Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Gas hot water heating boilers B-1, B-2, B-3 and B-4

1.2 REFERENCES

.1 American Boiler Manufacturer's Association (ABMA)

.2 American National Standards Institute (ANSI)

.1 ANSI Z21.13/CSA 4.9, Gas-Fired Low-Pressure Steam and Hot Water Boilers.

.3 American National Standards Institute (ANSI)/ American Society of Mechanical Engineers (ASME)

.1 ANSI/ASME Boiler and Pressure Vessel Code, Section IV.

.4 Canadian Gas Association (CGA)

.1 CAN1-3.1, Industrial and Commercial Gas-Fired Package Boilers.
.2 CAN/CSA-B149.1, Natural Gas and Propane Installation Code.

.5 Canadian Standards Association (CSA International)

.1 CSA B51, Boiler, Pressure Vessel, and Pressure Piping Code.

.6 Electrical and Electronic Manufacturer's Association of Canada (EEMAC)

.7 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

1.3 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheets. Include product characteristics, performance criteria, and limitations.

.2 Shop Drawings:

.1 Submit shop drawings.
.2 Indicate the following:
.1 General arrangement showing terminal points, instrumentation test connections.
.2 Clearances for operation, maintenance, servicing, tube cleaning, tube replacement.
.3 Foundations with loadings, anchor bolt arrangements.
.4 Piping hook-ups.
.5 Equipment electrical drawings.
.6 Burners and controls.
.7 All miscellaneous equipment.

.8 Flame safety control system.

.9 Breeching and stack configuration.

.3 Engineering data to include:

.1 Boiler efficiencies at different firing rates and specified return water temperatures.

1.4 MAINTENANCE

.1 Extra materials:

.1 Special tools for burners, hand-holes and Operation and Maintenance.

.2 Spare parts for one year of operation.

.3 Spare gaskets.

.4 Spare gauge glass inserts.

.5 Probes and sealants for electronic indication.

.6 Spare burner tips.

.7 Safety valve test gauge.

Part 2 Products

2.1 NEAR-CONDENSING BOILER, B-1:

.1 GENERAL

.1 Boiler shall be, natural gas fired, forced draft, factory packaged, low pressure hot water boilers. Each boiler shall be complete with all components, accessories and appurtenances necessary for a complete and operable boiler as hereinafter specified. Each unit shall be furnished factory assembled with required wiring and piping as a self-contained unit. Each unit shall be readily transported and ready for installation. Complete unit shall comply with all requirements of provincial and local codes. Boiler shall be CSA approved.

.2 Each boiler, including pressure vessel, trim, valve trains, burner, control system, and all related components, accessories and appurtenances as herein specified shall all be assembled and furnished by the boiler manufacturer. The boiler manufacturer shall provide unit responsibility for the workmanship, performance, warranties, and all field services for each boiler. The boiler manufacturer shall be fully responsible for all components assembled and furnished by him whether or not they are of his own manufacture.

.2 PERFORMANCE CRITERIA

.1 The boiler shall have a maximum input of 2,000 MBH, 1,700 MBH output and shall operate with 180°F supply water and 160°F return water. Boiler minimum flow rate shall be 120 gpm and 150 gpm maximum.

.2 Each boiler shall be capable of operating continuously at rated capacity while maintaining a CSA certified thermal efficiency of not less than 85 %.

.3 Boiler design pressure shall be 160 psig.

.4 Fuel shall be natural gas. Natural gas shall be supplied at a pressure of no less than (4" w.c. with a flue gas back pressure ≤ 1" w.c. or 5" w.c. with flue gas back pressure > 1" w.c.) and no more than 14" w.c. to the inlet of the gas train.

.5 Power shall be 208V/1ph/60Hz, 4-wire with neutral; and dedicated ground. Voltage between line and neutral shall be 120 VAC with single point power connection. Control voltage shall be 120 volts, 1-phase, 60 hertz.

.3 BOILER DESIGN

.1 Each hot water boiler shall be of the vertical, water-tube, copper fin tube heat exchanger type complete with trim, valve trains, burner, and boiler control system. The boiler manufacturer shall fully coordinate the boiler as to the interaction of its elements with the burner and the boiler control system in order to provide the required capacities, efficiencies, and performance as specified.

.2 Each boiler heat exchanger shall be of the vertical, concentric, copper fin tube type with three pass, counter-flow design.

.3 All boiler pressure parts shall be constructed in accordance with the latest revision of the ASME Boiler and Pressure Vessel Code, Section IV, and shall be so stamped along with a CRN registration.

.4 All boiler heat exchanger tubes shall be not less than 7/8 inches I.D. with a wall thickness of not less than 0.065" thick. All boiler heat exchanger tubes shall be straight, solid copper tubes and shall incorporate an extended finned surface of integral, extruded, copper fins spaced not less than 7 fins per inch. Boiler heat exchanger tubes shall be arranged vertically. All tubes must be full size for the entire length of each tube and extend from the upper header to the lower header with no tube bends. Boiler tubes shall be arranged and spaced for the most effective distribution of combustion gas flow through the entire boiler heat exchanger to provide for maximum heat transfer. Baffles between tubes shall be unacceptable.

.5 Boiler heat exchanger headers shall be cast grey iron with end covers completely removable for inspection. Seals shall be EPDM o-rings, rated for 400 deg F service. Gaskets are not acceptable.

.6 Boiler heat exchanger tubes shall be rolled into the top and bottom header collectors.

.7 Boiler combustion chamber shall be fabricated from minimum No. 14 gauge aluminium, shall completely enclose the boiler heat exchanger and shall be sealed for positive pressure operation. The combustion chamber access panel shall be readily removable and re-installed.

.8 Boiler shall be enclosed with a single wall outer casing. It shall completely enclose the boiler combustion chamber. It shall be fabricated from carbon steel with aluminium access panels. Steel casing sections shall be secured in place with bolts (sheet metal screws are not acceptable). Access panels shall be secured with push-to-close, quarter turn to open fasteners. The complete outer casing shall be finished inside and out with a powder coated finish. Combustion air shall be drawn form the insulating air space between the combustion chamber and the outer casing. The composite structure of the boiler combustion chamber, insulating air gap and outer casing shall be of such thickness and materials to assure an outer casing temperature of not more than 50°F above ambient temperature when the boiler is operated at full rated load. Boiler shall be fully capable of operation with all casing access panels removed.

.9 An observation port shall be located on the boiler to allow for observation of the burner flame.

.10 A flue gas outlet shall be located on the rear of the boiler. Boiler to be certified for installation with Category IV venting as defined in NFPA 54 (ANSI Z221). Forced draft burner shall be capable of firing against a back pressure of 2.0" w.c., using 6" diameter vent.

.4 BOILER TRIM

.1 Each boiler shall be provided with all necessary trim. Boiler trim shall be as follows:

.1 One safety valve shall be provided in compliance with the ASME code

.2 One water pressure-temperature gauge.

.3 One primary low water flow fuel cut off. The primary low water flow cut off shall be a flow switch as required by ASME Code.

.4 One high limit water temperature controller to stop burner operation at excess water temperature (shall be manually reset).

.5 One operating temperature control to control the sequential operation of the burner.

.6 A second float type low water cut off shall be **provided by the Contractor.**

.5 BOILER FUEL BURNING SYSTEM

.1 The boiler manufacturer shall furnish each boiler with an integral, pre-mixed, forced draft, gas, fully automatic fuel burner. The fuel burner shall be an assembly of gas burner, combustion air blower, valve train, and ignition system. The boiler manufacturer shall fully coordinate the burner as to the interaction of its elements with the boiler heat exchanger and the boiler control system in order to provide the required capacities, efficiencies, and performance as specified.

.2 Each burner shall be provided with an integral gas firing combustion head, properly sized to admit the fuel gas to the burner. The gas combustion head shall be provided with a orifice plate to meter the air flow to the burner and maintain precise fuel-to-air mixture. Air and gas shall be mixed as they pass through the blower to assure maximum combustion efficiency. Each burner shall provide adequate turbulence and mixing to achieve proper combustion without producing smoke or producing combustibles in the flue gases.

.3 Each boiler shall be provided with an integral power blower to supply combustion air. The combustion air blower shall have sufficient capacity at the rated firing rate to provide air for stoichiometric combustion plus the necessary excess air. Static and total pressure capability shall comply with the requirements of the boiler. The blower motor shall be a maximum of 1 motor horsepower and operate without undue vibration and noise and shall be designed and constructed for exposure to temperatures normal to its location on the boiler. The fan impeller shall be the non-sparking type, high efficiency, airfoil, backward inclined design.

.4 Each burner shall of the radial-fired type and constructed of steel with a stainless steel inner and woven stainless steel mesh outer screen, designed to produce a complete 360^{o} flame pattern.

.5 Each boiler shall be provided with a fully modulating firing control system whereby the firing rate is infinitely proportional at any point between 20% and 100% of maximum firing rate as determined by the input control signal. Fuel flow shall be controlled by air flow with cross-linked combination gas valve and air-fuel ratio controller. Both fuel and air control shall be completely linkage-less to assure the proper fuel/air ratios to achieve maximum combustion efficiency.

.6 The combustion control system shall automatically compensate for changes to atmospheric pressure and/or inlet air temperature.

.7 Burner shall incorporate soft start controls, which controls the ramp up speed of the burner.

.6 MAIN GAS VALVE TRAIN

.1 Each boiler shall be provided with an integral main gas valve train. The main gas valve trains shall be factory assembled, piped, and wired. Each gas valve train shall include at least the following;

.1 Two manual shutoff valves (gas train inlet connection & mixer inlet).

.2 Two safety shutoff valves.

.3 Linkage-less air – gas ratio control (maximum inlet pressure 14" w.c.)

.4 One low and one high gas pressure switch (manual reset)

.5 Air gas mixer

.6 Gas pressure regulator

.7 IGNITION SYSTEM

.1 Each boiler shall be provided with a factory installed, integral, interrupted electronic ignition system. Ignition system shall be removable for maintenance or replacement. Each ignition system shall include at least the following:

.1 A back pressure limit switch to shut down the burner in the event of a blocked vent.

.2 An electronic spark generator with ignition cable and ignition electrode.

.8 COMBUSTION AIR CONTROL SYSTEM

.1 Each boiler shall be provided with an integral combustion air control system. The combustion air system shall be factory assembled. Each combustion air control system shall include at least the following:

.1 A variable speed combustion air blower controlled using water temperature as the process variable.

.2 A low airflow differential pressure switch to insure that combustion air is supplied.

.3 An air inlet check valve shall be installed on the inlet flange to prevent reverse airflow in the cabinet.

.9 BURNER CONTROL SYSTEM

.1 The combustion control system shall operate on 120 volts, single phase, 60 hertz.

.2 A microprocessor based controller shall control burner functioning. If burner fails to light within 5 minutes after call for heat, the inverter shall enter a lockout condition requiring a manual reset. The controller shall perform the following control functions:

.1 Modulation controller

.2 Boiler circulator time delay relay (off delay)

.3 Flame status and firing rate output

.4 Operating temperature control shall be selectable for one of the following points;

.1 Boiler outlet temperature,

.2 Header temperature,

.3 Domestic hot water,

.4 Remote control,

.5 Boiler outdoor air reset or,

.6 Header outdoor air reset.

.5 Recycle the flame safeguard controller at least once in each 24 hour time period to reset the self check circuit of the UV scanner as required by the UV scanner manufacturer.

.3 Main flame shall be monitored and controlled by an ultra violet scanner. The boiler shall have a CSA approved, commercial-type, microprocessor based (Honeywell 7800) flame safeguard programmer with a flame failure response time of 0.8 seconds maximum. Controller shall have non-volatile diagnostic memory capable of maintaining operational history.

.4 Each boiler shall be provided with all necessary controls, all necessary programming sequences, and all safety interlocks. Each boiler control system shall be properly interlocked with all safeties.

.5 Each boiler control system shall provide timed sequence pre- and post-purge of boiler combustion chamber. The combustion airflow sensor shall monitor and prove the airflow purge.

.10 BOILER CONTROL PANEL

.1 **The boiler shall interface with the existing Metasys control system for the building. Manufacturer to provide N2 protocol interface to communicate with the Metasys system. The Metasys system will have ability to activate/deactivate boiler plant. Actual control of boilers will be through vendor supplied controls.**

.2 **Alarm conditions are to be transmitted through the Metasys system to alert system operators of a boiler failure/fault.**

.3 The boiler manufacturer shall provide each boiler with an integral factory prewired control panel. The control panel shall contain at least the following components, all prewired to a numbered terminal strip:

.1 Inverter/combustion air blower speed controller

.2 Burner "on-off" switch.

.3 Honeywell RM7800 Series electronic flame safeguard programmer.

.4 Control switches to select between local or BMS control of the following functions;

.1 Enable-Disable

.2 Modulation.

.5 An auto-manual firing rate controller

.6 Diagnostic annunciator indicating lights to signal "Power On", "Demand for Heat", "Low Water Flow", "Low Gas Pressure", "Low Combustion Air", and "Flame Failure".

.7 Air Flow Switch

.8 High Water Temperature Limit

.9 All necessary control switches, pushbuttons, relays, timers, terminal strips, etc.

.11 VENTING

.1 The Contractor shall provide category four AL29-4C stainless steel venting. The vent supplier shall size the venting based on a back pressure of 1.0 inches w.c. frictional resistance in the vent with a stack temperature of 325 degrees F. (gross) and a CO2 level of 8.5%. The maximum certified back pressure allowable is 2.0" w.c. frictional resistance.

.2 The vent supplier shall submit a calculation of stack loss to the Contract Administrator for review.

.3 Acceptable Manufacturer: "Security" or approved equivalent in accordance with B6.

.12 FACTORY TESTING – HYDROSTATIC

.1 Each boiler shall be hydrostatically tested. The boiler manufacturer shall perform a hydrostatic test in the presence of an inspector from the Authority having Jurisdiction. The inspector shall certify a data report which shall be submitted to the Contract Administrator as evidence of ASME compliance.

.2 In addition to the ASME symbol, each boiler shall bear CRN registration.

.13 FACTORY TESTING – FIRE TEST

.1 The boiler manufacturer shall perform a fire test under simulated operating conditions, with the boiler attached to a working chimney system and with water circulating through the heat exchanger. All controls and limits shall be tested. Results of combustion testing shall be recorded on a label, which is permanently attached to the boiler.

.14 Acceptable Product: "Patterson Kelly" Modu-Fire model N2000MFD 8" vent or approved equivalent in accordance with B6.

2.2 CONDENSING BOILERS, B-2, B-3 AND B-4:

.1 GENERAL

.1 Furnish and install factory packaged low pressure hot water boilers. Each boiler shall be complete with all components, accessories and appurtenances necessary for a complete and operable boiler as hereinafter specified. Each unit shall be furnished factory assembled with required wiring and piping as a self-contained unit. Each unit shall be readily transported and ready for installation.

.2 Each boiler, including pressure vessel, trim, valve trains, burner, control system, and all related components, accessories and appurtenances as herein specified shall all be assembled and furnished by the boiler manufacturer. The boiler manufacturer shall provide unit responsibility for the engineering, coordination, workmanship, performance, warranties, and all field services for each boiler. The boiler manufacturer shall be fully responsible for all components assembled and furnished by him whether or not they are of his own manufacture.

.2 PERFORMANCE CRITERIA

.1 Refer to schedule at end of specification for performance data.

.2 Each boiler shall be capable of operating continuously at rated capacity while maintaining a CSA certified efficiency of not less than 92 %. Each boiler shall be capable of operating with a minimum outlet water temperature of 68º F.

.3 Boiler shall comply with ASME Section IV for 50 psig (max 200º F)

.4 Fuel shall be natural gas. Natural gas shall be supplied at a pressure of no less than 3.5" w.c. to the inlet gas valve. Maximum inlet gas pressure shall not exceed 14" w.c.

.5 Power voltage shall be 120V/1ph/60Hz. Control voltage shall be 24 vac (transformer to be supplied by boiler manufacturer).

.3 BOILER DESIGN

.1 Each hot water boiler shall consist of a horizontal, cast aluminium heat exchanger complete with trim, valve trains, burner, and boiler control system. The boiler manufacturer shall fully coordinate the boiler as to the interaction of its elements with the burner and the boiler control system in order to provide the required capacities, efficiencies, and performance as specified.

.2 Each boiler heat exchanger shall be cast aluminium, counter-flow design for maximum heat transfer with the multiple sections arranged in a reverse return configuration to assure balanced flow through each section

.3 Contractor must, when filling the system, verify that the pH level is maintained between 6.0 and 8.5.

.4 All boiler pressure parts shall be constructed in accordance with the latest revision of the ASME Boiler and Pressure Vessel Code, Section IV, and shall be so stamped.

.5 Boiler heat exchanger headers shall be fabricated steel and be completely removable for inspection. Seals shall be EPDM, rated for 400 deg F service. Push nipples or gaskets between the sections are not permitted.

.6 Boiler shall be enclosed with a single wall outer casing. It shall be fabricated from minimum 16 gauge carbon steel. The front and top wall shall be secured in place with ¼ -20 NC bolts (sheet metal screws are not acceptable).The complete outer casing shall be finished, inside and out, with a powder coat finish. The composite structure of the boiler combustion chamber, insulating air gap and outer casing shall be of such thickness and materials to assure an outer casing temperature of not more than 50°F above ambient temperature when the boiler is operated at full rated load.

.7 An observation port shall be located on the boiler to allow for observation of the burner flame.

.8 A flue gas outlet shall be located on the rear of the boiler. Boiler to be certified for installation with Category IV venting as defined in NFPA 54 (ANSI Z221), latest edition. Contractor must provide venting certified for installation on a Category IV appliance.

.9 Contractor shall supply secondary float type low water cut off.

.4 BOILER CONNECTIONS

.1 Each boiler shall be provided with all necessary inlet and outlet connections. Boiler connections shall be as follows:

.1 One water supply outlet, 2 " Victaulic for C-1050 & 3" for C-2500

.2 One water return inlet, 2 " Victaulic for C-1050 and 3" for C-2500

.3 One relief valve outlet

.4 One flue gas vent outlet,

.5 One fuel gas inlet,

.5 BOILER TRIM

.1 Each boiler shall be provided with all necessary trim. Boiler trim shall be as follows:

.1 Safety relief valve shall be provided in compliance with the ASME code. Contractor to pipe to acceptable drain. and install factory supplied condensate neutralization tank.

.2 Water pressure-temperature gauge.

.3 Primary low water flow fuel cut off (probe type with manual reset).

.4 High limit water temperature controller to stop burner operation at excess water temperature (shall be manual reset).

.5 Operating temperature control to control the sequential operation of the burner.

.6 Separate inlet and outlet water temperature sensors capable of monitoring flow

.7 Exhaust temperature sensor

.6 BOILER FUEL BURNING SYSTEM

.1 The boiler manufacturer shall furnish each boiler with an integral, power type, straight gas, fully automatic fuel burner. The fuel burner shall be an assembly of gas burner, combustion air blower, valve train, and ignition system. The burner manufacturer shall fully coordinate the burner as to the interaction of its elements with the boiler heat exchanger and the boiler control system in order to provide the required capacities, efficiencies, and performance as specified.

.2 Each burner shall be provided with an integral gas firing combustion head.

.3 Each burner shall provide adequate turbulence and mixing to achieve proper combustion without producing smoke or producing combustibles in the flue gases.

.4 Each boiler shall be provided with an integral variable speed power blower to premix combustion air and fuel within the blower. The combustion air blower shall have sufficient capacity at the rated firing rate to provide air for stoichiometric combustion plus the necessary excess air. Static and total pressure capability shall comply with the requirements of the boiler. The blower shall be a maximum of 300 watts and operate at 6000 RPM maximum without undue vibration and noise and shall be designed and constructed for exposure to temperatures normal to its location on the boiler. The operating fan speed will be tachometer sensed and be capable of being displayed at the LED display.

.5 Each burner shall of the down-fired type and constructed of steel with a stainless steel inner and stainless steel mesh outer screen.

.6 Each boiler shall be provided with a fully modulating firing control system whereby the firing rate is infinitely proportional at any firing rate between 20% and 100% as determined by the pulse width modulation input control signal. Both fuel input and air input must be sequenced in unison to the appropriate firing rate without the use of mechanical linkage.

.7 The Micro Processor shall use a Proportional Integral Algorithm to determine the firing rate. The control must have the following capabilities:

.1 Maintain single set point

.2 Reset the set point based on outdoor air temperature.

.3 Boiler shutdown based on outdoor air temperature

.4 Internal dual set point program with an external switchover. (e.g. - night setback w/external clock, supplied by others)

.5 Alarm relay for any for any manual reset alarm function.

.6 Programmable Low Fire Delay to prevent short cycling based on a time and temperature factor for release to modulation.

.7 LED Display showing current supply and return temperatures, current set points as well as differential set points. It must also display any fault codes whether automatically reset or manually reset.

.8 Local Manual Operation.

.9 Remote Control System (Building Management / Sequencer Control) - The boiler control shall be capable of accepting a 0 -10vdc remote external analog signal to control the firing rate

.10 Computer (PC) interface for programming and monitoring all functions.

.7 MAIN GAS VALVE TRAIN

.1 Each boiler shall be provided with an integral main gas valve train. The main gas valve trains shall be factory assembled, piped, and wired. Each gas valve train shall include at least the following:

.1 One manual shutoff valve (gas train inlet connection).

.2 Two safety shutoff valves. Valves equipped with dual solenoids that can independently energized for leak testing.

.3 Air-gas ratio control (maximum inlet pressure 14" w.c.)

.4 One low gas pressure switch (manual reset).

.5 One high gas pressure switch (manual reset).

.6 Two pressure test ports

.8 IGNITION SYSTEM

.1 Each boiler shall be equipped for direct spark ignition.

.9 COMBUSTION AIR CONTROL SYSTEM

.1 Each boiler shall be provided with an integral combustion air control system. The combustion air system shall be factory assembled. Each combustion air control system shall include at least the following:

.1 The primary control shall vary the speed of the blower based on load demand. The blower shall apply a varying negative pressure on the gas valve which will open or close to maintain zero pressure at the valve orifice, thereby increasing or decreasing the firing rate. Both the air and gas shall be premixed in the blower.

.2 One low airflow differential pressure switch to insure that combustion air is supplied.

.3 High exhaust back pressure switch

.10 BURNER CONTROL SYSTEM

.1 The control system shall be supplied with a 24 vac transformer (120 vac, single phase, 60 hertz primary).

.2 The boiler must include an electric spark ignition system. Main flame shall be monitored and controlled by flame rod (rectification) system.

.3 Each boiler shall be provided with all necessary controls, all necessary programming sequences, and all safety interlocks. Each boiler control system shall be properly interlocked with all safeties.

.4 Each boiler control system shall provide timed sequence pre-ignition air purge of boiler combustion chamber. The combustion airflow sensor shall monitor and prove the airflow purge.

.11 BOILER CONTROL PANEL

.1 **The boiler shall interface with the existing Metasys control system for the building. Manufacturer to provide N2 protocol interface to communicate with the Metasys system. The Metasys system will have ability to activate/deactivate boiler plant. Actual control of boilers will be through vendor supplied controls.**

.2 **Alarm conditions are to be transmitted through the Metasys system to alert system operators of a boiler failure/fault.**

.3 The boiler manufacturer shall provide each boiler with an integral factory prewired control panel. The control panel shall contain at least the following components, all prewired to a numbered terminal strip:

.1 One burner "on-off" switch.

.2 One electronic combination temperature control, flame safeguard and system control.

.3 Control circuit breaker, 5 amp

.4 All necessary control switches, pushbuttons, relays, timers, terminal strips, etc.

.5 LED Display Panel to adjust set points and control operating parameters. LED display to indicate burner sequence, all service codes (0-65), fan speed, boiler set point and sensor values such as inlet, outlet, flue gas and outdoor air.

.12 VENTING

.1 The Contractor shall provide category four AL29-4C stainless steel venting. The vent supplier shall size the venting based on a combined back pressure of a maximum of .44 inches w.c. frictional resistance in the vent with a stack temperature of 185 degrees F. (gross) and a CO2 level of 9.2% for natural gas.

.2 The vent supplier shall submit a calculation of stack loss to the Contract Administrator for review.

.3 Acceptable Manufacturer: “Security” or approved equivalent in accordance with B6.

.13 FACTORY TESTING – HYDROSTATIC

.1 Each boiler shall be hydrostatically tested and bear the ASME “H” stamp.

.14 FACTORY TESTING - FIRE TESTING

.1 Each boiler shall be fire tested. The boiler manufacturer shall perform this fire test under simulated operating conditions, with the boiler attached to a working chimney system and with water circulating through the boiler. The manufacturer shall provide a fire test report, including fuel and air settings and combustion test results permanently affixed to the boiler.

.15 WARRANTIES

.1 The boiler manufacturer shall warrant each boiler, including boiler, trim, boiler control system, and all related components, accessories, and appurtenances against defects in workmanship and material for a period of eighteen (18) months from date of shipment, or twelve (12) months from date of start-up, whichever occurs first. Heat exchanger and fuel burner shall be warranted for a period of five (5) years from date of shipment.

.16 Acceptable Product: "Patterson Kelly" series MACH or approved equivalent in accordance with B6. See boiler schedule for model number.

Equipment	Rated Input (MBH)	Rated Maximum Output (MBH)	Turndown	Supply Water Temp. (°F)	Return Water Temp. (°F)	Maximum Flow Rate (gpm)	Make/Model
B-2	1,050	987	5:1	180	160	50	PK Mach, Model C-1050
B-3	2,500	2,375	5:1	140	100	119	PK Mach, Model C-2500
B-4	2,500	2,375	5:1	140	100	119	PK Mach, Model C-2500

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install in accordance with ANSI/ASME Boiler and Pressure Vessels Code Section IV, regulations of Province having jurisdiction, except where specified otherwise, and manufacturers recommendations.

.2 Make required piping connections to inlets and outlets recommended by boiler manufacturer.

.3 Maintain clearances as indicated or if not indicated, as recommended by manufacturer for operation, servicing and maintenance without disruption of operation of any other equipment/system.

.4 Mount unit level and plumb

.5 Pipe hot water relief valves full size to nearest drain.

.6 Natural gas fired installations - in accordance with CAN/CSA-B149.1.

3.3 MOUNTINGS AND ACCESSORIES

.1 Safety valves and relief valves:

.1 Run separate discharge from each valve.

.2 Terminate discharge pipe as indicated.

.3 Run drain pipe from each valve outlet and drip pan elbow to above nearest drain.

3.4 CLEANING

.1 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION