Power Flame Incorporated

SUGGESTED SPECIFICATION
FOR MODEL NVC7 THRU NVC10
ULTRA LOW NOx GAS BURNERS
SUB 9 PPM NOx
WITH CONTROLINKS CONTROLS

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
E-Mail: CSD@ powerflame.com

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Suggested Specification for Power Flame NVC

(Ultra Low NOx Gas Burners from 12,500 to 21,000 MBH)

A. General Requirements

1. Furnish and install NVC(R)XX-G-30 Ultra Low NOx natural gas burner. The burner and burner installation shall meet all applicable code requirements.

B. Low-NOx Burner Description

1. The burners shall be Power Flame Type NVC forced draft surface stabilized combustion. Each burner shall have a maximum fired duty of XX,XXX MBTU/hr. Gas pressure at the burner gas train supply connection shall be a minimum of 5.0 PSI

2. NOx emissions shall be guaranteed to be less than or equal to (9) ppm, corrected to 3% O_2, 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.

   The burner manufacturer shall have a minimum of fifteen (15) burners in operation for over one (1) year that have met the emission requirements stated above. The manufacturer will be required to furnish source test reports for each of the installed and operational burners.

3.A (Optional) The burner shall operate with induced flue gas recirculation (IFGR) with natural gas as the main fuel, to maintain combustion a 5.0% excess 0_2 at high fire. A servo motor shall control the positioning of the IFGR inlet damper.

4. Burner turndown from maximum heat input shall be a minimum of 3:1.

5. The entire combustion head shall be constructed using high temperature stainless steel. The exposed non-firing surfaces shall be protected using high temperature insulation. 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.

6. The combustion head shall be provided with an insulated boiler mounting plate.

7. All combustion air shall be supplied by a blower mounted integral to the burner. The blower wheel shall be of the forward curved centrifugal design (Note NVC7) or a backward inclined centrifugal design (Note NVC8 thru NVC10) and shall be directly driven by a XX hp 3450 RPM 460 volt, 60 Hz, 3 phase motor. Blower motors located

in the same chamber or blast tube as the premix gas is not allowed. A multi blade damper assembly located on the inlet side of the blower wheel shall meter the combustion air flow.

8. The burner assembly shall be of welded steel construction and have a baked on 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 design guidelines and be UL Listed. 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 and manual gas shutoff valve. The flame proving system shall incorporate a 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. Fuel/Air Control System

1. Main gas supply shall be controlled by dual motorized gas safety shut-off valves (one with proof of closure interlocks).

2. A servo motor shall control the positioning of the air inlet dampers and main gas flow control valve. The position of the main gas and combustion air servo motors shall be controlled by a modulating type (temperature) (pressure) controller. When the operating control is satisfied the burner shall shutoff and return to the closed position. The servo motors shall provide a feedback signal to ensure a guaranteed low fire start position prior to the pilot trial for ignition sequence.

F. 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 gas valve with proof of closure interlock switch
   d. Automatically operated auxiliary motorized gas valve
   e. Normally open vent valve
   f. Manual reset Low and High gas pressure switches
   g. Manual leakage test cock.
   h. Burner manifold gas pressure gauge
   i. (2) ¼" leak test cocks

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 position of the servo motors and other fuel/air components shall be controlled by a modulating type (pressure)(temperature) control in addition to the On-Off operating control.

H. Interlocks

1. The combustion air servo motor shall be sequenced to allow for four (4) complete air changes of the combustion chamber and breaching, and through a feedback signal electrically interlocked with the control burner circuit to insure the air damper is in the low fire start position before the burner ignition sequence can begin.

I. Flame Safeguard Control

1. The flame safeguard control shall include ultra-violet 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 high fire air flow rate for a minimum of four (4) air changes. Flame safeguard shall provide safety shutdown with manual reset on air flow failure. The flame safeguard control shall be a Honeywell RM7800L controller with an R7999 ControLinks microprocessor-based control that simultaneously directs up to four PPPA's (Universal Parallel Positioning Actuators), based on input from the firing rate control, limit and operating controls, primary flame safeguard control and/or an S7999B system display.

J. System Operation - Safety Provisions

1 The Fuel Air Ratio Control Shall Provide the Following Safety Provisions:

a. Dynamic self check of the feedback potentiometer circuitry. The Fuel Air Ratio Control microprocessor tests the feedback from the Positioning Actuator and will lockout on safety shutdown if the feedback test fails.

b. Curve verification algorithms. After the service technician has built the fuel/air curve for the burner, the fuel/air control requires that the curve is verified. This verification is a check that all points on the curve are at the optimum fuel air profile position.

c. Step size enforcement during commissioning. During the commissioning process of the Fuel Air Ratio Control, the movement of the Positioning Actuator is limited to a maximum of 3 degrees up to 20% of the actuator stroke. This prevents the service technician from accidentally entering fuel rich/lean territories.

d. Point plausibility algorithms. During the commissioning process, the Fuel Air Ratio Control will check the points that are entered to build the curve. If the point is not acceptable, a crosshair with a diamond will be shown and the point won't be allowed to be entered.

e. Password protection. The Fuel Air Ratio Control requires a password to commission the burner profile. The Fuel Air Ratio Control can be monitored without a password. This safety feature is used to prevent unauthorized personnel from changing the configured/verified burner profile.

f. Safety Relay Test/Weld-resistant algorithm for limit control input (LCI) and limit control output (LCO) contacts. Dynamic algorithm check of the LCI and LCO relay contacts fir weld/short-circuit. This safety feature will cause a safety shutdown and lockout of the Fuel Air Ratio Control.

g. Component anti-swap protection. The Fuel Air Ratio Control is programmed with the identification number on the Positioning Actuator. This safety feature prevents the installation of the actuators that have not been configured for the burner application.

h. Curve tracking verification/Off-curve checking algorithm. Dynamic algorithm checks the feedback of the fuel/air actuators against the burner profiled curve. If an actuator is off the curve and cannot be repositioned on the curve, a safety shutoff and lock-out will occur.

i. Integrated Thermal Shock Protection Algorithms.

- Water or stack Temperature Low Fire Hold. Based on a scalable 4-20mA auxiliary sensor input, the burner is held at light-off until the programmed temperature threshold is exceeded.

- FGR Hold. Based on a scalable 4-20mA auxiliary sensor input, the FGR damper is kept closed until the stack temperature has reached its programmed threshold.

- FGR and Low Fire Hold Combined. Performs both the Water or Stack Temperature Low Fire Hold and the FGR Hold algorithms.

2. Annunciation and Diagnostics - The Fuel Air Ratio Control Shall Provide**:**

a. First-out annunciation of fault occurrence.
b. Indication of sequence failures at start-up or during normal sequence operation.
c. Test of itself for failure, detecting and isolating and alarm, and reporting internal circuit faults.
d. System fault log history of the last six (6) faults.
e. Six (6) status LEDs for Power, Alarm and four (4) actuators.
f. Blinking fault code generation on Power LED using reset button (60 possible codes).
g. Alarm LED indicates lockout alarm condition.

3. The Positioning Actuator Shall Provide:

a. LED annunciation for actuator Unconfigured, Configured and On-Line or Faulty actuator states.
b. Actuator CW and CCW switches for manually driving hub for troubleshooting.

4. The System Display or Configuration software Shall Provide:

   a. HMI (Human Machine Interface) for commissioning of the Fuel Air Ration Control.
   b. First-out annunciation of fault occurrence.
   c. Indication of sequence failures at start-up or during normal sequence operation.
   d. System fault log history with date/time stamping of last six (6) faults.
   e. Fault code displayed on screen (60 possible codes).
   f. Audio feedback of alarm condition (with volume control).
   g. Status of the Fuel Air Ratio Control and Positioning Actuators.

K Control Panel

1. Each burner shall be complete with a burner mounted control panel which shall house all required operating electrical components. (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 step-down control circuit transformer fused on both the primary and secondary windings to power 120 V components.

4. The control panel shall have the following status indicators: Power On –Green; Limit Circuit Closed – Green; Main gas – Blue, Flame Failure – Red. High water or low water – Red

5. (Option) Provide an alarm buzzer and auto reset alarm silencing switch to signal any failure status.

L. 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.

M. 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).

N. Burner Start-up Information and Test Data

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.