Trinity Lx600 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 ___ 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 heating piping, fuel, electrical, combustion air, exhaust venting, condensate drainage and relief valve discharge piping.

C. The boiler shall be capable of normal operation and full rated input with fuel gas supply pressure between 4 inches w.c. [1.0kPa] and 10.5 inches w.c. [2.6kPa]. The boiler shall operate on natural gas fuel only.

D. The boiler shall operate at a thermal efficiency of 94%, with a minimum input of 120,000 BTU/hr [35.1 kW] and a maximum input of 600,000 BTU/hr [176 kW].

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 with zero clearance to combustibles, and shall be certified for closet and alcove installation when vented 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 shall have a limited lifetime warranty. All other parts shall have a five 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 installation. (effective 2015-06-01)

II. PRODUCT

A. Acceptable manufacturers

1. The boiler shall be Trinity Lx600 manufactured by NY Thermal Inc. (NTI).

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 160psi [1103kPa] maximum operating pressure.

(b) The heat exchanger shall be able to accept up to 35% mixture of inhibited propylene glycol HVAC antifreeze, without damage to the heat exchanger or other components.

(c) The heat exchanger shall be accessible for inspection and cleaning via a removable burner access cover. The cover shall include a flame observation port.

(d) The heat exchanger shall be provided with an automatic air vent.

(e) A built-in "U" trap shall be connected to the combustion chamber for collection and removal of condensate. The trap shall be translucent to permit visual inspection and shall be readily removable for cleaning.

2. Gas Train and Combustion System

(a) The combustion system shall be fully modulating with a 5:1 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 with woven stainless steel mesh covering
5) Dual-electrode spark igniter
6) Independent flame sensing electrode.

3. Venting and Combustion Air

(a) The boiler shall be designed for venting with 4 inch or 6 inch diameter Schedule 40 PVC, Schedule 40 CPVC, AL29-4C stainless steel or Polypropylene pipe. Maximum exhaust vent length shall be 100 equivalent ft. [30.5m].

(b) The combustion chamber exhaust outlet shall be fitted with a stainless steel adapter for 4 inch diameter Schedule 40 pipe. Exhaust vent piping may be field adapted to 6 inch pipe.

(c) The combustion chamber exhaust outlet shall include a ½ inch [12.5mm] 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 be fitted with a stainless steel adapter for 4 inch diameter Schedule 40 pipe, for direct inlet of outside combustion air. Combustion air piping may be field adapted to 6 inch pipe. Maximum air intake length shall be 100 equivalent ft. [30.5m].

(e) The boiler shall be capable of using indoor air for combustion with an optional kit available from the manufacturer.

4. Cabinet

(a) The unit internal structure shall be constructed of 16ga galvanized steel.

(b) The cabinet jacket shall be constructed of removable panels fabricated from 20ga steel finished with a durable factory applied coating on both sides. Removal of jacket panels shall not compromise sealing of the combustion chamber.

(c) The cabinet shall be provided with adjustable leveling legs.

5. Electrical

   (a) The boiler shall operate from a 120VAC/1 phase/60Hz power supply with a current draw of 12A.

   (b) A line-voltage barrier strip shall be provided for connection of supply power and up to three (3) circulator pumps. Pump control relays shall be sized for 1.5HP @ 120VAC.

   (c) A low-voltage barrier strip shall be provided for connection of:

      1) Outdoor or system temperature sensor
      2) DHW indirect tank aquastat
      3) Two (2) heating thermostats
      4) External safety limit
      5) Auxiliary proof
      6) Low gas pressure switch
      7) Time of day signal for night setback
      8) 4-20mA signal from external control for burner modulation
      9) Alarm signal to a building automation system
      10) EIA-485 communication for Lead-Lag cascade control.

   (d) A factory wired on-off switch shall be provided.

   (e) Factory wiring shall permit field installation of a high gas pressure switch.

   (f) A factory installed and wired flow switch shall be provided with the boiler.

6. Controls

   (a) The boiler control system shall operate on 24VAC provided by an internal 75VA transformer.

   (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 a proportional-integral-derivative (PID) algorithm for three (3) separate temperature controls: two (2) for space heating with independent setpoints; one (1) for domestic hot water.

   (d) The controller shall provide:

      1) Operation of up to three (3) pumps: Boiler, Central Heating and Indirect Domestic Hot Water
      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. An outdoor sensor shall be factory-supplied
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 central heat pumps when outlet water temperature falls below 45°F [7.2°C], and fire the burner at minimum modulation when the outlet temperature falls below 38°F [3.3°C]
8) Field setting of the following:
   - Low temperature central heat (CH1) setpoint from 60°F [15.6°C] to 195°F [90.5°C]
   - High temperature central heat (CH2) setpoint from 60°F [15.6°C] to 195°F [90.5°C]
   - Outdoor reset parameters – low temperature central heating
   - Outdoor reset parameters – high temperature central heating
   - Domestic hot water (DHW) setpoint from 60°F [15.6°C] to 195°F [90.5°C]
   - Time of Day (TOD) setpoint for CH1, CH2 and DHW
   - Boiler pump overrun time from 0 to 30 minutes
   - CH and DHW pump overrun time from 0 to 10 seconds
   - CH and DHW pump start delay from 0 to 5 seconds
   - Warm weather shutdown (WWSD) temperature from 50°F [10°C] to 90°F [32.2°C]
   - DHW priority override timer from 0 to 18 hours
   - CH modulation source (inlet, outlet or system water temperature)
   - DHW modulation source (inlet or outlet water temperature)
   - Lead and lag selection method (sequence order or measured runtime)
   - Lead rotation time from 0 to 960 hours
   - Slave order priority method (equalize runtime, use first or use last)
   - Anti short-cycle interval from 0 to 60 minutes
   - Temperature units, °F or °C.

(e) The control system shall include a built-in colour 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) Outdoor Temperature
10) Annunciation of limit devices

(f) The controller shall be capable of Lead-Lag staging and rotation of up to eight (8) Lx-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 touchscreen display.

(g) The controller shall provide integrated communication capability using the Modbus RTU protocol over an EIA-485 interface. Communication with external third-party building management networks utilizing BACnet MS/TP, BACnet/IP, Johnson Metasys N2, or LonWorks protocol shall be accomplished with __factory-optional NTI communication gateway(s). The gateway shall map factory-selected internal controller data registers to (*select one*): BACnet objects, Johnson Metasys N2 data points or LonWorks SNVTs. The gateway shall:

a) communicate with the boiler controller(s) at 38,400 bits/second
b) be equipped with DIP switches for field selection of node address and protocol
c) auto-discover Modbus addresses of up to 8 connected boilers.

(h) When two (2) or more boilers are connected in a Lead-Lag cascade configuration, the control shall allow for connection of an outdoor temperature sensor on any slave unit, thereby permitting connection of a system temperature sensor on the master unit.

C. Trim kit

1. The following shall be factory supplied with each boiler, for field installation:

(a) Qty. 1 - Outdoor air temperature sensor, 10k thermistor
(b) Qty. 1 - System temperature sensor, 10k thermistor
(c) Qty. 1 - Pressure gauge, 0-160psi
(d) Qty. 1 - Pressure gauge, 0-60psi
(e) Qty. 1 - ¾ inch NPT ASME relief valve, 150psi
(f) Qty. 1 - ¾ inch NPT ASME relief valve, 50psi
(g) Qty. 1 - 1 inch FNPT manual gas shutoff valve
(h) Qty. 1 - ¾ inch NPT brass tee
(i) Qty. 1 - ¾ inch x ¼ inch NPT brass bushing
(j) Qty. 1 - 4 inch length, 4 inch CPVC Schedule 40 pipe
(k) Qty. 4 - 3/8-16 x 1.5 inch zinc-plated steel hex-base leveling legs with polyethylene cap
(l) Qty. 1 - 4 inch diameter anti-bird screen
(m) Qty. 2 - 6 inch diameter anti-bird screen
(n) Qty. 2 - 500 ml Fernox F1 Protector

D. Manuals

1. Each boiler shall include the following manuals:

(a) Installation and Operating (I&O) manual
(b) Controller and display reference manual
(c) User Information 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 Direct Vent with termination by manufacturer specified concentric vent termination kit of separate exhaust and combustion air pipes
4) Sidewall Vent with exterior termination of exhaust; combustion air drawn from interior space
5) Vertical Direct Vent with exterior roof-top termination of separate exhaust and combustion air pipes
6) Vertical Direct Vent with termination by manufacturer specified concentric vent termination kit of separate exhaust and combustion air pipes
7) Vertical Vent with exterior roof-top termination of exhaust; combustion air drawn from interior space

(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) 4 inch/6 inch Schedule 40 PVC pipe, Schedule 40 CPVC pipe, AL29-4C stainless steel pipe, or Polypropylene pipe ***(Note to specifier** - <u>In Canada</u>: all vent pipe materials must meet ULC S636; PVC venting is limited to applications where exiting water temperature from heat exchanger is less than 140°F [60°C])*
   (ii) A 4 x 6 reducer shall be field supplied if 6 inch pipe is used
3) Exhaust vent length shall not exceed 100 equivalent ft. [30.5m] of pipe including fittings

(c) Combustion air inlet

1) Combustion air inlet material shall be *(select one)*:
   (i) 4 inch/6 inch Schedule 40 PVC pipe, Schedule 40 CPVC pipe, or *<u>(to be inserted by specifier using material acceptable to the local AHJ)</u>* pipe
   (ii) Interior combustion air kit specified by the boiler manufacturer
2) Combustion air inlet length shall not exceed 100 equivalent ft. [30.5m] of pipe including fittings
3) A 4 x 6 reducer shall be field-supplied if 6 inch pipe is used