

LXE SAMPLE SPECIFICATION

BURNER

INTEGRATED PACKAGED BURNER

All equipment shall be supplied as a factory assembled package to be mounted on the boiler front (onsite or at the boiler manufacture's facility). All equipment, material, and supplies used in or applied to this specification shall be new and of industrial grade, readily available, and with a serviceable design and configuration. All burner equipment shall meet all current insurance requirements of IRI, and NFPA and must not be modified by the burner manufacturer to create a single source for parts supply.

The firing equipment shall be a:

Low NOx register type package combustion system that is fully modular comprised of the following modules: body assembly, register assembly, throat, forced draft fan assembly with silencer and IFGR equipment, pilot, fuel and atomizing piping trains, flame safeguard, safety limits, combustion controls, auxiliary equipment, and power equipment. The modules shall be selected based upon the design conditions as described herein. The burner shall be a Faber Burner model number _____

DESIGN CONDITIONS

SITE DATA

Location _____
Plant Elevation-Ft. Above Sea Level _____
Type of Installation _____

BOILER DATA

Manufacturer and type _____
Furnace Volume..... No less than _____
Furnace Commercial Heating Surface No less than _____
Furnace Release Rate No greater than _____
Furnace Liberation No greater than _____
Total Heat Input, BTU/HR Gas/Oil _____
Steam Capacity, PPH _____
Operating Pressure, PSIG _____
Steam Temperature, °F..... _____
Feedwater Temperature, °F..... _____
+Furnace Press @ Proposed Conditions, Inches W.C..... _____

BURNER DATA

Burner Model # _____
Windbox & Burner Press Loss, Inches W.C..... _____
Burner Excess Air @MCR, Gas/Oil, %..... _____
Turndown Gas/Oil _____
Combustion Air Temperature, °F..... _____
Code Requirements IRI, NFPA

GAS DATA

Nat. Gas Higher Heating Value, BTU/SCF..... 1000
Regulation of Gas Pressure to Gas Train by..... _____
Main Gas Train Connection _____
Regulated Gas Pressure Required to Gas Train, PSIG _____
Gas Flow, SCFH _____

OIL & ATOMIZING DATA

Fuel Oil Type..... _____
 Oil Higher Heating Value, BTU/LB _____
 Regulation of Oil Pressure to Oil Train by _____
 Oil Train Connection Size _____
 Oil Pressure Required to Oil Train, PSIG _____
 Oil Flow, GPH _____
 Type Atomization _____
 Atomizing Pressure Required, PSIG @ Unit _____

ELECTRICAL & CONTROL DATA

Electrical Equipment Rating NEMA 12
 Forced Draft Motor Data ___-HP-3600 RPM-ODP Prem. Eff.
 Forced Draft Motor - Volt, Hertz, Phase _____
 Control Power - Volt, Hertz, Phase _____
 Control Power Transformer Faber Burner Company
 Combustion Controls Furnished by Faber Burner Company
 Type Combustion Controls..... As Required
 Type Operation Automatic

PAINT & FINISH

Preparation
 External Steel..... SSPC-SP3
 Piping/Fittings SSPC-SP1
 Electrical Panels Manufacturers Standard
 Instruments Manufacturers Standard
 Conduit Manufacturers Standard

Primer & Paint:

All unprimed components are primed with Steel-it. All unpainted components are painted with Steel-it. Steel-it is industrial grade stainless steel impregnated urethane based paint

Performance And Emission Guarantees

The burner shall operate without undue pulsation or vibration throughout the turndown range.

**EMISSION
 GUARANTEES**

Not to Exceed:

	#2 Oil		Gas	
	<u>lbs/MMBTU</u>	<u>PPM</u>	<u>lbs/MMBTU</u>	<u>PPM</u>
NOx	0.115	90	0.036	30
CO	0.078	100	0.074	100

Parts Per Million (PPM) @ 3% O2 Dry

Note:

- 1) #___ Oil guarantees are based upon nitrogen content in the fuel of _____% by weight
- 2) Guarantees are from 25% to 100% boiler MCR (maximum continuous rating) only
- 3) FABER field service must be present during testing for optimization of the equipment supplied.

BODY ASSEMBLY

Heavy-Duty, 3/16" steel construction with central lifting lug, baffles for balanced airflow distribution from the forced draft fan and necessary supports for auxiliary components. A plugged pipe coupling shall be installed on the body for pressure gauge connection, and other connections as required.

VENTURI REGISTER ASSEMBLY

The body houses a Faber venturi profile (parallel flow or adjustable vane register)

Parallel flow register provides uniform combustion air flow, minimizes pressure loss, and maximizes velocity without moving parts. (Common to applications with heat inputs less than 38 MMbtu/hr.)

Adjustable vane register provides on-the-fly register air mixing adjustment to give the operator the flexibility ability to control register air swirl from laminar flow, for optimum natural gas combustion, to intermediate mixing, for optimum oil combustion. Air mixing adjustment shall be through the use of directional vanes (counter-clockwise or clockwise rotation) readily adjustable from the front of the register. (Common to applications with heat inputs greater than 38 MMbtu/hr.)

The Register Shall Be Equipped With The Following:

OIL BURNER ASSEMBLY = The register shall be equipped with a UL listed Faber _____ type oil gun _____. The oil gun shall be a two-piece body & connector system that allows for easy oil gun removal for cleaning and inspection. A vise and wrench shall be provided to aid in maintenance of the oil gun. The oil gun's burner body shall be equipped with cleanout valve to manually purge oil from the gun. The oil gun should slide into an air-cooled jacket tube.

GAS BURNER ASSEMBLY = The register shall be furnished with a centrally located gas manifold designed specifically for the conditions and pressure of the natural gas. The gas manifold shall be equipped with no more than _____ removable high temperature stainless steel gas spuds.

DIFFUSER = The register shall be supplied with a stainless steel diffuser that connects to the furnace end of the jacket tube. The diffuser can be removed by loosening a series of setscrews.

PILOT = The register shall be fitted with a Faber IAF-I220 post-mix type gas-electric ignition system designed to produce a stable ignition flame when supplied with natural gas, or propane, at the pressure recommended by the burner manufacturer. The Ignitor assembly shall be readily accessible and removable at the burner front. An ignition transformer rated at 10,000 volts AC shall energize the Ignition system. Gas shall to be supplied to ignitor by a flexible 3/21 stainless steel hose.

BURNER THROAT = The register shall be supplied with a cured refractory burner throat cast in a heavy-duty retaining ring for mounting into the boiler furnace front wall. Plastic or metal shaped throat opening is not acceptable.

REGISTER ACCESSORIES = The register shall be equipped with (2) two 2 1/2" Observation Ports with sight glass. The register shall also be equipped with a scanner ball and swivel assembly to allow for proper positioning of the flame scanner.

FORCED DRAFT FAN ASSEMBLY

The forced draft (FD) fan conveniently bolts to (the body assembly or an air duct that connects the forced draft fan and the body assembly). The forced draft fan shall be a Chicago Blower Arrangement 4 highly efficient airfoil centrifugal type design equipped with a low leakage inlet vortex vane damper for optimum air control and fan performance. The fan motor shall be, ___ HP 3600, TEFC premium efficiency type, 460 VAC / 3 phase / 60 hertz. The forced draft fan shall be equipped with a heavy-duty steel silencer/IFGR box that attaches to the inlet of the fan. The silencer/IFGR box should provide smooth and quiet burner operation. The burner manufacturer shall provide the following flue gas recirculation:

- A flanged flue gas flow control damper that is operated with an electric actuator. The actuator will receive a control signal from a controller located in the panel.
- A stack scoop to aid in the recirculation of the flue gas (installation into the stack by contractor)
- (2) Rolled Angle Flanges (For connecting ducting from scoop to damper & damper to silencer/IFGR box).

NOTE: The necessary ducting, insulation, expansion joint, for flue gas recirculation from the boiler outlet to the silencer/IFGR box is to be supplied by installers.

PIPING TRAINS

To a maximum extent, the fuel oil, atomizing steam, gas ignitor and gas piping trains shall be factory assembled, burner mounted, wired and tested, and shipped as integral parts of the burner package. These trains shall include isolation valves, strainers, steam traps, control valves, tubing to limit devices and all necessary pipe and fittings to comply with NFPA, and IRI requirements. The piping shall be arranged in a neat and accessible manner.

MAIN GAS TRAIN

The main gas train with schedule 40 pipe and 150 pound malleable fittings up to 3" size. Pipe 4" and larger to have butt-welded fittings and flanged valve connections. Train shall consist of, but not limited to, the following shipped loose components, unless noted otherwise:

Items In The Box Are Mounted On The Burner Assembly

1	Pressure Gauge – 4" dial, stainless steel case (Wika)
1	Gauge Shutoff Valves – ¼" N.P.T. needle valve
1	Gas Burner Flex Hose – 321 stainless steel construction, braided
1	Gas Flow Control Valve – (See Combustion Controls)
1	Plug Valve with Wrench – (Homestead)
1	High Gas Pressure Switch – with visible set point indication (Ashcroft)
1	Low Gas Pressure Switch – with visible set point indication (Ashcroft)
2	Gas Safety Shutoff Valves – normally closed, with proof of closure switches (Maxon)
1	Gas Vent Manual Valve – 3 Piece Full Port Ball Valve, lockable in the open position (Apollo)
1	Vent Valve – normally open, full port (ASCO)
1	Pressure Regulating Valve
2	PRV Inlet & Outlet Pressure Gauges with Shutoff Valves (Wika)

PILOT GAS TRAIN

The ignitor gas train shall be factory installed complete including schedule 80 pipe and 150 pound malleable iron fittings and wired to terminal strip. Train shall consist of, but not limited to, the following components:

- 1 Pilot Gas Flex Hose – 321 stainless steel construction, braided
- 1 Pilot Gas Shutoff Valve – Apollo, 3 piece, full port, ball valve
- 2 Pilot Gas Shutoff Valves – ASCO, normally closed
- 1 Pilot Gas Vent Valve – ASCO, normally open
- 1 Pilot Gas Pressure Regulator – American Meter
- 1 Strainer – Mueller, with 30 mesh screen
- 1 Pilot Gas Train Shutoff Valve – Apollo, 3 piece, full port, ball valve
- 1 Ignition Transformer – 10,000 VAC output
- 1 High Temperature Ignition Cable Assembly

FUEL OIL TRAIN

The fuel oil train shall be factory installed, piped with schedule 80 pipe and 300 pound steel fittings, wired to terminal strip. Train shall consist of, but not limited to, the following components:

- 1 Oil Burner Flex Hose – 321 stainless steel construction, braided.
- 1 Gauge Shutoff Valves – ¼" N.P.T. needle valve.
- 1 Pressure Gauge – Wika, 4 ½" dial, stainless steel case.
- 1 Globe Valve – Milwaukee, 300#, with replaceable seat and disc.
- 1 Check Valve – Milwaukee 300#
- 1 Oil Safety Shutoff Valve, 2 way – normally closed, with proof of closure switch (ASCO)
- 1 Oil Safety Shutoff Valve, 3 way – normally closed, with proof of closure switch (ASCO)
- 1 Gate Valve – Milwaukee, 300#, with replaceable gate.
- 1 Oil Flow Control Valve – (See Combustion Controls)

The following items are for heated oils only:

- 1 Oil Header Assembly With The Following:
 - 1 Oil temperature thermometer with well assembly– 3" dial, all SS construction
 - 1 High/Low Temperature Switch with Thermowell. NEMA 4 enclosure, installed & wired on oil header assembly, F.M. approved

- 1 Low Oil Pressure Switch – with visible set point indication (Ashcroft)
- 1 Strainer – with 30-mesh screen (Mueller) (not used with oil pump)
- 1 Oil Pump Set, Channel Mounted – Shipped loose for installation by others - Consisting of the following items:
 - a. Rotary Gear Pump – Direct Coupled to Motor (Tuthill)
 - b. 460VAC/3PH/60CY, TEFC Motor, see performance data for horsepower rating.
 - c. Oil Pressure Regulator – (Cashco)
 - d. 1" NPT Duplex Basket Strainer
 - e. ¾" x 18", 321 Stainless Steel Flex Hose, pump discharge (shipped loose)

NOTE: Oil Return line to tank required.

ATOMIZING TRAIN

The atomizing train shall be factory installed, piped with schedule 80 pipe and 300 pound steel fittings, wired to terminal strip. Atomizing train shall be designed (For Steam, For Air, For Steam and Air)

Atomizing train shall consist of, but not limited to, the following components:

(Air)

Factory piped, installed & wired, with schedule 80 pipe and 300 psig fittings, consisting of:

- 1 High Temperature Ignition Cable Assembly
- 1 Atomizing Media Flex Hose – 321 stainless steel construction, braided
- 1 Gauge Shutoff Valves – ¼" N.P.T. needle valve
- 1 Atomizing Pressure Gauge 4" dial, stainless steel case (Wika)
- 1 Low Atomizing Burner Pressure Switch with visible set point indication (Ashcroft)
- 1 Gate Valve (Milwaukee)
- 1 Check Valve (Milwaukee)
- 1 Strainer with 30-mesh screen (Mueller)
- 1 Air Compressor Channel Mounted – Shipped loose for installation by others - Consisting of the following items:
 - a. Curtis "Master Line" Air Compressor
 - b. 460VAC/3PH/60CY, TEFC Motor
 - c. Belt Guards, Sheaves, Belts, and Adjustable Base
 - d. Accumulator Tank and safety relief valve
 - e. 1" x 18", 321 Stainless Steel Flex Hose, compressor discharge (shipped loose)

(Steam)

Factory piped, installed & wired, with schedule 80 pipe and 300 psig fittings, consisting of:

- 1 Atomizing Media Flex Hose – 321 stainless steel construction, braided
- 1 Gauge Shutoff Valves – ¼" N.P.T. needle valve
- 1 Atomizing Pressure Gauge 4" dial, stainless steel case (Wika)
- 1 Low Atomizing Burner Pressure Switch with visible set point indication (Ashcroft)
- 1 Gate Valve (Milwaukee)
- 1 Check Valve (Milwaukee)
- 1 Atomizing Media Solenoid Shutoff Valve (Magnatrol)
- 1 Atomizing Media Differential Pressure Regulator (Jordan)
- 1 Low Atomizing Supply Pressure Switch with visible set point indication (Ashcroft)
- 1 Strainer with 30-mesh screen (Mueller)
- 1 Steam Separator Shutoff Valve (Milwaukee)
- 1 Steam Separator With Trap (Hayward)

NOTE: Steam to atomizing train shall not exceed 200 psig and 500F.

FLAME SAFEGUARD EQUIPMENT

The flame safeguard system shall be a Faber Burner Company Model _____
(See Faber Catalog - Examples: Faber / Allen Bradley PLC, Autoflame, Fireeye, or Honeywell)

utilizing the following components in full accordance with the recommendations of FM, IRI and NFPA. Only a flame safeguard system designed and constructed by the burner manufacture will be acceptable.

A complete fully automatic flame-failure safety-control system of the electronic type _____, including a pre-wired and factory-tested programming assembly, shall be provided. The controls shall be of the fail-safe design, where component failure within the control or the presence of actual or simulated flame prior to start-up will prevent burner operation. The flame amplifier shall be readily removable from the chassis for servicing without disconnecting any wiring. Necessary devices for automatic starting and programming of the pilot and main burner equipment shall be furnished.

The flame-failure-sensing device or devices shall operate in conjunction with an electronic relay or relays that will open the circuit to the fuel valves in not more than 4 seconds if main burner flame is not properly established or upon flame failure, and shall also actuate an alarm. The controls shall create a safety shutdown prior to energization of the main fuel valve if the pilot flame is not ignited and detected by the sensing device. This pilot-proving period shall be limited to 10 seconds. Trial for main fuel ignition shall be limited to 15 seconds for No. 6 oil and 10 seconds for natural gas. Repurging the boiler of all combustion gases by at least five (5) air changes shall be mandatory if ignition does not occur during the ignition period. Control shall recycle automatically after an operating limit control opens or after an electrical failure. A safety shutdown due to flame failure or safety limit shall require manual reset of safeguard controls before operation can be resumed and shall prevent recycling of the burner equipment. A low-fire start interlock shall be provided. (Optional This flame safeguard system shall have three water level relays for high water, low water, and low water cut-out). The components of the system shall be of industrial construction and shall consist of, but shall not be limited to, the following:

Electronic Flame Relay - For each burner. _____

Audible and Visual Alarm - Failure of any burner shall cause an alarm bell or horn to sound and a red light to be illuminated. A red light shall be provided for each burner.

Programming - All system logic and timing functions to be performed by a _____

Relays – Shall be Allen Bradley industrial type where necessary.

Indicating Lights – Shall be Allen Bradley low voltage transformer type, oil tight construction with the appropriate colored Allen Bradley lens. The flame safeguard panel shall have the following lights: Power On = White, Operating Limits = Green, Safety Limits = Blue, Ignition On = Blue, Main Fuel On = Amber, Flame/Safety Limits Failure = Red).

Flame-Sensing Device – An ultraviolet self-checking detector type shall be provided for each burner complete with suitable mounting brackets and cables for connection to the safeguard relay. The flame-sensing device shall be sensitive to a live flame only and shall not be affected by incandescent brickwork or the heat in the furnace. The sensing device shall be installed in correct position to sense the pilot flame at a point where the main flame will be ignited promptly and smoothly.

Optional Water Level Relays – This system shall include three (3) Warrick relays (high water alarm, low water alarm and low water level cutout). The relays will be mounted and wired to terminals in the flame safeguard panel, the bell will be mounted on the bottom of the control panel, the silence push-button and abnormal water level light will be mounted on the control panel front. These items to be factory wired to terminals in the panel. Field wiring to these terminals to water level probes (probes by others) to be by others. When the water level goes out of normal range, the appropriate relay will be energized which, in turn, will energize the abnormal water level light and bell. The operator can silence the bell by pushing the silence push-button. The light will remain energized until the water level is returned to normal operating range.

Annunciator – Shall be a _____ which will receive annunciation information from a _____. The _____ shall be flush mounted on the flame safeguard panel, shall be pre-wired and tested in factory, and shall annunciate the following points:

- Forced Draft Fan Failure
- Low Water
- High Steam Pressure
- Low Gas Pressure
- High Gas Pressure
- Flame Failure
- Low Oil Pressure
- Low Atomizing Steam Pressure
- Combustion Air Failure (NAF)
- High Furnace Pressure
- Low Oil Temperature (if heated oil)
- High Oil Temperature (if heated oil)

Cabinets / Wiring – Shall be in accordance with NFPA 79 (Industrial Machinery) and the manufacturer's recommendations. Insulation for all wiring shall be number coded. All wiring to circuits outside of cabinet to be connected to numbered terminal strips. No more than two (2) wires per terminal. All wiring to be minimum of 14 ga.

All mechanical switches, limit switches and valves mounted on the burner to be factory wired to terminal strips in a NEMA 12 terminal enclosure mounted on the burner. Wiring between the control cabinet and the burner terminal enclosure to be by others. Wiring between the motor starters, mounted in the control cabinet, and the motors to be completed by others.

All components in control cabinet shall be factory mounted and wired to prenumbered industrial type terminal strip. The shipped loose control cabinet shall be (equipped with legs to allow for freestanding mounting or field mounted on the boiler). Cabinets shall be constructed out of steel no lighter than 14 gauge. Cabinet shall be of NEMA 12 construction with hinged door. All items in panel front (lights, switches, controllers, etc) shall have engraved plastic nameplates, black letters on a white field.

Power Control Equipment– The following items shall be included in the control panel

- 1 Disconnect Switch- 480V, Interlocking Type
- Fan
- 1 Forced Draft Fan Fuse Holder
- 3 Type R Time Delay Fuses
- 1 Forced Draft Fan Motor Starter
- 3 Forced Draft Fan Motor Starter Overload Heaters

Compressor

- 1 Air Compressor Fuse Holder
- 3 Type R Time Delay Fuses
- 1 Air Compressor Motor Starter
- 3 Air Compressor Motor Starter Overload Heaters

Pump

- 1 Oil Pump Fuse Holder
- 3 Type R Time Delay Fuses
- 1 Oil Pump Motor Starter (Allen-Bradley)
- 3 Oil Pump Motor Starter Overload Heaters

Control Power

- 1 Control Power Fuse Holder
- 2 Type KLK 15A Control Power Fuses
- 1 1.5 KVA Step Down Transformer For Control Power 480-120V AC

(Typically the forced draft fan motor starters for burners greater than 35 MMbtu/hr are shipped loose. Shipped loose forced draft fan motor starters shall be combination type with overloads and fusible disconnect supplied in a NEMA 12 enclosure.)

SAFETY INTERLOCKS

Suitable provisions shall be made in the control circuit to shutoff the fuel supply in the event of the following:

1. Excess boiler steam pressure
2. High boiler steam pressure
3. Insufficient combustion airflow
4. Low gas pressure
5. High gas pressure
6. Low oil pressure
7. Low atomizing steam supply pressure
8. Low atomizing burner pressure
9. Ignition failure
10. Main flame failure
11. Low water level
12. High Furnace Pressure
13. Low Oil Temperature (if heated oil)
14. High Oil Temperature (if heated oil)

COMBUSTION CONTROLS

The combustion control package shall be a Faber Burner Company Model _____

(See Faber Catalog - Examples: Faber / Allen Bradley PLC, Autoflame, or Siemens-Moore)

Example

CC-SPP-EC-OO-F2-DO-OO-X. Single point electric positioning modulating type with two-element feedwater control. The combustion control system shall be complete with all piping, fittings, operating mechanisms, linkages, and accessories required for a complete fully automatic system. The control system shall consist of a boiler master controller designed to control steam pressure and actuate the air and fuel through a manual-automatic station and power unit linked to a jackshaft. The combustion control system shall automatically maintain the desired steam pressure within 2% of the set point. Burner to have heavy-duty 1" diameter jackshaft complete with a minimum of three (3) pillow block lubricateable bearings, operating levers, and mechanical linkage to connect fuel valves and FD fan inlet vortex damper. Linkage to be constructed from 3/8 schedule 80 pipe with aircraft type ends. The steam pressure transmitter shall be Siemens. The actuator shall be a Valvcon electric actuator. The combustion controller shall be Siemens-Moore Products 353.

FEEDWATER CONTROLS

The feedwater controls shall be a Faber Burner Company Model _____

(See Faber Catalog - Examples: Faber/Allen Bradley PLC, Autoflame, or Siemens-Moore)

Example:

F2. Two-element feedwater control system includes a panel mounted feedwater controller. This system also includes the following shipped loose items for field installation: drum level transmitter, steam flow transmitter and steam flow orifice plate. All controllers shall be Siemens-Moore Products 353. All transmitters shall be Siemens.

SPARE PARTS

The following spare parts must be supplied with the package burner

- One oil gun assembly
- One gas pilot assembly

FACTORY TEST

The entire package burner shall be electrically and mechanically factory tested with a boiler room simulator for operation and settings. Test results shall be logged and a copy included with the burner package. The customer can witness the test upon request.

PAINTING

Each unit will be given one (1) shop coat of primer and high temperature paint prior to shipment. (See design conditions for more details)

SUBMITTALS

Provide two (2) sets of professional prepared burner submittal documentation in both hardcopy and electronic formats. The electronic format shall be presented on a compact disk in PDF file format and must contain the same information as the hardcopy format.

Burner submittals shall include, but not limited to, the following components:

- Instruction and maintenance manuals with cut sheets on all mechanical burner related components (valves, switches, gauges, etc.) that are manufactured by companies other than the burner manufacturer.
- Provide 3D model and interface software of the burner standalone and the burner on the boiler to ensure complete compatibility and proper fit of all components
- The following drawings: burner arrangement, piping, and electrical drawings. Mechanical and electrical Bill of Material must be provided on drawings. All hardcopy drawings shall be (18" x 24") or larger.

COMMISSIONING

The burner proposal shall include a total of one week for start-up and tuning by a factory service technician. The technician shall adjust the fuel/air ratio for optimal burner performance from minimum to maximum designed firing rate for both natural gas and #2 fuel oil. Burner data (including, but not limited to NO_x, CO, and excess air) will be recorded at 10% increments from minimum to the maximum firing rate. This test information will be logged onto a data sheet and will become part of the permanent job record.