

## SECTION 155XX

### FACTORY PACKAGED FIRE TUBE BOILER

#### 1.01 CODE REQUIREMENTS

- A. The package boiler(s), its installation, and all equipment associated with the operation of the system shall comply with all applicable codes. The contractor is cautioned that all aspects of the installation shall meet the requirements of:
1. A.S.M.E. Section IV, ANSI/ASME CSD-1A latest revision.
  2. National Fire Protection Agency.
  3. Underwriters Laboratories.
  4. Local DEP Code.
  5. Local Utility.
- B. The installation and any modifications shall be in accordance with the practices recommended by the American Society of Heating, Refrigeration, and Air Conditioning Engineers.
- C. The boiler(s) shall be designed and build to comply with the latest ASME (Section IV) Code Rules for Construction of Heating Boilers for \_\_\_ PSIG steam or hot water working pressure and be inspected and stamped by an authorized boiler inspector.

Section Instructions:

*C - Design pressure:            Select Steam or Hot Water  
   Steam up to 15 PSIG  
   Hot Water up to 160 PSIG*

#### 1.02 GENERAL BOILER DESIGN

- A. The unit(s) shall be three-pass waterback scotch marine design, horizontal firetube(s) boiler with a minimum of five square feet of fireside heating surface per boiler horsepower. The boiler(s) should be UL labeled as a package.
- B. The package shall consist of a boiler, boiler fittings, burner, safety controls and accessories; all piped, wired and assembled on a structural steel base. The unit(s) shall be a complete ready for connection of electrical, water, blowdown and fuel.
- C. The rear combustion chamber shall be full submerged within the boiler water. The boiler(s) shall have two separate rear tube sheets. The combustion chamber tube sheet and rear tube sheet are to have only one inside and outside surface temperature to eliminate stresses and prevent ligament cracks.
- D. Connections for bottom blowoffs shall be supplied on both ends of boiler shell. Sufficient handholes and manholes for thorough inspection and cleaning shall be provided. Front and rear doors shall be davited. Stack thermometer, front and rear observation ports as well as combustion relief doors shall be provided.
- E. The boiler(s) shall be factory insulated with 2" thick fibrous insulation, covered by a sheet metal jacket. Insulation shall be provided on boiler shell and rear head. The entire boiler, base and

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other components shall be painted prior to shipment using hard finish enamel.

**1.03 BOILER CAPACITY**

- A. The unit(s) shall be EASCO series \_\_\_\_, model \_\_\_\_- 000- \_\_\_\_, packaged steel firetube boiler(s), with a nominal rated capacity of \_\_\_\_\_ HP. The boiler(s) shall have a maximum gross output of \_\_\_\_\_ Lb/Hr of dry saturated steam from and at 212 Deg. F or \_\_\_\_\_ MBH when fired with the specified fuel. The heat release of the unit(s) shall not be more than \_\_\_\_\_ BTU per Cu. Ft. when operating at the rated capacity.

*Section Instructions:*

A - Model Nomenclature:                   XXX-YYY-ABBB  
  XXX - Boiler Series (SM4, FST or ESP)  
  YYY - Nominal Boiler Horsepower  
  A - Medium "S" steam, "W" hot water  
  BBB - Design pressure 015 PSIG to 160 PSIG

**1.04 BOILER TRIM**

- A1. Low Pressure Steam 15 PSIG:
1. ASME safety relief valve(s).
  2. Steam pressure gauge, 0-30 PSIG.
  3. Combination water column with low water cutoff and feed pump control.
  4. Auxiliary manual reset low water cutoff probe type.
  5. Operating pressure control.
  6. Manual reset high limit pressure control.
  7. Modulating pressure control (if applicable).
  8. Low fire hold switch.
- A2. Hot water 30 PSIG:
1. ASME safety relief valve(s).
  2. Combination pressure/temperature gauge, 0-60 PSIG.
  3. Low water cutoff manual reset.
  4. Operating temperature control.
  5. Manual reset high limit temperature control.
  6. Modulating temperature control (if applicable).
  7. Low fire hold switch.

*Section Instructions:*

A - Boiler Trim:                               Select upon application for A1-steam or A-2 hot water.

**1.05 BURNER EQUIPMENT**

\*\*\* PRESSURE ATOMIZING \*\*\*

- A1. Packaged boiler unit(s) should be equipped with UL labeled gas burner(s), having a rated

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capacity to burn \_\_\_\_\_ MBH of \_\_\_\_\_ gas at a pressure of \_\_\_\_\_ in. w.c. at inlet to the burner gas train.

- A2. Packaged boiler unit(s) should be equipped with UL labeled oil burner(s), having a rated capacity to burn \_\_\_\_\_ GPH of #2 fuel oil.
- A3. Packaged boiler unit(s) should be equipped with UL labeled combination gas/oil burner(s), having a rated capacity to burn \_\_\_\_\_ MBH of \_\_\_\_\_ gas at a pressure of \_\_\_\_\_ in. w.c. at inlet to the burner gas train or \_\_\_\_\_ GPH of #2 fuel oil.
- B. The burner(s) shall be Gordon-Piatt Turbo-Ring forced draft type, model \_\_\_\_\_. All combustion air shall be furnished by the burner fan which shall be an integral part of the burner.
- C. The burner(s) shall incorporate a stainless steel flame retention type combustion head for long life and efficient operation.
- D. The burner(s) are to be equipped with an external primary-secondary air ratio adjustment, in addition to the total air volume and adjustment such that it will be possible to adjust both the total air, and primary air-secondary air ratio, without dismantling the burner.
- E. A permanent observation port shall be provided in the burner to allow observation of both the pilot and main flame.
- F. Supply voltage available will be \_\_\_\_\_ volts, \_\_\_\_\_ phase, 60 hertz. All motors to be suitable for use on this voltage. All burner controls are to be for use on 120 volts, 1 phase, 60 hertz.

*Section Instructions:*

*A - Fuel: Select upon an application A1-gas, A2-fuel oil #2 or A3-combination gas/oil#2.*  
*B - Burner selection: Insert appropriate burner model selection see appendix*  
*F - Insert available voltage.*

**1.06 OIL SYSTEM COMPONENTS**

- A. The oil burner shall be designed for automatic operation when burning #2 fuel oil and shall burn the specified quantity of fuel without objectionable vibration, noise, or pulsation with not more than 20% excess air and a maximum of No.2 smoke as measured on the Bacharach Scale.
- B. A remote mounted two-stage oil pump shall be provided for the burner(s).
- C. Two approved automatically operated safety shutoff valves shall be provided in the oil supply line to the burner(s), valves to be piped in series but wired in parallel.
- D. Supply an oil pressure gauge to indicate the discharge oil pump pressure.
- E. Install a manual gate valve, fuel oil filter or strainer and vacuum gauge on the suction side of the oil pump.
- F. Install a fusible-link-actuated oil safety shutoff valve in the oil supply line between the oil tank and the manual gate valve at the oil pump.

- G. Oil pressure supervision shall be provided by an approved pressure switch interlocked to accomplish a non-recycling safety shutdown in the event of low oil pressure.

*Section Instructions:*

*Use this section for fuel oil#2 and combination gas/oil#2 applications.*

**1.07 GAS SYSTEM COMPONENTS**

- A. The gas burner(s) shall burn the specified quantity of fuel without objectionable vibration, noise or pulsation with not more than 20% excess air and no CO in the products of combustion.
- B. The gas train piping shall include a ¼” NPT pressure tapping with ¼” pipe plug upstream and downstream of each valve and regulator in the gas train.
- C. The gas burner(s) shall be equipped with \_\_\_\_\_ “ pre-piped and pre-wired main gas train consisting of:

(Up to 100 BHP)

1. Main gas cock.
2. Main gas pressure regulator.
3. Motorized safety shutoff valve with proof of closure.
4. High gas pressure switch.
5. Low gas pressure switch.
6. Butterfly gas valve (for full modulation burner(s) only).
7. Leakage test cock.

(125-250 BHP)

1. Main gas cock.
2. Main gas pressure regulator.
3. Motorized safety shutoff valve with proof of closure.
4. Auxiliary motorized safety shutoff valve.
5. High gas pressure switch.
6. Low gas pressure switch.
7. Butterfly gas valve.
8. Leakage test cock.

(300-1000 BHP)

1. Main gas cock.
2. Main gas pressure regulator.
3. Motorized safety shutoff valve with proof of closure.
4. Auxiliary motorized safety shutoff valve.
5. Normally open vent valve.
5. High gas pressure switch.
6. Low gas pressure switch.
7. Butterfly gas valve.
8. Leakage test cock.

*Section Instructions:*

*Use this section for gas and combination gas/oil#2 applications.  
C - Insert appropriate gas train size, select gas train base on BHP.*

**1.08 BURNER CONTROLS.**

- A. A factory pre-wired control panel should be supplied with the burner(s). Control panel may be mounted on burner, on adjacent wall, or on floor stand near burner.
- B. The panel shall include but not be limited to the following items:
  - 1. Control switch.
  - 2. Manual potentiometer and switch.
  - 3. Motor starters with thermal overload protection for each three phase motors.
  - 4. Honeywell model RM7800L combustion control with UL scanner.
  - 5. Control circuit transformer.
  - 6. (7) Indicator lights for: "power on", "call for heat", "ignition", "fuel on", "pilot failure", "low water" and "main flame failure".
  - 7. Manual fuel selector switch.
  - 7.1 Automatic fuel selector switch, controlled by the outdoor temperature.

*Section Instructions:*

*B - Use item 7 or 7.1 for combination gas/oil#2 burners.*

**1.09 DRAFT CONTROL**

- A1. There shall be provided and installed on the boiler(s) breeching a barometric draft control. The control shall be of the industrial type and shall have a free area equal to the cross sectional area of the boiler breeching.
- A2. An electric sequencing type draft control shall be provided and installed, complete with damper motor and linkage, draft gauge to measure overfire draft, low draft switch, diaphragm type draft sensing element and sequence relay. Sequencing shall provide for full open boiler damper purge prior to main burner ignition, damper modulation during burner operation to maintain constant overfire draft, open damper during post-purge and close damper during burner of period. In addition to the above sequencing requirements, the boiler damper shall return to an adjustable starting position for burner ignition before switching to damper modulation during burner operation. The sequencing draft control should be Gordon-Piatt model \_\_\_\_\_.

*Section Instructions:*

*A - Use A1 for a barometric draft control, A2 for an electric sequencing draft control. The above section, should be omitted in its entirety where boiler(s) will be supplied with stacks of 15 ft. high or under. On stacks of 30 ft. or higher, a draft control will definitely be required.*

## **1.10 LEAD-LAG BOILER SEQUENCING CONTROL SYSTEM**

**\*\*\* FOR MULTIPLE BOILER INSTALLATIONS ONLY \*\*\***

- A. Provide and install as a part of the burner control systems a Lead-Lag Boiler Sequencing Control System. The system shall be the Gordon-Piatt model \_\_\_\_\_, for a (\_\_\_) boilers. It shall be of the proportioning timed response type functioning in response to variations to the main header pressure or temperature.
- B. A drop in the main header pressure or temperature shall cause a single header mounted transducer to supply a proportioned signal to the wall mounted master controller. The master control will then, in a timed response, call the boilers on the line in sequence in proportion to the amount of variation. An adjustable timer is energized when a boiler is added to allow the effect of increased firing rate to be realized by the system before adding additional boilers.
- C. The master control shall further control the burner firing rate motors directly to provide modulated firing proportional to the controlled medium variation from the desired operating point. All burners shall modulate in unison when on the line. As the demand decreases, the master controller shall turn off the burners in the reverse order of starting.
- D. The master control shall be supplied as a semi-dust tight steel enclosure for wall mounting. It shall include a lead boiler selector switch to select the lead boiler. Indicator lamps shall show which boilers are in operation.
- E. The master controller shall include a manual-auto station to allow manual positioning of the master controller and thereby manual operation of the burners, independent of the header mounted transducer.
- F. In the event of power failure, the master controller shall bring the boilers on the line in sequence after power is restored.
- G. Provide and install two each boiler mounted pressure or temperature controls on each boiler, one of which shall be the manual reset type. These controls shall be in addition to the Lead-Lag System and shall function as high limit controls.

***Section Instructions:***

*A - Insert number of boilers as well as Lead/Lag model.*

*A;B;G - pressure controls – STEAM Boilers, temperature controls-HOT WATER BOILERS.*

## **1.11 FLUE GAS RECIRCULATION SYSTEM (FGR)**

**\*\*\* LOW NO<sub>x</sub> APPLICATIONS \*\*\***

- A. Provide and install, to control the NO<sub>x</sub> level, a Flue Gas Recirculation System. The system shall be the Gordon-Piatt model \_\_\_\_\_.
- B. The Flue Gas Recirculation System shall be complete with flue gas flow control damper with actuator, flue gas manifold/frontplate, flue gas blower and motor base mounted, flue gas

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temperature limit control, flue gas proof of flow switch, flanged transition to gas duct and flue gas motor control center.

- C. When the burner fuel valve is energized, the flue gas recirculation blower starts. The Flue Gas Recirculation Blower On Lamp lights and a 10-second time delay begins. After the 10-second delay, flue gas recirculation air flow must be proven or the burner shuts down as in air flow failure.
- D. When the fuel gas recirculation temperature switch makes. An adjustable time delay begins. After the time delay, the Release To Modulate Lamp lights and the flue gas recirculation damper motor is released to modulate. The damper motor will maintain the same position as the burner firing rate motor.
- E. When the burner fuel valve is de-energized, the flue gas recirculation blower stops and the flue gas recirculation damper motor drives to the "close" position.

**1.12 SAMPLE SCHEDULE**

- A. The schedule may appear in the Specifications or on the Drawings. The following Boiler Schedule may be used as a guide.

<b>BOILER SCHEDULE</b>			<b>B- 1</b>	<b>B- 2</b>
<b>PLAN NO.</b>				
BOILER MODEL				
DESIGN PRESSURE — PSIG				
WORKING OR OPERATING PRESSURE — PSIG				
GROSS I=B=R OUTPUT — MBh				
NET I=B=R STEAM		STEAM — MBh		
		WATER — MBh		
BOILER HORSEPOWER				
INPUT	GAS — MBh			
	OIL — GPH			
COMBUSTION EFFICIENCY				
ELECTRICAL CHARACTERISTICS	VOLTS			
	PHASE			
	HERTZ			
	TOTAL AMPERES			
OPERATING WEIGHT — LB				
WATER CAPACITY — GAL				
VENT DIAMETER — INCHES				
HEATING SURFACE	FIRESIDE — SQ. FT.			
	WATERSIDE — SQ. FT.			
NOTES:				

**REFERENCES**

The following publications are useful in specifying heating boilers and accessories.

- A. American Society of Heating, Refrigerating and Air-Conditioning Engineers.  
ASHRAE: *Energy Conservation in New Building.*

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- B. American Society of Heating, Refrigerating and Air-Conditioning Engineers.  
ASHRAE HANDBOOK: *Fundamentals*.
- C. American Society of Heating, Refrigerating and Air-Conditioning Engineers.  
ASHRAE HANDBOOK: HVAC System and Equipment.
- D. American Society of Mechanical Engineers.  
ASME BOILER & PRESSURE VESSEL CODE: *Section IV, Rules for Construction of Heating Boilers*.
- E. The Hydronics Institute.  
*Operation and Maintenance Manual for Commercial and Industrial Steel Boilers*.