Power Flame Incorporated

SUGGESTED SPECIFICATION
FOR
MODEL CGO COMBINATION
GAS/LIGHT OIL BURNERS

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CGOSP1294
Rev 0406

Suggested Specifications for Model CGO
Combination Gas/Light Oil Burners

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Suggested Specifications for Model CGO
Combination Gas/Light Oil Burners

General Requirements

1. Furnish and install _____ Underwriters Labeled combination gas/light oil burners. The burner design, construction, components and installation shall meet all applicable code requirements.

2. (Spec writer - omit the following boiler conversion installation descriptions if new boilers are being installed and are described in another section of the specification. If the following descriptions are used - select the most appropriate).

   a. The new burner system shall be installed in (Cast Iron), (Scotch Marine), (Steel Firebox), (Water Tube), (Other) _____ type boiler(s). The boiler model number is _____ manufactured by _____.

   b. The burner is to be installed in the (front) (rear) of the existing _____ inch high (brick) (steel) base. Chamber modifications as required to meet the burner manufacturers recommendations shall be made. The existing chamber shall be (repaired) (removed and replaced with new material).

   c. The burner shall be mounted to fire through the (right) (left) boiler firing door. The existing combustion chamber boiler base shall be filled with suitable material as recommended by the burner manufacturer. The boiler mud leg shall be protected and the burner tilted slightly downward to protect against boiler crown sheet flame impingement.

   d. The burner shall be mounted to fire on the centerline of the marine type boiler furnace tube. (The existing steel front plate will be adapted to fit the new burner). (A new _____ inch steel boiler/burner mounting plate will be supplied). A new refractory front plate shaped and installed in accordance with the burner manufacturers instructions will be provided.

General Burner Description

1. The burners shall be Power Flame forced draft flame retention model _____. Each burner shall be capable of burning _____ CFH of _____ BTU/Cu. Ft. (natural) (propane) (other)_____ gas, with a specific gravity of _____. Gas pressure applied to the burner gas train supply connection shall be a minimum of _____ (in. w.c.) (PSIG) at full high rate and a maximum of _____ (in. w.c.) (PSIG) at static conditions. Each burner shall be capable of burning _____ GPH of (No. 1, 2 fuel oil) (kerosene) (diesel) or _____ fuels with a rating of _____ BTU/GAL.

Approval Codes

1. Each burner shall be listed by Underwriters Laboratories and shall bear the appropriate U.L. label (in addition to the U.L. requirements, all equipment and installation procedures will meet the requirements of (IRI) (FM) (ASME CSD-1) (other)_____ codes). Each burner shall be designed and constructed as an integrated combustion system package and shall be factory fire tested.

Combustion Head Design

1. Each burner shall be of welded steel construction and have a baked on powder coat finish. The combustion head shall incorporate a multi blade, stainless steel, flame retention diffuser. The gas firing head shall be of the multiport type and constructed such as to place annular gas distribution opening between two parallel air flow streams to achieve maximum fuel/air mixing. Burners with cast alloy blower housings will not be accepted. The burner combustion head will carry full five (5) year replacement warranty.

2. (Spec writers - add the following for Scotch Marine boilers and/or very low gas pressure supply). The design shall also include a (fixed) (adjustable) primary air/gas mix chamber constructed such that a mixture of primary air and gas will be introduced into the combustion area, upstream of the secondary combustion air and ignition introduction zone. The burner combustion head will carry full five (5) year replacement warranty.

3. All air required for combustion shall be supplied by a blower mounted integral to the burner. The blower wheel shall be of the forward curved centrifugal design and shall be directly driven by a _____ HP 3450 RPM _____ volt, 60 Hertz _____ phase motor. A dual blade damper assembly located on the inlet side of the blower wheel shall meter the combustion air flow. Design shall permit the disconnecting and locking of either damper if firing rates are near minimum burner input ratings.

Ignition Systems

1. The burner ignition system, which will light either the main gas or oil flame, shall utilize (natural) (propane) gas as the fuel source. The gas pilot system components shall include spark ignited pilot assembly, 6000 Volt ignition transformer, pilot solenoid valve, pilot gas pressure regulator and manual gas shutoff cock. The flame proving system shall incorporate an Ultra-Violet flame detector, which will monitor both the pilot and main flames. The pilot assembly shall fit within the confines of the blast tube - avoiding special burner front plate pilot cut outs.

2. (Option) - To insure total fuel independence, the main oil flame shall be ignited by a 10,000-Volt direct spark oil ignition system (available on C4-GO-30 and smaller burners).

Fuel/Air Control System

(Spec writer - select one of the following described systems 1 through 5).

1. <u>On-Off Gas and Oil</u>

   The main gas supply shall be controlled by a motorized gas valve. The main oil supply shall be controlled by a solenoid oil valve. The air inlet control dampers shall be fixed

at the optimum fuel/air ratio at the high fire position.

2. On-Off Gas with Fixed Air Low Fire Start on Oil

The main gas supply shall be controlled by an electrically actuated gas valve without air control. The main oil supply shall be controlled by a solenoid oil valve with dual pressure integral oil pump, which includes adjustable bypass pressure regulator and normally open solenoid valve set to provide smooth low fire start and high fire run. The air inlet dampers shall be fixed at the optimum fuel/air ratio at the high fire position.

3. On-Off Gas with Reduced Air Low Fire Start on Oil

The main gas supply shall be controlled by an electrically actuated gas valve without air control. The air inlet damper shall be spring loaded to the optimum fuel/air ratio at the high fire position, but is moved to low fire light off position by a hydraulic cylinder and then returned to the high fire position by a spring.

4. Low-High-Off Gas and Oil

The main gas supply shall be controlled by a motorized gas valve mechanically linked to air inlet control dampers which will provide a reduced fuel/air volume for low fire start and then mechanically open to the high fire run position. The main oil supply shall be controlled by a solenoid oil valve train and hydraulic oil cylinder mechanically linked to air inlet control dampers which will provide a reduced fuel/air volume for low fire start and then mechanically open to the high fire run position. When the operating control is satisfied the burner will shutoff and return to the low fire start position.

5. Low-High-Low Gas and Oil

The main gas supply shall be controlled by a motorized gas valve mechanically linked to air inlet control dampers which will provide a reduced fuel/air volume for low fire start and then mechanically open to the high fire run position. The main oil supply shall be controlled by a solenoid oil valve train and hydraulic oil cylinder mechanically linked to air inlet control dampers which will provide a reduced fuel/air volume for low fire start and then mechanically open to the high fire run position.

A Low-High-Low (temperature) (pressure) control shall electrically switch the burner to low or high fire position when burning gas or oil - to best meet varying system load conditions. When the operating control is satisfied the burner shall shutoff and return to the low fire start position.

6. Modulation

The main On-Off gas supply shall be controlled by a motorized gas valve (diaphragm or solenoid valve when <2,500 MBH). The main On-Off oil supply shall be controlled by a solenoid oil valve. A modulating motor shall control the modulated positioning of the air inlet dampers, butterfly type gas proportioning valve and a metering type oil valve, to best meet varying system load conditions.

Provide a Cam actuated Characterized Fuel Metering device, which will be an integral part of the burner fuel metering system. The system shall be U.L. listed and capable of providing an adjustable and accurately repeatable fuel/air ratio throughout the

burner's full firing range. The system shall be capable of providing a constant fuel/air ratio, or a linearly adjusted fuel/air ratio, in order to satisfy individual burner application requirements. Each system shall be complete with fourteen (14) separately adjustable cam development set-points. Each set-point shall be complete with locking set screw. The cam follower shall be equipped with a double spring set, in order to insure maximum reliability. All bearing points shall be provided with oil impregnated bronze bushings, requiring no field lubrication.

The positioning of the modulating motor shall be controlled by a 135 Ohm, or 4-20 milliamp, or 0-10 VDC, modulating type (temperature) (pressure) controller. When the operating control is satisfied the burner shall shutoff and return to the low fire start position. The modulating motor shall provide an electrical interlock to insure a guaranteed low fire start position prior to the pilot trial for ignition sequence.

7. (Spec writer - Use the following for all but modulating burners).

   Gas flow shall be limited by a gas train mounted tee orifice assembly, which can be changed to suit job conditions without disconnecting the gas train.

Gas Control Train

1. U.L. Requirements

   The gas valve train shall contain the following:

   a. Manual Shutoff cock

   b. Main gas pressure regulator (Spec writer - Specify "tight shutoff type" if gas supply pressure exceeds 1 PSIG).

   c. Automatically operated main gas valve (for inputs at 2,500 MBH and below this can be a motorized, solenoid or diaphragm valve).

   d. Automatically operated main motorized gas valve with proof of closure interlock switch (specify as standard above 2,500 MBH - option at or below 2,500 MBH).

   e. Automatically operated auxiliary gas valve.

   f. Manual reset Low and High Gas Pressure switches (specify as standard above 2,500 MBH - option at 2500 MBH and below).

   g. Manual leak test cock.

   h. Burner manifold gas pressure gauge and gauge cock.

   i. Automatically operated Normally Open Vent Valve (specify as standard above 12,500 MBH for fuel gases with a specific gravity of less than 1.0 - optional at 12,500 and below and/or specific gravities of 1.0 or above).

2. FM Requirements

(Spec writer - note that a standard U.L. burner and gas train is furnished for units with input up to 2,500 MBH. For units with input exceeding 2,500 MBH, in addition to U.L. requirements, add the following:)

a. U.L. listed leak test cock.

b. Automatically operated main motorized gas valve with proof of closure shall carry a FM label.

(Spec writer - add for FM burners with input exceeding 5,000 MBH)

c. Automatically operated auxiliary gas valve shall be motorized type, incorporate proof of closure feature and carry a FM label.

d. Both automatically operated motorized gas valves shall be equipped with 13 second timing motorized operators.

(Spec writer - add for FM burners with input exceeding 12,500 MBH)

e. Both automatically operated motorized gas valves shall incorporate the proof of closure feature.

3. IRI Requirements

(Spec writer - In addition to U.L. gas train requirements, add the following:)

a. U.L. listed leak test cock.

b. Both automatically operated gas valves (main and auxiliary) shall have motorized operators.

c. Automatically operated main gas valve shall have proof of closure feature (burners with input exceeding 5,000 MBH).

d. One (1) normally open vent valve sized according to IRI requirements.

e. Manual reset low and high gas pressure switches (specify for all burner inputs).

Oil Control Train

1. General Requirements

The oil train shall incorporate U.L. approved components as supplied by the burner manufacturer to provide specified Fuel/Air Control System operation.

2. The high pressure nozzle supply oil pump shall be a two (2) stage gear type capable of producing 300 PSIG discharge pressure and 15 in. hg. vacuum. It shall be (direct driven by the burner motor) (a separate unit mounted on its own support base with direct drive motor). The unit shall be complete with suction line manual gate valve, removable mesh type oil strainer, 0-30" HG. 0-30 PSIG vacuum/pressure gauge with gauge dampening orifice, 0-300 PSIG oil nozzle pressure gauge with gauge

dampening orifice and nozzle line solenoid safety shutoff oil valve.

3. Additional oil components shall be provided as follows:

   a. Oil nozzle line auxiliary solenoid safety shutoff oil valve.

   b. Low oil pressure switch, when remote burner pump is furnished (optional for burner mounted oil pump).

4. Furnish and install (simplex) (duplex) oil circulating pump set(s) which will supply No. _____ fuel oil at _____ PSIG to inlet of the burner high pressure oil pump(s). The circulating pump shall have a minimum capacity of _____ GPH at a nominal discharge pressure of _____ PSIG. The pump set shall be completely factory pre-piped, wired and assembled. The oil pump shall be rotary gear type.

(Spec writer - add the following for FM:)

5. For burners above 2800 MBH thru 12,500 MBH use two (2) FM labeled valves, or one (1) valve with proof of closure and FM label.

6. For burners above 12,500 MBH, both valves shall have proof of closure and FM label.

Burner Operating Controls

1. The On-Off operation of the burner shall be controlled by a (pressure) (temperature) control. System (pressure) (temperature) shall be _____ (PSIG) (Degrees F).

2. A safety manual reset type limit control shall be provided to shut the burner down in the event of excessive (pressure) (temperature).

3. (Spec writer - select below listed system as required)
   a. Low-High-Low system. The low or high fire positioning of the fuel/air components shall be controlled by a (pressure) (temperature) control in addition to the On-Off operating control.

   b. Modulation. The position of the modulating motor and other fuel/air components shall be controlled by a 135 Ohm, or 4-20 milliamp, or 0-10 VDC, (pressure) (temperature) control in addition to the On-Off operating control.

Interlocks

(Spec writer - select below as required)

1. Option for Low-High-Off and Low-High-Low modes of operation. (Spec writer - specify this item for FM or IRI if a Low-High-Off or Low-High-Low Fuel/Air control system is specified). The burner operating circuit shall be electrically interlocked though an end switch located on the burner mounted combustion air damper which will insure that the fuel/air control linkage is in the low fire start position before the ignition sequence can begin.

2. For U.L. Modulation. The modulating motor shall be sequenced to allow for four (4) complete air changes of the combustion chamber and breaching, and through an integral end switch be electrically interlocked with the control burner circuit to insure the fuel/air linkage is in the low fire start position before burner ignition sequence can

begin.

3. For FM or IRI Modulation. Pre-purge operation of the modulating motor shall provide electrical interlock at the 60% air flow position of the burner damper and electrical interlock at the damper low fire start position before the ignition sequence can begin.

4. (If automatic outside fresh air intake louvers are specified). A fresh air louver end switch electrical interlock shall be provided in the burner operating circuit which will insure that the fresh air louvers are open before the burner can operate. Boiler room freeze protection circuit shall be provided to close the fresh air intake in the event of a flame failure.

5. (If induced draft fan has been specified). The induced draft fan operation will be electrically interlocked with the burner operating circuit to insure that the burner will not operate if the draft fan is not operating or if the draft is below a preset level.

6. (If automatic overfire draft equipment has been specified). The overfire draft system circuitry shall be interlocked with the burner circuitry to insure correct sequencing of all combustion system components.

Flame Safeguard Control

1. U.L. Requirement
(Spec writer - select below system as required)

   a. (For On-Off, Fixed Air Low Fire Start, Reduced Air Low Fire Start, Low-High-Off, Low-High-Low or Modulating Fuel/Air control systems firing at or below 2,500 MBH on gas or gas-oil (2,800 MBH on oil). The flame safeguard control system shall include Ultraviolet sensor for flame detection and provide fully automatic sequencing of pre-purge, blower motor, ignition system, and fuel/air flow components. The flame safeguard control shall be the Honeywell model RM7895 or equal as manufactured by Fireye.

   b. (Spec writer - Use the following description for any Fuel/Air Control System at or below 2,500 MBH on gas or gas-oil (2800 MBH on oil) where a separate blower post purge function is desired.

      The flame safeguard control shall in addition to the above requirements provide post purge sequencing of the blower motor. The flame safeguard control shall be the Honeywell Model RM7896 or equal as manufactured by Fireye.

   c. (For Low-High-Off, Low-High-Low or Modulating Fuel/Air control systems firing above 2,500 MBH on gas or gas-oil (2,800 MBH on oil) through 3650 MBH with burner starting at 60% of high fire rate). The flame safeguard control system shall include Ultraviolet sensor for flame detection and provide fully automatic sequencing of pre-purge and post-purge, blower motor, interrupted ignition system, and fuel/air flow components. Burner shall purge at 60% of high fire air flow for a minimum of four (4) air changes and minimum of 60 seconds. Flame safeguard shall provide safety shutdown with manual reset on air flow failure. The flame safeguard control shall be the Honeywell model RM7896 or equal as manufactured by Fireye.

d. (For all other applications above 2,500 MBH on gas, or gas-oil (2,800 MBH on oil) including when desired to start burner at less than 60% of high fire rate, a motorized open damper purge is required). The flame safeguard control system shall include Ultraviolet sensor for flame detection and provide fully automatic sequencing of pre-purge and post-purge, blower motor, interrupted ignition system, and fuel/air flow components. Burner shall purge with full open-air louver at not less than 60% of high fire airflow rate for a minimum of four (4) air changes and not less than 60 seconds. Flame safeguard shall provide safety shutdown with manual reset on air flow failure. The flame safeguard control shall be Honeywell model RM7840L or equal as manufactured by Fireye.

2. FM Requirements

a. FM flame safeguard requirements are the same as those imposed by U.L.

3. IRI Requirements

a. (Spec writer - specify the following for all fuel/air control systems with the exception of modulation, firing 3,650 MBH or below).

The flame safeguard control system shall include Ultraviolet sensor for flame detection and provide fully automatic sequencing of pre-purge and postpurge, blower motor, interrupted ignition system, and fuel/air flow components. The flame safeguard control shall be the Honeywell model RM7896C (RM7895C if firing rate is 2,500 MBH or below) or equal as manufactured by Fireye.

b. (Spec writer - specify the following for modulating burners).

The flame safeguard control system shall include Ultraviolet sensor for flame detection and provide fully automatic sequencing of pre-purge and post-purge, blower motor, interrupted ignition system, and fuel/air flow components. The flame safeguard control shall be the Honeywell model RM7840L or equal as manufactured by Fireye.

Control Panel – With Honeywell controls.

1. (Spec writer - select 1. a, b or c as appropriate)

a. Each burner shall be complete with an integral burner mounted control panel, which shall house all required operating electrical components. All flame safeguard wiring within the combustion control system shall be factory pre-wired utilizing a UL listed preprinted main circuit board. All optional controls will be wired to a din rail mounted terminal strip within the control panel. The main Honeywell flame safeguard control will plug into the main circuit board and provide minimal wiring within the control panel. The main circuit board will connect to the light and switch circuit board on the top of the control panel with a plug in connector. The light and switch circuit board will have a laminated indication label for each function on the light and switch circuit board.

(Spec writer - select system as appropriate for the mode of operation selected in the Fuel/Air Control System section above.)

(On-Off and Low-High-Off control system)
The light and switch circuit board will included On-off power switch, ultra bright LED indication lights for “Power On”, load “Demand”, “Main Fuel”, Flame Safeguard “FSG Alarm” and “Low Water” Fuel selector switch for Gas or Oil with ultra bright LED indication lights for fuel selected.

(Low-High-Low fuel control system)
The light and switch circuit board will included On-off power switch, ultra bright LED indication lights for “Power On”, load “Demand”, “Main Fuel”, Flame Safeguard “FSG Alarm” and “Low Water”, Fuel selector switch for Gas or Oil with ultra bright LED indication lights for fuel selected. Manual Low Fire Hold selector switch.

(Modulation fuel control system)
The light and switch circuit board will included On-off power switch, ultra bright LED indication lights for “Power On”, load “Demand”, “Main Fuel”, Flame Safeguard “FSG Alarm” and “Low Water”, Fuel selector switch for Gas or Oil with ultra bright LED indication lights for fuel selected. Manual-Auto selector switch and manual potentiometer with ultra bright LED indication when in the manual mode.

b. Each burner shall be complete with a remote control panel (wall mounted) (mounted on the side of the heat exchanger) which shall house all required operating electrical components. All flame safeguard wiring within the combustion control system shall be factory pre-wired utilizing a UL listed preprinted main circuit board. All optional controls will be wired to a din rail mounted terminal strip within the control panel. The main Honeywell flame safeguard control will plug into the main circuit board and provide minimal wiring within the control panel. The main circuit board will connect to the light and switch circuit board on the top of the control panel with plug in connector. The light and switch circuit board will have a laminated indication label for each function on the light and switch circuit board. A junction box pre-wired to the burner components shall be mounted on the burner. It shall have a din rail mounted terminal strip, which will match a terminal strip in the remote panel. Field wiring will be required between the burner mounted junction box and the remote control panel.

c. Each burner shall be complete with a remote control panel to be free standing and floor mounted, which shall house all, required operating electrical components All flame safeguard wiring within the combustion control system shall be factory pre-wired utilizing a UL listed preprinted main circuit board. All optional controls will be wired to a din rail mounted terminal strip within the control panel. The main Honeywell flame safeguard control will plug into the main circuit board and provide minimal wiring within the control panel. The main circuit board will connect to the light and switch circuit board on the top of the control panel with plug in connector. The light and switch circuit board will have a laminated indication label for each function on the light and switch circuit board. A junction box pre-wired to the burner components shall be mounted on the burner. It shall have a terminal strip, which will match a terminal strip in the remote panel. Field wiring will be required between the burner mounted junction

box and the remote control panel. The design and construction of the panel will incorporate fabrication that will insure the necessary rigidity and support of a free standing unit. The control panel will mount on a single 48" high x 3" deep x 7 gauge steel single vertical support column. The support column shall be mounted on a 12" x 12" steel base. All joints shall be welded. Construction of the back side of the control panel will mechanically match the vertical support column to allow raising and lowering the panel height in 6" increments to best suit job height requirements.

2. Appropriate electrical knockouts shall be provided on both sides and bottom of the panel to allow for necessary power and limit control wiring. The control panel shall be constructed of 16 gauge steel and shall be complete with a top mounted switch and control section which shall be hinged to allow for full access to all panel mounted components. The control panel shall be painted in a color and finish identical to the burner being supplied.

3. The control panel shall include (if 208, 230 or 460 volts) a din rail mounted control circuit transformer with integral fuses on both the primary and secondary windings. Flame safeguard control as specified above. Din rail mounted motor starters, relays, terminal blocks and other electrical devices as required.

(**Spec writer**: Select packaged light and alarm systems as needed)

4. Optional lights and alarms indications: Additional ultra bright LED auxiliary light circuit boards nested in groups of 4, 6 or 8 lights on printed circuit boards will be mounted in the top indication section of the panel and include an engraved label indicating the function of each light. The following indication lights will be supplied along with necessary isolation circuits as required.

    a. Auxiliary Light Circuit Board with **4** additional ultra bright LED's. "High Temperature" (R), "Low Gas Pressure" (R),"High Gas Pressure" (R), "Pilot Failure" (R) with alarm buzzer and alarm silencing switch.

    b. Auxiliary Light Circuit Board with **6** additional ultra bright LED's. "High Temperature" (R), "Low Gas Pressure" (R), "High Gas Pressure" (R), "Pilot Failure" (R), "Ignition On"(A) "Air Flow Failure" (B), with alarm buzzer and alarm silencing switch.

    c. Auxiliary Light Circuit Board with **8** additional ultra bright LED's. "High Temperature" (R), "Low Gas Pressure" (R), "High Gas Pressure" (R), "Pilot Failure" (R), "Ignition On"(A), "Air Flow Failure" (B), "Low Oil Pressure" (R), "High Limit" (R) with alarm buzzer and alarm silencing switch.

Additional auxiliary light circuit boards with ultra bright LED indications are available in-groups of 4, 6 or 8 lights specify desired light functions and isolation circuits as required.

Control Panels – With Fireye controls.

1. (Spec writer - select 1. a, b or c as appropriate)

   a. Each burner shall be complete with an integral burner mounted control panel, which shall house all required operating electrical components. All wiring within the combustion system shall be factory pre-wired to a din rail mounted terminal strip within the control panel.

   b. Each burner shall be complete with a remote control panel (wall mounted) (mounted on the side of the heat exchanger) which shall house all required operating electrical components. All wiring for remote panel electrical components will be factory pre-wired to a din rail mounted terminal strip within the control panel. A junction box pre-wired to the burner components shall be mounted on the burner. It shall have a terminal strip, which will match a terminal strip in the remote panel. Field wiring will be required between the burner-mounted junction box and the remote control panel.

   c. Each burner shall be complete with a remote control panel to be free standing and floor mounted, which shall house all, required operating electrical components. All wiring for remote panel electrical components will be factory pre-wired to a din rail mounted terminal strip within the control panel. A junction box pre-wired to the burner components shall be mounted on the burner. It shall have a terminal strip, which will match a terminal strip in the remote panel. Field wiring will be required between the burner-mounted junction box and the remote control panel. The design and construction of the panel will incorporate fabrication that will insure the necessary rigidity and support of a freestanding unit. The control panel will mount on a single 48" high x 3" deep x 7 gauge steel single vertical support column. The support column shall be mounted on a 12" x 12" steel base. All joints shall be welded. Construction of the back side of the control panel will mechanically match the vertical support column to allow raising and lowering the panel height in 6" increments to best suit job height requirements.

2. Appropriate electrical knockouts shall be provided on both sides and bottom of the panel to allow for necessary power and limit control wiring. The control panel shall be constructed of 16 gauge steel and shall be complete with a top switch and control section which shall be hinged to allow for full access to all panel mounted components. The control panel shall be painted in a color and finish identical to the burner being supplied.

3. The control panel shall include (if 208, 230 or 460 volts) a din rail mounted control circuit transformer with integral fuses on both the primary and secondary windings. Flame safeguard control as specified above, On-Off switch, Gas/Oil selector switch and din rail mounted motor starters, relays, terminal blocks and other electrical devices as required.

Burner Graphic Management System with integral annunciator status lights.

1. The control panel shall be furnished with an eight- (8) color Burner Graphic Management System with integral annunciator status lights. The system shall allow the operator a view of the operational status of the burner on a lighted graphic display. The Graphic shall be mounted on the control panel door with a quick disconnect device to enable the operator to disconnect the system or remove the access door while maintaining the annunciator in full operation. The following points shall be annunciated on the Graphic Display: (spec writer - select system below to match the specified Fuel/Air control system. Also see Section 6. for additional control panel options).

   a. (For On-Off)
      1. Power On - Green
      2. Limit Circuit Closed - Green
      3. Main Gas - Blue
      4. Main Oil - Amber
      5. Flame Failure - Red
      6. Low Water Cutoff - Red

   b. (For On-Off with Fixed Air Low Fire Start)
      1. Power On - Green
      2. Limit Circuit Closed - Green
      3. Main Gas - Blue
      4. Main Oil - Amber
      5. High Fire Oil Control - Amber
      6. Flame Failure - Red
      7. Low Water Cutoff – Red

   c. (For Low-High-Off)
      1. Power On - Green
      2. Limit Circuit Closed - Green
      3. Main Gas - Blue
      4. Main Oil - Amber
      5. High Fire Oil Control - Amber
      6. High Fire Air Control - Amber
      7. Flame Failure - Red
      8. Low Water Cutoff - Red

   d. (For Low-High-Low)
      1. Power On - Green
      2. Limit Circuit Closed - Green
      3. Main Gas Low - Blue
      4. Main Gas High - Blue
      5. Main Oil - Amber
      6. High Fire Oil Control - Amber
      7. High Fire Air Control - Amber
      8. Flame Failure - Red
      9. Low Water Cutoff - Red

   e. (For Modulation)
      1. Power On - Green
      2. Limit Circuit Closed - Green

3. Modulation Mode - Green
4. Main Gas - Blue
5. Main Oil - Amber
7. Flame Failure - Red
8. Low Water Cutoff - Red

The Burner Graphic Management System shall be the "Director®" as manufactured by Power Flame, Inc.

2. (Spec writer - the following are control panel options which can be added to the basic annunciation features listed in 1. a, b, c, d and e above):

a. The control panel shall also include an Alarm Buzzer (required for IRI) with automatic reset silencing switch. The buzzer shall activate on Flame Failure or Low Water condition.

b. For First-Out Annunciation include the following:

The Burner Graphic Management System shall include a pre-programmed controller, which shall annunciate all boiler failures on an first-out basis. The operation of the annunciator shall be as follows:

1. The first failure of any annunciated device in the burner/boiler system shall cause the associated indicating lamp to flash at a rate of 2.5 times per second, and the alarm buzzer shall sound until the alarm has been cleared and the annunciator reset.

2. Any subsequent failure(s) of annunciated devices in the burner/boiler system shall cause the associated indicating lamp to flash at a rate of 1 time per second, and the alarm buzzer shall sound until all alarm conditions are cleared and the annunciator is reset.

3. The programmed controller shall log all occurrences of any annunciated device, and shall keep a running total of all occurrences of each failed device. In addition the annunciator will store in an history table of last 50 individual failures the system has logged. The system will also store burner operation elapsed hours and lockout elapsed hours.

4. Depressing the reset button of the annunciator for 5 seconds will cause the programmed controller to energize all annunciation system lights and ring the alarm buzzer for 0.5 seconds.

5. An optional display panel can be attached to the front of the programmed controller for service and trouble shooting purposes to check failure history data.

6. In addition to the annunciation features detailed above for the Burner Graphic Management System, first out annunciation shall include the following annunciated points:

- low water
- low, low (or high) water

- high limit
- low gas and/or oil pressure
- high gas pressure
- low combustion air pressure
- flame failure lamp will indicate the following:
    - flashing 2.5 times per second - pilot flame failure
    - flashing 1.0 times per second - main flame failure
    - flashing sporadically - main flame ignition failure

Lead/Lag Boiler Control System

Introduction for Specification Writer: This guide specification is for a microprocessor based lead-lag-sequencing controller. This controller is generally employed for fire tube steam or hot water boiler applications where multiple boilers are in service, each with their own steam pressure or temperature controls and not under control of a *master* pressure or temperature controller. Plant energy demand is satisfied by the start up and operation of any single boiler to maintain required pressure set point or temperature, followed by the start up and operation of additional boiler(s) as additional energy is required. As the energy demand decreases, boilers are taken off-line in the reverse order sequence from which they were placed on-line.

Guide Specification

Part 1- Hardware and Control Capability Specifications

The lead lag-sequencing controller shall be microprocessor based menu driven site tunable unit that is preprogrammed for the specific functions delineated. The unit shall have a two-line Vacuum Fluorescent display with 20 alphanumeric characters per line. This display shall show all input variables, set points, status, alarm messages and prompts for on/off and timers. Operator interface shall be through a front panel alphanumeric keypad with 20 tactile-feedback buttons for entering configuration parameters and for scrolling between display screens. The controller shall exhibit sequential logic as well as proportional and integral loop control capable of full modulating control as specified. CPU failure with auto boiler failure skip and manual transfer capability for modulating control shall be standard.

As a minimum the controller shall have 22K RAM or 52K EPROM with a 0.5 ms/K scan time and CMOS RAM with battery back up. The unit shall have as a minimum 11 optically isolated inputs including transmitted or digital inputs, with expansion if the application should require it. Modulating outputs signals to the final elements shall be 135 ohm or 4-20 ma. On off and digital outputs shall be through isolation relays.

The process variable shall be continuously displayed by a 1/32nd din Digital Indicator mounted on the panel.

Two communications ports shall be available if required as RS-232 or RS-485 with the capability of remote initiation by a building management system.

The controller shall also have the optional capability of sequencing pumps, positioning combustion make-up air louvers, outside air temperature reset, firing rate indication, assured low fire shut down and warm up and night set back/weekend skip. For full modulating control, separate modulating M/A stations shall be available.

(Optional) The sequencer shall be supplied in a wall/surface mounting steel cabinet with the approximate dimensions of 16" H X 16" W X 61/2" D (24”X24”X10” for 5810 and depends on options selected). This cabinet shall contain all input and output interface devices, relays, alarm horn (5810, if specified), boiler on-off lights and Auto-Off-Manual switches for each (all) boiler(s).

An Open Mount (5830-*O-OM) version comprising a panel-mounted faceplate connected via a flexible wiring harness (up to 5ft in length) to a remote mounted electronics sub assembly board shall be available.

Part 2- Specifications for Lead Lag and Sequencing Control
Select <text 1> or <text 2> and add to final specification.

1. Provide panel mounted lead/lag sequencer with features per Paragraph ___ to operate ___ [insert quantity] <steam><hot water> boilers.
2. Boilers are to be taken from cold stand-by to low fire condition <manually><by the control system>. Boilers are to be taken from low to high fire by <the control system><each boilers existing control system>. Boilers are to be shut down <manually><by the control system>.
3. Auto-Off-Manual switches, boiler status (on) lights and boiler fail lights shall be provided for each boiler. Alarm horn optional (5810 only).
4. The Auto-Off-Manual feature shall provide boiler skip during sequence if switch is in the off position.
5. As the process <pressure><temperature> varies from set point, the controls shall enable additional boilers to be used to satisfy the load/demand, or remove boilers as the load decreases. The sequence for the boilers to come on or off line shall be selectable. An adjustable time delay (0 to 50 minutes) shall be utilized and compared to the process variable before bringing another boiler on or off line.
6. On/Off sequencing shall control the plant master <steam pressure><temperature> set point.
7. Specification Writer Select One (Optional); 7.a or 7.b.

    7.a. Supply a gauge pressure transmitter for the plant header steam line with 4-20ma input to the controller. Pressure transmitter shall be 4-wire type or be furnished with a 24 V loop power supply. It shall sense the steam pressure directly with a capsule that is inside the transmitter enclosure. The Pressure set point range shall be ___ to ___ psig.

    7.b. Supply a temperature transmitter to sense the supply water temperature with 4-20 ma input to the controller. The temperature sensor shall be 100 ohms Platinum RTD with 4.5-inch insertion length in a SS thermo well. Temperature set point range shall be ___ to ___ deg F.

8. The controller Vacuum Fluorescent panel shall display all inputs, set points and operating parameters.
9. Sequencer shall have retentive memory in case of power failure and shall recall the last operating sequence and number of boilers in service when power is restored.
10. Auto Lead Boiler Changeover shall be front panel programmable for either of the following, accumulated lead boiler run hours, day/hour changeover time.
11. Sequencer shall have the ability to accept universal types/ranges of process transmitters and be configurable from the front keypad.
12. Sequencer must have Master Set Point Tracking of all cut in/out points and modulation parameters.

Part 3- Options For Specification (Select and Add to Final Specification)

a. Provide full modulating control of each boiler with signals to match the actuators supplied for each boiler (135ohm standard or 4/20ma optional).

b. For full modulating control, provide auxiliary automatic/manual modulating control stations that provide both automatic and manual control of each boiler-firing rate that will operate in case of lead/lag sequencer control failure. Provide one per boiler on the front of the panel. The controller shall have a LED display of boiler firing rate actuator position and control capability of ratio, dead band and proportional action. Transfer from the sequencing controls to the auto/manual controls shall be automatic in the event of CPU failure or faults.

c. Provide outside air temperature reset control action. Include a temperature transmitter with 4-20 ma signal to the controller. The controller will reset the set points based on the variations in the outside air temperature. The outside air temperature sensor shall be 100 ohms Platinum RTD, equipped with a stainless steel weather/sun shield. A dedicated 24 VDC loop power supply shall be furnished in the cabinet for the transmitter.

d. Provide automatic sequencing upon boiler failure that shall enable another boiler to be brought into sequence in the event of flame failure of an on-line boiler.

e. Provide set point scheduling of all, on and off set points at a selectable time of day/week/month to implement night set back and weekend skip.

f. Provide output from the controller to enable hot water circulating pumps to be staged with the sequence of the boiler. Pumps are to remain on for a time adjustable period after the boiler is turned off.

g. Provide assured low fire warm up and low fire shut shutdown from proof of position contacts that are required on the firing rate actuators.

h. For boilers with non-modulating outlet draft dampers, provide outputs to fully open and fully close the outlet dampers in response to the sequence of bringing a boiler on or off.

i. Provide the RS-485 output and programming of the controller to permit remote changes of control commands from the building management system.

j. Provide combustion efficiency reading (available from the front panel display of the controller) for each boiler and based upon boiler flue gas temperature. For this, provide one flue gas temperature transmitter for each boiler with a stainless steel protected 18-inch insertion 100 ohm platinum RTD and a dedicated digital flue gas temp indicator mounted on the cabinet front for each transmitter (option available on 5810 only).

k. Flue Gas Temperature Monitoring, same as above but with FGT readout and no combustion efficiency readout.

2. The Sequence of Operation shall be as follows:

   a. Upon start-up, burners shall always start in the low-fire position. Upon release of the combustion control system, they shall modulate via the programmable controller.

   b. As the pressure/temperature increases, the header mounted transducer will signal the programmable controller. In turn, the programmable controller shall sequence the proportional firing rate circuits of each modulating burner in an appropriate lead/lag sequence.

   c. Upon still further increase in pressure/temperature, the programmable controller will - in a time response - de-energize the lag boiler(s) in the appropriate lead/lag sequence. The burners will be in the low fire position before de-energizing. Upon reaching the final pressure/temperature set point, the controller will de-energize the lead burner.

d. With a drop in pressure/temperature, the programmable controller will reverse the sequence and call the burners on line in a timed response.

e. In the event that the lead burner fails to operate, the programmable controller shall automatically transfer control to the lag burner without any requirement for changing pressuretrol/aquastat settings.

Item f. is optional.

f. The lead/lag control shall have a summer and winter range of operation requiring only that the operator depress a selector button to change ranges. Upon range changes all values (selected pressures/ temperature) shall be revised to the new value without intervention by the operator.

3. The lead/lag controller shall be mounted in a separate wall mounted panel made of 16 gauge steel with a hinged door and latch assembly. (Note: optional pedestal mounting is available).

4. The lead/lag control shall be complete with a pressure/temperature transducer to be installed in main steam/water header.

5. The control panel shall be constructed in accordance with U.L. specifications and shall bear the U.L. listing label for Enclosed Industrial Control Panels.

Draft Control

1. A double acting type of barometric draft damper shall be supplied and installed on (each) (the) boiler breeching. An electrical interlock will shut the gas supply off in the event that flue gases escape from the damper opening for a period of 60 seconds. The draft control shall be _____ inches in diameter.

2. Automatic Sequence Overfire Draft Control System.

   The contractor shall furnish and install a UL approved Power Flame Model DC-3 Sequence Overfire Draft Control System. The controller shall be installed in the burner panel and must have a two line vacuum florescent display for all tuning and scaling operations and for display of variables such as draft pressure. The operator interface must be have four pushbuttons on the front panel for all operator functions such as alarm acknowledgement, selection of displays and control functions. The display must include set points and tuning parameters and operational values such as flue gas temperature, draft pressure and alarms.

   The controller must sense the draft pressure by direct connection to the furnace tap without the need for an external transmitter. The controller must have a piezoresistive silicon sensing element that is capable of measuring positive or negative pressures within the range of 0 to + or – 2” W.C.. This element must be temperature compensated and must produce a signal that is directly proportional to the differential pressure between atmospheric and the furnace pressure.

   The controller must be field configurable for selecting the sequence mode from non-sequencing to sequencing with post and pre-purge capability and for positive or negative set point control applications. Post and pre-purge capability must have adjustable time delays of 20 to 120 seconds selectable from the front panel. The

controller must retransmit the draft pressure as 4-20 mADC signal for recording or remote display and must have Modbus (selectable as 9600 or 19200 baud rate) communications as standard.

The controller must have an electronic draft indicator. The draft pressure must be indicated on the two line vacuum florescent display for the range.

The controller must include a closed/auto/open selector switch and all necessary relays for full programming and control actions. The closed position will bypass all automatic functions and closes the damper. The open position will open the damper and the boiler can be operated in the case of controller malfunction or boiler maintenance. In the automatic position the controller will maintain the desired setting to within one-hundredth (0.01) inch water column by varying the position of the draft damper. The controller will include proportioning band adjustment and will filter out the furnace pulsation without loss of sensitivity.

The controller circuit shall interconnect with the combustion safeguard and limit control circuits governing burner operation, to provide fixed damper opening for pre-purge and stable ignition, full modulation of damper during firing, and close damper after boiler shut down. However, burner shall shut down when switch is moved from automatic. The open damper switch shall provide means to fully open damper without interrupting firing.

The controller must have a UL approved draft cutoff switch, Model AFS-952**,** that will shut down the system in the event of an unsafe draft condition in the furnace extending over 8 seconds. The switch must be mounted inside the controller cabinet. After safe draft is reestablished, the combustion system must recycle from the original starting position. The cutoff point of the minimum draft switch shall be adjustable from zero to within two-hundredths (0.02) inch of the operating draft. The relay panel and solid-state control section shall each be of the modular type, permitting easy replacement. The controller shall also indicate alarm values on the display.

The controller output shall drive a 150 inch-pound torque rotary actuator. Unit must be equipped with an adjustable “start position” switch. A purge position signal switch must be an integral part of the operator. The operator must be equipped with a mechanism permitting selection of any partially open setting of the damper for the purge position (minimum 20 percent). This feature must allow the full range of the damper opening to be utilized during the firing cycle, and also permit adjustment of the purge position to provide maximum opening of the damper without adverse effect on pilot operation.

All necessary linkage, including adjustable clevises, pipe adapters, and damper lever arms must be designed for the particular use of the equipment to be installed, to provide free, smooth and rigid operation, but eliminate unnecessary play and lost motion.

(Options)

(Thermocouple Option):

The controller must have an internal flue gas temperature indicator and transmitter and meet ISA Sequence M alarm functions. A Type J Thermocouple shall be provided and remote mounted by the contractor.

The controller shall accept the input from the thermocouple directly and shall display the temperature on the front panel vacuum florescent display. The controller must have the capability of setting the alarm temperature, provide a flashing display of temperature alarms and have two alarm contact outputs. The controller must have local reset; remote reset or automatic alarm reset capability. The controller must have dual fail-safe SPDT contacts for remote alarming or indication. This temperature must re-transmitter as a 4-20 mADC signal for the range of 32 deg F to 1000 deg F. The controller must have the capability of temperature display in degree Celcius via front panel operation. Thermocouple failure must result in a fail-safe response by immediately going to the maximum output of 20 mADC.

(Heavy Duty Linkage Option):

Supply a 300 inch-pound torque rotary actuator with mounting bracket and heavy-duty linkage.

(Remote Mount Option):

The controller may be remote mounted in a separate enclosure.

Product Liability Insurance

1. The burner manufacturer will provide an Insurance Certificate documenting his current coverage of Product Liability Insurance.

Burner Start Up Information and Test Data

1. On completion of the burner system start up - the installing contractor will complete the "Burner Start Up Information and Test Data" form and "Control Settings" form (both attached) and deliver to the Specifying Engineer.

NOx Emissions Reduction - Low NOx Burner

(Spec Writer - For a future low NOx burner, omit paragraphs 1. through 4. and use paragraphs for "Future Low NOx")

1. Burner(s) must be low NOx type, U.L. listed specifically for reduced emissions service. Burner NOx reduction strategy shall reduce the production of NOx by controlling low excess air operation and reducing flame temperature. Optimum stoichiometry shall be maintained by a Varicam operated fuel metering control with characterized cams for each fuel. Each cam shall have 14 points of adjustment through the modulating range assuring NOx reduction and high fuel efficiency.

2. Internal recirculation and staged air burners, where portions of the main flame are combusted within the burner head, behind a cone or diffuser assembly shall not be acceptable due to the potential for burner head failure caused by the resultant thermal stress of the referenced components.

3. Steam injection emissions reduction burners will not be acceptable because of the potential of mineral deposits on, and/or damage to heat transfer surface and refractory - and also due to the cost of steam.

(Spec Writer - Since NOx control is application specific, it is recommended that low NOx applications be reviewed by Power Flame's Engineering Department).

4. Low NOx Burner(s)

   a. Type: Induced Flue Gas Recirculation (IFGR).

      (1) Each burner shall be equipped with a burner mounted induced FGR purge assembly, complete with motor driven diverter damper to ensure that FGR is not introduced into the burner combustion air during the pre-purge, ignition, initial main flame establishment, or post purge cycles.

      (2) Induced FGR piping shall be furnished and installed by others (not provided by the burner manufacturer) to connect the boiler stack to the burner FGR inlet connection. FGR piping shall be seamless carbon steel pipe or tubing, minimum Schedule 10, sized in accordance with the burner manufacturers recommendations and run to avoid interference with flue doors, boiler inspection parts, etc.. Piping and insulation (by others, if required) shall be in accordance with all applicable codes.

      (3) On natural gas firing, NOx emissions will not exceed 30 PPM, and CO emissions will not exceed 50 PPM. NOx emissions on oil firing shall result in not less than a 40% reduction of NOx emissions, from that experienced without NOx control, with CO not exceeding 50 PPM. All emissions measurements are to be corrected to 3% O_2.

      (3) Burner Start-Up Information and Test Data Form must include NOx and CO emissions measurements. Form, completed with all test data values, shall be furnished to the owner prior to final payment.

Future Low NOx

The burner(s) shall be U.L. listed, forced draft type. Each system shall be capable of being field retrofitted to low NOx operation without modification to, or replacement of any major component assemblies initially supplied. The original burner blower housing, blower, blast tube (head), and diffuser assembly shall be used. Future retrofit hardware shall be limited to a factory supplied, bolt on, low NOx kit that shall be U.L. approved for field retrofit as well as for factory installation. The completed retrofit shall be in accordance with the U.L. listed low NOx system normally supplied by the burner manufacturer for new applications.

Low NOx retrofit shall be accomplished without the need for derating the boiler-burner input or output - and without the need to increase gas supply pressure or electrical power supply.

1. Internal recirculation and staged air burners, where portions of the main flame are combusted within the burner head, behind a cone or diffuser assembly shall not be acceptable due to the potential for burner head failure caused by the resultant thermal stress of the referenced components.

2. Steam injection emissions reduction burners will not be acceptable because of the potential of deposits on, and/or damage to heat transfer surface and refractory - and also due to the cost of steam.

3. At the time of bid, burner manufacturer shall specify the NOx reduction method and guarantee that, on natural gas firing, NOx emissions will not exceed 30 PPM, and CO emissions will not exceed 50 PPM. Low NOx retrofit on oil shall result in not less than a 40% reduction in NOx emissions, with CO not exceeding 50 PPM. All emissions measurements corrected to 3% O_2.

BURNER START UP INFORMATION & TEST DATA

The following information shall be recorded for each burner start up:

Power Flame Model _____ Job No. _____ Serial No. _____

Installation Name _____ Start Up Date _____

Start Up Contractors Name _____ Phone _____

Name of Technician doing Start Up _____

Type of Gas: Nat. ☐ LP ☐ Other ☐ Fuel Oil Grade No. _____

Gas Firing

Gas Pressure at Train Inlet

Burner in Off Position _____ "W.C.
Low Fire _____ "W.C.
High Fire _____ "W.C.

Gas Pressure at Firing Head

Low Fire _____ "W.C.
High Fire _____ "W.C.

Gas Pressure at Pilot Test

Tee _____ "W.C.

Flame Signal Readings D.C. Volts ☐ Micro Amps ☐

Pilot _____
Low Fire _____
High Fire _____

CO_2 or O_2 (Specify)

Low Fire _____ %
High Fire _____ %

CO

Low Fire _____ PPM
High Fire _____ PPM

Input Rate

Low Fire _____ BTU/HR
High Fire _____ BTU/HR

Overfire Draft

Low Fire _____ "W.C.
High Fire _____ "W.C.

NOx (Corrected to 3% O_2)

Low Fire _____ PPM
High Fire _____ PPM

Stack Outlet Test Point Draft

Low Fire _____ "W.C.
High Fire _____ "W.C.

Net Stack Temperature

Low Fire _____ ° F
High Fire _____ ° F

Combustion Efficiency

Low Fire _____ %
High Fire _____ %

Windbox O_2

Low Fire _____ %
High Fire _____ %

Oil Firing

High Fire Vacuum Reading on Oil

Pump Inlet _____ "H.G.

Gas pressure at Pilot Train

Inlet (if applicable) _____ "W.C.

Gas Pressure at Pilot Test

Tee (if applicable) _____ "W.C.

Oil Nozzle Supply Pressure

Low Fire _____ PSIG
High Fire _____ PSIG

Oil Nozzle Atomizing Medium Pressure

Low Fire _____ PSIG
High Fire _____ PSIG

Flame Signal Readings

Pilot (if applicable) _____ D.C. Volts
Low Fire _____
High Fire _____

GPH Firing Rate

Low Fire _____ GPH
High Fire _____ GPH

CO_2 or O_2 (Specify)

Low Fire _____ %
High Fire _____ %

Bachrach Scale Smoke Number

Low Fire _____
High Fire _____

NOx (Corrected to 3% O_2)

Low Fire _____ PPM
High Fire _____ PPM

Over Fire Draft

Low Fire _____ "W.C.
High Fire _____ "W.C.

Stack Outlet Test Point Draft

Low Fire _____ "W.C.

Net Stack Temperature

Low Fire _____
High Fire _____

Combustion Efficiency

Low Fire _____ %
High Fire _____ %

Control Settings

Operating control cut out setting _____
Operating control cut in setting _____

Limit control cut out setting _____
Limit control cut in setting _____

Power supply: Volts _____ Ph _____ Hz _____
Control circuit: Volts _____
Blower motor amps at high fire _____

Other _____

Gas

Low gas pressure switch _____ "W.C.
High gas pressure switch _____ "W.C.

Other _____

Oil

Low oil pressure switch _____ lbs.
High oil pressure switch _____ lbs.
Atomizing low pressure switch _____ lbs.

Oil pump motor amps at high fire _____
Other _____

Operation Checklist

Checked For Proper Operation Of:	Yes	No		Yes	No
Low water cut off			Barometric damper		
High water cut off			Boiler room combustion air &		
Flame safeguard control ignition failure			ventilation provision correct		
Flame safeguard control main flame failure			Oil tank vent system correct		
Burner air flow switch			All oil lines checked for leaks		
Induced draft fan controls			All gas lines checked for leaks		
Over fire draft controls			Gas lines & controls properly vented		
Fresh air damper end switch			Other system components (specify)		

Notified _____ of the following system deficiencies: _____

Comments to the Specification Writer
on FM and IRI Code Requirements

Factory Mutual (FM) Insurance Requirements

A standard U.L. burner will comply with published requirements for Factory Mutual for gas and gas-oil burners with inputs at or below 2,500 MBH - and for oil (only) burners with inputs at or below 2,800 MBH.

Local FM inspectors are empowered to examine risks and impose or modify requirements which could result in substantial equipment (and price) change depending on decisions of the local inspector.

Purchasers (owners), or their consulting engineers, should contact the local FM office to determine any items, not included above, which must be supplied.

All systems specified are subject to acceptance by the local FM inspector.

Industrial Risk Insurers (IRI) Insurance Requirements

The equipment specified in the attached under IRI incorporates the basic components and systems necessary to comply with the published standards.

Local IRI inspectors are empowered to examine the risks and modify the standards which could result in equipment (and price) change depending on the decision of the local inspector.
Purchasers (owners), or their consulting engineers, should contact the local IRI office to determine any items, not included above, which must be supplied.

All systems specified are subject to acceptance by the local IRI inspector