## General Requirements

A. Furnish and install _____ (qty) completely assembled, modulating, sealed combustion, high efficiency, gas-fired boiler(s) with a stainless steel, fire tube heat exchanger with a secondary heat exchanger for endless hot water

B. Installation of the boiler(s) shall be according to manufacturer's installation instructions and all work shall be completed in a neat and workmanship like manner.

C. The boiler(s) shall be a Triangle Tube Instinct 199 Combi having a modulating input rating of 24,875 BTU/H to 199,000 BTU/H.

D. The boiler(s) shall operate at a minimum Annual Fuel Utilization Efficiency of 95% and shall comply with the energy efficiency requirements of ASHRAE 90.1, latest edition and the minimum efficiency requirements of ASHRAE 103, latest edition.

E. The boiler(s) AFUE efficiency shall be verified through a third party testing agency under the guidance of the Hydronics Institute Division of AHRI and listed in the AHRI Certification Directory.

F. The boiler(s) shall be capable of full modulation, with a turn down of 8 to 1.

G. The heat exchanger shall contain a water volume of 4 gallons and have a pressure loss of 6.5ft at a volume flow rate of 9 gpm.

H. The boiler(s) shall be assembled by an ISO 9001 registered company and the heat exchanger shall bear the ASME "H" stamp according to Section IV of the ASME Boiler and Pressure Vessel Code.

   a. The stainless steel heat exchanger of the boiler(s) is to be hydrostatically pressure tested at the factory in accordance with ASME requirements.

   b. The maximum allowable working pressure is 50 psig water as listed on the ASME rating plate.

   c. The heat exchanger shall be registered with the National Board and contain a registry number and stamp on the ASME rating plate.

I. The boiler(s) shall meet the following regulatory requirements:

   a. The boiler(s) shall be ITS / ETL certified and listed to ANSI Z21.13/CSA 4.9 latest edition test standards for U.S. and Canada.

b. Boiler(s) shall meet or exceed the SCAQMD (South Coast Air Quality Management District of California) Low NOx emission requirement of 14 NG/J.

c. The boiler(s) shall meet Department of Energy guidelines for Energy Star energy efficiency and be listed as such.

## Product Specifications

A. Boiler Construction

a. The heat exchanger shall be a fire tube design constructed with 439 grade stainless steel to provide resistance to corrosion at elevated temperatures.

b. The heat exchanger body shall be of welded construction and shall not contain any banding materials, bolts, gaskets or O-rings in the construction.

c. The heat exchanger shall be of a counter flow / vertical design to assure that sediment and any potential lime that may form will fall to the bottom away from the tube sheet.

d. The boiler combustion chamber shall be sealed and located at the top of the heat exchanger.

e. The boiler(s) flue ways shall be of a vertical design that allows condensate to “wash down” the flue surface preventing potential combustion residue from adhering to the flue ways.

f. The boiler(s) shall be supplied with a gas valve designed for negative pressure regulation.

g. The gas valve on the boiler(s) shall operate with an inlet gas pressure between 5” w.c and 13” w.c on Natural Gas and between 8” w.c and 13” w.c on Propane Gas. If the inlet gas pressure exceeds the maximum allowable 13” w.c. a 100% lock-up type gas pressure regulator, properly sized, must be installed in the gas supply piping and adjust as to prevent an inlet gas pressure in excess of 13” w.c.

h. The burner shall be a premix combustion type system, made with a burner head constructed of stainless material and able to provide a wide range of modulating firing rates.

i. The boiler(s) shall be equipped with a variable speed blower system to precisely control the fuel/air mixture to provide modulating boiler firing rates for maximum efficiency.

j. The boiler(s) shall be constructed with a heavy gauge steel jacket assembly, painted on both sides.

k. The boiler control shall have an electronic graphical display for boiler set-up, boiler status and boiler diagnostics.

l. The condensate pan, internal flue pipe, and vent/air connections shall be constructed of polypropylene.

B. Boiler Controls and Trim

a. All electrical components shall be of the highest quality manufacture and bear a CSA, UL, or UL recognized label.

b. Supply voltage shall be 120 volt / 60 hertz / single phase.

c. ASME certified pressure relief valve, set to relieve at 30 psig.

d. Low water protection.

e. The boiler(s) shall be furnished with the "CTRLMax" Control System which provides:

1. High limit temperature control of 210°F.
2. Operating temperature limit of 60°F to 188°F.
3. Flue gas, supply and return water temperature sensors.
4. Outdoor sensor to provide Outdoor Reset Control.
5. Optional freeze protection feature.
6. Optional Domestic Hot Water priority and optional Domestic Hot Water priority timeout feature.
7. Modbus interface for integration into BMS systems.
8. Capability to accept a 0-10 VDC input signal for external modulation control.
9. Two space heating call inputs with independent outdoor reset curves.
10. EZ set up feature allows the installer to quickly and easily adjust boiler settings.
11. Graphical display shall have an icon based menu system and use plain text so that error code charts are unnecessary.

C. Water Heater Features

1. Endless hot water.
2. Large brazed plate heat exchanger.
3. Condensing in DHW Mode.
4. 3-Way diverting valve prepiped and prewired.
5. The indirect water heater shall have the following connections:
    a) Cold water inlet.
    b) Hot water outlet
6. A domestic hot water temperature sensor shall be factory installed in the indirect fired water heater to monitor and maintain the domestic hot water storage temperature.

C. Venting and Combustion Air

a. The boiler shall be vented with one of the following configurations:

1. **Direct Vent Sidewall** system with a horizontal sidewall termination of both the vent and combustion air pipes. The vent and combustion air pipes are not required to terminate on the same outside wall.
2. **Direct Vent Vertical** system with a vertical roof top termination of both the vent and combustion air pipes.
3. **Direct Vent Vertical with Sidewall Air** system with a vertical roof top termination of the vent pipe and combustion air being drawn horizontally from a sidewall.
4. **Sidewall Vent with Room Air** system with a horizontal sidewall termination of the vent pipe and the combustion air is drawn from the surrounding area in which the boiler is installed. If the room in which the boiler is installed in is less than 85 cubic feet in volume per boiler, combustion air must be supplied into the room per the National Fuel Gas Code NFPA 54, latest edition.
5. **Vertical Vent with Room Air** system with a vertical roof top termination of the vent and the combustion air is drawn from the surrounding area in which the boiler is installed. If the room in which the boiler is installed in is less than 85 cubic feet in volume per boiler, combustion air must be supplied into the room per the National Fuel Gas Code NFPA 54, latest edition.

b. The boiler's total equivalent vent pipe length shall not exceed 100 feet when using 3 pipe.

c. The boiler's total equivalent combustion air pipe length shall not exceed 100 feet when using 3 pipe.

d. The 3" vent pipe shall be PVC, CPVC, Polypropylene (PP), or AL29-4C® Stainless Steel. PVC or CPVC of Foam Core construction is not an approved material for vent piping.

e. The 3" combustion air pipe shall be PVC, CPVC, Polypropylene (PP), Galvanized or Stainless Steel.

D. Boiler Manuals

a. The boiler(s) shall be provided with complete instruction manuals, including:

1. Boiler Installation and Maintenance Manual.
2. Vent Supplement.
3. User's Guide.
4. Control Supplement.

## Warranty

A. The boiler heat exchanger shall carry up to 10 year warranty on heat exchanger limited warranty.

B. The parts used in the boiler shall carry up to 6 year warranty on parts, other than the igniter.

C. The boiler shall carry up to 3 year labor allowance on repairs.

## Performance Specifications

| Boiler Model | Fuel | Input Modulation MBH | AFUE | DOE Heating Capacity MBH | Net AHRI Rating MBH | Water Volume Gal. |
|---|---|---|---|---|---|---|
| Solo 199 | Natural / Propane | 24.875 – 199 | 95% | 185 | 161 | 4 |

## Domestic Hot Water Performance/Specifications

| DHW Minimum Flow Rate (GPM) | DHW Output GPM (70°F rise) | DHW Output GPM (80°F rise) | Domestic Connections |
|---|---|---|---|
| 0.5 | 5.3 | 4.6 | 3/4” |

## Connections/Dimensions/Data

| Supply / Return Connections | Gas Connection | Vent & Air Connections | Dimensions | Weight (Empty) | Electrical Requirements |
|---|---|---|---|---|---|
| 1” | 3/4” | 3” | 21 3/4" x 16 ¾” x 33” | 132 Lbs | 120VAC 60Hz 15A Full Load |