



**TFTN 399
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 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 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 and 10.5 inches w.c., or LP gas supply pressure between 8 and 13 inches w.c. The boiler shall be factory set for natural gas and shall include a factory-supplied kit for field conversion to LP gas operation.
- D. The boiler shall have a Thermal Efficiency rating of 95.4%, with a minimum input of 39,000 Btu/hr and a maximum input of 399,000 Btu/hr.
- E. The boiler shall be certified to the ANSI Z21.13 / CSA 4.9 Gas-fired Boiler Standard.
- F. 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.
- G. 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.
- H. 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 on the date of installation. The warranty is subject to the terms and conditions stated in *NTI High-Efficiency Gas Product Limited Warranty*.

II. PRODUCT

- A. Acceptable manufacturers
 - 1. The boiler shall be a model TFTN399 manufactured by NTI Boilers Inc.
- B. Boiler Construction
 - (a) The heat exchanger shall be a vertical firetube down-fired design. The combustion chamber, firetubes, tube sheet and shell shall be constructed of Type 439 (ASME SA-240, UNS S43932) Chromium stainless steel. The heat exchanger shall be rated for 80 psi maximum operating pressure.
 - (b) 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.



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- (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) A factory-supplied condensate 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 easily disassembled for cleaning.
 - (e) The combustion chamber exhaust outlet shall include a flue test port, sealed with a removable cap, to permit insertion of a combustion analyzer probe.
 - (f) The boiler shall employ a sealed cabinet with built-in silencer for quiet operation.
2. Gas Train and Combustion System
- (a) The combustion system shall be fully modulating with a 10:1 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. Cabinet
- (a) The unit internal structure shall be constructed of a combination of 20g and 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.
4. Electrical
- (a) The boiler shall operate from a 120V/1 phase/60Hz power supply with a current draw of less than 12A.
 - (b) A line-voltage barrier strip shall be provided for connection of supply power, boiler pump, DHW pump, up to two (2) auxiliary pumps, and up to three (3) zone outputs. The boiler, DHW and auxiliary pump connections shall be powered (120V). The zone outputs shall be configurable as powered 120V or 24V, depending on the placement of the Zone Input jumper.
 - (c) A low-voltage barrier strip shall be provided with the following connection points:
 - 1) Outdoor temperature sensor input
 - 2) DHW indirect water heater Aquastat or temperature sensor input
 - 3) Up to two (2) auxiliary temperature sensor inputs (System, Buffer Tank, or DHW Recirc.)
 - 4) 0-10V input for external temperature or burner power control
 - 5) 0-10V / PWM output for variable speed pump control
 - 6) 0-10V output proportional to boiler output power
 - 7) BUS data communication for connecting up to 8-boilers in cascade, or NTI room sensors or 3-zone control module.



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- 8) Up to three (3) heating thermostat inputs
 - 9) External safety limit end-switch input
 - 10) Alarm output contacts
- (d) A factory wired power on-off switch shall be provided.
- (e) A factory wired 120VAC convenience outlet shall be provided.
5. Controls
- (a) The boiler control system shall operate on 120VAC.
- (b) An automatic reset UL353 compliant Low Water Cutoff (LWCO) shall be factory installed on the boiler. A manual reset CSD-1 compliant LWCO shall be available for field installation as a replacement.
- (c) 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:
 - CW-400 requirements as Temperature Operation Control
 - CW-400 requirements as a Temperature High Limit Control.
- (d) The controller shall incorporate a proportional-integral-derivative (PID) algorithm for four (4) separate temperature controls: three (3) for space heating with independent setpoints, and one (1) for domestic hot water.
- (e) The controller shall provide:
- 1) The ability to manage up to three (3) CH zones and one (1) DHW zone independently, each with a dedicated setpoint, input, output, and adjustable priority logic/time
 - 2) Operation of up to seven (7) pumps: Boiler, DHW, Zone 1, Zone 2, Zone 3, Auxiliary 1 and Auxiliary 2. The auxiliary pumps shall be configurable as System, Buffer Tank, or DHW Recirculation pumps.
 - 3) Adjustable system pump activation logic, allowing the system pump to run for only CH, or both CH & DHW demands.
 - 4) Adjustable CH anti-cycle logic, to prevent excessive cycling of the burner.
 - 5) An anti-legionella function for the management of the DHW indirect water heater (only possible when utilizing a DHW tank sensor connected to the boiler)
 - 6) The ability to control, with an adjustable setpoint temperature, a DHW recirculation loop.
 - 7) The ability to control, with an adjustable setpoint temperature, a buffer tank, and can service heating (CH or CH & DHW) demands from the buffer tank to better serve micro-zones.
 - 8) Fixed and automatic temperature control modes, independently adjustable for each CH zone
 - 9) Adjustable reset curve and optional automatic reset curve slope boost, independently adjustable for each CH zone.



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- 10) Settings backup and restore options.
 - 11) Burner test mode, adjustable between maximum, minimum and manual burner power, for easy calibration and diagnosis of the gas valve.
 - 12) Manual mode operation for pumps, fan, and alarm outputs.
 - 13) Boiler statistics including, boiler power on time, CH burner on time, DHW burner on time, average CH cycle time, and pump, fan, and ignition cycles.
 - 14) Adjustable maintenance schedule/warning.
 - 15) Lockout, error, and warning history
 - 16) Pump exercise for 20 seconds at 23-hour intervals
 - 17) Freeze protection (on/off selectable) to operate the boiler and system and zone pumps when outlet water temperature falls below 46°F, and fire the burner at minimum modulation when the outlet temperature falls below 39°F.
 - 18) An embedded WiFi gateway to allow for internet connectivity, and the ability to register the boiler to the NTI remote monitoring service where the technician can remotely monitor/adjust/log the boiler.
 - 19) The ability to control the speed of a variable speed boiler pump by way of a 0-10V or PWM signal, to achieve the user adjustable boiler delta-T setting.
- (f) 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 provide password-protected access to the Tech Menu, Setup Wizard and Burner Test functions. The display shall be capable of visualizing all boiler operating parameters, including:
- 1) Heat demand source
 - 2) Burner state
 - 3) Firing rate in RPM, MBH, and percent
 - 4) Target RPM
 - 5) Boiler target and on/off temperature thresholds for burner operation
 - 6) Heat exchanger entering water temperature
 - 7) Heat exchanger exiting water temperature
 - 8) Water pressure
 - 9) Exhaust gas temperature
 - 10) Outdoor Temperature
 - 11) DHW tank temperature or Aquastat status
 - 12) CH zone status
 - 13) System Temperature
 - 14) Flame ionization strength
 - 15) 0-10V signal from external control device
 - 16) Lockouts, Errors, and Warnings
- (g) The controller shall be capable of Lead-Lag staging and rotation of up to eight (8) TFTN-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.



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- (h) The controller shall provide integrated communication capability using Ariston proprietary eBUS2 protocol. Communication with external third-party building management networks utilizing BACnet MS/TP, BACnet/IP, or LonWorks protocol shall be accomplished with a factory-optional NTI communication gateway(s). For the BACnet gateway, the building management network protocol shall be field selectable. The gateway shall map factory-selected internal controller data registers to (select one): BACnet objects or LonWorks SNVTs. The gateway shall:
- communicate with the boiler controller(s) at 2,400 bits/second.
 - be equipped with a GUI interface for configuration and troubleshooting, accessible via standard web browsers e.g. Google Chrome®, Microsoft Edge®
 - connect a single boiler, or up to 8 cascaded boilers. For non-cascaded multiple boilers, one gateway shall be required per boiler.

C. Trim kit

- The following shall be factory supplied with each boiler, for field installation:
 - Qty. 1 – Outdoor air temperature sensor, 10k thermistor
 - Qty. 1 – Pressure/temperature gauge, 0-75 psi / 50-320 °F
 - Qty. 1 – ASME pressure relief valve, 30 psi
 - Qty. 1 – LP conversion kit
 - Qty. 1 – Condensate trap
 - Qty. 1 – Stub of CPVC Schedule 40 pipe
 - Qty. 2 – anti-bird screen, 4-inch
 - Qty. 1 – upper wall mounting bracket
 - Qty. 1 – lower wall mounting
 - Qty. 1 – wall mounting hardware kit
 - Qty. 1 – automatic air vent, ½” NPT
 - Qty. 1 – brass tee, 1-1/2” x ½” x 1-1/2” NPT
 - Qty. 1 – brass bushing, 1-1/2” x ¾” NPT

D. Manuals

- Each boiler shall include the following manuals:
 - Installation and Operating Manual (IOM)
 - User Information Manual
 - Natural Gas to Propane Conversion Kit Manual

III. Installation

- The boiler shall be installed and vented in accordance with manufacturers’ instructions.
- Venting
 - The boiler shall be vented as shown on the plans and specified below:
 - Venting method (*select one*):



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- 1) Direct Vent system with sidewall termination of both the exhaust-vent and combustion air-inlet piping, using termination method detailed in the Installation and Operation Manual. Exhaust-vent and combustion air-inlet piping shall be sealed.
 - 2) Direct Vent system with rooftop termination of both the exhaust-vent and combustion air-inlet piping, using termination method detailed in the Installation and Operation Manual. Exhaust-vent and combustion air-inlet piping shall be sealed.
 - 3) Vent system with sidewall termination of the exhaust-vent piping and rooftop termination of the combustion air-inlet piping, using termination kit/method detailed in the Installation and Operation Manual. Exhaust-vent and combustion air-inlet piping shall be sealed.
 - 4) Vent system with rooftop termination of the exhaust-vent piping and sidewall termination of the combustion air-inlet piping, using termination kit/method detailed in the Installation and Operation Manual. Exhaust-vent and combustion air-inlet piping shall be sealed.
 - 5) Vent system with sidewall or rooftop termination of the exhaust-vent piping, using termination kit/method detailed in the Installation and Operation Manual. Exhaust-vent piping shall be sealed; combustion air-inlet shall be drawn from the equipment room in accordance with the *National Fuel Gas Code, ANSI Z223.1/NFPA 54* (U.S.), or Clause 8.2, 8.3 or 8.4 of *Natural Gas and Propane Installation Code, CAN/CSA B149.1* (Canada).
- (b) Exhaust venting
- 1) Foam Core pipe is not an approved exhaust vent material and shall not be used.
 - 2) The exhaust vent material shall be 4-inch Category IV approved PVC, CPVC, PP or SS special gas vent.
 - 3) The boiler exhaust vent connection shall be designed to receive 4-inch CPVC, 4-inch SS, or 4-inch (100 mm) PP special gas vent piping.
 - 4) An adapter shall be field supplied for adapting the boiler exhaust vent connection to receive other approved Category IV special gas vent material.
 - 5) Exhaust vent length shall not 150 equivalent ft. of pipe including fittings.
- (c) Combustion air inlet
- 1) Combustion air inlet material shall be 3-inch Schedule 40 PVC pipe, or *(to be inserted by specifier using material acceptable to the local Authority Having Jurisdiction)*.
 - 2) The boiler combustion air-inlet connection shall be designed to receive 4-inch Schedule 40 PVC (or equivalent), 4-inch SS, or 4-inch (100 mm) PP.
 - 3) Combustion air inlet length shall not exceed 150 equivalent ft. of pipe including fittings.