1. GENERAL
   1. RELATED DOCUMENTS
      1. General Contract Provisions
         1. Drawings and general provisions of the project contract apply to this specification.
   2. SUMMARY
      1. Summary of Work
         1. The work to be performed consists of providing all labor, equipment, materials, and documentation to furnish and install manufactured high-pressure steam boilers in accordance with this specification.
   3. REFERENCES
      1. ASME – American Society for Mechanical Engineers
         1. BPVC – Boiler and Pressure Vessel Code
            1. Section I – Power Boilers
         2. B16 – Standardization of Valves, Flanges, Fittings, and Gaskets
         3. CSD-1 – Controls and Safety Devices for Automatically Fired Boilers
      2. ASTM – American Society of the International Association for Testing and Materials
         1. A53 – Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
         2. A126 – Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
      3. CSA – Canadian Standards Association
         1. B51 – Boiler, Pressure Vessel, & Pressure Piping Code
            1. CRN – Canadian Registration Number
         2. B149 – Natural Gas and Propane Installation Code
      4. IEC – International Electrotechnical Commission
      5. ISO – International Organization for Standardization
         1. 9001 – International Standard for Quality Management Systems
      6. NEMA – National Electrical Manufacturers Association
         1. Panel enclosure types:
            1. Rating 1 – Indoor use, general purpose, and provide a degree of protection against the following:

Personnel access to hazardous parts.

Ingress of solid foreign objects (falling dirt) to enclosed equipment.

* + - * 1. Rating 12 – Indoor use, general purpose, and provide a degree of protection against the following:

Personnel access to hazardous parts.

Ingress of solid foreign objects (falling dirt, dust, lint, fibers, and flyings) to enclosed equipment.

Ingress of water (dripping and light splashing) to enclosed equipment.

Oil and coolant seepage.

* + - * 1. Rating 4 – Indoor/outdoor use, watertight, and provide a degree of protection against the following:

Personnel access to hazardous parts.

Ingress of solid foreign objects (falling dirt, dust, lint, fibers, and flyings) to enclosed equipment.

Ingress of water (hose-directed and splashing water) to enclosed equipment.

Undamaged by the external formation of ice on the enclosure.

* + - * 1. Rating 4X – Indoor/outdoor use, watertight, and provide a degree of protection against the following:

Personnel access to hazardous parts.

Ingress of solid foreign objects (falling dirt, dust, lint, fibers, and flyings) to enclosed equipment.

Ingress of water (hose-directed and splashing water) to enclosed equipment.

Undamaged by the external formation of ice on the enclosure.

Brushed stainless steel enclosure to provide an additional level of protection against corrosion.

* + 1. NFPA – National Fire Protection Association
       1. 54 – National Fuel Gas Code
       2. 70 – National Electrical Code
    2. UL/cUL – Underwriters Laboratories / Underwriters Laboratories of Canada
       1. 795 – Standard for Commercial-Industrial Gas Heating Equipment
  1. SUBMITTALS

**Note: Select multiple and strikeout others.**

* + 1. Calculations
       1. ASME calculations.
       2. Safety valve calculations.
    2. Drawings & Diagrams
       1. Dimensional diagrams (DD).
       2. Metric conversion drawings. **(Optional)**
       3. Piping and instrumentation diagrams (P&ID).
       4. Weld map drawings.
       5. Wiring diagrams.
          1. Control wiring.
          2. Power wiring.
          3. Signal wiring.
    3. Operation & Maintenance (O&M) Manuals
       1. Boiler.
       2. Burner.
       3. Controls.
       4. Operation.
       5. Maintenance.
       6. Parts.

Note: Manuals may be combined documents.

* + 1. Product Data
       1. Bill of materials (BOM).
       2. Instructions.
          1. Installation.
          2. Startup.
       3. Product performance.
          1. Efficiency.
          2. Emissions.
          3. Rated output capacity.
       4. Product cut sheets.
          1. Electrical.
          2. Motors.
          3. Pumps.
          4. Sensors.
          5. Valves.
       5. Product reports.
          1. ASME data reports.
          2. Fire test reports.
          3. Inspection reports.
       6. Product warranty.
    2. Quality Control Documents
       1. Quality control traveling document (QC).

Note: Additional submittals available upon request.

* 1. QUALITY ASSURANCE
     1. ASME BPVC-I Data Report
        1. The vendor shall assist the owner in executing the ASME BPVC-I Data Report at the vendor’s site.
           1. Fire test to ensure proper burner operation.
        2. The vendor shall submit all instrument calibration procedures and certificates to the owner prior to shipping and installation.
     2. Preliminary Hydrostatic Pressure Test
        1. The pressure vessel shall receive an ASME BPVC-I hydrostatic pressure test.
     3. Factory Hydrostatic Pressure Test
        1. The completed packaged boiler system shall receive an ASME BPVC-I hydrostatic pressure test with affixed valves, piping, and trim.
     4. Factory Inner Casing Pressure Test
        1. Testing pressure: 5 in. w.c.
     5. Interchangeable Parts
        1. The packaged boiler system shall have identical parts, accessories, and assemblies to other packaged boiler systems of the same classification to facilitate timely and cost-effective maintenance.
     6. Manufacturer Documentation
        1. The manufacturer shall supply written factory test procedures for each test including criteria used to determine a successfully executed test and completed test results.
     7. Owner Inspections
        1. The owner and/or owner’s representatives reserve the right to inspect the packaged boiler system during fabrication and factory quality control testing phases.
        2. The owner shall be notified at least ten (10) business days in advance of factory quality control testing.
     8. Quality Management System (QMS)
        1. The manufacturer shall manufacture the packaged boiler system in an ISO 9001 certified facility.
     9. Shipping, Handling, & Storage
        1. The packaged boiler system shall be shipped, handled, and stored in accordance with the manufacturer’s written shipping, handling, and storage instructions.
        2. The responsibility of making freight claims shall be performed by owner-authorized representatives.
  2. MANUFACTURER-PROVIDED TRAINING
     1. Online Training **(Optional)**
        1. Scope: Steam boilers, boiler systems, steam system fittings, steam system accessories, feedwater systems, water treatment, combustion equipment, combustion controls, boiler controls, draft controls, instrumentation, control systems, steam boiler operation, and licensing.
        2. Duration: Online access for one full calendar year.
        3. Proof of completion: Manufacturer’s training certificate of completion.
     2. Custom On-Site Training **(Optional)**
        1. Scope: Custom to on-site components, assemblies, and systems.
        2. Duration: As required by owner and/or owner’s representatives.
        3. Required minimum trainees: 5.
        4. Proof of completion: Manufacturer’s training certificate of completion.
        5. Trainer lodging and transportation expenses shall be paid by owner and/or owner’s representative.
     3. Boiler Operation & Electrical Troubleshooting Seminar **(Optional)**
        1. Scope: Thermodynamics, heat transfer, boiler types, combustion, burners, efficiency, steam load demand, equipment, controls, low water cutoff, flame safeguards, wiring diagrams, maintenance, boiler circuits exercise, troubleshooting on simulation boards, and shop floor tour.
        2. Duration: Two eight-hour days.
     4. Boiler Operations Seminar **(Optional)**
        1. Scope: Thermodynamics, heat transfer, boiler types, combustion, burners, efficiency, steam load demand, controls, low water cutoff, flame safeguards, wiring diagrams, and maintenance.
        2. Duration: One eight-hour day.
     5. Boiler Systems PLUS 1 Seminar **(Optional)**
        1. Scope: Thermodynamics, heat transfer, boiler types, combustion, burners, efficiency, steam load demand, equipment, controls, low water cutoff, flame safeguards, steam traps, wiring diagrams, and maintenance.
        2. Duration: Two eight-hour days.
     6. Boiler Systems PLUS 2 Seminar **(Optional)**
        1. Scope: Thermodynamics, combustion analysis, burner technology, boiler technology, controls evolution, steam systems, water softeners, dealkalizers, feed systems, deaerators, pumps, water treatment, chemical injection, capturing losses, boiler shutdown, cutting boilers into cold and hot systems, and checking boiler safeties.
        2. Duration: Two eight-hour days.

**Note: Training excludes owner’s custom combustion settings and equipment service passwords.**

* 1. WARRANTY
     1. Packaged Boiler System Warranty
        1. The packaged boiler system shall be warranted for twelve (12) months from the date of initial operation of the equipment, but in no event shall the warranty extend more than eighteen (18) months from the date of shipment of the equipment.
     2. Pressure Vessel Warranty
        1. The pressure vessel shall be warranted against thermal shock for a period of twenty-five (25) years in accordance with the vendor’s warranty statement and provided the boiler is operated and maintained in accordance with the owner’s Operation and Maintenance Manual.

**Note: Prorated warranties are not acceptable.**

1. PRODUCTS
   1. ACCEPTABLE MANUFACTURERS
      1. Cleaver-Brooks
   2. INSURANCE REQUIREMENTS
      1. XL GAP / CSD-1
      2. FM Global **(Optional)**
   3. GENERAL
      1. Codes & Standards
         1. Packaged boiler system UL Listed and bears the UL/cUL Listing Mark.
         2. Packaged boiler system constructed in accordance with ASME BPVC-I and bears the ASME “S” Mark.
         3. Packaged boiler system constructed in accordance with NFPA 54.
         4. Packaged boiler system constructed in accordance with NFPA 70.
         5. Packaged boiler system constructed in accordance with UL 795.
         6. Packaged boiler system constructed in accordance with CSA B51 and bears a CRN. **(Canada Only)**
         7. Packaged boiler system constructed in accordance with CSA B149. **(Canada Only)**
      2. Boiler Room Environmental Conditions

**Note: Select one and strikeout others.**

* + - 1. Indoor – Typical boiler room environment.
      2. Indoor – Dusty environment.
      3. Indoor – Damp or wet environment.
      4. Outdoor – Weather exposed environment.
    1. Electrical Panel Enclosure Types:

Note: Select one and strikeout others.

* + - 1. NEMA Rating 1.
      2. NEMA Rating 12. **(Optional)**
      3. NEMA Rating 4. (Rigid and Sealtite conduit provided.) **(Optional)**
      4. NEMA Rating 4X. (Rigid and Sealtite conduit provided.) **(Optional)**

Note: All electrical components in panel enclosures NEMA Rating 1 or higher rating.

Note: Rigid and Sealtite conduits optional on NEMA Rating 1 and NEMA Rating 12 electrical panels.

* + 1. Factory Assembled or Site Assembled

Note: Select one and strikeout other.

* + - 1. Factory-assembled packaged boiler system.
      2. Site-assembled packaged boiler system (Boiler Model FLE, “Field Erect Assembly”). **(Optional)**
  1. BOILER
     1. Boiler Design
        1. A two-drum flexible carbon steel watertube design with a tangent tube waterwall furnace mounted on a heavy-duty steel base frame.
        2. Two secured lifting lugs located on the top centerline of the upper drum to facilitate equipment rigging.
        3. Refractories in the boiler and burner installed before shipment.
        4. Front burner access door and multiple side panels to facilitate fireside tube access.
        5. Handholes located on the top and bottom boiler drums to facilitate waterside access.
        6. External insulated downcomer sized to provide positive natural internal circulation.
        7. Air vent tube located at the rear of the boiler to permit entrained air to be removed from the lower drum and moved to the upper drum.
        8. Maximum allowable working pressure (MAWP): 150 psig.
        9. Boiler casing:
           1. Outer boiler casing thickness: 20 gauge.
           2. Inner boiler casing thickness: 16 gauge.
           3. Insulation air gap thickness between inner and outer boiler casings: 2 in.
        10. Boiler inner casing insulation:
            1. Manufacturer: Morgan Advanced Materials
            2. Model: Superwool 607 HT Board and Superwool HT Blanket.
            3. Thickness: 1.5 in.
            4. Weight: 8 lb/ft2.
            5. Classification temperature: 2372°F.
        11. Boiler outer casing insulation:
            1. Material: Fiberglass.
            2. Thickness: 2 in.
            3. Weight: 1 lb/ft2.
            4. R-value: 3.85.
        12. Observation ports located at the rear and front of the boiler in the burner assembly to facilitate the inspection of the burner pilot flame and main flame conditions.

Note: Select one or none and strikeout others.

* + - * 1. Air-cooled rear sight port. **(Optional)**
        2. Tinted sight glasses. **(Optional)**

Note: Tinted sight glasses are used for oil fuel.

* + - 1. Factory painted boiler, base frame, and other components using a hard enamel paint finish to withstand heat and prevent rusting of the boiler.
    1. Furnace
       1. Furnace access at the rear wall of the boiler via hinged burner door.
       2. Water-cooled on furnace top, bottom, and sides.
       3. Fully-insulated front and rear furnace walls.
    2. Boiler Tubes
       1. Removable and replaceable without expanding or welding the tube attachment to the drums.
       2. Tangent wall tube insulation.
          1. Thickness: 1.5 in.
       3. Tube wall thickness:

Note: Select one and strikeout other.

* + - * 1. 0.095 in.
        2. 0.105 in. **(Optional)**
      1. Tube diameter:
         1. 1.5 in. diameter.
  1. BURNER
     1. Burner Design
        1. Manufacturer: Cleaver-Brooks ProFire V Series or equivalent.
        2. Included in the packaged boiler system from the boiler manufacturer.
        3. Maximum high-to-low fire turndown ratio: 10:1.
        4. NOxemissions level range: >60 ppm.
        5. Mounted on a hinged backing plate to facilitate fan and burner inspection.
        6. Equipped with a linkage drive to control the burner fuel-to-air ratio.
        7. Forced draft fan design with full firing rate modulation.
        8. Opposed blade air damper to control combustion air volume to the burner.
        9. Combustion air proving switch to prove proper fan operation.
        10. Pilot and flame scanner designed to facilitate access without opening or disassembling the burner.
        11. Ignition type: Gas pilot utilizing an ignition transformer for spark generation.
     2. Burner Fuel
        1. Burner designed to operate on natural gas (fuel series 700).
  2. PRESSURE VESSEL & CONNECTIONS
     1. Stack Connection
        1. Connection type: Flat face (FF) flange.
        2. Supported weight: 200 lb.
     2. Steam Nozzle Connection
        1. Connection type: Raised face (RF) flange.
        2. ASME B16 pressure class: Class 300.
     3. Feedwater Connection
        1. Connection type: NPT.
     4. Blowdown Connection
        1. Connection type: NPT.
     5. Surface Blowoff Connection
        1. Connection type: NPT.
     6. Overflow Connection
        1. Connection type: NPT.
  3. VALVES & VALVE PIPING
     1. Safety Relief Valves
        1. Sized in accordance with ASME BPVC-I requirements.
        2. Manufacturer: Kunkle.
        3. Valve material: Bronze.
        4. Valve set point: As scheduled.
        5. Valve relieving requirement: Full capacity.
        6. Fully-enclosed steel spring.
        7. Factory set and sealed.
        8. Shipping method: Shipped loose.
     2. Quick-Open Blowdown Valve(s)
        1. Manufacturer: Everlasting.
        2. ASME B16 pressure class: Class 250.
        3. Valve material: Iron.
        4. Connection type: NPT.
     3. Slow-Open Blowdown Valve(s)
        1. Manufacturer: United Brass.
        2. ASME B16 pressure class: Class 200.
        3. Valve material: Bronze.
        4. Valve type: Y-type.
        5. Connection type: NPT.
     4. Blowdown Assembly Piping (Quick-Open and Slow-Open Blowdown Valves)
        1. Piping thickness: Schedule 80.
        2. Shipping method: Factory piped.
     5. Feedwater Globe and Check Valves
        1. ASME B16 pressure class: Class 200.
        2. Valve material: Bronze.
        3. Connection type: NPT.
     6. Feedwater Bypass Valve (3-Valve)
        1. ASME B16 pressure class: Class 200.
        2. Valve material: Bronze.
        3. Connection type: NPT.
     7. Feedwater Control Valve
        1. Manufacturer: Worcester.
        2. Control system: Proportional.
        3. Valve type: Rotary ball valve.
        4. Maximum close-off pressure: 250 psi.
        5. Valve material: Brass.
     8. Feedwater Control Valve Actuator
        1. Actuator type: Rotational modulating motor.
        2. Input signal type: Analog (4-20 mA).
     9. Feedwater Valve Strainer
     10. Feedwater Assembly Piping (Globe and Check Valves, Control Valve and Actuator, Valve Strainer)
         1. Piping thickness: Schedule 80.
         2. Piping material: ASTM A53.
         3. Shipping method: Factory piped.
     11. Steam Header (Stop) Valve
         1. ASME B16 pressure class: Class 300.
         2. Connection type: Raised face (RF) flange.
         3. Orientation: Horizontal.
         4. Piping thickness: Schedule 80.
         5. Piping material: ASTM A53.
         6. Shipping method: Shipped loose.
     12. Surface Blowoff Manual Stop Valve
         1. Valve type: Ball valve.
         2. Valve material: Brass.
     13. Surface Blowoff Metering Valve
         1. Valve type: Needle valve.
         2. Valve material: Steel.
     14. Surface Blowoff Collector Pipe
     15. Surface Blowoff Assembly Piping (Manual Stop Valve, Metering Valve, Collector Pipe)
         1. Piping material: ASTM A53.
         2. Piping thickness: Schedule 80.
         3. Shipping method: Factory piped.
     16. Automatic Surface Blowdown Control System
         1. Manufacturer: Advantage Controls MegaTron.
         2. Microprocessor-based controller.
         3. Boiler water monitoring and control functions:
            1. Conductivity.
            2. Make-up conductivity.
            3. Acidity: 0-14 pH.
            4. Oxidation-reduction potential (ORP).
            5. Temperature.
            6. Saturation indexing.
            7. Digital inputs.
            8. Water meter inputs.
            9. Auxiliary flowmeter inputs.
         4. On-board data history and USB storage downloadable.
  4. WATER COLUMNS & TRIM
     1. Water Level Control System
        1. Manufacturer: McDonnell & Miller main low water cutoff device or equivalent.
        2. Listed by UL and bears the appropriate complete UL Listing Mark.
        3. Main low water cutoff (LWCO) device.
        4. Constructed as a Manufacturer’s Standard Pressure Part in accordance with ASME BPVC-I.
        5. Design style: Float device with magnetostrictive linear position sensor.
        6. Device operation: On/Off.
        7. Reset switch type: Automatic reset.
        8. Maximum operating pressure: 150 psig.
     2. Water Level Control Assembly Piping (Water Level Control System)
        1. Piping material: Carbon steel.
        2. Piping thickness: Schedule 80.
     3. Auxiliary Low Water Cutoff (ALWCO) Device
        1. Manufacturer: Warrick.
        2. Design style: Internal probe device.
        3. Device operation: On/Off.
        4. Reset switch type: Manual reset.
     4. Ball Check Gauge Cocks
     5. Stack Thermometer
        1. Gauge type: Dial.
        2. Minimum gauge face diameter: 3.0 in.
     6. Water Pressure Gauge
        1. Gauge type: Dial.
        2. Gauge range: 0 psig to 300 psig.
        3. Minimum gauge face diameter: 4.5 in.
        4. Piped with test cock as required by code.
  5. GAS TRAIN
     1. Primary Gas Train
        1. Gas regulating method: Safety shutoff valves.
        2. Piping material: Carbon steel.
     2. Primary Gas Train Manual Shutoff Valves
        1. ≤2 in.: Slow-close ball valve.
           1. Valve material: Bronze.
        2. >2 in.: Lubricated plug valve.
           1. Valve material: ASTM A126 Grade B body and plug.

**Note: Local codes may require lubricated plug valves regardless of piping size.**

* + 1. Primary Gas Train Safety Shutoff Valves (SSOVs)
       1. Manufacturer: Siemens.
       2. Single-body dual valve.
       3. Configuration: Dual-motorized valves with one proof-of-closure (POC) switch.
    2. Primary Gas Train High Gas Pressure Switch
       1. Manufacturer: Honeywell.
       2. Reset switch type: Manual reset.
    3. Primary Gas Train Low Gas Pressure Switch
       1. Manufacturer: Honeywell.
       2. Reset switch type: Manual reset.
    4. Primary Gas Train Plugged Leakage Test Cock
       1. Material: Brass ball.
    5. Primary Gas Train Valve Strainer
       1. Strainer material: Cast iron with stainless steel mesh.
       2. Shipping method: Shipped loose.
    6. Primary Gas Train Safety Shutoff Valve (SSOV) Outlet Pressure Gauge
       1. Minimum gauge face: 2.5 in.
    7. Primary Gas Train Bolted Brackets
    8. Gas Pilot Train
       1. Piping material: Carbon steel.
    9. Gas Pilot Train Gas Pressure Regulator
       1. Manufacturer: Maxitrol.
       2. Housing material: Aluminum.
       3. Thread type: NPT.
    10. Gas Pilot Train Manual Shutoff Cock
        1. Valve material: Bronze.
    11. Gas Pilot Train Solenoid Valves
        1. Two isolation valves and one vent valve.
        2. Valve material: Aluminum.
    12. Gas Pilot Train Gas Pressure Regulator Inlet Pressure Gauge
        1. Minimum gauge face: 2.5 in.
        2. Bronze shutoff cock included.
    13. Fuel Input Control Valve
        1. Valve type: Reduced port (RP) butterfly valve.
  1. BURNER CONTROLS
     1. Modular Motor
     2. Steam Pressure Control
        1. Maximum Error: 0.5%.
        2. Output signal type: Analog (0-135 ohm).
     3. Modulating Control
        1. Manufacturer: Honeywell.
     4. Operating Limit Control
        1. Manufacturer: Danfoss.
        2. Contact type: Pressure switch.
     5. High Limit Control
        1. Manufacturer: Danfoss.
        2. Reset switch type: Manual reset.
        3. Contact type: Pressure switch.
     6. Remote Emergency Shutoff Switch
        1. Contact type: Terminals only.
        2. Shipping method: Shipped loose.
     7. Burner Management System (BMS)
        1. Manufacturer: Cleaver-Brooks CB780E burner management system or equivalent.
        2. Microprocessor-based controller.
        3. Automatic boiler operation sequencing (standby, pre-purge, flame proving, run, post-purge).
        4. Flame scanner type: Ultraviolet spectrum (UV) scanner.
        5. Expanded annunciation of burner operating status.
        6. Building automation system (BAS) protocol:

**Note: Select one or none and strikeout others.**

* + - * 1. BACnet UDP/IP.
        2. BACnet MS/TP.
        3. Modbus RTU.
        4. Modbus TCP/IP.
        5. LonWorks.

**Note: Indicate other protocol if not listed above.**

* + 1. Multiple-Boiler Combustion Control System (CCS) **(Optional)**
       1. Three (3) to eight (8) boiler modulation control system.
       2. Lead-lag or unison modulation control system.
          1. Sequencing configuration.
          2. Set point configuration.
  1. ELECTRICAL
     1. Rotary Unfused Disconnect Switch
     2. Control Circuit Transformer (CCT)
     3. Burner (Blower) Fan
        1. Starter in accordance with IEC standards.
        2. Motor type: Open drip proof (ODP).
     4. Electrical Panels (Entrance Panel, Control Panel, High-Voltage Panel, and/or Junction Box)
     5. Electrical Panel Single Point Power Connection
     6. Electrical Panel Key Locks
     7. Audible Alarm
        1. Alarm type: Electric sounder.
     8. Audible Alarm Silence Switch
     9. Standard Panel Light Labels
     10. Base Indicator Lights
         1. Fuel valve.
            1. Light type: Green 22 mm LED light.
         2. Flame failure.
            1. Light type: Red 22 mm LED light.
         3. Low water.
            1. Light type: Red 22 mm LED light and annunciation.
         4. Load demand.
            1. Light type: White 22 mm LED light.
     11. Low-Voltage Time Delay Relay
         1. Terminals in entrance panel.

1. EXECUTION
   1. INSTALLATION
      1. Packaged Boiler System Installation
         1. The installation shall be performed in accordance with national, state/provincial, and local regulations.
            1. The installation shall be performed in accordance with NFPA 31.
            2. The installation shall be performed in accordance with NFPA 54.
            3. The installation shall be performed in accordance with NFPA 70.
         2. The installation shall be performed in accordance with the manufacturer’s written instructions.
         3. The installation shall include factory piped or shipped loose components and assemblies.
         4. The installation shall include interconnecting electrical wiring for control and power components.
      2. Pre-Startup Boiler Cleaning (Boiler Boil-Out)
         1. The pre-startup boiler cleaning results shall be submitted to the owner and/or owner’s representative.
   2. MANUFACTURER-PROVIDED SERVICES
      1. Pre-Installation Inspection
         1. Examine boiler room conditions affecting the safety of boiler room personnel and packaged boiler system installation, operation, performance, and maintenance.
         2. Verify boiler room clearances are in accordance with manufacturer’s recommended clearances.
         3. Verify boiler room air supply connections or louvers.
         4. Verify boiler room drain outlet connections.
         5. Verify boiler room electrical supply connections.
         6. Verify boiler room flue gas outlet (stack) connections.
         7. Verify boiler room fuel supply connections.
         8. Verify boiler room relief valve outlet connections.
         9. Verify boiler room steam outlet connections.
      2. Site Training
         1. Train boiler room personnel packaged boiler system safety, operation, and maintenance procedures.
         2. Minimum duration: 8 hours divided among boiler room personnel shifts as specified by owner and/or owner’s representative.
      3. Pre-Startup Inspection
         1. Inspect installed packaged boiler system for damaged, incorrect, incorrectly installed, and missing components, assemblies, and connections.
         2. Replace any damaged or nonfunctional components.
         3. The pre-startup inspection results shall be submitted to the owner and/or owner’s representative.
      4. Site Hydrostatic Pressure Test **(Optional)**
         1. The completed packaged boiler system shall receive an ASME BPVC-I hydrostatic pressure test with affixed valves, piping, and trim.
         2. The site hydrostatic pressure test results shall be submitted to the owner and/or owner’s representative.

**Note: The site hydrostatic pressure test may be required by national, state/provincial, or local codes.**

* + 1. Boiler Startup
       1. Test and document the following packaged boiler system components, assemblies, and connections:
          1. Safety valves.
          2. Low water cutoff.
          3. Auxiliary low water cutoff.
          4. High limit control.
          5. Operating control.
          6. Modulating control.
          7. Low gas pressure switch.
          8. High gas pressure switch.
          9. Combustion air proving switch.
          10. Low fire switch.
          11. High fire switch.
          12. Blower motor overloads.
          13. Gas valve auxiliary switch.
          14. Pilot valve leak test.
          15. Main gas valve leak test.
          16. Main gas vent leak test.
       2. Test, measure, and document the following packaged boiler system operation and performance metrics at a minimum of eight (8) firing rate data points at no more than 6% excess air:
          1. CO.
          2. NOx.
          3. O2.
          4. Stack temperature.
          5. Efficiency.
          6. Stack pressure.
          7. Gas pressure before gas pressure regulator.
          8. Gas housing manifold pressure.
          9. Steam pressure.
          10. Water pressure.
          11. Mechanical linkage position.
       3. The boiler startup results shall be submitted to the owner and/or owner’s representative.
       4. The owner and owner’s representatives reserve the right to witness the boiler startup.