



**SECTION 155XX**

**STEEL FIRE TUBE BOILER**

**1.01 CODE REQUIREMENTS**

- A. The boiler unit(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. EASCO/Federal boiler(s) erection procedure shall include rigging, unloading and transport of all boiler components from delivery vehicle to boiler room concrete housekeeping pad. Boiler shall be built in place on the pad. Boiler manufacturer shall have ASME "H" stamp to provide capability for final completion of boiler erection at installation site. Boiler manufacturer shall provide field tests and services of ASME inspector for completed pressure vessel. ASME documentation shall include H2 final fabrication stamp and report furnished by boiler manufacturer.
- D. The boiler(s) shall be designed and built 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.
- E. Contractor shall field mount burner(s) and controls as well as make all necessary piping and electrical connections in compliance with manufacturer's standards, utility requirements and regulations of government authorities having jurisdiction.
- F. The boiler(s) and burner(s) shall be furnished by one supplier and shall be provided as a complete product, tested and certified to meet the design criteria. Burners submitted separately from the boiler will not be acceptable.

Section Instructions:

*A(3) – UL 2106 Field Erected Boiler Assemblies*

*C – Use for field erected installations only.*

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



*E – Use for field erected installations only.  
F – Use for field erected installations only.*

**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 completely ready for connection of electrical, water, blowdown and fuel.
- C. The rear combustion chamber shall be fully 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 hinged. Stack thermometer, front and rear observation ports as well as combustion relief doors shall be provided.
- E. The boiler(s) shall be 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 other components shall be painted prior to shipment using hard finish enamel.
- F. The boiler(s) and burner(s) shall be furnished by one supplier and shall be provided as a complete product, tested and certified to meet the design criteria. Burners submitted separately from the boiler will not be acceptable.

**1.03 BOILER CAPACITY**

- A. The units(s) shall be EASCO series XXX, model XXX-YYY-ABBB-CCC, 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  
 CCC – FEB Field Erected Boiler, PBA Packaged Boiler Assembly.  
 \*\*\* See EASCO product catalogue*

**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. Manual reset LWCO should be in strict compliant with ASME CSD-1, and should prevent automatic reset after power failure. In addition manual reset probe LWCO should be installed prefabricated manifold fitting. Direct boiler shell installation will not be acceptable.
  - 5. Solid state steam pressure sensor.
  - 6. Manual reset high limit pressure control.
  
- A2. Hot water 30 PSIG:
  - 1. ASME safety relief valve(s).
  - 2. Combination pressure/temperature gauge, 0-60 PSIG.
  - 3. Auxiliary manual reset low water cutoff probe type. Manual reset LWCO should be in strict compliant with ASME CSD-1, and should prevent automatic reset after power failure.
  - 4. Solid state water temperature sensor.

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 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 EASCO product catalogue.*

*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 1/4" NPT pressure tapping with 1/4" 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 IGNITION SYSTEM.**

- A. The burner ignition system, which will light either the main gas or oil flame, shall utilize \_\_\_\_\_ gas as the fuel source.
- B. The interruptable type spark ignited gas pilot system shall include spark ignited pilot assembly, ignition transformer, pilot solenoid valve, pilot gas pressure regulator and manual gas shutoff cock.

Section Instructions:  
*A – Natural or propane.*

**1.09 BURNER CONTROL SYSTEM.**

- A. The burner control system supplied for each burner shall be complete with a freestanding floor mounted control panel which shall house all required operating electrical components and instrumentations. The panel shall be part of complete combustion system furnished by one manufacturer/supplier. Panel submitted separately from the boiler/burner will not be acceptable.
- B. The panel shall include but not be limited to the following items:
  - 1. Control switch.
  - 2. Control circuit transformer.
  - 3. Motor starters with thermal overload protection for each three phase motors.
  - 4. Microprocessor based combustion control system with display module. Fireye E110 or approved equal.
  - 5. Microprocessor based boiler management system to interface with burner combustion control system to utilize inputs from solid state sensors. Fireye E340 or approved equal.
  - 6. Control circuit transformer.
  - 7. (7) Indicator lights for: “power on”, “call for heat”, “ignition”, “fuel on”, “pilot failure”, “low water” and “main flame failure”.
  - 8. The Draft Control switch/gauge.
  - 9. Smoke Opacity System monitor.
  - 10. Manual fuel selector switch.
  - 10.1 Automatic fuel selector switch, controlled by the outdoor temperature.



11. Panel canopy light.

Section Instructions:  
*B - Use item 10 or 10.1 for combination gas/oil#2 burners.*

**1.10 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 (mounted in the burner control panel, see 1.09B). 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 \_\_\_\_\_ or approved equal.

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.*

**1.11 BOILER SMOKE OPACITY MONITORING SYSTEM**

**\*\*\* FOR FUEL OIL AND COMBINATION GAS/OIL INSTALLATIONS ONLY \*\*\***

- A. Provide and install as a part of the burner control systems a Boiler Smoke Opacity System. The system should provide a continuous digital readout of particulate density, expressed as percentage opacity. The unit should be capable of providing alarm, indication and shutdown control.
- B. Smoke Opacity System should include hinged front panel (mounted in the burner control panel, see 1.09B) as well as light source and receiver units (mounted in the boiler breeching). The system shall be the Cleveland Series 8000 or approved equal.



## 1.12 BOILER SEQUENCING CONTROL AND MONITORING SYSTEM

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

- A. Provide as a part of the boilers installation a programmable master boiler sequencing control and management system. The lead/lag function shall be designed to service ( ) boilers. It shall be of the proportioning timed response type functioning in response to variations to the main header pressure (steam boilers) or temperature (hot water boilers). The programmable control should be password protected, to prevent alteration of system parameters by unauthorized personal.
- B. The system should be based on LonMark ® compliant programmable controller for open communication. It should have an ability to communicate via a TP/FT-10 network, enabling it to be integrated with other systems. The systems which are not compliant with LonMark ® standards, will not be acceptable.
- C. A drop in the main header pressure (steam boilers) or temperature (hot water boilers) shall cause a single header mounted transducer to supply a proportioned signal to the master boiler sequencing 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. In addition the system should have provision for outdoor temperature reset, day/night and summer/winter programming level.
- D. A master boiler sequencing control and management system shall be supplied as complete steel enclosure control panel for wall mounting and should include programmable controller with controller stored trend logs, which can be retrieved and stored in controller either on-site or through a dial-up connection. A local LCD display to access and change the application parameters, view and acknowledge alarms and monitor system status shall be provided. The controllers shall support remote access via a standard 56K modem.
- E. The control system shall provide for the capability to override automatic control with manual control by the operator from both a central PC and a local operator terminal.
- F. In the event of power failure, the master controller shall bring the boilers on the line in sequence after power is restored.
- G. In the event that the lead boiler fails to operate, the programmable controller shall automatically transfer control to the lag boiler without any requirement for changing setting.
- H. ECOLOGIC System Control and Management Workstation should be provided. Workstation should be based on IBM® compatible computer with the following minimum technical characteristics: PC-Intel Pentium® III-1 GHz clock frequency; RAM-128 MB; Hard Drive-30 GB; Modem-56Kbps data transfer; CD-ROM-40X; Diskette Drive-3.5" 1.44 MB; Display-17"Color Supper VGA 1024x768; Color Printer; Keyboard; Mouse; Operating System- Windows® 95, 98 or NT 4.0; Control, Management and Monitoring Software-TAC Vista®.



- I. Control, management and monitoring software package should be a true 32-bit application adapted to Microsoft® Windows 95/98/NT and used for system controlling and monitoring. The operator should see what is happening and can influence the basic operation directly in color graphics. The basic functions of the system should include but not limited by: Color graphics, alarm handling, access control, time control, system documentation, communication (direct, dialed), report generator, database generator and historical logging.
- J. In the event of boiler failure or any alarms activation (pilot failure, low water and main flame failure, high stack temperature etc.), ECOLOGIC System Control and Management Workstation should automatically dialup boiler operator to deliver alarm text message.

Section Instructions:

A - Insert number of boilers.

**1.13 STEAM INJECTION LOW NO<sub>x</sub> SYSTEM**

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

- A. A Steam Injection Low NO<sub>x</sub> (SI) System will be utilized to lower NO<sub>x</sub> emissions. A small amount of steam shall be injected around the outside of the combustion head and into the primary combustion zone, resulting in lower flame temperatures and reduced NO<sub>x</sub> formation. The system shall be the Gordon-Piatt model \_\_\_\_\_ or approved equal.
- B. The system should include the following key components: A steam injection manifold incorporated into the combustion head, a steam flow control valve to regulate the quantity of steam to the steam injection manifold, a steam solenoid valve to start and stop the flow of steam to the steam injection manifold assembly, a steam manifold pressure gauge, a manual steam shutoff valve, a steam strainer, a steam trap to remove excess condensate from the steam supply, a low pressure steam switch.
- C. A Steam Injection Low NO<sub>x</sub> (SI) System should be UL listed and should meet or exceed guidelines of 30 ppm, when firing natural gas.

Section Instructions:

A - Insert Low NO<sub>x</sub> burner model.



**1.14 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				
OUTPUT	GROSS I=B=R OUTPUT — MBh			
	BOILER HORSEPOWER			
INPUT	GAS — MBh			
	OIL — GPH			
COMBUSTION EFFICIENCY				
ELECTRICAL CHARACTERISTICS	VOLTS			
	PHASE			
	HERTZ			
OPERATING WEIGHT — LB				
WATER CAPACITY — GAL				
VENT DIAMETER — INCHES				
HEATING SURFACE	FIRESIDE — SQ. FT.			
HEAT RELEASE RATE	BTU/HR. CU. FT.			
NOTES:				

**1.15 AUTOMATIC WATER MANAGEMENT SYSTEM**

- A. A boiler water scale control and automatic blowdown system should be a part of each boiler package. The system should control and adjust TDS level automatically, remove existing scale and prevent scale buildup.
- B. The system should include: TDS controller with probe, magnetic water conditioner, recirculation pump, automatic blowdown valve, manual shutoff valves and water sample cock. The system shall be the EASCO model BB-120 or an approved equal.

**1.16 BOILER FEEDWATER SYSTEM**

- A. Furnish and install one \_\_\_\_\_ packaged boiler feedwater system. The system shall be designed to deliver feedwater to \_\_\_\_\_, \_\_\_\_\_ horsepower boiler(s) operated at \_\_\_\_\_ PSIG.
- B. The unit shall be equipped with \_\_\_\_\_ gallon steel receiver, mounted with adequate height to prevent pump cavitation when handling 200 Deg. F. water.



- C. A boiler feedwater system should include electrical make-up water assembly, gauge glass assembly with shutoff cocks and protection rods, and individual pump suction piping (each to include a shutoff valve and strainer).
- D. The unit has to be equipped with \_\_\_\_\_ boiler feed pumps, each having a capacity of \_\_\_\_\_ GPM of 200 Deg. F. water at \_\_\_\_\_ PSIG. Each pump shall include a discharge throttling valve. Pumps shall be of the vertical, centrifugal, multi-stage design of stainless steel fitted construction with stainless steel shaft and impellers.
- E. Each pump shall have a mechanical seal at 250 Deg. F. Pumps shall be removable from system without disturbing suction or discharge piping. Each pump shall be vertically mounted and coupled with coupling to a \_\_\_\_\_ horsepower, 3500 RPM, \_\_\_\_\_ volts, \_\_\_\_\_ phase, 60 hertz motor, flange mounted to pump. Motors shall be non-overloading through out the pump performance curve.
- F. A feedwater unit shall be equipped with NEMA 12 control panel consisting main disconnect switch, fuse blocks, motor starters, pump control switches (hand-off-auto), electric alternator, control circuit transformer, pump run lights, and a low water alarm horn with silencing button. Wiring to be in accordance with the National Electric Code.
- G. The boiler feedwater system shall be the EASCO model \_\_\_\_\_ or an approved equal.

Section Instructions:

*A – Duplex (two pump system to serve one boiler with one stand-by pump), triplex (three pump system to serve two boilers with one stand-by pump), quadruple (four pump system to serve three boilers with one stand-by pump). Number of boilers. Each boiler capacity (BHP). Operating pressure (PSIG).*

*B – Receiver capacity (Gallons).*

*D – Pumps quantity. Pump capacity (GPM). Pump discharge pressure (PSIG).*

*E – Pump motor capacity (HP). Pump motor electrical data.*

*G – EASCO boiler feedwater system model.*

**1.17 MANUFACTURER'S SERVICES**

- A. Services of a manufacturer field engineer who is experienced in installation, adjustment, and operation of equipment specified shall be provided. Services should include but not limited to three site visits. Field engineer shall be on manufacturer's payroll on a continuing eight hours pay basis, especially trained, and regularly rendering such services.
- B. Site visits should be conducted on the different stages of installation. That is pre-installation, during installation and prior to start up. After the visit and installation evaluation a copy of the

manufacturer written report should be presented to the project engineer, mechanical contractor as well as the owner.

**1.18 FIELD TRAINING**

- A. Field training course shall be provided for staff members. Training shall be provided for a total period of 8 hours of normal working time and shall start after system is functionally complete.
- B. Field training shall cover items contained in approved safety, operation and maintenance instructions as well as demonstrations of routine maintenance operations. Mechanical contractor should notify manufacturer in writing at least 10 days prior to training.

**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*.
- 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. American Society of Mechanical Engineers.  
ASME BOILER & PRESSURE VESSEL CODE: *Section VI, Recommended Rules for the Care and Operation of Heating Boilers*.
- F. American Society of Mechanical Engineers.  
ASME CSD: *Controls and Safety Devices for Automatically Fired Boilers*.
- G. The Hydronics Institute.  
*Operation and Maintenance Manual for Commercial and Industrial Steel Boilers*.
- H. American Boiler Manufacturers Association  
*ABMA: Packaged Boiler Engineering Manual*.
- I. American Boiler Manufacturers Association  
*ABMA: Packaged Boiler Engineering Manual*.