

MATERIALS AND EQUIPMENT STANDARD**FOR****BOILERS & BURNERS****ORIGINAL EDITION****JULY ۱۹۹۴**

This standard specification is reviewed and updated by the relevant technical committee on Sep. ۱۹۹۸(۱) and July ۲۰۰۳(۲). The approved modifications are included in the present issue of IPS.

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١. INTRODUCTION

This Standard specifies material requirements for cast iron boilers and for packaged fire tube steel boilers when used in conjunction with year-round air conditioning and refrigeration system.

It is divided into the following parts:

PART I Specification requirements for boilers representing:

- Horizontal fire tube steel boilers hot water and steam type. (modified scotch type)
- Cast iron (water tube) boilers-hot water type.

PART II Specification requirements for burners.

PART III In formations required with Vendor's Proposal.

PART IV General Requirements.

PART V Data Sheets.

The boiler design shall be suitable for indoor installations and for the following applications:

- Commercial buildings.
- Industrial sites within capacity and site limitations.
- Residential and apartment blocks.
- Institutional and academic.
- Hospital and clinics.

The steam boilers shall be those where the condensate is returned to the condensate tank.

For informations on engineering standards of packaged fire tube boilers reference is made to [IPS-G-ME-١٧٠](#).

1. SCOPE

1.1 This Standard applies to packaged horizontal mount boilers constructed of steel for delivery of hot water or steam and cast iron boilers for delivery of hot water to locations remote from the boiler room.

1.2 The standard covers minimum requirements representing design, material selection, testing, inspection, packaging, shipment and storage of fire tube boilers and cast iron boilers.

1.3 The industrial boilers and utility boilers are not covered by this standard.

Note 1:

This standard specification is reviewed and updated by the relevant technical committee on Sep. 1998. The approved modifications by T.C. were sent to IPS users as amendment No. 1 by circular No 67 on Sep. 1998. These modifications are included in the present issue of IPS.

Note 2:

This standard specification is reviewed and updated by the relevant technical committee on July 2003. The approved modifications by T.C. were sent to IPS users as amendment No. 2 by circular No 212 on July 2003. These modifications are included in the present issue of IPS.

2. REFERENCES

Throughout this Standard the following standards and codes are referred to. The editions of these standards and codes that are in effect at the time of publication of this Standard shall, to the extent specified herein, form a part of this Standard.

The applicability of changes in standards and codes that occur after the date of this Standard shall be mutually agreed upon by the Company and the Vendor.

| | |
|------------------------------|---|
| ASME | "Boiler and Pressure Vessel Code Section IV" |
| BS 779-1989 | "Cast Iron Boilers for Central Heating and Indirect Hot Water Supply" |
| BS EN 1061-1997 | "Gray Cast Iron" |
| DIN 4702 | "Boilers for Central Heating" |
| IPS-E-TP-100 | "Engineering Standard for Sales" |
| IPS-G-SF-100 | "General Standard for Noise and Vibration" |

3. DEFINITIONS AND TERMINOLOGY

3.1 Acidity

Represents the amount of free carbon dioxide, mineral acids and salts. (especially sulfates or iron and aluminum) which hydrolyze to give hydrogen ions in water and is reported as milliequivalents per liter of acid, or ppm acidity as calcium carbonate, or pH, the measure of hydrogen ion concentration.

3.2 Air Atomizing Oil Burner

A burner for firing oil in which the oil is atomized by compressed air which is forced into and through one or more streams of oil, breaking the oil into a fine spray.

۳.۳ Air-Cooled Wall

A refractory wall of hollow construction through which air passes.

۳.۴ Air Deficiency

Insufficient air, in an air-fuel mixture, to supply the oxygen theoretically required for complete oxidation of the fuel.

۳.۵ Air Eliminator

An air vent, which is equipped with float valve used on the highest point of hot water.

۳.۶ Automatic Air Vent (AAV)

An air vent, which is equipped with thermal sensing auto element, used on the highest point of steam line.

۳.۷ Air Vent

A valved opening to the top of the highest point of a boiler or pressure vessel for venting air.

۳.۸ Base Load

Base load is the term applied to that portion of a station or boiler load that is practically constant for long periods.

۳.۹ Beaded Tube End

The rounded exposed end of a rolled tube when the tube metal is formed over against the sheet in which the tube is rolled.

۳.۱۰ Blowdown

Removal of a portion of boiler water for the purpose of reducing concentration, or to discharge sludge.

۳.۱۱ Breeching

A duct for the transport of the products of combustion between parts of a steam-generating unit or to the stack.

۳.۱۲ Burner Windbox

A plenum chamber around a burner in which an air pressure is maintained to insure proper distribution and discharge of secondary air.

۳.۱۳ Deaeration

The process by which the amount of air in solution can be reduced to the lowest possible, or desired percentage of the total system water volume.

۳.۱۴ Packaged Firetube Steel Boiler

A packaged steam or hot water firetube boiler is defined as a modified scotch type boiler unit, engineered, built, fire tested before shipment and guaranteed in material, workmanship and performance by one firm, with one manufacturer furnishing and assuming responsibility for all components in the assembled unit. Components include boiler, burner, controls and all auxiliary boiler-related equipment.

۳.۱۵ Pass

A confined passageway, containing heating surface, through which a fluid flows in essentially one direction.

۳.۱۶ Pour Point

The lowest temp at which an oil will flow or can be poured under specified conditions of test.

۳.۱۷ Rotary Oil Burner

A burner in which atomization is accomplished by feeding oil to the inside of a rapidly rotating cup.

۳.۱۸ Stack

A vertical conduit, which due to the difference in density between internal and external gases, creates a draft at its base.

۳.۱۹ Steam Atomizing Oil Burner

A burner for firing oil, which is atomized by steam. It may be of the inside or outside mixing type.

۳.۲۰ Water Column

A vertical tubular member connected at its top and bottom to the steam and water space respectively of a boiler, to which the water gage, gage cocks, and high and low level alarms may be connected.

۳.۲۱ Water Hammer

A sudden increase in pressure of water due to an instantaneous conversion of momentum to pressure.

۳.۲۲ Water Level

The elevation of the surface of the water in boiler.

۴. CONFLICTING REQUIREMENTS

In case of conflict between documents relating to the inquiry or purchase order the following priority of documents shall apply:

- First Priority: Purchase order (including attachments) and variations thereon.
- Second Priority: Data-requisition sheets and drawings.
- Third Priority : This specification.

All conflicting requirements shall be referred to the company in writing. The company will issue

confirmation documents if needed for clarification.

٥. UNITS

This standard is based on International System of Units, (SI) except where otherwise specified.

٦. GROUPING

٦.١ For the convenience of design engineers the classification of the firetube boilers are grouped for operations at or below the following temperatures and pressure:

- Low pressure steam boiler ١٠٣ kPa (١٥ psi).
- Low pressure hot water boiler ١١٠٣ kPa (١٦٠ psi) and ١٢١°C (٢٥٠°F) operating temperature.
- Medium and high-pressure boiler above ١٠٣ kPa for steam and above ١١٠٣ kPa or ١٢١°C for hot water.

٦.٢ The Objective of This Grouping Is:

- a) To cause the boiler provide a continuous supply of hot water or saturated steam at the desired condition of pressure and temperature.
- b) To continuously operate the boiler at the lowest cost of fuel and other boiler inputs consistent with high level of safety and full boiler design life, improving boiler efficiency.

PART I

BOILER-SPECIFICATION REQUIREMENTS

1. TYPES OF BOILERS

This standard is aimed to cover the specifications on the construction and design features of the following types of boilers:

- Cast Iron Boilers
- Packaged Fire Tube Steel Boilers Steam/ Hot Water

1.1 Cast Iron Boilers

1.1.1 General

1.1.1.1 The sectional cast iron commercial boilers shall be of 2 or 3-pass horizontal forced draft design suitable for operation with fuel oil or gas.

1.1.1.2 The overall specification of cast iron boiler shall conform to BS 779-1989 and DIN 4702, suitable for open pressurized hot water system, limited to the following conditions:

- a) Capacity outputs from 44 kW (150,000 BTU) and above.
- b) System design pressure shall be upto 6 bar (87,0 psi) and design temperature up to 120°C (248°F).

1.1.2 Construction and assembly

1.1.2.1 The sections shall be interchangeable constructed in accordance with BS EN 1061-1997, capable to withstand test pressure of according to BS 1989.

1.1.2.2 The connections between each section shall be compatible metallic and grommet seal nipples or header type whichever is specified.

1.1.2.3 The boiler front door/plates shall be available for openings by exchanging positions of support and locking hinges (handles) for right hand or left hand opening.

1.1.2.4 The burner mounting plates shall be either cast iron or steel plate type.

1.1.2.5 To provide turbulence and maximum heat transfer, the combustion chamber shall be finned complete with flue gas retarders.

1.1.2.6 The combustion chamber shall be fully accessible for cleaning flue passages with cleaning cover to provide access to the rear flue outlet (smoke head).

1.1.2.7 Insulation shall be provided to the complete boiler block with a series of mineral wool with aluminum foil to ensure minimal heat loss through radiation. A heat resisting sealing rope shall be provided throughout the boiler block.

1.1.2.8 The boiler shall be housed in an easy-to-fit steel enclosure with the instrument panel integrated, flushed – fixed or exposed, to the steel casing; the casing shall be coated with heat resistant paint.

1.1.2.9 The boilers shall be available with sections assembled or unassembled, as specified.

4.1.3 Connections

- 4.1.3.1 The flue connection shall be spigot at the rear cast integral with the boiler smokehead.
- 4.1.3.2 The flue gas temperature at 100% load shall be less than 200°C.
- 4.1.3.3 Water flow and return connections shall be preferably at the rear as required by BSI or DIN Standards.
- 4.1.3.4 Drain connection shall be provided with suitable drain cock.
- 4.1.3.5 A phial pocket shall be provided for thermostats and thermometers for fitting in the rear section to efficiently sense outgoing temperatures.

4.1.4 Instruments & control

- 4.1.4.1 The instrument panel shall be provided with controls and instruments to suit application requirements.
- 4.1.4.2 All thermometers for water flow and return, plus for flue gas temperature shall be either digital or calibrated combined in SI and Metric units.
- 4.1.4.3 The instrument panel shall include, but not limited to, the following items:
 - Control thermostat.
 - Limit thermostat and pilot light.
 - Hours run meter.
 - Thermometers (for supply/return water temperature and flue gas temperature).
 - Pressure gage.
- 4.1.4.4 The panel shall be factory - wired internally onto a terminal block duly supported by a descriptive schematic diagram showing methods of connection, etc.

4.2 Packaged Fire Tube Steel Boilers-Steam / Hot Water

4.2.1 Operating conditions

Each unit shall be suitable for operation under rated capacity and pressure conditions as specified in the data sheet. The capacity ratings shall be from minimum 40 kW to maximum 98.9 kW heating output.

4.2.2 Construction features

- 4.2.2.1 The boiler shall be packaged horizontal, a 2-pass or 4-pass wet back or dry back firetube updraft-unit with five square feet of heating surface per rated boiler horse power.
- 4.2.2.2 Fire tested at the factory approved by Underwriter's Laboratories (UL) and affixed to it the UL label.
- 4.2.2.3 The unit shall incorporate a forced draft burner and burner control, either flange mounted or on a base frame.
- 4.2.2.4 The unit shall be fully assembled, floor or foundation mounting with connections of steam, water, electrical, fuel, vent and blow down lines.

4.2.3 Pressure vessel (shell)

4.2.3.1 The pressure vessel shall be constructed in accordance to ASME boiler and pressure vessel code section IV.

4.2.3.2 Two or more lifting lugs (eyes) suitable for lifting the boiler shall be provided on top of the pressure vessel.

4.2.3.3 The front and rear doors on the boiler shall be bolted or hinged.

4.2.3.4 The front door with refractory shall be contained by a welded steel liner and guaranteed by the manufacturer for a period of not less than ten years.

4.2.3.5 The wetback boilers shall have no refractory on its rear doors.

4.2.3.6 Rear refractory and insulation on dry back boilers shall be contained in the formed door, swing open type for inspection of brick work.

4.2.3.7 All doors shall be sealed with heat -resistant gaskets, fastened securely using lugs and nuts threaded onto studs welded into the vessel.

4.2.3.8 The entire boiler base frame and other components shall be factory painted, before shipment with the manufacturer's standard paint system that will consist of minimum one prime coat and high temperature finish coat suitable for site environmental conditions.

4.2.3.9 The pressure vessel shall be furnished with appropriate handholes and/or manholes for easy inspection and service of boiler and burner. Also the heating surface shall be fully accessible for cleaning/inspection purposes without disturbing the burner equipment.

4.2.3.10 For hot water boilers, the hot water inlet and outlet shall be located such that it properly mixes return water with the boiler water.

4.2.3.11 Observation sight ports shall be located at each end of the boiler to facilitate inspection of flame conditions.

4.2.3.12 The exhaust gas flue connection shall contain a thermo well with stack thermometer.

4.2.4 Insulation

4.2.4.1 The insulation shall consist of a minimum 50 mm thick heat-resistant blanket covering the entire circumference of the pressure vessel protected by preformed steel jacket.

4.2.4.2 The boiler insulation and lagging must be easily removable and readily reinstalled when necessary.

4.2.4.3 The insulation shall be installed in a manner and quantity to prevent undue heat loss and to prevent skin temperatures over 57°C where personnel could possibly come in contact with the vessel.

4.2.5 Boiler auxiliaries (trim)

4.2.5.1 The boiler shall include, but not necessarily limited to , the following installed components.

a) Safety relief valves for steam and water relief valves for hot water, selected in accordance with relevant ASME code requirements.

b) Water column/pump control/low water cut-off integrated control used to:

- Act as a water column.
- Automatically actuate the feed water pump to maintain normal boiler water level.
- Act as a safety device if the boiler water falls below a safe level, duly interlocked

with burner control system.

- c) All controls for steam boiler shall be located preferably on the right hand side of the boiler and shall be complete with gage glass set and gage glass assembly.
- d) The boiler shall have a steam pressure gage or water pressure gage with cock and test connections located at the front end of the boiler unit.
- e) A temperature gage shall be provided for the hot water boiler.

4.2.6 Safety valves

4.2.6.1 General

All vessels subject to pressure must be protected by a properly sized safety valve such that the pressure cannot rise more than 10% above the boiler maximum allowable working pressure.

For steam boilers the set pressure tolerance of the safety valves shall not exceed ± 13.8 kPa and for hot water boilers for pressures upto and including 910 kPa (9.1 bars) shall not exceed ± 20.6 kPa and at $\pm 0\%$ for pressures above 910 kPa.

Manufacturers shall have the valves marked in a manner it remains legible throughout its use. The valves shall be inspected and certified with ASME stamp indicating the size, pressure and capacity providing the manufacturer's model and serial number plus the year of manufacture.

4.2.6.2 Description

The pressure relieving devices used on equipment requiring safeguard from over-pressure may be the spring loaded (pop type), high lift or diaphragm type, as specified.

The inlet opening of these valves shall have an inside dia. equal to, or greater than, the seat diameter. Each valve shall be furnished with wrenching surfaces to allow for normal adjustment on installation without causing damage to operating parts.

The thermal/pressure element of these valves shall be such that flow passages are not restricted and official capacity not reduced.

4.3 Mechanical Features

4.3.1 Controls of each steel boiler shall represent the following minimum specifications as applicable for steam or hot water operation.

a) Combustion control

1) Boilers rated at 450 kg per hour (1000 lbs) and larger shall have full modulation controls.

Boilers rated below 450 kg per hour shall have (high-low-off) or (on-off) controls.

2) A flame failure safeguard unit shall be provided to automatically close all fuel valves and shutdown burner on flame failure or de-energization of ignition equipment if the flame is not established for any reason. Failure of any component of the safeguard unit shall cause safety shutdown. All shutdowns due to such safety failures shall require manual reset before operations can be resumed. The safety shutdown system should include a time-delay feature to accommodate reasonably short current outages and voltage drops. A maximum time delay of 3-5 seconds should be used unless the vendor determines this will jeopardize the safety of the boiler operation.

3) Proper boiler/burner management system programming sequence must include

provisions for precombustion purging and post-combustion purging, and the blower must be operating, when the burner is operating. A sequence of operation together with set point, and timing chart shall be provided.

b) Feedwater pump control

The boiler feedwater pump control shall be an integral part of the water column. It shall automatically actuate a motor driven feedwater pump to maintain the boiler water level within normal limits. (Low-level start high-level shutdown).

c) Water column and low water cutoff

A water column for steam boilers shall be provided on each unit complete with trycocks, gage glass, and water column blowdown valves. The low-water cutoff shall be an integral part of the boiler feedwater control. It shall be wired to sound an alarm and to prevent burner operation if the boiler water falls below a safe level. The water level control shall be either probe or float type. For safety, a low water level control shall be provided in both water column and shell.

d) All controls shall be in one central location except the steam pressure controls (for regulation of burner operation) which can be mounted near the water column.

e) The instrumentation shall be water proof type unless otherwise mentioned.

4.3.2 Vent stack (outside building)

4.3.2.1 In the event necessary the vendor shall design and supply materials for the complete venting system including the vent stack and connecting ductwork (breaching). The stack shall be fabricated from not less than 1/4 inch steel plate, and shall have a weather hood and clean out and drain connections. The stack will be self-supporting and will be designed for a horizontal wind load of 40 kg/m² and seismic forces for zone 3 UBC. Aerodynamic vibrations need not be considered if

the stack has an L/D_R ratio less than 10 and a $W/L D_R^2$ ratio in excess of 400 kg/m³ (20 lbs/ft³) in which:

L = Total tower height, (m).

D_R = Average inside diameter for top half of structure, (m).

W = Erection weight, (kg).

If either of these two criteria are not met, the vendor is responsible for vibratory behavior of the stack up to the maximum wind velocity expected at the jobsite.

4.3.2.2 The stack shall be furnished to a height of sufficient size to carry away all flue gases and overcome all stack and duct losses.

4.3.2.3 The combustion and venting system shall be designed to maintain the flue gases at temperatures sufficiently above the dew point to prevent condensation throughout the design operating range.

4.3.3 Boiler tapings

ANSI flanges shall be supplied as standard where applicable. Threaded connections shall be NPT,

DIN or BS as instructed.

4.3.4 Forced draft blower

Each burner shall be provided with one forced draft blower with constant speed drive, inlet control damper and screen.

4.3.5 Burner & piping

For selection of proper burner units' reference is made to burner specification requirements part II. The fuel supply, piping, tubing and fittings shall be rigidly supported.

4.3.6 Noise level

Noise level shall be based on ABMA test procedure for the measurement of sound level from boiler units.

Manufacturers shall have available fan inlet silencer for reduction of decibels dB (A) as specified in the data sheet.

Note:

1) For overall noise level limitation reference is made to [IPS-G-SF-1.1](#) (Noise & Vibration Control). For consideration of minimum noise level the relevant pages of subject standard shall be attached.

4.3.7 Accessories:

Per job requirements the manufacturer shall be responsible to provide supply of accessories, such as:

- Feed water pump.
- Main steam stop valve.
- Blow down valve.
- Stop & check valve.
- Alarm for flame failure and low water level.
- Remote oil pump.

4.3.8 Welding

Welding procedures, processes, welders and welding equipment shall be qualified in accordance with the ASME boiler and pressure vessel code.

The manufacturer shall submit all welding procedures to the purchaser for approval prior to issuing final drawings.

PART II

BURNER-SPECIFICATION REQUIREMENTS

A. BURNERS (FUEL BURNING EQUIPMENT)

A.1 Capacity Conditions

Burners for packaged firetube and cast iron boiler shall meet manufacturer's standard capacity or shall conform to the following capacity conditions:

- Upto 40000 kcal/h per UL code.
- Above 40000 kcal/h per FIA code.

A.2 General Conditions

A.2.1 The fuel burning equipment shall be capable of meeting all operating conditions as specified in the data sheet.

A.2.2 The burner shall be of rugged construction and capable of maintaining a stable operation over the complete load range without continuous pilots.

A.2.3 The burner shall have observation port to permit sighting and inspection.

A.2.4 In combination dual fuel fired units; the changeover from one fuel to the other shall be accomplished by means of an automatic or manual fuel selector switch in the control cabinet.

A.2.5 Burner nozzles and other parts exposed to the radiant heat of the furnace shall be made of heat resisting alloy steel.

A.2.6 The energy released by the igniters and pilots shall be compatible to the specified fuels. The igniters shall be supplied complete with air-cooled high-tension transformers.

A.2.7 The burner location and firing method shall be such that combustion takes place within the water backed or refractory-backed furnace of the boilers, maintaining a low NOx level.

A.2.8 The burner shall be completely factory wired, assembled and fire tested ready for hook-up to fuel and electrical supplies.

A.2.9 The burner of the firetube boilers shall contain, but not necessarily limited to, the following interlocks.

- a) Operating pressure control for automatic start and stop of burner operation.
- b) Two low water cut-off probes to cause shutdown of unit when water level drops to minimum safe level, (one in the water column and one in the boiler shell).
- c) An auxilliary contact for a feedwater pump shall be included.
- d) Gas fired burner shall have an air safety switch to prevent operation until sufficient combustion air is assured.
- e) A flame safeguard to provide full protection against flame failure.
- f) Burner motor controller shall have thermal over-load and under voltage protection.
- g) A limit control to limit steam pressure or hot water temperature; all controls to be panel mounted and so located on the boiler as to provide ease of servicing the burner and boiler without disturbing the controls; and also located to prevent possible damage by water, fuel or heat of combustion gases.

A.2.10 The gas-fired burners shall be available for use with natural gas as specified in the data sheet.

8.2.11 For the fuel oil burner, a direct driven oil pump with a capacity of approx 120% maximum burning rate shall be furnished.

8.2.12 The draft fan shall be forced draft type, powered by a suitable blower motor, complete with suitable instrumentation to control the airflow over the range of boiler operation.

8.2 Burner Management Controls

8.2.1 General

The control system for packaged firetube boilers shall be suitable for single burner operation. These shall be suitable on applications for burner sequences, line voltages, ultra-violet and ionisation detection system with flame scanning choice based on fuel compositions and relevant safety codes.

8.2.2 Solid state management control

8.2.2.1 The solid-state management controls shall be available for automatic ignition of oil or gas burners.

8.2.2.2 The control shall cycle automatically when the operating control closes and following a power interruption, capable for manual reset following a safety shutdown.

8.2.2.3 The start-up programming shall include a safe start check on each start. When detecting flame signal (real or simulated), the ignition shall not be energized when safety lockout occurs.

8.2.2.4 For increased safety and reliability an autocheck ultraviolet or infrared amplifier (using flame pulsing or scanner method) shall be available to check the function of the flame detecting system for any component failure during each burner firing cycle.

8.2.3 Microprocessor based control

8.2.3.1 The system shall be designed to provide the proper burner sequencing and flame monitoring on automatic burners, single or dual-fired, direct spark or pilot ignited burners.

8.2.3.2 It shall comprise of non-volatile memory and different scroll (minimum 20) messages in its Message Center (built-in or remote use).

8.2.3.3 The Message Center shall indicate in English language, the program sequence and reasons of alarm, burner shutdown etc.

8.2.3.4 For humid areas the control panel shall be furnished with over load and short-circuit protection and shall be epoxy coated inside out.

8.2.3.5 The applicable NEMA standard classification code for flame safety control enclosures shall apply per job requirements.

PART III
INFORMATION REQUIRED WITH VENDOR'S PROPOSAL

1. INFORMATION REQUIRED WITH VENDOR'S PROPOSAL

1.1 The Vendor's proposal shall specify, but not necessarily be limited to, the following:

- a) Performance guarantee at rated capacity.
- b) Moisture carry-over at the guarantee point.
- c) Predicted maximum continuous capacity when firing the specified fuel(s).
- d) Total heating surface.
- e) Complete description of firing equipment and combustion controls with schematic diagram and bill of materials.
- f) Detailed description of refractory and insulation including materials used and thickness of such materials.
- g) Boiler trim, valves and fittings included. The set pressure of safety valves shall be given.
- h) Dimensions and weights (dry & operating) of the complete unit and of all major items.
- j) Equipment removed to shipping clearances or necessary weight reduction.
- k) Maximum acceleration of output upon demand. Minimum acceleration of output in the range from 70 to 100 percent capacity.
- l) Outline drawing and foundation loading diagram.
- m) Material used in boiler.
- n) Corrosion allowance used in the design of boiler.
- o) Turndown ratio.
- p) Detailed description of combustion bypass arrangement including sealing method and materials.
- q) Flue gas outlet temperatures from the boiler and in the stack at the minimum, normal and maximum operating conditions.
- r) The following noise level data:
 - 1) Noise levels in dB(A) and in octave bands at the specified locations. ABMA test procedures are acceptable.
 - 2) Noise levels shall be based on measurements on identical or very similar equipment operating under comparable conditions. Details of noise measurements, equipment tested and operating conditions during the test shall be stated. Any adjustments made to noise measurements to allow for differences between equipment tested and equipment offered shall be stated.
 - 3) Where equipment noise levels are calculated using theoretical formula, the source of the theoretical data and the calculations will be supplied.
 - 4) Noise level measurements shall be made using a sound level meter and octave band analyzer.
- s) All modifications to standard equipment required meeting the specified noise limits. The additional cost of any such modifications (if required) shall be stated separately.
- t) The vendor shall specify the earthquake load on the strength of unit structural.
- u) Allowable stresses for all plate material used in the vent stack.

1.2 Inspection

The vendor shall submit (four) copies on each of the following reports to the owner.

- 1) Manufacturer's data report as defined by the ASME boiler and pressure vessel code.
- 2) Material test certificates giving chemical and physical properties of all material used in fabrication. Each certificate is to be properly identified with part description or number.
- 3) Stress relieving charts.
- 4) Pressure test charts.
- 5) Nameplate rubbings.

Each of the above shall be clearly identified with the owner's item number.

1.3 Terminals

All piping and wiring shall terminate at one central location where purchaser will make tie-ins.

1.4 Schedule of documents to be furnished by the vendor shall be as per following table 1.

TABLE 1 - SCHEDULE OF DOCUMENTS TO BE FURNISHED BY VENDOR

| ITEM | DESCRIPTION (REFER TO SUPPORTING NOTE) | PRINTS REQUIRED WITH QUOTATION | | CERTIFIED INFORMATION REQUIRED | | |
|------|---|---|-----|-----------------------------------|-------------------|--------------------------------|
| | | | | No. OF COPIES | | DATE NEEDED (SEE NOTE 4) |
| | | | | TRANSP AGENCY | PRINTED MATTER | |
| * 1 | DIMENSIONAL OUTLINE DRAWINGS | | YES | | 3 | ARC-4 |
| * 2 | FOUNDATION PLAN / ANCHOR BOLT LOCATION | | | 1 | 3 | ARC-4 |
| * 3 | GENERAL ARRANGEMENT DRAWINGS | | | 1 | 3 | ARC-1 |
| * 4 | SECTIONS AND DETAIL DRAWINGS | x | | 1 | 3 | 4 B/M |
| 5 | MILL TEST REPORT | x | | 1 | 3 | ON M/O |
| * 6 | WELDING PROCEDURES & QUALIFICATIONS | x | | --- | 3 | 4 B/M |
| * 7 | CALCULATIONS FOR PRESSURE VESSELS | | | 1 | 3 | 1 B/M |
| 8 | MANUFACTURERS REPORTS CODE CERTIFICATION | | | 1 | 3 | 1 ALT |
| * 9 | P & I DIAGRAMS | x | | 1 | 3 | ARC-4 |
| * 10 | INSTRUMENT CONTROL DRAWINGS | x | YES | 1 | 3 | ARC-1 |
| * 11 | WIRING DIAGRAMS AND CIRCUITRY | | | 1 | 3 | ARC-1 |
| * 12 | HOOK-UP DIAGRAMS | | | 1 | 3 | AS REQUIRED |
| 13 | VALVE SCHEDULE | x | | 1 | 3 | ARC-4 |
| * 14 | INSTRUMENT SCHEDULE | x | | 1 | 3 | ARC-4 |
| 15 | PRELIMINARY DRAWING LIST | | YES | 1 | 3 | ARC-4 |
| * 16 | RECOMMENDED SPARE PARTS WITH PRICES | | | --- | 3 | --- |
| * 17 | COMMISSIONING SPARE PARTS WITH PRICES | | YES | 1 | 3 | --- |
| 18 | PERFORMANCE DATA & CURVES | | YES | 1 | 3 | ARC-1 |
| 19 | OPERATING & MAINTENANCE MANUAL | | YES | 1 | 10 | 1 A/T |
| 20 | FULLY COMPLETED BUYER S DATA SHEET | | | --- | 3 | ARC-1 |
| 21 | INITIAL / FINAL PRODUCTION SCHEDULE | | YES | 1 | 3 | ARC-4 |
| 22 | HAZARDOUS AREA CLASSIFICATION | | YES | --- | 3 | ARC-4 |
| 23 | CERTIFICATIONS | x | | 1 | | 1 A/T |
| * 24 | NOTARISED TEST CERTIFICATES | | | 1 | 3 | 4 B/T |
| 25 | PAINTING SCHEDULE | | | 1 | 3 | AS REQUIRED |
| | LIST OF SUB-MANUFACTURERS | | YES | | | |

Notes:

1) Categories preceded by an asterisk are to be submitted for approval.

2) Each drawing/document must show job title, job order no. and tag numbers.

3) Drawings/documents required with quotation to be sent in same number of copies as quotation.

4) Abbreviations defined as follows:

ARC-After receipt of commitment (in weeks).

A/T-After test.

M/O-Material order.

X-Key documents.

B/M-Before manufacturing.

B/P-Before painting.

B/T-Before test.

PART IV GENERAL REQUIREMENTS

1.1. GENERAL REQUIREMENTS

1.1.1 Packaging and Shipment

The manufacturer shall be responsible to pack all units suitable for export, protected against all damages or defects which may occur during handling, ocean shipment, overland shipment and shall meet the purchasers general conditions of purchase, including:

- a) All exposed steel and flanged faces shall be thoroughly applied with rust preventive coatings.
- b) The exposed parts including threads and bolts shall have a metallic base coat with water-resistant lubricant/ grease.
- c) The overall exposed metal surfaces shall be suitably protected and conform to IPS painting standard [IPS-E-TP-100](#).
- d) All open-end pipe coupling, flanges and tapings shall be protected with air tight gasket sheets.
- e) Necessary bracings and reinforced supports shall be provided to withstand any abusive shipping route.

1.1.2 Transit & Storage

1.1.2.1 Vendor shall provide adequate shipment preparation and protection as per owners' instructions for equipment and materials against mechanical damage and against corrosion and deterioration during transit and due to either direct or indirect exposure to climatic conditions (including sunlight and salt water sprays) for up to eighteen months storage at site.

1.1.2.2 Fragile pieces of equipment shall be separately boxed and secured by fastening, strapping, bolting or other suitable measures to prevent shipment damage.

1.1.3 Service Engineer

The vendor shall state the number of man days included in his quotation, or the recommended number of man days and per diem rate, for the services of an authorized and competent engineer to inspect the boiler installation, supervise burner and combustion control adjustment, start up, and instruct operating personnel.

1.1.4 Efficiency Guarantee

Steam boilers shall have minimum radiation and convection losses (to be specified by the manufacturer) at full load boiler rating. Fuel to steam efficiency shall be guaranteed to be a minimum of 80 percent from 90 percent to 100 percent full rating.

1.1.5 Spare Parts

A recommended list of spare parts for 3-years' operation including a complimentary supply of gaskets, fuses, indicating lights, gage glasses etc. A more comprehensive list including such major components as flame safeguard control, pressure controls, damper motor, oil nozzle, flame detector, gas/oil pressure regulator etc. shall be quoted and submitted with equipment quotation.

10.6 Proprietary Items

The manufacturer shall clearly identify all proprietary items.

10.7 Reject Clauses

The equipment will be rejected if measurements, data figures and inspection reveal any discrepancies between quoted figures resulting in the purchase order and those measured actually.

10.8 Tests

10.8.1 The unit and its components shall be factory tested under load and environmental (as specified in data sheet) conditions and as required by the relevant standards, all dimensional, operational and limit checks shall be carried out and verified.

10.8.2 The owner shall remain at liberty to inspect all tests visual/dimensional and functional. The tests shall include a hydrostatic test in the presence of the Company's authorized representative.

10.8.3 Proper operation of the boiler and all controls shall be assumed by filling the boiler with water and test firing at the factory. Test firing shall include checking of safety controls for proper operations.

10.8.4 The following tests shall be carried out:

a) All mechanical equipment and safety controls shall be factory tested and test certificates supplied with the units.

b) After installation performance tests shall be carried out on each installation to verify the heating, and air change requirements. Should the performance and noise level not meet the requirements of this standard, the supplier shall, at no extra cost, replace or rectify the installation or parts thereof to meet all clauses of this specification and to the satisfaction of the purchaser's appointed supervisory engineer.

10.9 Nameplate

10.9.1 A stainless steel nameplate in English language shall be supplied showing the purchase order number, year of manufacture, factory order no., model and serial no. And relevant technical data and code references. Motors and auxiliaries shall have their individual nameplates securely attached at proper locations.

10.9.2 A second plate 20 x 70 mm reserved for the purchaser shall be screwed to the unit engraved as follows:

| |
|---------------|
| NIOC NO |
|---------------|

10.10 Warning Plates

Warning plates when required shall be in English language and attached to the boiler in a prominent location as follows:

- In the event of critical condition of boiler indicate "CAUTION-DO NOT WELD, CHIP, BURN OR ALLOW ARC STRIKES ON THIS EQUIPMENT".
- Warning plate shall be provided where equipment failure may occur as a result of normal maintenance, operation or testing.

10.11 Guarantee

All equipment and component parts shall be guaranteed by vendor against defective material, design and workmanship when operated under normal condition for 12 months after being placed in specified service but not exceeding 18 months after date of shipment. If any malperformance or defects occur during the guarantee period, vendor shall make available repaired, altered or replacement parts free of any charges, direct on the purchaser's job site. Vendor shall make available free of charge qualified representatives as deemed necessary to supervise the removal, repair and replacement of the defective parts in such a manner that the guarantee be maintained.

The guarantee period for repaired or replaced parts shall be 12 months after start up of repaired equipment but not more than 18 months after the repaired parts and equipment are shipped.

10.12 Site Conditions

10.12.1 The manufacturer shall clearly specify the accessories required for field erection duly supported by pertinent drawings.

10.12.2 Any correction and deration factors to meet site conditions shall be clearly specified by the manufacturer.

PART V DATA SHEETS

۱۱. DATA SHEETS

The manufacturer of steel and cast iron boilers shall be furnished with site data sheet together with relevant data sheets.

As required by the provisions of ASME Code, the firetube boiler manufacturer shall be responsible to fill the data sheet blanks duly supported by certificate of compliance with ASME.

As an alternate the manufacturer may submit the duly filled ASME Form P-۲ (E ۰۰۰۶۸) clearly indicating the date of section ۱ edition under which the boiler was constructed.

The data sheet for cast iron boilers shall be as shown in ۱۱.۴ of this Standard.

۱۱.۱ Site Data Sheet (to be provided by purchaser)

a) AMBIENT TEMPERATURE:

- SUMMER Max. ----- °C DB ----- °C WB
Min. ----- °C DB ----- °C WB
- WINTER Max. ----- °C DB ----- °C WB
Min. ----- °C DB ----- °C WB
- SITE ELEVATION ----- METER ABOVE SEA LEVEL

b) WIND VELOCITY -----Km/h

c) TYPE OF BUILDING -----

d) ENVIRONMENT:

- DUSTY -----
- SALIEROUS -----
- OTHRs -----

* e) MAXIMUM INTENSITY OF EARTHQUAKE...-----RICHTERS

f) AVAILABLE SERVICES:

- POWER SUPPLY----- V ----- Ph ----Hz
- HEATING WATER:
FROM CENTRAL SYSTEM
FROM CITY WATER SOURCE
- FUEL:

g) AREA CLASSIFICATION -----

h) JOB DESCRIPTION -----

۱۱.۲ Data Sheets for Firetube Steel Boilers (To be filled by manufacturer)

A) GENERAL

MANUFACTURED..BY.....

MANUFACTURED FOR

PROJECT ----- LOCATION

* Earthquake belt of Iran is located in zone ۳.

ORDER No. ----- CUSTOMER-----FACTORY
 TYPE ----- YEAR BUILT-----
 CERTIFICATE NO. ----- DRAWING No. -----
 NOISE LEVEL dBA -----
 MAX AWP ----- kPa
 HEATING SURFACE -----m²
 TOTAL WEIGHT (Kg) ----- DRY ----- WET
 GASKET----- MATERIAL ----- THICKNESS
 OVERALL LENGTH OF BOILER-----
 OVERALL WIDTH -----
 FFL TO TOP OF BOILER-----
 BURNER PROJECTION (APPROX)-----
 TUBE WITHDRAWAL AREA-----
 SUPPORT CENTERS-----
 HEIGHT TO TOP OF SAFETY VALVE-----
 STACK DIA-----
 SAFETY VALVE OUTLET (S) NB-----

B) BOILER DATA

- Boiler Shell: No.....Dia.....Length.....
 -Shell Plates
 (For each Shell state: Material Specification No. & grade, nominal thickness)
 -Longitudinal Joints.....Joint Efficiency.....
 (Seamless, Welded) (As compared to Seamless)
 -Heads
 (Material Specification No.: Thickness-Flat, Dished, Ellipsoidal-Radius of Dish)
 -Girth Joint (s).....No. of Shell Courses
 (Seamless, Welded)
 -TubesheetTube Holes
 (Mat'l Spec., Grade, Thickness) (Dia.)
 -Boiler Tubes: No.
 (Mat'l Spec., Grade) (Straight or Bent)
 -Dia.....Length.....Gage
 (If various, give max. & min.) (or thickness)
 -Furnace No.Size.....Length, each sectionTotal
 (O. D. or W x H)
 -Staybolts: No.Size
 (Diam., Mat'l . Spec. Grade, Size Telltale, Net Area)
 -Pitch.....Max. AWP.....psig.
 (Hor. and Vert.)

-Openings: (a) Steam.....(b) Safety Valve.....
 (No., Size, and Type) (No., Size, and Type)
 (c) Blowoff.....(d) Feed.....
 (No., Size, Type, and Location) (No., Size, Type, and Location)
 (e) Manholes: No.Size.....Location
 (f) Handholes: No.....Size.....Location
 -Boiler Supports: No.....Type.....Attachment
 (Saddles, Legs, Lugs) (Bolted or Welded)

-Shop Hydrostatic Test.....kpa

11.3 Data Sheet for Burners (For packaged firetube boilers)

BURNER MODEL
 BURNER FUEL FUEL OIL FUEL GAS COMBINATION
 TYPE AND CAPACITY OF
 TYPE OF BURNER PRESS ATOM AIR ATOMIZATION
 CONFIGURATION BASEMOUNT FLANGE MOUNT
 FIRING SEQUENCES ORIFICE DIA
 TYPE OF IGNITION SYSTEM GAS / ELECTRIC DIRECT SPARK
 BURNER BLOWER.....HP
 OIL PUMPHP
 AIRHP
 ELECTRIC OIL HEATER.....KW
 APPROX BURNER DIMENSIONS:.....L..... WH
 WT OF BURNER (kg)
 ELECTRICAL CHARACTERISTICV.....Ph.....Hz

Note:

Weight of Gas train and air compressor shall not be included in the Burner weight.

11.4 Data Sheet For Cast Iron Boiler

PROJECT
 ORDER NO.CUSTOMER.....FACTORY
 MANUFACTURER.....MODEL No.
 SITE ELEVATION..... METER ABOVE SEA LEVEL
 SITE ENVIRONMENT..... DUSTYSALIFEROUS
 TECHNICAL DATA
 NO. OF SECTIONS.....
 OUTPUT RATING kW (Btuh)Mcal/h
 DESIGN RATINGSBAR (Psig)°C (°F)
 FLUE GAS VOLUME AT 200°C TEMP (392 °F) m³ /h
 FLUE GAS RESISTANCE mm(Inch)

FLUE GAS OUTLET SIZEcm(Inch)

MIN WATER VOLUME (m^3/h)

AT DELTA T 10°C

AT DELTA T 15°C

AT DELTA T 20°C.....

HYDRAULIC RESISTANCE (mm/wg)

AT DELTA T 10°C

AT DELTA T 15°C

AT DELTA T 20°C

BURNER DATA

TYPE OF BURNER

TYPE OF FUEL..... GAS OIL.....GAS COMBINATION

FAN MOTORTYPE.....HP

ELECTRICALV.....PhHz

BOILER BLOCK DIMENSION (mm)

WITH CASING.....L.....W.....H

WITHOUT CASING.....L..... W.....H

BOILER WEIGHT (kg).....DRYWET

SPECIAL FEATURES

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