - Scheduler, Maintenance		14.51
01311 - Secretary I		14.51
01312 - Secretary II		16.37
01313 - Secretary III		18.25
01320 - Service Order Dispatcher		15.58
01410 - Supply Technician		20.11
01420 - Survey Worker		15.95
01531 - Travel Clerk I		11.09
01532 - Travel Clerk II		12.21
01533 - Travel Clerk III		13.10
01611 - Word Processor I		12.31
01612 - Word Processor II		13.81
01613 - Word Processor III		15.45
05000 - Automotive Service Occupations		
05005 - Automobile Body Repairer, Fiberglass		18.21
05010 - Automotive Electrician		17.48
05040 - Automotive Glass Installer		16.74
05070 - Automotive Worker		16.74
05110 - Mobile Equipment Servicer		15.29

05130 - Motor Equipment Metal Mechanic	18.21
05160 - Motor Equipment Metal Worker	16.74
05190 - Motor Vehicle Mechanic	18.21
05220 - Motor Vehicle Mechanic Helper	14.51
05250 - Motor Vehicle Upholstery Worker	16.01
05280 - Motor Vehicle Wrecker	16.74
05310 - Painter, Automotive	17.48
05340 - Radiator Repair Specialist	16.74
05370 - Tire Repairer	14.77
05400 - Transmission Repair Specialist	18.21
07000 - Food Preparation And Service Occupations	
07010 - Baker	9.21
07041 - Cook I	9.04
07042 - Cook II	10.08
07070 - Dishwasher	7.98
07130 - Food Service Worker	8.55
07210 - Meat Cutter	12.89
07260 - Waiter/Waitress	7.25
09000 - Furniture Maintenance And Repair Occupations	
09010 - Electrostatic Spray Painter	16.65
09040 - Furniture Handler	13.82
09080 - Furniture Refinisher	16.65
09090 - Furniture Refinisher Helper	13.82
09110 - Furniture Repairer, Minor	15.25
09130 - Upholsterer	17.70
11000 - General Services And Support Occupations	
11030 - Cleaner, Vehicles	10.49
11060 - Elevator Operator	8.92
11090 - Gardener	12.98
11122 - Housekeeping Aide	8.92
11150 - Janitor	9.67
11210 - Laborer, Grounds Maintenance	10.24
11240 - Maid or Houseman	7.55
11260 - Pruner	9.86
11270 - Tractor Operator	12.15
11330 - Trail Maintenance Worker	10.24
11360 - Window Cleaner	10.67
12000 - Health Occupations	
12010 - Ambulance Driver	16.18
12011 - Breath Alcohol Technician	16.18
12012 - Certified Occupational Therapist Assistant	25.05
12015 - Certified Physical Therapist Assistant	25.45
12020 - Dental Assistant	13.95
12025 - Dental Hygienist	26.11
12030 - EKG Technician	23.84
12035 - Electroneurodiagnostic Technologist	23.84
12040 - Emergency Medical Technician	16.18
12071 - Licensed Practical Nurse I	15.14
12072 - Licensed Practical Nurse II	16.93
12073 - Licensed Practical Nurse III	18.88
12100 - Medical Assistant	10.96
12130 - Medical Laboratory Technician	13.70
12160 - Medical Record Clerk	13.21
12190 - Medical Record Technician	16.14
12195 - Medical Transcriptionist	13.92

12210 - Nuclear Medicine Technologist		25.78
12221 - Nursing Assistant I		9.86
12222 - Nursing Assistant II		11.12
12223 - Nursing Assistant III		12.13
12224 - Nursing Assistant IV		13.62
12235 - Optical Dispenser		12.11
12236 - Optical Technician		11.26
12250 - Pharmacy Technician		12.34
12280 - Phlebotomist	13.62	
12305 - Radiologic Technologist		22.62
12311 - Registered Nurse I		25.83
12312 - Registered Nurse II		31.60
12313 - Registered Nurse II, Specialist		31.60
12314 - Registered Nurse III		38.23
12315 - Registered Nurse III, Anesthetist		38.23
12316 - Registered Nurse IV		45.82
12317 - Scheduler (Drug and Alcohol Testing)		20.05
13000 - Information And Arts Occupations		
13011 - Exhibits Specialist I		16.99
13012 - Exhibits Specialist II		20.82
13013 - Exhibits Specialist III		25.46
13041 - Illustrator I	16.99	
13042 - Illustrator II	20.82	
13043 - Illustrator III	25.46	
13047 - Librarian	23.18	
13050 - Library Aide/Clerk		10.03
13054 - Library Information Technology Systems Administrator		20.94
13058 - Library Technician		12.51
13061 - Media Specialist I		15.10
13062 - Media Specialist II		16.90
13063 - Media Specialist III		18.84
13071 - Photographer I		13.47
13072 - Photographer II		16.43
13073 - Photographer III		19.23
13074 - Photographer IV		23.46
13075 - Photographer V		28.47
13110 - Video Teleconference Technician		14.29
14000 - Information Technology Occupations		
14041 - Computer Operator I		14.77
14042 - Computer Operator II		16.52
14043 - Computer Operator III		18.43
14044 - Computer Operator IV		20.48
14045 - Computer Operator V		22.67
14071 - Computer Programmer I	(see 1)	21.52
14072 - Computer Programmer II	(see 1)	26.05
14073 - Computer Programmer III	(see 1)	
14074 - Computer Programmer IV	(see 1)	
14101 - Computer Systems Analyst I	(see 1)	26.75
14102 - Computer Systems Analyst II	(see 1)	
14103 - Computer Systems Analyst III	(see 1)	
14150 - Peripheral Equipment Operator		14.77
14160 - Personal Computer Support Technician		20.48
15000 - Instructional Occupations		
15010 - Aircrew Training Devices Instructor (Non-Rated)		27.65

15020 - Aircrew Training Devices Instructor (Rated)	33.46
15030 - Air Crew Training Devices Instructor (Pilot)	39.29
15050 - Computer Based Training Specialist / Instructor	27.65
15060 - Educational Technologist	26.91
15070 - Flight Instructor (Pilot)	39.29
15080 - Graphic Artist	20.98
15090 - Technical Instructor	18.85
15095 - Technical Instructor/Course Developer	23.06
15110 - Test Proctor	15.22
15120 - Tutor	15.22
16000 - Laundry, Dry-Cleaning, Pressing And Related Occupations	
16010 - Assembler	8.21
16030 - Counter Attendant	8.21
16040 - Dry Cleaner	9.65
16070 - Finisher, Flatwork, Machine	8.21
16090 - Presser, Hand	8.21
16110 - Presser, Machine, Drycleaning	8.21
16130 - Presser, Machine, Shirts	8.21
16160 - Presser, Machine, Wearing Apparel, Laundry	8.21
16190 - Sewing Machine Operator	10.14
16220 - Tailor	10.68
16250 - Washer, Machine	8.61
19000 - Machine Tool Operation And Repair Occupations	
19010 - Machine-Tool Operator (Tool Room)	18.54
19040 - Tool And Die Maker	21.95
21000 - Materials Handling And Packing Occupations	
21020 - Forklift Operator	11.29
21030 - Material Coordinator	23.55
21040 - Material Expediter	23.55
21050 - Material Handling Laborer	10.07
21071 - Order Filler	10.37
21080 - Production Line Worker (Food Processing)	11.29
21110 - Shipping Packer	13.35
21130 - Shipping/Receiving Clerk	13.35
21140 - Store Worker I	13.50
21150 - Stock Clerk	18.20
21210 - Tools And Parts Attendant	11.77
21410 - Warehouse Specialist	11.77
23000 - Mechanics And Maintenance And Repair Occupations	
23010 - Aerospace Structural Welder	25.10
23021 - Aircraft Mechanic I	24.06
23022 - Aircraft Mechanic II	25.10
23023 - Aircraft Mechanic III	26.15
23040 - Aircraft Mechanic Helper	19.17
23050 - Aircraft, Painter	20.41
23060 - Aircraft Servicer	21.17
23080 - Aircraft Worker	22.11
23110 - Appliance Mechanic	19.18
23120 - Bicycle Repairer	13.35
23125 - Cable Splicer	20.98
23130 - Carpenter, Maintenance	17.36
23140 - Carpet Layer	17.64
23160 - Electrician, Maintenance	19.38
23181 - Electronics Technician Maintenance I	20.66
23182 - Electronics Technician Maintenance II	22.55

23183 - Electronics Technician Maintenance III		23.59
23260 - Fabric Worker	16.74	
23290 - Fire Alarm System Mechanic		17.34
23310 - Fire Extinguisher Repairer	15.82	
23311 - Fuel Distribution System Mechanic		24.91
23312 - Fuel Distribution System Operator		20.32
23370 - General Maintenance Worker		14.41
23380 - Ground Support Equipment Mechanic		24.06
23381 - Ground Support Equipment Servicer		21.17
23382 - Ground Support Equipment Worker		22.11
23391 - Gunsmith I	15.82	
23392 - Gunsmith II	17.64	
23393 - Gunsmith III	19.39	
23410 - Heating, Ventilation And Air-Conditioning Mechanic		19.18
23411 - Heating, Ventilation And Air Contditioning Mechanic (Research Facility)		20.00
23430 - Heavy Equipment Mechanic		17.79
23440 - Heavy Equipment Operator		17.34
23460 - Instrument Mechanic	20.98	
23465 - Laboratory/Shelter Mechanic		18.54
23470 - Laborer	12.71	
23510 - Locksmith	17.53	
23530 - Machinery Maintenance Mechanic		21.16
23550 - Machinist, Maintenance		20.96
23580 - Maintenance Trades Helper		13.91
23591 - Metrology Technician I		20.98
23592 - Metrology Technician II		21.88
23593 - Metrology Technician III		22.78
23640 - Millwright	19.39	
23710 - Office Appliance Repairer		16.65
23760 - Painter, Maintenance		18.10
23790 - Pipefitter, Maintenance		19.64
23810 - Plumber, Maintenance		18.87
23820 - Pneudraulic Systems Mechanic		19.39
23850 - Rigger	21.25	
23870 - Scale Mechanic		17.64
23890 - Sheet-Metal Worker, Maintenance		23.54
23910 - Small Engine Mechanic		16.63
23931 - Telecommunications Mechanic I		20.85
23932 - Telecommunications Mechanic II		21.75
23950 - Telephone Lineman		23.11
23960 - Welder, Combination, Maintenance		18.30
23965 - Well Driller	19.15	
23970 - Woodcraft Worker		19.39
23980 - Woodworker		15.94
24000 - Personal Needs Occupations		
24570 - Child Care Attendant		8.99
24580 - Child Care Center Clerk		11.21
24610 - Chore Aide	8.36	
24620 - Family Readiness And Support Services Coordinator		11.85
24630 - Homemaker		13.71
25000 - Plant And System Operations Occupations		
25010 - Boiler Tender		20.98

25040 - Sewage Plant Operator	18.32
25070 - Stationary Engineer	20.98
25190 - Ventilation Equipment Tender	15.93
25210 - Water Treatment Plant Operator	18.16
27000 - Protective Service Occupations	
27004 - Alarm Monitor	14.13
27007 - Baggage Inspector	10.84
27008 - Corrections Officer	19.97
27010 - Court Security Officer	19.97
27030 - Detection Dog Handler	13.78
27040 - Detention Officer	19.97
27070 - Firefighter	20.34
27101 - Guard I	10.84
27102 - Guard II	13.78
27131 - Police Officer I	23.49
27132 - Police Officer II	26.10
28000 - Recreation Occupations	
28041 - Carnival Equipment Operator	12.34
28042 - Carnival Equipment Repairer	12.85
28043 - Carnival Equipment Worker	10.10
28210 - Gate Attendant/Gate Tender	12.94
28310 - Lifeguard	11.34
28350 - Park Attendant (Aide)	14.48
28510 - Recreation Aide/Health Facility Attendant	10.57
28515 - Recreation Specialist	17.94
28630 - Sports Official	11.54
28690 - Swimming Pool Operator	16.28
29000 - Stevedoring/Longshoremen Occupational Services	
29010 - Blocker And Bracer	17.93
29020 - Hatch Tender	17.93
29030 - Line Handler	17.93
29041 - Stevedore I	17.11
29042 - Stevedore II	18.79
30000 - Technical Occupations	
30010 - Air Traffic Control Specialist, Center (HFO) (see 2)	35.77
30011 - Air Traffic Control Specialist, Station (HFO) (see 2)	24.66
30012 - Air Traffic Control Specialist, Terminal (HFO) (see 2)	27.16
30021 - Archeological Technician I	18.17
30022 - Archeological Technician II	20.32
30023 - Archeological Technician III	25.17
30030 - Cartographic Technician	25.17
30040 - Civil Engineering Technician	22.71
30061 - Drafter/CAD Operator I	18.17
30062 - Drafter/CAD Operator II	20.32
30063 - Drafter/CAD Operator III	22.67
30064 - Drafter/CAD Operator IV	27.89
30081 - Engineering Technician I	15.64
30082 - Engineering Technician II	17.56
30083 - Engineering Technician III	19.64
30084 - Engineering Technician IV	24.33
30085 - Engineering Technician V	31.55
30086 - Engineering Technician VI	36.00
30090 - Environmental Technician	22.96
30210 - Laboratory Technician	19.91
30240 - Mathematical Technician	25.17

30361 - Paralegal/Legal Assistant I	17.64	
30362 - Paralegal/Legal Assistant II	21.86	
30363 - Paralegal/Legal Assistant III	26.74	
30364 - Paralegal/Legal Assistant IV	32.35	
30390 - Photo-Optics Technician	24.33	
30461 - Technical Writer I	25.17	
30462 - Technical Writer II	30.80	
30463 - Technical Writer III	37.26	
30491 - Unexploded Ordnance (UXO) Technician I		22.74
30492 - Unexploded Ordnance (UXO) Technician II		27.51
30493 - Unexploded Ordnance (UXO) Technician III		32.97
30494 - Unexploded (UXO) Safety Escort		22.74
30495 - Unexploded (UXO) Sweep Personnel		22.74
30620 - Weather Observer, Combined Upper Air Or	(see 3)	21.55
Surface Programs		
30621 - Weather Observer, Senior	(see 3)	24.33
31000 - Transportation/Mobile Equipment Operation Occupations		
31020 - Bus Aide	11.03	
31030 - Bus Driver	14.79	
31043 - Driver Courier	11.98	
31260 - Parking and Lot Attendant		8.91
31290 - Shuttle Bus Driver		12.80
31310 - Taxi Driver	9.28	
31361 - Truckdriver, Light	12.80	
31362 - Truckdriver, Medium	15.17	
31363 - Truckdriver, Heavy	15.38	
31364 - Truckdriver, Tractor-Trailer	15.38	
99000 - Miscellaneous Occupations		
99030 - Cashier	8.97	
99050 - Desk Clerk	8.99	
99095 - Embalmer	21.11	
99251 - Laboratory Animal Caretaker I		9.41
99252 - Laboratory Animal Caretaker II		9.88
99310 - Mortician	21.11	
99410 - Pest Controller	15.36	
99510 - Photofinishing Worker	11.95	
99710 - Recycling Laborer	14.32	
99711 - Recycling Specialist	17.01	
99730 - Refuse Collector	12.97	
99810 - Sales Clerk	10.96	
99820 - School Crossing Guard		9.95
99830 - Survey Party Chief		18.65
99831 - Surveying Aide		12.54
99832 - Surveying Technician		15.43
99840 - Vending Machine Attendant		10.82
99841 - Vending Machine Repairer		12.50
99842 - Vending Machine Repairer Helper		10.82

-

ALL OCCUPATIONS LISTED ABOVE RECEIVE THE FOLLOWING BENEFITS:

HEALTH & WELFARE: \$4.27 per hour or \$170.80 per week or \$740.13 per month

VACATION: 2 weeks paid vacation after 1 year of service with a contractor or successor; and 3 weeks after 8 years. Length of service includes the whole span of continuous service with the present contractor or successor, wherever employed, and with the predecessor contractors in the performance of similar work at the same Federal facility. (Reg. 29 CFR 4.173)

HOLIDAYS: A minimum of ten paid holidays per year, New Year's Day, Martin Luther King Jr's Birthday, Washington's Birthday, Memorial Day, Independence Day, Labor Day, Columbus Day, Veterans' Day, Thanksgiving Day, and Christmas Day. (A contractor may substitute for any of the named holidays another day off with pay in accordance with a plan communicated to the employees involved.) (See 29 CFR 4174)

THE OCCUPATIONS WHICH HAVE NUMBERED FOOTNOTES IN PARENTHESES RECEIVE THE FOLLOWING:

1) COMPUTER EMPLOYEES: Under the SCA at section 8(b), this wage determination does not apply to any employee who individually qualifies as a bona fide executive, administrative, or professional employee as defined in 29 C.F.R. Part 541. Because most Computer System Analysts and Computer Programmers who are compensated at a rate not less than \$27.63 (or on a salary or fee basis at a rate not less than \$455 per week) an hour would likely qualify as exempt computer professionals, (29 C.F.R. 541.400) wage rates may not be listed on this wage determination for all occupations within those job families. In addition, because this wage determination may not list a wage rate for some or all occupations within those job families if the survey data indicates that the prevailing wage rate for the occupation equals or exceeds \$27.63 per hour conformances may be necessary for certain nonexempt employees. For example, if an individual employee is nonexempt but nevertheless performs duties within the scope of one of the Computer Systems Analyst or Computer Programmer occupations for which this wage determination does not specify an SCA wage rate, then the wage rate for that employee must be conformed in accordance with the conformance procedures described in the conformance note included on this wage determination.

Additionally, because job titles vary widely and change quickly in the computer industry, job titles are not determinative of the application of the computer professional exemption. Therefore, the exemption applies only to computer employees who satisfy the compensation requirements and whose primary duty consists of:

(1) The application of systems analysis techniques and procedures, including consulting with users, to determine hardware, software or system functional specifications;

(2) The design, development, documentation, analysis, creation, testing or modification of computer systems or programs, including prototypes, based on and related to user or system design specifications;

(3) The design, documentation, testing, creation or modification of computer programs related to machine operating systems; or

(4) A combination of the aforementioned duties, the performance of which requires the same level of skills. (29 C.F.R. 541.400).

2) APPLICABLE TO AIR TRAFFIC CONTROLLERS ONLY - NIGHT DIFFERENTIAL: An employee is entitled to pay for all work performed between the hours of 6:00 P.M. and 6:00 A.M.

at the rate of basic pay plus a night pay differential amounting to 10 percent of the rate of basic pay.

3) AIR TRAFFIC CONTROLLERS AND WEATHER OBSERVERS - NIGHT PAY & SUNDAY PAY: If you

work at night as part of a regular tour of duty, you will earn a night differential and receive an additional 10% of basic pay for any hours worked between 6pm and 6am.

If you are a full-time employed (40 hours a week) and Sunday is part of your regularly scheduled workweek, you are paid at your rate of basic pay plus a Sunday premium of 25% of your basic rate for each hour of Sunday work which is not overtime (i.e. occasional work on Sunday outside the normal tour of duty is considered overtime work).

HAZARDOUS PAY DIFFERENTIAL: An 8 percent differential is applicable to employees employed in a position that represents a high degree of hazard when working with or in close proximity to ordnance, explosives, and incendiary materials. This includes work such as screening, blending, dying, mixing, and pressing of sensitive ordnance, explosives, and pyrotechnic compositions such as lead azide, black powder and photoflash powder. All dry-house activities involving propellants or explosives.

Demilitarization, modification, renovation, demolition, and maintenance operations on sensitive ordnance, explosives and incendiary materials. All operations involving regrading and cleaning of artillery ranges.

A 4 percent differential is applicable to employees employed in a position that represents a low degree of hazard when working with, or in close proximity to ordnance, (or employees possibly adjacent to) explosives and incendiary materials which involves potential injury such as laceration of hands, face, or arms of the employee engaged in the operation, irritation of the skin, minor burns and the like; minimal damage to immediate or adjacent work area or equipment being used. All operations involving, unloading, storage, and hauling of ordnance, explosive, and incendiary ordnance material other than small arms ammunition. These differentials are only applicable to work that has been specifically designated by the agency for ordnance, explosives, and incendiary material differential pay.

**** UNIFORM ALLOWANCE ****

If employees are required to wear uniforms in the performance of this contract (either by the terms of the Government contract, by the employer, by the state or local law, etc.), the cost of furnishing such uniforms and maintaining (by laundering or dry cleaning) such uniforms is an expense that may not be borne by an employee where such cost reduces the hourly rate below that required by the wage determination. The Department of Labor will accept payment in accordance with the following standards as compliance:

The contractor or subcontractor is required to furnish all employees with an adequate number of uniforms without cost or to reimburse employees for the actual cost of the uniforms. In addition, where uniform cleaning and maintenance is made the responsibility of the employee, all contractors and subcontractors subject to this wage determination shall (in the absence of a bona fide collective bargaining agreement providing for a different amount, or the furnishing of contrary affirmative proof as to the actual cost), reimburse all employees for such cleaning and maintenance at a rate of \$3.35 per week (or \$.67 cents per day). However, in those instances where the uniforms furnished are made of "wash and wear" materials, may be routinely washed and dried with other personal garments, and do

not require any special treatment such as dry cleaning, daily washing, or commercial laundering in order to meet the cleanliness or appearance standards set by the terms of the Government contract, by the contractor, by law, or by the nature of the work, there is no requirement that employees be reimbursed for uniform maintenance costs.

The duties of employees under job titles listed are those described in the "Service Contract Act Directory of Occupations", Fifth Edition, April 2006, unless otherwise indicated. Copies of the Directory are available on the Internet. A links to the Directory may be found on the WHD home page at <http://www.dol.gov/esa/whd/> or through the Wage Determinations On-Line (WDOL) Web site at <http://wdol.gov/>.

REQUEST FOR AUTHORIZATION OF ADDITIONAL CLASSIFICATION AND WAGE RATE {Standard Form 1444 (SF 1444)}

Conformance Process:

The contracting officer shall require that any class of service employee which is not listed herein and which is to be employed under the contract (i.e., the work to be performed is not performed by any classification listed in the wage determination), be classified by the contractor so as to provide a reasonable relationship (i.e., appropriate level of skill comparison) between such unlisted classifications and the classifications listed in the wage determination. Such conformed classes of employees shall be paid the monetary wages and furnished the fringe benefits as are determined. Such conforming process shall be initiated by the contractor prior to the performance of contract work by such unlisted class(es) of employees. The conformed classification, wage rate, and/or fringe benefits shall be retroactive to the commencement date of the contract. {See Section 4.6 (C)(vi)} When multiple wage determinations are included in a contract, a separate SF 1444 should be prepared for each wage determination to which a class(es) is to be conformed.

The process for preparing a conformance request is as follows:

- 1) When preparing the bid, the contractor identifies the need for a conformed occupation(s) and computes a proposed rate(s).
- 2) After contract award, the contractor prepares a written report listing in order proposed classification title(s), a Federal grade equivalency (FGE) for each proposed classification(s), job description(s), and rationale for proposed wage rate(s), including information regarding the agreement or disagreement of the authorized representative of the employees involved, or where there is no authorized representative, the employees themselves. This report should be submitted to the contracting officer no later than 30 days after such unlisted class(es) of employees performs any contract work.
- 3) The contracting officer reviews the proposed action and promptly submits a report of the action, together with the agency's recommendations and pertinent information including the position of the contractor and the employees, to the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, for review. (See section 4.6(b)(2) of Regulations 29 CFR Part 4).
- 4) Within 30 days of receipt, the Wage and Hour Division approves, modifies, or disapproves the action via transmittal to the agency contracting officer, or

notifies the contracting officer that additional time will be required to process the request.

5) The contracting officer transmits the Wage and Hour decision to the contractor.

6) The contractor informs the affected employees.

Information required by the Regulations must be submitted on SF 1444 or bond paper.

When preparing a conformance request, the "Service Contract Act Directory of Occupations" (the Directory) should be used to compare job definitions to insure that duties requested are not performed by a classification already listed in the wage determination. Remember, it is not the job title, but the required tasks that determine whether a class is included in an established wage determination. Conformances may not be used to artificially split, combine, or subdivide classifications listed in the wage determination.

252.232-7006 WAWF

252.232-7006 WIDE AREA WORKFLOW PAYMENT INSTRUCTIONS (MAY 2013)

(a) Definitions. As used in this clause--

Department of Defense Activity Address Code (DoDAAC) is a six position code that uniquely identifies a unit, activity, or organization.

Document type means the type of payment request or receiving report available for creation in Wide Area WorkFlow (WAWF).

Local processing office (LPO) is the office responsible for payment certification when payment certification is done external to the entitlement system.

(b) Electronic invoicing. The WAWF system is the method to electronically process vendor payment requests and receiving reports, as authorized by DFARS 252.232-7003, Electronic Submission of Payment Requests and Receiving Reports.

(c) WAWF access. To access WAWF, the Contractor shall--

(1) Have a designated electronic business point of contact in the System for Award Management at <https://www.acquisition.gov>; and

(2) Be registered to use WAWF at <https://wawf.eb.mil/> following the step-by-step procedures for self-registration available at this Web site.

(d) WAWF training. The Contractor should follow the training instructions of the WAWF Web-Based Training Course and use the Practice Training Site before submitting payment requests through WAWF. Both can be accessed by selecting the "Web Based Training" link on the WAWF home page at <https://wawf.eb.mil/>.

(e) WAWF methods of document submission. Document submissions may be via Web entry, Electronic Data Interchange, or File Transfer Protocol.

(f) WAWF payment instructions. The Contractor must use the following information when submitting payment requests and receiving reports in WAWF for this contract/order:

Contract number, typically in the form N69450-14-M-1234, for example.

(1) Document type. The Contractor shall use the following document type(s).

Naval Construction/Facilities Management Invoice

(2) Inspection/acceptance location. The Contractor shall select the following inspection/acceptance location(s) in WAWF, as specified by the contracting officer.

Inspection – N44215

Acceptance – N44215

(3) Document routing. The Contractor shall use the information in the Routing Data Table below only to fill in applicable fields in WAWF when creating payment requests and receiving reports in the system.

Routing Data Table*

Field Name in WAWF	Data to be entered in WAWF
Pay Official DoDAAC	N68732
Issue By DoDAAC	N69450
Admin DoDAAC	N44215
Inspect By DoDAAC	N44215
Ship To Code	N/A
Ship From Code	N/A
Mark For Code	N/A
Service Approver (DoDAAC)	N/A
Service Acceptor (DoDAAC)	N/A
Accept at Other DoDAAC	N/A
LPO DoDAAC	N44215
DCAA Auditor DoDAAC	N/A
Other DoDAAC(s)	N/A

(4) Payment request and supporting documentation. The Contractor shall ensure a payment request includes appropriate contract line item and subline item descriptions of the work performed or supplies delivered, unit price/cost per unit, fee (if applicable), and all relevant back-up documentation, as defined in DFARS Appendix F, (e.g. timesheets) in support of each payment request.

(5) WAWF email notifications. The Contractor shall enter the email address identified below in the “Send Additional Email Notifications” field of WAWF once a document is submitted in the system.

joel.overson@navy.mil

(6) WAWF point of contact. (1) The Contractor may obtain clarification regarding invoicing in WAWF from the following contracting activity's WAWF point of contact.

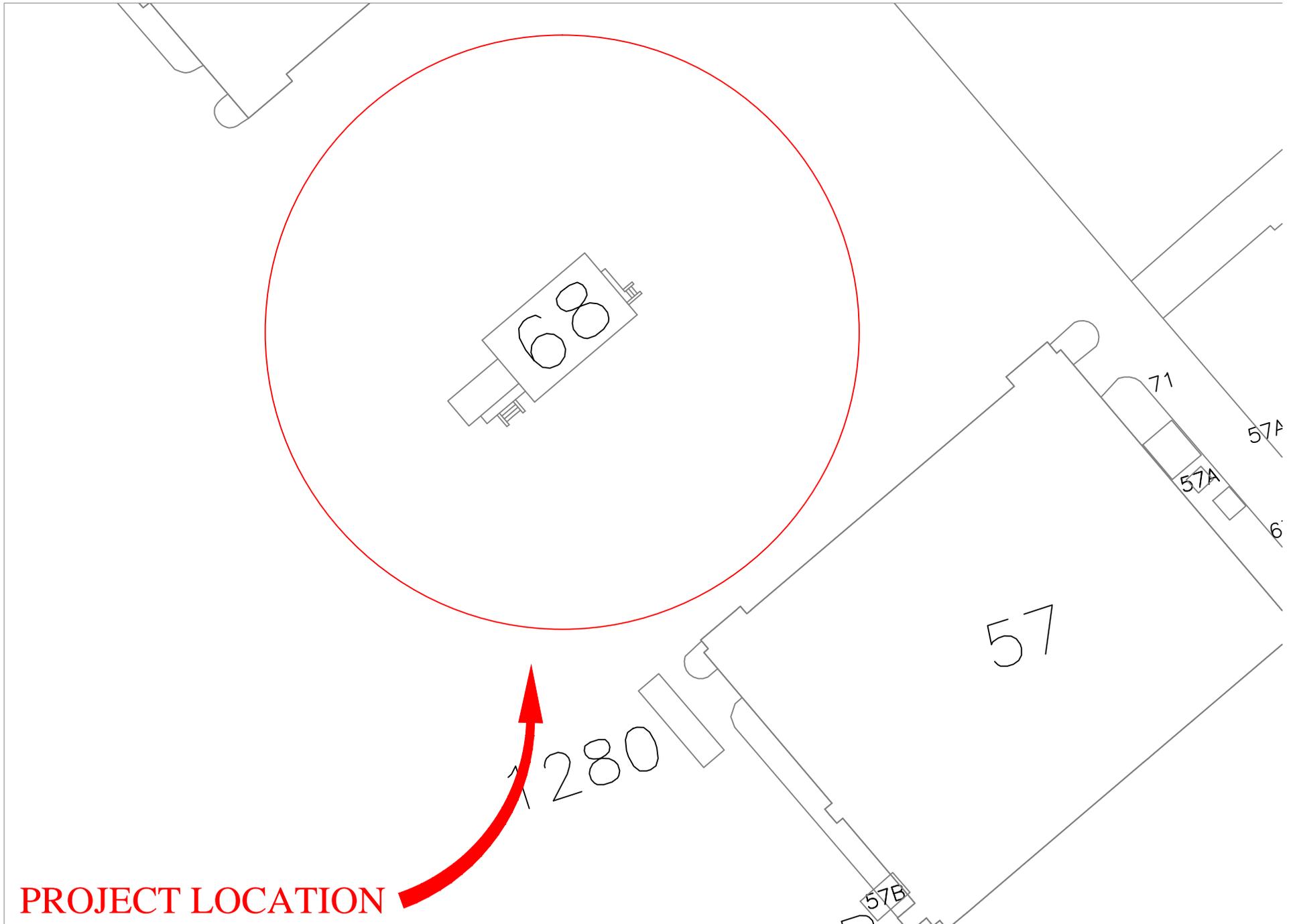
WAWF Technician: Dana Villarreal (361)516-6210 dana.villarreal@navy.mil

Contracting Officer: Joel Overson (361)961-3397 joel.overson@navy.mil

(2) For technical WAWF help, contact the WAWF helpdesk at 866-618-5988.

(End of clause)

ATTACHMENT A PROJECT LOCATION MAP



PROJECT LOCATION

NAVAL AIR STATION CORPUS CHRISTI TEXAS - WASTE SUMMARY SHEET

Name: Project Title: POC/Phone:
 Number: Delivery Order: Project Location:
 Activity*: Date of Project: Start: End:

Types of Wastes	Landfill		Incinerated		**Recycled			***Composted		
	Tons	Cost	Tons	Cost	Tons	Cost	Revenue	Tons	Cost	Revenue
Metals	<input type="text"/>				<input type="text"/>					
Glass	<input type="text"/>				<input type="text"/>					
Paper & Paperboard Plastic	<input type="text"/>				<input type="text"/>					
Wood	<input type="text"/>				<input type="text"/>					
Asbestos	<input type="text"/>				<input type="text"/>					
Yard/Green Waste	<input type="text"/>				<input type="text"/>			<input type="text"/>		
Other <input type="text"/>	<input type="text"/>				<input type="text"/>					
Ethylene Glycol Antifreeze	<input type="text"/>				<input type="text"/>					
Lead-Acid Batteries Used	<input type="text"/>				<input type="text"/>					
Motor Oil	<input type="text"/>				<input type="text"/>					
Construction & Demolition	<input type="text"/>				<input type="text"/>					
General Refuse	<input type="text"/>				<input type="text"/>					

*Recycling Facility used:
 **Composting Facility used:
 *** Asbestos Disposal Facility:
 **** Waste (Hazardous/Non-Hazardous) Disposal Facility:

PMI EQUIPMENT INVENTORY

Attachment C

EQUIPMENT NO.		EQUIPMENT NAME		FACILITY SUFFIX		PROPERTY NO.		
USER CODE		PRIORITY INSPECT		MAP GRID		ZONE		ROOM-WING
JOB NO.		PW CONTROL NO.		INVENTORY CODE		WARRANTY EXPIRATION DATE		
MODEL				MODEL YEAR		MAKE		
SERIAL NO.				USER FIELD ONE			USER FIELD TWO	
				CAP:				
REMARKS								
COST:								
		BTU		VOLT.		PHASE		
OR		TON.		H.P.		AMP		

NASCORPC 11014/25 (REV. 1-86)

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 450 (2007) Water-Cooled Refrigerant Condensers, Remote Type
- AHRI 480 (2007) Refrigerant-Cooled Liquid Coolers, Remote Type
- AHRI 550/590 I-P (2011; Addendum 1 2012; Addendum 2-3 2013) Performance Rating Of Water-Chilling and Heat Pump Water-Heating Packages Using the Vapor Compression Cycle
- AHRI 575 (2008) Method of Measuring Machinery Sound Within an Equipment Space
- ANSI/AHRI 460 (2005) Performance Rating of Remote Mechanical-Draft Air-Cooled Refrigerant Condensers
- ANSI/AHRI 495 (2005) Performance Rating of Refrigerant Liquid Receivers

AMERICAN BEARING MANUFACTURERS ASSOCIATION (ABMA)

- ABMA 11 (2014) Load Ratings and Fatigue Life for Roller Bearings
- ABMA 9 (2015) Load Ratings and Fatigue Life for Ball Bearings

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

- ANSI/ASHRAE 15 & 34 (2013; Addenda A 2014; ERTA 1 2014; ERTA 2 2015; INT 1 2015; ERTA 3 2015) ANSI/ASHRAE Standard 15-Safety Standard for Refrigeration Systems and ANSI/ASHRAE Standard 34-Designation and Safety Classification of Refrigerants
- ASHRAE 64 (2011) Methods of Testing Remote Mechanical-Draft Evaporative Refrigerant Condensers

ASHRAE 90.1 - IP	(2010) Energy Standard for Buildings Except Low-Rise Residential Buildings
AMERICAN WELDING SOCIETY (AWS)	
AWS Z49.1	(2012) Safety in Welding and Cutting and Allied Processes
ASME INTERNATIONAL (ASME)	
ASME BPVC SEC VIII D1	(2010) BPVC Section VIII-Rules for Construction of Pressure Vessels Division 1
ASTM INTERNATIONAL (ASTM)	
ASTM B117	(2011) Standard Practice for Operating Salt Spray (Fog) Apparatus
ASTM D520	(2000; R 2011) Zinc Dust Pigment
ASTM E84	(2015b) Standard Test Method for Surface Burning Characteristics of Building Materials
NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)	
NEMA MG 1	(2014) Motors and Generators
NEMA MG 11	(1977; R 2012) 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 Submittals with an "S" are for inclusion in the Sustainability Notebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following 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 including full-load and IPLV efficiencies (DOE PL-109-58), 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. Refrigerant - Provide MSDS sheets for all refrigerants
- d. 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.

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 multi-year warranty for compressor(s) in air-cooled water chillers as specified.

Factory Tests

Schedules which identify the date, time, and location for each test. Schedules shall be submitted for both the Chiller Performance Test and the Chiller Sound Test.

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

Factory Tests

Two copies of the report shall be provided in bound 8 1/2 by 11 inch booklets. Reports shall certify the compliance with performance requirements and follow the format of the required testing standard for both the Chiller Performance Tests and the Chiller Sound Tests. Test report shall include certified calibration report of all test instrumentation. Calibration report shall include certification that all test instrumentation has been calibrated within 6 months prior to the test date, identification of all instrumentation, and certification that all instrumentation complies with requirements of the test standard. Test report shall be submitted 1 week after completion of the factory test.

System Performance Tests

Two copies of the report shall be provided in bound 8 1/2 by 11

inch booklets.

SD-07 Certificates

Refrigeration System; G

Where the system, components, or equipment are specified to comply with requirements of AGA, NFPA, AHRI, 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 AHRI rating conditions, computer printouts, catalog, or other application data certified by AHRI or a nationally recognized laboratory as described above shall be included. If AHRI 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; G

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals; G

Two 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. Two 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.

SD-11 Closeout Submittals

Energy Efficient Equipment for Chillers;

Indoor Air Quality During Construction;

Ozone Depleting Substances;

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, pump, and coils.

1.7 MANUFACTURER'S MULTI-YEAR COMPRESSOR WARRANTY

The Contractor shall provide a 5 year parts only (excludes 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 Indexed Notebook

The Contractor shall furnish to the Contracting Officer a bound and indexed notebook containing a complete listing of all water chillers covered by a manufacturer's multi-year warranty. The chiller list shall state the duration of the warranty thereof, start date of the warranty, ending date of the warranty, location of the warranted equipment, and the point of contact for fulfillment of the warranty. This information shall be provided for each chiller and the recorded chiller serial numbers shall identify each chiller. Point of contact shall include the name of the service representative along with the day, night, weekend, and holiday phone numbers for a service call. The completed bound and indexed notebook shall be delivered to the Contracting Office prior to final acceptance of

the facility. The Contractor shall furnish with each manufacturer's multi-year warranty the name, address, and telephone number (day, night, weekend, and holiday) of the service representative nearest to the location where the equipment is installed. Upon a request for service under the multi-year warranty, the service representative shall honor the warranty during the warranty period, and shall provide the services prescribed by the terms of the warranty.

1.7.2 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 PRODUCT SUSTAINABILITY CRITERIA

For products in this section, where applicable and to extent allowed by performance criteria, provide and document the following:

2.1.1 Energy Efficient Equipment for Chillers

Provide chillers meeting the efficiency requirements as stated within this section and provide documentation in conformance with Section 01 33 29 SUSTAINABILITY REPORTING paragraph ENERGY EFFICIENT EQUIPMENT.

2.1.2 Ozone Depleting Substances

Chillers must not use CFC-based refrigerants, and must have an Ozone Depletion Potential (ODP) no greater than 0.0, with exception to R-123, in conformance with this section. Provide documentation in conformance with Section 01 33 29 SUSTAINABILITY REPORTING paragraph OZONE DEPLETING SUBSTANCES.

2.2 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.

2.3 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.

]2.4 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 1.
- 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. 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.
- e. Provide inverter duty premium efficiency motors for use with variable

frequency drives.

- f. Where two-speed or variable-speed motors are indicated, solid-state variable-speed controllers may be provided to accomplish the same function. Use solid-state variable-speed controllers for motors rated 10 hp or less and variable frequency drives for larger motors. Provide variable frequency drives for motors as specified in Section 26 29 23 VARIABLE FREQUENCY DRIVE SYSTEMS UNDER 600 VOLTS

]2.5 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 standard water boxes with flanged connections.

2.5.1 Scroll, Reciprocating, or Rotary Screw Type

Chiller shall be rated in accordance with AHRI 550/590 I-P. 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 and oil
- b. Structural base
- c. Chiller refrigerant circuit
- d. Controls package
- e. Scroll, reciprocating, or rotary screw compressor
- f. Compressor driver,
- g. Compressor driver connection
- h. Water cooler (evaporator)
- i. Air-cooled condenser coil

]2.5.2 Centrifugal or Rotary Screw Type

Chiller shall be constructed and rated in accordance with AHRI 550/590 I-P. 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 and oil
- b. Structural base

- c. Chiller refrigerant circuit
- d. Controls package
- e. Centrifugal or rotary screw compressor
- f. Compressor driver,
- g. Compressor driver connection
- h. Water cooler (evaporator)
- i. Air-cooled condenser coil

2.6 SPLIT-SYSTEM WATER CHILLER, VAPOR COMPRESSION TYPE

Total chiller system shall be constructed and rated in accordance with AHRI 550/590 I-P. Individual chiller components shall be constructed and rated in accordance with the applicable AHRI standards. Chiller system shall be conform to ANSI/ASHRAE 15 & 34. The chiller shall be ASHRAE 90.1 - IP compliant and meet 10 CFR Part 433, 434 and 435 efficiency performance standards for federal construction. The manufacturer shall provide certification of compliance. Chiller shall be assembled, leak-tested, charged (refrigerant and oil), and adjusted at the job site in strict accordance with manufacturer's recommendations. Unit components delivered separately shall be sealed and charged with a nitrogen holding charge. Unit assembly shall be completed in strict accordance with manufacturer's recommendations. Chiller shall operate within capacity range and speed recommended by the manufacturer. Parts weighing 50 pounds or more which must be removed for inspection, cleaning, or repair, shall have lifting eyes or lugs. Chiller shall include all customary auxiliaries deemed necessary by the manufacturer for safe, controlled, automatic operation of the equipment. Chiller's condenser and water cooler shall be provided with standard water boxes with flanged connections. Chillers shall operate at partial load conditions without increased vibration over normal vibration at full load, and shall be capable of continuous operation down to minimum capacity. As a minimum, chiller shall include the following components as defined in paragraph CHILLER COMPONENTS.

- a. Refrigerant and oil
- b. Structural base
- c. Chiller refrigerant circuit
- d. Controls package

2.6.1 Compressor-Chiller Unit

As a minimum, the compressor-chiller unit shall include the following components as defined in paragraph CHILLER COMPONENTS.

- a. Scroll, reciprocating, or rotary screw compressor
- b. Compressor driver, electric motor

- c. Compressor driver connection
- d. Water cooler (evaporator)

2.6.2 Condensing Unit

As a minimum, the condensing unit shall include the following components as defined in paragraph CHILLER COMPONENTS.

- a. Scroll, reciprocating, or rotary screw compressor
- b. Compressor driver, electric motor
- c. Compressor driver connection
- d. Air or water cooled condenser

2.6.3 Remote Water Cooler (Evaporator)

2.6.3.1 Shell and Tube Type

Cooler shall be constructed and rated in accordance with AHRI 480. Cooler shall be of the shell-and-coil or shell-and-tube type design. Cooler's refrigerant side shall be designed and factory pressure tested to comply with ANSI/ASHRAE 15 & 34. Cooler's water side shall be designed and factory pressure tested for not less than 150 psi. Cooler shell shall be constructed of seamless or welded steel. 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. Cooler shall be skid-mounted. Refrigerant circuit shall be complete with liquid solenoid valve and expansion device capable of modulating to the minimum step of capacity unloading. For the water side of water cooler, performance shall be based on a water velocity not less than 3 fps and not more than 12 fps and a fouling factor of 0.00025. Evaporator shall be provided with electric freeze protection type.

2.6.3.2 Brazed Plate Type

Cooler shall be constructed and rated in accordance with AHRI 480. Cooler shall be of the brazed plate design. Cooler's refrigerant side shall be designed and factory pressure tested to comply with ANSI/ASHRAE 15 & 34. Cooler's water side shall be designed and factory pressure tested for not less than 150 psi. Cooler shell shall be constructed of stainless steel plates brazed together with copper. Refrigerant circuit shall be complete with liquid solenoid valve and expansion device capable of modulating to the minimum step of capacity unloading. For the water side of water cooler, performance shall be based on a water velocity not less than 3 fps and not more than 12 fps and a fouling factor of 0.00025. Evaporator shall be provided with electric freeze protection type.

2.6.4 Remote Air-Cooled Condenser

Condenser shall be a factory-fabricated and assembled unit, consisting of coils, fans, and condenser fan motors. Condenser shall be constructed and rated in accordance with ANSI/AHRI 460. Unless the condenser coil is completely protected through inherent design, louvered panel coil guards

shall be provided by the manufacturer to prevent physical damage to the coil. Manufacturer shall certify that the condenser and associated equipment are designed for the submitted condensing temperature. For design conditions, if matched combination catalog ratings matching remote condensers to compressors are not available, the Contractor shall furnish a crossplotting of the gross heat rejection of the condenser against the gross heat rejection of the compressor, for the design conditions to show the compatibility of the equipment furnished.

2.6.4.1 Condenser Casing

Condenser casing shall be aluminum not less than 0.040 inch or hot-dip galvanized steel not lighter than 18 gauge. Condensers having horizontal air discharge shall be provided with discharge baffle to direct air upward, constructed of the same material and thickness as the casing.

2.6.4.2 Coil

Condenser coil shall be of the extended-surface fin-and-tube type and shall be constructed of seamless copper 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 coating must be able to adhere to ASTM B117 salt spray for 3000 hours.

2.6.4.3 Fans

Fans shall be centrifugal or propeller type as best suited for the application. Fans shall be direct or V-belt driven. Belt drives shall be completely enclosed within the unit casing or equipped with a guard. When belt drive is provided, an adjustable sheave to furnish not less than 20 percent fan-speed adjustment shall be provided. Sheaves shall be selected to provide the capacity indicated at the approximate midpoint of the adjustment. Fans shall be statically and dynamically balanced.

2.6.4.4 Condenser Sizing

Size condensers for full capacity at 30 degrees F temperature difference between entering outside air and condensing refrigerant. Subcooling shall not be considered in determining compressor and condenser capacities. For design conditions, submit a cross-plot of net refrigeration effect of compressor to establish net refrigeration effect and compatibility of equipment furnished.

2.6.4.5 Low Ambient Control

Provide factory mounted head pressure control for operation during low ambient conditions. Head pressure shall be controlled by fan cycling, fan speed control, or condenser refrigerant flooding. Low ambient control shall permit compressor operation below 40 degrees F.

2.6.4.6 High Ambient Unloading

Provide unloading capability to allow operation in high ambient conditions 30 degrees F above design conditions.

2.6.5 Remote Water-Cooled Condenser

Condenser shall be a factory-fabricated and assembled unit constructed and rated in accordance with AHRI 450. Condenser 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 150 psi. Condensers shall be complete with pressure relief valve or rupture disk, water drain connections, refrigerant charging valve, refrigerant valves, liquid-level indicating devices, and stand or saddle. Low pressure refrigerant condenser shall be provided with a purge valve located at the highest point in the condenser to purge non-condensibles trapped in the condenser. Condenser shell shall be constructed of seamless or welded steel. Tubes shall be seamless copper, plain, integrally finned with smooth bore or integrally finned with enhanced bore. Each tube shall be individually replaceable, except for the coaxial tubes. 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. Condenser performance shall be based on water velocities not less than 3 fps nor more than 12 fps and a fouling factor of 0.0005. Water-cooled condensers may be used for refrigerant storage in lieu of a separate liquid receiver, if the condenser storage capacity is 20 percent in excess of the fully charged system for remote water cooled condensers. As a minimum, the condenser shall include the following components as defined in paragraph CHILLER COMPONENTS.

- a. Liquid-level indicating devices.
- b. Companion flanges, bolts, and gaskets for flanged water connections.

2.6.6 Remote Evaporatively-Cooled Condenser

Condenser shall be rated and tested in accordance with the requirements of ASHRAE 64. Condenser shall include fans, water pump with suction strainer, electric motor and drive equipment, water eliminators if required, condensing coil, liquid receiver if required, water pan or sump, spray nozzles or water-distribution pan, water strainer, water make-up assembly, bleeder with flow valve of the needle valve type sized for the flow required or a fixed orifice, enclosure with suitable access doors, and air-inlet and outlet openings. No water shall carry over into the unit discharge outlet.

2.6.6.1 Condenser Casing

Enclosure shall be constructed of not lighter than 18 gauge hot-dip galvanized steel, reinforced and braced. Access doors or panels suitably sized and located shall be provided for access to water nozzles or distribution pan, coils, and valves for cleaning, repair, or removal of the item. Access doors or panels shall be gasketed with synthetic rubber, or equivalent gasket material, and locked in place with thumb screws or catches. One-half inch mesh hot-dip galvanized steel or copper air-inlet screens shall be provided on each air inlet.

2.6.6.2 Refrigerant Section

Condenser coil shall be constructed of unfinned copper or steel tubes hot-dip galvanized after fabrication. The receiver shall be welded steel and shall be fitted and tested in accordance with ANSI/AHRI 495. A refrigerant charging valve shall be installed in the liquid line between

the receiver cut-off valve and the expansion device. Refrigerant section shall be tested in accordance with ASHRAE 15 for the refrigerant employed in the system.

2.6.6.3 Fans

Fans shall be centrifugal or propeller type as best suited for the application. Fans shall be direct or V-belt driven. Belt drives shall be completely enclosed within the unit casing or equipped with a guard. When belt drive is provided, an adjustable sheave to furnish not less than 20 percent fan-speed adjustment shall be provided. Sheaves shall be selected to provide the capacity indicated at the approximate midpoint of the adjustment. Fans shall be statically and dynamically balanced. Fan motor shall be totally enclosed type or open dripproof and located within an enclosure to be fully protected from the weather.

2.6.6.4 Water Section

Water eliminators shall be constructed of nonferrous metal, of an approved nonmetallic material, or of not lighter than 24 gauge steel, hot-dip galvanized after fabrication. Spray nozzles shall be brass nonclogging type designed to permit easy disassembly, and shall be arranged for easy access. Water pump shall be bronze-fitted centrifugal or turbine type, and may be mounted as an integral part of the evaporative condenser or remotely on a separate mounting pad. Pump suction shall be fully submerged and provided with screened inlet. Water pan or sump shall be constructed of not lighter than 14 gauge steel, hot-dip galvanized after fabrication, or molded acid-resistant glass-fiber-reinforced polyester. Water distribution pan shall be constructed of not lighter than 16 gauge steel, hot-dip galvanized after fabrication. Joints shall be watertight. Water pan or sump shall be provided with drain, overflow, and make-up water connection with stop valve and float valve. A bleed line with a flow valve of the needle type sized for the flow required or fixed orifice shall be provided in the pump discharge line and shall be extended to the nearest drain for continuous discharge.

2.7 CHILLER COMPONENTS

2.7.1 Refrigerant and Oil

Refrigerants shall be one of the fluorocarbon gases. Refrigerants shall have number designations and safety classifications in accordance with ANSI/ASHRAE 15 & 34. Refrigerants classified by the EPA as Class 2 shall not be allowed with the exception of R-123.

2.7.2 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, vibration isolators with published load ratings. Vibration isolators shall have isolation characteristics as recommended by the manufacturer for the unit supplied and the service intended.

2.7.3 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 filter and drier, combination sight glass and moisture indicator, liquid-line solenoid valve for reciprocating, an electronic or thermostatic expansion valve with external equalizer or float valve, charging ports, compressor service valves for field-serviceable compressors, and superheat adjustment.

2.7.4 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, power wiring, and control wiring. Controls package shall provide operating controls, monitoring capabilities, programmable setpoints, safety controls, and EMCS interfaces as defined below.

2.7.4.1 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 40 degrees F.
- g. Fan sequencing for air-cooled condenser

2.7.4.2 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. Magnetic bearing levitation status (if applicable)
- i. Magnetic bearing temperatures (if applicable)
- j. Oil pressure
- k. Condenser water entering and leaving temperatures

2.7.4.3 Programmable Setpoints

The control system shall be capable of being reprogrammed directly at the unit. The programmable setpoints shall include the following as a minimum.

- a. Leaving Chilled Water Temperature
- b. Leaving Condenser Water Temperature
- c. Time Clock/Calendar Date

2.7.4.4 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
- f. Low oil flow protection if applicable
- g. Magnetic bearing controller (MBC), Internal fault (if applicable)
- h. MBC, High bearing temperature (if applicable)
- i. MBC, Communication fault (if applicable)
- j. MBC, Power supply fault (if applicable)
- k. Motor current overload and phase loss protection (if applicable)

2.7.4.5 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
- c. MBC, Vibration (if applicable)
- d. MBC, No levitation (if applicable)

- e. Phase reversal protection

2.7.4.6 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.

2.7.4.7 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
- b. Remote Chilled Water Reset
- c. Remote Condenser Water Reset

2.7.5 Compressor(s)

2.7.5.1 Reciprocating Compressor(s)

Rotating parts shall be statically and dynamically balanced at the factory to minimize vibration. Compressors shall be capable of operating at partial-load conditions without increased vibration over the normal vibration at full load operation and shall be capable of continuous operation down to the lowest step of unloading as specified. Compressors of size 10 horsepower and above shall have an oil lubrication system of the reversible, forced-feed type with oil strainer. Shaft seal in open-type units shall be mechanical type. Piston speed for open-type compressors shall not exceed the manufacturer's recommendation or 1200 fpm, whichever is less. Compressors shall include:

- a. Vertical, V, W, or radial cylinder design
- b. Oil lubrication
- c. Integrally cast block of close-grained iron or cast aluminum block with hardened steel cylinder sleeves
- d. Oil-level bull's eye
- e. Cast cylinder heads
- f. Cast-aluminum or forged-steel connecting rods
- g. Cast iron or forged-steel crankshaft
- h. Main bearings of the sleeve-insert type

- i. Crankcase oil heaters controlled as recommended by the manufacturer
- j. Suction and discharge refrigerant service valves that are flange connected, wrench operated, with cap
- k. A strainer on the suction side of the compressor

2.7.5.2 Scroll Compressor(s)

Compressors shall be of the hermetically sealed design. Compressors shall be mounted on vibration isolators to minimize vibration and noise. Rotating parts shall be statically and dynamically balanced at the factory to minimize vibration. Lubrication system shall be centrifugal pump type equipped with a means for determining oil level and an oil charging valve. Crankcase oil heater shall be provided if standard or if available as an option. If provided, the crankcase oil heater shall be controlled as recommended by the manufacturer.

2.7.5.3 Rotary Screw Compressor(s)

Compressors shall operate stably for indefinite time periods at any stage of capacity reduction without hot-gas bypass. Provision shall be made to insure proper lubrication of bearings and shaft seals on shutdown with or without electric power supply. Rotary screw compressors shall include:

- a. An open or hermetic, positive displacement, oil-injected design directly driven by the compressor driver. Compressor shall allow access to internal compressor components for repairs, inspection, and replacement of parts.
- b. Rotors shall be solid steel, possessing sufficient rigidity for proper operation.
- c. A maximum rotor operating speed no greater than 3600 RPM. Provide cast iron rotor housing.
- d. Casings of cast iron, precision machined for minimal clearance about periphery of rotors with minimal clearance at rotor tops and rotor ends.
- e. A lubrication system of the forced-feed type that provides oil at the proper pressure to all parts requiring lubrication (if applicable).
- f. Bearing housing shall be conservatively loaded and rated for an L(10) life of not less than 200,000 hours. Shaft main bearings of the sleeve type with heavy duty bushings or rolling element type in accordance with [ABMA 9](#) or [ABMA 11](#).
- g. A differential oil pressure or flow cutout to allow the compressor to operate only when the required oil pressure or flow is provided to the bearings (if applicable).
- h. Use a Variable Frequency Drive (VFD) to modulate capacity modulation from 100 percent to 15 percent.
- i. An oil separator and oil return system to remove oil entrained in the refrigerant gas and automatically return the oil to the compressor (if applicable).

- j. Crankcase oil heaters controlled as recommended by the manufacturer (if applicable).

2.7.5.4 Centrifugal Compressor(s)

Centrifugal compressors shall be single or multistage, having dynamically balanced impellers, either direct or gear driven by the compressor driver. Impellers shall be over-speed tested at 1.2 times the impeller-shaft speed. Impeller shaft shall be heat-treated alloy steel with sufficient rigidity for proper operation at any required operating speed. Compressors shall be variable speed and may have either oil-free, frictionless magnetic bearing drives or oil-lubricated bearing drives. Centrifugal compressors shall include:

- a. Shaft main bearings that are either oil lubricated, oil free ceramic or frictionless magnetic levitated. The oil lubricated bearings shall be the rolling element type in accordance with [ABMA 9](#) or [ABMA 11](#), journal type with bronze or babbitt liners, or of the aluminum-alloy one-piece insert type. Oil lubricated or oil free ceramic bearings shall be rated for an L(10) life of not less than 200,000 hours. Frictionless main shaft bearings shall be provided with radial and axial magnetic levitated bearings (combination permanent and electro magnets) to levitate the shaft thereby eliminating metal to metal contact and thus eliminating friction and the need for oil. The active magnetic bearings shall be equipped with an automatic vibration reduction and balancing system. Each bearing position shall be sensed by position sensors and provide real time positioning of the rotor shaft, controlled by on-board digital electronics. In the event of a power failure, the magnetic bearings will remain in operation throughout the compressor coast-down using a reserve power supply. Provide mechanical bearings with an oil lubrication system, designed for emergency touchdowns, as a backup to the magnetic bearings.
- b. Casing of cast iron, aluminum, or steel plate with split sections gasketed and bolted or clamped together.
- c. Lubrication system of the forced-feed type that provides oil at the proper pressure to all parts requiring lubrication.
- d. Provisions to ensure proper lubrication of bearings and shaft seals prior to starting and upon stopping with or without electric power supply (if applicable). On units providing forced-feed lubrication prior to starting, a differential oil pressure cutout interlocked with the compressor starting equipment shall allow the compressor to operate only when the required oil pressure is provided to the bearings (if applicable).
- e. Oil sump heaters controlled as recommended by the manufacturer.
- f. Temperature-or pressure-actuated prerotation vane or suction damper to provide automatic capacity modulation from 100 percent capacity to 10 percent capacity. If operation to 10 percent capacity cannot be achieved without providing hot-gas bypass, then the Contractor shall indicate in the equipment submittal the load percent at which hot gas bypass is required.

2.7.6 Compressor Driver, Electric Motor

Motors, starters, variable speed drives, wiring, etc. shall be in accordance with paragraph ELECTRICAL WORK. Motor starter shall be unit mounted as indicated with starter type, wiring, and accessories coordinated with the chiller manufacturer.

2.7.7 Compressor Driver Connections

Each compressor shall be driven by a V-belt drive or direct connected through a flexible coupling, except that flexible coupling is not required on hermetic units. V-belt drives shall be designed for not less than 150 percent of the driving motor capacity. Flexible couplings shall be of the type that does not require lubrication.

2.7.8 Water Cooler (Evaporator)

Cooler shall be of the shell-and-coil or shell-and-tube type design. 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 0.0005 h(ft²) (degrees F)/Btu.

2.7.9 Air-Cooled Condenser Coil

Condenser coil shall be of the extended-surface fin-and-tube type and shall be constructed of seamless copper 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.

2.7.10 Water-Cooled Condenser Coil

Condenser 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 150psi. Condensers shall be complete with refrigerant relief valve/rupture disc assembly, water drain connections, and refrigerant charging valve. Low pressure refrigerant condenser shall be provided with a purge valve located at the highest point in the condenser to purge non-condensibles trapped in the condenser. Condenser 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, except for the coaxial tubes. Tube baffles shall be properly spaced to provide adequate tube support and cross flow. Performance shall be based on water velocities not less than 3 fps nor more than 12 fps and a fouling factor of 0.0005 h(ft²) (degrees F)/Btu. Water-cooled condensers may be used for refrigerant storage in lieu of a separate liquid receiver, if the condenser storage capacity is 5 percent in excess of the fully charged system for single packaged systems.

2.7.11 Receivers

Receiver shall bear a stamp certifying compliance with ASME BPVC SEC VIII D1 and shall meet the requirements of ANSI/ASHRAE 15 & 34. Inner surfaces shall be thoroughly cleaned by sandblasting or other approved means. Each receiver shall have a storage capacity not less than 20 percent in excess of that required for the fully-charged system. Each receiver shall be equipped with inlet, outlet drop pipe, drain plug, purging valve, relief valves of capacity and setting required by ANSI/ASHRAE 15 & 34, and two bull's eye liquid-level sight glasses. Sight glasses shall be in the same vertical plane, 90 degrees apart, perpendicular to the axis of the receiver, and not over 3 inches horizontally from the drop pipe measured along the axis of the receiver. In lieu of bull's eye sight glass, external gauge glass with metal glass guard and automatic closing stop valves may be provided.

]2.8 FABRICATION

2.8.1 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 3,000 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 D520, Type I.

2.8.2 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 E84. 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 E84.

2.9 FACTORY TESTS

2.9.1 Chiller Performance Test

The Contractor and proposed chiller manufacturer shall be responsible for performing the chiller factory test to validate the specified full load capacity, full load EER, and IPLV in accordance with AHRI 550/590 I-P except as indicated. The Contractor and chiller manufacturer shall provide to the Government a certified chiller factory test report in accordance with AHRI 550/590 I-P to confirm that the chiller performs as specified. Tests shall be conducted in an AHRI certified test facility in conformance with AHRI 550/590 I-P procedures and tolerances, except as indicated. At a minimum, chiller capacity shall be validated to meet the scheduled requirements indicated on the drawings. Tolerance or deviation shall be in strict accordance with AHRI 550/590 I-P. Stable operation at minimum load of 10 percent of total capacity shall be demonstrated during the factory test.

2.9.1.1 Temperature Adjustments

Temperature adjustments shall adhere to AHRI 550/590 I-P to adjust from the design fouling factor to the clean tube condition. Test temperature adjustments shall be verified prior to testing by the manufacturer. There shall be no exceptions to conducting the test with clean tubes with the temperature adjustments per AHRI 550/590 I-P. The manufacturer shall clean the tubes, if necessary, prior to testing to obtain a test fouling factor of 0.0000.

2.9.1.2 Test Instrumentation

The factory test instrumentation shall be per AHRI 550/590 I-P and the calibration shall be traceable to the National Institute of Standards and Technology.

2.9.1.3 Test Report

A certified test report of all data shall be forwarded to the Government for approval prior to project acceptance. Calibration curves and information sheets for all instrumentation shall be provided.

2.9.1.4 Equipment Adjustments

If the equipment fails to perform within allowable tolerances, the manufacturer shall be allowed to make necessary revisions to his equipment and retest as required. The manufacturer shall assume all expenses incurred by the Government to witness the retest.

2.9.2 Chiller Sound Test

Chillers shall be sound tested at the factory prior to shipment to confirm the sound pressure level specified herein. Tests and data shall be conducted and measured in strict accordance with AHRI 575 at the full load system operating conditions. The chiller sound pressure level, in decibels (dB), with a reference pressure of 20 micropascals, shall not exceed 90 dB, A weighted. Ratings shall be in accordance with AHRI 575. No reduction of entering condenser water temperature or raising of leaving chilled water temperature shall be allowed. A minimum of 75 percent of the sound data points shall be taken along the length of the machine, and established as the minimum percentage of total possible points used to

determine sound levels. In the event that the chiller does not meet the dBA sound pressure level, the manufacturer shall, at his expense, provide sufficient attenuation to the machine to meet the specified value. This attenuation shall be applied in such a manner that it does not hinder the operation or routine maintenance procedures of the chiller. The attenuation material, adhesives, coatings, and other accessories shall have surface burning characteristics as determined by [ASTM E84](#).

2.10 SUPPLEMENTAL COMPONENTS/SERVICES

2.10.1 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, CHILLED-HOT, AND CONDENSER WATER PIPING SYSTEMS.

2.10.2 Refrigerant Piping

Refrigerant piping for split-system water chillers shall be provided and installed in accordance with Section [23 23 00](#) REFRIGERANT PIPING.

2.10.3 Temperature Controls

Chiller control packages shall be fully coordinated with and integrated into the temperature control system specified in Section [23 00 00](#) AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM and Section [23 09 00](#) INSTRUMENTATION AND CONTROL FOR HVAC Section [23 09 23.13 20](#) BACnet DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC into the existing air-conditioning system.

PART 3 EXECUTION

3.1 CONSTRUCTION-RELATED SUSTAINABILITY CRITERIA

For construction activities in this section, provide and document the following:

3.1.1 [Indoor Air Quality During Construction](#)

Provide documentation showing that after construction ends, and prior to occupancy, new filters were installed in conformance with Section [01 33 29](#) SUSTAINABILITY REPORTING paragraph INDOOR AIR QUALITY DURING CONSTRUCTION.

3.2 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

3.2.1 Connections to Existing Systems

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.

3.2.2 Refrigeration System

3.2.2.1 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. Concrete for foundations shall be as specified in Section 03 30 00 CAST-IN-PLACE CONCRETE. Equipment shall be properly leveled, aligned, and secured in place in accordance with manufacturer's instructions. This unit currently resides on a pedastal. A new pedastal will be included with this package.

3.2.2.2 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.

3.2.2.3 Oil Charging

Except for factory sealed units, two complete charges of lubricating oil for each compressor crankcase shall be furnished. One charge shall be used during the performance testing period, and upon the satisfactory completion of the tests, the oil shall be drained and replaced with the second charge.

3.2.3 Mechanical Room Ventilation

Mechanical ventilation systems shall be in accordance with Section 23 00 00 AIR SUPPLY, DISTRIBUTION, VENTILATION, AND EXHAUST SYSTEM.

3.2.4 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.

3.2.5 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.

3.3 MANUFACTURER'S FIELD SERVICE

The services of a factory-trained representative shall be provided for 10 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 micrometers.
- (2) Charging the machine with refrigerant.
- (3) Starting the machine.

b. Open Machines:

- (1) Erection, alignment, testing, and dehydrating.
- (2) Charging the machine with refrigerant.
- (3) Starting the machine.

3.4 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.

3.5 FIELD ACCEPTANCE TESTING

3.5.1 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 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 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, BACnet DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC.
- c. Prerequisite testing: 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.

3.5.2 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.

3.6 SYSTEM PERFORMANCE TESTS

3.6.1 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 72 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.

3.6.2 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.

3.7 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 24 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 09 23.13 20

BACnet DIRECT DIGITAL CONTROL SYSTEMS FOR HVAC
11/15

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 (2012) Laboratory Methods of Testing
Dampers for Rating

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

ASHRAE 135 (2012; Addenda AR 2013; Errata 1 2013; INT
1-9 2013; Errata 2 2013; INT 10-12 2014;
Errata 3-4 2014; Addenda AI-AY 2014; INT
13-19 2015; Errata 5 2015) BACnet-A Data
Communication Protocol for Building
Automation and Control Networks

ASHRAE 135.1 (2014; ADD O) Method of Test for
Conformance to BACnet

ARCNET TRADE ASSOCIATION (ATA)

ATA 878.1 (1999) Local Area Network: Token Bus

ASME INTERNATIONAL (ASME)

ASME B16.5 (2013) Pipe Flanges and Flanged Fittings:
NPS 1/2 Through NPS 24 Metric/Inch Standard

ASME B31.1 (2014; INT 1-47) Power Piping

ASME B40.100 (2013) Pressure Gauges and Gauge
Attachments

ASTM INTERNATIONAL (ASTM)

ASTM A126 (2004; R 2014) Standard Specification for
Gray Iron Castings for Valves, Flanges,
and Pipe Fittings

ASTM B117 (2011) Standard Practice for Operating
Salt Spray (Fog) Apparatus

CONSUMER ELECTRONICS ASSOCIATION (CEA)

CEA-709.1-D (2014) Control Network Protocol

Specification

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) Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000v and less)AC Power Circuits

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

- ISO 8802-3 (2000) Information Technology - Telecommunications and Information Exchange Between Systems - Local and Metropolitan Area Networks - Specific Requirements - Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD)Access Method and Physical Layer Specifications

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

- NFPA 70 (2014; AMD 1 2013; Errata 1 2013; AMD 2 2013; Errata 2 2013; AMD 3 2014; Errata 3-4 2014; AMD 4-6 2014) National Electrical Code

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 (2014;Reprint Mar 2015) Surge Protective Devices
- UL 506 (2008; Reprint Oct 2013) Specialty Transformers
- UL 508A (2013; Reprint Jan 2014) Industrial Control Panels
- UL 916 (2007; Reprint Aug 2014) Standard for 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

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 Building Controller (B-BC)

ASHRAE 135 building controller that is the main interface for the building control system.

1.2.5 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".

1.2.6 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.

1.2.7 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.

1.2.8 BACnet Segment

One or more physical segments of BACnet devices on a BACnet network, connected at the physical layer by repeaters.

1.2.9 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".

1.2.10 BAS

Building Automation Systems, including DDC (Direct Digital Controls) used for facility automation and energy management.

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 Middleware

Communication hardware and software connecting two or more different protocols, similar to human language translators. The Middleware translates one protocol into equivalent concepts for the other protocol. In BACnet applications, a middleware has BACnet on one side and non-BACnet 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

CEA-709.1-D. 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 8802-3. 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/Protocol Gateway

A BACnet router is a component that joins together two or more networks

using different LAN technologies and protocols. Examples include joining a BACnet RS485 field bus (serial network) to an IP or Ethernet network..

In the above case the protocol gateway encapsulates BACnet data from the field bus within UDP headers for transport over IP

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 or communications will not cause other network devices to fail. Internal time clocks and onboard scheduling are required to allow for stand-alone control. 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. Provide stand-alone control routines to provide for energy saving sequences such as free cooling. Provide stand-alone control routines that operate without connection to the BACnet/IP and MS/TP networks during a loss of communication.

1.3 SUBCONTRACTOR SPECIAL REQUIREMENTS

Perform all work in this section in accordance with the paragraph 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

- a. Modify existing and merge with existing non-BACnet DDC systems including associated equipment and accessories. All new devices are accessible using a Web browser interface and communicate using ASHRAE 135 BACnet communications without the use of gateways, unless gateways are shown on the design drawings and specifically requested by the Government. Where gateways are allowed, they must support ASHRAE 135, including all object properties and read-write services shown on Government approved interoperability schedules. Manufacturer's products, including design, materials, fabrication, assembly, inspection, and testing shall be in accordance with ASHRAE 135, ASME B31.1, and NFPA 70, except where indicated otherwise.
- b. The existing DDC system is manufactured by Carrier. The server and operator workstation are located on the unit. If installing a system made by the same manufacturer, upgrade or replace the existing server, operator workstation, and laptop computer software with the manufacturer's latest software version for all used applications. Upgrade hardware, memory, and operating systems if required.

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, model, part number, firmware version, serial number, and physical location (e.g. Building 4, room 112 overhead). 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 BACnet Communication Architecture Schematic

Provide a schematic showing the project's entire BACnet communication network, including Internet Protocol (IP), Media Access Control (MAC), BACnet network, Device ID, field bus address, BBMDs, any devices using BACnet FDR, and Firmware version / Operating System, LAN devices including routers and bridges, gateways, controllers, workstations, and field interface devices. If applicable, show connection to existing networks.

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.

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are Submittals with an "S" are for inclusion in the Sustainability Notebook, in conformance with Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 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;
- BACnet 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 Discovery Tool;

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; G

Controls System Operators Manuals, Data Package 4; G

VFD Service Manuals, Data Package 4; G

SD-11 Closeout Submittals

Training Documentation; G

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 B117](#), 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.

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 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 and VFD Service Support. Submit at least 30 days before training.
- i. Deliver the final Controls System Operators Manuals and VFD Service 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 a networked DDC system for stand-alone control in compliance with the latest revision of the **ASHRAE 135** BACnet standard. Include all programming, objects, and services required to meet the sequence of control. Provide BACnet communications between the DDC system and native BACnet devices furnished with HVAC equipment and plant equipment including boilers, chillers, and variable frequency drives. Devices provided shall be certified in the BACnet Testing Laboratories (BTL) Product Listing and in accordance with **ASHRAE 135.1** Method of Test for Conformance to BACnet.

2.1.1 BACnet Building Controller (B-BC)

ASHRAE 135 building controller that is the main interface for the building control system. New equipment finishing shall be factory provided.

2.1.2 Direct Digital Controllers

Direct digital controllers shall be **UL 916** rated.

2.1.2.1 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.

2.1.2.2 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.

2.1.2.3 Stand-Alone Controllers

Provide stand-alone direct digital controllers with internal time clocks. Each piece of equipment shall be controlled by a single controller to provide stand-alone control in the event of any building communication failure. All I/O points specified for a piece of equipment shall be

integral to its controller and serial connected expansion modules. Provide stable and reliable stand-alone control using default values or other method for values normally read over the network.

2.1.2.4 Internal Clock

Provide internal clocks and scheduling for all Direct Digital Controllers. Provide controllers with BTL listed profiles for all BACnet Building Controllers (B-BC) and BACnet Advanced Application Controllers (B-AAC) using BACnet time synchronization services. This includes but is not limited to VAV Controllers, Fan Coil controllers, Heat Pump controllers and any terminal controllers. BACnet Application specific controllers (B-ASC) will only be accepted for dedicated small exhaust system control such as restroom and mechanical room exhaust fans. Automatically synchronize system clocks daily from an operator-designated controller. The system shall automatically adjust for daylight saving time.

2.1.2.5 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.

2.1.2.6 Immunity to Power Fluctuations

Controllers shall operate at 90 percent to 110 percent nominal voltage rating.

2.1.2.7 Transformer

The controller power supply shall be fused or current limiting and rated at 125 percent power consumption.

2.1.2.8 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.

2.1.2.9 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.

2.1.2.10 Digital Controller BACnet Internetwork

Provide a BACnet internetwork with control products, communication media, connectors, repeaters, hubs, and routers. Provide intermediate gateways, only when requested by the Government and shown on the contract drawings, to connect existing non-BACnet devices to the BACnet internetwork. Controller and operator interface communication shall conform to [ASHRAE 135](#), BACnet. Use the building's existing Ethernet backbone for network segments marked "existing" on project drawings. Coordinate connections to existing Ethernet backbones with the BAS Owner and LAN administrator. If a controller becomes non-responsive, the remaining controllers shall continue operating and not be affected by the failed controller.

2.1.2.11 Communications Ports

- a. Direct-Connect Interface Ports: Provide at least one extra communication port at each local BACnet network for direct connecting a notebook computer or BACnet hand-held terminal so all network BACnet objects and properties may be viewed and edited by the operator.
- b. BACnet routers supporting ARCnet shall also be capable of supporting MS/TP.

2.1.2.12 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. Middleware 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. Middleware 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. Middleware shall provide single-pass (only one protocol to BACnet without intermediary protocols) translation from the non-BACnet protocol to BACnet and vice versa.
- d. Middleware 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. Middleware 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.

2.1.2.13 Digital Controller Cabinet

Provide each digital controller in a factory fabricated cabinet enclosure. Cabinet shall be locked and alarmed. The alarm shall include both a local audible alarm and a networked alarm (e.g. switch connected to controller DI). Networked alarm events shall be recorded remotely for a period not less than one year.

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.

2.1.2.14 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.

2.1.3 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. All logic programming and control functions shall be closed loop, command and feedback for fault detection and alarming when status != command.

- 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 (variable types include but are not limited to the following: local, global, real, and integer) 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, 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 BACnet trend services 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. The minimum number of consecutive trend values stored at one time shall be 100 per variable. When trend memory is full, the most recent data shall overwrite the oldest data.

The BACnet system shall allow for Change-Of-Value (COV) subscription based trending at user defined thresholds.

The operator workstation shall upload trends automatically 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 workstation 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 Device Management

System shall be capable of managing devices remotely to include updating/loading firmware, restarting, and network configuration. These capabilities shall be restricted to authorized roles. The system shall support, either natively or with provided add-on software, remote read/write and management of BBMD tables.

2.1.3.14 Power Loss

Upon restoration of power, the DDC system shall perform an orderly restart and restoration of control.

2.2 OUTPUT HARDWARE

2.2.1 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 3 cfm per sq. foot of damper face area at 1.0 inches water gage static pressure.

2.2.2 Control Valves

2.2.2.1 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 A126 Class B or C.

2.2.2.2 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.

2.2.2.3 Two-Way Valves

Two-way modulating valves shall have an equal percentage characteristic.

2.2.2.4 Three-Way Valves

Three-way valves shall have an equal percentage characteristic.

2.2.2.5 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.

2.2.3 Output Signal Conversion

2.2.3.1 Electronic-to-Pneumatic Transducers

Electronic to pneumatic transducers shall convert a 4 to 20 mA or 0 to 10 VDC digital controller output signal to a proportional 0 to 20 psig pressure signal (operator scaleable). Accuracy and linearity shall be 1.0 percent or better.

2.2.4 Output Switches

2.2.4.1 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.

2.3 ELECTRICAL POWER AND DISTRIBUTION

2.3.1 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.

2.3.2 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.

2.3.2.1 Power Line Surge Protection

Provide surge suppressors on the incoming power at each direct digital controller or grouped terminal controllers and shall be installed externally to the device or devices being protected. 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.

2.3.2.2 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.

2.3.2.3 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.

2.3.3 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.

2.3.3.1 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.

2.3.3.2 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.

2.4 INDICATORS

2.4.1 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.

2.4.2 Pressure Gauges for Piping Systems

Provide pipe-mounted pressure gauges at the locations shown. Gauges shall conform to ASME B40.100 and have a 4-inch diameter dial and shutoff cock. Provide gauges in steam piping with a pressure snubber pigtail fitting. Select scale ranges suitable for the intended service, with the normal operating pressure near the scale's midpoint. The gauge's accuracy shall be plus or minus 2 percent of the scale range.

2.5 VARIABLE FREQUENCY (MOTOR) DRIVES

Provide variable frequency drives (VFDs) as indicated. VFDs shall convert 208 or 480 volt (plus or minus 10 percent), three phase, 60 hertz (plus or minus 2Hz), utility grade power to adjustable voltage/frequency, three phase, AC power for stepless motor control from 5 percent to 105 percent of base speed. VFDs shall be UL listed as delivered to the end user. The VFD shall meet the requirements specified in the most current National Electrical Code. Each VFD shall also meet the following:

- a. The VFD shall use sine coded Pulse Width Modulation (PWM) technology. PWM calculations shall be performed by the VFD microprocessor.
- b. The VFD shall be capable of automatic control by a remote 4-20 mA signal, by network command, or manually by the VFD control panel.

2.5.1 VFD Quality Assurance

VFDs shall be the manufacturer's current standard production unit with at least 10 identical units successfully operating in the field.

2.5.2 VFD Service Support

- a. **Warranty:** Provide the VFDs with a minimum 24-month full parts and labor warranty. The warranty shall start when the contract's HVAC system is accepted by the Government. Include warranty documentation, dates, and contact information with the VFD on-site service manuals.
- b. **VFD Service Manuals:** Provide the VFDs with all necessary installation, operation, maintenance, troubleshooting, service, and repair manuals in English including related factory technical bulletins. Provide the documents factory bound, in sturdy 3-ring binders, or hard bound covers. Provide a title sheet on the outside of each binder indicating the project title, project location, installing contractor, contract number, and the VFD manufacturer, address, and telephone number. Each binder shall include a table of contents and tabbed dividers, with all material neatly organized. The documentation provided shall be specifically applicable to this project, shall be annotated to reflect the actual project conditions, and shall provide a complete and concise depiction of the installed work. Provide a storage cabinet on or near the VFD large enough to hold all of the documentation. Have the cabinet's proposed installation site approved in advance by the Contracting Officer. Prominently label the cabinet "VFD OPERATION AND MAINTENANCE MANUALS." Clearly label each manual with the wording "MECHANICAL ROOM COPY - DO NOT REMOVE".
- c. **Technical Support:** Provide the VFDs with manufacturer's technical telephone support in English, readily available during normal working hours, and free of charge for the life of the equipment.
- d. **Initial Start-Up:** Provide the VFDs with factory-trained personnel for the on-site start-up of the HVAC equipment and associated VFD. The personnel shall be competent in the complete start-up, operation, and repair of the particular model VFD installed. The factory start-up representative shall perform the factory's complete recommended start-up procedures and check-out tests on the VFD. Include a copy of the start-up test documentation with the VFD on-site service manuals.
- e. Provide the VFDs with on-site/hands-on training for the user and maintenance personnel. Provide a capable and qualified instructor with minimum two years field experience with the operation and maintenance of similar VFDs. The training shall occur during normal working hours and last not less than 2 hours. Coordinate the training time with the Contracting Officer and the end user. The VFD service manuals shall be used during the training. The contractor shall ensure the manuals are on-site before the start of training. The training shall cover all operational aspects of the VFD.

2.5.3 VFD Features

VFDs shall have the following features:

- a. A local operator control keypad capable of:
 - (1) Remote/Local operator selection with password access.
 - (2) Run/Stop and manual speed commands.
 - (3) All programming functions.

- (4) Scrolling through all display functions.
- b. Digital display capable of indicating:
 - (1) VFD status.
 - (2) Frequency.
 - (3) Motor RPM.
 - (4) Phase current.
 - (5) Fault diagnostics in descriptive text.
 - (6) All programmed parameters.
- c. Standard PI loop controller with input terminal for controlled variable and parameter settings.
- d. User interface terminals for remote control of VFD speed, speed feedback, and an isolated form C SPDT relay, which energizes on a drive fault condition.
- e. An isolated form C SPDT auxiliary relay which energizes on a run command.
- f. A metal NEMA 1 enclosure for indoors, NEMA 4 with heater for outdoors.
- g. An adjustable carrier frequency with 16 KHz minimum upper limit.
- h. A built in or external line reactor with 3 percent minimum impedance to protect the VFDs DC buss capacitors and rectifier section diodes.

2.5.4 Programmable Parameters

VFDs shall include the following operator programmable parameters:

- a. Upper and lower limit frequency.
- b. Acceleration and Deceleration rate.
- c. Variable torque volts per Hertz curve.
- d. Starting voltage level.
- e. Starting frequency level.
- f. Display speed scaling.
- g. Enable/disable auto-restart feature.
- h. Enable/disable soft stall feature.
- i. Motor overload level.
- j. Motor stall level.
- k. Jump frequency and hysteresis band.

1. PWM carrier frequency.

2.5.5 Protective Features

VFDs shall have the following protective features:

- a. An electronic adjustable inverse time current limit with consideration for additional heating of the motor at frequencies below 45Hz, for the protection of the motor.
- b. An electronic adjustable soft stall feature, allowing the VFD to lower the frequency to a point where the motor will not exceed the full-load amperage when an overload condition exists at the requested frequency. The VFD will automatically return to the requested frequency when load conditions permit.
- c. A separate electronic stall at 110 percent VFD rated current, and a separate hardware trip at 190 percent current.
- d. Ground fault protection that protects the output cables and motor from grounds during both starting and continuous running conditions.
- e. The ability to restart after the following faults:
 - (1) Overcurrent (drive or motor).
 - (2) Power outage.
 - (3) Phase loss.
 - (4) Over voltage/Under voltage.
- f. The ability shut down if inadvertently started into a rotating load without damaging the VFD or the motor.
- g. The ability to keep a log of a minimum of four previous fault conditions, indicating the fault type and time of occurrence in descriptive text.
- h. The ability to sustain 110 percent rated current for 60 seconds
- i. The ability to shutdown safely or protect against and record the following fault conditions:
 - (1) Over current (and an indication if the over current was during acceleration, deceleration, or running).
 - (2) Over current internal to the drive.
 - (3) Motor overload at start-up.
 - (4) Over voltage from utility power.
 - (5) Motor running overload.
 - (6) Over voltage during deceleration.
 - (7) VFD over heat.

(8) Load end ground fault.

(9) Abnormal parameters or data in VFD EEPROM.

2.5.6 Minimum Operating Conditions

VFDs shall be designed and constructed to operate within the following service conditions:

- a. Ambient Temperature Range, 0 to 120 degrees F.
- b. Non-condensing relative humidity to 90 percent.

2.5.7 Additional Features

Provide VFDs with the following additional features:

- a. BACnet communication interface port
- b. RFI/EMI filters
- c. Manual bypass circuit and switch integral to the drive to allow drive bypass and operation at 100 percent speed. Motor overload and short circuit protective features shall remain in use during the bypass mode.
- d. One spare VFD of each model provided, fully programmed and ready for back-up operation when connected.

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.

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 01 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 using camelCase. Abbreviations, while necessary, shall be standard throughout the control environment and unique (i.e. Don't use SA for supply air temperature everywhere there is air blowing. Use it for FAN supply air temperature, and use a different abbreviation for VAV supply air temperature). 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 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

<u>Priority Level</u>	<u>Application</u>
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 and Protocol Gateways

Provide the quantity of BACnet routers 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 BBMD tables to enable unicast forwarding of broadcast messaging across Layer-3 IP subnets.

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 or 54 inches above the floor to meet ADA requirements.

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.

3.1.10.4 Outside Air Temperature Sensors

Provide outside air temperature sensors in weatherproof enclosures on the north side of the building, away from exhaust hoods and other areas that may affect the reading. Provide a shield to shade the sensor from direct sunlight.

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.

3.1.16 Network and Telephone Communication Lines

When telephone lines or network connections by the Government are required, provide the Contracting Officer at least 60 days advance notice of need.

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 CONTROLS SYSTEM OPERATORS MANUALS

Provide two electronic and printed copies of a Controls System Operators Manual. The manual shall be specific to the project, written to actual project conditions, and provide a complete and concise depiction of the installed work. Provide information in detail to clearly explain all operation requirements for the control system.

Provide with each manual: CDs of the project's control system drawings, control programs, data bases, graphics, and all items listed below. Include gateway back-up data and configuration tools where applicable.

Provide CDs in jewel case with printed and dated project-specific labels on both the CD and the case. For text and drawings, use Adobe Acrobat or MS Office file types. When approved by the Government, AutoCAD and Visio files are allowed. Give files descriptive English names and organize in folders.

Provide printed manuals in sturdy 3-ring binders with a title sheet on the outside of each binder indicating the project title, project location, contract number, and the controls contractor name, address, and telephone number. Each binder shall include a table of contents and tabbed dividers, with all material neatly organized. Manuals shall include the following:

- a. A copy of the as-built control system (shop) drawings set, with all items specified under the paragraph SUBMITTALS. Indicate all field changes and modifications.
- b. A copy of the project's mechanical design drawings, including any official modifications and revisions.
- c. A copy of the project's approved Product Data submittals provided under the paragraph SUBMITTALS.
- d. A copy of the project's approved Performance Verification Testing Plan and Report.
- e. A copy of the project's approved final TAB Report.
- f. Printouts of all control system programs, including controller setup pages if used. Include plain-English narratives of application programs, flowcharts, and source code.
- g. Printouts of all physical input and output object properties, including tuning values, alarm limits, calibration factors, and set points.
- h. A table entitled "AC Power Table" listing the electrical power source for each controller. Include the building electrical panel number, panel location, and circuit breaker number.
- i. The DDC manufacturer's hardware and software manuals in both print and CD format with printed project-specific labels. Include installation and technical manuals for all controller hardware, operator manuals for all controllers, programming manuals for all controllers, operator manuals for all workstation software, installation and technical manuals for the workstation and notebook, and programming manuals for the workstation and notebook software.
- j. A list of qualified control system service organizations for the work provided under this contract. Include their addresses and telephone numbers.
- k. A written statement entitled "Technical Support" stating the control system manufacturer or authorized representative will provide toll-free telephone technical support at no additional cost to the Government for a minimum of two years from project acceptance, will be furnished by experienced service technicians, and will be available during normal weekday working hours. Include the toll-free technical support telephone number.
- l. A written statement entitled "Software Upgrades" stating software and

firmware patches and updates will be provided upon request at no additional cost to the Government for a minimum of two years from contract acceptance. Include a table of all DDC system software and firmware provided under this contract, listing the original release dates, version numbers, part numbers, and serial numbers.

3.4 PERFORMANCE VERIFICATION TESTING (PVT)

3.4.1 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.

3.4.2 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 purpose of each test, intended test procedure, test setup and test conditions, 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.

3.4.3 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.

3.4.4 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 the paragraph 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.
 - v. Verify the as-built (shop) control drawings are completed.
- 3.4.5 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.

3.4.6 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.

3.4.7 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.

3.4.8 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 (types of transition include but are not limited to the following: TO-OFF NORMAL and TO-NORMAL).
- 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

3.4.9 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.

3.4.10 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.

3.4.11 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.

3.5 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 and location with the Contracting Officer and BAS Owner after receiving approval of the training course documentation. Training shall take place at the job site and 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.

3.5.1 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.

3.5.2 Phase I Training - Fundamentals

The Phase I training session shall last two consecutive days and be

conducted in a classroom environment with complete audio-visual aids provided by the contractor. Provide each trainee a printed 8.5 by 11 inch hard-copy of all visual aids used. Upon completion of the Phase I Training, each trainee should fully understand the project's DDC system fundamentals. The training session shall include the following:

- a. BACnet fundamentals (objects, services, addressing) and how/where they are used on this project
- b. This project's list of control system components
- c. This project's list of points and objects
- d. This project's device and network communication architecture
- e. This project's sequences of control, and:
- f. Alarm capabilities
- g. Trending capabilities
- h. Troubleshooting communication errors
- i. Troubleshooting hardware errors

3.5.3 Phase II Training - Operation

Provide Phase II Training shortly after completing Phase I Training. The Phase II training session shall last two consecutive days 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. Upon completion of the Phase II Training, each trainee should fully understand the project's DDC system operation. The training session shall include the following:

- a. A walk-through tour of the mechanical system and the installed DDC components (components include but are not limited to the following: controllers, valves, dampers, surge protection, switches, thermostats, and sensors)
- 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

-- End of Section --