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USACE / NAVFAC / AFCEC / NASA **UFGS-23 82 23.00 40 (May 2017)**

Preparing Activity: NASA **Superseding**
UFGS-23 82 23.00 40 (May 2014)
UFGS-23 82 23 (February 2011)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated January 2021
****

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DIVISION 23 - HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)

SECTION 23 82 23.00 40

UNIT VENTILATORS

05/17

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****

SECTION 23 82 23.00 40

UNIT VENTILATORS
05/17

****

NOTE: This guide specification covers the requirements for unit heaters and ventilators.

Adhere to UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable item(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR).

****

PART 1 GENERAL

****

NOTE: If Section 23 30 00 HVAC AIR DISTRIBUTION is not included in the project specification, insert applicable requirements therefrom and delete the following paragraph. If Section 23 05 48.00 40 VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT is not included in the project specification, insert applicable requirements therefrom and delete the second paragraph.

****

[Section 23 30 00 HVAC AIR DISTRIBUTION applies to work specified in this section.

]1.1 REFERENCES

****

NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a Reference Identifier (RID) outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text are automatically deleted from this section of the project specification when you choose to reconcile references in the publish print process.
****

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.

ACOUSTICAL SOCIETY OF AMERICA (ASA)

ASA S12.11/Part 1	(2013) Acoustics-Measurement of Noise and Vibration of Small Air-Moving Devices, Part 1: Airborne Noise Emission
ASA S12.11/Part 2	(2013) Acoustics-Measurement of Noise and Vibration of Small Air-Moving Devices, Part 2: Structure-borne Vibration
ASA S12.53/1	(2011; R 2016) Acoustics- Determination of Sound Power Levels of Noise Sources - Engineering Methods for Small, Movable Sources in Reverberant Fields - Part1: Comparison Method for Hard-Walled Test Rooms
ASA S12.53/2	(1999; R 2015) Acoustics- Determination of Sound Power Levels of Noise Sources Using Sound Pressure - Engineering Methods for Small, Movable Sources in Reverberant Fields - Part2: Methods for Special Reverberation Test Rooms

AIR-CONDITIONING, HEATING AND REFRIGERATION INSTITUTE (AHRI)

AHRI 840 I-P	(2015) Performance Rating of Unit Ventilators

ALUMINUM ASSOCIATION (AA)

AA DAF45	(2003; Reaffirmed 2009) Designation System for Aluminum Finishes

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z83.8/CSA 2.6	(2016; Errata 2017) Gas Unit Heaters, Gas Packaged Heaters, Gas Utility Heaters, and Gas-Fired Duct Furnaces

ASTM INTERNATIONAL (ASTM)

ASTM A568/A568M	(2019a) Standard Specification for Steel, Sheet, Carbon, Structural, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for
ASTM A653/A653M	(2020) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

INTERNATIONAL CODE COUNCIL (ICC)

ICC IFGC	(2018) International Fuel Gas Code
ICC IMC	(2018) International Mechanical Code

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1	(2018) Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 54	(2021) National Fuel Gas Code
NFPA 70	(2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4) National Electrical Code
NFPA 90A	(2021) Standard for the Installation of Air Conditioning and Ventilating Systems

U.S. DEPARTMENT OF DEFENSE (DOD)

DOD-G-24508	(1977; Rev A; Am 4 1998) Grease, High Performance, Multipurpose (Metric)

1.2 SUBMITTALS

****

NOTE: Review Submittal Description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list, and corresponding submittal items in the text, to reflect only the submittals required for the project. The Guide Specification technical editors have classified those items that require Government approval, due to their complexity or criticality, with a "G." Generally, other submittal items can be reviewed by the Contractor's Quality Control System. Only add a “G” to an item, if the submittal is sufficiently important or complex in context of the project.

For Army projects, fill in the empty brackets following the "G" classification, with a code of up to three characters to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

The "S" classification indicates submittals required as proof of compliance for sustainability Guiding Principles Validation or Third Party Certification and as described in Section 01 33 00 SUBMITTAL PROCEDURES.

Choose the first bracketed item for Navy, Air Force and NASA projects, or choose the second bracketed item for Army projects.

****

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Material, Equipment, and Fixture List; G[, [____]]

List of Product Installations; G[, [____]]

SD-02 Shop Drawings

Electrical Diagrams; G[, [____]]

Pneumatic Diagrams; G[, [____]]

SD-03 Product Data

Gas Unit Heaters; G[, [____]]

Propeller Unit Heaters; G[, [____]]

Cabinet Unit Heaters; G[, [____]]

Unit Ventilators; G[, [____]]

Casing; G[, [____]]

Heat Exchangers; G[, [____]]

Burners; G[, [____]]

Fans; G[, [____]]

Motors; G[, [____]]

Controls; G[, [____]]

Vertical Discharge Units; G[, [____]]

Horizontal Discharge Units; G[, [____]]

Heating Element; G[, [____]]

Propellers; G[, [____]]

Filters; G[, [____]]

Enclosures; G[, [____]]

Wall Sleeve; G[, [____]]

Fresh-Air Intakes; G[, [____]]

Insulation; G[, [____]]

Vibration Isolation; G[, [____]]

SD-04 Samples

Color Chart; G[, [____]]

SD-05 Design Data

Connection Diagrams; G[, [____]]

Control Diagrams; G[, [____]]

SD-07 Certificates

Records of Existing Conditions; G[, [____]]

Spare Parts List

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals

SD-11 Closeout Submittals

Record Drawings; G[, [____]]

Warranty

1.3 QUALITY CONTROL

Provide a list of product installations that identifies at least five units, similar to those proposed for work, that have been in successful service for a minimum of 5 years. Provide a list that includes the name of the purchaser, address of installation, name of service organization, and date of installation.

1.4 PROJECT/SITE CONDITIONS

Submit records of existing conditions including the results of a survey of work area conditions and features of existing structures and facilities within and adjacent to the jobsite. Commencement of work constitutes acceptance of existing conditions.

PART 2 PRODUCTS

****
NOTE: When possible use sealed bearings. Over lubrication and lubrication contamination are major causes of bearing failures. Using sealed bearings helps to eliminate this failure mode.
****

****
NOTE: Provide fan and motor balancing that conforms to ISO Std. 1940/1 - (2003) Balance Quality Requirements for Rotors in a Constant(Rigid) State. Provide motor vibration levels that conform to NEMA Specification MG-1, Motors and Generators, Part 7, unless otherwise noted.
****

2.1 SYSTEM DESIGN

Ensure that units are tested and certified in accordance with AHRI 840 I-P.

Provide control diagrams that show physical and functional relationships of equipment. Provide electrical diagrams that show size, type, and capacity of the systems. Submit pneumatic diagrams for air and gas systems.

Submit connection diagrams indicating the general physical layout of all controls, and internal tubing and wiring details on the drawings.

Submit equipment and performance data for [Gas Unit Heaters][Propeller Unit Heaters][Cabinet Unit Heaters][Unit Ventilators], consisting of use life, system functional flows, safety features, and mechanical automated details. Submit curves indicating the responses and performance characteristics of the tested and certified equipment.

Submit product data for vibration isolation components.

2.2 MANUFACTURED UNITS

Provide a material, equipment, and fixture list that includes the manufacturer's style or catalog numbers, specification and drawing reference numbers, and warranty information.

Submit the manufacturer's standard color chart for [Gas Unit Heaters][Propeller Unit Heaters][Cabinet Unit Heaters][Unit Ventilators], showing the manufacturer's standard color selections and finishes.

Submit a spare parts list and information meeting referenced standards within this section.

2.2.1 Gas Unit Heaters (GUH)

Provide drawings or schedules that include capacity, gas data and mounting height.

2.2.1.1 Type

Provide suspended unit heaters, arranged for discharge of air as indicated. Provide a unit that complies with ANSI Z83.8/CSA 2.6 and NEMA MG 1.

2.2.1.2 Casing

Provide a casing that is manufactured of at least 1.0 millimeter 20-gage steel. Provide a casing with a phosphate pretreatment, primer, and baked enamel finish inside and outside. Provide horizontal [adjustable] [non-adjustable] louvers, completely recessed inside the casing frame.

[Provide [four-way] [_____] deflection vanes.

]2.2.1.3 Heat Exchangers

Provide welded, heavy aluminized-steel heat exchangers. Provide exchangers that are formed in a clamshell design that completely surrounds the burner. Provide individual combustion chambers for each burner.

2.2.1.4 Burners

Provide die-formed, aluminum-painted, heavy mild steel burners with long slot ports for an even supply of gas. Provide a unitized-construction burner assembly with an integral crossover for positive burner ignition. Provide a draft diverter as an integral part of each heat exchanger section to allow backdrafts to bypass the burner assembly without affecting normal operation.

2.2.1.5 Fans

Provide propeller fans, designed and manufactured for unit heater application. Provide fans with at least three aluminum blades.

2.2.1.6 Motors

Provide motors that are totally enclosed, with built-in overload protection. Mount motors to the back panel by a fan guard motor mount constructed of spring steel wire.

2.2.1.7 Controls

Provide controls that include a high-limit switch, fan controls [including a fan timer, a lockout timer [_____]], a 24-volt automatic gas valve with a 100 percent safety pilot shutoff, a pressure regulator with a leak-limiting device, and manual main and pilot valves. Provide an integral junction box for all power and control connections.

[Provide a low-voltage transformer.] [Provide a spark ignition controller.]

2.2.2 Propeller Unit Heaters (PUH) Hot Water and Steam

Provide drawings or schedule that include data on the capacity, heating media data and mounting height.

****
NOTE: This specification is applicable to both hot water and steam heating medium.
****

[2.2.2.1 Type

Provide suspended unit heaters, arranged for discharge of air as indicated.

]2.2.2.2 Vertical Discharge Units

[Provide vertical discharge units that operate at speeds up to 1,200 revolutions per minute (rpm), with the exception of units with 14.6 kilowatt an output of 50,000 British thermal units per hour or less which may operate at speeds up to 1,800 rpm. Cover the discharge opening with a fan guard.
]

****
NOTE: When one of the following paragraphs is selected, the mounting height is affected.
****

[Provide louver cone diffusers.] [Provide adjustable vane diffuser.]

[2.2.2.3 Horizontal Discharge Units

Provide a maximum volume for horizontal discharge unitsin cubic meter per second (cms) feet per minute (cfm)and face velocity in meter second (m/s) feet per minute (fpm) as follows:

Volume (cms)	Velocity (cms)
Up to 0.47	4.1
0.48 to 1.42	4.6
1.43 and over	5.1

Volume (cfm)	Velocity (fpm)
Up to 1,000	800
1,001 to 3,000	900
3,001 and over	1,000

Provide adjustable double-deflection louvers.

]2.2.2.4 Heating Element

Provide heating elements of the manufacturer's standard construction,

rated for [standard] [low output temperature] service of not less than 149 degrees C at 517 kilopascal 300 degrees F at 75 pounds per square inch (psi).

2.2.2.5 Casings

Provide casings with smoothly contoured propeller orifice rings constructed of cold-rolled carbon steel that is 1.0 millimeter 20-gage or thicker. Provide casing surface finish that includes a phosphate pretreatment, prime coat, and baked enamel finish.

2.2.2.6 Propellers and Motors

Provide propellers that have at least four aluminum blades and that are dynamically balanced.

[Provide horizontal discharge units with a fan inlet safety guard.

][Mount motors on elastomer vibration isolators.

][2.2.2.7 Sound Rating

****
NOTE: Select the title and the following paragraph only if supplemented on the drawings or herein by a sound rating in decibels.
****

Test and sound-rate unit heater in accordance with ASA S12.11/Part 1, ASA S12.11/Part 2, ASA S12.53/1, and ASA S12.53/2.

][2.2.2.8 Control

Control unit heaters [by line-voltage thermostats] [_____].

]2.2.3 Cabinet Unit Heaters (CUH)

Provide drawings or schedules that include capacity, power rating, heating media, filter, pressure drop, size, and other pertinent data.

****
NOTE: This specification is applicable to both hot-water and steam heating medium.
****

2.2.3.1 Type

Provide quiet-operating cabinet unit heaters, complete with heating elements, fans and drives, filters, baffles and division walls, control provisions, and enclosures with access panels.

Provide cabinets that do not exceed the dimensions given in the drawing.

Provide unit pressure components rated for service to at least 1050 kilopascal 150 psi at the system working temperature.

2.2.3.2 Heating Element

Provide a [manufacturer's standard aluminum finned] [serpentine copper

tube] heating element that can be drained and vented.

Provide a heating element with a constant and permanent cataloged capacity.

Construction uses seamless deoxidized copper tube material.

Provide fins that are mechanically connected to the tubes. Regard loose fins as causing a reduction in capacity at operating temperatures, requiring replacement of all such material at no additional cost to the Government. Elements with bent or damaged fins are not acceptable.

Make provisions for expansion and supports so that the element movement is strainfree and noiseless.

[Provide a coil with a face area of the coil no smaller than the dimensions specified on the drawings.

]2.2.3.3 Fan and Drive Assembly

[Provide a centrifugal, forward-curved, double-width, double-inlet fan, that has been statically and dynamically balanced at the factory.

][Provide direct fan drives.

][Provide direct fan drives, except where belt drives are indicated. Provide belt-drive motors that are fitted with adjustable rails and asheave that permits a 20-percent adjustment to the fan speed. Elastomer mount independent fan shafts in self-aligning [antifriction] [sleeve-type] bearings, with lifetime lubrication.

][Provide [two] [three] [four]-speed drives. Provide switch positions that include an off position.

] [Provide rotating elements that are statically and dynamically balanced. Vibration-isolate the fan and drive assembly.] Refer to Section 23 05 48.00 40 VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT for vibration-isolation considerations.

Ensure that the direct-drive motor's rotational speed does not exceed 1,200 rpm.

2.2.3.4 Filters

Provide replaceable, throwaway filters that are at least 25 millimeter 1 inch thick.

Install filters in a bypass-proof frame to ensure that the moving air is filtered before entering the heating element. Ensure that filters can be removed without tools.

2.2.3.5 Enclosures

****
NOTE: Show architectural and mechanical details not covered herein on the drawings or supplement the following.
****

[Provide an enclosure configuration that does not deviate from drawing

specifications.

][Provide an enclosure made of cold-rolled carbon steel, 1.6 millimeter 16-gage, or heavier, that is conforming to ASTM A568/A568M. Provide construction that has smooth, blemish-free surfaces, without sharp edges, and with flush joints. Do not provide construction with wrinkled-metal or notched-corners. Provide an enclosure that has space for all riser pipes and controls. Provide access doors that have tamperproof latches, hinge doors, and panels to protect surface finishes and personnel.

][Provide a surface finish for the enclosure that includes the manufacturer's standard phosphate pretreatment, prime coat, and baked enamel finish. Provide the color selected by the Contracting Officer.

][2.2.3.6 Insulation

Insulate backs of recessed units with at least 13 millimeter 1/2 inch of 48 kilogram per cubic meter 3 pound per cubic foot fibrous-glass insulation conforming to NFPA 90A.

]2.2.3.7 Control Cycle

[Sequence the operation [in accordance with the manufacturer's recommendations] [_____].

][Provide control components that conform to the requirements in Section 23 09 33.00 40 ELECTRIC AND ELECTRONIC CONTROL SYSTEM FOR HVAC.

]2.2.4 Unit Ventilators (UV)

Provide drawings or schedule that include capacity, power rating, heating duty and method, and other pertinent data.

****

NOTE: This specification is applicable to both hot-water and steam heating equipment.

Where large numbers of units are required, a standard size cabinet is allowed.

Where only one or two units are involved, the polarized plug-in module requirement does not apply.

****

2.2.4.1 Type

[Provide quiet-operating modular unit ventilators, complete with heating elements, fans and drives, filters, baffles and division walls, dampers, control provisions, and enclosures with access panels.

][Provide unit pressure components that are rated for service to at least 1050 kilopascal 150 psi at system working temperature.

][Ensure that intercomponent wiring conforms to NFPA 70. Ensure that the components of the unit assembly are UL-listed and approved.

][Provide heating, fan, and control modules that have polarized, color-coded, plug-in connections.

]2.2.4.2 Heating Element

[Provide a [manufacturer's standard aluminum finned,] [serpentine copper-tube,] heating element that can be drained and vented.

][Provide a heating element with constant and permanent cataloged capacity.

][Provide a heating element made of seamless deoxidized copper tube.

][Mechanically connect the fins to the tubes. Regard loose, bent, or damaged fins as causing a reduction in capacity at operating temperatures, and replace all loose, bent, or damaged fins at no additional cost to the Government. Do not provide elements with loose, bent or damaged fins.

][Make provisions for expansion and supports so that the element can be moved without strain or noise.

][Provide a coil with a face area that is no smaller than the dimensions specified in the drawing.

]2.2.4.3 Fan and Drive Assembly

Provide a centrifugal, forward-curved, double-width, double-inlet fan that has been is statically and dynamically balanced.

****
NOTE: Select, rewrite, or delete the following paragraph only after checking direct-drive units.
****

[Provide belt-driven fans, mounted on a common shaft. Support the shaft by independent, elastomer-mounted, self-aligning, antifriction or sleeve bearings with lifetime lubrication. Provide an adjustable motor sheave that can vary in speed by at least 20-percent in either direction from the capacity point. Provide adjustable belt tension.

][Provide a motor that is manually controlled by a two-position on/off switch.
][
****
NOTE: Select the following paragraph for direct-drive units in lieu of the preceding paragraph.
****

Provide a motor that is manually controlled by a [three] [four]-position switch.
]
****
NOTE: For very small units, only shaded-pole motors are available from some manufacturers.
****

Provide split-capacitor motors with elastomer vibration isolation mounts and with an adjustable rail mounting.

2.2.4.4 Filters

Provide replaceable, throwaway filters that are at least 25 millimeter 1

inch thick.

Install filters in a bypass-proof frame to ensure that moving air is filtered before entering the heating element. Ensure that filters can be removed without tools.

2.2.4.5 Dampers

Provide opposed-blade dampers constructed to resist salt air. Provide galvanized steel blades, that [are mechanically attached,] [have secure sealing provisions,] and are not dependent upon adhesives. Provide high-grade commercial-quality flanged bearings with an extended race, corrosion-resistant steel balls, and [plated races] [heat-treated carbon steel] construction with factory-applied grease conforming to DOD-G-24508, suitable for salt air exposure. Provide oil-impregnated bronze sleeve bearings.

[Provide a face and bypass damper with an external bypass duct if required by the unit.

][Provide mixing dampers as an assembly within a mixing box. Provide dampers that can vary the mixed air in any proportion from 100 percent room air to 100 percent outside air.

]2.2.4.6 Enclosures

****
NOTE: Show architectural and mechanical details not covered herein on the drawings or supplement the following.
****

[Provide an enclosure configuration in accordance with the manufacturer's recommendations.

][Provide an enclosure made of cold-rolled carbon steel 1.6 millimeter 16-gage or heavier conforming to ASTM A568/A568M. Provide construction that has smooth, blemish-free surfaces, without sharp edges, and with flush joints. Form and brace the enclosure to ensure that surfaces are plane and have no oilcan effect. Do not provide construction with wrinkled metal or notched corners. Provide pencilproof venetian louvers. Provide louvers that are constructed of metal and, when in normal position, can sustain a distributed load of up to 890 newton 200 pounds. Provide an enclosure that has space for all riser pipes and controls. Provide access doors that have tamperproof latches.

][Use [heavy coatings] [non-corroding materials] to protect the internal surfaces of the enclosure that are exposed to condensation and salt air Do not provide flash chrome plating or cadmium plating.

][Provide a surface finish for the enclosure that includes the manufacturer's standard phosphate pretreatment, prime coat, and baked enamel finish. Provide the color selected by the Contracting Officer.

]2.2.4.7 Wall Sleeve

Provide a wall sleeve made of galvanized carbon steel not less than 1.3 millimeter 18-gage pr heavier, with a commercial zinc weight conforming to ASTM A653/A653M. Provide a finish that consists of manufacturer's

standard galvanized surface preparation and at least [two finish coats of baked enamel] [one finish coat of high-build epoxy]. Provide the color selected by the Contracting Officer.

2.2.4.8 Thermal and Acoustic Insulation

Provide insulation to prevent heat loss, heat gain, and condensation. Provide an acoustic treatment for surfaces.

2.2.4.9 Control Cycle

****
NOTE: Select or delete the title and the following two paragraphs or rewrite and supplement by including the control cycle for this equipment to suit the project conditions.
****

[Sequence the operation in accordance with the manufacturer's recommendation's.

][Provide control components that conform to the requirements in Section 23 09 33.00 40 ELECTRIC AND ELECTRONIC CONTROL SYSTEM FOR HVAC.

]2.2.4.10 Fresh Air Intakes

Provide extruded-aluminum intake louvers with 1.6 millimeter 16-gage, 13 by 13 millimeter 1/2 by 1/2 inch mesh aluminum wire birdscreens for all fresh-air intakes. Provide extruded aluminum that has undergone caustic etching and been given a 0.5 micrometer anodic coating in accordance with AA DAF45. Use elastomeric seals to protect aluminum from dissimilar metals and the causticity of concrete or mortar. Provide an intake that is compatible with the penetration used in the building construction.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Equipment

Install equipment in accordance with the manufacturer's recommendations.

3.1.2 Gas Piping

Install gas piping in compliance with ICC IFGC, NFPA 54, Section 23 11 20 FACILITY GAS PIPING and Section 33 51 15 NATURAL-GAS / LIQUID PETROLEUM GAS DISTRIBUTION.

3.1.3 Combustion Air

Provide combustion air in compliance with ICC IMC.

3.1.4 Location

Install heaters in compliance with the clearance and mounting height requirements of ICC IFGC and NFPA 70.

3.1.5 Venting

Provide heaters that are vented in compliance with NFPA 54, ICC IMC, and ICC IFGC.

3.2 FIELD QUALITY CONTROL

Conduct operational tests in accordance with the manufacturer's instructions.

3.3 CLOSEOUT ACTIVITIES

Submit record drawings with current information on deviations from, and amendments to the drawings and concealed and visible changes in the work.

Submit [six] [_____] copies of the operation and maintenance manuals at least 30 calendar days before the system is tested.

Submit the manufacturer's warranty to the Contracting Officer.

Update and resubmit data for final approval at least 30 calendar days before contract completion.

-- End of Section --