|  |  |  |
| --- | --- | --- |
| Version | Date | Description of Revisions |
| 1 | August 30, 2006 | Approved final document. |
| 2 | November 16, 2009 | Modified ‘Related Sections’ and approved suppliers |
| 3 | December 2, 2014 | First draft review (AV) |
| 4 | June 8, 2015 | Second Draft for Review (AV) |
| 5 | September 16, 2015 | Updated, Finalized Specification – Reference eDOCS #5823608-v4 (AV) |
| 6 | November 11, 2016 | Updated NEMA MG-1 reference to 2016 new version and NFPA 70 to 2017 edition (AV) |
| 7 | June 28, 2017 | Updated references to Standards ANSI Z83.4-2017/CSA 3.7-2017, ASHRAE 52.2-2017, ASHRAE 90.1-2016, ASME Boiler and Pressure Vessel Code, 2017 Edition, ASME CSD-1-2015, CSA B149.1-15, CSA B149.6-15, CSA B139 Series 15 (AAM) |

NOTE:

This is a CONTROLLED Document. Any documents appearing in paper form are not controlled and should be checked against the on-line file version prior to use.

**Notice:** This Document hardcopy must be used for reference purpose only.

**The on-line copy is the current version of the document.**

# GEneral

## Related Sections

### *[Under "Related Sections", identify other Sections that are related to, and/or dependent on, the work results or information specified elsewhere. The list should be limited to Sections with specific information that the reader might expect to find in this Section, but is specified elsewhere. For example, if hardware for aluminum entrances is specified in the aluminum entrance Section, a cross-reference would be appropriate in the finish hardware Section. The purpose of this cross-referencing is for information only, to aid in finding those other requirements—not to define the scope of the Section.*

### *Cross-referencing here may also be used to coordinate assemblies or systems whose components may span multiple Sections and which must meet certain performance requirements as an assembly or system.*

### *Contractor is responsible for coordination of the Work.*

### *This Section is to be completed/updated during the design development by the Consultant. If it is not applicable to the section for the specific project it may be deleted.]*

### [List Sections specifying installation of products supplied but not installed under this Section and indicate specific items.]

### Section [\_\_\_\_\_\_ – \_\_\_\_\_\_\_\_\_\_\_\_]: Execution requirements for ...[item]... specified under this Section.

### [List Sections specifying products installed but not supplied under this Section and indicate specific items.]

### Section [\_\_\_\_\_\_ – \_\_\_\_\_\_\_\_\_\_\_\_]: Product requirements for ...[item]... for installation under this Section.

### [List Sections specifying related requirements.]

### Section [\_\_\_\_\_\_ – \_\_\_\_\_\_\_\_\_\_\_\_]: [Optional short phrase indicating relationship].

#### Section 01300 – Submittals

#### Section 01425 - Computerized Maintenance Management System Data Requirements

#### Section 01430 – Operation and Maintenance Data

#### Section 01640 - Manufacturers’ Services

#### Section 01780 – Contract Closeout

#### Section 01810 – Equipment Testing and Facility Commissioning

#### Section 01820 - Demonstration and Training

#### Section 03300 - Cast-in-Place Concrete

#### Section 05500 - Metal Fabrications General

#### Section 09900 – Painting and Protective Coatings

#### Section 15200 - Process Piping and Fittings

#### Section 15205 - Process Valves and Operators

#### Section 15950 – HVAC Systems Testing, Adjusting, and Balancing

#### Section 16050 - Basic Materials and Methods

#### Division 1 – General Requirements

#### Division 16 - Electrical

## References

[Delete .1 if Section 01060 – Regulatory Requirements is included in Contract Documents.]

### Comply with the latest edition of the following statutes, codes, standards, and all amendments thereto:

#### Air Moving and Conditioning Association (AMCA):

##### ANSI/AMCA Standard 300-14, Reverberant Room Method for Sound Testing of Fans.

#### American National Standards Institute (ANSI):

##### ANSI Z83.4-2017/CSA 3.7-2017, Non-recirculating direct gas-fired heating and forced ventilation appliances for commercial and industrial application

#### American Society of Heating, Refrigerating and Air-Conditioning Consultants, Inc. (ASHRAE):

##### ASHRAE 52.2-2017, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.

##### ASHRAE 90.1-2016 (I-P), Energy Standard for Buildings Except Low-Rise Residential Buildings.

#### American Society of Mechanical Consultants (ASME):

##### ASME Boiler and Pressure Vessel Code, 2017 Edition.

##### ASME CSD-1-2015, Controls and Safety Devices for Automatically Fired Boilers.

#### Building Code Act, 1992, S.O. 1992, c. 23, Ontario Building Code

#### Canadian Standards Association (CSA)

##### CSA B149.1-15 Natural Gas and Propane Installation Code.

##### CSA B149.6-15 Code for Digester Gas and Landfill Gas Installations.

##### CSA B139 Series 15, Installation Code for Oil-Burning Equipment.

#### Institute of Electrical and Electronics Consultants, Inc. (IEEE):

##### IEEE 112-2004, IEEE Standard Test Procedure for Polyphase Induction Motors and Generators.

#### National Electrical Manufacturers’ Association (NEMA):

##### NEMA MG 1-2016 Motors and Generators.

##### NEMA 250-2014. Enclosures for Electrical Equipment (1000 Volts Maximum)

#### National Fire Code of Canada 2010 (including supplements).

#### National Fire Protection Association (NFPA):

##### NFPA 54, National Fuel Gas Code. 2015 Edition

##### NFPA 70, National Electric Code (NEC), 2017 Edition.

#### Occupational Health and Safety Act, R.S.O. 1990, c. O.1

#### Underwriters Laboratories Inc. (UL).

##### Gas and Oil Equipment Directory.

##### Electric Heating and Air-Conditioning Directory. *[Consultant to provide UL Standard numbers as appropriate]*

#### Underwriters Laboratories of Canada (ULC).

##### *[Consultant to provide UL Standard numbers as appropriate]*

## Measurement and Payment

*[Choose one of the following payment language provisions that best suits the individual project.*

*If this Section is not specifically referenced by an item in the Bid Form, please use the following language:*

.1 The work of this Section will not be measured separately for payment. All costs associated with the work of this Section shall be included in the Contract Price.

*OR If this Section is specifically referenced in the Bid Form, use the following language and identify the relevant item in the Bid Form:*

.1 All costs associated with the work of this Section shall be included in the price(s) for Item No(s). \_\_\_ in the Bid Form.

*If the work of this Section is to be measured and paid for by several different methods, please amend the standard wording given above to reflect the different methods of measurement and payment.*]

## Submittals

### Action Submittals, in accordance with Section 01300 - Submittals:

#### Shop Drawings:

#### Complete specifications, descriptive drawings, catalog cuts, and descriptive literature that include make, model, dimensions, weight of equipment, and electrical schematics [for products specified.] [for the following products:]

##### [ ].

##### [ ].

#### Recommended procedures for protection and handling of equipment and materials prior to installation.

### Informational Submittals, in accordance with Section 01300 - Submittals:

#### Manufacturer’s Certificate of Compliance for the [direct gas fired air supply units] [energy efficient motors] [       ].

#### Operation and Maintenance Data: As specified in Section 01430 - Operation and Maintenance Data.

#### Manufacturer’s Certificate of Proper Installation.

## Factory Testing

### Balancing: Rotating elements of equipment, except small, commercially packaged equipment, shall be statically and dynamically balanced at the factory prior to final assembly. The Contractor shall furnish certified copies of all test results.

### Witnesses: The Region and the Consultant reserves the right to witness factory tests.

## Structural Analysis

### All equipment and equipment anchoring systems shall be designed in accordance with the latest edition of the Building Code Act, 1992 , S.O. 1992, c. 23, Ontario Building Code, Seismic requirements.

## Quality Assurance

### Provide the Work in accordance with NFPA 70 2017 Edition, National Electrical Code (NEC). Where required by the authority having jurisdiction (local) *[Consultant to define in detail relevant authorities and incorporate into the Contract Documents]*, material and equipment shall be labeled or listed by a nationally recognized testing laboratory or other organization acceptable to the authority having jurisdiction *[Consultant to define in detail relevant authorities and incorporate into the Contract Documents] i*n order to provide a basis for approval under the NEC.

### Products manufactured within scope of standards published by Underwriters Laboratories, Inc. and/or Underwriters Laboratories Canada Inc. shall conform to those standards and shall have an applied UL and/or ULC listing mark.

# PRODUCTS

## Approved Suppliers

### Boilers:

#### Cleaver-Brooks, Inc.

#### Approved Equivalent

### Air Handling System:

#### Engineered Air.

#### Trane Canada Co. (Part of Ingersoll Rand Canada Inc.).

#### Approved Equivalent

## General

### Heating equipment shall have minimum operating efficiencies as specified in [Chapter 6 of ASHRAE 90] [the Province of \_\_\_\_\_ Energy Code].

### Boiler Assemblies: Built in accordance with Section IV *[Consultant to confirm]* of ASME Boiler and Pressure Vessel Code 2017 Edition.

### Fans: Sound power level (ref. 10 to 12 watts) at design operating point; ratings based on AMCA Standard 300-08, Setup No. 1. *[Consultant to confirm]*

## Service Conditions

### Ambient Dry Bulb Temperature:[ ]to [ ] degrees Celsius.

### Sludge Gas: *[Consultant to amend as appropriate for project]*

#### Heat Content: 20.1 J per standard cubic meter.

#### Specific Gravity: 0.80.

#### Inlet Temperature: 21 to 49 degrees Celsius.

#### Inlet Moisture Content: Saturated.

#### Inlet Pressure to Gas Train: 20 33.9 kPa.

#### Hydrogen Sulfide Content: 1,400 ppm, maximum.

### Natural Gas:

#### Heat Content: 33.5 J per standard cubic metre.

#### Specific Gravity: 0.65.

#### Inlet Temperature: 21 to 35 degrees Celsius.

#### Inlet Pressure to Gas Train: 40.6 94.8 kPa.

### Emission: All air emission equipment shall meet the performance requirements of Table 1, Air Emission Limits per Boiler. *[Consultant to amend as appropriate for project]*

### Performance Requirements: Air Emissions from the boiler when operating at full design capacity with natural gas shall not exceed the values listed in Table 1. *[Consultant to amend as appropriate for project]*

### **TABLE 1** Air Emission Limits per boiler

|  |  |
| --- | --- |
| Criteria Pollutant | Emissions Factor |
| NOx as NO2 | 4.66 kg/kW |
| SO2  as SO2 | 0.13 kg/kW |
| CO | 14.65 kg/kW |
| NMTHC (non-methane THC) | 2.13 kg/kW |
| TSP (PM 10) | 1.33 kg/kW |
| Pb | 6.42 kg/m3 |

### Boilers for building heating or process heating shall be suitable for use with glycol solution specified in Section [       ] - Hydronic and Steam Specialties.

## Electric Boilers

### Self Contained Packaged Electric [Hot Water] [Steam] Boiler:

#### Tank.

#### Heating elements.

#### Control panel with operating and safety controls.

#### Mounted on common structural steel frame.

#### Built in accordance with ASME Boiler and Pressure Vessel Code, 2017 Edition *[Consultant to provide detailed references]*

### Receiver and Heating Tank - Steel:

#### Manufactured under ASME Boiler and Pressure Vessel Code, 2017 Edition Section VIII, Division 2, of ASME Code and bear the UV Code symbol stamp. *[Consultant to provide detailed references]*

#### Multilayer phenolic resin coating on interior of heating tank.

### Heating Elements:

#### Inconel tube sheathing.

#### Medium watt density.

#### Easily removable from heating tank.

### Exterior Cabinet:

#### Steel with 100 mm batt insulation.

#### Finish in manufacturer’s standard heat resistant primer and enamel.

### Electric Control Cabinet:

#### Integral with boiler.

#### Finished to match boiler enclosure.

#### Complete with magnetic contactors with three phase cartridge type current limiting fusing.

#### Modulating [electric] [electronic] [pneumatic] step controller with pilot switches.

#### Automatic timing device to energize each stage in timed increments.

#### Visual pilot lights to indicate operation of each heating stage and control power ON.

#### Manual override toggle switches to de-energize each heating stage.

#### Alarm pilot lights in conjunction with an alarm horn with manual reset button to indicate both visual and audible alarms for low water level, high temperature, and no flow.

#### Auxiliary contact to be used for remote annunciation whenever alarm horn is energized.

#### Automatic and manual reset low water cutoff.

#### Automatic and manual reset high limit cutoff.

#### No flow cutoff.

#### Wattmeter with three phase selector switch.

#### Control fusing.

### Boiler Trim for Hot Water Service:

#### ASME, Section IV, rated to the boiler pressure with relief valve stamped with HV Code symbol.

#### Switch to prevent boiler operation under conditions of no flow.

#### Manual drain and blow-down valves.

#### Dial pressure and temperature gauges.

### Boiler Trim for Low Pressure Steam Service:

#### ASME, Section IV, rated to the boiler pressure with relief valve stamped with HV Code symbol.

#### Gauge glass with guard and shutoff valves and drain.

#### Two operating pressuretrols.

#### Feed-water valve and regulator for control of remote feed pumps.

#### Manual drain and blow-down valves.

#### Dial pressure gauge.

#### Two steam pressure regulators, one set at 275.8 kPa for day control, and one set at 103.6 kPa for night control.

#### Regulators: Energize from remote controls as specified in the Contract Documents. [*Consultant to confirm Contract Documents include details of regulators]*

### Capacity: [ ] kW, [ ] stages of control with [ ] at [ ] kW and [     ]at [ ]kW each, [ ]volt, three phase power supply, [ ] litre storage.

### Manufacturers and Products:

#### *[Consultant to provide names of three approved products]*

#### Approved Equivalent

## Pulse Combustion or Air to Fuel Matching Modulation Gas Fired Boilers

### Boiler Design:

#### Fire tube or cast iron sectional design, utilizing the principles of pulse combustion or air-to-fuel matching modulation. Suitable for [ ]percent propylene glycol solution heating fluid.

#### Self-venting and self-aspirating, requiring no additional forced or induced draft equipment to supply air for combustion after ignition.

#### Furnish adequate openings for access to the waterside of the boiler.

#### Completely insulate pressure vessel 50 mm minimum and encase in an 18-gauge metal cabinet with primer and finish coat of paint.

#### Approved by the Consultant as a direct vent boiler.

#### Factory assembled, factory fire-tested, self-contained, ready for automatic operation except for connection of water, fuel, electrical, and vent services.

#### Gas-fired, pulse combustion or air-to-fuel matching modulation type complete with boiler fittings and automatic controls.

#### Design and Construction: In accordance with ASME Boiler and Pressure Vessel Code, 2017 Edition Section IV of the ASME Code *[Consultant to provide detailed references]* for hot water heating boilers with maximum water working pressure of 206.8 kPa. Heating fluid shall be [ ] percent propylene glycol and water solution.

### Boiler Fittings:

#### Safety Valve: ASME Boiler and Pressure Vessel Code, 2017 Edition, Section IV *[Consultant to provide detailed references]*, approved side outlet type set to open at 206.8 kPa.

#### Mount temperature and pressure gauges on top of the boiler.

### Pulse Combustor or Air-To-Fuel Load matching Modulation Controls: Locate combustor assembly components within water backed areas.

#### Pulse or air-to-fuel load matching combustion controls - ON/OFF operative type and include:

##### Operating temperature controller for automatic START and STOP of the pulse or air-to-fuel matching modulation combustor.

##### HIGH limit temperature controller (manual reset).

##### One LOW water cutoff probe in boiler shell (manual reset).

##### Air safety switch to prevent operation until sufficient pre-purge air is assured.

##### Electronic type combustion flame safeguard, specifically designed for pulse or air-to-fuel load matching combustion.

#### Controls:

##### NEMA 1 type enclosure panel mounted and located on the boiler to provide ease of servicing the boiler without disturbing the controls.

##### Mounted and wired according to CGA requirements. Electric power supply 120-volt, 60-Hz, single phase.

##### User interface screen with keypad.

##### DDC communication: digital input for heating ON/OFF enable signal from DDC System; one digital output trouble alarm signal to DDC system; digital output ON/OFF status for each boiler to the DDC system; analog input supply water temperature from DDC system; analog input return water temperature from DDC system; analog input supply water temperature set point from DDC system; may be supplied by others outside of boiler manufacturer.

##### Provide complete integration of controls specified in Section 15950 – HVAC Systems Testing, Adjusting, and Balancing.

##### Control Selector Switch: Local/Off/Remote selection for remote (master boiler control panel) boiler control.

##### Outdoor Air Temperature Reset Schedule: The reset schedule shall be adjustable from the DDC System. Once the boiler is enabled by the DDC system, the boiler integral control panel shall control the boiler operation in accordance with the outdoor reset schedule. *[Consultant to provide operating schedule as part of the Contract Documents].*

### Boiler Accessories:

#### Mufflers: Stainless steel exhaust and carbon steel or PVC intake mufflers as recommended and furnished by the boiler manufacturer or separately in accordance with the boiler manufacturer’s performance specifications.

#### Exhaust and Combustion Inlet Air Piping: Schedule 40 PVC for inlet air. Type AL29-4C stainless steel for exhaust.

#### Thermometer: Provide thermometer with a scale equivalent to 1.5 times outlet water temperature. Provide on located on supply water piping and one on return water piping.

#### Drain Tapping: Route condensate drain piping to a floor drain.

#### Make-up Water Station (for hot water boiler only): Provide a water pressure-reducing valve and relief valve, or a combination of the two in the makeup water line to the boiler to maintain a water pressure of 137.9 kPa in the hot water system. Provide a 20 mm globe valve by-pass around this valve. Backflow preventers are specified under Section 15205 - Process Valves and Operators and shown on the Contract Drawings. *[Consultant to ensure details are contained in the Contract Drawings]*

### Performance:

#### Minimum Efficiency: 85 percent from 33 to 100 percent of full load firing rate.

#### Minimum output [ ] kW, [ ] kW gas input rating; flue gas not to exceed 165.6 degrees C.

### Manufacturer and Product:

#### *[Consultant to provide names of three approved products]*

#### Approved Equivalent

## Steam Humidification Boiler Package

### General:

#### Factory packaged unit shall include boiler, burner, boiler simplex feed-set with 151.4 litres of storage, Blow-down separator (56.9 litres) with after-cooler, all mounted on a painted steel skid, complete with all interconnecting piping , wiring, controls and accessories all piped and wired for single point field connections. Boiler and all panels shall carry packaged label of Underwriters Laboratory (UL) and be in accordance with ASME/CSD-1-2012, all codes required by the local governing authorities and as indicated on the design performance data sheet. *[Consultant to ensure details are provided]* A certified factory fire-test shall be provided on all fuels with data sheets furnished to the Consultant and Region. ASME Boiler and Pressure Vessel Code, 2017 Edition certified, labeled, stamped and designed for 103.4 kPa steam in accordance with Section (I or IV) of ASME Code *[Consultant to provide detailed references]*. The unit shall be designed in accordance with Ontario based seismic building code requirements and shall be provided with tie down clips and calculations showing bolt diameter requirements for the entire skid mounted package. The manufacturer's representative shall provide services for field testing and adjusting of boiler and controls to meet the design requirements.

### Performance: Boiler Size and Ratings

#### Horsepower: [ ] kW

#### Output: [ ](from and at 100 degrees Celsius)

#### Gas Input: [ ] kW

#### Design Pressure: [ ] kPa

#### Operating Pressure [ ] kPa

#### Electrical: [ ]V / [ ]H /[ ]P

##### Fan Motor: [ ] kW

##### Boiler feed pump [ ] kW

#### Available Gas Supply Pressure: *[Consultant to provide gas supply pressures and details]*

#### Code Requirements:

##### ASME / National Board

##### CSD-1-2012/NFPA *8501 [Consultant to confirm applicability of NFPA 8501]*

##### Underwriter’s Lab (UL) and/or ULC *[Consultant to amend with UL/ULC detailed code requirements]*

### Boiler Design:

#### Two pass, vertical tubeless steel boiler for positive pressurized firing with forced draft burner. The cylindrical furnace shall be centrally located with burner firing down. Adequate hand holes to facilitate inspection and cleaning shall be provided.

#### The standard two pass boiler shall make use of welded convection fins to enhance heat transfer and distribute the flow of gasses.

#### The entire vessel shall be covered with 89.0 mm of cast-able insulation covered with painted 18 gauge metal jacket. The boiler jacket and base frame will be painted with high grade enamel paint. Flame observation ports shall be located on top boiler. Lifting lugs will be provided on boiler top frame.

### Burner Design:

#### General: Forced draft burner system shall include blower fan; motor(s); single point positioning system consisting of air shutter and linkage; air flow switch; fuel trains and control panel. To conform to UL/ULC. *[Consultant to provide additional details as required]*

#### Gas Burner: Shall be of the high radiant multi-port type for natural gas. Minimum pilot safety burner shall consist of gas-electric spark ignition with 100 percent safety shut-off pilot, solenoid gas valve, pressure regulator and shut-off cock. Minimum main gas train shall include manual shut-off valve, pressure regulating valve, dual safety gas valves, manual test valve, high-low pressure switches, manifold pressure gauge and butterfly gas valve. Gas train shall be factory packaged in compliance with all regulatory and code requirements. *[Consultant to amend with details] .*

#### Fuel-Air Control: Natural gas shall be On-Off control. Provide operating and limit control with manual reset.

### Boiler Trim:

#### Shall include the following:

##### 100 mm diameter pressure gauge.

##### ASME safety relief valve(s).

##### Auxiliary low water cutoff, [M/M Model 150]

##### Primary low water cut-off.

##### Operating control.

##### Limit control with manual reset.

##### Stack thermometer.

##### One slow opening blow-down valve, Size 25 mm.

##### One quick opening blow-down valves, Size 25 mm.

##### Feed-water ball valve, Size 25 mm, Class 60 U

##### One feed-water check valve, Size 25 mm, Class 60 U

##### One stop valve (steam header valve), Size 65 mm, flanged, cast iron, outside screw and yolk.

##### Factory mounted, installed, tested, and certified piping (by A, S, or PP ASME stamp holder) *[Consultant to provide details]* and valves in accordance with ASME Boiler and Pressure Vessel Code, 2017 Edition, including all boiler external piping.

### Self-Contained Control System Control Panel:

#### Boiler mounted NEMA 1 enclosure(s) with key lock; fusing, magnetic starters; flame safeguard and burner management system; annunciator lights for load demand, fuel on, low water and flame failure; selector switches, required dry contacts, relays and terminal strips. In accordance with UL/ULC and NFPA 70, National Electric Code 2017.

#### User interface screen with keypad.

#### Control Selector Switch: Local/Off/Remote selection for additional analog input signal from DDC for boiler pressure set-point adjustment.

#### DDC communication: digital input ON/OFF enable signal from DDC System; one digital output trouble alarm signal to DDC system; digital output ON/OFF status to the DDC system.

#### Provide complete integration of controls as specified in the Contract Documents. *[Consultant to ensure Contract Documents details the control strategy and integration of controls]*

### Burner Management System:

#### Boiler mounted in control panel enclosure.

#### Microprocessor-based control to monitor all critical boiler and burner interlocks control and supervise burner light off sequence, and initiate an orderly safety procedure in the event of interlock or flame failure.

#### Dynamic self checking.

#### System to provide pre-post purge status, fault history, and diagnostic information by means of a two-line alpha-numeric display with alarm/status LEDS.

#### Honeywell 7800 or Approved Equivalent with display module. *[Consultant to confirm and/or amend with additional acceptable products]*

### Skid Mounted Auxiliary Equipment:

#### Boiler Feed System: The boiler skid shall be equipped with a vertical boiler feed system complete with water makeup valve, gage glass, simplex pump/motor assembly and steam preheat system including sparge tube, and pressure/temperature regulating valve.

#### Tank shall be a minimum 75.7 litres to overflow and include a thermometer.

#### Makeup water shall connect to the RO water system specified in Section [       ] - Water Softener Systems. *[Consultant to amend as appropriate]*

#### Blow-down Separator:

##### The boiler skid shall also include a blow-down separator built in accordance with ASME Boiler and Pressure Vessel Code, 2017 Edition and complete with hand-hole and a after-cooler system that includes a temperature regulating valve, thermometer and strainer.

#### Interconnecting Piping:

##### Boiler, feed-set, and blow-down separator shall be pre-piped at factory to provide a single point connection for fuel, water make-up, blow-down drain and steam.

##### All feed-water piping between the boiler and feed-set shall be insulated at the factory.

#### Interconnecting Wiring:

##### All wiring on boiler and feed-set and between the two and to the single point of connection entry panel shall be included on the skid.

##### Wiring shall be in conduit and shall meet NFPA 70, 2017 Edition (NEC) requirements.

### Shop Test:

#### The complete packaged boiler shall receive factory tests to check construction, operation and function of all controls.

#### All shop tests may be witnessed by the purchaser at his own expense and upon sufficient notice to the company.

### Accessories:

#### Boiler stack as specified in this Section.

### Manufacturers:

#### Approved Suppliers/manufacturers:

##### *[Consultant to provide names of three approved products]*

##### Approved Equivalent

## Gas Fired Boilers

### Packaged Gas Fired Boiler:

#### [Forced draft.] [Natural draft with draft diverter.] [Induced draft.]

#### Suitable for building heating water system.

#### Natural gas burner and gas train.

#### Cast iron heating section.

#### Control panel with operating and safety controls.

#### Mount on common structural steel frame.

### Boiler Cabinet:

#### Insulated with 25 mm thick, 16 kg/m3 density fibreglass interior insulation.

#### Metal enclosure finished in manufacturer’s standard heat resistant primer and enamel.

### Gas Train:

#### Manual main and pilot shutoff valves.

#### Gas pressure regulator.

#### [Two automatic gas valves to provide HIGH/LOW firing rates.] [Modulating fire control.]

#### High and low gas pressure safety switches.

#### Electronic ignition.

### Boiler Trim:

#### ASME Boiler and Pressure Vessel Code, 2017 Edition Section IV *[Consultant to confirm or amend details]*, rated to the boiler pressure with relief valve stamped with HV Code (Heating Boiler Safety Valves, ASME) symbol.

#### Manual drain and blow-down valves.

#### Dial pressure and temperature gauges.

#### Manual reset low water cutoff.

#### Manual reset high limit temperature control.

#### Electronic flame safeguard control.

#### Built in dip tube.

### Combustion Chamber:

#### Cast iron and water backed.

#### High temperature seal strip gasketing for individual section assemblies.

#### Top cleanout plates.

#### Cast horizontal flue gas collector with exterior smoke collar.

### Self Contained Control Panel:

#### Power switch.

#### Terminal strip.

#### Operating and safety controls.

#### Pilot indicator lights for power ON, gas valve ON, flame failure, and low water.

#### Furnish an alarm horn with manual reset button to indicate audible alarms for low water level, high temperature, no flow, and flame failure.

#### Include an auxiliary contact to be used for remote annunciation whenever alarm horn is energized.

### Capacity:

#### [ ] nominal boiler horsepower,

#### [ ] kW input,

#### [ ] kW gross IBR output,

#### [ ]volt,

#### [ ]-phase power supply,

#### [ ] gas firing rate at [ ] kPa gas supply pressure and [ ] joules per cubic metre heat value.

### Approved Suppliers/manufacturers:

#### [Consultant to provide names of three approved products]

#### Approved Equivalent

## Oil Fired Boilers

### Packaged Oil Fired Boiler:

#### Suitable for building heating water system.

#### Cast iron heating section/combustion chamber.

#### Oil burner.

#### Operating and safety controls.

#### Mount on common steel frame.

### Boiler Cabinet:

#### Insulated with 25 mm thick, 16 kg/m3 density fibreglass interior insulation.

#### Metal enclosure finished in manufacturer’s standard heat resistant primer and enamel.

### Oil Burner:

#### Flame retention pressure atomizing type.

#### Attached to burner mounting flange with relief door and observation port.

#### Oil pump.

#### Oil piping to nozzles.

#### Adjustable air ports.

#### Integral pump motor thermal overloads.

#### Wiring harness.

#### Two pipe, two stage fuel feed unit with control.

### Combustion Chamber:

#### Cast iron and water backed.

#### High temperature seal strip gasketing for individual section assemblies.

#### Top cleanout plates.

#### Cast horizontal flue gas collector with exterior smoke collar.

### Boiler Trim:

#### ASME Boiler and Pressure Vessel Code, 2017 Edition Section IV rated *[Consultant to confirm and /or amend details]* to the boiler pressure and relief valve stamped with HV Code symbol.

#### Manual drain and blow-down valves.

#### Dial pressure and temperature gauges.

#### Manual reset low water cutoff.

#### Manual reset high limit temperature control.

#### Electronic light sensing flame safeguard control.

### Self Contained Control Panel:

#### Power switch.

#### Terminal strip.

#### Operating and safety controls.

#### Pilot indicator lights for power ON, flame failure, and low water.

#### Alarm horn with manual reset button to indicate audible alarms for low water level, high temperature, no flow, and flame failure.

#### Auxiliary contact to be used for remote annunciation whenever alarm horn is energized.

### Capacity:

#### [ ]nominal boiler horsepower,

#### [ ] kW gross IBR output,

#### [ ] L/s maximum consumption of No. 2 diesel fuel oil,

#### [ ] kW oil pump,

#### [ ] volt,

#### [ ]phase power supply.

### Manufacturers and Products:

#### Approved Suppliers/manufacturers:

##### *[Consultant to provide names of three approved products]*

##### Approved Equivalent

## Fire Tube Boilers

### General:

#### Assembly: Complete factory assembled and tested packaged unit, suitable for [ ]percent propylene glycol solution heating fluid.

#### Approvals: UL/ULC listed and labelled.

#### Construction: All steel.

#### Base Frame: Welded steel.

#### Configuration: 3 pass, wet back, forced draft, 0.46 m2/BHP minimum fireside heating surface area.

### Performance Requirements:

#### Heating Capacities: Minimum output [ ] kW.

#### Boiler Design Pressure: [ ]**.**

#### Guaranteed Fuel Efficiency: Overall 84 percent minimum for natural gas combustion.

#### Sound Level: Maximum 81 dB, high fire, measured 1 m in front of boiler.

#### Natural Gas: Supply gas pressure: [ ].

### Boiler Shell:

#### Construction:

##### In accordance with the ASME Boiler and Pressure Vessel Code, 2017 Edition Section IV *[Consultant to confirm]*.

#### Handling Features:

##### Fixed lifting eyes, handling instructions.

#### Access Panels:

##### Removable, insulated, for maintenance access to internal parts.

#### Inspection Ports:

##### Water side hand-holes,

##### Observation ports for inspection of flame condition.

#### Insulation: 50 mm minimum glass fibre.

### Boiler Trim:

#### Gauges: Pressure and temperature at hot water inlet and outlet.

#### Relief Valves: In accordance with ASME Boiler and Pressure Vessel Code, 2017 Edition.

#### Cut-off Valves: Low water.

#### Air Vent: Top air vent tapping.

#### Drains: Drain connections with shut-off valves.

#### Modulating temperature control.

### Burner:

#### Natural gas Power-flame, welded steel construction burner. Combustion head with a multi blade, stainless steel, flame retention diffuser.

#### Type: Multiport manifold.

#### Burner Operation: Full modulation, minimum 4:1 turn down ratio.

#### Flame Pattern: To suit furnace dimensions.

#### Forced Draft Fan: Enclosed centrifugal type, direct drive, dynamically balanced.

#### Motor:

##### [ ]kW,

##### [ ] V,

##### [ ] ph, 60 Hz.

##### Comply with the requirements of Division 16.

#### Ignition:

##### Gas pilot with automatic electric ignition,

##### Natural gas pilot.

#### Gas/Air Control Damper Linkage:

##### Heavy duty, roller/ball bearing mountings,

##### Threaded adjusters min. linkage dia. 6 mm.

#### Stack thermometer, barometric damper.

### Gas Trains:

#### Gas Train Piping and Components:

##### UL/ULC approved.

#### Gas Train Location:

##### Refer to the Contract Drawings.

#### Gas Train Sizing:

##### For specified inlet gas pressures and limit total pressure drop to provide sufficient control by pressure regulator.

#### Gas Piping and Components: Conform to the requirements of Section 15200 - Process Piping and Fittings. *[Consultant to confirm applicability of Section 15200 and if necessary, amend Section 15200 to be relevant to this Section]*

#### Provide following for natural gas piping:

##### Gas safety shut-off valve:

###### Automatic shut-off of gas supply on flame failure, high or low gas pressure, low water condition, loss of power.

###### Manual reset.

###### Second motorized shut off valve plus an additional plugged leakage test connection.

##### High gas pressure switch: For all boilers.

##### Low gas pressure switch: For all boilers.

##### Manual shut-off valves: Lubricated, plug type ball or butterfly valves.

##### Pressure gauges: For all boilers.

##### Pressure regulators: For all boilers.

##### Strainer.

#### Provide following for natural gas piping.

### Self-Contained Control Panels:

#### Enclosure: Boiler mounted NEMA 1 enclosure, metal, factory finished, with hinged, lockable door.

#### Wiring:

##### Comply with Division 16 - Electrical.

##### Factory wired and tested.

#### Sensors: Solid state.

#### Control Power:

##### 120 V, 1 ph, 60 Hz from integral control transformer with fused primary and fused secondary windings,

##### Minimum 50 VA extra capacity over known requirements.

#### Disconnect Switch: Comply with Division 16 - Electrical.

#### Control Selector Switch:

##### Local/Off/Remote selection for remote (master boiler control panel) boiler control,

##### Boiler supply heating temperature set point for local mode operation.

#### Alarm horn with manual reset button for any alarm activation.

#### Auxiliary Contact: To be used for remote annunciation whenever alarm horn is energized.

#### Firing Rate Control:

##### Remote local firing rate selection, 4 20 mA in remote mode,

##### Face mounted potentiometer in local mode.

#### Burner Controls:

##### Control of fuel, combustion air and firing rate based on system demand,

##### Automatic burner sequencing to include standby, pre purge, pilot, main fuel ignition, run and post purge,

##### Non recycle type with fixed operating sequence incapable of being manually altered,

##### Flame supervision and safeguard controller, air safety switch, safety shutdown, indication of system status, faults, self-diagnostics, tailored pre-purge cycle, low water cut-off.

#### Burner Motor Starter: Comply with Section 16050 - Basic Materials and Methods.

#### Green Indicator Lights: Flame failure, low water shutdown, high water temperature shutdown, safety shutdown, boiler primary pump failure.

#### Burner Permissive Interlock:

##### 5 amps or 120 VAC, normally open,

##### Closes when the primary hot water circulation pumps is running.

#### User Interface Screen with Keypad: Microprocessor based door mounted operating unit.

#### Outdoor Air Temperature Reset Schedule:

##### This reset schedule shall be adjustable from the DDC System.

##### Once the boiler is enabled by the DDC System, the boiler integral control panel shall control the boiler operation in accordance with the outdoor reset schedule as detailed in the Contract Documents. *[Consultant to ensure details of outdoor reset schedule is in the Contract Documents]*.

#### DDC Communication:

##### Digital input for heating ON/OFF enable signal from DDC System;

##### One digital output trouble alarm signal to DDC system;

##### Digital output ON/OFF status for each boiler to the DDC system; analog input supply water temperature from DDC system;

##### Analog input supply water temperature set point from DDC system;

##### DDC communication may be supplied by others (other than the boiler manufacturer).

#### Provide complete integration of controls as specified.

### Manufacturers:

#### Approved Suppliers/manufacturers:

##### *[Consultant to provide names of three approved products]*

##### Approved Equivalent

## Firebox Boilers

### Packaged Dual Gas Fired Boiler:

#### Assembly packaged unit.

#### Forced draft with 0.46 m2 of heating surface per boiler horsepower.

#### Suitable for [ ]percent propylene glycol solution heating fluid.

#### Natural gas and digester gas burners.

#### Natural and digester gas trains.

#### Control panel with operating and safety controls.

#### Mount on common structural steel frame.

### Performance Requirements:

#### Heat Capacities: Minimum output [ ]kW.

#### Boiler Design Pressure: [ ] kPa.

#### Sound Level: Maximum 81 dBa, high fire, measured 1 m front of boiler.

#### Natural Gas Supply Pressure: [ ]kPa.

#### Digester Gas Supply Pressure: [ ] kPa.

### Boiler Cabinet:

#### Insulated with 25 mm thick, 16 kg/m3 density fibreglass interior insulation.

#### Metal enclosure finished in manufacturer’s standard heat resistant primer and enamel.

### Burner:

#### Dual fuel gas Power-flame full modulation digester gas and natural gas burner. Welded steel construction burner. Combustion head with multi blade, stainless steel, flame retention diffuser. The design includes an adjustable primary air/gas mix chamber for very low digester gas pressure supply.

#### Forced draft fan, direct drive and dynamically balanced.

#### Blower motor, [ ] kW, [ ] V, [ ] ph, [ ] hz.

#### Dual manifold with separate orifice plate for natural and digester gas.

#### Automatic fuel change over. Automatically change to natural gas when digester gas pressure drops below [ ]kPa. Automatically change back to digester gas when digester gas pressure rises above [ ] kPa (field adjustable).

#### Pre-purge sequence.

#### Ultra violet flame detector.

#### Combustion air flow proving switch.

#### Electronic ignition.

#### Modulating firing sequence, low-fire start.

#### Stack thermometer barometric damper.

### Gas Trains:

#### Gas Train Location:

##### Refer to the Contract Drawings.

#### Gas Train Sizing:

##### For specified inlet gas pressures and limit total pressure drop to provide sufficient control by pressure regulator.

#### Gas Piping and Components:

##### Conform to the requirements of Section 15200 - Process Piping and Fittings.

#### Natural Gas Train:

##### UL/ULC approved.

##### Strainer.

##### Check valve.

##### Manual shut off valve gas pressure regulator:

###### Rockwell Automation Canada

###### Emerson Electric Co.

###### Maxitrol Company

###### Approved Equivalent.

##### Low gas pressure switch.

##### Safety gas valve.

##### Second safety gas valve.

##### High gas pressure switch.

##### Common manual leak test valve.

##### Modulating gas valve.

##### Pilot manual shut off valve.

##### Pilot pressure regulator.

##### Pilot solenoid valve.

##### Pressure gauges.

#### Digester Gas Train:

###### UL/ULC approved.

###### Stainless steel piping.

###### Stainless strainer.

###### Check valve.

###### Stainless steel manual shut off valve.

###### Drip leg with stainless steel drain valve.

###### Manual shut off valve gas pressure regulator with stainless steel trim:

Rockwell Automation Canada

Emerson Electric Co.

Maxitrol Company

Approved Equivalent.

###### Low gas pressure switch.

###### Second safety gas valve, stainless steel.

###### Safety gas valve, stainless steel.

###### High gas pressure switch.

###### Manual leak test valve, stainless steel.

###### Modulating gas valve.

###### Pressure gauges.

###### Flame arrestor.

###### Digester gas pressure transmitter.

### Boiler Trim:

#### ASME Boiler and Pressure Vessel Code, 2017 Edition, Section IV, *[Consultant to confirm details]* rated to the boiler pressure with relief valve stamped with HV Code symbol.

#### Manual drain and blow-down valves.

#### Dial pressure and temperature gauges.

#### Manual reset low water cutoff.

#### Manual reset high limit temperature control.

#### Electronic flame safeguard control.

#### Built in dip tube.

#### Modulating temperature control.

### Combustion Chamber:

#### Cast iron and water backed.

#### High temperature seal strip gasketing for individual section assemblies.

#### Top cleanout plates.

#### Cast horizontal flue gas collector with exterior smoke collar.

#### Adjustable manual smoke outlet damper.

### Self Contained Control Panel:

#### Enclosure: Boiler mounted NEMA 1 enclosure, metal, factory finished, with hinged, lockable door.

#### Wiring:

##### Comply with Division 16 - Electrical.

##### Factory wired and tested.

#### Sensors: Solid state.

#### Control Power:

##### 120 V, 1 ph, 60 Hz from integral control transformer with fused primary and fused secondary windings,

##### Minimum 50 VA extra capacity over known requirements.

#### Disconnect Switch: Comply with Division 16 - Electrical.

#### Firing Rate Control:

##### Remote local firing rate selection, 4 20 mA in remote mode,

##### Face mounted potentiometer in local mode.

#### Burner Controls:

##### Control of fuel, combustion air and firing rate based on system demand,

##### Automatic burner sequencing to include standby, pre-purge, pilot, main fuel ignition, run and post purge,

##### Non recycle type with fixed operating sequence incapable of being manually altered,

##### Flame supervision and safeguard controller,

##### Air safety switch, safety shutdown, indication of system status, faults, self-diagnostics, tailored pre-purge cycle, low water cut-off.

#### Burner Motor Starter: Comply with Section 16050 - Basic Materials and Methods.

#### Local/Off/Remote switch, digester gas/natural gas/auto fuel selector switch, boiler supply heating temperature setpoint for local mode operation.

#### Terminal strip.

#### Operating and safety controls.

#### Green pilot indicator lights for power ON, main digester gas fuel valve open, main natural gas fuel valve open, automatic control, digester gas *[Consultant to modify as appropriate for the project]* pressure normal.

#### Red indicator lights for safety shutdown, boiler primary pump fail, flame failure, high temperature, and low water.

#### Furnish an alarm horn with manual reset button to indicate audible alarms for low water level, high temperature, no flow, and flame failure.

#### Include an auxiliary contact to be used for remote annunciation whenever alarm horn is energized.

#### Burner Permissive Interlock: 5 amps or 120 VAC, normally open, closes when the primary hot water pump is running.

#### User interface screen with keypad: Microprocessor based door mounted operating unit.

#### Outdoor Temperature Reset Schedule:

##### This reset schedule shall be adjustable from the DDC System.

##### Once the boiler is enabled by the DDC System, the boiler integral control panel shall control the boiler operation in accordance with the outdoor reset schedule as detailed in the Contract Documents*. [Consultant to ensure details of outdoor reset schedule is in the Contract Documents]*

#### DDC Communication:

##### Digital input for heating ON/OFF enable signal from DDC System;

##### One digital output trouble alarm signal to DDC system;

##### Digital output ON/OFF status for each boiler to the DDC system;

##### Analog input supply water temperature from DDC system;

##### Analog input return water temperature from DDC system;

##### Analog input supply water temperature set point from DDC system;

##### May be supplied by others outside of boiler manufacturer,

##### Digital output signal to DDC system to indicate fuel type being used (digester gas or natural gas). *[Consultant to amend as appropriate]*

##### One digital input signal from the DDC system to switch between fuel type.

#### Provide complete integration of controls as specified in the Contract Documents. *[Consultant to ensure such details are in the Contract Documents]*

#### Manufacturers and Products:

###### *[Consultant to provide names of three approved products]*

##### Approved Equivalent

## Boiler Stack

### Double Wall Boiler Stack:

#### UL/ULC listed Type PS with rain cap.

#### Stainless steel inner and outer jacket.

#### Insulating thimble.

#### Tee section with drain where stack is offset.

#### Manufacturer’s standard fittings as required.

### Manufacturers and Product:

#### *[Consultant to provide names of three approved products]*

#### Approved Equivalent

## Gas Vent Stack

### For Gas Fired Unit Heaters and Water Heaters:

#### UL/ULC listed Type [A: B] [B: PS] double wall, insulated gas vent pipe with rain cap.

#### [Galvanized steel outer jacket, aluminum inner sleeve.] [Stainless steel inner and outer jacket.]

#### Insulating thimble.

#### Pier section with cleanout where stack is offset.

#### Manufacturer’s standard fittings as required.

### Manufacturers and Product:

#### *[Consultant to provide names of three approved products]*

#### Approved Equivalent

## Boiler Feed System

### Components:

#### Vertical [multistage]duplex centrifugal unit.

#### Heavy steel receiver with pipe connections.

#### Mechanical shaft seal for 104.4 degrees Celsius.

#### Not more than 6 kPa NPSH at any operating point.

#### Close coupled motor.

#### Steel channel baseplate.

#### Makeup water assembly.

#### Temperature gauge for receiver.

#### Gauge glass with guard and shutoff valves.

#### Pump pressure gauges on each pump.

#### Stainless steel check valves.

#### Factory mounted power and control panel with starting contactors and three phase overload protection.

#### Pump transfer selector switches.

#### Pilot lights.

#### Terminal strip for remote feedwater signal.

### Capacity:

#### [ ] litre storage,

#### [ ] L/s feed, twin feed pumps,

#### [ ]kPa discharge pressure.

### Manufacturers and Products:

#### *[Consultant to provide names of three approved products]*

#### Approved Equivalent

## Boiler Blow-down Separator

### Furnish the following:

#### ASME Boiler and Pressure Vessel Code, 2017 Edition rated.

#### Fabricate from minimum 10 mm plate steel with welded seams.

#### Support legs.

#### Welded piping connections for blow-down, vent, drain, and cold water.

#### Size as required to match steam boiler.

#### Furnish automatic water regulating valve with remote sensing bulb, well, and separate thermometer.

#### Boiler Operating Pressure: [ ]kPa.

### Manufacturers:

#### *[Consultant to provide names of three approved products]*

#### Approved Equivalent

## Direct Gas Fired Air Handling Unit

### Components:

#### Blower section.

#### Heating section.

#### Gas controls.

#### Filter and mixing sections.

#### Power vent fan.

#### Factory assembled on a structural steel support.

### Housing:

#### 16 gauge steel.

#### Supported on a structural steel frame.

#### Hinged doors for access and service to controls, filters, and fan shaft.

#### Watertight seams.

#### Inside surfaces of housing insulated with 25 mm thick, 24 kg/m3 density insulation on outdoor units.

#### Cabinet and accessory surfaces inside and out treated with rust inhibitive surface coating and painted with prime and finish coat of machinery enamel.

### Blower:

#### Single width, single inlet, centrifugal type fan.

#### Backwardly inclined, non-overloading, and belt driven.

#### Multi V belt drive designed for 50 percent over the motor nameplate capacity.

#### Bearings rated for minimum of 100,000 operating hours.

#### Motor mounted on an adjustable slide base.

### Gas Burner:

#### Designed to burn natural gas with a heating value of [1,000] [ ]Joules per cubic metre and at a pressure of [     kPa] [or propane]at the maximum non-contaminating levels below that required by OHSA and local public health authorities.

#### Non-clogging, stainless steel baffles attached to a cast iron gas supply section with no moving parts.

#### 25:1 turndown ratio.

#### 100 percent thermal efficiency.

#### Outdoor air velocity across the burner designed to assure complete combustion through a fixed factory set profile as recommended by the burner manufacturer for proper operation.

#### No air from the space being heated to be recirculated across the burner.

### Heater:

#### Separate chamber containing two 16 gauge galvanized dampers interlinked to work opposite each other.

#### Return air damper shall control up to 80 percent of the total heater fan volume.

#### Dampers controlled by a manual potentiometer for a total outdoor air turndown ratio of 5:1.

#### Wired for automatic and accurate modulating space temperature control.

#### Electric Control Panel: NEMA [A: ] enclosures and contain standard electrical components.

##### Motor starter.

##### 115 volt and 24 volt transformers.

##### Fused disconnect switch.

##### Control circuit fuse.

##### Electronic ignition/safety.

##### Full number coded terminal strip.

#### Gas Manifold and Electrical Controls:

##### Conform to the requirements of NFPA 70 2017 Edition (NEC).

#### Heater shall have an [Electrical Testing Laboratories (ETL) Testing Laboratory] *[Consultant to provide appropriate testing laboratory details and labels in this specification]* label certifying that the heater meets ANSI Z83.4-2013/CSA 3.7-2013 Standards.

#### Each heater shall be test fired for minimum and high fire conditions.

### Filters:

#### 50 mm thick strainer type.

#### Pleated non-woven media.

#### Rated at 30 percent efficiency and 90 percent average arrestance in accordance with ASHRAE 52.2-2017.

#### Arranged in a suitable leak tight frame and enclosure.

#### Face velocity shall not exceed 1.78 m/s.

#### Manufacturers and Products:

##### Camfil Canada, Farr 30/30 type filters.

##### Tri-Dim Filter Corporation; TRI-DEK filters.

##### Approved Equivalent

### Remote Control Panel:

#### Furnish with each heater.

#### Locate a three position selector switch and two pilot lights to indicate sequence of fan and burner operation on the face of the panel.

#### All electric, room air sensing type control with separate selector dial.

#### Potentiometer mounted inside of the remote panel.

#### Panel entry secured with a keyed lock.

#### [Furnish unit with a field adjustable differential pressure sensor that will modulate the amount of outside and return air to maintain a fixed building static pressure relative to the outdoors.]

### Capacity, ASU [ ]**:**

#### [ ]kW,

#### [ ]L/s at [ ]kPa external static pressure.

### Manufacturers and Product:

#### *[Consultant to provide names of three approved products]*

#### Approved Equivalent

## Indirect Gas-Fired Air Handling Unit

### General:

#### Blower section.

#### Heating section.

#### Gas controls.

#### Filter and mixing sections.

#### Power vent fan.

#### Factory assembled on a structural steel support.

### Blower Section:

#### One or more forward curved.

#### Double width, double inlet centrifugal blowers.

#### Self aligning, permanently lubricated ball bearings.

#### Motor.

#### Drive parts for the specified air delivery and external static pressure.

#### Baked on rust resistant finish.

#### Fan wheel statically and dynamically balanced.

### Heating Section:

#### CGA design certified duct furnaces, [ETL] *[Consultant to provide equivalent to ETL]* listed.

#### 1.04 mm minimum electrically welded heavy duty aluminized steel heat exchanger.

#### Individually removable aluminized steel burners.

#### Stainless steel ribbons and cross lighters.

#### Pilot assembly.

#### 115 volt power venting system for operation with natural gas at inlet pressure of 0.1 kPa to 0.175 kPa pressure.

#### Housing to have baked on enamel finish.

#### Electronic ignition/safety.

#### Main solenoid gas valve.

#### High limit.

#### 24 volt control transformer.

### Options:

#### Modulating gas burner and controls with a minimum of 20:1 turndown ratio.

#### 50 mm washable filters; 30 percent dust spot efficiency minimum.

#### Mixing dampers, linkage, and 120 volt, single phase, two wire modulating damper motor.

#### Vibration isolators.

### Capacity:

#### [ ] kW input,

#### [ ]kW minimum output,

#### [ ] L/s of standard air at [ ] kPa external static pressure.

### Manufacturer and Product:

#### *[Consultant to provide names of three approved products]*

#### Approved Equivalent

## Accessories

### Lifting Lugs:

#### Furnish suitably attached for equipment assemblies and components weighing over 45.4 kg.

### Equipment Identification Plates:

#### Furnish 16 gauge [Type ] stainless steel identification plate securely mounted on each separate equipment component [and control panel] in a readily visible location.

#### Plate shall bear [10] [6] mm high [engraved] [die stamped]block type[black enamel filled] equipment [identification number] [and letters] indicated in this Section [and as shown on the Drawings].

### Anchor Bolts:

#### [Galvanized,] [Type 316 stainless steel,] [sized by equipment manufacturer,] [12 mm minimum diameter,]and as specified in Section 05500 - Metal Fabrications General.

#### [Coat in accordance with Section 09900 – Painting and Protective Coatings.

## Source Quality Control

### [Factory Inspections] Inspect [control panels] [Direct Gas Fired Air Supply Unit] for required construction, electrical connection, and intended function.

### [Factory Tests and Adjustments: Test [equipment] [Consultant to clarify]

### Functional Test: Perform [manufacturer’s standard] test on [heater, blower, motor, and drive, circuits for continuity, operability of valves and control motors, fan speed, linkages, switches, motor load, air quantity, velocity across the burner.]

# EXECUTION

## Installation

### Boiler:

#### Install in accordance with the manufacturer’s recommendations.

#### Pipe drains and relief valve discharges to floor drain, terminating with an elbow discharging downward.

#### Provide chain wheel operators on boiler isolation valves higher than 2 m above floor level.

#### Flush out boiler and connecting piping prior to initial fill.

#### Provide seismic restraints for the boiler utilizing lateral and vertical motion limiters described in SMACNA “Seismic Restraint Manual Guidelines for Mechanical Systems” third edition, 2008.

#### Before being placed in service, the boiler and piping system shall be boiled out for a period of 24 hours. Solution to be used in the boiler for the boiling out process only shall consist of 1 kg of trisodium phosphate per 378.5 L of water. Upon completion of boiling out, flush out the boiler with potable water, drain, and charge with chemically treated glycol solution. Protect boiler and appurtenances against internal corrosion until testing is completed and boiler is accepted. Professional services are required for cleaning/treatment process. The Contractor is responsible for all costs related to procurement of services and services rendered for the cleaning/treatment processes.

#### Grout equipment mounted on concrete foundations before installing piping. Install piping in such a manner as not to place a strain on equipment. Do not bolt flanged joints tight unless they match. Grade, anchor, guide, and support piping without low pockets.

#### Locate equipment foundations as indicated on the Drawings, designed and made of sufficient size and weight to preclude shifting of equipment under operating conditions or under abnormal conditions that could be imposed upon the equipment. Foundations shall meet requirements of the equipment manufacturer. Concrete and grout shall be in accordance with Section 03300 - Cast-in-Place Concrete.

### Boiler Stack and Breeching:

#### Assemble individual sections of stack together to provide a completely supported stack.

#### Follow the manufacturer’s drawings and directions for installation of stack.

### Gas Vent Stack: Install in accordance with manufacturer’s recommendations and requirements of NFPA 54, National Fuel Gas Code, 2015 Edition.

### Boiler Feed System: Install in accordance with the manufacturer’s instructions.

### Boiler Blowdown Separator: Install in accordance with the manufacturer’s instructions.

### Gas Fired Air Supply Units: Install in accordance with the manufacturer’s instructions.

## Field Quality Control

### Functional Tests: Conduct on each [boiler] [assisted by the manufacturer’s representative], as follows:

#### Startup Assistance:

##### Inspect all gas piping, system piping with accessories, and boiler breeching.

##### Initial startup of boiler, and observe four subsequent starts.

##### Adjust devices in fuel piping circuit.

##### Perform checks on operating and safety controls.

##### Calibrate integral controls, gauges, and thermometers.

##### Perform and furnish everything required for inspections and tests as specified in this Section to demonstrate that boiler and auxiliary equipment, as installed, are in compliance with the Contract requirements.

##### Clean strainers until no further accumulation of foreign material occurs. Exercise care to minimize loss of glycol when strainers are cleaned.

##### Adjust safety and automatic control instruments as necessary to place them in proper operation and sequence.

##### Test instrumentation shall be calibrated and have full scale readings from 1.5 to 2 times test values.

### Performance Test:

#### Conduct on each [boiler] [assisted by the manufacturer’s representative].

#### Perform under actual or approved simulated operating conditions.

#### Conduct the preliminary operation test for a continuous 8 hour period without malfunction.

#### Acceptance Operating Test and Inspection: 15 Working Days advance notice to the Consultant and the Region is required.

#### The air emission compliance test shall be conducted to demonstrate that each unit is operating and meeting the air permit requirements.

##### The system supplier will retain an independent firm acceptable to the Consultant and permitting entities that specialize in this type of work to collect all required data and prepare the necessary documentation.

##### The air emission compliance test shall be conducted when the equipment is functioning at a "steady-state" condition. Obtain approval from the Consultant of the steady-state conditions and when the 8-hour test is to begin.

#### A detailed test protocol for the Air Emission Compliance Test shall be submitted a minimum of 60 Days prior to the initiation of the test.

#### Conduct the Air Emission Compliance Test after successful completion of field mechanical tests, computer system tests, and the integrated systems tests to ensure that all equipment is in operating condition.

#### Emission testing shall be conducted in accordance with test methods acceptable to the permitting entity.

#### The emission tests shall be performed during the Performance Test.

#### The supplier shall perform these tests within 90 Days of commencements of operations. The Region shall be notified a minimum of 60 Days in advance of the testing.

#### The system supplier shall submit the final test reports within 60 days after completion of the tests.

#### Tests shall be conducted by an authorized representative of the manufacturer of the boiler system. Costs of this representative shall be included in the bid for this equipment. Provide notice to the Consultant a minimum of 5 Working Days prior to testing to allow witnessing of the tests.

#### Ensure that the required instrumentation not included in the system equipment will be provided by the supplier.

#### Upon completion of the tests, the Contractor shall make final adjustments and alignment checks to the equipment, and shall demonstrate the proper operation of all equipment to the Consultant and the Region’s representative.

#### The Contractor shall instruct the Region’s representative in the maintenance and operation of the equipment.

## Manufacturer’s Services

### Ensure that a manufacturer’s representative for the equipment specified in this Section will be present at the Site for the minimum person-days listed below to provide the following, travel time excluded:

#### 4 Person-Days for installation assistance (including meetings prior to fabrication to discuss equipment packaging), inspection, and certification of the installation, Provide Certificate of Proper Installation.

#### 1 Person-Day for functional and performance testing.

#### 1 Person-Day for pre-startup classroom or Site training.

### Perform demonstration training in accordance with Section 01820 – Demonstration and Training in conjunction with the above requirements.

### Training of Region’s personnel shall be a minimum of 8 hours instruction time for each boiler provided and at such locations as requested by Region.

### Provide a list of suggested spare parts required to maintain the equipment in service for a minimum period of 5 years.

### Include a list of special tools required for checking, testing, parts replacement, and maintenance with current price information and electronically up-loadable to the Region’s CMMS (Maximo).

### Provide all other required information as detailed in the Equipment Information Template and in a format electronically up-loadable to the Region’s CMMS (Maximo) in accordance with Section 01425 - Computerized Maintenance Management System Data Requirements.

### Furnish all spare parts in accordance with Section 01780 – Contract Closeout.

### See Section 01640 - Manufacturers’ Services, and Section 01810 - Equipment Testing and Facility Commissioning.

## Commissioning

### For all Commissioning activities on systems where components of this Section are integral to functionality, refer to Section 01810 – Equipment Testing and Facility Commissioning.

### All inspection and testing activities shall be completed in accordance with the documentation provided to the Consultant prior to the commencement of commissioning activities.

## Manufacturer’s Certificate(s)

### Provide the manufacturer’s certificate(s) in accordance with Section 01640 - Manufacturers’ Services.

## Supplements

### The supplement listed below, attached following “End of Section,” forms part of this Section.

#### Data Sheets: Section 15500-01, Air Handling Unit.

**END OF SECTION**