



VICTORY ENERGY HIGH TEMPERATURE HOT WATER GENERATOR SPECIFICATION

PART 1. GENERAL

1.01 SCOPE

- A. This specification shall govern the design, materials, shop fabrication, inspection, shipment, and field support of a shop-assembled High Temperature Hot Water (HTHW) generator by a qualified manufacturer. The scope includes:
- B. HTHW generator
- C. HTHW generator trim
- D. Low-NOx Burner with integrated windbox
- E. Forced draft fan
- F. Burner Management System (BMS)
- G. Combustion Controls System (CCS)
- H. Generator Start-up services consisting of supervision of installing Contractor, boiler start-up support, testing, and commissioning support.

1.02 REFERENCES

- A. Design and performance of components and methods specified herein shall comply with the latest industry standards listed below.
- B. American Society of Mechanical Engineers (ASME): Boiler and Pressure Vessel Code
 - 1. Section I – Power Boilers
 - 2. Section II – Materials
 - 3. Section V – Nondestructive Examination
 - 4. Section IX – Welding and Brazing Qualifications
 - 5. B31.1 – Power Piping
- C. National Board of Boiler and Pressure Vessel Inspectors
- D. American Institute of Steel Construction (AISC)
- E. American Welding Society (AWS)
- F. American National Standards Institute (ANSI)
- G. American Society for Testing and Materials (ASTM)
- H. Steel Structures Painting Council (SSPC)
- I. National Fire Prevention Association (NFPA 87)

- J. National Fire Prevention Association (NFPA 85)
- K. National Electrical Manufacturers Association (NEMA)
- L. Occupational Safety and Health Administration (OSHA)
- M. Underwriters Laboratories Inc. (UL)
- N. Factory Mutual (FM)
- O. Instrument Society of America (ISA)

1.03 QUALITY ASSURANCE

- A. The generator shall be constructed in accordance to ASME Section I for construction of boilers and shall be registered with the National Board of Boiler and Pressure Vessel Inspectors.
- B. All materials shall conform to the requirements of ASTM.
- C. Materials and equipment incorporated into the work shall be new. No used or remanufactured parts or equipment shall be permitted.
- D. Workmanship and materials shall in every respect be free from defects and shall be in accordance with the best modern practice.
- E. Fuel Train and Safety Controls shall conform to NFPA 85. Applicable components shall comply with Factory Mutual requirements.
- F. Any reference to standards of any society, institution, association, or governmental authority in the Specifications or on the Contract Drawings shall mean to the latest edition in effect at the time of purchase unless specifically stated otherwise.
- G. If required by the Engineer, furnish satisfactory evidence as to the kind and quality of materials and equipment to be employed in performing the Work. All materials and equipment shall be applied, installed, connected, erected, used, cleaned, and conditioned in accordance with the approved instructions of the applicable supplier.
- H. Develop and maintain a quality control system which will establish that all code and standard requirements including material, design, fabrication, examination, and inspection will be met.
 - 1. Upon request, provide the Engineer with certifications that the welding procedure and the welders are qualified in accordance with the requirements of Section IX of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code.
 - 2. Upon request, provide to the Engineer a copy of Welding Procedure Specifications with proof of welder's qualifications.

1.04 SUBMITTALS

- A. The HTHW Manufacturer shall submit the following documents.

1. Delivery schedule including dates of submittals.
 2. General arrangement drawings and thermal performance data.
 3. The fabrication of equipment shall not proceed until the Engineer has approved the general arrangement drawings.
 4. Process and instrumentation diagram clearly identifying all components included in the boiler manufacturer's scope of work.
 5. Identify revisions to drawings with revision numbers, descriptions, and bubbling.
 6. Forced draft fan efficiency and power usage information plotted on the fan vendor performance curves. The submittal shall include static pressure inches W.C., shaft horsepower, and mechanical efficiency versus fan CFM capacity.
 7. Operations and maintenance manuals for the HTHW generator and all manufacturer provided components.
 8. ASME Boiler Code Data Report.
- B. The HTHW Manufacturer shall submit the following BMS, CCS, and electrical documents.
1. Control Panel and Junction Box layouts.
 2. Control narratives and functional descriptions of intended method of operation for each control loop implemented in the HTHW control panel.
 3. Sequence of Operation description for the BMS.
 4. Manufacturer catalog cut sheets for the supplied equipment and components.
- C. The HTHW Manufacturer shall submit the following manuals and drawings.

1. Drawings
 - a. Submit four (4) hard copies and one (1) electronic copy of completed non-proprietary drawings of equipment and systems including, but not limited to, the following:
 - (1) HTHW generator
 - (2) HTHW generator P&IDs
 - (3) HTHW foundation drawings
 - (4) Combustion and burner management control panels
 - (5) Electrical schematics
 - (6) Field instruments
 - (7) Piping diagrams
 - (8) Burner fuel trains
 - (9) Combustion control and burner management wiring diagrams
 - (10) Fuel requirements
 - (11) Compressed air requirements
 - (12) Breeching and stack requirements
 - b. Drawings shall include:
 - (1) Dimensional drawings for plan and section views of equipment.
 - (2) Combustion control and burner management wiring diagrams including location of remote indication/alarm terminal points. The diagrams shall consist of component layout drawings, showing numbered terminals on components together with the unique number of the wire to be connected to each terminal.
 - (3) System schematics clearly indicating and identifying components, supporting utility connections, instrumentation, controls, piping and wiring.
 - (4) Equipment specifications and descriptive literature.
 - (5) Weights of equipment.
 - (6) Rigging and installation instructions.

2. Operation and Maintenance Manuals

- a. Submit four (4) hard copies and one (1) electronic copies of completely bound sets of instructions for operating and maintaining the generator and equipment. Hard copies binders shall be 3-ring loose-leaf type with title on front cover and binding. Electronic copies shall be on CD or DVD. Complete and submit manuals prior to training.
- b. Manuals shall include:
 - (1) Table of Contents and Index with binder page numbers.
 - (2) Summarization table briefly describing all specified equipment items and related capacities.
 - (3) Provide tabs for each item section in binder.
 - (4) Each item section shall include the following:
 - (a.) Brief description of each system and equipment sub-components.
 - (b.) Basic operating features.
 - (c.) Performance limiting conditions.
 - (d.) Equipment start-up instructions.
 - (e.) Equipment shutdown instructions.
 - (f.) Safety considerations.
 - (g.) Emergency procedures.
 - (h.) Complete lubrication instructions and schedule (may be included in preventive maintenance schedule section). Separate listing of lubricants required for all components including recommended domestic manufacturers and specific grades with "equivalent" cross-referencing.
 - (i.) Complete preventive maintenance schedule including instructions and recommended intervals for both normal and severe operating conditions with statements clearly defining conditions which may be considered "severe".
 - (j.) Complete guide to troubleshooting including list of symptoms and instructions for corrective action.
 - (k.) Electrical motor data (separate section).
 - (l.) Listing of special tools for equipment servicing.
 - (m.) Listing of recommended spare parts, quantity and current price. Complete separate listing and schedule for replacement of all "normal-wear" items.
 - (n.) Include catalog sections and diagrams for all components and sub-assemblies not detailed in Drawings.
 - (o.) Copy of approved general arrangement drawing of equipment with parts identification and listing.
 - (p.) Copy of approved wiring diagrams including provisions made for correction of remote alarm, control, recording, etc.
 - (q.) Copy of approved as-built P&ID drawings.
 - (r.) Copies of written equipment guarantee and manufacturer's equipment warranty.
 - (s.) Procedure for wet lay-up (seasonal decommissioning) during summer shutdown.

PART 2. PRODUCTS

2.01 HIGH TEMPERATURE HOT WATER GENERATOR

- A. The contractor shall furnish **One (1)** Victory Energy Genesis® Series High Temperature Hot Water Generator with an output capacity of **XX** MMBtu/hr.
- B. The generator shall be equipped with a **dual-fuel** Victory Energy **VISION**® burner capable of burning **natural gas and No. 2 oil** and meet the emission requirements per this specification. The burner shall come complete with forced draft fan with VFD, integral windbox, fully metered fuel trains, burner management system, combustion control system, and oxygen trim.
- C. Each generator shall be equipped with its own burner management system and combustion control panel.
- D. The generator system shall be provided with standard trim and instrumentation.
- E. The generator manufacturer is responsible for providing a spare parts list.

2.02 CONSTRUCTION REQUIREMENTS

A. GENERAL

- 1. The generator shall be designed in accordance with Section I of the ASME Boiler and Pressure Vessel Code.
- 2. The equipment shall be constructed on a rigid structural steel base frame designed to distribute the generator load onto a flat concrete foundation. The pressure vessel shall be allowed to thermally expand independent of the structural base. This design eliminates the need for sole plates and/or slide plates
- 3. Lugs shall be provided on the generator and accessory equipment for unloading, lifting, and/or skidding
- 4. The burner and windbox shall be installed and shipped with the generator when possible.
- 5. The generator shall be factory-wired to the maximum extent feasible.
- 6. Items listed as “shipped loose”, such as safety valves, forced draft fans, FGR ducts, gas ducts, air ducts, dampers, actuators, gauges, thermocouples, transmitters, flow meters and any other components or parts identified as “shipped loose”, shall be mounted in the field.
- 7. The generator shall be a forced circulation design. Hot spots shall be eliminated under all specified operating conditions. Permanent baffle plates—**orifices are not allowed**—shall evenly distribute water to the heating surfaces in both the radiant and convective sections of the generator.
- 8. The generator must be purpose-built for the supply of hot water and not a modified steam generator designed in an attempt to create high temperature hot water. All tube to header connections must be welded and not rolled.
- 9. The use of an external economizer to achieve the specified efficiencies is strictly prohibited.

B. Furnace Design

1. The furnace shall be sized to ensure complete combustion of the fuel within the furnace proper and without flame impingement on the walls or tubes.
2. The generator furnace walls shall consist of full membrane wall construction made up of a minimum of 2” diameter tubes. The tube spacing shall be such that the membrane temperature does not exceed the maximum allowable metal temperature. Membrane thickness shall not be less than ¼” thick. Swaged tubes are not allowed.
3. Furnace tube-to-header connections shall be welded. Expanded connections are not allowed.
4. The furnace tube lengths shall be minimized to prevent sagging by arranging the axis of the furnace tubes perpendicular to the flame.
5. Membrane furnace tubes shall be fabricated from SA-178A material and shall have a minimum thickness of 0.135”.
6. The furnace front wall shall consist of full membrane wall construction. Refractory or ceramic fiber front walls are not allowed.
7. The Furnace Heat Release Rates shall not exceed the following:
 - a. Volumetric Heat Release Rate: <200,000 Btu/hr-ft³
Volumetric Heat Release Rate shall be calculated as the total heat input divided by the furnace volume. Furnace shall not extend beyond the first row of screen tubes.
 - b. Area Heat Release Rate: <80,000 Btu/hr-ft²
Area Heat Release Rate shall be calculated as the total heat input divided by the furnace flat projected area. Heating surfaced covered by refractory shall not be counted in the calculation of heating surface.
8. The furnace shall be accessible through minimum 15”x18” access door located in the rear wall.

C. Convection Section Design

1. The convection section of the generator shall be all-welded construction consisting of bare and finned tubes with a minimum diameter of 2” and a minimum thickness of 0.120”.
2. Bare tubes shall form a screen such that finned tubes do not received direct radiation from the burner flame.
3. The fins shall be carbon steel and high frequency resistance welded to the tubes. The fin thickness and widths shall be chosen such that the fin tip temperatures do not exceed 750°F.
4. The convection section shall be self-supporting. The use of tube sheets is not allowed.
5. The convection tubes shall be allowed to expand and contract as necessary to avoid thermal shock.

D. Generator Finish

1. Insulation shall be manufacturer's proven standard materials and methods. The average external casing temperature shall not exceed 140° F with a 2 MPH wind and 80°F ambient air temperature.
2. The outer casing of the generator must be a minimum of 10 gauge carbon steel.
3. The use of asbestos insulation, on any equipment, IS PROHIBITED.

2.03 PERFORMANCE REQUIREMENTS

A. HTHW Performance Data

NATURAL GAS NO. 2 OIL

- Heat Output, MMBtu/hr
- Water Flow Rate, lb/hr
- Water Inlet Temperature, °F
- Water Outlet Temperature, °F
- Operating Pressure, psig
- Maximum Water Pressure Drop, psi
- Minimum Full Load Efficiency, %
- NOx Emissions Requirements, lb/MMBtu
- CO Emissions Requirements, lb/MMBtu
- SO2 Emissions Requirements, lb/MMBtu

2.04 BURNER

A. Burner type shall be forced draft, low NOx arranged for automatic natural gas and steam atomized No. 2 fuel oil firing.

1. The burner shall be compatible with the HTHW generator and furnace volume and dimensions.
2. The burner shall have a clear glass front door—with a minimum diameter of 12”—for ease of viewing flame.
 - a. Material: Carbon Steel
 - b. Side thickness: 0.25 in
 - c. Front plate: 0.25 in
3. Gas Burner Construction
 - a. The burner shall not be a gas spud type to reduce maintenance.
 - b. The burner shall be spark-ignited without the need for a stand-alone ignitor.
 - c. The burner shall meet the OSHA minimum door width for accessing oil equipment and future maintenance.

(a) Gas burner trim as follows:

 - (1) Two (2) safety shut off valves with SPDT switches, cast iron body similar to Maxon or approved equal.
 - (2) Vent valve with aluminum body similar to ASCO or approved equal.
 - (3) Manual shut off valve with semi-steel flange similar to Homestead or approved equal.
 - (4) Gas flow control valve with positioner and electrically interruptible pilot similar to Fisher or approved equal.

- (5) Main gas flow controls valve will be fail closed with Class VI shutoff.
- (6) Ignition gas pressure regulator with aluminum body.
- (7) Ignition gas safety shut off valves, two (2) with brass bodies and vent connection (except when propane fuel is used).
- (8) Ignition transformer (10,000 Volts), 120/6000 V similar to Dongan or approved equal.

(b) Oil burner trim as follows:

- (1) Gun – internal mixing with air atomization. Piping arrangement shall be cross connected to permit air purging through oil passages of gun for removal without leaking or dripping of oil.
- (2) Oil burner shall have integral oil hose and steam hose and shall come with a vise/wrench set for nozzle removal.
- (3) Furnish one spare atomizing oil burner gun per HTHW generator.
- (4) Atomizing media and fuel oil train shall be factory assembled and mounted and shall include a safety shut off valve similar to Maxon or approved equal.
- (5) Fuel flow shall be controlled through a flow control valve with positioner similar to Fisher or approved equal. Valve shall have a mechanical stop and normally closed action. Valve shall fail in closed position.

2.05 PERFORMANCE GUARANTEE

- A. The modulating firing range of the burner on natural gas fuel shall be not less than 10 to 1. and that the modulating firing range of the burner on #2 oil fuel shall be not less than 6 to 1.
- B. When the installation is completed, a performance test shall be conducted. The burner and combustion controls shall be put into operation under the supervision of the manufacturer's representative. Submit to the Engineer a detailed written record of the startup performance, including NOx emissions, gas burner pressure, windbox air pressure, furnace pressure, gas supply pressure, gas flow, percent oxygen, stack temperature, atomizing media pressure, oil flow, and oil pressure.

2.06 FORCED DRAFT FAN

- A. General Design
 1. Fans shall be designed and constructed to operate satisfactorily at all specified operating conditions (included in the project data sheets), maximum continuous speed, and to the trip speed setting of the driver, if applicable.
 2. Fan blade design shall be of the backward inclined airfoil type and impellers shall be single width, single inlet wherever capacity permits.
 3. Fan shall be either Arrangement No. 3 or Arrangement No. 7 with fan directly coupled to electric motor. Fan arrangements with overhung impellers will not be accepted.
 4. If required, the fan assembly shall include silencers, and/or acoustic treatment necessary to meet the sound levels specified in the project data sheets.
 5. The inlet box silencer shall be provided with an air measurement sensing element.
 6. All equipment shall be designed to permit rapid and economical maintenance.

7. Design static pressure shall be a minimum of 110 percent of the required volume pressure at MCR. Design volume shall be a minimum of 121 percent of the required static at MCR.
8. A Variable Frequency Drive (VFD) shall be supplied in a stand-alone NEMA-4 enclosure to control the speed of the FD fan motor.
9. The fan shall be supplied with a premium efficiency inverter duty rated TEFC motor with a minimum 1.15 service factor. Provide the required VFD to operate the forced draft fan. Selection of motor shall be coordinated with the VFD supplier.

B. Flue Gas Recirculation

Size the flue gas recirculation line as required to meet the specified emission requirements. Furnish and install a butterfly damper in the duct between the generator exhaust and the mixing box. The FGR duct shall be of carbon steel construction.

C. HTHW Generator Accessories

1. This section defines the accessories or trim items to be furnished with the generator. Include valves, fittings and accessories not identified below but required by code or recommended by generator manufacturer for convenient and efficient generator operation. Ship loose only as required to facilitate ease of transportation and rigging.
2. Furnish safety valves in accordance with the ASME Boiler and Pressure Vessel Code. The set pressure selection of the safety relief valves shall take into consideration the maximum normal system pressurization and the generator circulating pump shutoff head, shall not create inefficient system operation and shall minimize the number of times the safety valves lift as a function of specified system characteristics.
3. Furnish valves at each drain.
4. Furnish vent valves at each vent.
5. Furnish and install a minimum of one test well with cap as recommended.
6. Outlet Damper
 - a. Installed at the HTHW generator exit or in the stack.
 - b. Carbon steel construction suitable for the flue gas temperature and pressure.
 - c. Furnish a pneumatic/mechanical actuator for modulating operation of the damper by the HTHW generator control system external to the damper enclosure.
7. Fresh Air Damper
 - a. Installed at the fan inlet.
 - b. Construction suitable for open/close operation.
 - c. Furnish a pneumatic/mechanical actuator external to the damper enclosure for modulating operation of the damper by the HTHW generator control system.

2.07 CONTROL SYSTEM

- A. The Boiler Control System (BCS) is to be built upon a Fireye YB-110 Burner Management System (BMS) and an Allen-Bradley CompactLogix PLC processor for the Combustion Control System (CCS) together in one independent enclosure. The enclosure

shall have an integrated Human-Machine-Interface (HMI) and audible annunciators for alarms and trips.

- B. The HMI systems shall be built upon the Allen Bradley PanelView Plus 6 on local 15” Color industrial touchscreen monitors at each boiler, and on a remote desktop HMI in the control-room. The remote HMI shall have all the capabilities of each local HMI simultaneously for each of the generators. The HMI screen designs shall be efficient and operator-friendly.
- C. The enclosure shall be NEMA-4 and shall contain internal lighting and power receptacles for maintenance activities. All panels shall be pre-wired and tested and shall include testing protocol, test results, wiring diagrams and general-arrangement drawings.
- D. The Control Systems shall be engineered, manufactured, and factory tested and shall meet or exceed the requirements of NFPA-87.
- E. The following electrical components shall be used:
 - 1. Allen Bradley 15” Color Industrial Touchscreen Interface
 - 2. Allen Bradley CompactLogix family of Processors and I/O Modules
 - 3. Allen Bradley Control Relays or equal brand under Rockwell
 - 4. Allen Bradley Terminal Systems or equal brand under Rockwell

2.08 BURNER MANAGEMENT SYSTEMS

- A. The Burner Management Systems (BMS) shall be engineered, manufactured and factory tested and shall meet or exceed the requirements of NFPA-87.
- B. The BMS shall provide First Out Indication, giving troubleshooting information to operators and technicians.
- C. All system I/O shall be fused and shall be able to be monitored on the HMI. HMI indication shall include, but not be limited to the following:

Low Gas Pressure	Low Combustion Air Flow
High Gas Pressure	FD Fan Motor Interlock
Main Gas Shutoff Valves Closure	Low Water Flow
Gas Flow Control Valve Start Position	Low Instrument Air Pressure
Low Oil Pressure	Critical Input Failure
High Oil Pressure	Critical Output Failure
Main Oil Shutoff Valves Closure	Loss of Start Limits
Oil Flow Control Valve Start Position	Low Fire Release
Low Atomizing Media Supply	High Water Temperature
Low Atomizing Media Flow	Excess Water Temperature

Select Fuel	Pilot & Main Light-off Timing
Fuel Changeover	Flame Detector Relays
Purge Air Flow	Pilot Flame Failure
Purge Timing	Main Flame Light-off Failure
Purge Timeout	Main Flame Failure
Combustion Air Actuator Positions	VFD

D. The Fireye system shall direct all of the BMS functions required for automatic start up, shutdown, and on-line supervision of the combustion process. Logic implemented in the BMS shall include:

1. Permissive supervision
2. Furnace purge
3. Master fuel trip
4. Ignition fuel valve management
5. Main fuel valve management
6. Interlock supervision
7. Shutdown
8. Post-purge
9. Critical I/O testing
10. Watchdog timer handshaking.

E. The BMS shall include the following safety and reliability features:

1. Master Fuel Trip Relay circuitry
2. Independent Watchdog Timer monitoring of PLC health
3. Critical Input and Critical Output testing
4. Protection from on-line editing and forced I/O
5. Fused inputs and outputs
6. Interposing Isolation Relays on all outputs
7. "First Out" reporting of all Trip conditions
8. Ethernet Communications with Plant SCADA systems

2.09 COMBUSTION CONTROL SYSTEMS

A. The combustion control system (CCS) shall be built upon the Allen-Bradley CompactLogix controller using function-block programming. The system shall be fully-metered and cross-limited with excess oxygen trim.

1. Fully Metered – Characterized inputs for Fuel Flow and Air Flow shall provide accurate air-to-fuel ratios and precise firing control.
 2. Cross Limited – Air shall lead fuel on load increases; fuel shall lead air on load reductions. Air or Fuel Flow upsets override load demand to maintain safe air-to-fuel ratios.
 3. Excess Oxygen Trim – Continuous monitoring of stack oxygen and active PID control maintain characterized oxygen levels for increased efficiency and reduced emissions.
 4. Draft Control
 5. Plant Master / Boiler Master – Independent Boiler Master for manual, automatic or biased Lead / Lag operation from a Plant Master. Plant Master Control shall be able to be enabled from any of the boiler control panels.
- B. All points of I/O shall be available to be read by the Plant’s SCADA system through a manufacturer-provided fast-Ethernet switch to the Allen-Bradley / Rockwell Automation Ethernet/IP network.
- C. Furnish and install transmitters, valve manifolds, orifice plates, RTD’s, thermowells, etc. for:

Combustion Air Flow	Generator Flue Gas Outlet Temperature
Fuel Gas Flow	Water Supply Temperature
Fuel Oil Flow	Water Return Temperature
Draft Pressure	Water Flow
Flue Gas Oxygen	Furnace Pressure
VFD Speed	

- D. Typical instrument transmitters shall be Rosemount or equal
- E. Flow meters will be Rosemount 1595 conditioning orifices or equal
- F. Pressure and Temperature measurement gauges shall be Ashcroft or equal

2.10 HUMAN-MACHINE-INTERFACES (HMI)

- A. The HMI system shall be built upon the Allen Bradley PanelView Plus 6 application on a 15” Color industrial touchscreen monitor local to each boiler. The HMI screen designs shall be efficient and operator-friendly.
- B. Critical actions shall be initiated by a two-step process to avoid problems created by accidental touchscreen inputs. Help screens shall provide detailed information for each operator screen, a safe place to clean the touchscreen, and technician’s access to PLC and communication status information.
- C. Provide real-time trending and historical-trending.

D. Critical touchscreen objects shall appear in the same location from screen to screen. Screens and information shall follow natural and intuitive sequences, and shall include such information as:

1. Main Menu
2. Established Limits
3. Simplified Light-off Sequencing
4. Process Overview
5. Boiler / Burner Control
6. Totalizers
7. Real-Time Trending
8. Historical Trending
9. Shutdown
10. Alarm Management
11. Alarm History (including First Out Trip Annunciation and time-stamps)
12. Tuning

2.11 SPARE PARTS

A. GENERAL

1. Furnish spare parts and consumables identified on the Spare Parts List contained in this Section.
2. Spare parts shall be identical to the parts actually furnished on the equipment.
3. All spare parts shipments shall be delivered in properly and clearly labeled containers. Each container label shall be indelibly marked with complete descriptive information including part name and number and equipment for which the part is to be used.
4. Deliver all required spare parts for each piece of equipment prior to the start-up of that piece of equipment.
5. The inventory listing shall identify each spare part as follows:
 - a. Equipment name or description; i.e., forced draft blower motor, VFD, etc.
 - b. Schedule Tag Number
 - c. Spare Part Name (impeller, wearing ring, relay, gauge, float assembly, etc.)
 - d. Quantity

B. PRODUCTS

1. General
Provide spare parts as indicated in the Spare Parts list which follows.

2. Spare Parts List:

<u>Component</u>	<u>Quantity</u>
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Pilot Electrode (complete assembly)	2
Ignition Transformer	1
Flame Scanner (complete assembly)	1
Instrument switches (critical components only)	1
Fuses (all sizes)	1 set
Burner Management Controller (Flame scanner with accessory boards and enunciator)	1
HTHW generator Gaskets	2 sets
Fuel Oil Pump Gaskets	2 sets
Oil Burner Gun/Atomizer (complete assembly)	1
Oil Atomizer Nozzles, each type and size	1 set
Pressure and Temperature Gauges	1 set

PART 3. EXECUTION

3.01 FACTORY TESTS

- A. Vendor shall perform and document factory testing to meet ASME Code requirements and their submitted quality control plans. At a minimum, testing shall include the following:
 - 1. Non-Destructive Examination (NDE) of HTHW pressure parts shall be carried out in accordance with the requirements of Section I of the ASME Code.
 - 2. The HTHW shall be hydrostatically tested in accordance with ASME Section I.
 - 3. The HTHW and setting shall be factory-tested for gas tightness.

- B. Documentation to the Engineer
 - 1. For the HTHW generator, supply the Engineer with legible hard copies and one electronic copy of:
 - (1) Manufacturer's ASME Data Report P-3
 - (2) Manufacturer's partial ASME Data Report P-4
 - (3) Manufacturer's data report for fabricated piping
 - (4) All material certifications
 - (5) Welding procedure specification
 - (6) Welding procedure qualification records
 - (7) Welding procedure qualifications record of testing

3.02 PAINTING

- A. All exposed, non-galvanized carbon steel surfaces of the HTHW and casing shall be painted.
 - 1. Surface shall be prepared per SSPC SP-3
 - 2. Primer Coat: One (1) Coat of Capitol Capcoat Universal Quick Dry Paint 2446 Gray Primer, 1.6 - 3 Mils DFT (Dry Film Thickness).
 - 3. Finish Coat: One (1) Coat Required. Devthane 379. T135 Victory Blue, 2 to 3 Mils DFT.
 - 4. Total 3.6 - 6 Mils DFT
- B. The use of lead containing paint is prohibited.
- C. All name plates and warning plates are to be suitably protected by taping or other means before painting.
- D. All temporary supports, bracing, lifting lugs are to be identified with yellow paint markings.

3.03 SHIPPING PREPARATION

- A. Products susceptible to corrosion must be packaged in a dry non-corrosive environment or adequately protected prior to shipment.
- B. Flanges and threaded connections shall be coated with a rust preventative.
- C. Exposed machined surfaces shall be coated as needed to prevent oxidation and corrosion.
- D. Lifting and support points shall be clearly identified.
- E. Any temporary bracing installed for shipment shall be painted yellow.
- F. Packages shall be clearly identified with item and serial numbers, purchase order numbers and item descriptions. Identifying tags shall be corrosion and weather resistant.

3.04 CONSTRUCTION

- A. Equipment Field Services
 - 1. A manufacturer's representative should be present on-site to assist the contractor during the installation, equipment clean-up, start-up, and testing of all specified equipment. The representative shall inspect, check, inform, and advise the Contractor during all phases of equipment installation, cleaning, and testing.

3.05 MANUFACTURER'S FIELD SERVICES

- A. Arrange for factory-trained technicians to start-up and service the equipment.
 - 1. Arrange for all field service to be supported by a fully-qualified field service representative and burner manufacturer's representative. The field service department and the burner manufacturer's representative shall be trained for the equipment supplied under this specification.
- B. Arrange for the manufacturer to furnish qualified technical personnel to supervise and assist the Contractor during generator unloading, rigging, installation, construction, cleaning, commissioning, start-up, testing and training. The manufacturer shall allocate twenty (20) man days over two separate site visits. Expenses shall be included.

3.06 TRAINING

- A. Include 40 hours of class room training for up to 10 people.
- B. For each specified piece of equipment, arrange for trained representatives to provide operating instructions and maintenance procedures training to the Owner's operating and maintenance personnel, in accordance with the Schedule that follows.
- C. Conduct operating instructions and equipment "hands-on" training in a classroom setting.
- D. Operating instructions and maintenance procedures training shall commence only after all adjustments, field testing, combustion testing, emissions testing, hydrostatic testing, etc., and all other specified duties have been completed for each specific equipment item and prior to the time that each equipment item is placed into continuous operation.
- E. Coordinate the scheduling of training sessions with the supporting equipment manufacturer's training representatives so that cohesive training with proper sequencing of topics may be implemented.
- F. Ensure that instructors utilize equipment manufacturer's operation and maintenance manuals as basis for instruction. Review contents of each manual with the Engineer's personnel in detail to explain all aspects of operation and maintenance.
- G. Demonstrations shall include, but not be limited to, start-up, operation, control, adjustment, troubleshooting, servicing, maintenance, shutdown and emergency operation of the equipment on location.
- H. Submit to the Engineer for his review and approval four copies of the Training Schedule indicating times and dates.
- I. All times shown in the following Training Schedule are exclusive of any travel time.
- J. Training Schedule
 - 1. Training shall be done in three (3) equal phases: at start up, at mid operation and at follow up.
 - 1. HTHW Generator
 - a. Operations Training (Each Phase)
Two (2) consecutive days for one (1), eight (8) hour shift (total 16 hours).
 - b. Maintenance Training (Each Phase)
Two (2), eight (8) hour shifts equally divided for classroom and "hands-on" training (total 16 hours).
 - 2. Operations Review Training
Conduct two (2), eight (8) hour training shifts six months after commissioning and acceptance of the HTHW generator to review the Engineer's operating experience and resolve any outstanding operating problems.