

# Power Flame Incorporated



**SUGGESTED SPECIFICATION  
FOR MODEL NP2  
ULTRA LOW NO<sub>x</sub> GAS BURNERS  
SUB 9 to 20 PPM NO<sub>x</sub>  
LMV3 Control System**

***THE POWER TO MANAGE ENERGY***

2001 South 21st Street, Parsons, Kansas 67357

Telephone: 620-421-0480, Fax: 620-421-0948

Web Site: [www.powerflame.com](http://www.powerflame.com)

E-Mail: [CSD@powerflame.com](mailto:CSD@powerflame.com)

## **Suggested Specification for Power Flame NP2**

(Ultra Low NOx Gas Burners from 400 to 6,100 MBH)

### A. General Requirements

1. Furnish and install Power Flame Model NP(R)2-G-XXX Ultra Low NOx natural gas burner. The burner and burner installation shall meet all applicable local code requirements.

### B. Low-NOx Burner Description

1. The burners shall be Power Flame Type NP2 forced draft surface stabilized combustion. Each burner shall have a maximum fired duty of (X,XXX) MBTU/hr. Gas pressure at the burner gas train supply connection shall be a minimum of (XX) and maximum (1) PSI
2. NOx emissions shall be guaranteed to be less than or equal to (9, 12, 20) PPM, corrected to 3% O<sub>2</sub>, and CO emissions shall be guaranteed to be less than or equal to 50 ppm, over the full range of burner operation.
3. The burner shall operate **without flue gas recirculation** (FGR) with natural gas as the main fuel. Burner using flue gas recirculation will not be approved.
4. Burner turndown from maximum heat input shall be a minimum of 3:1.
5. Combustion head shall be of high temperature stainless steel all metal construction. The surface stabilized combustion head shall use a knitted fiber matrix material (woven material will not be accepted) utilizing an ultra thin, high temperature resistant stainless steel fiber. The fiber matrix material shall be knitted in a manner to create 3-dimensional loops that give flexibility to the material, provide excellent insulation and the optimum cooling to the fibers close to the flame. The knitted structure shall be relatively open creating less chance of contamination and blockage of the surface during operation. The burner manufacturer shall provide a five (5) year written warranty for the combustion head. Surface stabilized combustion head and be provided with refractory boiler mounting plate.
6. All combustion air shall be supplied by a blower mounted integral to the burner. The blower wheel shall be forward curved R series industrial model and shall be directly driven by a (XX) hp 3450 RPM 208/230/460 volt, 60 Hz, 3 phase motor. Open air inlet assemblies on the side of the blower wheel will have no moving parts, dampers or linkage. Combustion air connection shall be provided with a washable stainless steel metal mesh air filter assembly and be capable of accepting a direct fresh air connection.
7. The burner assembly shall be of welded steel construction. All surfaces shall be treated with a phosphate coating prior to applying a baked on polymer powder coat finish. Supply a three dimensional AutoCAD drawing of the burner to assure proper fit up to the boiler or heat exchanger

### C. Approval Codes

1. Each burner shall adhere to UL **(GE-Gap, FM, CSD-1 and former IRI)** design guidelines. Each burner shall be designed and constructed as an integrated combustion system package and shall be factory fire tested.

### D. Ignition System

1. The burner ignition system shall utilize natural 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 ball valve. **(Optional: pilot normally open vent valve with locking shutoff cock, pilot gas strainer, gas pressure gauge and manual gas shutoff valve.)** 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 burner/pilot assembly front mounting plate.

### E. BMS Fuel Air Ratio Control shall have the following functionality:

- 1.1.1 Capability of positioning 2 actuators and one Variable Speed Drive (VSD) simultaneously on their programmed curves with an accuracy of 0.3 degree (actuators) and 0.1% (VSD).
- 1.1.2 Tachometer feedback of fan motor speed for VSD applications.
- 1.1.3 The possibility of 10 programmable points per curve, per fuel.
- 1.1.4 Separate, programmable actuator positions for ignition and low-fire.
- 1.1.5 The unit shall have the capability to use either one or two fuel actuators for dual fuel burners.
- 1.1.6 The speed of the blower motor shall be controlled by a variable frequency drive suitable to accept a 4-20 mA or 0-10 Volt control signal from a modulating type (temperature) (pressure) controller. When the operating control is satisfied the burner shall shutoff and return to the closed position. The proportional fuel-air ratio controller shall ensure a guaranteed low fire start position prior to the pilot trial for ignition sequence.

### F. U. L. Gas Control Trains

1. The gas train shall contain the following:
  - a. Manual shutoff cock
  - b. Main gas pressure regulator
  - c. Automatically operated main motorized proportional on ratio fuel-air valve
  - d. Automatically operated auxiliary gas valve
  - e. Manual reset Low and High gas pressure switches **(Optional: < 2,500 MBH)**
  - f. Manual leakage test cock.
  - g. Burner manifold gas pressure gauge
  - h. (2) ¼" leak test cocks

## 2. FM Requirements (Optional)

(Spec writer – For FM 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.

## 3. Former IRI Requirements (Optional)

(Spec writer – For IRI 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).  
(Spec writer - add the following for FM:)
4. 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.
5. For burners above 12,500 MBH, both valves shall have proof of closure and FM label.

## G. 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). A safety manual reset type limit control shall be provided by others to shut the burner down in the event of excessive (pressure) (temperature). The proportional fuel-air ratio controller shall be controlled by a modulating type (pressure)(temperature) control in addition to the On-Off operating control.

## H. Interlocks

1. The combustion sequenced will allow for four (4) complete air changes of the combustion chamber and breaching. Proven low fire start interlock to insure burner starts at the low fire setting.
  - 1.1 Pre-purge and post-purge time adjustable from 20 seconds to 60 minutes.
  - 1.2 Programmable overlap of spark (ignition transformer energized) and pilot valve energized (open).

- 1.3 Programmable overlap of the proven pilot and the main gas valves energized (open).
- 1.4 Programmable stops so that the startup sequence can be stopped and held in all of the following phases: pre-purge, pre-ignition, pilot ignition, and main flame.
- 1.5 Integrated gas valve proving via a pressure switch located between the main and blocking gas valves, and monitoring POC (Proof of Closure) switches on the gas valves.
- 1.6 Gas valve proving on start-up, shut down or both.
- 1.7 Programmable actuator positions for prepurge, postpurge, home and ignition position.
- 1.8 Actuator shaft position verification by optical encoder.
- 1.9 Intrinsically safe, low voltage actuators.
- 2.0 Password protected access to OEM level safety related parameters.
- 2.1 Password protected access to service level parameters.

I. Flame Safeguard Control

- 1.1 Each boiler / burner shall be equipped with a burner management system (BMS) having functionality equal to a Siemens LMV 3 BMS with Variable Speed Drive (VSD) and a Touch Screen Human Machine Interface (HMI)
- 1.2 The BMS Fuel Air Ratio Control shall have the following functionality:
  - 1.2.1 Capability of positioning 2 actuators and one Variable Speed Drive (VSD) simultaneously on their programmed curves with an accuracy of 0.3 degree (actuators) and 0.1% (VSD).
  - 1.2.2 Tachometer feedback of fan motor speed for VSD applications.
  - 1.2.3 The possibility of 10 programmable points per curve, per fuel.
  - 1.2.4 Separate, programmable actuator positions for ignition and low-fire.
  - 1.2.5 The unit shall have the capability to use either one or two fuel actuators for dual fuel burners.
- 1.3 The BMS shall have the following Communications capabilities:
  - 1.3.1 Modbus RTU communications

- 1.3.2 Internal registers have both read and write capabilities.
- 1.3.3 Separate connection available for configuring the unit with a PC.
- 1.4 The BMS shall have the following Annunciation capabilities:
  - 1.4.1 A real time display detailing the status (energized / de-energized) of the unit's outputs.
  - 1.4.2 A log of the last 25 faults, detailing the error and the phase of operation in which it occurred.
- 1.5 The BMS shall have burner / boiler Efficiency Monitoring with the following capabilities:
  - 1.5.1 The ability to read, record and display fuel usage when connected to appropriate fuel flow meters.
- 1.6 The BMS shall have a touch screen HMI device capable of the following functions:
  - 1.6.1 Access and change all non password protected, user-adjustable parameters.
  - 1.6.2 Display and trend the following:
    - 1.6.2.1 Hours run on a specific fuel, number of starts.
    - 1.6.2.2 Boiler water level & setpoint (with optional Feedwater Control)
    - 1.6.2.3 Load, boiler pressure / temperature
    - 1.6.2.4 Actuator position
    - 1.6.2.5 Flame signal
    - 1.6.2.6 Fuel Flow
    - 1.6.2.7 Fuel Pressures, Oil temperature, Steam Flow, Economizer Temperature (with optional equipment)
    - 1.6.2.8 Customer Defined
  - 1.6.3 Animations that change with the following:
    - 1.6.3.1 Actuator Position
    - 1.6.3.2 Load
    - 1.6.3.3 Steam Pressure / Water Temperature
    - 1.6.3.4 Water level
    - 1.6.3.5 Customer defined
  - 1.6.4 Storage of the last 120 faults with error code, plain text description, and a time/ date stamp.
  - 1.6.5 User defined alarms for values read by the HMI.
  - 1.6.6 Password protection of HMI settings.

- 1.6.7 Boiler Sequencing for multiple boilers, lead/lag control.
- 1.6.8 Paging or emailing of faults or alarms.
- 1.6.9 Accessibility of data and control over the internet.
- 1.6.10 Interface to many Building Management Systems

## 2.0 Special Features

### 2.1 The BMS shall have the following Special Features:

- 2.1.1 Programmable high low gas buffer so that pressure shocks (caused by main valves opening) can be ignored for a specified, short period of time.
- 2.1.2 Gas Pilot Valve Proving (double pilot valve applications)

## J. Control Panel

1. Each burner shall be complete with a 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. All optional controls will be wired to a din rail mounted terminal strip within the control panel. On-off power switch, lights for "Power On", load "Demand", "Main Fuel", Flame Safeguard "FSG Alarm" and "Low Water", Manual-Auto selector switch and manual potentiometer in the manual mode. Include in the panel a variable speed drive and panel vents.

(Optional remote panel) All wiring for remote panel electrical components shall be factory pre-wired to a terminal strip mounted 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 shall match a terminal strip in the remote panel. Field wiring shall be required between the burner mounted junction box and the remote control panel.

2. Appropriate electrical knockouts shall be provided on both sides of the panel to allow for necessary power and limit control wiring. The control panel shall be constructed of 14 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 have a baked on powder coat finish in a color identical to the burner being supplied.
3. The control panel shall include a din rail mounted control circuit transformer with integral fuses on both the primary and secondary windings to power 120 V components, din rail mounted motor starters, relays, terminal blocks and other electrical devices as required. The control panel shall include a step-down control circuit transformer fused on both the primary and secondary.

4. Provide an alarm buzzer and auto reset alarm silencing switch to signal any failure status.
5. **Optional lights and alarms indications:** Light packages in groups of 4, 6 or 8 lights 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. **4** additional lights and alarm.  
"High Temperature" (R), "Low Gas Pressure" (R), "High Gas Pressure" (R), "Pilot Failure" (R) with alarm buzzer and alarm silencing switch.
  - b. **6** additional lights and alarm.  
"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. **8** additional lights and alarm.  
"High Temperature" (R), "Low Gas Pressure" (R), "High Gas Pressure" (R), "Pilot Failure" (R), "Ignition On"(A), "Air Flow Failure" (B), "Pilot On" (A), "High Limit" (R) with alarm buzzer and alarm silencing switch.

Specify desired light functions and isolation circuits as required.

K. Documentation

The burner manufacturer shall furnish as a minimum a burner specification sheet, comprehensive Bill of Material, piping diagram, ladder logic wiring diagram and job specific 3-D model of the complete burner that includes dimensional information, "see through" feature for viewing internal assemblies and component identification.

L. Product Liability Insurance

The burner manufacturer will provide an Insurance Certificate documenting his current coverage of Product Liability Insurance (no less than \$10 million coverage).

M. Burner Start-up Information and Test Data

- (1) On natural gas firing, NO<sub>x</sub> emissions will not exceed **(9, 12, 20) PPM**, and CO emissions will not exceed 50 PPM all emissions measurements are to be corrected to 3% O<sub>2</sub>.
- (2) Burner Start-Up Information and Test Data Form must include NO<sub>x</sub> and CO emissions measurements. On completion of the burner system start up, the installing contractor shall complete a Burner Startup Information Sheet and a Control Setting Sheet and deliver to the Specifying Engineer and to the owner prior to final payment.