

Part 1 General

1.1 SUMMARY

- .1 The work to be performed consists of providing all labor, equipment, materials, etc. to furnish and commission new factory assembled, low pressure full condensing hot water boilers as described in the specifications herein.

1.2 REFERENCES

- .1 American Boiler Manufacturer's Association (ABMA).
- .2 American National Standards Institute (ANSI):
 - .1 ANSI Z21.13 2004/CSA 4.9 2004, Gas Fired Low Pressure Steam and Hot Water Boilers.
- .3 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME):
 - .1 ANSI/ASME Boiler and Pressure Vessel Code, Section IV, 2004.
- .4 Canadian Gas Association (CGA):
 - .1 CAN1 3.1 77 (R2001), Industrial and Commercial Gas Fired Package Boilers.
 - .2 CAN/CSA B149.1 05, Natural Gas and Propane Installation Code.
- .5 Canadian Standards Association (CSA International):
 - .1 CSA B51 03, Boiler, Pressure Vessel, and Pressure Piping Code.
 - .2 CSA B139 04, Installation Code for Oil Burning Equipment.
 - .3 CSA B140.7-05, Oil Burning Equipment: Steam and Hot-Water Boilers.
- .6 Electrical and Electronic Manufacturer's Association of Canada (EEMAC).
- .7 Health Canada/Workplace Hazardous Materials Information System (WHMIS):
 - .1 Material Safety Data Sheets (MSDS).

1.3 SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Division 01 – General Requirements and Other Submittal procedures. Include product characteristics, performance criteria, and limitations.
 - .2 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Division 01 – General Requirements and Other Submittal Procedures.
- .2 Shop Drawings:
 - .1 Submit shop drawings in accordance with Division 01 – General Requirements and Other Submittal Procedures.

- .2 Indicate the following:
 - .1 General arrangement showing terminal points, instrumentation test connections.
 - .2 Clearances for operation, maintenance, servicing, tube cleaning, tube replacement.
 - .3 Foundations with loadings, anchor bolt arrangements.
 - .4 Piping hook ups.
 - .5 Equipment electrical drawings.
 - .6 Burners and controls.
 - .7 All miscellaneous equipment.
 - .8 Flame safety control system.
 - .9 Breeching and stack configuration.
- .3 Engineering data to include:
 - .1 Boiler efficiency at 25%, 50%, 75% and 100% of design capacity.
 - .2 Radiant heat loss at 100% design capacity.
- .3 Quality assurance submittals: submit following in accordance with Division 01 – General Requirements and Other Submittal Procedures.
 - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .2 Instructions: submit manufacturer's installation instructions.
- .4 Closeout Submittals:
 - .1 Submit operation and maintenance data for incorporation into manual specified in Division 01 – General Requirements.

1.4 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with manufacturer's written instructions and Division 01 – General Requirements.
 - .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

1.5 MAINTENANCE

- .1 Extra materials:
 - .1 Spare parts for 1 year of operation.
 - .2 Spare gaskets.
 - .1 Gasket, Flame Sensor.
 - .2 Gasket set, Burner, Heat Exchanger, Sight Glass – Lower.
 - .3 Gasket, Fan.
 - .3 Probes and sealants for electronic indication.
 - .4 Ignitor, Spark w/ Gasket.
 - .5 Condensate Neutralization Kit.

Part 2 Products

2.1 HEATING BOILERS HB-1 TO HB-4 (IDENTICAL)

- .1 Contractor shall furnish natural gas fired, hot water boilers with an input of 117.2 kW (399 MBH).
- .2 The Boiler shall have a modulating burner input and shall be operated on Natural Gas. The Boiler shall be capable of full modulation firing down to 20% of rated input with a turndown ratio of 5:1.
- .3 The Boiler shall bear the ASME "H" stamp for 552 kPa (80 psi) working pressure and shall be National Board listed. There shall be no banding material, bolts, gaskets or "O" rings in the header configuration. The Boiler shall have a 316L stainless steel heat exchanger. The combustion chamber shall be designed to drain condensation to the bottom of the heat exchanger assembly including a condensate trap. The complete heat exchanger assembly shall carry a fifteen (15) year limited warranty.
- .4 The Boiler shall be certified and listed by C.S.A. International under the latest edition of the harmonized ANSI Z21.13 test standard for the U.S. and Canada. The Boiler shall comply with the energy efficiency requirements of the latest edition of the ASHRAE 90.1 Standard and the minimum efficiency requirements of the latest edition of the ASHRAE 103 Standard. The Boiler shall operate at a minimum of 94.4% thermal efficiency. The Boiler shall be certified for indoor installation.
- .5 The Boiler shall be constructed with a heavy gauge steel jacket assembly, primed and pre-painted on both sides. The combustion chamber shall be sealed and completely enclosed, independent of the outer jacket assembly, so that integrity of the outer jacket does not affect a proper seal. A burner/flame observation port shall be provided. The burner shall be a premix design and constructed of high temperature stainless steel with a woven metal fiber outer covering to provide modulating firing rates. The Boiler shall be supplied with a gas valve designed with negative pressure regulation and be equipped with a variable speed blower system, to precisely control the fuel/air mixture to provide modulating boiler firing rates for maximum efficiency. The Boiler shall operate in a safe condition at a de-rated output with gas supply pressures as low as 995 Pa (4 inches of water column).
- .6 The Boiler shall utilize a 24 VAC control circuit and components. The control system shall have a Liquid Crystal touch screen display for boiler set-up, boiler status, and boiler diagnostics. All components shall be easily accessed and serviceable from the front of the jacket. The Boiler shall be equipped with a temperature/pressure gauge; high limit temperature control with manual reset; ASME certified pressure relief valve set for 345 kPa (30 psi); outlet water temperature sensor; return water temperature sensor; outdoor air sensor, flue temperature sensor; low water cut off with manual reset, system supply sensor and bulbwell, and a condensate trap for the heat exchanger condensate drain.
- .7 Remote, wall mount boiler control panels are not acceptable. The boiler shall feature the "SMART SYSTEM™" control which is standard and factory installed with 128 x 128 resolution display, password security, outdoor air reset, pump delay with freeze protection, pump exercise, ramp delay featuring six steps, domestic hot water prioritization with limiting capabilities, USB drive for simple uploading of parameters and a PC port connection for connection to a local computer for programming and trending.

Three programmable parameters shall be built into the SMART SYSTEM integrated control package to help minimize potential boiler on-off cycling issues:

- .1 Ramp delay
- .2 Programmable Modulation Aggressiveness Factor
- .3 Programmable Anti-Cycle Time

A secondary operating control that is field mounted outside or inside the appliance is not acceptable. The boiler shall have alarm contacts for any failure, runtime contacts and data logging of runtime at given modulation rates, ignition attempts and ignition failures. The boiler shall have a built-in "Cascade" with leader redundancy to sequence and rotate while maintaining modulation of up to eight boilers of different Btu inputs without utilization of an external controller. The internal "Cascade" function shall be capable of lead-lag, efficiency optimization, front-end loading, and rotation of lead boiler every 24 hours. The boiler shall be capable of remote communication via optional CON-X-US™ Remote Connectivity with the capability of historical trending and sending text message or email alerts to notify the caretaker of a boiler alarm and remote programming of onboard boiler control. The boiler shall have an optional gateway device which will allow integration with BACnet protocols.

The "SMART SYSTEM™" control shall increase fan speed to boost flame signal when a weak flame signal is detected during normal operation. A 0-10 VDC output signal shall control a variable speed boiler pump (pump shall be supplied by manufacturer) to keep a fixed Delta T across the boiler regardless of the modulation rate. The boiler shall have the capability to receive a 0-10 VDC input signal from a variable speed system pump to anticipate changes in system heat load in order to prevent flow related issues such as erratic temperature cycling.

- .8 The boiler shall be equipped with two terminal strips for electrical connection. A low voltage connection board with 46 connection points for safety and operating controls, i.e., Alarm Contacts, Runtime Contacts, Low Water Cut Off, Louver Proving Switch, Tank Thermostat, Domestic Hot Water Building Recirculation Pump Contacts, Domestic Hot Water Building Recirculation Temperature Sensor Contacts, Remote Enable/Disable, System Supply Temperature Sensor, Outdoor Temperature Sensor, Tank Temperature Sensor, BACnet MS/TP Building Management System Signal and Cascade Control Circuit. A high voltage terminal strip shall be provided for Supply voltage. Supply voltage shall be 120 volt / 60 hertz / single phase on all models. The high voltage terminal strip plus integral relays are provided for independent pump control of the System pump, the Boiler pump and the Domestic Hot Water pump.
- .9 The boiler shall be installed and vented with a direct vent system with horizontal sidewall termination of both the exhaust vent and combustion air. The flue shall be Category IV approved material constructed of CPVC or Stainless Steel. A separate pipe shall supply combustion air directly to the boiler from the outside. The boiler's total combined air intake length shall not exceed 30.5 equivalent meters (100 equivalent feet). The boiler's total combined exhaust venting length shall not exceed 30.5 equivalent meters (100 equivalent feet).

- .10 The Boiler shall have an independent laboratory rating for Oxides of Nitrogen (NO_x) of 30 ppm or less corrected to 3% O₂. The manufacturer shall verify proper operation of the burner, all controls and the heat exchanger by connection to water and venting for a factory fire test prior to shipping.
- .11 The Boiler shall operate at altitudes up to 4,500 feet above sea level without additional parts or adjustments.
- .12 Boiler unit(s) schedule:
 - .1 Input Capacity: 117 kW.
 - .2 Output Capacity: 111kW.
 - .3 Thermal Efficiency: 94.4.
 - .4 Turndown Ratio: 5:1.
 - .5 Gas Train Max Inlet Pressure: 3.48 kPa.
 - .6 Gas Train Min Inlet Pressure: 0.995 kPa.
 - .7 Gas Connection: 19 mm (3/4").
 - .8 Vent Size: 100 mm (4").
 - .9 Air Inlet Size: 100 mm (4").
 - .10 Flow at 11.1°C: 2.4 L/s (38 gpm).
 - .11 Pressure Drop: 4.24 kPa.
 - .12 Max Working Pressure: 552 kPa.
 - .13 Water Connection: 38mm (1-1/2").
 - .14 Water Capacity: 24.6 Litres.
 - .15 Dimensions: 901.7 mm High, 635 mm Wide, 552.5 mm Deep.
 - .16 Weight: 96.6 kg.
 - .17 Volt/Phase/Hz/MCA: 120/1/60/4.5.
- .13 Each boiler shall be c/w the following:
 - .1 Welded Stainless steel condensate collection basin.
 - .2 CPVC side wall concentric vent termination (To be CSA/ULC Certified).
 - .3 Condensate trap and condensate neutralization kit.
 - .4 ECM variable speed boiler circulating pump.
 - .5 Flow switches.
 - .6 Direct Spark Ignition.
 - .7 Multi-color graphic LCD display with navigation.
 - .8 Cascading sequencer with built-in redundancy.
 - .9 BACnet MSTP Communication kit.
 - .10 Built-in cascade of up to 8 boilers.
 - .11 Three boiler setpoint temperature inputs w/ three programmable indoor-outdoor curves.
 - .12 Wall mounting brackets.

- .13 BMS Integration including but not limited to:
 - .1 Plant enable.
 - .2 Plant heating supply setpoint.
 - .3 General alarms.
 - .4 Boiler output.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

- .1 Install in accordance with ANSI/ASME Boiler and Pressure Vessels Code Section IV, regulations of Province having jurisdiction, except where specified otherwise, and manufacturers recommendations.
- .2 Make required piping connections to inlets and outlets recommended by boiler manufacturer.
- .3 Maintain clearances as indicated or if not indicated, as recommended by manufacturer for operation, servicing and maintenance without disruption of operation of any other equipment/system.
- .4 Mount unit level.
- .5 Pipe hot water relief valves full size to nearest drain.
- .6 Pipe blow down/drain to blow down tank/floor drain.
- .7 Natural gas fired installations in accordance with CAN/CSA B149.1.

3.3 MOUNTING AND ACCESSORIES

- .1 Safety valves and relief valves:
 - .1 Run separate discharge from each valve.
 - .2 Terminate discharge pipe as indicated.
 - .3 Run drain pipe from each valve outlet and drip pan elbow to above nearest drain.
- .2 Blow down valves:
 - .1 Run discharge to terminate as indicated.

3.4 FIELD QUALITY CONTROL

- .1 Commissioning:
 - .1 Manufacturer to:
 - .1 Certify installation.

- .2 Start-up and commission installation.
 - .3 Carry out on site performance verification tests.
 - .4 Demonstrate operation and maintenance.
- .2 Provide Departmental Representative at least 24 hours' notice prior to inspections, tests, and demonstrations. Submit written report of inspections and test results.
- .2 Verification requirements in accordance with Division 01 – General Requirements.

3.5 MANUFACTURER'S FIELD SERVICE

- .1 General: The boiler supplier's factory authorized service organization shall be responsible for performance of inspections, start up and testing of the package boiler, and accessory equipment and materials furnished under this Section. A detailed written record of the start-up performance, including burner setting data over the entire load range shall be furnished to the engineer before final acceptance. All labour, equipment and test apparatus shall be furnished by the authorized service organization. All equipment defects discovered by the tests shall be rectified either by the service organization or boiler manufacturer.
- .2 Equipment inspection and pre-start walk through services are as identified in specification sections.
- .3 Start-up shall be conducted by experienced and factory authorized technician in the regular employment of the authorized service organization and shall include:
 - .1 Demonstrate that boiler, burner, controls and accessories comply with requirements of this Section as proposed by the boiler and accessories supplier. Pre-test all items prior to the scheduling the final testing that will be witnessed by the test engineer.
 - .2 Readings at different firing rates 20, 50, 75 and 100% of load for the modulating burner shall be taken with a written report of the tests submitted to the engineer. The reports shall include readings for each firing rate tested and include stack temperatures, O₂, CO, NO_x and overall boiler efficiency.
 - .3 Auxiliary Equipment and Accessories: Observe and check all valves, draft fans, electric motors and other accessories and appurtenant equipment during the operational and capacity tests for leakage, malfunctioning, defects and non-compliance with referenced standards or overloading as applicable.
 - .4 Commissioning Requirements:
 - .1 Fireside inspection.
 - .2 Set up fuel train and combustion air system.
 - .3 Set up operating set points.
 - .4 Check all safeties, including Flame safeguard, LWCO, Airflow, Fuel pressures and High limits.
 - .5 Set up and verify efficiencies at 25%, 50%, 75% and 100%.
 - .6 Set up and verify burner turndown.
- .4 Training to include all safety procedures, maintenance procedures, control operations and diagnostic procedures.

3.6 CLEANING

- .1 Proceed in accordance with Division 01 – General Requirements.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION