



AJAX E-4000B High Efficiency Gas Condensing Boiler

Suggested Specification

Part I - General
Part II - Product
Part III - Installation

Project Name: _____ **Date:** _____

Location: _____

Engineer: _____

Contractor: _____ **Rep:** _____

I. GENERAL

- A. Supply and install _____ (qty) modulating and condensing boiler(s) as specified herein.
- B. Each boiler shall be factory assembled and tested. Each boiler shall be shipped complete on a factory-supplied wooden pallet, self-contained and ready for operation except for connection at the installation site of domestic water piping, fuel, electrical, combustion air, exhaust venting, condensate drainage and relief valve discharge piping.
- C. The boiler shall be capable of operating on natural gas or LP gas. The boiler shall be capable of normal operation and full rated input with natural gas supply pressure between 3.5 inches w.c. and 10.5 inches w.c., or LP gas supply pressure between 8 inches w.c. and 13 inches w.c. The boiler shall be factory set for natural gas.
- D. The boiler shall operate at a thermal efficiency of 99.9 %, with a minimum input of 500,000 BTU/hr and a maximum input of 4,000,000 BTU/hr.
- E. The boiler shall be certified to the ANSI Z21.13 / CSA 4.9 Gas Fired Boiler Standard.
- F. The boiler controls shall be CSD-1 compliant.
- G. The boiler shall be certified for installation either indoors or outdoors in accordance with the manufacturer's instructions.
- H. The boiler stainless steel heat exchanger shall be designed and constructed in compliance with the ASME Boiler and Pressure Vessel Code Section IV. A permanent nameplate bearing the "H" stamp and National Board registration number shall be attached to the heat exchanger and duplicated on the exterior of the unit in a readily viewable location.
- I. The heat exchanger limited warranty shall be ten (10) years. All other parts shall have a two (2) year limited warranty covering defects in materials and workmanship. The warranty period is based from the date of installation, if the installation is registered within 6 months of shipment.

II. PRODUCT

- A. Acceptable manufacturers
 1. The boiler shall be model AJAX E-4000B manufactured by ACE Heaters (The Nudyne Group, LLC).
- B. Boiler Construction
 1. Heat Exchanger and Combustion Chamber
 - (a) The heat exchanger shall be constructed of 316L stainless steel and mounted in a sealed stainless steel combustion chamber. The heat exchanger and combustion chamber assembly shall be of all-welded construction. The heat exchanger shall be rated for 160 psi maximum operating pressure.
 - (b) The heat exchanger shall be accessible for inspection and cleaning via a removable burner access cover. The cover shall include a flame observation port.
 - (c) A built-in "U" trap shall be connected to the combustion chamber for collection and removal of condensate. The trap shall be readily removable for cleaning.

- (d) The heat exchanger shall be able to accept up to 50% mixture of inhibited propylene glycol HVAC antifreeze, without damage to the heat exchanger or other components.
2. Gas Train and Combustion System
- (a) The combustion system shall be fully modulating with an 8:1 turndown ratio.
 - (b) The combustion system shall contain:
 - 1) Adjustable air/gas ratio valve with integral regulator
 - 2) Mixing venturi
 - 3) Variable speed blower utilizing pulse width modulation
 - 4) Stainless steel cylindrical premix burner
 - 5) Electrode spark igniter
 - 6) Independent flame sensing electrode
3. Venting and Combustion Air
- (a) The boiler shall be designed for venting with 12-inch diameter Schedule 40 CPVC, AL29-4C stainless steel or Polypropylene pipe. Maximum exhaust vent length shall be 150 equivalent ft.
 - (b) The combustion chamber exhaust outlet shall include a factory supplied, field installed, stainless steel connector for 12-inch diameter Schedule 40 pipe.
 - (c) The combustion chamber exhaust outlet shall include a ½ inch access port to permit insertion of a combustion analyzer probe. The access port shall be provided with a Viton sealing plug.
 - (d) The boiler shall include a factory supplied, field installed, stainless steel adapter for 12 inch pipe, for direct inlet of outside combustion air. Maximum air intake length shall be 150 equivalent ft.
 - (e) The boiler shall be capable of using indoor air for combustion.
4. Cabinet
- (a) The unit internal structure shall be constructed of heavy gauge steel finished with a durable factory applied coating.
 - (b) The cabinet jacket shall be constructed of removable panels fabricated from steel finished with a durable factory applied outdoor powder coating on both sides. Removal of jacket panels shall not compromise sealing of the combustion chamber. The cabinet shall be capable of outdoor utilization, NEMA 4X, without additional weather protection.
 - (c) The cabinet shall be provided with foundation anchoring bolt holes. Adjustable leveling legs are optional.
 - (d) The cabinet shall be fitted with lifting eye lugs to facilitate installation.
5. Electrical
- (a) The boiler shall operate from a 480VAC/3 Phase/60Hz power supply with a current draw of 3A with the capability to operate circulator pumps from a 277VAC/3 phase/60Hz power supply.
 - (b) A line-voltage barrier strip shall be provided for connection of
 - 1) Main supply power
 - 2) DHW diverter valve
 - 3) Boiler circulator pump. Pump control relays shall be sized for 5HP @ 208/3 phase/60HzVAC.
 - 4) System pump (Optional Relay 2)
 - 5) Boiler pump (Optional Relay 3)
 - 6) Flame detect dry contact for connection to a building automation system
 - 7) Alarm signal dry contact for connection to a building automation system
 - (c) A low-voltage barrier strip shall be provided for connection of:
 - 1) Outdoor sensor
 - 2) System sensor
 - 3) DHW temperature sensor
 - 4) Modbus

- 5) Communication for Lead-Lag cascade control (dependent unit)
- 6) On/Off Thermostat
- 7) 0-10VDC input
- 8) 0-10VDC circulator control
- 9) PWM circulator control
- 10) Communication for Lead-Lag cascade control (managing unit)
- 11) External low water cut off
- 12) Flue damper feedback
- 13) External safety limit
- 14) External safety limit

(d) A factory installed on/off switch shall be provided

6. Controls

(a) The boiler control system shall be provided by the factory fully wired.

(b) The integrated microprocessor-based controller shall incorporate all operational and safety control functions, including:

- 1) Burner spark ignition
- 2) Flame detection and supervision
- 3) Burner firing rate modulation
- 4) High temperature limit (UL353 rated)
- 5) Meets the following CSD-1 requirements:
 - (i) CS-300 requirements as Primary Safety Control
 - (ii) CW-400 requirements as Temperature Operation Control
 - (iii) CW-400 requirements as a Temperature High Limit Control

(c) The controller shall incorporate three outputs for proportional-integral-derivative (PID) algorithm for temperature control.

(d) The controller shall provide:

- 1) Operation of up to three (3) circulators. Output (relay) 1 is standard, outputs (Relays)2 & 3 are options.
- 2) Domestic hot water prioritization with a field-adjustable priority time.
- 3) Field-adjustable outdoor reset to automatically set system water temperature based on outdoor air temperature.
- 4) Manual firing rate control, adjustable between minimum and maximum firing rate.
- 5) Warm weather shutdown to disable heating, with field adjustable setpoint.
- 6) Pump exercise for 10 seconds at 24-hour intervals.
- 7) Freeze protection to operate the boiler and pump and fire the burner at minimum modulation when the temperature falls below setpoint.
- 8) Field setting of the following:
 - Central heat (CH) setpoint from 68°F to 194°F
 - Domestic hot water (DHW) setpoint from 32°F to 185°F
 - Time of Day (TOD) setpoint
 - CH and DHW pump overrun time from 10 to 900 seconds
 - DHW pump start delay from 0 to 255 seconds
 - DHW modulation source (inlet or outlet water temperature)
 - Lead and lag selection method (sequence order or measured runtime)
 - Lead rotation time from 0 to 720 hours
 - Slave order priority method (equalize runtime, use first or use last)
 - Anti short-cycle interval from 0 to 15 minutes
 - Temperature units, °F or °C.

(e) The control system shall include a built-in display for commissioning and maintenance and a color touchscreen display to permit monitoring of unit operation and field adjustment of control parameters.

The control shall support three (3) levels of password-protected access permission: User (no password), Installer, and OEM. The display shall be capable of showing:

- 1) Heat demand source
 - 2) Burner state
 - 3) Demanded firing rate in RPM
 - 4) Actual blower RPM
 - 5) Current setpoint
 - 6) Heat exchanger entering water temperature
 - 7) Heat exchanger exiting water temperature
 - 8) Exhaust gas temperature
 - 9) Annunciation of limit devices
- (f) The controller shall be capable of Lead-Lag staging and rotation of up to sixteen (16) AJAX series boilers with no additional control hardware required, apart from the necessary field-supplied cabling to connect the units via terminals provided on the low-voltage barrier strip. Field configuration of Lead-Lag operation shall be accomplished through the built-in display.
- (g) The controller shall provide integrated communication capability using the Modbus RTU protocol over an RS-485 interface. Communication with external third-party building management networks utilizing BACnet MS/TP, BACnet/IP, or LonWorks protocol shall be accomplished with factory optional communication gateway(s). The gateway shall map factory selected internal controller data registers to (select one): BACnet objects, or LonWorks SNVTs.
7. The manufacturer shall verify proper operation of the burner, all controls and the heat exchanger during factory fire test prior to shipment.

C. Trim kit

1. The following shall be factory supplied with each boiler, for field installation:
 - (a) Qty. 1 – ASME Pressure Relief Valve, 30 psi, 2” FNPT x 2-1/2” FNPT
 - (b) Qty. 1 – Manual Gas Shutoff Valve, 2 in FNPT
 - (c) Qty. 1 – Outlet piping Tee 316 SS, 4” Victaulic
 - (d) Qty. 1 – Adapter, 316 SS, 4” Victaulic x 2” FNPT
 - (e) Qty. 2 – Flange adapter, 316 SS, 4” Victaulic x 4” ANSI Flange
 - (f) Qty. 4 – Pipe coupling, 4” Victaulic
 - (g) Qty. 1 – Vent adapter, 12”
 - (h) Qty. 1 – Intake adapter, 12”
 - (i) Qty. 1 – Nipple, Close, 2” NPT

D. Manuals

1. Each boiler shall include the following manuals:
 - (a) Installation and Operating (I&O) manual

III. Installation

A. Boiler shall be installed and vented in accordance with the manufacturers’ instructions.

B. Venting

1. The boiler shall be vented as shown on the plans and specified below:
 - (a) Venting method (*select one*):
 - 1) Sidewall Direct Vent with exterior termination of separate exhaust and combustion air pipes
 - 2) Sidewall Direct Vent with termination by manufacturer specified sidewall termination kit of separate exhaust and combustion air pipes
 - 3) Sidewall Vent with exterior termination of exhaust; combustion air drawn from interior space
 - 4) Vertical Direct Vent with exterior roof-top termination of separate exhaust and combustion air pipes
 - 5) Vertical Vent with exterior roof-top termination of exhaust; combustion air drawn from interior space
 - 6) Vertical Vent with exterior roof-top termination of exhaust; combustion air drawn from sidewall exterior termination

(b) Exhaust venting

- 1) Foam Core pipe is not an approved exhaust vent material and shall not be used.
- 2) Exhaust vent material shall be *(select one)*:
 - (i) 12 inch Schedule 40 PVC pipe, Schedule 40 CPVC pipe, AL29-4C stainless steel pipe, or Polypropylene pipe
- 3) Exhaust vent length shall not exceed 150 equivalent ft. of pipe including fittings

(c) Combustion air inlet

- 1) Combustion air inlet material shall be *(select one)*:
 - (i) 12 inch Schedule 40 PVC pipe, Schedule 40 CPVC pipe,
- 2) Combustion air inlet length shall not exceed 150 equivalent ft. of pipe including fittings