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 sthis 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
      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. B140 – Oil-Burning Equipment
         3. 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. 31 – Standard of the Installation of Oil-Burning Equipment
       2. 54 – National Fuel Gas Code
       3. 70 – National Electrical Code
       4. 85 – Boiler and Combustion Systems Hazards Code
    2. UL/cUL – Underwriters Laboratories / Underwriters Laboratories of Canada
       1. 726 – Standard for Oil-Fired Boiler Assemblies
       2. 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: 10 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. NFPA 85
      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 31.
         4. Packaged boiler system constructed in accordance with NFPA 54.
         5. Packaged boiler system constructed in accordance with NFPA 70.
         6. Packaged boiler system constructed in accordance with NFPA 85.
         7. Packaged boiler system constructed in accordance with UL 726.
         8. Packaged boiler system constructed in accordance with UL 795.
         9. Packaged boiler system constructed in accordance with CSA B51 and bears a CRN. **(Canada Only)**
         10. Packaged boiler system constructed in accordance with CSA B140. **(Canada Only)**
         11. 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.s

* + - 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. Insulation type: High-temperature insulation wool (HTIW) blanket.
            2. Thickness: 1.5 in.
            3. Weight: 8 lb/ft2.
            4. Classification temperature: 2372°F (1300°C).
        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.
       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:

Note: Select one and strikeout other.

* + - * 1. 1250 MBH to 1450 MBH boilers: 1.5 in. diameter.
        2. 1650 MBH to 2500 MBH boilers: 2 in. diameter.
  1. BURNER
     1. Burner Design
        1. Manufacturer: Cleaver-Brooks ProFire EV Series or equivalent.
        2. Included in the packaged boiler system from the boiler manufacturer.
        3. Atomization method: Air atomization.
        4. Maximum high-to-low fire turndown ratio: 7:1.
        5. NOxemissions level range: 30 ppm to 60 ppm.
        6. Mounted on a hinged backing plate to facilitate fan and burner inspection.
        7. Equipped with individual servomotors to control the burner fuel-to-air ratio.
        8. Forced draft fan design with full firing rate modulation.
        9. Opposed blade air damper to control combustion air volume to the burner.
        10. Combustion air proving switch to prove proper fan operation.
        11. Pilot and flame scanner designed to facilitate access without opening or disassembling the burner.
        12. 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). or #2 light oil (fuel series 200).
     3. Flue Gas Recirculation Piping
        1. Flue gas recirculation (FGR) ductwork:
           1. Non-insulated sheet metal.
           2. Shipping method: Shipped loose.

Note: Flue gas recirculation (FGR) ductwork insulation required to be installed on site.

* 1. 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.
  2. 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. Non-Return Steam Valve
         1. Manufacturer: Flowserve.
         2. Valve type: Edward valve with disk skirt.
         3. Valve material: Cast steel.
         4. ASME B16 pressure class: Class 300.
         5. Connection type: Raised face (RF) flange.
     12. 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.
     13. Surface Blowoff Manual Stop Valve
         1. Valve type: Ball valve.
         2. Valve material: Brass.
     14. Surface Blowoff Metering Valve
         1. Valve type: Needle valve.
         2. Valve material: Steel.
     15. Surface Blowoff Collector Pipe
     16. 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.
     17. 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.
  3. WATER COLUMNS & TRIM
     1. Water Level Control System
        1. Manufacturer: Cleaver-Brooks Level Master main low water cutoff device or equivalent.
        2. Listed by UL and bears the appropriate complete UL Listing Mark on the electronic controller.
        3. Constructed as a Manufacturer’s Standard Pressure Part in accordance with ASME BPVC-I.
        4. Design style: Float device with magnetostrictive linear position sensor.
        5. Device operation: Modulating.
        6. Device material: 316 stainless steel.
        7. Reset switch type: Automatic reset.
        8. Maximum operating pressure: 250 psig.
        9. Maximum operating temperature: 400°F.
        10. Minimum float sensor accuracy: 0.01 in.
        11. Float sensor material: 316 stainless steel.
        12. Connections included for gauge glass, tricock, blowdown pipe, and blowdown valve.
        13. Microprocessor-based electronic controller.
            1. Installed in individual control panel.
            2. Automatic or manual reset control.
            3. On/off or modulating analog (4-20 mA) signal to feedwater control valve.
            4. High and low water level alarm.
            5. Alarm annunciation, timestamp, and history.
            6. Continuous monitoring of float operation.
            7. Stationary float detection and alarm.
            8. Continuous water level indicating LED’s.
            9. Error and operational status LED’s.
            10. Alphanumeric message LCD display.
            11. MENU/RESET button to provide diagnostic retrieval.
            12. Time display in hours and minutes.
            13. Auxiliary low water cutoff device check reminder routine.
            14. Water column blowdown detection, reminder routine, and history.
            15. Password protection of level settings, alarms, and water column blowdown history.
            16. Remote connection access via RS-232 interface.
            17. Ambient temperature operation range: 32°F to 125°F.
     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. 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.
  4. 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 each with 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 Low Gas Pressure Switch
        1. Manufacturer: Honeywell.
        2. Reset switch type: Manual reset.
    13. Gas Pilot Train Gas Pressure Regulator Inlet Pressure Gauge
        1. Minimum gauge face: 2.5 in.
        2. Bronze shutoff cock included.
    14. Fuel Input Control Valve
        1. Valve type: Reduced port (RP) butterfly valve.
  1. OIL TRAIN
     1. Oil Train Oil Supply Pump
        1. Motor type: Open drip proof (ODP).
        2. Shipping method: Shipped loose.
     2. Oil Train Oil Metering Pump
        1. Motor type: Open drip proof (ODP).
     3. Oil Train Atomizing Air Compressor
        1. Compressor type: Direct drive integral air-cooled.
           1. Motor type: Open drip proof (ODP).
        2. Atomizing air switch included.
        3. Atomizing air pressure gauge included.
     4. Oil Train Back Pressure Relief Valve
     5. Oil Train Discharge Oil Pressure Gauge
        1. Minimum gauge face: 2.5 in.
     6. Oil Train Safety Shutoff Valves (SSOVs)
        1. One (1) two-way motorized valve with proof-of-closure (POC) switch.
        2. One (1) three-way motorized valve with proof-of-closure (POC) switch.
     7. Oil Train Low Oil Pressure Switch (LOPS)
        1. Switch type: Snap acting.
     8. Oil Train Strainer
        1. Strainer type: Suction strainer.
  2. BURNER CONTROLS
     1. Parallel Positioning Actuators
        1. General.
           1. Servomotors.
           2. Actuator type: Quick disconnect.
           3. Modbus controlled.
        2. Primary fuel.
        3. Secondary fuel.
        4. Air.
        5. Flue gas recirculation (FGR).
     2. Steam Pressure Control
        1. Maximum error: 0.5%.
        2. Output signal type: Analog (0-135 ohm).
     3. Operating Limit Control
        1. Manufacturer: Danfoss.
        2. Contact type: Pressure switch.
     4. High Limit Control
        1. Manufacturer: Danfoss.
        2. Reset switch type: Manual reset.
        3. Contact type: Pressure switch.
     5. Oxygen Air Trim Probe
        1. Automatic calibration.
        2. Output signal type: Analog (4-20 mA).
     6. Oxygen Trim Stack Adapter
        1. Adapter type: Single wall stack.
     7. Remote Emergency Shutoff Switch
        1. Contact type: Terminals only.
        2. Shipping method: Shipped loose.
     8. Burner Management System (BMS)
        1. Manufacturer: Cleaver-Brooks CB780E burner management system or equivalent.
        2. Microprocessor-based controller.
        3. Burner management system (flame safeguard and flame scanner) functionality is passed through to the programmable boiler control system (PLC) via Modbus communication.
        4. Automatic boiler operation sequencing (standby, pre-purge, flame proving, run, post-purge).
        5. Flame scanner type: Infrared spectrum (IR) scanner.
     9. Boiler Combustion Control System (CCS)
        1. Manufacturer: Cleaver-Brooks HAWK boiler combustion control system or equivalent.
        2. Programmable logic controller (PLC).
        3. Channel inputs and outputs:

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

* + - * 1. Steam pressure.
        2. Stack temperature.
        3. Water temperature.
        4. Oxygen level.
        5. Combustion air temperature.
        6. Economizer water temperature inlet. **(Optional with HAWK 4000)**
        7. Economizer water temperature outlet. **(Optional with HAWK 4000)**
        8. Exhaust temperature. **(Optional with HAWK 4000)**
        9. Water level. **(Optional with HAWK 4000)**
        10. Steam flow. **(Optional with HAWK 4000)**
        11. Gas flow. **(Optional with HAWK 4000)**
        12. Oil flow. **(Optional with HAWK 4000)**
        13. Feedwater flow. **(Optional with HAWK 4000)**
        14. Maximum of eight (8) additional custom analog inputs. **(Optional with HAWK 4000)**

**Note: If selected, indicate number of additional custom analog inputs.**

* + - 1. System (PLC) functionality:
         1. Communicates with burner management system controller.
         2. Sends/receives boiler control commands.
         3. Receives primary fuel, secondary fuel, air, and flue gas recirculation (FGR) actuator position data.
         4. Receives boiler diagnostic data.
         5. Boiler firing rate optimization.
         6. Boiler efficiency calculation.
         7. Thermal shock protection (warm-up, low-fire hold, and hot standby).
         8. Assured low-fire cutoff (low-fire before shutdown).
         9. External interlock with auxiliary devices (fresh air dampers/louvers, circulating pumps, etc.).
         10. Flue gas recirculation (FGR) damper control.
         11. Maximum of two air damper controls.
         12. Maximum of two fuel actuator controls.
         13. Maximum of two lead-lag controlled boilers.
      2. Ethernet functionality:
         1. Email or mobile texting of boiler alarms to owner and/or owner’s representatives.
         2. Remote boiler start/stop operations.
         3. Remote firing rate modulation.
         4. Networked control system (NCS) of multiple boilers with a building automation system (BAS).
         5. Communicates with the burner fan variable frequency drive (VFD).
         6. Communicates with the human-machine interface (HMI).
         7. Communicates with a laptop to facilitate diagnostics to owner and/or owner’s representatives.
         8. Communicates with a building automation system (BAS) with OPC server software.
         9. Communicates with a customer local area network (LAN).
         10. Communicates with a customer wide area network (WAN) or Internet to facilitate remote monitoring.
      3. 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. Graphical human-machine interface (HMI).
         1. Manufacturer: Allen-Bradley.
         2. Model: PanelView Plus.
         3. System configuration.
         4. Combustion settings.
         5. Boiler process monitoring.
         6. Alarm management, annunciation, and history.
         7. Display motor amps, fan RPM, drive output (kW), and specific drive faults from VSD (if provided).
         8. Graphic terminal touch screen:

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

4 in. color touch screen. **(Standard with HAWK 1000)**

6 in. color touch screen. **(Optional with HAWK 1000)**

7 in. color touch screen. **(Standard with HAWK 4000)**

10 in. color touch screen. **(Optional with HAWK 4000)**

* + - * 1. Touchscreen units:

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

US Standard units.

Metric units. **(Optional)**

* + - * 1. Language:

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

English.

French. **(Optional)**

Spanish. **(Optional)**

Mandarin. **(Optional)**

* + 1. Integrated Draft Control **(Optional with HAWK 4000)**
       1. Damper type: Double blade.
       2. Actuator type: Independent electric actuator.
    2. Multiple-Boiler Combustion Control System (CCS)
       1. Manufacturer: Cleaver-Brooks Master Panel or equivalent.
       2. Programmable logic controller (PLC).
       3. Three (3) to eight (8) boiler modulation control system.
       4. Lead-lag or unison modulation control system.
          1. Sequencing configuration.
          2. Set point configuration.
       5. Individual boiler combustion control systems (PLCs) functionality is passed through to the multiple-boiler combustion control system (PLC) via Ethernet/IP.
       6. Ethernet functionality:
          1. Networked control system (NCS) of multiple boilers with a building automation system (BAS).
          2. Local and remote operating, range, and ramp rate set points.
          3. Remote system diagnostic/information monitoring web server via internet browser interface.
       7. Graphical human-machine interface (HMI).

**Note: Some Master Panel options or features are unavailable for boilers without HAWK controls.**

* + - * 1. Manufacturer: Allen-Bradley.
        2. Model: PanelView Plus.
        3. System configuration.
        4. Multiple boiler process monitoring.
        5. Alarm management, annunciation, and history.
        6. Graphic terminal touch screen: 10 in. color touch screen.
        7. Touchscreen units: Same as individual CCS touchscreen units selection.
        8. Language: Same as individual CCS language selection.
  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).
        3. Variable frequency drive (VFD) motor starter.
     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. Oil Metering Pump Fuse
         1. Included with oil metering pump.
     12. Oil Metering Pump Motor Starter
         + 1. Starter in accordance with IEC standards.
           2. Motor type: Open drip proof (ODP).
     13. Oil Pump Fuse
     14. Oil Pump Motor Starter
         + 1. Starter in accordance with IEC standards.
           2. Motor type: Open drip proof (ODP).
     15. Air Compressor Motor Starter
         + 1. Starter in accordance with IEC standards.
           2. Motor type: Open drip proof (ODP).
     16. 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.
            4. The installation shall be performed in accordance with NFPA 85.
         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. Oil drawer switch.
          15. Low oil pressure switch.
          16. Atomizing air pressure switch.
          17. Oil valve auxiliary switch.
          18. Pilot valve leak test.
          19. Main gas valve leak test.
          20. 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. Oil pressure at burner.
          10. Oil supply pressure.
          11. Oil atomizing pressure.
          12. Steam pressure.
          13. Water pressure.
          14. Gas actuator position.
          15. Air actuator position.
          16. Oil actuator position.
          17. Flue gas recirculation (FGR) actuator position.
          18. Variable frequency drive (VFD) frequency.
       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.