METROLINX

Condensing Hot Water Boilers Specification

Specification 23 52 22

Revision 01

September 2025

Condensing Hot Water Boilers Specification

Specification 23 52 22

Publication: August 2018
Revised: September 2025

Metrolinx,

an Agency of the Government of Ontario

Amendment Record Sheet

Amendment in Clause No.	Date of Amendment	Description of Changes
N/A	Sept. 20, 2018	Wrong specification was uploaded to internal and external websites.
1.3.4, 1.3.5, 1.3.6, 1.3.10, 1.3.11	September 2025	Added additional specification sections to list of Related Works.
1.9.1 d)	September 2025	Revised references for Quality Assurance to Canadian standards and deleted US references.

Contents:

1. GENERAL

1.1. SCOPE OF WORK

1.1.1. Provide condensing hot water boilers as detailed on drawings and as specified herein.

1.2. DESIGN REQUIREMENTS

1.2.1. Condensing hot water boilers with performance requirements are as follows:

a) NOx emissions in accordance with Canadian Council of Ministers of the Environment Initiative N306, PN 1286, and Provincial Regulations; and

b) 99.3% boiler efficiency with 15.5 °C (60 °F) entering water.

1.2.2. Boiler plant control sequence based on Part 2 specified requirements of products.

1.2.3. 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 20 05 50 – Testing, Adjusting and Balancing.

1.3.5. Section 23 11 23 – Natural Gas Piping System.

1.3.6. Section 23 20 00 – HVAC Piping and Pumps.

1.3.7. Section 23 51 23 – Flue Gas Vents.

1.3.8. Section 23 21 12 – Hydronic Radiant Floor Heating.

1.3.9. Section 23 21 18 - Glycol Solution Snow Melting System.

1.3.10. Section 23 30 00 - HVAC Air Distribution.

1.3.11. Section 23 75 00 - Custom Made Air Handling Units.

1.4. REFERENCE STANDARDS

1.4.1. Standards and codes shall 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.

1.5. TRAINING

1.5.1. Training shall 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.

1.5.2. Include for 3 training sessions of maximum 7 hours duration per session for 10 Metrolinx people per session.

1.5.3. Refer to Section 20 05 05 for additional general requirements.

1.6. WARRANTY

1.6.1. Products shall be guaranteed by manufacturer, after acceptance by Metrolinx, as follows:

a) Boiler stainless steel 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-year parts and labour warranty, which shall be submitted on boiler manufacturer letterhead with shop drawings for review and approval;

b) Boiler Manufacturer shall submit written confirmation of a minimum 5 years complete parts and labour warranty with boiler shop drawings. Shop drawings shall be rejected without confirmation letter on warranty; and

c) Warrant the Positive Pressure Vent System against defects in material and workmanship for a period of 15 years from the date of substantial completion. Any portion of the vent repaired or replaced under the warranty shall be warranted for the remainder of the original warranty period.

1.7. DELIVERY, STORAGE AND HANDLING

1.7.1. 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.

1.8. SUBMITTALS

1.8.1. Refer to submittal requirements in Section 20 05 05.

1.8.2. Submit shop drawings/product data sheets for boilers, including accessories, and all required wiring schematics. Include boiler flue product data sheets with the submission.

1.8.3. 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.

1.8.4. Boiler Pressure Drop Curve: Submit pressure drop curve for flows ranging from 0 GPM to maximum value of boiler.

1.8.5. Submit with delivery of boilers a copy of factory inspection and test report for each boiler. A copy of each report shall be included within the O&M Manual as part of project close-out document.

1.8.6. Submit a site inspection and boiler start-up report from boiler manufacturer's representative as specified in Part 3 of this Section.

1.8.7. Submit signed copies of a manufacturer's extended warranty as required in section 1.6 Warranty above.

1.8.8. 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.

1.8.9. 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 reference standards, characteristics, limitations, and troubleshooting protocol;

3) Product transportation, storage, handling, and installation requirements; and

4) Product identification in accordance with Metrolinx requirements.

1.8.10. Shop Drawings

a) Submit shop drawings including:

1) Capacity and ratings;

2) Dimensions;

3) Mounting details shall be coordinated with locations shown, indicating methods and hardware used; and

4) Control components and control wiring schematic.

1.8.11. 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; and

5) Source Quality Control inspection and test results, and attach to the Certificate of Readiness.

1.8.12. Commissioning Closeout Package

a) Submit the following in accordance with Section 20 05 05:

1) Deficiency Report;

2) Commissioning Closeout Report; and

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; and

ix) Commissioning Report.

1.9. QUALITY ASSURANCE

1.9.1. Manufacturers Qualifications

a) Manufacturer shall be ISO 9000, 9001 or 9002 certified. Manufacturer of product shall have produced a 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 shall be current members of Air-Conditioning, Heating and Refrigeration Institute (AHRI), ASHRAE/IESNA 90.1 Compliance: Boilers shall have minimum efficiency according to "Gas and Oil Fired Boilers - Minimum Efficiency Requirements."

d) Electrical Components, Devices and Accessories: Boilers shall be CSA listed and labelled by a testing agency acceptable to authorities having jurisdiction, and marked for intended use; and

e) ASME Compliance: Condensing boilers shall be constructed in accordance with ASME Boiler and Pressure Vessel Code, Section IV "Heating Boilers."

1.9.2. Installers Qualifications

a) Installers for work shall be performed by or work under a licensed Mechanical Contractor;

b) Installers of equipment, systems, and associated work shall be qualified and experienced installers of respective products and work in which they are installing;

c) Boiler installation tradesmen shall be journeyman tradesmen licensed to install boiler equipment; and

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.

1.9.3. Regulatory Requirements

a) Products and work to comply with applicable local governing authority regulations, bylaws, and directives; and

b) Include required inspections and certificate of approvals of installation work from local governing authorities.

2. PRODUCTS

2.1. CONDENSING HOT WATER BOILERS

2.1.1. Fully condensing, single-stage, factory assembled, factory pressure and fire tested hot water boilers in accordance with drawing schedule and with performance requirements are as follows:

a) NOx emissions in accordance with Canadian Council of Ministers of the Environment Initiative N306, PN 1286, and Provincial Regulations; and

b) Approved to ANSI Z21.13 CSA 4.9- standards with minimum thermal efficiency of 98% at high fire.

2.1.2. Boilers complete with following construction features:

a) Heat exchanger constructed of 316L stainless steel water tubes with a three-pass combustion gas flow design. Any metal in contact with flue gases shall be made of 316L stainless steel. No carbon steel shall be accepted on heat exchanger. The heat exchanger shall be ASME stamped for a working pressure not less than 1100 kPa (160 psig). Access to the heat exchanger shall be available via burner side and back side, without exhaust manifold removal;

b) Burner fully modulating and provided to meet or exceed CSA and or CSD-1 requirements;

c) Vent and condensate manifold with minimum 250 mm (10") dia. (and greater depending on unit model) flue connection with gravity drain for condensate elimination without a collection reservoir, and a port for cleaning and inspection;

d) Baked powder epoxy-coated steel casing and framework mounted on casters for ease of moving boiler to its final location;

e) Factory-supplied and certified seismic restraint anchor points; and

f) Single-Point Field Power Connection: Factory-installed and factory-wired switches, motor controllers, transformers and other electrical devices shall provide a single-point field power connection to the boiler.

2.1.3. Boiler trim includes following:

a) Pressure gauge, temperature gauge, low water cut-off, high limit control, operating control, high fire control, and drain valve;

b) Low water cut-off control supplied loose for site installation, which, when installed and wired to burner control circuit, shall prevent burner operation if boiler water falls below a safe level, an auxiliary low water cut-off as above, and a McDonnell & Miller Model TC-4 "Test-N-Check" or approved equivalent, valve above and below both low water cut-offs; and

c) ASME-rated factory-sized and set relief valve, and a flow switch, both shipped loose for site installation.

2.1.4. Forced draft, total burner modulation turndown ratio of up to 16:1, fully modulating premix stainless steel cylinder burner with perforated holes for precise air-fuel mixture producing a maximum of 30 ppm of NOx corrected to 3% excess oxygen, 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. (0.99 to 3.5 kPa) without objectionable noise, pulsation, or vibration. Each burner complete with:

a) Automatic electric spark ignition of premix gas pilot, and a flame detector to monitor pilot flame to prevent primary fuel valve from opening until pilot flame has been established;

b) Stainless steel cylinder with perforated holes for precise air-fuel mixture and velocity, and woven stainless steel fibre for flame stability and heat insulation;

c) Pulse width modulation controlled forced draft fan for optimum mixing of air and fuel between air-fuel valve and burner, mounted in front head above burner, direct connected to motor conforming to requirements specified in Section entitled Basic Mechanical Materials and Methods, equipped with an overload protected automatic motor starter with auxiliary contacts, and with maximum sound level of 60 dBA measured 1 m (3') in front of boiler;

d) Modulating air-gas ratio valve to meter natural gas input;

e) Gas train with primary motorized gas shut-off valve controlled to start or stop burner and to close automatically in event of power failure, flame failure, excessive pressure or temperature, high or low gas pressure, or low water condition, a manual shut-off valve located ahead of primary valve, a plugged leakage test connection with shut-off cock as a means of testing tightness of primary valve, a gas pressure regulator, and high and low gas pressure switches; and

f) factory piped and wired pilot gas piping train with separate pilot gas cock, gas pressure regulator, and pilot safety shut-off gas valve.

2.1.5. Burner controls, unless otherwise specified, are to be factory-installed in a dead front enclosure mounted on front head of boiler and equipped with disconnect switch, power and control wiring terminal blocks, motor starter, fuses, control circuit transformer, and control switches and relays as required. Controls include solid-state, microprocessor-based boiler and burner control which incorporates functions of temperature control, 100% shut-down combustion safeguard control, message annunciation, and fault diagnostic display, a flash card to permit replacement of control without need to re-commission boiler, and features as follows:

a) 3 levels of access; one for end user, one for advanced trained set-up and service technicians, and one for factory;

b) Hardware and circuitry for building automation system control and enable/disable contacts;

c) Ability to communicate with a PC or PDA with communication software and interface cable;

d) Regulate supply water temperature for one high temperature circuit, two mixing valve circuits and one DHW circuit with the standard control package;

e) On/off switch, and supply and return water temperature indication;

f) Blocked heat exchanger and blocked vent indication;

g) Operating, service, and fault diagnostic coding;

h) Ability to be set-up with or without a computer;

i) Hardware and circuitry for pre-operation and post-operation of burner fan; and

j) Contacts for connection to Boiler Room ventilation system to prevent boilers from operating unless ventilation system is operating (ventilation system shall "fail-open" to permit boiler operation when fan or damper motors fail or a power failure occurs).

2.1.6. 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 shall operate under Category IV positive vent pressure conditions for room air-dependent operation. Venting shall feature condensate disposal and have 50 mm (2") clearance to combustibles.

2.1.7. Include condensate acid neutralizing kit suitable for the 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.

2.1.8. Standard of accepted manufacturers are:

a) De Dietrich Enerpro EPN series;

b) Viessmann Manufacturing Co.; or

c) Approved equivalent.

2.2. BOILER PLANT SEQUENCING CONTROL PANEL

2.2.1. Where controls are not integral with boiler, provide wall-mounted unit as specified herein.

2.2.2. Surface wall mounting, NEMA 2, dead front, enamelled steel, 115 VAC, 60Hz, 1-phase electronic, microprocessor-based, CSA-certified, fully automatic boiler plant master sequencing control panel, compatible with boilers, supplied by boiler manufacturer for lead-lag control of boiler operation with simple on-off switching of individual boilers, and boiler water temperature control as indicated.

2.2.3. Panel shall complete with:

a) Key lock door, and a door interlock type disconnect switch;

b) Green "Power On" LED and a white "Boiler Operating" LED for each boiler;

c) Door-mounted 2-position "Manual/Automatic" switch for each boiler, connected such that when a switch is in "Manual" position, respective boiler is disconnected from automatic sequence and shall operate independently through its own controls while remaining boilers operate automatically through sequencing controls;

d) Rotary type, door mounted lead boiler selector switch, connected such that regardless of which boiler is chosen as lead boiler remaining boilers shall operate in required sequence in numerical order, and with circuits isolated in programmer circuit such that switch shall be rotated at any time with any number of boilers operating without overloading its contacts, and such that boilers remaining on line shall not recycle thereby permitting changing of lead boiler without material loss of load;

e) Fused 24 V secondary control transformer;

f) Numbered terminal strips for power and control wiring connections;

g) Hardware and circuitry required for specified control and sequencing, including adjustable time delay, which shall be activated before lead boiler reaches high fire to allow lead boiler time to satisfy system demand before first lag boiler is activated;

h) Permanent identification of door-mounted LEDs and switches; and

i) Operating control components as required, supplied loose for site installation.

2.2.4. Boiler plant conceptual control sequence as follows:

a) On first call for heat, lead boiler shall come online at low fire, and boiler shall modulate to high fire when system demand is not satisfied by the output of lead boiler at low fire;

b) If lead boiler is unable to satisfy system demand by time it reaches 80% of its firing rate, and over a reasonable period of time, first lag boiler shall come online at low fire and, if required, modulate to high fire;

c) Remaining lag boilers are brought online as above, as required to satisfy system demand; and

d) As system demand is satisfied, boilers shall modulate back to low fire and shut-off in reverse order.

2.2.5. Panel shall be suitable in all respects for interface connection into building automation system without site installation of any additional hardware.

3. EXECUTION

3.1. INSTALLATION OF BOILERS

3.1.1. Provide condensing hot water boilers. In accordance with specified codes and standards with specific reference to TSSA O. Reg. 220/01 in design, construction, maintenance, use, operation, repair and service of boilers, pressure vessels and piping.

3.1.2. Move boilers into position, remove casters, and 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 requirements specified in Section entitled Seismic Control and Restraint. Provide flexible connections in piping connections to each boiler.

3.1.4. Connect each boiler with piping and flue. Refer to Section 23 51 23 for flue venting requirements.

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, including low water cut-offs, relief valve, and flow switch. 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 lead/lag 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 manufacturer certification requirements.

3.1.11. Refer to Section 20 05 10 for equipment/system start-up requirements.

END OF SECTION