
USACE / NAVFAC / AFCEC / NASA UFGS-23 52 43.00 20 (May 2015)

Preparing Activity: NAVFAC Superseding
UFGS-23 52 43.00 20 (July 2006)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated April 2015

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DIVISION 23 - HEATING, VENTILATING, AND AIR CONDITIONING

SECTION 23 52 43.00 20

LOW PRESSURE WATER HEATING BOILERS (UNDER 800,000 BTU/HR OUTPUT)

05/15

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SECTION 23 52 43.00 20

LOW PRESSURE WATER HEATING BOILERS (UNDER 800,000 BTU/HR OUTPUT) 05/15

NOTE: This guide specification covers the requirements for low pressure hot water heating boilers under 235 kilowatt 800,000 BTU/hr output.

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 items(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

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 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 will automatically
be 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.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z21.13/CSA 4.9 (2014; Errata 2014) Gas-Fired Low Pressure
Steam and Hot Water Boilers

ASME INTERNATIONAL (ASME)

ASME BPVC SEC IV (2010) BPVC Section IV-Rules for
Construction of Heating Boilers

ASME CSD-1 (2012) Control and Safety Devices for
Automatically Fired Boilers

ASTM INTERNATIONAL (ASTM)

ASTM A53/A53M (2012) Standard Specification for Pipe,
Steel, Black and Hot-Dipped, Zinc-Coated,
Welded and Seamless

ASTM C592 (2013) Standard Specification for Mineral
Fiber Blanket Insulation and Blanket-Type
Pipe Insulation (Metal-Mesh Covered)
(Industrial Type)

ASTM E2129 (2010) Standard Practice for Data
Collection for Sustainability Assessment
of Building Products

NATIONAL BOARD OF BOILER AND PRESSURE VESSEL INSPECTORS (NBBI)

NBBI NB-23 PART 1 (2013) National Board Inspection Code -
Part 1 Installation

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA MG 1 (2014) Motors and Generators

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 211 (2013) Standard for Chimneys, Fireplaces,
Vents, and Solid Fuel-Burning Appliances

NFPA 31 (2011) Standard for the Installation of
Oil-Burning Equipment

NFPA 54 (2015) National Fuel Gas Code

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

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

Energy Star (1992; R 2006) Energy Star Energy
Efficiency Labeling System (FEMP)

UNDERWRITERS LABORATORIES (UL)

UL 296 (2003; Reprint Sep 2013) Oil Burners
UL 726 (1995; Reprint Oct 2013) Oil-Fired Boiler
Assemblies
UL 795 (2011; Reprint Nov 2013) Standard for
Commercial-Industrial Gas Heating Equipment

1.2 RELATED REQUIREMENTS

Section 23 03 00.00 20 BASIC MECHANICAL MATERIALS AND METHODS, applies to this section, with the additions and modifications specified herein.

1.3 DESIGN REQUIREMENTS

NOTE: Insert boiler output capacity or indicate in
boiler schedule. Select boiler design working
pressure, operating pressure, operating temperature,
and return water temperature and indicate in boiler
schedule on drawings.

NOTE: Use Energy Star option for boilers less than
88 kW 300,000 BTU/hr and FEMP option for boilers 88
kW 300,000 BTU/hr or greater.

Boiler shall be suitable for installation in the space shown with ample room for opening doors and cleaning and removal and replacement of tubes. Boiler shall have an output of [_____] kW BTU/hr with an efficiency not less than that recommended by [Energy Star][FEMP]. Boiler shall be designed and tested in accordance with ASME BPVC SEC IV, ASME CSD-1, NFPA 54, NFPA 31, NFPA 70 and ANSI Z21.13/CSA 4.9. Boiler shall be installed in accordance with NBBI NB-23 PART 1. Paint boiler in accordance with manufacturer's recommendations. Boiler design working pressure shall be [207 kPa (gage)] [30 psig] [_____]. Boiler operating pressure shall be [83 kPa (gage)] [12 psig] [_____]. Boiler operating temperature shall be [82 degrees C] [180 degrees F] [_____]. Boiler return water temperature shall be [71 degrees C] [160 degrees C] [_____]. Provide a thermostatically controlled three-way mixing valve on boiler suitable for operating conditions of the boiler.

1.3.1 Boiler Installation Requirements

1.3.1.1 Location

Install Boiler(s) and associated hot water pumps in a mechanical room inside the facility in accordance with NBBI NB-23 PART 1. Provide ample

clearance around boilers to allow access for inspection, maintenance and repair. Passageways around all sides of boilers shall have an unobstructed minimum width of 36 inches or the clearances recommended by the boiler manufacturer whichever is greater.

1.3.1.2 Combustion Air

Provide supply of air for combustion and ventilation. In accordance with NFPA 54, NFPA 211 and manufacturer's installation manual, calculate the amount of combustion air necessary to operate the boiler. Install and locate properly sized combustion air dampers and louvers.

1.3.1.3 Sequence of Operation

Local, manual starting of boilers is required. Remote starting and stopping of the boiler by the HVAC control system is not permitted. This is to ensure that an operator witness the initial firing of the boiler at the beginning of each heating season to verify proper operation of the boiler and to promote proper maintenance.

1.3.2 Detail Drawings

1.3.2.1 Drawings

Show boiler hot water isolation valves, emergency disconnect switch, and complete boiler gas train on the contract drawings.

1.3.2.2 Fuel Train / Wiring Diagram

Submit fuel train and wiring diagram.

1.3.3 Water Analysis

Provide test reports of water analysis. UFC 3-240-13FN Industrial Water Treatment shall be followed for all boiler installations.

1.4 SAFETY STANDARDS

Hot water boilers, burners and supplementary control devices, safety interlocks, or limit controls required under this specification, shall meet requirements of the following standards as applicable:

- a. Oil-Fired Units: UL 726, NFPA 31, NFPA 70, ASME CSD-1.
- b. Gas-Fired Units: ASME CSD-1, NFPA 54, NFPA 70, ANSI Z21.13/CSA 4.9 or UL 795.
- c. Combination Gas- and Oil-Fired Units: ASME CSD-1, NFPA 54, NFPA 31, NFPA 70, UL 726, ANSI Z21.13/CSA 4.9, UL 795 or UL 296.
- d. All Units: ASME BPVC SEC IV, NFPA 70 and ASME CSD-1.

Controls not covered by the above shall have a UL label, UL listing mark, or shall be listed in the Factory Mutual Approval Guide.

1.5 SUBMITTALS

NOTE: Submittals must be limited to those necessary

for adequate quality control. The importance of an item in the project should be one of the primary factors in determining if a submittal for the item should be required.

A "G" following a submittal item indicates that the submittal requires Government approval. Some submittals are already marked with a "G". Only delete an existing "G" if the submittal item is not complex and can be reviewed through the Contractor's QC system. Only add a "G" if the submittal is sufficiently important or complex in context of the project.

For submittals requiring Government approval on Army projects, a code of up to three characters within the submittal tags may be used following the "G" designation 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.

An "S" following a submittal item indicates that the submittal is required for the Sustainability Notebook to fulfill federally mandated sustainable requirements in accordance with Section 01 33 29 SUSTAINABILITY REPORTING.

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" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.][for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] 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:

[Submittals for this Section shall be delivered to the project Contracting Officer, who shall forward two complete sets of copies to the appropriate approving official for review and approval.]

SD-02 Shop Drawings

Fuel Train

Wiring Diagram

SD-03 Product Data

Boilers: power output, thermal efficiency, ASME certification, allowable working pressure, model number, documentation for Energy Star qualifications or meeting FEMP requirements

Boiler Trim and Control Equipment

Burners and Control Equipment

Stack, Breeching, and Supports

[Local/Regional Materials

Documentation indicating distance between manufacturing facility and the project site. Indicate distance of raw material origin from the project site. Indicate relative dollar value of local/regional materials to total dollar value of products included in project.]

[Environmental Data]

SD-06 Test Reports

Operational Tests

Water Analysis

SD-07 Certificates

Boilers

Burners and Control Equipment

Boiler Trim and Control Equipment

Boiler manufacturer's certificate of boiler performance including evidence that the burners provided shall be a make, model, and type certified and approved by the manufacturer of the boiler being provided.

SD-08 Manufacturer's Instructions

Boilers

Feedwater Treatment Feeder

SD-10 Operation and Maintenance Data

Boilers, Data Package 4

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

SD-11 Closeout Submittals

Posted operating instructions for heating water boilers

1.6 SUSTAINABLE DESIGN REQUIREMENTS

1.6.1 Local/Regional Materials

NOTE: Using local materials can help minimize transportation impacts, including fossil fuel consumption, air pollution, and labor.

Use materials or products extracted, harvested, or recovered, as well as manufactured, within a [800][_____] kilometer [500][_____] mile radius from the project site, if available from a minimum of three sources.

1.6.2 Environmental Data

NOTE: ASTM E2129 provides for detailed documentation of the sustainability aspects of products used in the project. This level of detail may be useful to the Contractor, Government, building occupants, or the public in assessing the sustainability of these products.

[Submit Table 1 of ASTM E2129 for the following products: [____].]

PART 2 PRODUCTS

2.1 BOILERS

NOTE: Select boiler type and style required. The Energy Policy Act of 2005 requires new buildings to use 30 percent less energy than the ASHRAE 90.1 - SI ASHRAE 90.1 - IP level. Efficient heating equipment and components contribute to achieving sustainability requirements.

NOTE: Annual Fuel Utilization Efficiency (AFUE) of 90 percent for residential gas-fired boilers, or 87 percent for residential oil-fired boilers less than 88 kW 300,000 Btuh is per Energy Star Eligibility Criteria Version 3.0 requirements: and AFUE of 80 percent for gas-fired and 82 percent for oil-fired commercial boilers less than 88 kW (300,000 Btuh) is per ASHRAE 90.1-2010. 87 percent is an option that is readily available for these boilers.

Provide hot water heating boiler complete with firing equipment, combustion chamber, insulation with steel jacket, safety and operating controls, integral electrical wiring and other appurtenances, to make the boiler a complete, self-contained, fully-automatic unit, ready for service upon completion of utility connections. [Gas fired residential boilers less than 88 kW 300,000 Btuh shall have an Annual Fuel Utilization Efficiency (AFUE) of at least 90 percent.] [Oil-fired residential boilers less than 88

kW 300,000 Btuh shall have an Annual Fuel Utilization Efficiency (AFUE of at least 87 percent.) [Commercial boilers less than 88 kW 300,000 Btuh shall have an Annual Fuel Utilization Efficiency (AFUE) of at least 80 percent.] [Gas fired boilers greater than 88 kW 300,000 Btuh input shall have a thermal efficiency of at least 80 percent when fired at the maximum and minimum capacities which are provided and allowed by the controls.] [Oil-fired boilers greater than 88 kW 300,000 Btuh output shall have a thermal efficiency of at least 82 percent when fired at the maximum and minimum rated capacities which are provided and allowed by the controls.]

2.1.1 General Requirements

Design, construction, installation, testing, and operation of boiler and appurtenances shall comply with NBBI NB-23 PART 1, ASME BPVC SEC IV, ASME CSD-1, NFPA 54, NFPA 31, ANSI Z21.13/CSA 4.9, and the manufacturer's instructions.

2.2 BURNERS AND CONTROL EQUIPMENT

NOTE: Indicate fuel trains on the drawings.
Conform to the requirements of ASME CSD-1.

[2.2.1 Atmospheric-Type Gas Burner

Atmospheric-type gas burner (under 117 kW 400,000 BTU/hr input). ASME CSD-1 and ANSI Z21.13/CSA 4.9. Automatic recycling burner. ON-OFF type combustion control system. [Interrupted] [Intermittent] pilot type ignition system, and pilot shall be electrode-ignited natural gas type. Design burner and combustion control equipment for firing natural gas having a specific gravity of [0.6] [_____] and a heating value of approximately [37,300 kJ per cubic meter] [1000 BTU per cubic foot] and be an integral part of the boiler. Burner controls and safety equipment shall conform to applicable requirements of ASME CSD-1 and ANSI Z21.13/CSA 4.9, including complete gas shut-off and pilot gas. Gas pressure available: [[_____] inches of water gage (WC)] kPa gage psig.

]2.2.2 Gas-Fired Power Burner

Gas-fired power burner (over 117 kW 400,000 BTU/hr input). Interrupted pilot type ignition system, and pilot shall be the electrode-ignited natural gas type. Design burner and combustion control equipment for firing natural gas having a specific gravity of [0.6] [_____] and a heating value of approximately [37,300 kJ per cubic meter] [1000 BTU per cubic foot] [_____] and be an integral part of the boiler. Burner controls and safety equipment shall conform to applicable requirements of ASME CSD-1, NFPA 54, ANSI Z21.13/CSA 4.9 and UL 795. Mount controls; including operating switches, indicating lights, gages, alarms, motor starters, fuses, and circuit elements of control systems on a single control panel or cabinet designed for separate mounting not on the burner. The combustion control system shall be the [on/off] [high-low-off] [positioning] [metering] type. Locate flame scanner such that testing and cleaning of scanner can be accomplished without disassembly of burner. Provide fuel train as indicated. Gas pressure available: [[_____] Pa inches of water gage] [[_____] kPa (gage) psig].

]2.2.3 Oil-Fired Power Burner

Oil-fired power burner (under 117 kW 400,000 BTU/hr input). Direct electric-spark-ignited type ignition system. Burner controls and safety equipment shall conform to applicable requirements of ASME CSD-1, NFPA 31 and UL 726. The combustion control system shall be the [on/off] [high-low-off] [positioning] [metering] type.

]2.2.4 Oil-Fired Power Burner

Oil-fired power burner (over 117 kW 400,000 BTU/hr input). Pressure-atomizing type burner. Direct electric-spark-ignited type ignition system. Design burner and combustion control equipment for firing commercial grade number 2 fuel oil and be an integral part of the boiler. Burner controls and safety equipment shall conform to applicable requirements of ASME CSD-1, NFPA 31 and UL 726. The combustion control system shall be the [on/off] [high-low-off] [positioning] [metering] type. Mount controls; including operating switches, indicating lights, gages, alarms, motor starters, fuses, and circuit elements of control systems on a single control panel or cabinet designed for separate mounting not on the burner. Locate flame scanner such that testing and cleaning of scanner can be accomplished without disassembly of burner. Provide fuel train as indicated.

]2.2.5 Gas and Light Oil-Fired Power Burner

Gas and light oil-fired power burner (over 117 kW 400,000 BTU/hr Input). The combustion control system shall be the [on/off] [high-low-off] [positioning] [metering] type. Pressure-atomizing type oil burner. Interrupted-pilot type ignition system, and pilot be electrode-ignited natural gas type, except that the oil burner be direct electric-spark-ignited. Design burner and combustion control equipment for firing commercial grade number 2 fuel oil and natural gas having a specific gravity of [0.6] [_____] and a heating value of approximately [37,300 kJ per cubic meter] [1000 BTU per cubic foot] [_____] and be an integral part of boiler. Burner controls and safety equipment shall conform to applicable requirements of ASME CSD-1, NFPA 31, UL 726, NFPA 54, ANSI Z21.13/CSA 4.9 and UL 795. Mount controls; including operating switches, indicating lights, gages, alarms, motor starters, fuses, and circuit elements of control systems on a single control panel or cabinet designed for separate mounting not on the burner. Locate flame scanner such that testing and cleaning of scanner can be accomplished without disassembly of burner. Provide fuel train as indicated. Gas pressure available: [[_____] Pa inches of water gage] [[_____] kPa (gage) psig].

]2.3 BOILER TRIM AND CONTROL EQUIPMENT

Provide in accordance with ASME CSD-1 and ASME BPVC SEC IV and additional requirements specified below.

2.3.1 Emergency Disconnect Switch

NOTE: Indicate location of emergency disconnect switch on drawings. Insert emergency switch amperage required.

Provide and locate on wall outside boiler room entrance or just inside

door, when boiler room door is on building exterior as required by ASME CSD-1 to allow rapid and complete shutdown of the boiler in the event of an emergency. Emergency switch shall be a [____]-amp. fuse-type safety switch. Switch shall be red and furnished with a label indicating function of switch.

2.3.2 Relief Valves

Provide relieving capacity for the full output of boiler installed. Safety relief-valve piping shall conform to ASTM A53/A53M, schedule 40 steel pipe and be piped full-size [to a floor drain] [to 150 mm 6 inches above floor].

2.3.3 Pressure and Altitude Gage or Combination Pressure/Altitude Gage

Provide one located on supply water piping and one on return water piping.

2.3.4 Thermometer

Provide thermometer with a scale equivalent to 1.5 times outlet water temperature. Provide one located on supply water piping and one on return water piping.

2.3.5 Drain Tapping

Provide drain valve and piping [to a floor drain] [to 150 mm 6 inches above floor].

2.3.6 Make-up Water Station

2.3.6.1 Pressure Reducing Station

NOTE: Select operating pressure required.

Provide a water pressure-reducing valve and relief valve, or a combination of the two in the makeup water line to the boiler to maintain a water pressure of [83 kPa (gage)] [12 psig] [____] in the hot water system. Provide a 20 mm 3/4 inch globe valve by-pass around this valve.

2.3.6.2 Backflow Preventers

Section 22 00 00 PLUMBING, GENERAL PURPOSE. Locate upstream of by-pass.

2.3.7 Feedwater Treatment Feeder

Provide floor mounted, Type II - Shot-Type Feeder (manual, intermittent feed), as indicated for use with pressures up to 1379 kPa (gage) 200 psig maximum.

2.3.8 Combustion Regulator

Provide adjustable temperature, thermostatic immersion type that shall limit boiler water temperature to a maximum of 121 degrees C 250 degrees F. Control shall actuate burner through an electric relay system to maintain boiler water temperature within normal prescribed limits at loads within rated capacity of boiler.

2.3.9 Air Vent Valve

Provide with screwed connection, stainless steel disk, and stainless steel seats to vent entrapped air.

2.3.10 High Temperature Limit Switch

NOTE: Specify alarm and indicating lights if input exceeds 117 kW 400,000 BTU/hr.

Provide adjustable immersible aquastat type with a temperature setting above that of the combustion regulator and below that of the lowest relief valve setting. Aquastat shall function to cause a safety shutdown by closing fuel valves[,] [and] shutting down burner equipment [, activating a red indicating light, and sounding an alarm] in the event that boiler water temperature rises to the high temperature limit setting. A safety shutdown due to high temperature shall require manual reset before operation can resume and prevent recycling of burner equipment. Pre-set high temperature limit devices that cannot be easily tested are not allowed.

2.3.11 Low Water Level Cutoff Switch

NOTE: Specify alarm and indicating lights if input exceeds 117 kW 400,000 BTU/hr.

Low water level cutoff shall cause a safety shutdown by closing fuel valves[,] [and] shutting down burner equipment [, activating a red indicating light, and sounding an alarm] in the event that water level drops below the lowest safe permissible water level established by the boiler manufacturer and ASME BPVC SEC IV. A safety shutdown due to low water shall require manual reset before operation can resume and prevent recycling of burner equipment.

2.3.12 Boiler Safety Control Circuits

NOTE: Include draft fan if power burner is specified.

Provide boiler safety control circuits, including control circuits for burner [and draft fan], shall be single-phase, two-wire one-side grounded, and not over 120 volts. Provide safety control switching in ungrounded conductors. Provide overcurrent protection. In addition to circuit grounds, ground metal parts which do not carry current to a grounding conductor.

2.3.13 Indicating Lights

NOTE: Delete entire paragraph if boiler input does not exceed 117 kW 400,000 BTU/hr. Include draft fan if power burner is specified.

Each safety interlock requiring a manual reset shall have an individually labeled red indicating light. Non-recycling control interlocks shall have the reset located on the control itself. Red indicating lights on the control panel may be omitted if the burner combustion control system has a Keyboard Display Module installed that will identify the lockout information required in Item c. below. Indicating lights shall have colors as follows

:

- a. Amber: Ignition on
- b. Green: Main fuel safety shut-off valves open
- c. Red (One for Each): Safety lockout, flame failure, low water level, and high temperature
- [d. Blue: Draft]

2.3.14 Alarm Bell

NOTE: Delete entire paragraph if boiler input does not exceed 117 kW 400,000 BTU/hr.

Provide alarm bell, electrically operated, with a manual disconnect switch. Disconnect switch shall be type and wired so that switching off alarm following a safety shutdown will not prevent alarm from sounding again upon recurrence of a subsequent safety shutdown condition.

2.3.15 Post-Combustion Purge

NOTE: Delete entire paragraph if atmospheric burner is specified.

Provide controls and wiring necessary to ensure operation of draft fan for a period of not less than 15 seconds or of sufficient duration to provide four complete air changes in the boiler combustion chamber (whichever is greater) following shutdown of burner upon satisfaction of heat demand and in accordance with ASME CSD-1 . Upon completion of post-combustion purge period, draft fan shall automatically shutdown until next restart.

2.3.16 Draft

Comply with boiler manufacturer's recommendations.

2.3.17 Stack, Breeching, and Supports

NOTE: NFPA 211, Type B vent can only be used with an atmospheric burner.

NOTE: Boiler stacks shall conform to the boiler manufacturer's installation and operational manual.

[Provide boiler stack constructed of sheet steel having a thickness of not less than 2.47 mm 0.0972 inches with welded joints. Insulate stack located inside the building with 38 mm 1 1/2 inches of mineral wool conforming to applicable requirements of ASTM C592, Class II - for use up to 649 degrees C 1200 degrees F. Insulation shall receive a finish coat of finishing cement not less than 19 mm 3/4 inch thick, trowelled to a smooth finish. Provide stack supports, umbrella collar and cap, and flue transition piece. Stack diameter and height shall be in accordance with manufacturer's recommendations and conform to NFPA 211.]

[NFPA 211, [Type B - gas] [Type L - oil and gas/oil], prefabricated multi-wall type, flashed to the roof, and complete with rain cap. Stack diameter and height shall be in accordance with manufacturer's recommendations and conform to NFPA 211.]

2.3.18 Hot Water Coils

NOTE: Delete entire paragraph unless hot water coils are required to instantaneously heat domestic water.

Provide coils capable of heating [_____] L/s GPM of water with [_____] degree C F rise conforming to ASME BPVC SEC IV.

2.3.19 Stack Thermometer

Provide flue gas dial type thermometer with scale calibrated from 66 to 399 degrees C 150 to 750 degrees F and mounted in flue gas outlet.

2.4 ELECTRIC MOTORS

Electric motors shall meet requirements of NEMA MG 1. Motors less than 3/4 kW 1 hp shall meet NEMA High Efficiency requirements. Motors 3/4 kW 1 hp and larger shall meet NEMA Premium Efficiency requirements. Motors which are an integral part of the packaged boiler system shall be the highest efficiency available by the manufacturer of the packaged boiler. Motors shall be variable speed.

PART 3 EXECUTION

3.1 EQUIPMENT INSTALLATION

Install equipment in accordance with manufacturer's installation instructions and NBBI NB-23 PART 1. Grout equipment mounted on concrete foundations before installing piping. Install piping in such a manner as not to place a strain on equipment. Do not bolt flanged joints tight unless they match. Grade, anchor, guide, and support piping without low pockets. Feedwater treatment feeders shall be mounted so that the top of the feeder is no higher than 1219 mm 48 inches above the finished floor.

3.2 EQUIPMENT FOUNDATIONS

Locate equipment foundations as indicated, designed, and made of sufficient size and weight to preclude shifting of equipment under operating conditions or under abnormal conditions that could be imposed upon the equipment. Foundations shall meet requirements of the equipment

manufacturer. Concrete and grout shall conform to Section 03 30 00
CAST-IN-PLACE CONCRETE.

3.3 BOILER CLEANING

Before being placed in service, boiler shall be boiled out for a period of 24 hours at a pressure not exceeding 83 kPa (gage) 12 psig. Solution to be used in the boiler for the boiling out process shall consist of two pounds of trisodium phosphate per 379 liters 100 gallons of water. Upon completion of boiling out, flush out boiler with potable water, drain, and charge with chemically treated water. Protect boiler and appurtenances against internal corrosion until testing is completed and boiler is accepted. Professional services are required for cleaning/treatment process.

3.4 FIELD QUALITY CONTROL

Perform and furnish everything required for inspections and tests as specified herein to demonstrate that boiler and auxiliary equipment, as installed, are in compliance with contract requirements. Start-up and operate the system. During this time, clean strainers until no further accumulation of foreign material occurs. Exercise care to minimize loss of water when strainers are cleaned. Adjust safety and automatic control instruments as necessary to place them in proper operation and sequence. Test instrumentation shall be calibrated and have full scale readings from 1.5 to 2 times test values.

3.4.1 Operational Tests

Furnish the services of an engineer or technician approved by the boiler manufacturer of installation, startup, operational and safety testing. This person shall remain on the job until each boiler has been successfully operated. Furnish and perform everything required for inspections and tests of the boiler and auxiliary equipment. Test instrumentation shall be calibrated and have full-scale reading from 1.5 to 2 times test values. Demonstrate proper operability of combustion control, flame safeguard control and safety interlocks. Provide a detailed description of all boiler startup and operational tests in the Commissioning Plan.

3.4.1.1 Preliminary Operational Test

Operate the boilers continuously for a period of at least 8 hours to demonstrate proper operability of the combustion control, flame safeguard control, and safety interlocks.

3.4.1.2 Acceptance Operational Test and Inspection

**NOTE: Insert the appropriate Facility Engineering
Command Acceptance Operational test and inspection
by NAVFAC Boiler Inspector only required for boilers
with capacity of 400,000 Btu/hr or greater.**

Prior to requesting an acceptance test, conduct a satisfactory operational test for at least 8 hours, and provide a certified statement that the equipment is installed per all requirements of this guide. Contracting Officer, upon receipt of the notice from the Contractor, shall request a boiler inspection by a Naval Facilities Engineering and Expeditionary

Warfare Center (EXWC) NAVFAC boiler inspector. Fifteen days advance notice is required for scheduling inspector to conduct acceptance operational test and inspection.

3.5 WASTE MANAGEMENT

NOTE: Diverting waste from the landfill contributes to the following LEED credit: MR2. Coordinate with Section 01 74 19 CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT.

Separate waste in accordance with the Waste Management Plan. Close and seal tightly all partly used adhesives and solvents; store protected in a well-ventilated, fire-safe area at moderate temperature.

3.6 SCHEDULE

Some metric measurements in this section are based on mathematical conversion of inch-pound measurements, and not on metric measurements commonly agreed on by the manufacturers or other parties. The inch-pound and metric measurements shown are as follows:

<u>Products</u>	<u>Inch-Pound</u>	<u>Metric</u>
a. Alarm Bell Diameter	= 4 inches	= 100 mm
b. Stack Thermometer Scale Range	= 150-750 degrees F	= 66-399 degrees C

-- End of Section --