

Capital Projects Group

Condensing Hot Water Boilers Specification

Specification 23 52 19

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Amendment Record Sheet

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1. GENERAL

1.1. SCOPE OF WORK

- 1.1.1. Provide condensing hot water boilers for hydronic heating and in-floor heating, as detailed on drawings and as specified herein.

1.2. DESIGN REQUIREMENTS

- 1.2.1. Condensing hot water boilers with performance requirements as specified in Part 2.
- 1.2.2. Boiler plant control sequence based on Part 2 specified requirements of products.
- 1.2.3. Additional design requirements are based on Part 2 specified requirements of products.

1.3. RELATED WORKS

- 1.3.1. Section 20 05 05 - Mechanical Work General Instructions.
- 1.3.2. Section 20 05 10 - Basic Mechanical Materials and Methods.
- 1.3.3. Section 20 05 40 - Mechanical Work Commissioning.
- 1.3.4. Section 23 51 23 - Flue Gas Vents.
- 1.3.5. Section 23 21 12 - Hydronic Radiant Floor Heating.

1.4. REFERENCE STANDARDS

- 1.4.1. Standards and codes to be latest editions adopted by and enforced by local governing authorities.
- 1.4.2. ANSI Z21.13/CSA 4.9 - Gas-Fired Low Pressure Steam and Hot Water Boilers.
- 1.4.3. Canadian Council of Ministers of the Environment Initiative N306, PN 1286.
- 1.4.4. CSA B51, Boiler, Pressure Vessel and Pressure Piping Code.
- 1.4.5. CAN/CSA B149.1, Natural Gas and Propane Installation Codes.
- 1.4.6. CAN1-3.1, Industrial and Commercial Gas-Fired Package Boilers.
- 1.4.7. Technical Standards and Safety Act, 2000, Ontario Regulation 220/01, Boilers and Pressure Vessels.
- 1.4.8. Boiler installation tradesmen are to be journeyman tradesmen licensed to install boiler equipment.

1.5. SPARE PARTS

- 1.5.1. Supply a complete spare charge of calcium silicate chips for acid neutralizing assembly.

1.6. TRAINING

- 1.6.1. Training is to be a full review of all components including but not limited to a full boiler internal inspection, construction details, burner operation, maintenance, flame characteristics, and adjustments, gas train maintenance, boiler normal operation, abnormal events, normal shut-down, emergency shut-down, and setting up controls.
- 1.6.2. Include for 3 training sessions of maximum 7 hours duration per session for 10 Metrolinx people per session.
- 1.6.3. Refer to Section 20 05 05 for additional general requirements.

1.7. WARRANTY

- 1.7.1. Products to be guaranteed by manufacturer, after acceptance by Metrolinx as follows:
- a) boiler heat exchanger shall carry a minimum 10 year warranty from project substantial completion, against any failure due to condensate corrosion, thermal stress, mechanical defects or workmanship. All boiler components including but not limited to burner, gas train control, jacket and accessories shall have minimum 10 years parts and labor warranty which shall be submitted on boiler manufacturer letterhead with shop drawings for review and approval;
 - b) manufacturer shall submit written confirmation of minimum 5 years complete parts and labor warranty as in boiler shop drawings; shop drawings will be rejected without confirmation letter on warranty;
 - c) warrant the Positive Pressure Vent System against defects in material and workmanship for a period of 15 years from the date of original installation. Any portion of the vent repaired or replaced under the warranty shall be warranted for the remainder of the original warranty period.

1.8. DELIVERY, STORAGE AND HANDLING

- 1.8.1. Handle and store products in accordance with manufacturer's instructions, in locations approved by Metrolinx. Include one copy of these instructions with product at time of shipment.

1.9. SUBMITTALS

- 1.9.1. Refer to submittal requirements in Section 20 05 05.

- 1.9.2. Submit shop drawings/product data sheets for boilers, including accessories, and all required wiring schematics. Include boiler flue product data sheets with the submission.
- 1.9.3. Boiler efficiency Curves: At a minimum, submit efficiency curves for 100 %, 80 %, 50 %, and 20 % input firing rates at incoming water temperatures ranging from 60 °F to 160 °F.
- 1.9.4. Boiler pressure Drop Curve: Submit pressure drop curve for flows ranging from 0 GPM to maximum value of boiler.
- 1.9.5. Submit with delivery of boiler(s) a copy of factory inspection and test report for each boiler, and include a copy of each report with O & M Manual project close-out data.
- 1.9.6. Submit a site inspection and boiler start-up report from boiler manufacturer's representative as specified in Part 3 of this Section.
- 1.9.7. Submit signed copies of a manufacturer's extended warranty for stainless steel heat exchanger against corrosion, thermal stress, mechanical defects, and workmanship, and extended warranty for all other boiler components.
- 1.9.8. ASME Stamp Certification and Report: Submit "A," "S," or "PP" stamp certificate of authorization, as required by authorities having jurisdiction, and document hydrostatic testing of piping external to boiler.
- 1.9.9. Product Data
 - a) Submit manufacturer's Product data indicating:
 - 1) technical data, supplemented by bulletins, component illustrations, detailed views, technical descriptions of items, and parts lists;
 - 2) performance criteria, compliance with appropriate reference standards, characteristics, limitations, and troubleshooting protocol;
 - 3) product transportation, storage, handling, and installation requirements;
 - 4) product identification in accordance with Metrolinx requirements.
- 1.9.10. Shop Drawings
 - a) Submit shop drawings including:
 - 1) capacity and ratings;
 - 2) dimensions;
 - 3) mounting details to suit locations shown, indicating methods and hardware to be used;

- 4) control components and control wiring schematic.

1.9.11. Commissioning Package

- a) Submit the following in accordance with Sections 20 05 05 and 20 05 40:
 - 1) Commissioning Plan;
 - 2) Commissioning Procedures;
 - 3) Certificate of Readiness;
 - 4) complete test sheets specified in Section 20 05 40 and attach them to the Certificate of Readiness;
 - 5) Source Quality Control inspection and test results and attach to the Certificate of Readiness.

1.9.12. Commissioning Closeout Package

- a) Submit the following in accordance with Section 20 05 05:
 - 1) Deficiency Report;
 - 2) Commissioning Closeout Report;
 - 3) submit the following for each Product for incorporation into the Operation and Maintenance Manuals in accordance with Section 20 05 05:
 - i) Identification: manufacturer's name, type, year, serial number, number of units, capacity, and identification to related systems;
 - ii) functional description detailing operation and control of components;
 - iii) performance criteria and maintenance data;
 - iv) safety precautions;
 - v) operating instructions and precautions;
 - vi) component parts availability, including names and addresses of spare part suppliers;
 - vii) maintenance and troubleshooting guidelines/protocol;
 - viii) product storage, preparation, handling, and installation requirements;

ix) Commissioning Report.

1.10. QUALITY ASSURANCE

1.10.1. Manufacturers Qualifications

- a) Manufacturer shall be ISO 9000, 9001 or 9002 certified. Manufacturer of product shall have produced similar product for a minimum period of five years. When requested by Consultant, an acceptable list of installations with similar product and similar application shall be provided demonstrating compliance with this requirement.
- b) Manufacturer shall have a facility in Ontario with qualified manufacturing/ combustion technicians and spare parts readily available within GTA region.
- c) Manufacturers are to be current members of Air-Conditioning, Heating and Refrigeration Institute (AHRI),
- d) Electrical Components, Devices and Accessories: Boilers must be listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- e) ASME Compliance: Condensing boilers must be constructed in accordance with ASME Boiler and Pressure Vessel Code, Section IV "Heating Boilers".

1.10.2. Installers Qualifications

- a) Installers for work to be performed by or work under licensed Mechanical Contractor.
- b) Installers of equipment, systems and associated work are to be fully qualified and experienced installers of respective products and work in which they are installing.
- c) Boiler installation tradesmen are to be journeyman tradesmen licensed to install boiler equipment.
- d) Where manufacturers provide training sessions to installers and certificates upon successful completion, installers to have obtained such certificates and submit copies with shop drawings.

1.10.3. Regulatory Requirements

- a) Products and work to comply with applicable local governing authority regulations, bylaws and directives.
- b) Include for required inspections and certificate of approvals of installation work from local governing authorities.

2. PRODUCTS

2.1. CONDENSING HOT WATER BOILERS

- 2.1.1. Viessmann Manufacturing Co. "Vitocrossal" or approved equivalent, fully condensing, factory assembled and tested hot water boilers in accordance with drawing schedule, and with performance requirements as follows:
- a) boilers and burners, CSA certified and ULC listed and labelled as one unit, have a CRN, and comply with Provincial regulations;
 - b) NO_x emissions in accordance with Canadian Council of Ministers of the Environment Initiative N306, PN 1286, and Provincial Regulations;
 - c) 98.3 % maximum boiler efficiency with 15.5 °C (60 °F) entering water, 210 kPa (30 psi) maximum operating pressure, and 100 °C (215 °F) maximum operating temperature.
- 2.1.2. Water/flue gas counter-flow design boilers complete with following construction features:
- a) horizontal pressure vessel design permitting boiler to be delivered in sections if required for entry into Boiler Room through existing building openings;
 - b) vertical heat exchanger plates with surfaces which turbulate flue gas flow, straight-through, water cooled front combustion chamber, and bottom flue gas condensate collector pan are constructed using SA 240 - 316Ti stainless steel, and outer pressure vessel walls are constructed from carbon steel;
 - c) fitted boiler door with burner mounting plate, a clean-out cover, and a flue gas collector;
 - d) boiler shell insulation is 100 mm (4") thick wrap-around mineral wool with a nylon backing;
 - e) enclosure panels and structural steel skid type base assembly are to be factory finished with baked electrostatically coated powder epoxy enamel;
 - f) 2 return water connections provided, one above other at back of boiler, and 2 supply connections provided on top and connected to supply piping header provided;
 - g) lifting lugs on top of boiler for ease of moving boiler to its final location;
 - h) factory installed and certified seismic restraint anchor points.

2.1.3. Boiler trim includes following:

- a) low water cut-off control supplied loose for site installation, which, when installed and wired to burner control circuit will prevent burner operation if boiler water falls below a safe level;
- b) auxiliary low water cut-off as above, and a McDonnell & Miller Model TC-4 "Test-N-Check" or approved equivalent, valve supplied by Contractor for site installation above and below both low water cut-offs;
- c) cast iron safety header with ASME rated factory sized and set relief valve, brass air vent with manual spring-loaded shut-off base, and pressure gauge;
- d) adjustable automatic reset high limit control and manual reset high limit control in accordance with ASME Section IV and CSD-1;
- e) hose end drain valve.

2.1.4. Weishaupt Corp. "WG" Series or "WM-G" Series (depending on boiler capacity) or approved equivalent, low NOx, linkage less, factory prewired, fully modulating forced draft burner in accordance with requirements of CAN/CSA B149.1, flange mounted to front burner plate, designed to return to low fire position prior to ignition and to remain in low fire position during ignition and until main flame has been proven, and constructed to burn specified quantity of fuel at between 4" to 14" w.c. (minimum 7" w.c.) to maximum 34.5 kPa (5 psi) gas supply pressure without objectionable noise, pulsation, or vibration. Each burner complete with:

- a) mixing tube, flame tube, and adjustable diffuser;
- b) automatic electric spark ignition, and a 100% safety shut-down ionization flame detector to monitor flame to prevent primary fuel valves from opening until flame has been established;
- c) transverse fan and burner motor with capacitor, and with maximum sound level of 78 dBA measured 1 m (3') in front of boiler;
- d) air pressure switch, and an air damper and a butterfly gas valve, both with stepping motors;
- e) microprocessor-based combustion manager with digital display and keys to:
 - 1) regulate gas butterfly valve and air damper motors and display positions;
 - 2) control ignition and safety shut-down;
 - 3) display sequence of operation, safety lock-out error messages and codes, and display information, service, and operating parameters.
- f) sound insulated air intake housing, and a removable cover;

- g) gas piping train with ball type shut-off valve, main gas pressure regulator, low gas pressure switch, double main gas valves, secondary gas pressure regulator, ball type shut-off valve, and gas butterfly valve, controlled through combustion manager to start or stop burner and to close automatically in event of power failure, flame failure, excessive pressure or temperature, low gas pressure, or low water condition.
- 2.1.5. Viessmann "Vitoltronic 100" or approved equivalent, 120/1/60 Hz controls factory installed in an enclosure mounted on side of each boiler and equipped with power and control wiring terminal blocks, and an extension output module to provide LED's and dry contacts for boiler status, alarm, high temperature, and low water level, and outputs for burner modulation and firing to achieve required supply water temperature.
- 2.1.6. Viessmann "Vitocontrol-S" or approved equivalent, microprocessor-based, master, wall mounting digital control panel supplied loose for site installation, and to provide indoor/outdoor boiler reset control and staging and rotation of individual boilers. Panel communicates with boiler control panels via LON communications, and equipped with a 0-10 VDC input module for interfacing with building automation system for boiler water temperature control. BAS interface includes:
 - a) boiler enable/disable (to be used for warm weather shutdown and not to override control panel internal sequencing);
 - b) common supply water temperature reset;
 - c) general alarm input.
- 2.1.7. Double wall stainless steel AL29-4C stainless steel flue gas vent for each boiler with a type 304 outer casing and AL29-4C inner flue supplied by boiler manufacturer. Each boiler is to operate under Category IV positive vent pressure conditions for room air dependent operation. Venting is to feature condensate disposal and have 50 mm (2") clearance to combustibles.
- 2.1.8. JJM Boiler Works or Condensate Neutralizer or approved equivalent, condensate acid neutralizing PVC tube sized to suit boiler condensate discharge, supplied with boiler, filled with 12 mm (½") and 20 mm (¾") aggregate calcium carbonate and complete with floor mounting galvanized steel strut clamps, threaded PVC inlet and outlet fittings, and a spare charge of calcium silicate.
- 2.1.9. Standard of quality assurance manufacturers are:
 - a) Viessmann Manufacturing Co.;
 - b) De Dietrich Products;
 - c) Buderus;
 - d) or approved equivalent.

2.2. WALL HUNG CONDENSING HOT WATER BOILERS

- 2.2.1. Viessmann Manufacturing Co. "Vitodens 200-W" or approved equivalent, fully condensing, wall hung, zero clearance, factory assembled hot water boilers in accordance with drawing schedule.
- 2.2.2. Performance requirements are as follows:
 - a) boilers and burners, CSA certified and ULC listed and labelled as one unit, have a CRN, and comply with Provincial regulations;
 - b) NO_x emissions, maximum 8.9 ppm and in accordance with Canadian Council of Ministers of the Environment Initiative N306, PN 1286, and Provincial guidelines;
 - c) 95.2% boiler annual fuel efficiency;
 - d) 420 kPa (60 psi) boiler operating pressure rating.
- 2.2.3. Each boiler complete with an enamelled steel accessible enclosure, and following construction features:
 - a) high alloy (SA240 316Ti) stainless steel radial design coil type heat exchanger with defined gaps between coils for efficient heat transfer;
 - b) factory calibrated, self-adjusting, fully modulating, stainless steel cylinder type burner capable of operating at altitudes of up to 3000 m (10,000') adjusting automatically to either natural gas or propane, and with a 3:1 turndown ratio, in accordance with CAN/CSA B149.1 or .2 as applicable, complete with variable speed DC blower for positive flue discharge, designed to return to the low fire position prior to ignition and to remain in the low fire position during ignition and until main flame has been proven and complete with:
 - 1) automatic electric spark ignition, and 100% safety shut-down ionization flame detector to monitor flame to prevent primary fuel valves from opening until flame has been established;
 - 2) microprocessor-based combustion manager to regulate gas butterfly valve, control ignition and safety shut-down, and display sequence of operation, safety lock-out error messages and codes, and information, service, and operating parameters;
 - 3) gas piping train with ball type shut-off valve, main gas pressure regulator, low gas pressure switch, double main gas valves, secondary gas pressure regulator, ball type shut-off valve, and gas valve, controlled through combustion manager to start or stop burner excessive pressure or temperature, low gas pressure, or low water condition.

2.2.4. Boiler trim is to include the following:

- a) integral flow switch and an ASME rated factory sized and set relief valve;
- b) adjustable automatic reset high limit control and a manual reset high limit control in accordance with ASME Section IV;
- c) boiler manufacturer supplied, site installed low loss header to decouple high flow rate systems and ensure low return boiler water temperatures at all times, factory insulated with insulation and jacket conforming to requirements specified in Section entitled Mechanical Insulation, and equipped with NPT pipe connections, air vent, and drain valve;
- d) boiler manufacturer supplied, site installed distribution manifold with supply and return pipe connections, factory insulated with insulation and jacket conforming to requirements specified in Section entitled Mechanical Insulation.

2.2.5. Multi-function, self-diagnostic, outdoor reset, weather responsive, digital controls with menu-driven programmable unit factory installed on each boiler, capable of communicating via KM-BUS protocol to a "Vitocontrol-S WB2B" or approved equivalent, distribution manifold mounted cascade control with temperatures sensor, accepting remote 0 to 10 volt input, boiler sequencing and firing rate, indoor/outdoor reset and user interface with graphic output. Boiler control is to self-adjust to varying operating environments and have priority for both electrical and fuel savings in its self-learning, self-adaption logic, and is to include fault code and alarm indication. Self-diagnostic cascade control is to operate up to 4 boilers and, where applicable, be capable of interface to building automation system.

2.2.6. Boiler flue gas venting supplied with each boiler by boiler manufacturer for boiler operation under Category IV positive vent pressure conditions for room air dependent operation. Venting is to be complete with required installation and termination accessories, is to feature condensate disposal, and is to have zero clearance to combustibles.

2.2.7. Condensate acid neutralizer equal to JJM Boiler Works or Condensate Neutralizer or approved equivalent, condensate acid neutralizing PVC tube sized to suit boiler condensate discharge, supplied with boilers, filled with 12 mm (½") and 20 mm (¾") aggregate calcium carbonate and complete with floor mounting galvanized steel strut clamps, threaded PVC inlet and outlet fittings, and a spare charge of calcium.

2.2.8. Where seismic restraint required per OBC, provide factory installed and certified seismic restraint anchor points.

3. EXECUTION

3.1. INSTALLATION OF CONDENSING HOT WATER BOILERS

3.1.1. Provide condensing hot water boilers.

- 3.1.2. Secure each boiler in place, level and plumb, on neoprene-steel-neoprene vibration isolation pads on a concrete housekeeping pad.
- 3.1.3. Anchor each boiler and concrete base in accordance with local governing authority and code requirements for seismic control and restraint. Provide flexible connections in piping connections to each boiler.
- 3.1.4. Connect each boiler with an auxiliary low water cut-off and a cut-off test and check unit, piping, and flue as indicated. Follow flue manufacturer's instructions and boiler manufacturer's directions when installing and terminating flue sections.
- 3.1.5. Install condensate acid neutralizers adjacent to boilers and connect with piping from boilers to neutralizers and from neutralizers to drain in accordance with manufacturer's directions and drawing requirements.
- 3.1.6. Install control components shipped loose for each boiler. Unless otherwise instructed, follow manufacturer's installation instructions. Provide pressure gauges and thermometers in boiler water supply and return piping connections.
- 3.1.7. Wall mount master control panel where shown but confirm exact location prior to installation.
- 3.1.8. Perform required control wiring in conduit to connect control components. Follow boiler manufacturer's control wiring schematics and conduit and conductor installation requirements specified as part of electrical work.
- 3.1.9. When boiler plant installation is substantially complete, but prior to start-up, and prior to flushing and cleaning heating piping system as specified in Section entitled HVAC Water Treatment, inspect each boiler and remove visible dirt, oil and debris, then cooperate with the boiler boil-out chemical supplier to ensure proper boil-out procedures are followed.
- 3.1.10. Refer to Section 20 05 10 for equipment/system start-up requirements.

3.2. INSTALLATION OF WALL MOUNTED BOILERS

- 3.2.1. Provide wall mounted condensing boilers.
- 3.2.2. Conform to requirements of CAN/CSA B149.1 or .2 as applicable.
- 3.2.3. Secure each boiler in place, level and plumb, on wall bracket assemblies supplied with boilers.
- 3.2.4. Anchor each boiler in accordance with requirements specified in Section entitled Seismic Control and Restraint. Provide flexible connections in all piping connections to each boiler.

- 3.2.5. Connect each boiler with a distribution manifold, cascade control, and other accessories supplied loose. Follow boiler manufacturer's instructions when installing accessories supplied loose. Provide pressure gauges and thermometers in boiler water supply and return piping.
- 3.2.6. Install condensate acid neutralizers adjacent to boilers and connect with piping from boilers to neutralizers and from neutralizers to drain in accordance with manufacturer's directions and drawing requirements;
- 3.2.7. Install control components shipped loose with boilers. Perform required control wiring in conduit to connect control components. Follow boiler manufacturer's control wiring schematics and conduit and conductor installation requirements specified as part of the electrical work.
- 3.2.8. Refer to Section entitled Basic Mechanical Materials and Methods for equipment/system manufacturer certification requirements.
- 3.2.9. Refer to Section entitled Basic Mechanical Materials and Methods for equipment/system start-up requirements.

END OF SECTION