



**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 \_\_\_\_\_  
 Forced Draft Motor Data ..... -HP-1800 RPM- \_\_\_\_\_  
 Forced Draft Motor - Volt, Hertz, Phase ..... /60/3  
 Control Power - Volt, Hertz, Phase..... 120/60/1  
 Control Power Transformer ..... \_\_\_\_\_  
 Combustion Controls Furnished by ..... \_\_\_\_\_  
 Type Combustion Controls ..... \_\_\_\_\_  
 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:

All unprimed components are primed with Sherwin-Williams B50 Kem Bond primer

Paint:

All unpainted components are painted with Sherwin-Williams B54 Industrial Enamel. The burner shall be painted to match the color of the boiler.

**Performance And Emission Guarantees**

Flame pattern shall be tailored to the furnace configuration so that flame impingement on the tubes does not occur and furnace heat distribution is uniform. The burner shall operate without undue pulsation or vibration throughout the turndown range.

EMISSION GUARANTEES	Not to Exceed:			
	Oil		Gas	
	lbs/MMBTU	PPM	lbs/MMBTU	PPM
NOx	_____	_____	_____	_____
CO	_____	_____	_____	_____

Parts Per Million (PPM) @ 3% O2 Dry

**Note:**

- 1) Guarantees are from 25 to 100% of the firing range.
- 2) Oil guarantees are based upon nitrogen content in the fuel of \_\_\_\_\_ % by weight

## **WINDBOX**

The windbox shall be fabricated from ¼" steel plate properly stiffened and reinforced, and shall be designed to provide an even air distribution. The forced draft (FD) fan shall be mounted on a 3/8" top plate. A 19 ½" x 15 ½" access door shall be furnished in the windbox. A plugged pipe coupling shall be installed in the burner windbox for windbox pressure gauge connection, and other connections as required. A plugged pipe coupling shall be installed in the bottom of the windbox for a drain. The windbox shall be designed for seal welding to the boiler front plate.

## **VENTURI REGISTER ASSEMBLY**

The register shall be a Faber VPSSS forced draft, (As required dual zone) venturi profile, low NOx type. The register shall have 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 windbox. Registers without directional vanes will not be acceptable.

### **The Register Shall Be Equipped With The Following:**

**OIL BURNER ASSEMBLY** = The register shall be equipped with a UL listed Faber "\_\_\_" steam atomizing type oil gun with air start-up capabilities. 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 should slide into an air-cooled jacket tube. The operator end of the jacket tube shall have a blast valve that prevents hot furnace gas from escaping out the jacket tube after oil gun removal.

**GAS BURNER ASSEMBLY** = The register shall be furnished with an internal gas manifold designed specifically for the conditions and pressure of the natural gas, as well as thermal expansion. The gas manifold shall be equipped with no more than (4) 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 RPN 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 321 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. Faber Burner Company will supply the throat assembly to the boiler manufacturer. 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. Factory piped cooling air shall be supplied to the Flame Scanner Mounting Assembly.

## **FORCED DRAFT FAN**

The forced draft (FD) fan shall be a Chicago Blower Arrangement 4 of the airfoil centrifugal type arranged for mounting on top of the windbox with inlet vortex air vane control and inlet screen. An outlet damper control is not permitted. The combustion air to the fan shall be 80°F. The fan motor shall be, \_\_HP 1760 RPM, \_\_\_\_\_ type, \_\_\_\_ VAC / 3 phase / 60 hertz. The FD fan shall be designed with an additional margin of 15% on the volume and 21% on the static pressure. The fan shall have a Normal Air Flow Switch and a Forced Draft Damper Open Switch. The forced draft fan shall be equipped with a silencer to reduce sound to 85 dBA at five feet from the fan inlet. **If required** (This silencer shall bolt into the IFGR mixing box).

### **If required**

(The burner shall be equipped with a burner mounted forced draft fan Allen Bradley motor starter. The motor starter shall be supplied with a lockable disconnect which allows it to supply or terminate total burner power (lock by customer). The lockable disconnect will be used for lock-out-tag-out situations. The burners control panel shall be equipped with an ACME 1.5 KVA control transformer. 480v power is supplied to the burner's motor starter. The 480v power from the motor starter is then "stepped-down" by the control transformer to supply the burner mounted control panel.)

## **PIPING TRAINS**

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. Loose miscellaneous valves or safety limit devices will not be acceptable

## **MAIN GAS TRAIN**

The main gas train shall be factory installed, piped 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 components:

1. Gas Burner Pressure Gauge – Wika 4 ½" dial, stainless steel case.
2. Gauge Shutoff Valve – ¼" N.P.T. needle valve.
3. Gas Flow Control Valve – Maxon, characterizable (12 points).
4. Plug Valve with Wrench – Homestead.
5. High & Low Gas Pressure Switches – Ashcroft, with visible set point indication.
6. Gas Safety Shutoff Valves – Maxon, normally closed, with proof of closure switches.
7. 3 Piece Full Port Ball Valve, lockable in the open position – Apollo.
8. Vent Valve – ASCO, normally open, full port.
9. Leak Test Valves – ¼" N.P.T. needle valves, plugged with ¼" pipe plug.

## IGNITOR 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.
2. Pilot Gas Shutoff Valve – Apollo, 3 piece, full port, ball valve.
3. Leak Test Valves – ¼" N.P.T. needle valves, plugged with ¼" pipe plug.
4. Pilot Gas Shutoff Valves – ASCO, normally closed.
5. Pilot Gas Vent Valve – ASCO, normally open.
6. Pressure Gauge – Wika, 2 ½" dial.
7. Gauge Shutoff Valve – ¼" N.P.T. needle valve.
8. Pilot Gas Pressure Regulator – American Meter.
9. Strainer – Mueller, with 30 mesh screen.
10. Pilot Gas Train Shutoff Valve – Apollo, 3 piece, full port, ball valve.
11. Ignition Transformer – 10,000 VAC output.
12. 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.
2. Gauge Shutoff Valves – ¼" N.P.T. needle valve.
3. Pressure Gauge – Wika, 4 ½" dial, stainless steel case.
4. Gauge Shutoff Valve – ¼" N.P.T. needle valve.
5. Globe Valve – Milwaukee, 300#, with replaceable seat and disc.
6. Check Valve – Milwaukee 300#
7. Oil safety shutoff valve, 3-way automatic, with proof of closure switch (ASCO General Control).
8. Oil safety shutoff valve, 2-way automatic, with proof of closure switch (ASCO General Control).
9. Gate Valve – Milwaukee, 300#, with replaceable gate.
10. Oil Flow Control Valve – Maxon, characterizable (12 points).

If required for heated oil

11. Oil Temperature Thermometer with well assembly
12. High/Low Temperature Switch with Thermowell. NEMA 4 enclosure, installed & wired on oil header assembly, F.M. approved

14. Low Oil Pressure Switch – Ashcroft, with visible set point indication.
15. Pressure Gauge – Wika, 4 ½" dial, stainless steel case.
16. Gauge Shutoff Valve – ¼" N.P.T. needle valve.
17. Strainer – Mueller, with 30 mesh screen.

**Note:** Required Oil Return piping to by others

## SCAVENGER PUMP SYSTEM-

The scavenger pump system shall evacuate oil from the oil gun and hose on each shutdown. It shall be factory installed, piped with schedule 80 pipe and 300 pound fittings, wired to terminal strip and consist of the following components:

1. Scavenger pump and motor assembly.
2. Scavenger shut-off solenoid valve.
3. Two (2) Scavenger spring loaded lift check valves.

## 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 with an air supply connection and steam supply connection. Plant air will be used for start-up. Atomizing train shall consist of, but not limited to, the following components:

1. Atomizing Media Flex Hose – 321 stainless steel construction, braided
2. Gauge Shutoff Valves – ¼” N.P.T. needle valve
3. Pressure Gauge – Wika, 4 ½” dial, stainless steel case
4. Gauge Shutoff Valve – ¼” N.P.T. needle valve.
5. Low Atomizing Pressure Switch – Ashcroft, with visible set point indication
6. Gate Valve – Milwaukee, 300#, with replaceable gate
7. Check Valve – Milwaukee 300#
8. Atomizing Steam Shutoff Valve - Magnatrol, normally closed
9. Oil Impulse Line Shutoff Valve – ¼” N.P.T. needle valve
10. Atomizing Media Differential Pressure Regulator -Jordan
11. Low Atomizing Supply Pressure Switch – Ashcroft, with visible set point indication
12. Strainer – Mueller, with 30 mesh screen
13. Steam Trap Shutoff Valve, – Milwaukee 300# gate valve, with replaceable gate
14. Steam Trap – Sarco, balanced pressure thermostatic steam trap.
15. For air to steam change over
  - 2 Media Change Over Shutoff Valves (Milwaukee)
  - 2 Media Change Over Check Valves (Milwaukee)

## MISCELLANEOUS EQUIPMENT

The following equipment shall be provided by the burner manufacture:

- 1 Low Air Flow Pressure Limit Switch (Cleveland Controls)
- 1 Purge Air Flow Pressure Limit Switch (Cleveland Controls)
- 1 High Boiler Pressure Limit Switch (Ashcroft)
- 1 Excess Boiler Pressure Limit Switch (Ashcroft)
- 1 High Furnace Pressure Limit Switch

If required

## LOW NO<sub>x</sub> EMISSION EQUIPMENT

One (1) set of equipment, shipped loose for field installation, required for compliance with natural gas NO<sub>x</sub> emission limits specified earlier. Equipment shall consist of, but not limited to, the following components:

1. IFGR Stack Scoop - To aid in the recirculation of flue gas
2. IFGR Flow Control Damper With electric operator – Control Signal (4 to 20 maDC) to this damper to be from control system.
3. IFGR/Air Inlet Mixing Box - For mounting on FD fan inlet
4. (4) Rolled Angle Flanges - For connecting ducting from scoop to damper & damper to mixing box
5. (4) High Temperature IFGR Duct Gaskets
6. (1) High Temperature IFGR Mixing Box Gasket

**Note:** The necessary \_\_\_” ID ducting, insulation, expansion joint, for flue gas recirculation from the boiler outlet to the inlet mixing box is to be supplied by installers.

## FLAME SAFEGUARD EQUIPMENT

The flame safeguard system shall be a Faber Burner Company Model FSG-\_\_\_\_\_ -\_-\_\_\_\_\_ -\_-\_-\_\_ utilizing the following components in full accordance with the recommendations of FM, IRI and NFPA. The flame safeguard system shall be burner mounted. 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 Fireye E110, 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 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. 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 heavy industrial construction and shall consist of, but shall not be limited to, the following:

Electronic Flame Relay - For each burner. (Fireye E110)

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 Fireye E110

Relays – Shall be Allen Bradley industrial type where necessary.

Indicating Lights – Shall be Allen Bradley transformer type, oil tight construction with the appropriate colored Allen Bradley lens. The flame safeguard panel shall have the following lights Ignition = Blue, Operating limits = Green, Safety limits =Blue, Gas Valve = Blue, Oil Valve= Amber, Flame failure = Red, and Water level alarm = Red

Flame-Sensing Device – A Fireye 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.

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 FSG panel, the silence

push-button and abnormal water level light will be mounted on the FSG 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 Fireye ED 510 which will receive annunciation information from a Fireye E300. The ED510 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
- High Oil Temperature

Wiring - Between sensing elements and control cabinet shall be in accordance with 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.

Cabinet - Components shall be mounted in a pre-wired, factory-assembled cabinet. Cabinet shall be constructed out of steel no lighter than 14 gauge. Cabinet shall be of NEMA 12 construction with hinged door. The complete system including safety interlocks shall be suitable for control power supply of 120 volts, 1 phase, 60 hertz. All items in panel front (lights, switches, controllers, etc) shall have engraved plastic nameplates, black letters on a white field.



**PAINTING**

Each unit will be given one (1) shop coat of primer and high temperature paint prior to shipment. Paint to match boiler to reduce the need for several colors of touch-up paint. (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.

**EXPERIENCE**

Burner manufacturer must have minimum of at least five (5) years experience manufacturing similar low NOx burners installed on boilers with configuration similar to this boiler and with the fuel being fired. Manufacturer must have factory trained service technician in its employment to service the new burner.

**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 NOx, 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.