



**DESIGN & CONSTRUCTION GROUP
THE GOVERNOR NELSON A. ROCKEFELLER
EMPIRE STATE PLAZA
ALBANY, NY 12242**

ADDENDUM NO. 1 TO PROJECT NO. M3215

**HVAC AND ELECTRICAL WORK
REFURBISH BOILER PLANT & REPLACE FEEDWATER SYSTEM
WALLKILL CORRECTIONAL FACILITY
50 MC KENDRICK RD
WALLKILL, NY**

September 14, 2026

NOTE: This Addendum forms a part of the Contract Documents. Insert it in the Project Manual. Acknowledge receipt of this Addendum in the space provided on the Bid Form.
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HVAC WORK SPECIFICATIONS

1. SECTION 230926 COMBUSTION CONTROL AND INSTRUMENTATION: Discard the Section bound in the Project Manual and substitute the accompany Section (pages 230926 -1 thru 230926 – 26) noted “Addendum 1.”
2. SECTION 235233 WATER-TUBE BOILER REFURBISHMENT: Add the following attachments:
 - a. Attachment A: Cleaver-Brooks Form P-3 Manufacturer's Data Report, Boiler No. 3
 - b. Attachment B: Cleaver-Brooks Form P-3 Manufacturer's Data Report, Boiler No. 2
 - c. Attachment C: Cleaver-Brooks Model D-26 dimensional and capacity cut sheet, Boiler No. 1
 - d. Attachment D: Cleaver-Brooks D-Style Construction Bulletin, Casing, Setting and Insulation, including the Original Tube Removal and Convection Section Arrangement Bulletin
 - e. Attachment E: Boiler No. 3 Tube Replacement Map

ELECTRICAL WORK SPECIFICATIONS

3. SECTION 262213 LOW-VOLTAGE DISTRIBUTION TRANSFORMERS: Add the accompanying Section (pages 262213 -1 thru 262213 – 8) to the Project Manual.
4. SECTION 263213.13 DIESEL-ENGINE-DRIVEN GENERATOR SETS: Discard the Section bound in the Project Manual and substitute the accompany Section (pages 263213.13 -1 thru 263213.13 – 20) noted “Addendum 1.”

HVAC WORK DRAWINGS

5. Revised Drawings:
 - a. Drawing Nos. M-702 and M-703, noted Addendum 01, dated 9/10/2026, accompanies this Addendum and supersedes the same numbered previously issued drawings.

ELECTRICAL WORK DRAWINGS

6. Revised Drawings:
 - a. Drawing Nos. ES-101, E-302, and E-501, noted Addendum 01, dated 9/09/2026, accompanies this Addendum and supersedes the same numbered previously issued drawings.

END OF ADDENDUM

Brady M. Sherlock, P.E.
Director, Division of Design
Design & Construction

SECTION 230926 - COMBUSTION CONTROL AND INSTRUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes requirements for replacement boiler burner controls, burner management systems, flame safeguard systems, No. 2 fuel oil trains, propane pilot gas trains, atomizing media systems, water level safety devices, emergency stop systems, plant master controller, and associated instrumentation for Boilers 1, 2, and 3 at the Wallkill facility.
- B. Furnish complete No. 2 fuel oil burner systems, propane pilot systems, atomizing air systems, water level safety devices, emergency stop systems, and all interlocks required for full compliance with NFPA 85, NFPA 31 for fuel oil work where applicable, NFPA 54 for propane pilot gas work, ASME Section I, and NYS Industrial Code Rule 4. All combustion safety interlocks shall be hardwired and independent of PLC logic.
- C. Boiler retubing, refractory renewal, casing and insulation repairs, restoration of OEM gas path clearances, blowdown valves, and mechanical boiler refurbishment are specified in Section 235233. This section specifies combustion controls, burner management, burner-mounted fuel and air systems, instrumentation, startup, and tuning.

1.2 DESCRIPTION OF THE EXISTING SYSTEM

- A. Existing boilers are Cleaver-Brooks D-style watertube units constructed in 1976-1977, originally fabricated under ASME Section I.
 - 1. Boiler 1: Cleaver-Brooks Model D-26 watertube, 260 PSIG MAWP, No. 2 oil-fired. Steam capacity: 10,000 LB/HR.
 - 2. Boiler 2: Cleaver-Brooks Model D-42 watertube, 260 PSIG MAWP, No. 2 oil-fired. Steam capacity: 26,000 LB/HR each.
 - 3. Boiler 3: Cleaver-Brooks Model D-42 watertube, 260 PSIG MAWP, No. 2 oil-fired. Steam capacity: 26,000 LB/HR each.
 - 4. Boiler 2 has not been fired since 2022 and is presently inoperable.
 - 5. Boiler 3 was partially re-tubed in 2026. Approximately 1/3 of the tubes were replaced and multiple tubes were repaired.
 - 6. Boiler Operating Pressure (Typical all boilers): 110 PSIG, Safety Relief Valve Setting: 150 PSIG.
 - 7. Each boiler utilizes an original 1977 Coen Fyr-Compak forced-draft oil-fired burner and associated controls utilizing a single-point positioning mechanical combustion control system.

1.3 MODIFICATIONS TO EXISTING SYSTEM

- A. Boiler Modifications (Typical for Boiler 1, 2 and 3)

1. Remove obsolete Coen Fyr-Compak burner controls and provide replacement servo-based parallel-positioning system.
2. Provide 12-inch HMI with graphical burner overview, alarms, and trends.
3. Provide direct electrically operated actuators for forced-draft air damper, and oil metering valve. Pneumatic actuators are not permitted.
4. Provide self-checking flame detection suitable for monitoring pilot and main flame, flame safeguard controller, and first-out annunciation.
5. Provide furnace draft control with DP transmitter, pressure cutout switch and modulating stack damper actuator.
6. Provide variable-speed combustion blower control including variable-speed motor controller (VSD) and replacement TEFC blower motor sized for the burner.
7. Provide 3 element drum water level control and safety system.
8. Replace pneumatically controlled feedwater valve with electrically operated v-ball valve.
9. Provide O₂ trim system with in-situ probe and zirconia sensor, automatic calibration, and feedback to blower VSD.
10. Provide fuel-oil metering valve, low/high pressure switches, and complete replacement of No. 2 fuel oil train compliant with NFPA 85.
11. Provide replacement burner-mounted fuel atomizing media system capable of utilizing either plant compressed air or medium-pressure steam
12. Provide stack oxygen and temperature probes, draft sensor, and efficiency readout.
13. Integrate steam, and oil flow meters to display on HMI with trending.
14. Perform burner tuning for No. 2 oil firing and verify proper O₂ trim and draft stability.

B. General Requirements:

1. All panels UL 508A labeled, NEMA 12, segregated power/control wiring, LED lighting, and GFCI outlet.
2. Perform complete I/O checkout, dry-sequence test, valve-proving test, pilot and main flame light-off, O₂ trim tuning, and safety-trip verification.
3. Provide a replacement Plant Master Controller and integrate it with Boilers 1, 2, 3 for supervision and sequencing of boilers. Plant master controller shall be a PLC type.

1.4 SUBMITTALS

- A. Waiver of Submittals: The "Waiver of Certain Submittal Requirements" in Section 013300 does not apply to this Section.
- B. Submittal Package: Submit the shop drawings, product data and quality control submittals specified below at the same time as a package.
- C. Shop Drawings: Certified detailed drawings for Plant Master Controller and individual boiler panels.
- D. Product Data: Catalog sheets, performance charts, test data, standard schematic drawings, specifications and installation instructions for all controls and instruments.
- E. Quality Control Submittals
 1. Certificates: Manufacturer's certified letters of agreement, in accordance with this section of the Specification, for the providing of the services of qualified field service engineers

for the supervision of the installation; service of installed control system and on-site training of State Operating Personnel.

F. Contract Closeout Submittals

1. Operation and Maintenance Data: Deliver 2 copies, covering the installed products, to the Director's Representative.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Electrical components shall be UL listed and labeled.

B. Company Field Advisor: The services of the Company Field Advisor are included in the allowance for the following:

1. Render advice regarding installation and final adjustment of the boiler and controls in coordination with the boiler manufacturer's Company Field Advisor.
2. Visit the Site upon completion of boiler to inspect the Work, and to notify the Director's Representative of any Work which must be done or modified prior to NYS Department of Labor inspection.
3. Assist in the initial firing of boilers.
4. Witness final system test and then certify with an affidavit that the boiler control system is installed in accordance with the Contract Documents and is operating properly.
5. Train facility personnel on the operation and maintenance of the system (minimum of three 8 hour sessions).

PART 2 - PRODUCTS

2.1 BOILER COMBUSTION CONTROL SYSTEM

A. General: Supply a self-contained Boiler Control System to provide both electricity and fuel savings within the limits of stable burner operation. The control system shall be suitable for wall or boiler-front mounting. Provide logic required to ensure automated pre-purge, post-purge, light-off, and burner modulating cycles. Provide a 12-inch HMI designed to provide local operation, graphic display of information, alarm messages, historical and real-time trending, controller tuning, fuel-air curve data, ethernet connectivity, and browser-based remote communication. The HMI shall be networked to the boiler control and burner management systems.

1. Acceptable Manufacturers:

- a. Rockwell Automation Allen-Bradley CompactLogix PLC with 12-inch HMI.
2. Cleaver-Brooks.
3. Combustion Control: A PID-based, parallel positioning control strategy shall position the oil-metering valve and combustion air final control elements with independent servo motors while regulating the forced draft fan speed via VSD. The system shall continuously trim the fuel/air ratio based on measured flue gas O₂ levels for minimum fuel consumption and for maintaining stable combustion. Systems that control forced draft fan speed based solely on burner wind box pressure are not acceptable. Firing rate shall modulate in response to an external Plant Master demand signal or drum pressure compared to setpoint.
 - a. Boiler Firing Rate

- b. Boiler Steam Pressure
 - c. Drum/Boiler water level
 - d. Drum Pressure Setpoint
 - e. Boiler Efficiency
 - f. Trim %, Flue Gas Oxygen Setpoint
 - g. Flue Gas Oxygen
 - h. Flue Gas Temperature
 - i. Fuel and Air Damper Position
 - j. VSD speed and alarm messages for boiler low pressure, high pressure, high flue gas temperature, low O₂, low O₂ trip, fuel trip, damper trip, VSD trip, and oxygen cell fault
4. The control system shall include a dedicated, normally energized, fail-safe relay output contact in the running interlock circuit of the flame safeguard that will cause a fired equipment shutdown in the event of low O₂, air damper/fuel valve actuator fault, VSD fault, or controller fault. Provide high flue gas temperature lockout. Include minimum air flow pressure switch and purge air flow pressure switch safe-start check.
 5. Boiler Efficiency Display: Calculations shall be based on the ASME by-losses method and must utilize real-time inputs of boiler firing rate, flue gas O₂, flue gas temperature, and No. 2 fuel oil parameters, allowing the boiler operator to identify inefficiencies and potential operational problems. Adjustable fuel chemistry data parameters shall be included, and firing-rate-scaled radiation losses shall be used for maximum accuracy. Calculations that rely on fixed constants or manually input values for measured conditions are not acceptable. Provide and install flue gas temperature transmitters at the boiler outlet.
 6. Boiler Controllers: To assure system integrity, provide a pre-wired and factory-tested, microprocessor-based, programmable controller system. The controller shall include programmable memory, 120 Vac discrete inputs and outputs, and 4-20 mA dc analog inputs and outputs. Configuration and calibration data shall be stored on non-volatile memory. All control logic, tuning, and fuel/air ratio curves shall be field configurable by authorized personnel.
 - a. Hardware features shall include the following as a minimum:
 - 1) 10 or 12" Color touchscreen
 - 2) Ethernet communication, 10 BASE-T / 100 BASE-TX, RJ45 jack connection with protocols: web enabled, Modbus TCP/IP, Allen-Bradley DF1 Master, and OPC.
 - 3) Field-replaceable backlight, real-time clock, battery-backed clock, time-stamped critical data, 8 MB on-board flash application memory, 512 MB memory card, expanded memory card for historical alarm and event storage, resistive analog touch screen, and adjustable formatting to fit target shape.
 - b. Software features shall include the following:
 - 1) Operation interaction shall be touch screen based to allow for easy selection of screens, manual / automatic status changes, start/stop functions, setpoint changes, output changes and PID tuning parameters without any special programming skills. Screen selection shall also be available through tactile feedback function keys.
 - 2) The HMI shall provide facsimiles of the local loop controllers and clearly labeled English language and engineering unit display of the control parameters. When the HMI is used with the boiler fuel/air ratio control, provide automated fuel/air ratio curve and oxygen trim setpoint curve adjustment for burner setup. Provide required profile for No. 2 fuel oil.
 - c. Graphic Display: Information shall be displayed on the HMI as part of an easy-to-understand pictorial representation of the steam boiler and burner process. At a

minimum, provide individual boiler overview and individual control loop overview screens for each boiler. Display boiler status, flame failure, fuel flow, combustion air temperature, flue gas temperature, boiler efficiency by ASME losses method, VSD speed, controlled variables, process variables, trends, and alarms. Display values in engineering units adjacent to the pictorial point of measurement.

- d. Tuning: Following password entry, each controller in the system shall be capable of tuning gain, reset rate, and other important parameters via the HMI. These functions shall be password protected for security.
 - 1) Fuel vs. Firing Rate
 - 2) Fuel vs. Variable Speed Drive (VSD) Demand
 - 3) Fuel vs. Flue Gas Oxygen Setpoint
 - 4) Firing Rate vs. Exhaust Temperature
- e. Alarm and Event Generation: Display alarm status on HMI process pictorials. Log alarms and events in an alarm and event log. The alarm log shall indicate the time each alarm occurred, the time each alarm was acknowledged, and the time each value returned to normal status. The log shall also document status changes such as transfer from automatic to manual and setpoint changes so that alarms and events form a complete log of plant operating conditions.
- f. Historical and Real-Time Trending: The HMI shall include up to ten (10) historical and real-time trend displays with up to four traces per chart. Provide adjustable time ranges from minutes to 2 hours and chart cursor function to display the value of each trace at a selected point. Real-time data shall be displayed when a trend is first displayed.
- g. The HMI shall automatically create a historical data file.
- h. Flame Safeguard Interface: The HMI shall have dedicated communications interface between the HMI and the Flame Safeguard system to allow all alarms to be graphically represented and summarized. The HMI must be capable of displaying and recording the following statistics: Burner Limits, Individual Lockouts, Burner Operational Hours, Total Burner Cycles, Burner Status, Last Six Lockouts, Total Lockouts, and Flame Signal Strength.

2.2 MICRO-PROCESSOR BASED BURNER MANAGEMENT AND FLAME SAFETY SYSTEM (BMS)

A. General:

- 1. Furnish the complete system for the operation of boiler. All external components shall be included as part of the entire control system except as noted.
- 2. Control systems shall be engineered, assembled, fabricated and tested at the factory of manufacturer of electronic flame failure, limit and interlock safety system in conjunction with burner piping trains and miscellaneous components.

B. Acceptable Manufacturers

- 1. Fireye YB110 with E300, or approved equivalent
- 2. Fireye Nexus 6100, or approved equivalent
- 3. Honeywell 7800, or approved equivalent

C. Types:

- 1. Fully automatic preprogrammed sequence.

2. Non-recycling.
3. For No. 2 fuel oil main firing with propane pilot ignition.
4. Capable of automatic start from operator interface unit.

D. Performance:

1. Provide a non-recycling Burner Management and Flame Safety System designed to safely fire No. 2 fuel oil with propane pilot ignition.
2. The principal logic provided with the Burner Management System shall:
 - a. Prevent the introduction of any ignition flame or main fuel flame to the furnace until it is proven that the furnace has been sufficiently purged of any residual combustible gases.
 - b. Provide pre-purge duration required by NFPA 85 for watertube boilers.
 - c. Confirm proof of open or closed position of safety shut-off valves located in the fuel feed and propane pilot systems as required by NFPA 85.
 - d. Correctly limit the trial time period for the establishment of the main flame after the pilot ignition flame has been proven.
 - e. Require the operator to manually reset the system after a boiler trip or flame failure occurrence.
3. The Burner Management System shall, upon acknowledging the loss of main flame, automatically drive the safety shut-off valves in the fuel lines into the closed position within four (4) seconds or less.
4. The Burner Management System shall include self-checking UV/IR flame detection suitable to monitor both the pilot ignition flame and the main fuel flame. Locate the scanner head to view pilot and main flame. Mount the flame viewing head on a gimbal-type swivel mount that provides universal movement for flame sighting. Send the output signal from the flame monitor directly to the microprocessor-type amplifier module via shielded cable in dedicated conduit.
5. Provide first-out alarm annunciation.
6. In case of electrical failure all safety shutoff valves shall close, timers shall automatically reset, and the system shall be reset by the operator pressing the 'Start' button.
7. After a normal and emergency shutdown of the system shall drive the FD fan damper and windbox damper and register to purge position and hold fan on at 100% speed for thirty (30) seconds for post purging of the furnace after which the fan will be de-energized and damper controls released. The fan shall shut down immediately for a flame failure condition.
8. The same purge cycle shall be included in boiler startup before light off.
9. Provide low-consumption devices for equipment requiring compressed air.
10. Provide system provisions to prevent nuisance burner shutdown due to momentary power interruptions of up to 500 milliseconds.
11. Provide tamperproof timers.
12. Coordinate with the plant control system.

E. Provide the following switches and provisions in addition to sensors and limit switches specified for burner trains:

1. High steam drum pressure switch.
2. Steam drum high water level switch.
3. Steam drum low water level switch.
4. Low atomizing air pressure switch.
5. Vortex and outlet damper position switches minimum for light off and full open for purge.

- F. Panel Mounted Equipment (arrangement as approved by Engineer). Note: These indicators can be excluded from panel front if included within the panel front HMI.
1. Panel Lights:
 - a. Power on - white.
 - b. Purge in Progress - green.
 - c. Purge Air Flow Adequate - green.
 - d. Purge Complete - green.
 - e. Pilot Flame - blue.
 - f. Main Flame - blue.
 - g. Main fuel valve energized - red.
 - h. FD fan ON auto - green.
 - i. FD fan on manual - yellow.
 - j. FD fan OFF - red.
 2. Pushbuttons:
 - a. Burner Start.
 - b. Burner Stop.
 - c. FD Fan Start, hand-off-auto (Fan is set at 100% speed in "Hand" position).
 - d. FD Fan Stop.
 - e. Remote/Local Switch
- G. Provide complete limit circuits for the following conditions and functions:
1. Flame Failure (alarm and trip).
 2. Fuel Valve Closed (alarm).
 3. FD Fan ON interlock (alarm and trip). (Differential pressure sensor across fan inlet and windbox).
 4. High Water Level (alarm).
 5. Low Water Level (alarm and trip).
 6. High Steam Pressure.(alarm and trip).
 7. Minimum Air Flow (alarm and trip).
 8. Proof of purge air flow.
 9. Low Oil Pressure (alarm and trip)
 10. Low Atomizing Air Pressure (alarm)
- H. When activated, the alarm horn to sound and an annunciator light and main alarm light to be illuminated. Provide an alarm horn silencing switch but the circuit arrangement will not prevent the alarm from sounding upon the subsequent failure of any limit. The failure of burner or operation of any limit causing a burner shutdown will sound the alarm and energize a main alarm light on top of panel and annunciator light suitably identified as to make known which limit has caused the shutdown. Parallel alarm points shall be sent to the boiler plant SCADA system in the control room which will display a general boiler failure.
- I. Terminal Blocks: Shall be provided for the termination of all cabinet or panel wiring with numbered or identified terminals for the connection of field-erected components. Wire and equipment code shall conform to that submitted on shop drawings. Supply 10% spare terminals on terminal strip.
- J. Mounting Components: All panel components and devices shall be factory mounted to be readily observed and accessible. Switches mounted on switch plates or panels shall be arranged in a neat

and approved manner and to conform where possible to the position of the equipment controlled or indicated. No externally visible item shall be mounted to be within 32" of the floor.

K. Flame Sensing Device

1. Furnish and install for each burner a proven self-checking UV/IR flame-sensing device capable of sensing both pilot and main flame and electronic relay of the self-check type. Locate scanners to view the pilot and main burner flame properly. Provide solid-state circuitry with built-in voltage regulation and supervised circuit. Scanner locations must be approved by the manufacturer of the electronic flame safety relay. Protect the scanner from excessive temperatures and dirt by heat-insulating nipple and air purging device. Provide housing suitable for temperatures encountered. Mount shall be ball-and-socket type.

L. Panel Lights

1. LED type.

M. Panel

1. Fully enclosed, dust tight. Free Standing.
2. Fabricated from steel:
3. NEMA - 12.
4. Not less than 10 gauge furniture steel.
5. Fabricated with reinforcing members to sustain forces and stresses that may be encountered during shipping, installation and operation.
6. Sheets shall be smooth and level containing no flaws.

N. Doors:

1. Continuous piano type hinge, full length.
2. Full size on front of panel.
3. Gasketed.
4. With locking mechanism contained in handle and 2 keys.
5. Finishing: Steel surfaces shall be prepared for painting by grinding, sandblasting, straightening, etc. After surface preparation, all surfaces shall be cleaned with solvent and painted on the outside with a heavy duty, rust resistant primer and sprayed with two (2) coats of machinery grade lacquer.
6. Panel interior shall be prepared as described above and finished with primer and two (2) coats of white machinery grade enamel.

O. Wiring:

1. In accordance with National Electrical Code and with local regulations.
2. Control wiring No. 16 gauge (minimum) stranded with 600 V THHN insulation.
3. Wiring formed into neat bundles and secured with plastic ties.
4. Wiring to be run in troughs or raceways.
5. Power wiring to be cabled and tied or run in metallic raceways.
6. Wiring to be connected to external circuits to terminate at terminal strips.
7. Each terminal has an identifying number.
8. Terminal strips to have not less than 10% spare terminals.
9. Terminal strips are located at least 6" below top of panel enclosure.

10. Connections to terminals to be with IEC finger safe terminal blocks.
11. All wires to be tagged with adhesive backed markers.
12. Convenience outlets provided on inside and outside of panel.

P. Panel Illumination:

1. Two (2) parallel LED lamps.
2. Front mounted toggle switch.

Q. Inspection and testing of control panels:

1. Operational tests.
 - a. Wiring to be meggered and then subjected to dielectric test for one minute between live parts and ground.

R. Nameplates:

1. Each panel to be provided with nameplate with one (1) inch high letter. All components to be labeled with laminated identification plates, 'lamacoid' type attached to panel with two bronze screws.
2. Provide space in panel for instrumentation and controls specified in this section.

2.3 PARALLEL POSITIONING COMBUSTION

- A. Provide parallel positioning combustion control with oxygen trim.
- B. Individual Boiler Master Controllers shall drive actuators for the fuel and air final control elements. Fuel and air must be cross-limited to avoid a fuel-rich atmosphere during load changes.
- C. Individual airflow/oxygen trim controllers shall drive variable frequency drives for modulation of boiler airflow. Fine tune airflow through an oxygen trim control loop to maintain optimum combustion efficiency. Field instrumentation associated with this portion of the control system shall include oxygen analyzers with calibration stations.

2.4 SERVO MOTORS

A. Features:

1. Fastest actuating time for 90° angle of rotation: 30 seconds
2. Slowest actuating time for 90° angle of rotation: 126 seconds
3. Nominal torque: 3ft.-lb. to 37 ft.-lb
4. Maximum angle of rotation: 100°
5. Positioning Accuracy: +/- 0.1 °
6. Nominal voltage 24 VDC ± 10%
7. Nominal power consumption: 5W nominal, 7.5W peak
8. Angle of rotation limited by: Firmware
9. Degree of protection: NEMA 4 IP 65 (see note below)
10. Installation orientation: Any
11. Working temperature range: -4°F to +140°F (-20°C to +60°C)
12. Duty cycle: 100%

2.5 OXYGEN ANALYZER AND TRIM

- A. Furnish and install one (1) oxygen analyzer on each boiler. The analyzers shall be installed in the outlet breech.. To maximize reliability the oxygen analyzer shall have no moving parts, pumps or sample lines.
- B. The analyzer shall be of the direct probe type utilizing a zirconium oxide electrolyte.
- C. This element shall be in direct contact with the flue gas. The analyzer reaction time of the O₂ trim shall not be longer than 5 seconds, to changes as measured at the sensor. Oxygen measurement accuracy +/- 1% of value.
- D. The analyzer shall be equipped with a facility to allow "in place" calibration without removing the analyzer from the process.
- E. All parts in contact with the flue gas shall be constructed of 316 S.S.
- F. The analyzer shall be capable of operating in flue gas temperatures up to 1300°F. Circuit boards and heat sensitive electronic components shall be mounted away from the high heat location of the oxygen probe and breeching.
- G. The power source shall be 120 volts 60 Hz. A microprocessor-based electronic control package and indicator shall be mounted in a NEMA 4 enclosure for local installation.
- H. The control package shall supply an output of 4-20 mA, representing 0-20 % oxygen as a log or linear function.
- I. Operator interface shall be permitted from a menu driven format provided by an alphanumeric display and general-purpose keyboard located on the control unit. Displays shall include:
 - 1. System OK
 - 2. Calibration in Progress
 - 3. Calibration Error
 - 4. Heater Error
 - 5. Test Gas is Low
 - 6. High O₂
 - 7. Low O₂
 - 8. Resistance High
- J. Analyzer shall come complete with all accessories required such as reference air set with filter regulator, sensor heater, flue gas thermocouple, pressure gauge and air flow rotameter.
- K. Subject to compliance with the specifications, furnish the products of one (1) of the following manufacturers:
 - 1. Fireye NX 6083
 - 2. Yokogawa
 - 3. Rosemount
 - 4. ABB

2.6 FURNACE DRAFT CONTROL

- A. DP Transmitter: Provide span suited to installation, typically -1.0 to +1.0 inches w.c.; accuracy +/-0.25 percent of span; impulse lines with isolation and traps as needed.
- B. Stack Damper Actuator: Electric actuator with position feedback; full stroke 10-20 seconds; mechanical end stops; interlocked to CCS.
- C. Control: CCS PID with feedforward from firing rate.

2.7 FLAME DETECTION (PILOT & MAIN)

- A. Provide one self-checking UV/IR flame scanner per boiler, or alternate self-checking flame detection arrangement approved by the burner management system manufacturer, suitable for pilot and main flame detection in accordance with NFPA 85. Provide scanner air purge where required by temperature, soot, or manufacturer requirements.
- B. Provide sight ports at proper angle and line of sight with sleeves, plugs, and high-temperature gaskets.
- C. Basis of Design: Fireye 45UV5-1009 self-check UV and Fireye 95IRF IR, or equal system approved by burner management system manufacturer.

2.8 NO. 2 FUEL OIL TRAIN

A. General Requirements:

- 1. Furnish and install a complete replacement No. 2 fuel oil train for each boiler burner.
- 2. Provide all valves, strainers, instruments, switches, transmitters, test ports, wiring, supports, and accessories required for a fully operational and NFPA 85 compliant system.
- 3. All components shall be specifically rated for No. 2 fuel oil service.
- 4. Minimum pressure class shall be ASME Class 300 unless burner OEM requires higher.
- 5. Minimum temperature rating 250°F.
- 6. All safety devices shall be hardwired into the flame safeguard safety circuit.
- 7. Provide complete piping spool assembly where feasible to minimize field joints.
- 8. Provide engraved phenolic tags on all components.

B. Fuel Oil Train Components

- 1. Arrange in flow direction from upstream supply toward burner.
- 2. Upstream Manual Isolation Valve
 - a. Type: Full port ball valve
 - b. Rating: 600 WOG minimum or ASME Class 300
 - c. Body: Carbon steel
 - d. Acceptable manufacturers:
 - 1) Apollo 77C Series
 - 2) NIBCO T-595-CS-66
 - e. Provide locking handle
- 3. Duplex Basket Strainer with Differential Pressure Indication
 - a. Type: Changeover duplex basket strainer

- b. Basket: Stainless steel
 - c. Mesh: 60 to 100 mesh unless burner OEM requires otherwise
 - d. Body: Cast or forged steel, Class 300
 - e. Provide either:
 - 1) Differential pressure gauge across strainer, or
 - 2) Two pressure gauges upstream and downstream with calculated differential
 - f. Basis of design:
 - 1) Eaton Model 53BTX Duplex
 - 2) Keckley Duplex Basket Strainer
4. Oil Supply Pressure Gauge (Upstream of Safety Valves)
- a. Dial: Minimum 4.5 inch
 - b. Type: Industrial, liquid filled where vibration exists
 - c. Range: Sized so normal operating pressure is mid-scale
 - d. Basis of design:
 - 1) Ashcroft 1009 or 1035
 - 2) WIKA industrial series
 - e. Provide gauge root valve and snubber
5. Oil Temperature Gauge
- a. Type: Dial thermometer with stainless thermowell
 - b. Range: Suitable for expected No. 2 oil temperature, minimum 0-250°F
 - c. Provide thermowell and isolation
 - d. Basis of design:
 - 1) Ashcroft
 - 2) WIKA
6. Low Oil Pressure Switch (Trip)
- a. Function: Burner trip on low oil pressure
 - b. Type: Industrial pressure switch, SPDT
 - c. Adjustable setpoint
 - d. Hardwired into flame safeguard safety circuit
 - e. Provide isolation valve and test port
 - f. Acceptable manufacturers:
 - 1) United Electric H100 Series
 - 2) Ashcroft B4 Series
 - 3) SOR Series
7. High Oil Pressure Switch (Alarm)
- a. Function: Alarm at HMI and Plant Master
 - b. Type: Industrial pressure switch
 - c. Adjustable setpoint
 - d. Provide isolation and test capability
 - e. Acceptable manufacturers same as low pressure switch
8. Two Motorized Safety Shutoff Valves (SSV-1 and SSV-2)
- a. Quantity: Two in series
 - b. Type: Electrically actuated, normally closed
 - c. Service: Fuel oil rated
 - d. Closure time: System shall shut off fuel within 4 seconds of trip
 - e. Rating: ASME Class 300
 - f. Fail safe: Spring return closed on loss of power
 - g. Acceptable manufacturers:
 - 1) Maxon oil-rated shutoff valves
 - 2) Emerson ASCO oil service models
 - 3) Burner OEM packaged oil shutoff valves approved by Engineer

9. Proof-of-Closure Switches
 - a. Provide proof-of-closure switches on safety shutoff valves where required by the flame safeguard valve-proving logic. If selected valve models do not support integral switches, provide equivalent external proof devices approved by the burner management system manufacturer.
 - b. Integrate into permissive logic.
 - c. Provide terminal block wiring.
 - d. Wire to terminal blocks in burner management panel
10. Leak Test Ports
 - a. Provide valved test ports between SSV-1 and SSV-2
 - b. Provide additional test cocks upstream and downstream as required
 - c. Provide caps and chains
 - d. Provide labeling for leak testing
11. Oil Metering Valve with Electric Actuator
 - a. Function: Primary modulating fuel control valve
 - b. Type: Characterized V-ball or globe suitable for fuel oil
 - c. Actuator: Electric, 4-20 mA or digital signal
 - d. Provide position feedback to PLC
 - e. Provide local mechanical position indication
 - f. Valve sized for full firing rate and stable low-fire operation
 - g. Minimum rangeability 50:1
 - h. Basis of design:
 - 1) Fisher V150 with electric actuator
 - 2) Burner OEM supplied metering valve assembly
12. Oil Return Valve
 - a. Provide oil return/bypass valve arrangement where required by burner OEM.
 - b. Provide check valve where reverse flow possible
 - c. Provide isolation valves for maintenance
13. Fuel Oil Flow Meter and Transmitter
 - a. Type: Positive displacement or Coriolis
 - b. Accuracy: ± 1 percent of reading
 - c. Output: 4-20 mA to PLC
 - d. Provide totalized and instantaneous display on HMI
 - e. Provide isolation valves
 - f. Acceptable manufacturers:
 - 1) AW-Lake JVKG
 - 2) Emerson Micro Motion
 - 3) Badger oil-rated meters meeting accuracy
14. Isolation Valves for Maintenance
 - a. Provide full port ball valves at:
 - 1) Strainer inlet and outlet
 - 2) Flow meter inlet and outlet
 - 3) Control valve inlet and outlet where accessible for maintenance and compatible with burner operation.
 - 4) Pressure switch tapings
 - b. Rating to match piping class
15. Fuel Safety Shutdown Requirement
 - a. Upon any safety trip, both safety shutoff valves shall de-energize and close.
 - b. Total fuel isolation shall occur within 4 seconds.
 - c. Flame safeguard shall monitor valve status.
 - d. Failure to achieve closed proof shall initiate alarm and lockout.

C. Additional Performance Requirements

1. Provide a complete fuel oil P&ID for each boiler with all components tagged.
2. Submit valve C_v calculations and actuator sizing.
3. Submit safety shutoff valve closure time certification.
4. Submit flow meter sizing calculations.
5. Submit wiring diagram for all switches and proof-of-closure devices.
6. Provide field test procedure for leak test verification.

2.9 PROPANE PILOT GAS TRAIN

A. Furnish and install a complete propane pilot gas train for each boiler burner.

1. Pilot system shall comply with NFPA 85 and NFPA 54.
2. Pilot gas shall be propane (LPG) supplied from the plant propane system.
3. All components shall be listed or approved for LP gas service.
4. Pilot gas train shall be independent of the main fuel oil train.
5. All safety devices shall be hardwired into the flame safeguard safety circuit.
6. Provide all valves, regulators, strainers, switches, gauges, test ports, tubing, fittings, supports, and wiring required for a complete operational system.
7. Provide engraved phenolic tags on all components.
8. All threaded connections shall be NPT with approved LP-rated thread sealant. Flanged connections shall be Class 150 minimum unless upstream pressure requires higher rating.

B. Pilot Gas Train Components

1. Arrange in flow direction from upstream propane supply toward pilot burner assembly.
2. Upstream Manual Isolation Valve
 - a. Type: Full port ball valve
 - b. Rating: Minimum 600 WOG
 - c. Body: Brass or carbon steel rated for LP gas
 - d. Lockable handle required
 - e. Acceptable manufacturers:
 - 1) Apollo 70 Series
 - 2) NIBCO LP-rated ball valves
3. Gas Strainer
 - a. Type: Y-strainer suitable for LP gas
 - b. Screen: Stainless steel, removable
 - c. Provide blow-off plug for cleaning
 - d. Acceptable manufacturers:
 - 1) - Maxitrol GS Series
 - 2) - Watts Y-strainer LP-rated
4. Pilot Gas Pressure Gauge (Upstream of Regulator)
 - a. Dial: Minimum 2.5 inch
 - b. Range: Sized to display supply pressure accurately
 - c. Provide gauge cock and test port
 - d. Acceptable manufacturers:
 - 1) - Ashcroft
 - 2) - WIKA
5. Gas Pressure Regulator

- a. Type: Lock-up type regulator for propane
- b. Sized for pilot firing rate
- c. Provide vent limiter or vent piping per NFPA 54
- d. Outlet pressure adjustable to burner manufacturer requirement
- e. Acceptable manufacturers:
 - 1) - Maxitrol 325 Series
 - 2) - Fisher 299H
 - 3) - Emerson TESCO LP-rated regulators
- 6. Low Gas Pressure Switch (Trip)
 - a. Function: Prevent pilot ignition and trip burner on low pilot gas pressure
 - b. Type: Industrial diaphragm switch
 - c. Hardwired into flame safeguard
 - d. Adjustable setpoint
 - e. Acceptable manufacturers:
 - 1) - Dungs LGW Series
 - 2) - United Electric H100 Series
 - 3) - SOR LP-rated switches
- 7. High Gas Pressure Switch
 - a. Adjustable setpoint.
 - b. Provide alarm at HMI and Plant Master. Hardwire into safety circuit where required by burner OEM or flame safeguard manufacturer.
 - c. Acceptable manufacturers same as low pressure switch.
 - d. Acceptable manufacturers same as low pressure switch
- 8. First Safety Shutoff Valve (SSV-P1)
 - a. Type: Normally closed solenoid valve
 - b. Listing: UL listed for LP gas
 - c. Voltage: Match control voltage
 - d. Fail-safe: Closed on loss of power
 - e. Acceptable manufacturers:
 - 1) - ASCO 8210G Series (LP rated)
 - 2) - Honeywell V5055
 - 3) - Dungs solenoid valves
- 9. Second Safety Shutoff Valve (SSV-P2)
 - a. Installed in series with first
 - b. Same listing and requirements as SSV-P1
 - c. Provide independent wiring
- 10. Proof-of-Closure Switches
 - a. Provide proof-of-closure switches on safety shutoff valves where required by the flame safeguard valve-proving logic. If selected valve models do not support integral switches, provide equivalent external proof devices approved by the burner management system manufacturer.
 - b. Integrate into permissive logic.
 - c. Provide terminal block wiring.
 - d. Provide terminal block wiring
- 11. Vent Valve / Valve-Proving Provisions
 - a. Provide vent valve between SSV-P1 and SSV-P2 where required by NFPA 85, NFPA 54, or the approved flame safeguard valve-proving arrangement.
 - b. Vent piping routed to safe location per NFPA 54
 - c. Provide flame arrestor where required by NFPA 54 or approved pilot gas train design.
- 12. Leak Test Ports

- a. Provide valved test ports upstream and between safety shutoff valves
- b. Provide caps and labeling
- c. Allow verification of seat tightness
- 13. Pilot Gas Flow Adjustment Valve
 - a. Provide needle or metering valve as required by burner OEM
 - b. Lockable adjustment
 - c. Located downstream of safety shutoff valves
- 14. Pilot Burner Assembly
 - a. Provide pilot burner sized for reliable main flame ignition
 - b. Stainless steel construction
 - c. Stable flame at low fire and purge draft conditions
 - d. Provide mounting bracket and viewing arrangement
- 15. Ignition Transformer / Igniter
 - a. Type: High energy spark igniter
 - b. Insulated cable rated for boiler front temperature
 - c. Ceramic electrode with adjustable gap
 - d. Acceptable manufacturers:
 - 1) Fireye
 - 2) Honeywell
 - 3) Coen-compatible ignition systems

2.10 ATOMIZING MEDIA SYSTEM

- A. Furnish and install a complete burner-mounted atomizing media system for each oil-fired boiler capable of operation using either plant compressed air or medium-pressure steam as the atomizing medium. Final arrangement and operating pressures shall be in accordance with the burner manufacturer's requirements.

- 1. System shall utilize plant compressed air supply and medium pressure steam.
- 2. All components shall be rated minimum 150 psig working pressure.
- 3. Loss of atomizing air pressure shall trip the burner.
- 4. All safety devices shall be hardwired into the flame safeguard circuit.
- 5. Provide all valves, filtration, regulation, gauges, switches, tubing, supports, and wiring required for a complete and operable system.
- 6. OEM-recommended steam pressure regulating/conditioning components

B. Components

- 1. Manual Isolation Valve
 - a. Full port ball valve, 600 WOG minimum
 - b. Apollo 77C or equal
- 2. Primary Filter / Regulator
 - a. 5 micron filtration minimum
 - b. Metal bowl construction
 - c. Adjustable outlet pressure
 - d. Basis of design: SMC AW Series (metal bowl) or Wilkerson FRP Series
- 3. Moisture Separator with Drain
 - a. Automatic float drain
 - b. Wilkerson or Parker industrial series
- 4. Pressure Gauge

- a. 2.5 inch minimum dial
 - b. Range 0-60 psig unless burner OEM requires otherwise
 - c. Ashcroft or WIKA industrial series
- 5. Low Atomizing Air Pressure Switch (Trip)
 - a. Adjustable industrial pressure switch
 - b. Hardwired into flame safeguard
 - c. Basis of design: United Electric H100, Ashcroft B4, or SOR
- 6. High Atomizing Air Pressure Switch (Alarm)
 - a. Adjustable setpoint
 - b. Alarm to HMI and Plant Master
- 7. Relief Valve
 - a. Spring-loaded relief valve
 - b. Set above normal operating pressure
 - c. Conbraco or Watts industrial series
- 8. Solenoid Valve
 - a. Normally closed
 - b. Fail closed on power loss
 - c. ASCO or Parker industrial series
- 9. Check Valve
 - a. Spring-loaded
 - b. Prevent backflow from burner oil system
- 10. Final Needle / Flow Adjustment Valve
 - a. Lockable adjustment
 - b. Stainless construction

C. Performance Requirements

- 1. Provide regulated pressure per burner OEM requirements.
- 2. Dew point of supply air shall be minimum 20°F below boiler room ambient.
- 3. Burner shall not initiate ignition unless atomizing air pressure is proven.
- 4. Loss of atomizing air during firing shall cause immediate safety shutdown.
- 5. Record final operating pressure during commissioning.

2.11 FORCED-DRAFT FAN VARIABLE FREQUENCY MOTOR CONTROLLER

- A. The variable speed drive (VSD) shall provide full rated output from a line of +/-10 percent of nominal voltage. The VSD shall continue to operate without faulting from a line of +30 percent to -35 percent of nominal voltage.

- 1. VSDs shall be capable of continuous full-load operation under the following environmental operating conditions:
 - a. -15 to 40° C (5 to 104° F) ambient temperature. Operation to 50° C shall be allowed with a 10% reduction from VSD full load current.
 - b. Altitude 0 to 3300 feet above sea level. Operation to 6600 shall be allowed with a 10% reduction from VSD full load current.
 - c. Humidity less than 95%, non-condensing.

- B. All VSDs shall have the following standard features:

- 1. All circuit boards shall be coated to protect against corrosion.

2. All VSDs shall have the same customer interface, including digital display, and keypad, regardless of horsepower rating. The keypad shall be removable, capable of remote mounting and allow for uploading and downloading of parameter settings as an aid for start-up of multiple VSDs.
3. The keypad shall include Hand-Off-Auto selections and manual speed control. The drive shall incorporate "bumpless transfer" of speed reference when switching between "Hand" and "Auto" modes. There shall be fault reset and "Help" buttons on the keypad. The Help button shall include "on-line" assistance for programming and troubleshooting.
4. There shall be a built-in time clock in the VSD keypad. The clock shall have a battery backup with 10 years minimum life span. The clock shall be used to date and time stamp faults and record operating parameters at the time of fault. VSD programming shall be held in non-volatile memory and is not dependent on battery power
5. The VSD's shall utilize pre-programmed application macros specifically designed to facilitate start-up. The Application Macros shall provide one command to reprogram all parameters and customer interfaces for a particular application to reduce programming time. The VSD shall have two user macros to allow the end-user to create and save custom settings.
6. The VSD shall have cooling fans that are designed for easy replacement. The fans shall be designed for replacement without requiring removing the VSD from the wall or removal of circuit boards. The VSD cooling fans shall operate only when required, based on the temperature of and run command to the drive. VSD protection shall be based on thermal sensing and not cooling fan operation.
7. The VSD shall be capable of starting into a coasting load (forward or reverse) up to full speed and accelerate or decelerate to set point without tripping or component damage (flying start).
8. The VSD shall have the ability to automatically restart after an over-current, overvoltage, under-voltage, or loss of input signal protective trip. The number of restart attempts, trial time, and time between attempts shall be programmable.
9. The overload rating of the drive shall be 110% of its normal duty current rating for 1 minute every 10 minutes, 130% overload for 2 seconds every minute. The minimum FLA rating shall meet or exceed the values in the NEC/UL table 430.250 for 4-pole motors.
10. VSDs through 200 HP shall have internal swinging (non-linear) chokes providing impedance equivalent to 5% to reduce the harmonics to the power line. Swinging choke shall be required resulting in superior partial load harmonic reduction. Linear chokes are not acceptable. 5% impedance may be from dual (positive and negative DC bus) chokes, or 5% swinging AC line chokes. VSD's with only one DC choke shall add an AC line choke.
11. The input current rating of the VSD shall not be greater than the output current rating. VSD's with higher input current ratings require the upstream wiring, protection devices, and source transformers to be oversized per NEC 430.122. Input and output current ratings must be shown on the VSD nameplate.
12. The VSD shall include a coordinated AC transient surge protection system consisting of 4 MOVs (phase to phase and phase to ground), a capacitor clamp, 1600 PIV Diode Bridge and internal chokes. The MOV's shall have a minimum 125 joule rating per phase across the diode bridge. VSDs that do not include coordinated AC transient surge protection shall include an external TVSS (Transient Voltage Surge Suppressor).
13. The VSD shall provide a programmable loss-of-load (broken belt / broken coupling) Form-C relay output. The drive shall be programmable to signal the loss-of-load condition via a keypad warning, Form-C relay output, and / or over the serial communications bus. The loss-of-load condition sensing algorithm shall include a programmable time delay that will

allow for motor acceleration from zero speed without signaling a false loss-of-load condition.

14. The VSD shall include multiple "two zone" PID algorithms that allow the VSD to maintain PID control from two separate feedback signals (4-20mA, 0-10V, and / or serial communications). The two zone control PID algorithm will control motor speed based on a minimum, maximum, or average of the two feedback signals. All of the VSD PID controllers shall include the ability for "two zone" control.
15. Upon loss of input reference, the VSD shall stop and display a fault unless the approved burner management system requires a more restrictive safety response. Signal loss of reference via keypad warning, Form-C relay output, and communication bus.
16. The VSD shall have programmable "Sleep" and "Wake up" functions to allow the drive to be started and stopped from the level of a process feedback signal.

2.12 PLANT MASTER CONTROLLER (PMC)

A. General Description

1. Provide a replacement Plant Master Controller to coordinate and supervise the operation of Boilers 1, 2, and 3.
2. The PMC shall automatically regulate steam-header pressure by adjusting the firing-rate demand and sequencing of the individual boiler controllers.
3. The PMC shall interface directly with each boiler control system using open, documented protocols without third-party converters.
4. The PMC shall provide automatic lead/lag sequencing, load sharing, plant demand control, and alarm/event monitoring.
5. The PMC shall include all logic, communication hardware, operator interface, software licenses, and ancillary equipment required for a complete and fully functional system.

B. Basis of Design

1. The Plant Master Controller design shall be Rockwell Compact Logix, Schneider Electric/Modicon or equal.
2. The platform shall utilize an industrial PLC or industrial PC controller with non-volatile memory and deterministic scan times suitable for continuous duty operation.

C. Functional Requirements

1. Header-Pressure Control:
 - a. Provide a proportional-integral (PI) control loop regulating steam-header pressure to a configurable setpoint.
 - b. Incorporate feedforward based on total boiler firing-rate demand.
 - c. Provide adjustable gain, reset, and deadband parameters accessible from the HMI.
2. Boiler Sequencing and Lead/Lag Rotation:
 - a. Automatically enable and disable boilers based on plant demand and header pressure deviation.
 - b. Maintain adjustable minimum on- and off-times to prevent short-cycling.
 - c. Rotate the lead boiler automatically at a configurable interval (time or cycle-based).
 - d. Allow manual assignment of lead, lag, or standby roles through the HMI.
3. Load Sharing:
 - a. Distribute demand equally among active boilers to maintain similar firing rates.

- b. Maintain synchronized ramp rates and limit rate-of-change to prevent header-pressure oscillations.
- 4. Alarm and Event Management:
 - a. Collect alarm summaries from each boiler controller and display them on the PMC HMI with time-stamped records.
 - b. Maintain at least 5 000 alarm/event records in non-volatile memory.
 - c. Generate local audible and visual alarm annunciation.
- 5. Data Logging and Trending:
 - a. Log the following parameters at one-minute intervals for a minimum of 30 days:
 - 1) Header pressure
 - 2) Plant firing-rate demand
 - 3) Individual boiler firing rates
 - 4) O₂ concentration per boiler
 - 5) Stack temperature per boiler
 - 6) Boiler run/stop status and lockout conditions
 - b. Provide trend viewing and CSV export capability directly from the HMI or via Ethernet.
- 6. Setpoint and Parameter Management:
 - a. Store all control constants, alarm limits, and sequencing parameters in non-volatile memory.
 - b. Require password-protected access levels for operator, supervisor, and engineer.
- 7. Communications:
 - a. Provide BACnet/IP and Modbus TCP/IP communication capability.
 - b. Support simultaneous communication with all three boiler controllers.
 - c. Provide one managed Ethernet switch within the enclosure for dedicated boiler-control networking.
 - d. Assign fixed IP addresses and provide a documented network map.
- 8. Fail-Safe Operation:
 - a. Upon communication loss with one boiler, isolate that boiler and continue operation with the remaining units.
 - b. Upon loss of the PMC controller, each boiler shall revert to local firing-rate control at its last valid demand signal until manual intervention.

D. Hardware

- 1. Provide an industrial-grade control panel, NEMA 12 enclosure, UL 508A labeled.
- 2. Include an industrial PLC, 24-VDC redundant power supplies, Ethernet switch, UPS with 15-minute ride-through, and circuit protection.
- 3. Provide an operator interface terminal (HMI) not less than 15 inches diagonal, color touchscreen, rated for continuous operation in boiler-room ambient conditions.
- 4. Mount all components on a back-panel subplate; provide labeled terminal blocks and ferruled wiring.
- 5. Provide interior LED lighting and 120-V GFCI convenience outlet.
- 6. Provide a surge suppressor and EMI/RFI filtering on control-power feeds.

E. Software

- 1. Programming shall be developed in a recognized industrial language (IEC 61131-3 ladder or structured text).
- 2. All source code and configuration files shall be provided to the Owner in editable format.

3. HMI software shall permit configuration of setpoints, schedules, and alarm limits through password-protected menus.
4. Provide trending, alarm acknowledgement, runtime and cycle counters, and maintenance reminders.
5. Software shall include secure Ethernet access for future diagnostics and remote support, disabled by default until enabled by the Owner.

F. Integration and Compatibility

1. Provide all communication gateways, cabling, and software mapping to ensure reliable data exchange with the following:
 - a. Boiler 1 local control panel
 - b. Boiler 2 local control panel
 - c. Boiler 3 local control panel
2. Exchange points shall include, as a minimum:
 - a. Boiler enable/disable command
 - b. Firing-rate demand signal (0-10 VDC or digital)
 - c. Boiler availability and lockout status
 - d. Alarm summary
 - e. Run status and firing-rate feedback
 - f. Steam-header pressure and plant-demand data

2.13 WATER LEVEL SAFETY SYSTEM

A. General

1. Furnish and install a complete water level measurement, control, and safety system for each boiler.
2. System shall comply with ASME Section I and NFPA 85.
3. Provide independent mechanical and electronic level devices.
4. Low water protection shall be hardwired into the flame safeguard circuit.
5. Loss of PLC power shall not defeat low water trip protection.
6. All components shall be rated for minimum 300 psig saturated steam service.

B. Water Columns and Gauge Glass

1. Water Column Assemblies
 - a. Quantity: Two per boiler
 - b. Manufacturer: Clark-Reliance, Jerguson, or equal
 - c. Construction: Carbon steel body with stainless trim
 - d. Rating: 300 psig minimum
 - e. Provide:
 - 1) Top and bottom isolation valves
 - 2) Blowdown valve
 - 3) Vent valve
 - 4) Try cocks
 - 5) Drain connection

Gauge Glass

- a. Type: Reflex type with stainless guards
- b. Manufacturer: Clark-Reliance Type A or equal

- c. Provide automatic ball checks in top and bottom valves
- d. Provide mica shields where required

C. Low Water and High Water Cutoffs

- 1. Primary Low Water Cutoff (Trip)
 - a. Type: Mechanical float type
 - b. Manufacturer: Clark-Reliance, Jerguson, or boiler OEM-compatible device suitable for high-pressure watertube boiler service.
 - c. Hardwired to flame safeguard
 - d. Manual reset required
- 2. Secondary Low Water Cutoff (Trip)
 - a. Independent of primary device
 - b. Mechanical or electronic type independent of primary device, suitable for high-pressure watertube boiler service and approved by boiler OEM and authority having jurisdiction.
 - c. Hardwired trip
- 3. High Water Cutoff (Alarm)
 - a. Mechanical or electronic type suitable for high-pressure watertube boiler service.
 - b. Alarm at HMI and Plant Master.
 - c. Hardwired into alarm circuit

D. Drum Level Transmitters

- 1. Quantity: Two redundant transmitters per boiler.
- 2. Type: Differential pressure with remote seals suitable for steam service.
- 3. Accuracy: ± 0.5 percent of span.
- 4. Output: 4-20 mA to boiler control system.
- 5. Manufacturer:
 - a. Emerson Rosemount 3051 series
 - b. Yokogawa EJX series
 - c. ABB 2600T series
- 6. Provide 3-valve manifold and isolation valves.

E. Feedwater Control Valve

- 1. Type: Characterized globe or V-ball control valve suitable for modulating service.
- 2. Body rating: ASME Class 300 minimum.
- 3. Actuator: Electric with positioner and feedback.
- 4. Control signal: 4-20 mA from 3-element control loop.
- 5. Provide upstream and downstream isolation valves.
- 6. Basis of design:
 - a. Fisher EZ globe valve
 - b. Fisher V150 V-ball
 - c. Equivalent industrial control valve approved by Engineer.

F. Interlocks and Performance

- 1. Burner shall not initiate light-off unless water level is proven normal.

2. Low water condition during operation shall immediately trip burner.
3. Manual reset shall be required after low water trip.
4. High water alarm shall annunciate at local HMI and Plant Master and shall not trip burner unless required by approved boiler manufacturer safety logic.
5. Provide test provisions for exercising low water devices during annual inspection.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Verify that all field conditions are suitable for installation of combustion controls and instrumentation.
- B. Confirm boiler types, burner configurations, fuel trains, fan motors, scanner ports, and stack-damper assemblies prior to commencing work.
- C. Inspect mounting locations for transmitters, probes, actuators, and panels; verify accessibility for calibration, service, and observation during tuning.
- D. Report discrepancies in wiring, power availability, grounding, or equipment condition to the Engineer before proceeding.
- E. Lock out and tag all energy sources before removal of flame-safeguard or combustion-control wiring.

3.2 INSTALLATION

- A. Install control panels, transmitters, actuators, sensors, and wiring in accordance with the manufacturer's written instructions, the approved shop drawings, and NFPA 70.
- B. Mount panels plumb, level, and readily accessible for maintenance.
- C. Segregate power and signal wiring within each panel and in field conduits.
- D. Provide flexible metallic conduit for final connections to vibrating or hot components.
- E. Label all field conductors at both ends using heat-shrink markers; label all devices with engraved phenolic tags matching the I/O list.
- F. Mount pressure and draft transmitters with isolation valves and calibration tees; slope impulse lines toward the process connection and away from transmitters.
- G. Install oxygen probes with removable spool-piece and sample port for calibration gases.
- H. Mount servo actuators directly to shafts or valve stems using keyed couplings; eliminate lost motion and verify full travel.
- I. Provide all wiring between field devices and control panels, including signal, power, and communication cables.

- J. Install all Ethernet network cabling in shielded industrial-rated CAT 6A cable; terminate to managed switches inside each control panel.

3.3 VERIFICATION AND CALIBRATION

- A. Perform point-to-point continuity check for every field I/O point; record loop tag, terminal number, and verification signature.
- B. Calibrate all analog transmitters (pressure, draft, temperature) using certified reference instruments traceable to NIST. Record as-found and as-left readings.
- C. Confirm correct scaling and engineering units on each HMI and on the Plant Master Controller.
- D. Stroke all servo actuators from minimum to maximum command; record position feedback versus command at 10 percent increments.
- E. Document all calibration data in the Commissioning Log.

3.4 DRY SEQUENCE TESTING

- A. Perform a complete dry-sequence test of each boiler control system prior to introducing fuel.
- B. Demonstrate the following steps without firing:
 - 1. Power-up and initialization.
 - 2. Purge timing and airflow verification.
 - 3. Safety-interlock permissive including water level, draft, atomizing-air pressure, fuel-pressure switches, and flame-scanner status.
 - 4. Pilot-ignition sequence, trial-for-ignition timing, and flame-failure response.
 - 5. Main-fuel valve proving and tightness-testing cycle.
 - 6. Proper operation of all safety lockouts, manual resets, and first-out annunciation.
 - 7. Draft-control actuator movement and PID output tracking under simulated pressure inputs.
 - 8. O₂-trim system disable during purge and enable only after stable main flame.
 - 9. Local/remote demand hand-off and mode changeover.
- C. Correct deficiencies before proceeding to live-fire tuning.

3.5 ATOMIZING-MEDIA SYSTEM TESTS

- A. Operate each atomizing media system independently at burner OEM required pressure and flow.
- B. Demonstrate pressure regulation under varying burner demand.
- C. Trip low-pressure switch to verify burner shutdown and automatic recovery sequence.

3.6 LIVE-FIRE START-UP AND TUNING

- A. Purge and light off each boiler on oil at minimum fire.

- B. Tune combustion curves across the entire firing range at 25 %, 50 %, 75 %, 100 % firing rate.
- C. Record O₂, CO, NO_x, draft, and stack temperature at each point.
- D. Enable O₂ trim and set bias limits and rate-of-change clamps.
- E. Tune draft PID loop for stable header pressure under load transitions.
- F. Confirm local and Plant Master demand operation without manual adjustment of servo curves.
- G. Document final tuning values, PID constants, O₂ trim setpoints, and efficiency readings.

3.7 PLANT MASTER FUNCTIONAL TESTS

- A. Verify communication between Plant Master Controller and each boiler.
- B. Demonstrate read/write of the following: enable, demand, firing rate feedback, lockout status, alarm summary, and run indication.
- C. Simulate loss of one boiler; confirm automatic redistribution of load among remaining units.
- D. Demonstrate automatic lead/lag rotation and respect of minimum on/off times. Vary header-pressure setpoint and observe proportional response of plant demand.
- E. Conduct step tests:
- F. Increase load demand 20%. Observe response time and overshoot.
- G. Decrease load demand 20%. Observe stability and recovery.
- H. Record 8-hour continuous trend showing header pressure, total firing rate, individual boiler loads, and O₂ readings.
- I. Verify alarm logging, event timestamps, and data export to CSV format.
- J. Demonstrate manual lead selection, forced boiler off-line, and remote acknowledgment of alarms.

3.8 FAIL-SAFE AND INTERLOCK VERIFICATION

- A. Simulate loss of any of the following and verify system response:
 - 1. O₂ analyzer signal.
 - 2. Draft-pressure transmitter signal.
 - 3. Servo-feedback failure.
 - 4. VSD fault.
 - 5. Communication loss between Plant Master and any boiler.
 - 6. Loss of 24-VDC control power within a panel.
- B. Confirm transition to safe state, annunciation on all HMIs, and preservation of lockout until manual reset.

- C. Verify manual emergency stop stations de-energize combustion circuits for all boilers.

3.9 DOCUMENTATION AND REPORTING

- A. Compile commissioning log including:
 - 1. I/O verification sheets.
 - 2. Calibration certificates.
 - 3. Dry-sequence and live-fire test results.
 - 4. Tuning curves and O2 trim data.
 - 5. Plant Master test records.
- B. Provide electronic copies of PLC, BMS, and HMI programs with version control and password list.
- C. Provide network diagram identifying IP addresses and communication protocols.
- D. Include final trend and alarm export covering at least 24 hours of normal operation.

3.10 TRAINING

- A. Provide a minimum of (24) hours of operator training on-site, conducted by manufacturer-certified personnel.
- B. Training shall include:
 - 1. System overview and control philosophy.
 - 2. HMI navigation and alarm acknowledgment.
 - 3. Adjustment of O2 trim, draft, and header-pressure setpoints.
 - 4. Lead/lag rotation, manual override, and trend retrieval.
 - 5. Routine maintenance for O2 probe and flame scanners.

END OF SECTION 230926

UNIT WL- 2629
D.P. 260 psi

As Required by the Provisions of the ASME Code Rules

Q25-1979A 6/75

1. Manufactured by Cleaver-Brooks Division of Aqua-Chem, Inc., Milwaukee, Wisconsin
(Name and address of manufacturer)
2. Manufactured for " WALLKILL CORRECTIONAL FACILITY " Wallkill, New York
(Name and address of purchaser)
3. Location of Installation " WALLKILL CORRECTIONAL FACILITY " Wallkill, New York
(Name and address)
4. Unit Identification Complete Boiler Identifying Nos. 61427
(Complete boiler, superheater, water wall, economizer, etc.) (Mfrs. Serial No.)
- (CRN) 39000 1977
(Drawing No.) (Nat'l. Brd. No.) (Year Built)
5. The chemical and physical properties of all parts meet the requirements of material specifications of the ASME BOILER AND PRESSURE VESSEL CODE. The design, construction, and workmanship conform to the ASME Rules, Section I, 1974 and Addenda to Summer 1976
(Year) (Date)

Remarks: Manufacturers' Partial Data Reports properly identified and signed by Commissioned Inspectors have been furnished for the following items of this report: **NONE**

6(a) Drums

[illegible]

No	Longitudinal joints		Circum joints		Heads						Hydrostatic test, psi
	No & type*	Efficiency	No & type	Efficiency	Matl Spec No. Grade	Thickness, in		Type**	Radius of dish	Manholes No. Size	
1	1-2	90%	3-2	90%	SA-515-70	1/2	1/2	2	30"	2 @ 12" x 16"	390
2											
3	0-1	100%	2-2	90%	SA 515-70	9/16	9/16	2	18"	2 @ 12" x 16"	494

* 1010: 1010 (1) Seamless (2) 1010-1010-1010

* 1: Flat 2: Dish 3: Ellipsoidal 4: Hemispherical

45 (14) Nichols, T. 1983.

Diameter	Thickness	Material Spec. No.
2" O.D.	106"	SA 178 A

Figure 3: *Chlorophyll content and leaf area*

(இலக்க 59: அழகத்தோடு இருக்க வேண்டிய அழகம், இயற்கை)

0404-0000/95 \$07.00 + 0.00

Hydrogen T and no.

Springer, N.Y.

2008年 12月 12日 星期五

2000 年 4 月 20 日

2008-09-01 10:00:00 2008-09-01 10:00:00 2008-09-01 10:00:00 2008-09-01 10:00:00 2008-09-01 10:00:00

伊 麗 莎

2000 4 26

—continued from p. 100—

1. 在 1990 年 1 月 1 日以前

Figure 2. Mean Δ of the 1000 trials. Error bars represent the standard error of the mean.

Wiley-Blackwell, 1999, p. 102.

me₁ = 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830, 831, 832, 833, 834, 835, 836, 837, 838, 83

● 2010 年 10 月 1 日起, 凡在中华人民共和国境内销售货物或者提供加工、修理修配劳务以及进口货物的单位和个人, 均应按照《中华人民共和国增值税暂行条例》及实施细则有关规定缴纳增值税。

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Left Wheelset Details			Right Wheelset Details			Left Wheelset Details		
Part	Part and Description	Material spec. no.	Part	Part and Description	Material spec. no.	Part	Part and Description	Material spec. no.
1	Wheel and axle		1	Wheel and axle		1	Wheel and axle	
2	Hub		2	Hub		2	Hub	
3	Spoke		3	Spoke		3	Spoke	
4	Spoke		4	Spoke		4	Spoke	
5	Spoke		5	Spoke		5	Spoke	
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圖 10.2 爲 q - β 關係圖。其 β 值係由式 (10.1) 算出。

UNIT WL- 2629
D.P. 200 psi

As Required by the Provisions of the ASME Code Rules

2019年12月14日 星期六

5. The chemical and physical properties of all parts meet the requirements of material specifications of the **ASME BOILER AND PRESSURE VESSEL CODE**. The design, construction, and workmanship conform to the ASME Rules, Section I, **19 74** and Addenda to **Summer 1976**

(Year) (Date)

Remarks: Manufacturers' Partial Data Reports properly identified and signed by Commissioned Inspectors have been furnished for the following items of this report: **NONE**

File Number	(Name of part, item number, maker's name, and identifying stamp)
61(a) Drums	

[illegible]

No.	Longitudinal joints		Circum. joints		Heads						Hydro-static test, psi
	No. & type*	Efficiency	No. & type	Efficiency	Mat'l. Spec. No., Grade	Thickness, in.		Type**	Radius of dish	Manholes No Size	
1	1-2	90%	3-2	90%	SA-515-70	1/2	1/2	2	30"	2 @ 12" x 16"	390
2											
3	0-1	100%	2-2	90%	SA-515-70	9/16	9/16	2	18"	2 @ 12" x 16"	494

*Indicate if (1) Seamless; (2) Fusion welded

**Indicate if (1) Flat; (2) Dished; (3) Ellipsoidal; (4) Hemispherical.

6(b) Boiler Types

6(c) Header's No. 313453

Diameter	Thickness	Mat'l. Spec. No., Grade
2" O.D.	.105"	SA-178-A

(Box or sinus or round; Mat. spec. no.; Thickness)

Holds or ends _____ Hydro. Test, psi _____

(Shape; Mat.

spec. no.: Thickness)

6(d) Staybolts

(Mat. spec. no.; Diameter; Size telltale; Net area)

Pitch _____ in. Net Area _____ in.² Max. A.W.P. _____ psi

(Supported
by one bolt)

6(e) Mud Drum	Heads or Ends	Hydro. Test, psi
---------------	---------------	------------------

(For sect. header boilers, State Size, Shape, Mat. spec. no., Thickness) (Shape, Mat. spec. no., Thickness)

7(a) Waterwall Headers

Heads or Ends

7(b) Waterwall Tubes

No.	Size and shape	Material spec. no.	Thickness in.	Shape	Thickness in.	Material spec. no.	Hydro. test, psi.	Diameter in.	Thickness in.	Material spec. no.
								2" O.D.	.105"	SA-178-A

8(a) Economizer Headers

8(b) Economizer Tubes

[illegible]

UPPER DRUM WT- 1537-28
LOWER DRUM WT- 8540-28

S.O. WT-92256
MODEL D-42

UNIT WL- 2630
D.P. 260 psine

FORM P-3 MANUFACTURERS' DATA REPORT FOR WATERTUBE BOILERS, SUPERHEATERS, WATERWALLS AND ECONOMIZERS

As Required by the Provisions of the ASME Code Rules

1248.1010A 5278

1. Manufactured by Cleaver-Brooks Division of Aqua-Chem, Inc., Milwaukee, Wisconsin
(Name and address of manufacturer)

2. Manufactured for: " WALLKILL CORRECTIONAL FACILITY " Wallkill, New York
(Name and address of purchaser)

3. Location of Installation: "WALKILL CORRECTIONAL FACILITY" Wallkill, New York
(Name and address of the installation)

4. Unit Identification	Complete Boiler (Complete boiler, superheater, water wall, economizer, etc.)	Identifying Nos.	61429 (Mfr's Serial No.)
------------------------	--	------------------	-----------------------------

(CRN)	(Drawing No.)	(Date)	(Year Built)
		39002	1977

5. The chemical and physical properties of all parts meet the requirements of material specifications of the ASME BOILER AND PRESSURE VESSEL CODE. The design, construction, and workmanship conform to the ASME Rules, Section I, 1974 and Addenda to Summer 1976.

Remarks: Manufacturers' Patent Data Reports properly identified and signed by Commissioned Inspectors have been furnished for the following items of this report: **NONE**

(Name of part, item number, major's name, and identifying stamp)

[illegible]

No	Longitudinal joints		Circum joints		Heads						Hydro-static test, psi
	No. & type*	Efficiency	No. & type	Efficiency	Mat'l Spec. No., Grade	Thickness, in.		Type**	Radius of dish	Manholes No. Size	
1	1-2	90%	3-2	90%	SA-515-70	1/2	1/2	2	30"	2 @ 12" x 16"	390
2											
3	0-1	100%	2-2	90%	SA-515-70	9/16	9/16	2	18"	2 @ 12" x 16"	494

*Indicate if (1) Seamless, (2) Fusion welded

**Indicate if (1) Flat; (2) Dished; (3) Ellipsoidal; (4) Hemispherical

6(b) Hoier Tubes

Diameter	Thickness	Mat'l Spec. No. Grade
2" O.D.	.105"	SA-173-A

6(c) Header No:

(Box or shape or round, Mat. spec. no., Thickness)

Heads or Ends _____ Hydro Test _____ psi

IShape, Mr.
spac no Thicknes

Grid Staysheets

(Mat spec no, Diameter, Size relative, Net area)

Pitch _____ in Net Area _____ in Max. A.W.P. _____ psi
(Supported
by one bolt)

Enter Myc Drum

Heads or Ends

Hydro Test 93

(If present) Part Jet buffers State Size, Shape, Mat spec no, Thickness: (Shape, Mat spec no, Thickness)

(a) Waterwall Headers

Heads or Ends

7(b) Waterwall Tubes

No.	Size and shape	Material spec. no.	Thickness in.	Shape	Thickness in.	Material spec. no.	Hydro test, psi.	Diameter in.	Thickness in.	Material spec. no.
								2" O.D.	.105"	SA-178-A

Blue Economy Headlines

B(h) Economize: Tactics

[illegible]

9(a) Superheater Headers 3 G 9(b) Superheater Tubes 10(b) Tubes for Other Parts

10(a) Other Parts (1) (2) (3) 10(b) Tubes for Other Parts

11 Openings (1) Steam 1 @ 6" 300 lb. Flg. (2) Safety Valve 1 @ 2" & 1 @ 3" 300 lb. Flg.
(3) Blowoff 1 @ 1-1/4" x 17" NPT Piping (4) Feed 1 @ 2" x 10-1/2" NPT Piping

12	Maximum Allowable Working Pressure	Code Par. and/or Formula on which AWP is Based	Shop hydro. test psi	Heating Surface sq. ft.	13 Field hydro. test psi
a Boiler	260 psi	PG 27 &	390	2410	
b Waterwall	260 psi	PG-29	390	461	
c Economizer					
d Superheater					
e Other parts					

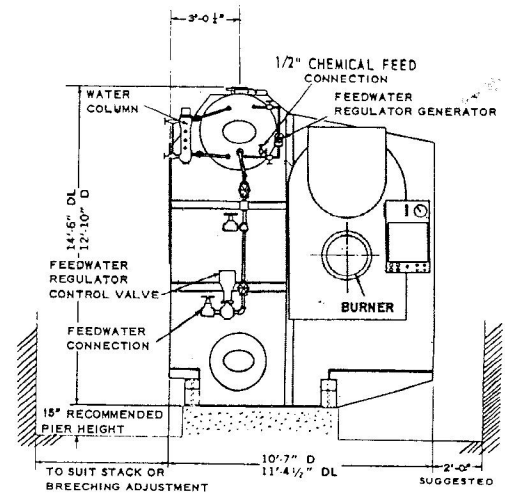
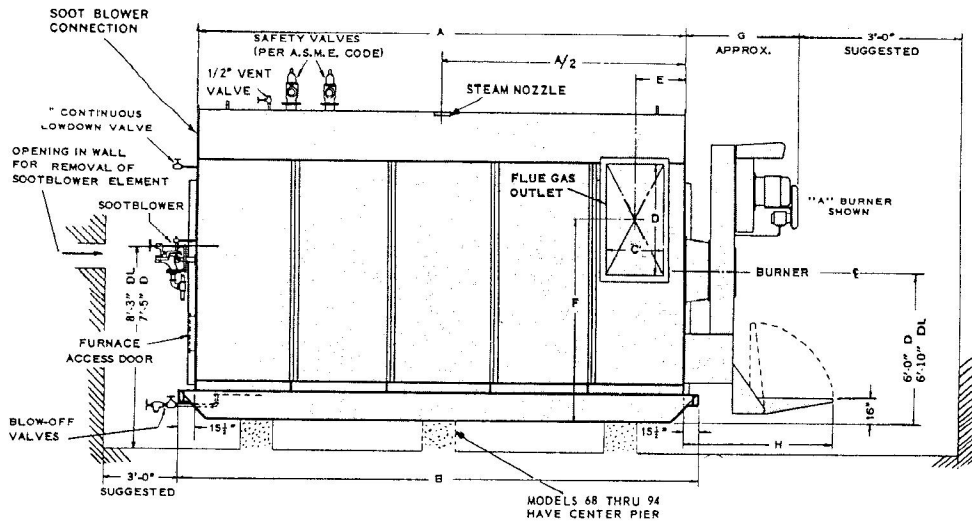
CERTIFICATE OF COMPLIANCE
We certify the statement in this data report to be correct. Cleaver-Brooks Division of Aqua-Chem, Inc.
Date January 27, 1977 Signed Joseph A. Winter (Manufacturer)
Our Certificate of Authorization No. 10905 to use the (A) or (S) S Symbol expires January 15, 1980

CERTIFICATE OF SHOP INSPECTION
BOILER MADE BY Cleaver-Brooks Division of Aqua-Chem, Inc. at Lebanon, Pa.
I, the undersigned, holding a valid commission issued by the National Board of Boiler and Pressure Vessel Inspectors and/or the State or Province of Pennsylvania and employed by The Hartford Steam Boiler I & I Co. of Hartford, Conn. have inspected parts of this boiler referred to as data items 6(a), 6(b), 7(b), 11 and 12 and have examined Manufacturer's Partial Data Reports for items 6(a), 6(b), 7(b), 11 and 12 and state that, to the best of my knowledge and belief, the manufacturer has constructed this boiler in accordance with the applicable sections of the ASME BOILER AND PRESSURE VESSEL CODE.
By signing this certificate neither the Inspector nor his employer makes any warranty, expressed or implied, concerning the boiler described in this Manufacturer's Data Report. Furthermore, neither the Inspector nor his employer shall be liable in any manner for any personal injury or property damage or a loss of any kind arising from or connected with this inspection.
Date January 27, 1977
Thomas J. Jackson Commissions NB 6315 PA WC 1702
Nat'l Board, State, Province and No

CERTIFICATE OF COMPLIANCE
We certify that the field assembly of all parts of this boiler conforms with the requirements of SECTION I of the ASME BOILER AND PRESSURE VESSEL CODE.
Date _____ Signed _____ By _____
(Assembler) (Representative)
Our Certificate of Authorization No. _____ to use the (A) or (S) _____ Symbol expires _____ 19 _____

CERTIFICATE OF FIELD ASSEMBLY INSPECTION
I, the undersigned, holding a valid commission issued by the National Board of Boiler and Pressure Vessel Inspectors and/or the State or Province of _____ and employed by _____ of _____ have compared the statements in this Manufacturer's Data Report with the described boiler and state that the parts referred to as data items _____, not included in the certificate of shop inspection, have been inspected by me and that to the best of my knowledge and belief the manufacturer and/or the assembler has constructed and assembled this boiler in accordance with the applicable sections of the ASME BOILER AND PRESSURE VESSEL CODE. The described boiler was inspected and subjected to a hydrostatic test of _____ psi.
By signing this certificate neither the Inspector nor his employer makes any warranty, expressed or implied, concerning the boiler described in this Manufacturer's Data Report. Furthermore, neither the Inspector nor his employer shall be liable in any manner for any personal injury or property damage or a loss of any kind arising from or connected with this inspection.
Date _____
Inspector _____ Commissions _____
Nat'l Board, State, Province and No

PHYSICAL DIMENSIONS



NOMINAL CAPACITY LB./H.R.	16000	21000	26000	32200	37100	42200	50400	57500	63300	42500	49500	56500	63500	72000	78-80000
DELTA DIMENSIONS										DL DIMENSIONS					
MODEL	26	34	42	52	60	68	76	86	94	52	60	68	76	86	94
A Length, Over Casing	9'5"	11'10"	14'3"	17'3"	19'8"	22'1"	24'6"	27'6 1/2"	29'11 1/2"	17'3"	19'8"	22'1"	24'6"	27'6 1/2"	29'11 1/2"
B Length, Over Skid	12'0"	14'5"	16'10"	19'10"	22'3"	24'8"	27'1"	30'1 1/4"	32'6 1/4"	19'10"	22'3"	24'8"	27'1"	30'1 1/4"	32'6 1/4"
C Width, Gas Outlet	15"	1'6"	2'3"	2'6"	2'6"	2'9"	3'0"	3'0"	3'6"	2'6"	2'9"	3'0"	3'6"	3'6"	3'6"
D Height Gas Outlet	4'6"	4'6"	4'6"	4'6"	5'6"	5'6"	5'6"	5'6"	6'3"	5'6"	5'6"	5'6"	6'3"	6'3"	7'0"
E Front to Gas Outlet	12 1/4"	13 3/4"	1'6 1/4"	1'7 3/4"	1'7 3/4"	1'9 1/4"	1'10 3/4"	1'10 3/4"	2'1 3/4"	1'8"	1'9 1/2"	1'11"	2'2"	2'2"	2'2"
F Skid to Gas Outlet	7'7"	7'7"	7'7"	7'7"	7'1"	7'1"	7'1"	7'1"	6'8 1/2"	8'9"	8'9"	8'9"	8'4 1/2"	8'4 1/2"	8'0"
G Burner Type A	4'11"	4'11"	4'11"	—	—	—	—	—	—	—	—	—	—	—	—
G Burner Type B	—	1'11"	1'11"	1'11"	1'11"	1'11"	—	—	—	1'11"	1'11"	—	—	—	—
G Burner Type CN	—	—	—	—	—	4'7"	4'7"	5'1"	5'1"	4'7"	4'7"	5'1"	5'1"	5'1"	5'1"
H "A" With Platform	6'0"	6'0"	6'0"	—	—	—	—	—	—	—	—	—	—	—	—
H "B" With Platform	—	6'0"	6'0"	6'0"	6'0"	6'0"	—	—	—	—	6'0"	6'0"	—	—	—
H "CN" With Platform	—	—	—	—	—	6'4 1/2"	6'4 1/2"	6'4 1/2"	6'4 1/2"	6'4 1/2"	6'4 1/2"	6'4 1/2"	6'4 1/2"	6'4 1/2"	6'4 1/2"

NOTES:

Upper Drum . . . 36" Dia. with 12" x 16" Manhole in Each End. Lower Drum . . . 24" Dia. with 12" x 16" Manhole in Each End. All Tubes . . . 2" O.D.
 Boiler Models 76 thru 94 use two sootblowers.
 Accompanying dimensions, while sufficiently accurate for layout purposes, must be confirmed for construction by certified dimension prints.

WEIGHTS

MODEL	26	34	42	52	60	68	76	86	94	52	60	68	76	86	94
Weight, Dry—Lbs.	35,200	40,700	45,870	52,580	57,970	66,330	72,490	79,640	85,250	62,700	68,200	77,550	83,600	91,300	96,800
Weight, Filled to Oper. Level—Lbs.	41,900	49,350	56,470	65,610	72,970	83,280	91,310	100,990	108,550	78,700	86,200	96,990	105,220	115,400	131,300
Weight, Flooded—Lbs.	44,400	52,540	60,340	70,340	78,380	89,380	98,200	108,630	116,865	83,430	91,610	103,090	111,830	122,900	137,200

The various sizes for these connections are as follows:

CONNECTION SIZES

MODEL	26	34	42	52	60	68	76	86	94	52	60	68	76	86	94
(1) Main Steam Outlet*	4"	6"	6"	6"	6"	8"	8"	8"	8"	6"	8"	8"	8"	10"	10"
(1) Feedwater Inlet	2"	2"	2"	2"	2"	2"	2 1/2"	2 1/2"	2 1/2"	2"	2"	2"	2 1/2"	2 1/2"	2 1/2"
(2) Safety Valves*	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code	Code
(1) Blowdown	1"	1"	1"	1"	1"	1"	1"	1"	1"	1"	1"	1"	1"	1"	1"
(1) Soot Blower	2"	2"	2"	2"	2"	2"	2"	2"	2"	2"	2"	2"	2"	2"	2"
(2) Water Column	1"	1"	1"	1"	1"	1"	1"	1"	1"	1"	1"	1"	1"	1"	1"
(2) Feedwater Regulator -	1"	1"	1"	1"	1"	1"	1"	1"	1"	1"	1"	1"	1"	1"	1"
(1) Chemical Feed	1/2"	1/2"	1/2"	1/2"	1/2"	1/2"	1/2"	1/2"	1/2"	1/2"	1/2"	1/2"	1/2"	1/2"	1/2"
(1) Vent	1"	1"	1"	1"	1"	1"	1"	1"	1"	1"	1"	1"	1"	1"	1"

*It should be noted the steam outlet sizes and the safety valve sizes are based on a 100 psig operating pressure and sizes may vary with pressure increase and the actual steam output.

E. CASING, SETTING and INSULATION

DESIGN

The unit is enclosed with a double panel casing with that portion of the casing exposed to the products of combustion completely seal welded to form an air and gas tight enclosure. The outer casing panels are also seal welded and are suitable for outdoor installation. Stainless

shields are used discriminately as required to suit temperature.

The casing is supported off the structural steel frame and is **not welded or attached to tubing**, thereby insuring free expansion of pressure parts within the casing enclosure.

ARRANGEMENT OF CASING

Construction of the boiler enclosure is as follows:

Front Wall — Furnace Area	3" 3-way interlocking tile 2" High-temperature block insulation 2-1/2" High-temperature block insulation 10 Ga. Inner seal welded casing 2-1/2" Low-density block insulation 1/4" Front casing and burner plate
Rear Wall —	3" 3-way interlocking tile 2" High-temperature block insulation 2-1/2" High-temperature block insulation 10 Ga. Inner seal welded casing 2-1/2" Low-density block insulation 1/4" Outer casing
Convection Section and Furnace Side Wall and Roof	10 Ga. carbon steel inner seal welded casing and stainless steel shields to suit temperature range 4-3/8" Low-density mineral wool block No. 10 Ga. outer steel casing

FURNACE FLOOR

Furnace floor tubes are covered with 1-1/2" square edge tile.

DRUM ENCLOSURE

The steam drum is shop insulated with mineral wool block and enclosed in a welded 10 Ga. casing. All drum heads will be shop insulated and enclosed in a 10 Ga. casing. No further insulation in the field will be required.

SM-614.4

Effective November 1, 1976

(Supersedes SM-614.3 dated March 3, 1975)

D. CONVECTION TUBES

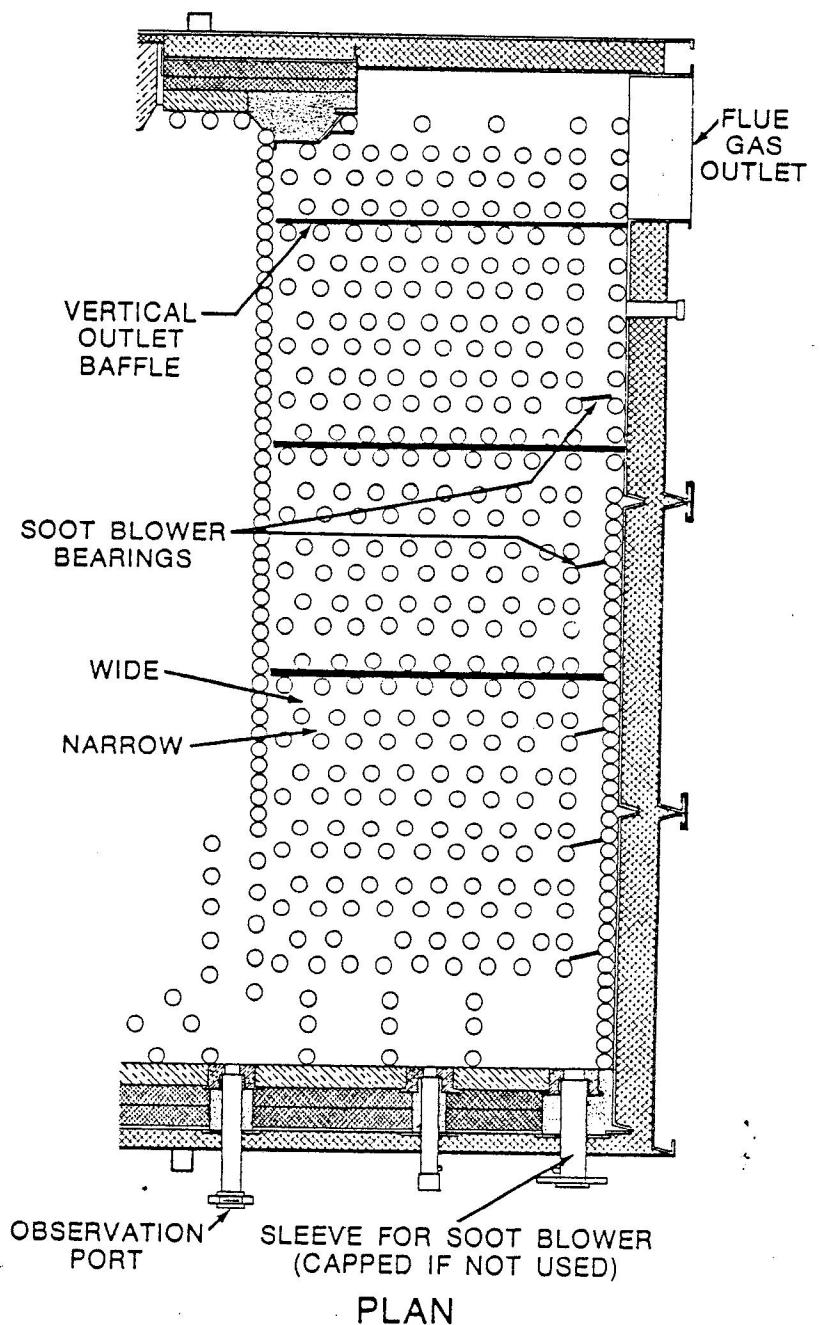
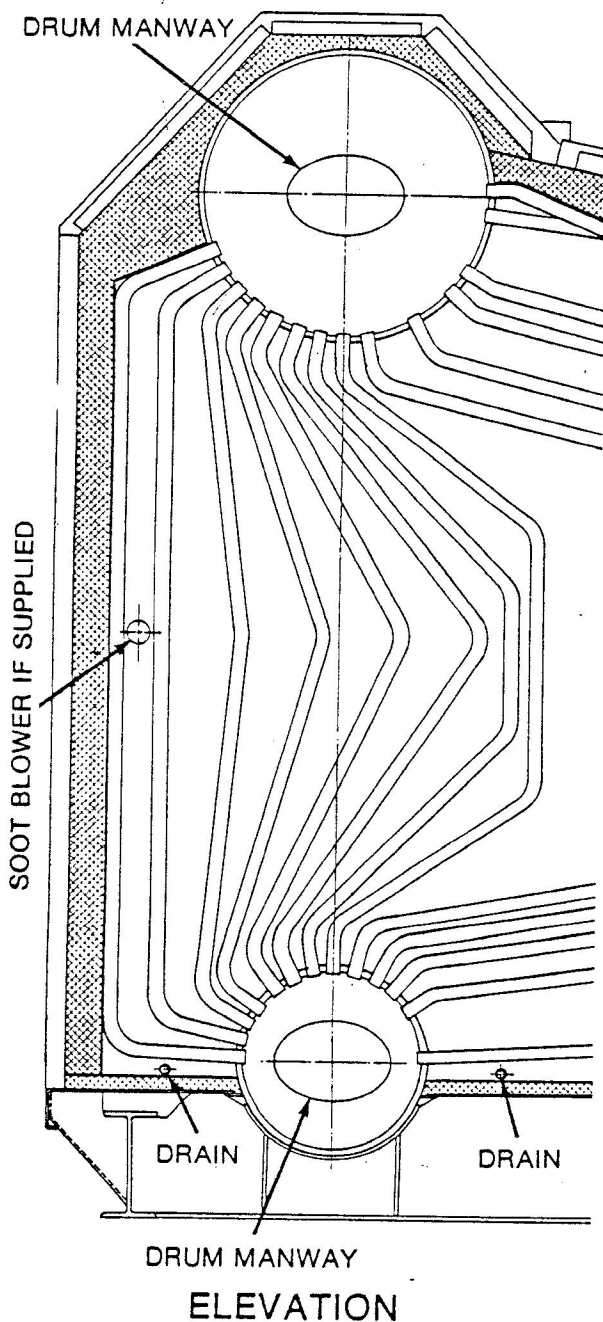
TUBE REMOVAL

The use of the alternate wide and narrow spacing of boiler tube rows makes it possible to remove and replace individual tubes in the convection section without the necessity of cutting and removing adjacent tubes. In staggered convection bank arrangements, it is often necessary to remove many good tubes in order to have

physical cleanance to remove a damaged tube.

WATER WASHING

Water washing of the convection bank of the boiler is not recommended unless provision is made for complete drainage of the wash water and the ability of light off and dry out the unit immediately after water washing.

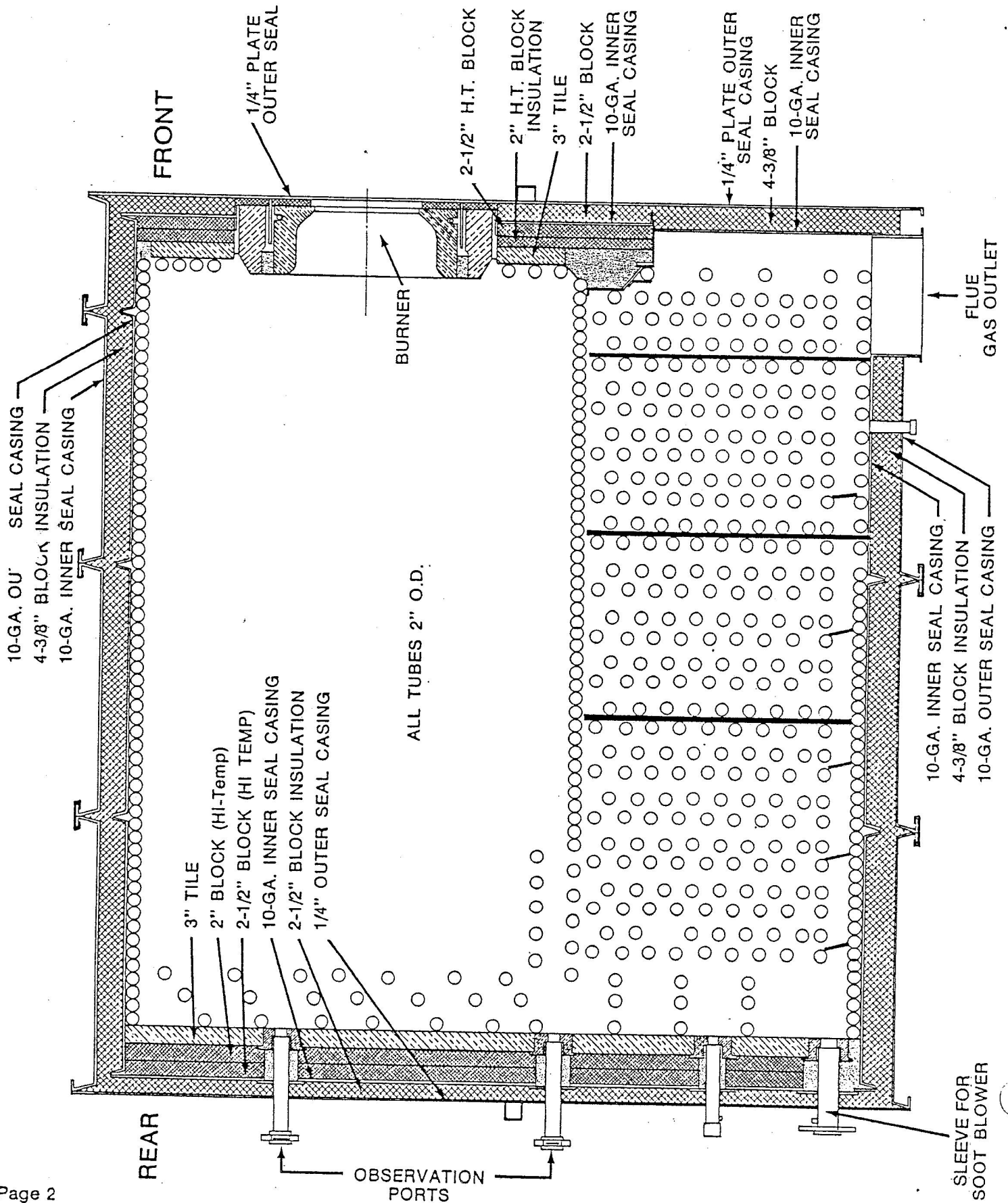


SM-615.5

Effective November 1, 1976

(Supersedes SM-615.4 dated March 3, 1975)

E. CASING, SETTING and INSULATION



Louis E. Okonski

Louis E. Okonski

2. if refractory stays, the three rows of tubes would need to come out (and be replaced)

Drown By:

Scale: N.T

Prefix to all tube numbers is "93A", except as noted

Pinkie replaced 2026 (Spring)

Tuber (Blue) were not replaced.*

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

SECTION 262213 - LOW-VOLTAGE DISTRIBUTION TRANSFORMERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes distribution, dry-type transformers with a nominal primary and secondary rating of 600 V and less, with capacities up to 1500 kVA.

1.2 SUBMITTALS

- A. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.
- B. Manufacturer's installation instructions shall be provided along with product data.
- C. Submittals shall be provided in the order in which they are specified and tabbed (for combined submittals).
- D. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type and size of transformer.
 - 2. Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer.
- E. Shop Drawings:
 - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment.
 - 3. Include diagrams for power, signal, and control wiring.
- F. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.
- G. Qualification Data: For testing agency.
- H. Seismic Qualification Data: Certificates, for transformers, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
4. Certification: Indicate that equipment meets equipment seismic requirements.

I. Field quality-control reports.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For transformers to include in emergency, operation, and maintenance manuals.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Inspection: On receipt, inspect for and note any shipping damage to packaging and transformer.
1. If manufacturer packaging is removed for inspection, and transformer will be stored after inspection, re-package transformer using original or new packaging materials that provide protection equivalent to manufacturer's packaging.
- B. Storage: Store in a warm, dry, and temperature-stable location in original shipping packaging.
- C. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.
- D. Handling: Follow manufacturer's instructions for lifting and transporting transformers.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
1. Eaton.
 2. Maddox.
 3. Square D; Schneider Electric USA.
 4. Or equal.
- B. Source Limitations: Obtain each transformer type from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Transformers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7 .

1. The term "withstand" means "the transformer will remain in place without separation of any parts when subjected to the seismic forces specified and the transformer will be fully operational after the seismic event."

2.3 GENERAL TRANSFORMER REQUIREMENTS

- A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.
- B. Comply with NFPA 70.
 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
- C. Transformers Rated 15 kVA and Larger:
 1. Comply with 10 CFR 431 (DOE 2016) efficiency levels.
 2. Marked as compliant with DOE 2016 efficiency levels by an NRTL.
- D. Shipping Restraints: Paint or otherwise color-code bolts, wedges, blocks, and other restraints that are to be removed after installation and before energizing. Use fluorescent colors that are easily identifiable inside the transformer enclosure.

2.4 DISTRIBUTION TRANSFORMERS

- A. Comply with NFPA 70, and list and label as complying with UL 1561.
- B. Cores: Electrical grade, non-aging silicon steel with high permeability and low hysteresis losses.
 1. One leg per phase.
 2. Core volume shall allow efficient transformer operation at 10 percent above the nominal tap voltage.
 3. Grounded to enclosure.
- C. Coils: Continuous windings without splices except for taps.
 1. Coil Material: Aluminum.
 2. Internal Coil Connections: Brazed or pressure type.
 3. Terminal Connections: Bolted.
- D. Enclosure: Ventilated.
 1. NEMA 250, Type 3R: Core and coil shall be encapsulated within resin compound to seal out moisture and air.
 2. KVA Ratings: Based on convection cooling only and not relying on auxiliary fans.
 3. Wiring Compartment: Sized for conduit entry and wiring installation.
 4. Finish: Comply with NEMA 250.
 - a. Finish Color: ANSI 61 gray weather-resistant enamel.

- E. Taps for Transformers 3 kVA and Smaller: One 5 percent tap above normal full capacity.
- F. Taps for Transformers 7.5 to 24 kVA: One 5 percent tap above and one 5 percent tap below normal full capacity.
- G. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and two 2.5 percent taps below normal full capacity.
- H. Insulation Class, Smaller Than 30 kVA: 180 deg C, UL-component-recognized insulation system with a maximum of 115 deg C rise above 40 deg C ambient temperature.
- I. Insulation Class, 30 kVA and Larger: 220 deg C, UL-component-recognized insulation system with a maximum of 150 deg C rise above 40 deg C ambient temperature.
- J. Grounding: Provide ground-bar kit or a ground bar installed on the inside of the transformer enclosure.
- K. K-Factor Rating: Transformers indicated to be K-factor rated shall comply with UL 1561 requirements for non-sinusoidal load current-handling capability to the degree defined by designated K-factor.
 - 1. Unit shall not overheat when carrying full-load current with harmonic distortion corresponding to designated K-factor, without exceeding the indicated insulation class in a 40 deg C maximum ambient and a 24-hour average ambient of 30 deg C.
 - 2. Indicate value of K-factor on transformer nameplate.
 - 3. Unit shall comply with requirements of DOE 2016 efficiency levels when tested according to NEMA TP 2 with a K-factor equal to one.
 - 4.

2.5 IDENTIFICATION

- A. Nameplates: Engraved, laminated-acrylic or melamine plastic signs for each distribution transformer, mounted with corrosion-resistant screws. Nameplates and label products are specified in Section 260553 "Identification for Electrical Systems."

2.6 SOURCE QUALITY CONTROL

- A. Test and inspect transformers according to IEEE C57.12.01 and IEEE C57.12.91.
 - 1. Resistance measurements of all windings at rated voltage connections and at all tap connections.
 - 2. Ratio tests at rated voltage connections and at all tap connections.
 - 3. Phase relation and polarity tests at rated voltage connections.
 - 4. No load losses, and excitation current and rated voltage at rated voltage connections.
 - 5. Impedance and load losses at rated current and rated frequency at rated voltage connections.
 - 6. Applied and induced tensile tests.
 - 7. Regulation and efficiency at rated load and voltage.
 - 8. Insulation-Resistance Tests:

- a. High-voltage to ground.
- b. Low-voltage to ground.
- c. High-voltage to low-voltage.

9. Temperature tests.

B. Factory Sound-Level Tests: Conduct sound-level tests on equipment for this Project.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.
- B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.
- C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.
- D. Verify that ground connections are in place and requirements in Section 260526 "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance shall be 5 ohms at location of transformer.
- E. Environment: Enclosures shall be rated for the environment in which they are located. Covers for NEMA 250, Type 4X enclosures shall not cause accessibility problems.
- F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install transformers level and plumb on a concrete base with vibration-dampening supports. Locate transformers away from corners and not parallel to adjacent wall surface.
- B. Construct concrete bases according to Section 033000 "Cast-in-Place Concrete" and anchor floor-mounted transformers according to manufacturer's written instructions, seismic codes applicable to Project, and requirements in Section 260529 "Hangers and Supports for Electrical Systems."
 - 1. Coordinate size and location of concrete bases with actual transformer provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.
- C. Secure transformer to concrete base according to manufacturer's written instructions.
- D. Secure covers to enclosure and tighten all bolts to manufacturer-recommended torques to reduce noise generation.

- E. Remove shipping bolts, blocking, and wedges.

3.3 CONNECTIONS

- A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- D. Provide flexible connections at all conduit and conductor terminations and supports to eliminate sound and vibration transmission to the building structure.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Director's Representative will engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections with the assistance of a Company Service Advisor.
- C. Small (Up to 167-kVA Single-Phase or 500-kVA Three-Phase) Dry-Type Transformer Field Tests:
 - 1. Visual and Mechanical Inspection.
 - a. Inspect physical and mechanical condition.
 - b. Inspect anchorage, alignment, and grounding.
 - c. Verify that resilient mounts are free and that any shipping brackets have been removed.
 - d. Verify the unit is clean.
 - e. Perform specific inspections and mechanical tests recommended by manufacturer.
 - f. Verify that as-left tap connections are as specified.
 - g. Verify the presence of surge arresters and that their ratings are as specified.
 - 2. Electrical Tests:
 - a. Measure resistance at each winding, tap, and bolted connection.
 - b. Perform insulation-resistance tests winding-to-winding and each winding-to-ground. Apply voltage according to manufacturer's published data. In the absence of manufacturer's published data, comply with NETA ATS, Table 100.5. Calculate polarization index: the value of the index shall not be less than 1.0.
 - c. Perform turns-ratio tests at all tap positions. Test results shall not deviate by more than one-half percent from either the adjacent coils or the calculated ratio. If test fails, replace the transformer.

- d. Verify correct secondary voltage, phase-to-phase and phase-to-neutral, after energization and prior to loading.
- D. Large (Larger Than 167-kVA Single Phase or 500-kVA Three Phase) Dry-Type Transformer Field Tests:
 - 1. Visual and Mechanical Inspection:
 - a. Inspect physical and mechanical condition.
 - b. Inspect anchorage, alignment, and grounding.
 - c. Verify that resilient mounts are free and that any shipping brackets have been removed.
 - d. Verify the unit is clean.
 - e. Perform specific inspections and mechanical tests recommended by manufacturer.
 - f. Verify that as-left tap connections are as specified.
 - g. Verify the presence of surge arresters and that their ratings are as specified.
 - 2. Electrical Tests:
 - a. Measure resistance at each winding, tap, and bolted connection.
 - b. Perform insulation-resistance tests winding-to-winding and each winding-to-ground. Apply voltage according to manufacturer's published data. In the absence of manufacturer's published data, comply with NETA ATS, Table 100.5. Calculate polarization index: the value of the index shall not be less than 1.0.
 - c. Perform power-factor or dissipation-factor tests on all windings.
 - d. Perform turns-ratio tests at all tap positions. Test results shall not deviate by more than one-half percent from either the adjacent coils or the calculated ratio. If test fails, replace the transformer.
 - e. Perform an excitation-current test on each phase.
 - f. Perform an applied voltage test on all high- and low-voltage windings to ground. See IEEE C57.12.91, Sections 10.2 and 10.9.
 - g. Verify correct secondary voltage, phase-to-phase and phase-to-neutral, after energization and prior to loading.
- E. Remove and replace units that do not pass tests or inspections and retest as specified above.
- F. Infrared Scanning: Two months after Substantial Completion, perform an infrared scan of transformer connections.
 - 1. Use an infrared-scanning device designed to measure temperature or detect significant deviations from normal values. Provide documentation of device calibration.
 - 2. Perform two follow-up infrared scans of transformers, one at four months and the other at 11 months after Substantial Completion.
 - 3. Prepare a certified report identifying transformer checked and describing results of scanning. Include notation of deficiencies detected, remedial action taken, and scanning observations after remedial action.
- G. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.

3.5 ADJUSTING

- A. Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 5 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.
- B. Output Settings Report: Prepare a written report recording output voltages and tap settings.

3.6 CLEANING

- A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

END OF SECTION 262213

SECTION 263213.13 - DIESEL-ENGINE-DRIVEN GENERATOR SETS

1.1 GENERAL SUMMARY

- A. Section Includes, provide two (2) genset units each consisting of:
 - 1. Diesel engine.
 - 2. Modular Control and monitoring system.
 - 3. Generator overcurrent and fault protection.
 - 4. Generator, exciter, and voltage regulator.
 - 5. Outdoor engine generator enclosure (where selected).
 - 6. Vibration isolation devices (where applicable).
- B. Pad Mount Docking Station
- C. Related Requirements:
 - 1. Section 262313 "Paralleling Low-Voltage Switchgear" for controls and paralleling equipment for large or multiple parallel engine generators.
 - 2. Section 263343 "Battery Chargers" for remote engine battery chargers.
 - 3. Section 263600 "Transfer Switches" for transfer switches including sensors and relays to initiate automatic-starting and -stopping signals for engine generators.

1.2 DEFINITIONS

- A. EPS: Emergency power supply.
- B. EPSS: Emergency power supply system.
- C. Operational Bandwidth: The total variation from the lowest to highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
 - 2. Include thermal damage curve for generator.
 - 3. Include time-current characteristic curves for generator protective device.
 - 4. Include fuel consumption in gallons per hour at 0.8 power factor at 0.5, 0.75, and 1.0 times generator capacity.
 - 5. Include generator efficiency at 0.8 power factor at 0.5, 0.75, and 1.0 times generator capacity.
 - 6. Include airflow requirements for cooling and combustion air in cubic feet per minute at 0.8 power factor, Provide Drawings indicating requirements and limitations for location of air intake and exhausts.

7. Include generator characteristics, including, but not limited to, kilowatt rating, efficiency, reactance, and short-circuit current capability.

B. Shop Drawings:

1. Dimensioned Outline Drawings of Equipment Unit: With engine and generator mounted on rails, identify center of gravity and total weight for provided components; enclosure, silencer, base tank, each piece of equipment not integral to the engine generator.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Identify fluid drain ports and clearance requirements for proper fluid drain.
4. Design calculations for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
5. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include base weights.
6. Include diagrams for power, signal, and control wiring. Complete schematic, wiring, and interconnection diagrams indicating terminal markings for engine generators and functional relationship between all electrical components.
7. Rigging Information: Indicate location of each lifting attachment, generator-set center of gravity, and total package weight in submittal drawings.
- 8.

C. Coordination Drawings:

1. Provide coordination drawings showing placement on site. Show equipment pad layout, electrical equipment positions, fuel oil management equipment and controls, fuel oil tanks, piping, connections, fencing, and appurtenances. Fully coordinate with Director's Representative and M-Contractor.

1.4 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Data: Certificates, for engine generator, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Source Quality-Control Reports: Including, but not limited to, the following:

1. Certified summary of prototype-unit test report. Perform tests at rated load and power factor. Provide the following test results:
 - a. Maximum Power Level
 - b. Maximum Motor Starting (sKVA)
 - c. Structural Soundness
 - d. Torsional Analysis
 - e. Transient Response

- f. Alternator Temperature Rise
 - g. Engine Cooling Requirements (unit mounted radiator)
 - h. Harmonic Analysis (per IEEE-115 and ANSI-100)
 - i. Voltage Regulation
 - j. Endurance Testing
- 2. Certified Test Reports: For components and accessories that are equivalent, but not identical, to those tested on prototype unit.
- 3. Report of factory test on units to be shipped for this Project, indicating evidence of compliance with specified requirements.
- 4. Report of sound generation.
- 5. Report of exhaust emissions indicating compliance with applicable regulations.
- 6. Certified Torsional Vibration Compatibility: Comply with NFPA 110.
- C. Field quality-control reports. Field start-up report and unit in-service documentation, including load bank test results if applicable.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For packaged engine generators to include in emergency, operation, and maintenance manuals. Include manufacturer's recommended maintenance and periodic testing plan in accordance with NFPA 110, Chapter 8.
- B. Furnish extra materials required by local Authority Having Jurisdiction (AHJ) and defined in project documents that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1.6 QUALITY ASSURANCE

- A. The generator set covered by these specifications shall be designed, tested, rated, assembled and installed in accordance with all applicable standards below:
 - 1. CSA C22.2, No. 14-M91 Industrial Control Equipment.
 - 2. CSA C22.2, No. 100 Motors and Generators
 - 3. CSA 282-15
 - 4. EN 61000-6
 - 5. EN 55011
 - 6. FCC Part 15 Subpart B
 - 7. ISO 8528
 - 8. IEC 61000
 - 9. UL 508
 - 10. UL 2200
 - 11. UL 142
 - 12. UL 6200
 - 13. Designed to allow for installed compliance to NFPA 37, NFPA 70, NFPA 99 and NFPA 110
- B. Manufacturer Qualifications:

1. Current certificate holder for ISO 9001 compliance.
 2. The power system shall be produced by a manufacturer who has produced this type of equipment for a period of at least 25 years and who maintains a service organization of factory-authorized generator technicians available twenty-four hours a day throughout the year.
 3. Manufacturing and assembly of products must be done in the United States using domestically sourced materials to the extent practical.
- C. Installer Qualifications: An authorized representative who is trained and certified by the manufacturer on stationary power systems.

1.7 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of packaged engine generators and associated auxiliary components that fail in materials or workmanship within specified warranty period.
1. Warranty: 5 Year Comprehensive from date of Substantial Completion.
 2. A Comprehensive Warranty is defined as the manufacturer covering replacement parts, labor, and limited technician travel costs for covered warranty repairs during the listed warranty period. A Limited warranty is defined as the manufacturer covering replacement parts, labor, and limited technician travel costs for the first 2 years and then replacement parts for the remainder of the listed warranty period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Generac Power Systems, Inc.; 300 kW, 10.3L with a K0300124Y21-300kW alternator and integrated modular paralleling controls. Each three-phase generator shall be rated for 300 kW at 480 volts and 60 Hz, at 0.8 power factor lagging while operating at a maximum ambient temperature of 104 Fahrenheit and maximum altitude of 3000 feet above sea level without reduction in electrical output capacity. Comparable products by one of the following will be considered:
1. Generac Industrial Power, Inc.
 2. Caterpillar, Inc.
 3. Cummins Power Generation.
- B. Source Limitations: Obtain packaged engine generators and auxiliary components from single source from single manufacturer. "Source Limitations: Obtain packaged engine generators and auxiliary components from single supplier. The equipment supplied and installed shall meet the requirements of NEC and all applicable local codes and regulations. All equipment shall be new, of current production. There shall be one source responsibility for warranty: parts and service through a local representative with factory certified service personnel.
- C. Requests for substitutions shall be made a minimum of ten (10) days prior to bid date. Manufacturers catalog data and a completed generator sizing model using the proposed

manufacturer's generator sizing software shall accompany each request and authorized acceptance shall be addenda only. Should any substitutions be made, the contractor shall bear responsibility for the installation, coordination, and operation of the system as well as any engineering and redesign costs, which may result from such substitutions.

2.2 PERFORMANCE REQUIREMENTS

A. NFPA Compliance:

1. Comply with NFPA 37.
2. Comply with NFPA 70.
3. Comply with NFPA 99.
4. Comply with NFPA 110 requirements for Level 1 EPSS.

B. UL Compliance: Engine generator assembly and factory enclosure (if provided) shall be UL 2200 listed.

C. Engine Exhaust Emissions: Comply with applicable US EPA, State and Local Government requirements. Diesel Stationary Emergency: Engines shall be certified by the manufacturer to comply with 40 CFR Part 60 Subpart IIII.

2.3 ENGINE GENERATOR ASSEMBLY DESCRIPTION

A. Factory-assembled and -tested, water-cooled engine, with brushless generator and accessories.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

C. Power Rating: Standby.

D. Service Load: The generator system shall consist of Generac model 300 kW, 10.3L with a K0300124Y21-300kW alternator units. Each generator unit shall provide 300 kW and 375 kVA while operating at the maximum ambient operating temperature and elevation specified in the project documents. Capable of being operated in modular paralleling configuration.

E. Power Factor: 0.8 lagging.

F. Frequency: 60 Hz.

G. Voltage: 480 Volts ac.

H. Phase: Three Phase, Four Wire.

I. Induction Method: Turbocharged.

J. Governor: Adjustable isochronous, with speed sensing.

- K. Mounting Frame: Structural steel framework to maintain alignment of mounted components without depending on concrete foundation. Provide lifting attachments sized and spaced to prevent deflection of base during lifting and moving.
- L. Nameplates: For each major system component to identify manufacturer's name, model, and serial number of components.
- M. Engine Generator Performance:
1. Steady-State Voltage Operational Bandwidth: 3 percent of rated output voltage from no load to full load.
 2. Transient Voltage Performance: Not more than 8.75 percent variation for 50 percent step-load increase or decrease at unity power factor. Voltage shall recover and remain within the steady-state operating band within three seconds.
 3. Steady-State Frequency Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.
 4. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
 5. Transient Frequency Performance: Less than 3.0 Hertz variation for 50 percent step-load increase or decrease at unity power factor. Frequency shall recover and remain within the steady-state operating band within five seconds.
 6. Output Waveform: At no load, harmonic content measured line to line or line to neutral shall not exceed 5 percent total and 3 percent for single harmonics. Telephone influence factor, determined in accordance with NEMA MG 1, shall not exceed 50 percent.
 7. Sustained Short-Circuit Current: For a three-phase, bolted short circuit at system output terminals, system shall supply a minimum of 300 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to generator system components.
 8. Start time to comply with NFPA system requirements.
- N. Parallel Engine Generators Controller
1. The generator controller shall be capable of paralleling with other generators of the same controller type using a dedicated communications network between the generator controllers and integrated (commonly referred as onboard) paralleling capabilities.
 - a. The controller shall support paralleling up to sixteen generators on a common bus.
 - b. Automatic reactive output power control and load sharing between engine generators operated in parallel.
 - c. The parallel generator system controller shall be capable of managing six levels of load shedding (Automatic regulation, automatic connection to a common bus, and automatic synchronization, with manual controls and instruments to monitor and control paralleling functions).
 - d. Digital communications shall enhance system operation but shall not be required to synchronize or operate the generators in parallel. Systems that require external control hardware or digital communications to synchronize and operate the generators in parallel are not acceptable. During a failure of generator load share communications (analog or digital), generators must be able to start, parallel, and load share.

- e. Control systems that have any systemic single point failure modes are not acceptable. This is inclusive of systems that rely on reactive cross current and isochronous load sharing control loops. During start-up commission, all load share and communication lines will be opened while the generators are running. The generators must continue running and continue to share load.
- f. Protective Relays. The controller shall provide a standard set of protective relay functions with programmable limits and time delays that include Under Voltage (27), Reverse Power (32R), Over Power (32O), Loss of Field (40 Reverse VARS), Over Voltage (59), Over Frequency (81O), and Over Current with Voltage Range.
- g. Circuit Breaker/Contactor Control
 - 1) The controller shall be capable of operating a circuit breaker or contactor to apply electricity to the parallel electrical bus.
 - 2) The controller system shall have a contact to provide an energizing signal to open or close the circuit breaker or contactor.
 - 3) The controller will monitor current to detect an individual failure and open the respective generator circuit breaker or contactor (separating the generator from the common bus).

2.4 ENGINE PERFORMANCE

- A. Fuel: ASTM D975, diesel fuel oil, Grade 2-D S15. Engine shall be capable of operating on hydrotreated vegetable oil blends (up to HVO 100) conforming to the EN 15940 specification without modification.
- B. Rated Engine Speed: 1800 rpm.
- C. Lubrication System to be engine mounted.
 - 1. Oil filter shall be engine-mounted replaceable cartridge type with integral bypass valve, in accordance with manufacturer recommendations.
 - 2. Thermostatic Control Valve: Control flow in system to maintain optimum oil temperature. Unit shall be capable of full flow and is designed to be fail-safe.
 - 3. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.
- D. Jacket Coolant Heater: Jacket water heater shall be sized per NFPA110 and UL listed to ensure that genset will start within the specified time period and ambient conditions.
- E. Integral Cooling System: Closed loop, liquid cooled, with radiator factory mounted on engine generator set mounting frame and integral engine-driven coolant pump.
 - 1. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
 - 2. Expansion Tank: Constructed of welded steel plate and rated to withstand maximum closed-loop coolant system pressure for engine used. Equip with gauge glass and petcock.
 - 3. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
 - 4. Maximum Ambient Operating Temperature on Radiator: 122 degrees F (50 degrees C).

5. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, UV-, and abrasion-resistant fabric.
 - a. Rating: 50-psig (345-kPa) maximum working pressure with coolant at 180 deg F (82 deg C), and non-collapsible under vacuum.
 - b. Meets SAE 100R1A Type S, EN853 1SN, ISO 1436-1 Type 1SN
 - c. a Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.

F. Muffler/Silencer:

1. Critical type, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements.

G. Air-Intake Filter: Heavy duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.

H. Starting System: 12 or 24-V electric, with negative ground.

1. Cranking Cycle: As required by NFPA 110 for system level specified.
2. Battery: Lead acid, with capacity within ambient temperature range specified in "Performance Requirements" Article to provide specified cranking cycle as required by NFPA 110 for system level specified.
3. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 35 minimum continuous rating.
4. Battery Charger: Current-limiting, automatic-equalizing, and float-charging type designed for lead-acid batteries. Unit shall comply with UL 1236 and NFPA 110 Section 5.6.4.6 for Level 1 systems.:

2.5 REMOTE DIESEL FUEL-OIL SUPPLY SYSTEM

- A. Comply with NFPA 37.
- B. Reference Specification Sections 231113 and 231323 for information.

2.6 CONTROL AND MONITORING

- A. Automatic Starting System Sequence of Operation: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of engine generator. When mode-selector switch is switched to the on position, engine generator starts. The off position of same switch initiates engine generator shutdown. When engine generator is running, specified system or equipment failures or derangements automatically shut down engine generator and initiate alarms.
- B. Manual Starting System Sequence of Operation: Switching on-off switch on the generator control panel to the on position starts engine generator. The off position of same switch initiates engine generator shutdown. When engine generator is running, specified system or equipment failures or derangements automatically shut down engine generator and initiate alarms.

- C. Provide minimum run time control set for 15 minutes with override only by operation of a remote emergency-stop switch.
- D. Control panel must comply with UL 6200. The controller shall meet ASTM B117 (salt spray test).
- E. Remote Connectivity: Controller shall be capable of remote connectivity via RS485. Remote connectivity shall be provided by a physically separate module that can be secured, access limited, and/or physically removed to restrict and/or completely isolate the generator system from any outside control or monitoring.
- F. Connection to Building Management: Provide connections for data transmission of indications to remote data terminals via Modbus.
- G. Environmentally Hardened Design: Open circuit boards, edge cards, and PC ribbon cable connections are unacceptable.
- H. PCB Construction: Circuit boards with surface-mounted components to provide vibration durability. Circuit boards utilizing large capacitors or heat sinks must utilize encapsulation methods to securely support these components.
- I. Configuration:
 - 1. Operating and safety indications, protective devices, basic system controls, and engine gauges shall be grouped in a common control and monitoring panel mounted on the engine generator. Mounting method shall isolate the control panel from engine generator vibration. Panel powered from the engine generator battery.
- J. Control and Monitoring Panel:
 - 1. Digital engine generator controller with integrated touch screen, controls, and microprocessor, capable of local and remote control, monitoring, and programming, with battery backup.
 - 2. Instruments: Located on the control and monitoring panel and viewable during operation.
 - a. Engine lubricating-oil pressure gauge.
 - b. Engine-coolant temperature gauge.
 - c. DC voltmeter (alternator battery charging).
 - d. Running-time meter.
 - e. AC voltmeter, for each phase.
 - f. AC ammeter, for each phase.
 - g. AC frequency meter.
 - h. Generator-voltage adjusting feature.
 - 3. Controls and Protective Devices: Controls, shutdown devices, and common alarm indication, including the following:
 - a. Cranking control equipment.
 - b. Run-Off-Auto switch.
 - c. Control switch not in automatic position alarm.
 - d. Overcrank alarm.

- e. Overcrank shutdown device.
- f. Low-water temperature alarm.
- g. High engine temperature pre-alarm.
- h. High engine temperature.
- i. High engine temperature shutdown device.
- j. Overspeed alarm.
- k. Overspeed shutdown device.
- l. Low fuel day tank.

1) Low-fuel-level alarm shall be initiated when the level falls below that required for operation for duration required for the indicated EPSS class.

- m. Coolant low-level alarm.
- n. Coolant low-level shutdown device.
- o. Coolant high-temperature pre-alarm.
- p. Coolant high-temperature alarm.
- q. Coolant low-temperature alarm.
- r. Coolant high-temperature shutdown device.
- s. EPS load indicator.
- t. Battery high-voltage alarm.
- u. Low cranking voltage alarm.
- v. Battery-charger malfunction alarm.
- w. Battery low-voltage alarm.
- x. Lamp test.
- y. Contacts for local and remote common alarm.
- z. Remote manual stop shutdown device.
- aa. Total engine run hours, non-resettable.
- bb. Engine generator metering, including voltage, current, hertz, kilowatt, kilovolt ampere, and power factor.

K. External Alarm & Status Relays: Provide a separate terminal block, factory wired to Form C dry contacts, for each alarm and status condition required by Building Management or other external systems as shown on electrical drawings.

L. Common Remote Panel with Common Audible Alarm: Include necessary contacts and terminals in control and monitoring panel. Remote panel shall be powered from the engine generator battery.

M. Remote Alarm Annunciator: An LED indicator light labeled with proper alarm conditions shall identify each alarm event, and a common audible signal shall sound for each alarm condition. Silencing switch in face of panel shall silence signal without altering visual indication. Connect so that after an alarm is silenced, clearing of initiating condition will reactivate alarm until silencing switch is reset. Cabinet and faceplate are surface- or flush-mounting type to suit mounting conditions indicated.

- 1. Over-crank alarm.
- 2. Low water-temperature alarm.
- 3. High engine temperature pre-alarm.
- 4. High engine temperature alarm.
- 5. Low lube oil pressure alarm.

6. Overspeed alarm.
 7. Low fuel day tank alarm.
 8. Low coolant level alarm.
 9. Low cranking voltage alarm.
 10. Contacts for local and remote common alarm.
 11. Audible-alarm silencing switch.
 12. Air shutdown damper when used.
 13. Run-Off-Auto switch.
 14. Control switch not in automatic position alarm.
 15. Fuel tank derangement alarm.
 16. Fuel tank high-level shutdown of fuel supply alarm.
 17. Lamp test.
 18. Low-cranking voltage alarm.
 19. Generator overcurrent-protective-device not-closed alarm.
- N. Remote Emergency-Stop Switch: Provide remote emergency stop switch and circuitry in quantity and style as shown on electrical drawings. Electrical contractor to coordinate exact location with Director's Representative, Engineer, and local AHJ.
- O. Engine Run Relay: The generator set shall be provided with a run relay which shall provide a double-pole, double-throw relay with 10-amp/ 250 VAC contacts to indicate that the generator is running. The run relay dry contacts can be used for energizing or de-energizing customer devices while the generator is running (e.g. louvers, indicator lamps, etc.)
- P. Data Logging:
1. Event Logging – the controller keeps a record of up to 8,000 events with date and time locally for warning and shutdown faults. This event log can be downloaded onto a USB storage device or onto a PC through the service program.
 2. Event Snapshot – the control system shall capture 15 seconds of critical data around the time a fault or warning. This data shall be viewable on the controller and downloadable.
 3. Data Logging – the controller shall allow customized parameters to be logged based on a start trigger from the controller interface.
 - a. The parameters are selectable from all monitored parameters.
 - b. The sample period shall be configurable from 1 second to 1 day.
 - c. The collected data shall be stored on a USB storage device plugged into the control panel.

2.7 GENERATOR OVERCURRENT AND FAULT PROTECTION

- A. Overcurrent protective devices shall be coordinated to optimize selective tripping when a short circuit occurs.
1. Overcurrent protective devices for the entire EPSS shall be coordinated to optimize selective tripping when a short circuit occurs. Coordination of protective devices shall consider both utility and EPSS as the voltage source.
 2. Overcurrent protective devices for the EPSS shall be accessible only to authorized personnel.

B. Generator Overcurrent Protective Device:

1. Unit mounted circuit breakers. Rating, ampacity, accessories, as shown on drawings or as listed below:
2. Molded-case circuit breaker, electronic-trip type; 100 percent rated; complying with UL 489:
 - a. Tripping Characteristics: Adjustable long-time and short-time delay and instantaneous.
 - b. Trip Settings: Selected to coordinate with generator thermal damage curve.
 - c. Shunt Trip: Connected to trip breaker when engine generator is shut down by other protective devices.
 - d. Mounting: Adjacent to, or integrated with, control and monitoring panel.

C. Generator Controller Integrated Alternator Protective Functions:

1. Short-time I^2t function: Generator controller-based function shall continuously monitor current level in each phase of alternator output, integrate alternator heating effect over time, and predict when thermal damage of alternator will occur. As overcurrent heating effect on the alternator approaches the thermal damage point of the unit, protector switches the excitation system off, opens the generator disconnect device, and shuts down the engine generator. When signaled by generator protector or other engine generator protective devices, a shunt-trip device in the generator disconnect switch shall open the switch to disconnect the generator from load circuits.
2. Long-time function: Initiates a generator overload alarm when generator has operated at an overload equivalent to 110 percent of full-rated load for 60 seconds. Indication for this alarm is integrated with other engine generator malfunction alarms. Contacts shall be available for load shed functions.
3. Short-circuit fault clearing: Under single- or three-phase fault conditions, regulates generator to 300 percent of rated full-load current for up to 10 seconds.
4. Senses clearing of a fault by other overcurrent devices and controls recovery of rated voltage to avoid overshoot.

2.8 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

- A. Comply with NEMA MG 1.
- B. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.
- C. Electrical Insulation: Class H.
- D. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required.
- E. Range: Provide range of output voltage by adjusting the excitation level.

- F. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity. Stator shall be skewed construction to minimize harmonic voltage distortion.
- G. Enclosure: Drip proof.
- H. Instrument Transformers: Mounted within generator enclosure.
- I. Voltage Regulator:
 - 1. Voltage Regulator: Solid-state type, separate from exciter. The digital voltage regulator shall be microprocessor based with fully programmable operating and protection characteristics. The regulator shall maintain steady-state generator output voltage within +/- 0.25% for any constant load between no load and full load. The regulator shall be capable of sensing true RMS. The regulator shall provide an adjustable Volts/Hz slope regulation characteristic in order to optimize voltage and frequency response for site conditions.
 - 2. Alternator Excitation: Permanent Magnet Generator (PMG) shall provide excitation power for optimum motor starting and short circuit performance.
 - 3. The generator must accept rated load in one-step.
 - 4. System Transient Voltage Performance: Alternator shall be capable of supplying 884 sKVA with a voltage dip not more than 35% at 0.3 starting power factor. Sustained voltage dip data or manufacturer-published SKVA numbers based on unity PF alternator-only dynamometer testing will not be accepted.
- J. Strip Heater: Thermostatically controlled unit arranged to maintain stator windings above dew point. The strip heater shall be wired directly to the incoming power distribution panel or load center.
- K. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.

2.9 OUTDOOR ENGINE GENERATOR ENCLOSURE

- A. Basis of design is a Sound Attenuation Level 2.
- B. Generator packaged within manufacturer's weather protective, sound attenuated enclosure. Enclosure and generator set shall be UL 2200 Listed as a system.
- C. Enclosure Construction: Minimum 14-gauge construction. Roof construction shall be raised-seam, gasket-free interlocking panels. Rivets shall not be used on external painted surfaces. Design shall be rodent resistant.
- D. Doors shall be equipped with lift-off pin and sleeve type hinges to allow access to the engine, alternator, and control panel. Hinges shall be adjustable for door alignment. Hinges and all exposed fasteners shall be stainless steel. Each door shall be equipped with minimum 2-point latching mechanism and identical keys. Perimeter of all door openings shall include polyethylene gasket.
- E. Upward discharging exhaust hood for engine cooling airflow and exhaust.

- F. Engine exhaust silencer mounted within enclosure discharge hood.
- G. Enclosure Finish: Electrostatic applied powder paint, baked and finished to manufacturer's specifications. Finish system shall be subjected to the following tests:
1. ASTM D1186 - 87; 2.5+ mil Paint Thickness
 2. ASTM D3363 - 92a; Material Hardness
 3. ASTM D522 - B; Resistance to Cracking
 4. ASTM D3359 - B; Adhesion
 5. ASTM B117 D 1654; Resistant to Salt Water Corrosion
 6. ASTM D1735 D 1654; Resistant to Humidity
 7. ASTM 2794 93 (2004); Impact Resistance
 8. SAE J1690 - UV Protection"
- H. Enclosure Color: Manufacturer's standard color, or custom color matched based on architect's design with color sample provided to generator manufacturer.
- I. Wind Rating: Enclosure shall be constructed to attain basic wind speed rating of 110 MPH; WIF 1.15, Exposure Category "C", Building Classification "Enclosed", Topographic Factor $K_{zt} = 1$. Wind Design Pressures: windward, 20.6 lb/ft²; leeward, -12.9 lb/ft²; roof, -18.0 lb/ft²."
- J. Snow Load Rating: Minimum 70 pounds per square foot.
- K. Engine-Cooling Airflow through Enclosure: Maintain temperature rise of system components within required limits when unit operates at 110 percent of rated load for two hours with ambient temperature at top of range specified in system service conditions.
- L. Sound Insulation: Enclosure and air discharge hood completely lined with reflective silver mylar faced sound attenuating closed cell foam that meets UL 94 HF1 standards for flammability (FMVSS 302 test method). Roof sound insulation panels shall include additional mechanical retention.
- M. Sound Performance: The engine generator, while operating at full rated load, shall not exceed 75.00 dBA average measured at 23 ft (7 meters) from the engine generator in a free field environment.
- N. Louvers: Fixed-engine, cooling-air inlet and discharge. Stormproof and drainable louvers prevent entry of rain and snow.
- O. Distribution Panel for Accessory Loads: Accessory Load Panel: Provide an internal, factory mounted and wired, electrical distribution panel to serve accessory loads; including:
1. Engine block heater
 2. Battery charger
 3. Battery warmer (if included)
 4. Enclosure lights (if included)
 5. Enclosure heater (if included)
 6. Accessory outlets
 7. Motorized louvers (if included)
 8. Other accessories (if included)

- P. Convenience Outlet: Factory-wired convenience 120v duplex-outlet within enclosure, GFCI.

2.10 VIBRATION ISOLATION DEVICES

- A. Elastomeric Isolator Pads: Oil- and water-resistant elastomer or natural rubber, arranged in single or multiple layers, molded with a nonslip pattern and galvanized-steel baseplates of sufficient stiffness for uniform loading over pad area, and factory cut to sizes that match requirements of supported equipment for units with a ratings 750kw or below.
 - 1. Material: Standard neoprene separated by steel shims.
- B. Spring Isolators: Freestanding, steel, open-spring isolators with seismic restraint for units with a rating larger than 750kw.
 - 1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to wind loads or if weight is removed; factory-drilled baseplate bonded to 1/4-inch- (6-mm-) thick, elastomeric isolator pad attached to baseplate underside; and adjustable equipment-mounting and -leveling bolt that acts as blocking during installation.
 - 2. Outside Spring Diameter: Not less than 80 percent of compressed height of the spring at rated load.
 - 3. Minimum Additional Travel: 50 percent of required deflection at rated load.
 - 4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - 5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 - 6. Minimum Deflection: 0.5.
- C. Vibration isolation devices shall not be used to accommodate misalignments or to make bends.

2.11 PAD MOUNT DOCKING STATION

A. DOCKING STATION

- 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. TRYSTAR #GDS-2.
 - b. Larson Electronics, Inc
 - c. Fox Fab Power Solutions.
- 2. Enclosure
 - a. NEMA 4X Rain-Tight Stainless-Steel Enclosure
 - 1. Pad-lockable front door shall include a hinged access plate at the bottom for entry of temporary cabling that prevents unauthorized tampering while in use.
 - 2. NEMA 4X Integrity shall be maintained while temporary cabling is connected during use.

3. Front and Side shall be accessible for maintenance.
 4. Top, Side, and Bottom shall be accessible for permanent cabling.
 3. Powder coat finish
 - a. Manufacturer's standard finish over corrosion-resistant pretreatment and compatible primer, color as selected by Director's Representative.
 4. Phase, Neutral, and Ground Busbar
 - a. Material: Silver-plated Copper
 - b. Equipment Ground Bus: bonded to box.
 - c. Isolated Ground Bus: insulated from box.
 - d. Ground Bus: 50% of phase size.
 - e. Neutral Bus: Neutral bus rated 100 percent of phase bus.
 5. Temporary generator connectors shall be Camlok style mounted on gland plate.
 - a. Camlok shall be 16 Series model and color coded according to system voltage requirements.
 - b. Camlok connections shall be Bus Bar Style, Cabling or Double Set Screw is not acceptable.
 - c. Camlok connection shall be protected against accidental contact while not in use
 6. Permanent Connection shall be factory installed broad range set-screw mechanical type, located behind a physical barrier.
 7. Short Circuit & Withstand Rating
 - a. Shall be minimum 65 KAIC unless otherwise indicated on drawings.
 8. Voltage & Amperage
 - a. 800 Amps, 277/480 volts 3 Phase
 9. Factory Installed Phase Rotation Monitor Device:
 - a. Phase monitoring relay to be Siemens 3U4512-1AR20 or equal and factory installed.
 10. Kirk Key Interlocks, Access door is kirk keyed with permanent generator set main line circuit breaker.
- B. Additional accessories shall be included as follows:
1. Option #A: Two Wire Auto Start.
 2. Option #C: Battery Charger Receptacle 20A GFCI 125V.
 3. Option #D: Block Heater Receptacle 30A L5-30 125V.
 4. Kirk Key Door Interlock.

2.11 FINISHES

- A. Indoor and Outdoor Enclosures and Components: Manufacturer's standard finish over corrosion-resistant pretreatment and compatible primer, color as selected by Director's Representative.

2.12 SOURCE QUALITY CONTROL

- A. Prototype Testing: Factory test engine generator using same engine model, constructed of identical or equivalent components, and equipped with identical or equivalent accessories.
 - 1. Tests: Comply with IEEE 115 and with NFPA 110, Level 1 Energy Converters.
- B. Project-Specific Equipment Tests: Before shipment, factory test engine generator and other system components and accessories manufactured specifically for this Project. Perform tests at rated load and power factor. Include the following tests:
 - 1. Test components and accessories furnished with installed unit that are not identical to those on tested prototype to demonstrate compatibility and reliability.
 - 2. Test generator, exciter, and voltage regulator as a unit.
 - 3. Full load run.
 - 4. Maximum power.
 - 5. Voltage regulation.
 - 6. Transient and steady-state governing.
 - 7. Single-step load pickup.
 - 8. Safety shutdowns.
 - 9. Report factory test results within 10 days of completion of test.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, equipment bases, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine generator performance.
- B. Examine roughing-in for piping systems and electrical connections. Verify actual locations of connections before packaged engine generator installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service in accordance with requirements indicated:
 - 1. Notify Project Manager in advance of proposed interruption of electrical service.

2. Do not proceed with interruption of electrical service without written permission.
- 3.

- B. Coordination: Thoroughly coordinate all aspects of installation with M-Contractor. Provide working coordination drawings showing each trades component locations, dimensions, connections, and working clearances. Coordinate fuel supply system connections and rough-in requirements.

3.3 INSTALLATION

- A. Comply with NECA 1 and NECA 404.
- B. Comply with packaged engine generator manufacturers' written installation and alignment instructions and with NFPA 110.
- C. Equipment Mounting:
 1. Install packaged engine generators on cast-in-place concrete equipment bases or steel dunnage as indicated on drawings.
 2. Coordinate size and location of mounting bases for packaged engine generators.
 3. Install unit with vibration isolation devices described in section 2.11.

3.4 FIELD QUALITY CONTROL

- A. Tests and Inspections: The supplier of the electric generating plant and associated items covered herein shall provide factory certified technicians to inspect the completed installation and to perform an initial startup inspection to include:
 1. Ensuring the engine starts (both hot and cold) within the specified time.
 2. Verification of engine parameters within specification.
 3. Verify no load frequency and voltage, adjusting if required.
 4. Test all automatic shutdowns of the engine-generator.
 5. Perform a load test of the electric plant, ensuring full load frequency and voltage are within specification by using building load.
- B. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here, including, but not limited to, single-step full-load pickup test.
- C. Battery and Charger Tests:
 1. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions.
 2. Verify that measurements are within manufacturer's specifications."
- D. System Integrity Tests: Verify proper installation, connection, and integrity of each element of engine generator system before and during system operation. Check for air, exhaust, and fluid leaks.
- E. Coordinate tests with tests for transfer switches and run them concurrently.

- F. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation for generator and associated equipment.
- G. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- H. Remove and replace malfunctioning units and retest and reinspect as specified above.
- I. Retest: Correct deficiencies identified by tests and observations, and retest until specified requirements are met.
- J. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators.

3.6 MAINTENANCE SERVICE

- A. Repair Service Capabilities:
 - 1. The generator set supplier shall maintain service parts inventory for the entire power system at a central location which is accessible to the service location 24 hours per day, 365 days per year. The manufacturer of the generator set shall maintain a central parts inventory to support the supplier, covering all the major components of the power system, including engines, alternators, control systems, paralleling electronics, and power transfer equipment.
 - 2. The generator set shall be serviced by a local service organization that is trained and factory certified in generator set service. The supplier shall maintain an inventory of power system replacement parts in the local service location. Service vehicles shall be stocked with critical replacement parts. The service organization shall be on call 24 hours per day, 365 days per year. The service organization shall be physically located within 50 miles of the site.
 - 3. The manufacturer shall maintain model and serial number records of each generator set provided for at least 20 years.
- B. Preventative Maintenance Service Agreement: The supplier shall include as a line-item adder in the proposal, a one-year maintenance service agreement. The maintenance shall be performed by factory authorized service technicians capable of servicing both the engine generator set(s) and the transfer switch(es). This agreement shall include semi-annual preventative maintenance visits to verify operation and/or complete the following:
 - 1. All periodic engine maintenance as recommended by the service manual.
 - 2. All electrical controls maintenance and calibrations as recommended by the manufacturer.
 - 3. All auxiliary equipment as a part of the emergency systems.
 - 4. The supplier shall guarantee emergency service.
 - 5. All expendable maintenance items are to be included in this agreement.

6. A copy of this agreement and a schedule shall be provided in the submittal documents, detailing scope of work and preventative maintenance service visit interval.

END OF SECTION 263213

INSTRUMENTATION AND CONTROLS SCHEDULE - HEATING PLANT (CONTINUED)

ITEM	INSTRUMENT	TAG No.	DESCRIPTION	LOCATION	A/I	D/I	A/O	D/O	RANGE	REMARKS
PLC CONTROLLER										
1	PLC CONTROLLER	BPC-100	PLANT MASTER CONTROLLER	BOILER PLANT						PLANT MASTER CONTROLLER (BCP-100)
2	PLC CONTROLLER	BC-101	BOILER #1 CONTROLLER	BOILER #1			BPC-100			BOILER CONTROLLER (BC-101)
3	PLC CONTROLLER	BC-102	BOILER #2 CONTROLLER	BOILER #2			BPC-100			BOILER CONTROLLER (BC-102)
4	PLC CONTROLLER	BC-103	BOILER #3 CONTROLLER	BOILER #3			BPC-100			BOILER CONTROLLER (BC-103)
MISCELLANEOUS DEVICES										
1	FLOW CONTROL VLV	FCV 101	FEEDWATER CONTROL VALVE	BOILER #1			BC-101			FAIL CLOSED
2	FLOW CONTROL VLV	FCV 102	FEEDWATER CONTROL VALVE	BOILER #2			BC-102			FAIL CLOSED
3	FLOW CONTROL VLV	FCV 103	FEEDWATER CONTROL VALVE	BOILER #3			BC-103			FAIL CLOSED
4	O2 TRANS	OX 101	BOILER #1 OXYGEN MONITOR	BOILER #1	BC-101					
5	O2 TRANS	OX 102	BOILER #2 OXYGEN MONITOR	BOILER #2	BC-102					
6	O2 TRANS	OX 103	BOILER #3 OXYGEN MONITOR	BOILER #3	BC-103					
7	OPACITY MONITOR	OM 101	BOILER #1 STACK	BOILER #1	BC-101					
8	OPACITY MONITOR	OM 102	BOILER #2 STACK	BOILER #2	BC-102					
9	OPACITY MONITOR	OM 103	BOILER #3 STACK	BOILER #3	BC-103					
10	STACK DAMPER	SD 101	BOILER #1 STACK	BOILER #1			BC-101			
11	STACK DAMPER	SD 102	BOILER #2 STACK	BOILER #2			BC-102			
12	STACK DAMPER	SD 103	BOILER #3 STACK	BOILER #3			BC-103			
13	AIR DAMPER SERVO	AS 101	BOILER #1 BURNER	BOILER #1			BC-101			
14	AIR DAMPER SERVO	AS 102	BOILER #2 BURNER	BOILER #2			BC-102			
15	AIR DAMPER SERVO	AS 103	BOILER #3 BURNER	BOILER #3			BC-103			
16	BOILER FAN VFD	VFD 101	BOILER #1 FAN	BOILER #1			BC-101			
17	BOILER FAN VFD	VFD 102	BOILER #2 FAN	BOILER #2			BC-102			
18	BOILER FAN VFD	VFD 103	BOILER #3 FAN	BOILER #3			BC-103			
19	BOILER #1 LWCO PROBE	LWC 101		BOILER #1			BC-101			
20	BOILER #2 LWCO PROBE	LWC 102		BOILER #2			BC-102			
21	BOILER #3 LWCO PROBE	LWC 103		BOILER #3			BC-103			
22	BURNER FRONT AIR HOUSING			BOILER #1						
23	BURNER FRONT AIR HOUSING			BOILER #2						
24	BURNER FRONT AIR HOUSING			BOILER #3						
25	MOTORIZED OIL VALVE OPEN/CLOSE	OV 101		BOILER #1			BC-101			
26	MOTORIZED OIL VALVE OPEN/CLOSE	OV 102		BOILER #2			BC-102			
27	MOTORIZED OIL VALVE OPEN/CLOSE	OV 103		BOILER #3			BC-103			
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-

INSTRUMENTATION AND CONTROLS SCHEDULE - HEATING PLANT

ITEM	INSTRUMENT	TAG No.	DESCRIPTION	LOCATION	A/I	D/I	A/O	D/O	RANGE	REMARKS
PRESSURE TRANSMITTERS										
1	PRESSURE XMTR	PT 101	BOILER #1 PRESSURE	BOILER #1	BC-101				0-200 PSIG	
2	PRESSURE XMTR	PT 102	BOILER #2 PRESSURE	BOILER #2	BC-102				0-200 PSIG	
3	PRESSURE XMTR	PT 103	BOILER #3 PRESSURE	BOILER #3	BC-103				0-200 PSIG	
4	PRESSURE XMTR	PT 104	MAIN STEAM HEADER PRESSURE	STEAM HEADER	BPC-100				0-200 PSIG	
5	PRESSURE XMTR	PT 201	FEEDWATER HEADER PRESSURE	FEEDWATER HEADER	BPC-100				0-200 PSIG	
6	PRESSURE XMTR	PT 301	FUEL OIL SUPPLY PRESSURE	FUEL OIL HEADER	BPC-100				0-200 PSIG	
-	-	-	-	-	-	-	-	-	-	-
8	DRAFT PRESSURE XMTR	PT 501	BOILER #1 DRAFT PRESSURE	BOILER #1 STACK	BC-101					
9	DRAFT PRESSURE XMTR	PT 502	BOILER #2 DRAFT PRESSURE	BOILER #2 STACK	BC-102					
10	DRAFT PRESSURE XMTR	PT 503	BOILER #3 DRAFT PRESSURE	BOILER #3 STACK	BC-103					
TEMPERATURE TRANSMITTERS										
1	TEMPERATURE XMTR	TT 101	FLUE GAS TEMPERATURE BOILER #1	BOILER #1	BC-101				0-1000 DEG F	
2	TEMPERATURE XMTR	TT 102	FLUE GAS TEMPERATURE BOILER #2	BOILER #2	BC-102				0-1000 DEG F	
3	TEMPERATURE XMTR	TT 103	FLUE GAS TEMPERATURE BOILER #3	BOILER #3	BC-103				0-1000 DEG F	
LEVEL TRANSMITTERS										
1	LEVEL XMTR	LT 101	BOILER #1 LEVEL TRANSMITTER	BOILER #1	BC-101				0-5.5 INCH	
2	LEVEL XMTR	LT 102	BOILER #2 LEVEL TRANSMITTER	BOILER #2	BC-102				0-5.5 INCH	
3	LEVEL XMTR	LT 103	BOILER #3 LEVEL TRANSMITTER	BOILER #3	BC-103				0-5.5 INCH	
4	LEVEL XMTR	LT 104	BOILER #1 LEVEL TRANSMITTER	BOILER #1	BC-101				0-5.5 INCH	REDUNDANT DRUM LEVEL TRANSMITTER
5	LEVEL XMTR	LT 105	BOILER #2 LEVEL TRANSMITTER	BOILER #2	BC-102				0-5.5 INCH	REDUNDANT DRUM LEVEL TRANSMITTER
6	LEVEL XMTR	LT 106	BOILER #3 LEVEL TRANSMITTER	BOILER #3	BC-103				0-5.5 INCH	REDUNDANT DRUM LEVEL TRANSMITTER
FLOW TRANSMITTERS										
1	FLOW XMTR	FT 101	FUEL OIL SUPPLY TO BOILER #1	BOILER #1	BC-101				0-3 GPM	AMCO 20 OIL METER WITH HIGH & LOW PULSE OUTPUT
2	FLOW XMTR	FT 102	FUEL OIL SUPPLY TO BOILER #2	BOILER #2	BC-102				0-3 GPM	AMCO 20 OIL METER WITH HIGH & LOW PULSE OUTPUT
3	FLOW XMTR	FT 103	FUEL OIL SUPPLY TO BOILER #3	BOILER #3	BC-103				0-3 GPM	AMCO 20 OIL METER WITH HIGH & LOW PULSE OUTPUT
7	FLOW XMTR	FT 201	STEAM FLOW METER BOILER #1	BOILER #1	BPC-100				0.7k-22.1k PPH	
8	FLOW XMTR	FT 202	STEAM FLOW METER BOILER #2	BOILER #2	BPC-100				1.6k-50.0k PPH	
9	FLOW XMTR	FT 203	STEAM FLOW METER BOILER #3	BOILER #3	BPC-100				1.6k-50.0k PPH	
10	FLOW XMTR	FT 204	STEAM FLOW METER SHAWANGUNK	SHAWANGUNK BRANCH	BPC-100				1.6k-50.0k PPH	
11	FLOW XMTR	FT 205	STEAM FLOW METER WALKILL	WALKILL BRANCH	BPC-100				1.6k-50.0k PPH	
12	FLOW XMTR	FT 206	CONDENSATE FLOW METER SHAWANGUNK	SHAWANGUNK BRANCH	BPC-100				3-40 GPM	
13	FLOW XMTR	FT 207	CONDENSATE FLOW METER WALKILL	WALKILL BRANCH	BPC-100				3-40 GPM	
14	FLOW XMTR	FT 301	BOILER FEEDWATER FLOW METER	BOILER #1	BC-101				0-75 GPM	
15	FLOW XMTR	FT 302	BOILER FEEDWATER FLOW METER	BOILER #2	BC-102				0-75 GPM	
16	FLOW XMTR	FT 303	BOILER FEEDWATER FLOW METER	BOILER #3	BC-103				0-75 GPM	
PRESSURE SWITCHES										
1	PRESSURE SWITCH HIGH	PSH 101	BOILER PRESSURE HIGH BOILER #1	BOILER #1			FSS-1		12-15 PSIG	INITIAL SETTING - 13 PSIG/ AUTOMATIC RESET
2	PRESSURE SWITCH HIGH	PSH 102	BOILER PRESSURE HIGH BOILER #2	BOILER #2			FSS-2		12-15 PSIG	INITIAL SETTING - 13 PSIG/ AUTOMATIC RESET
3	PRESSURE SWITCH HIGH	PSH 103	BOILER PRESSURE HIGH BOILER #3	BOILER #3			FSS-3		12-15 PSIG	INITIAL SETTING - 13 PSIG/ AUTOMATIC RESET
4	PRESSURE SWITCH HIGH	PSH 104	BOILER PRESSURE HIGH BOILER #1	BOILER #1			FSS-1		12-15 PSIG	INITIAL SETTING - 15 PSIG/ MANUAL RESET
5	PRESSURE SWITCH HIGH	PSH 105	BOILER PRESSURE HIGH BOILER #2	BOILER #2			FSS-2		12-15 PSIG	INITIAL SETTING - 15 PSIG/ MANUAL RESET
6	PRESSURE SWITCH HIGH	PSH 106	BOILER PRESSURE HIGH BOILER #3	BOILER #3			FSS-3		12-15 PSIG	INITIAL SETTING - 15 PSIG/ MANUAL RESET
7	PRESSURE SWITCH LOW	PSL 101	FEEDWATER PRESSURE LOW	FEEDWATER HEADER			BPC-100		0-150 PSIG	INITIAL SETTING - 20 PSIG
8	PRESSURE SWITCH LOW	PSL 201	FUEL OIL PRESSURE LOW	FUEL OIL HEADER			BPC-100		0-200 PSIG	INITIAL SETTING - 75 PSIG
-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
LEVEL SWITCHES										
1	LEVEL SWITCH LOW	LSL 101	LOW WATER BOILER #1	BOILER #1	BC-101		FSS-1			AUTO RESET/ ALARM
2	LEVEL SWITCH LOW	LSL 102	LOW WATER BOILER #2	BOILER #2	BC-102		FSS-2			AUTO RESET/ ALARM
3	LEVEL SWITCH LOW	LSL 103	LOW WATER BOILER #3	BOILER #3	BC-103		FSS-3			AUTO RESET/ ALARM
4	LEVEL SWITCH LOW	LSL 105	LOW-LOW WATER LEVEL BOILER #1	BOILER #1	BC-101		FSS-1			MANUAL RESET/ BOILER CUT-OUT
5	LEVEL SWITCH LOW	LSL 106	LOW-LOW WATER LEVEL BOILER #2	BOILER #2	BC-102		FSS-2			MANUAL RESET/ BOILER CUT-OUT
6	LEVEL SWITCH LOW	LSL 107	LOW-LOW WATER LEVEL BOILER #3	BOILER #3	BC-103		FSS-3			MANUAL RESET/ BOILER CUT-OUT

1 BOILER CONTROLS POINTS
M-702 NOT TO SCALE

DESIGN & CONSTRUCTION

CONSULTANT:

CERTIFICATE OF AUTHORIZATION #: 0018644



SAGE ENGINEERING ASSOCIATES, LLP

TO THE BEST OF THE ENGINEER'S KNOWLEDGE, BELIEF AND PROFESSIONAL JUDGEMENT, THESE PLANS AND/OR SPECIFICATIONS ARE IN COMPLIANCE WITH THE 2025 ENERGY CONSTRUCTION CODE OF NEW YORK STATE.

TO THE BEST OF THE ENGINEER'S KNOWLEDGE, BELIEF AND PROFESSIONAL JUDGEMENT, THESE PLANS AND/OR SPECIFICATIONS ARE IN COMPLIANCE WITH THE 2025 BUILDING CODE OF NEW YORK STATE.

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REGISTRATION EXPIRES: 02/28/2029

CONTRACT:

HVAC

TITLE:
REFURBISH BOILER PLANT &
REPLACE FEEDWATER SYSTEM

LOCATION:
WALLKILL CORRECTIONAL FACILITY
50 MC KENDRICK RD
WALKILL, NY

CLIENT:
DEPARTMENT OF CORRECTIONS AND
COMMUNITY SUPERVISION

	09/10/2026	ADDENDUM 01
	05/20/2026	BID DOCUMENT
MARK	DATE	DESCRIPTION
PROJECT NUMBER:		M3215 - H
DESIGNED BY:		DJB
DRAWN BY:		DP
FIELD CHECK:		-
APPROVED:		DPL

SHEET TITLE:

BOILER PLANT CONTROL
SYSTEM POINTS

DRAWING NUMBER

M-702



SAGE ENGINEERING
ASSOCIATES, LLP

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REGISTRATION EXPIRES:
02/28/2029

CONTRACT:

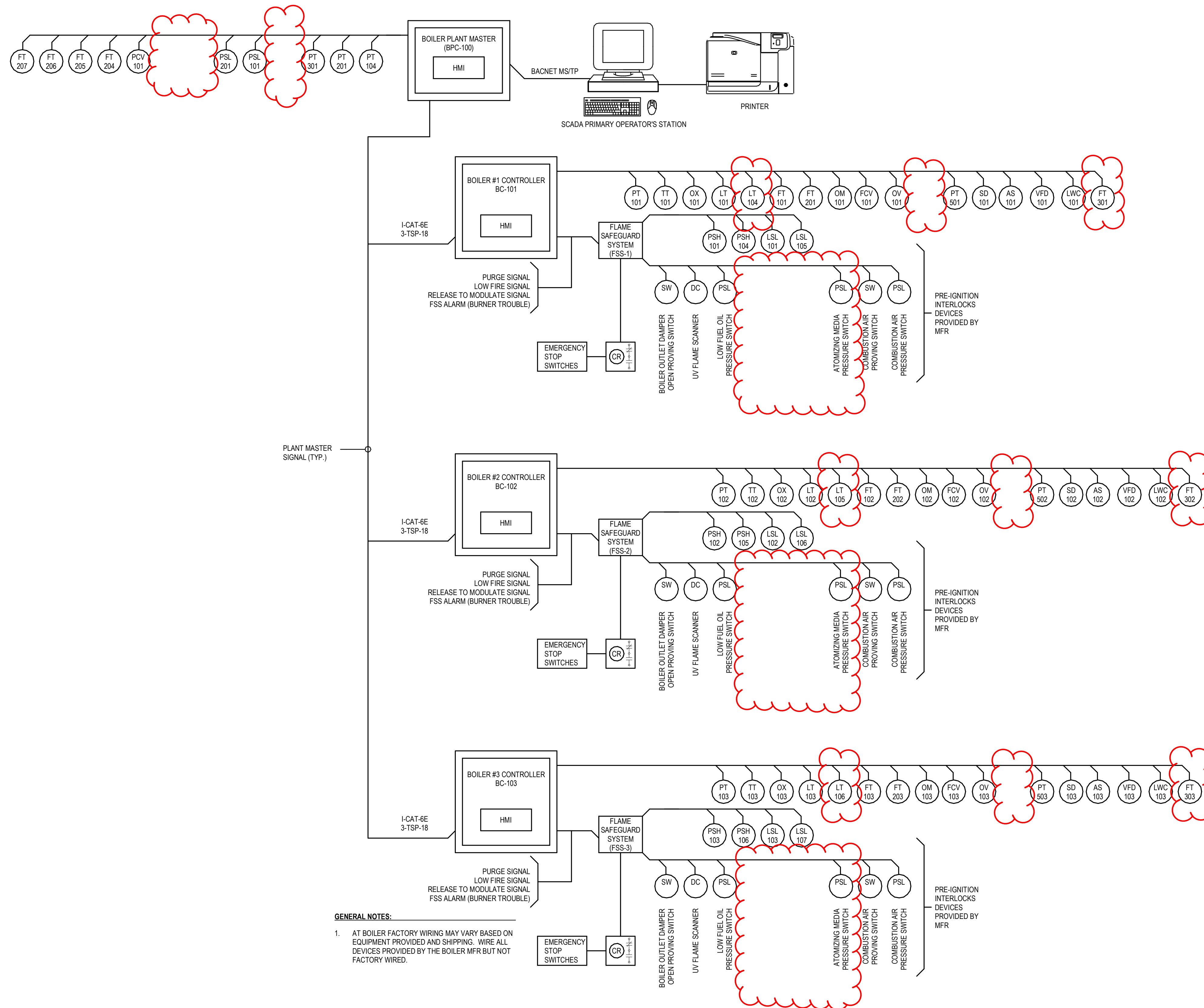
HVAC

TITLE:

**REFURBISH BOILER PLANT &
REPLACE FEEDWATER SYSTEM**

LOCATION:
WALLKILL CORRECTIONAL FACILITY
50 MC KENDRICK RD
WALLKILL, NY

CLIENT: **DEPARTMENT OF CORRECTIONS AND
COMMUNITY SUPERVISION**



GENERAL NOTES:

1. AT BOILER FACTORY WIRING MAY VARY BASED ON EQUIPMENT PROVIDED AND SHIPPING. WIRE ALL DEVICES PROVIDED BY THE BOILER MFR BUT NOT FACTORY WIRED.

1 BOILER CONTROLS DIAGRAM

M-703 NOT TO SCALE

SHEET TITLE:

BOILER PLANT CONTROL SYSTEM DIAGRAM

DRAWING NUMBER

M-703

SHEET 33 OF 49

CONCRETE PAD BY H-CONTRACT (TYP).

PROVIDE PACKAGED MODULAR, STAND-BY GENERATOR WITH INTEGRAL LEVEL 2 SOUND ATTENUATED ENCLOSURE, AND INTEGRAL DAY TANK ON 6 INCH HOUSE KEEPING PAD. SEE ONE-LINE DIAGRAM - POWER INSTALLATIONS FOR INFORMATION. BASIS OF DESIGN: GENERAC POWER SYSTEMS MD300, 300kW, 375KVA 480V, 3 PHASE WITH MAIN LINE OUTPUT BREAKER AND EXHAUST SYSTEM.

TYP LIGHT POLE
BASE DETAIL
(6)
E-40Z

PROVIDE 600V AUTOMATIC TRANSFER SWITCH IN METACLAD ENCLOSURE, NEMA 3R RATED

TRANSFORMER T-1
13.2KVA TO 480V/277V, 5 PHASE 300 KVA, OIL FILLED TRANSFORMER COMPARTMENT, NEMA 3R ENCLOSURE

PROVIDE 15KV RATED, METAL ENCLOSURE LOAD INTERRUPTER SWITCH, NEMA 3R ENCLOSURE ON 6" CONCRETE HOUSE KEEPING PAD

PROVIDE PAD MOUNT 15KV RATED PRIMARY SWITCH 1 (PSW1)

GENERATOR FUEL TANK ALARM / MONITOR PANEL BY H-CONTRACT. POWER HOME RUN BY E-CONTRACT

CONCRETE PAD BY H-CONTRACT (TYP).

DTP1-30

DSH

RIM: 338.66
-29 (10" CIP)

GENERATOR

GENERATOR

EMP4

TRANSFORMER T-DTP1
75KVA, 480V/208Y/120V, PAD MOUNT NEMA 3R ENCLOSURE

PROVIDE PANEL DTP1 ON STRUCTURAL CHANNEL PEDESTAL

PROVIDE TEMPORARY GENERATOR DOCKING STATION, (AKA- QUICK CONNECT), KEY-INTERLOCK-AND ASSOCIATED COMPONENTS FOR MAINTENANCE AND TESTING ACTIVITIES. MOUNT ON CONCRETE PAD ADJACENT TO STRUCTURAL CHANNEL PEDESTAL.

DTP1-10,12

NO ACCESS

RIM: 338.69

[illegible]

A. REFER TO DRAWING E-001 FOR APPLICABLE ABBREVIATIONS, GENERAL NOTES, AND SYMBOLS LEGEND.

(P1) INTERRUPT EXISTING 13.2KV, 600A, THW INSULATED PRIMARY FEED LOOP CONDUCTORS WITHIN EXISTING MY ELECTRIC MANHOLE 1 (EMP3), MODIFY/EXTEND 13.2KV PRIMARY CONDUCTORS TO EXTERIOR PAD MOUNT 15KV LOAD INTERRUPTER PRIMARY SWITCH 1 (PSW1). SEE ONE-LINE DIAGRAM. COORDINATE WITH DIRECTOR'S REPRESENTATIVE AND ALL TRADES.

(P2) PROVIDE GENERATOR EM-OFF BUTTON ADJACENT TO DOOR. PROVIDE CIRCUITRY AND ASSOCIATED COMPONENTS, CONNECT PER MANUFACTURER'S SPECIFICATIONS. LOCATE IN ACCORDANCE WITH DIRECTOR REPRESENTATIVE'S DIRECTIONS.

(P3) EXISTING TEMPORARY STEAM BOILER #1 TO REMAIN FULLY FUNCTIONAL AND OPERATING FOR THE DURATION OF PROJECT. FULLY COORDINATE ALL POWER SHUT-DOWNS AND SWITCH-OVERS WITH DIV23 WORK AND DIRECTOR'S REPRESENTATIVE.

(P4) PROVIDE 480V, 3 PHASE, POWER HOME RUN CIRCUITRY CONNECTION TO TEMPORARY STEAM BOILER #2 CONNECTION TO MDP LOCATED IN MEZZANINE LEVEL SWITCHBOARD ROOM (USING, COPPER (3)#20, (1)# 20N, (1)#20G, 4G, 2"C). UPON POWER CONNECTIONS TO STEAM BOILER #2, POWER IS TO BE MAINTAINED AT ALL TIMES DURING CONSTRUCTION. COORDINATE SHUT-DOWNS / SWITCHOVERS WITH DIRECTOR'S REPRESENTATIVE AND H-CONTRACTOR.

(P5) STAND-BY GENERATOR FUEL OIL PUMP SYSTEM SKID WITH INTEGRAL CONTROLLER AND DISCONNECT BY H-CONTRACTOR. E-CONTRACTOR TO PROVIDE SINGLE POINT POWER CIRCUITRY CONNECTION TO CONTROLLER DISCONNECT SWITCH. PROVIDE 208V, 1 PHASE, 30 AMP POWER HOME RUN CIRCUITRY CONNECTIONS BACK TO PANEL DTP1 AND CONNECT USING (3)#10, (1)#10G, 3/4".

(P6) STAND-BY GENERATOR FUEL FILTER & FO PIPING HEAT TRACE SYSTEM BY H-CONTRACTOR. E-CONTRACTOR TO PROVIDE SINGLE POINT POWER CIRCUITRY CONNECTION TO CONTROLLER DISCONNECT SWITCH. PROVIDE THREE (3) 120V, 1 PHASE, 20 POWER HOME RUN CIRCUITRY CONNECTIONS BACK TO PANEL DTP1 AND CONNECT USING THREE SETS OF (2)#10, (1)#10G, 3/4".

SHEET 37 OF 49



KEYED DIAGRAM NOTES

9. PROVIDE MANUFACTURER'S FURNISHED MOUNTING RACK / BRACKETS / DUNNAGE, SIZED PER APPROVED EQUIPMENT SUBMITTALS.
10. UPON COMPLETION OF WORK, PROVIDE TYPE WRITTEN DIRECTORY OF ALL LOADS SERVED FROM PANEL. IDENTIFY UNUSED LOADS AS SPARE, AND SWITCHED TO THE OFF POSITION.
11. PROVIDE PERMANENT IDENTIFICATION LABEL ACCURATELY IDENTIFYING ALL LOADS SERVED FROM MCC. IDENTIFY UNUSED BUCKETS AS SPARE, AND SWITCHED TO THE OFF POSITION.
12. PROVIDE PERMANENT IDENTIFICATION LABEL ACCURATELY IDENTIFYING ALL LOADS SERVED FROM MDP. IDENTIFY UNUSED BREAKERS AS SPARE, AND SWITCHED TO THE OFF POSITION.
13. UPON COMPLETION OF THE NEW ELECTRIC SERVICE SEQUENCE, MODIFY / EXTEND POWER CIRCUITRY SERVING TEMPORARY STEAM BOILER #1 TO BE RE-FEED FROM THE NEW MDP. TEMPORARY BOILER #1 IS TO REMAIN FULLY OPERATIONAL FOR DURATION OF PROJECT, EXCLUDING LIMITED SWITCH-OVERS. COORDINATE IN FIELD WITH DIRECTORS REPRESENTATIVE.
14. UPON COMPLETION OF THE NEW ELECTRIC SERVICE SEQUENCE, MODIFY / EXTEND POWER CIRCUITRY SERVING TEMPORARY STEAM BOILER #2 TO BE RE-FEED FROM THE NEW MDP. TEMPORARY BOILER #2 IS TO REMAIN FULLY OPERATIONAL FOR DURATION OF PROJECT, EXCLUDING LIMITED SWITCH-OVERS. COORDINATE IN FIELD WITH DIRECTORS REPRESENTATIVE.
15. PRIOR TO PROJECT SUBSTANTIAL COMPLETION, DISCONNECT AND REMOVE ALL TEMPORARY AND/OR ABANDONED ELECTRICAL EQUIPMENT AND APPURTENANCES, IN THEIR ENTIRETY.

- ### GENERAL DIAGRAM NOTES

- A. SET ADJUST SETTINGS IN ACCORDANCE WITH SECTION 26057 "OVER CURRENT PROTECTIVE DEVICE SHORT-CIRCUIT STUDY" AND SECTION 260573.16 "COORDINATION STUDIES.
- B. PROVIDE THERMAL MAGNETIC TRIP FOR BREAKERS HAVING TRIP RATINGS UP TO 249AMPS. SQUARE D (OR EQUAL BY SIEMENS, EATON), UNLESS NOTED OTHERWISE.
- C. PROVIDE 100% RATED BREAKERS FOR FRAME SIZES OF 250 AMPS AND ABOVE. SQUARE D (OR EQUAL BY SIEMENS, EATON)
- D. PROVIDE FIELD ADJUSTABLE LSI ELECTRONIC TRIP UNITS ON BREAKERS RATED 250A UP TO 800A. SQUARE D (OR EQUAL BY SIEMENS, EATON)
- E. PROVIDE FIELD ADJUSTABLE LSI ELECTRONIC TRIP UNITS ON BREAKERS RATED 800A AND LARGER. SQUARE (OR EQUAL BY SIEMENS, EATON)
- F. PROVIDE FIELD ADJUSTABLE LSI ELECTRONIC TRIP UNITS ON BREAKERS RATED 800A AND LARGER. SQUARE MICROLOGIC 6.0 (OR EQUAL BY SIEMENS, EATON)
- G. FIELD CONFIGURE ADJUSTABLE ELECTRONIC TRIP SETTINGS BASED ON POWER COORDINATION STUDY AND APPROVED EQUIPMENT SUBMITTALS.
- H. PROVIDE PERMANENT EQUIPMENT LABELS MATCHING NOMANCLATURE INDICATED IN ACCORDANCE WITH IDENTIFICATION FOR ELECTRICAL SYSTEMS SPECIFICATIONS.
- I. PROVIDE ARC FLASH IDENTIFICATION LABELS ON ALL DISTRIBUTION EQUIPMENT IN ACCORDANCE WITH IDENTIFICATION FOR ELECTRICAL SYSTEMS SPECIFICATIONS.
- J. COORDINATE ALL WORK ON SITE WITH DIRECTOR'S REPRESENTATIVE AND LOCAL UTILITY REPRESENTATIVE.
- K. SEE PANEL SCHEDULES AND LAYOUTS FOR EQUIPMENT INTERRUPT AIC RATINGS.
- L. PROVIDE POWER SYSTEM COORDINATION STUDY ASSOCIATED WITH WORK PERFORMED THIS PROJECT. SEE SPECIFICATIONS SECTION 260573 FOR INFORMATION AND ADDITIONAL REQUIREMENTS.

MOTOR CONTROL CENTER SCHEDULE							
BUCKET NO.	EQUIPMENT SERVED	MOTOR HP	NEMA STARTER	CONTROL	FRAME SIZE (A)	TRIP SETTING (A)	NUMBER OF POLES
MAIN	MCC MCB				400	400	3
1	BOILER 1 - FD FAN	5	1	HOA	100	20	3
2	BOILER 2 - FD FAN	10	2	HOA	100	30	3
3	BOILER 3 - FD FAN	10	2	HOA	100	30	3
4	BURNER 1 - PANEL	-	-	-	100	20	1
5	BURNER 2 - PANEL	-	-	-	100	20	1
6	BURNER 3 - PANEL	-	-	-	100	20	1
7	COMBUSTION CONTROL PANEL	-	-	-	100	20	1
8	COMBUSTION CONTROL INSTRUMENT	-	-	-	100	20	1
9	COMBUSTION CONTROL INSTRUMENT	-	-	-	100	20	1
10	COMBUSTION CONTROL INSTRUMENT	-	-	-	100	20	1
11	BOILER CHEMICAL FEED CONTROLLER	-	-	-	100	30	1
12	DEAERATOR CHEMICAL FEED CONTROLLER	-	-	-	100	20	1
13	AIR COMPRESSOR 1	10	1	HOA	100	30	3
14	AIR COMPRESSOR 2	10	1	HOA	100	30	3
15	AIR DRYER AD-1	-	-	HOA	100	15	3
16	EXG. AIR DRYER 1	-	-	-	100	20	1
17	EXG. AIR DRYER 2	-	-	-	100	20	1
18	TEMPORARY STEAM BOILER #1	-	-	-	200	200	3
19	TEMPORARY STEAM BOILER #2	-	-	-	200	200	3
20	MAU-1	3	0	HOA	100	15	3
21	EVAP. COOLER PUMP	-	-	-	100	20	1
22	BOILER TRI-PLEX FUEL OIL PUMP SKID	3	1	-	100	15	3
23	BOILER BREAK GLASS SWITCH	-	-	-	100	15	1
24	FWP-1	10	1	HOA	100	30	1
25	FWP-2	10	1	HOA	100	30	1
26	FWP-3	10	1	HOA	100	30	1
27	SPARE	-	-	-	100	20	1
28	SPARE	-	-	-	100	20	1
29	SPARE	-	-	-	100	20	1
30	SPARE	-	-	-	100	60	3
31	MCC-T	-	-	-	100	45	3
	15kVA, 480V - 208V/120 TRANSFORMER MCC-T	-	-	-	100	30	3
32	MCC1 - BREAKER PANEL, MCB	-	-	-	100	60	3

BRANCH CIRCUIT CONDUCTOR AND CONDUIT SCHEDULE			
OVER-CURRENT PROTECTION	PHASE AND/OR NEUTRAL CONDUCTORS	GROUND CONDUCTOR	CONDUIT
THREE POLE CIRCUITS			
50A/3P	#6	#10	1" C
40A/3P	#8	#10	1" C
30A/3P	#10	#10	3/4" C
20A/3P	#12	#12	3/4" C
15A/3P	#12	#12	3/4" C
TWO POLE CIRCUITS			
50A/2P	#6	#10	1" C
40A/2P	#8	#10	3/4" C
30A/2P	#10	#10	3/4" C
20A/2P	#12	#12	3/4" C
15A/2P	#12	#12	3/4" C
ONE POLE CIRCUITS			
40A/1P	#8	#10	3/4" C
30A/1P	#10	#10	3/4" C
20A/1P	#12	#12	3/4" C
15A/1P	#12	#12	3/4" C

- A. USE THIS SCHEDULE AS FOLLOWS:
-FOR ALL RECEPTACLE AND LIGHTING CIRCUITS.
-WHERE SPECIFIC CONDUCTOR/CONDUIT SIZING IS NOT INDICATED ELSEWHERE ON PLANS
-FOR ANY BRANCH CIRCUITS THAT ARE REQUIRED TO BE RELOCATED EXTENDED, ETC.
- B. DO NOT USE THIS SCHEDULE AS FOLLOWS:
-FOR LARGE MECHANICAL LOADS (REFER TO EQUIPMENT CONNECTION SCHEDULES).
-FOR SERVICE ENTRANCE CONDUCTORS
-WHERE SPECIFIC CONDUCTORS/CIRCUIT IS INDICATED ON DRAWINGS.

PANEL: GEN2											
LOCATION: GENERATOR 1 ENCLOSURE						BUS/MAIN: 100A, 3P					
MOUNTING: INTERIOR SURFACE						FEEDER: SEE ONE-LINE DIAGRAM					
VOLTAGE/PHASE: 208Y, 120V, 3ø4W						FED FROM: DTP1					
MIN AIC RATING: 22,000						ACCESSORIES: NEMA 4 ENCLOSURE WITH LOCK HASP					
CKT #	BRANCH CIRCUIT			TRIP POLE#	PHASE	LOAD (W)			TRIP POLE#	PHASE	CKT #
	LOAD DESCRIPTION	A	B	C		A	B	C			
1	LTS - GEN ENCLOSURE	500			*20A,2P	A			*20A,2P	1554	2
3	RECPTS - GEN ENCLOSURE		400		*20A,2P	B			*20A,2P	1600	4
5	GEN ALTERNATOR - HEATER STRIP			1650	*20A,2P	C			*40A,2P	1650	6
7		1650				A					8
9	SPARE		0		*20A,2P	B			*40A,2P		10
11	SPARE			0	*20A,2P	C					12
13	SPARE	0			-	A	-	0			14
15	SPARE		0		-	B	-		0		16
17	SPACE			0	-	C	-			0	18
19	SPACE	0			-	A	-	0			20
21	SPACE		0		-	B	-		0		22
23	SPACE			0	-	C	-			0	24

*GFCI PROTECTED

INDICATED BY  ON PLAN SHEETS

			DISCONNECT TYPES					STARTER TYPES					MOTOR STARTER TYPES								
			A-	NONFUSED DISCONNECT SWITCH				1-	MAGNETIC X-LINE FVNR				S1- START/STOP PB W/PILOT LIGHT IN COVER								
			B-	FUSED DISCONNECT SWITCH				2-	COMBINATION STARTER/DISC				S2- H-O-A SWITCH W/PILOT LIGHT IN COVER								
			C-	SNAP SWITCH WITH OVERLOADS				3-	MANUAL MOTOR STARTER				S3- AUX. CONTACTS								
			D-	CORD & PLUG				4-	VFD FURNISH BY H-CON, INSTALLED & CONNECTED BY E-CON				S4- SNAP								
			E-	ENCLOSED CIRCUIT BREAKER				5-	PACKAGE UNIT BY MANUFACTURER				S5- CONTROL TRANSFORMER								
								6-	SEE REMARKS				S6- CONTROLS BY H-CON								
EQUIP TAG	EQUIPMENT DESCRIPTION	LOCATION	HP MCA KW	VOLTS	PHASE	POWER SOURCE		WIRE & CONDUIT	DISCONNECT				STARTER				FIRE ALARM FAN SHUT-DOWN	DUCT MOUNTED SMOKE DETECTOR(S)	ADDITIONAL COMMENTS	EQUIP TAG	
						PANEL / CIRCUIT#	MOP (A)		TYPE	NEMA ENCL.	BY	LOCATION	TYPE	NEMA ENCL.	BY	LOCATION					
FOP-1	FUEL OIL PUMP 1	WEST BOILER FLOOR	1/3 HP	120	1	MCC1 / 26	15A, 1P	(2) #12, (1)#12G, 3/4"	A	1	E-CON	UNIT	5	1	MFR	UNIT	S6	--	--	--	FOP-1
FOP-2	FUEL OIL PUMP 2	WEST BOILER FLOOR	1/3 HP	120	1	MCC1 / 28	15A, 1P	(2) #12, (1)#12G, 3/4"	A	1	E-CON	UNIT	5	1	MFR	UNIT	S6	--	--	--	FOP-2
FOP-3	FUEL OIL PUMP 3	WEST BOILER FLOOR	1/3 HP	120	1	MCC1 / 30	15A, 1P	(2) #12, (1)#12G, 3/4"	A	1	E-CON	UNIT	5	1	MFR	UNIT	S6	--	--	--	FOP-3
FOP-4	FUEL OIL PUMP 4	WEST BOILER FLOOR	1/3 HP	120	1	MCC1 / 30	15A, 1P	(2) #12, (1)#12G, 3/4"	A	1	E-CON	UNIT	5	1	MFR	UNIT	S6	--	--	--	FOP-4
FWP-1	FEED WATER PUMP 1	WEST BOILER FLOOR	10 HP	480	3	MCC BUCKET	25A, 3P	(3)#10, (1)#10N, (1)#12G 3/4"	A	1	E-CON	MCC	4	1	H-CON	UNIT	S6	--	--	--	FWP-1
FWP-2	FEED WATER PUMP 2	WEST BOILER FLOOR	10 HP	480	3	MCC BUCKET	25A, 3P	(3)#10, (1)#10N, (1)#12G 3/4"	A	1	E-CON	MCC	4	1	H-COM	UNIT	S6	--	--	--	FWP-2
FWP-3	FEED WATER PUMP 3	WEST BOILER FLOOR	10 HP	480	3	MCC BUCKET	25A, 3P	(3)#10, (1)#10N, (1)#12G 3/4"	A	1	E-CON	MCC	4	1	H-COM	UNIT	S6	--	--	--	FWP-3
FWP-4	FEED WATER PUMP 4	WEST BOILER FLOOR	10 HP	480	3	MCC BUCKET	25A, 3P	(3)#10, (1)#10N, (1)#12G 3/4"	A	1	E-CON	MCC	4	1	H-COM	UNIT	S6	--	--	--	FWP-4
TP-1	TRANSFER PUMP 1	WEST BOILER FLOOR	7.5 HP	480	3	MCC BUCKET	20A, 3P	(3)#12, (1)#12N, (1)#12G 3/4"	A	1	E-CON	MCC	4	1	H-COM	UNIT	S6	--	--	--	TP-1
TP-2	TRANSFER PUMP 2	WEST BOILER FLOOR	7.5 HP	480	3	MCC BUCKET	20A, 3P	(3)#12, (1)#12N, (1)#12G 3/4"	A	1	E-CON	MCC	4	1	H-COM	UNIT	S6	--	--	--	TP-2
EF-1	EXHAUST FAN - 1	MEZZANINE ELECTRIC ROOM	1/2 HP	120	1	LP2-15	20A, 1P	(2)#12, #12G, 3/4"	A	1	E-CON	UNIT	3	1	H-COM	UNIT	S6	--	--	--	EF-1
MAU-1	MAKE-UP AIR UNIT 1	MEZZANINE LEVEL	3 HP	480	3	MCC BUCKET	15A, 3P	(3)#12, (1)#12N, (1)#12G 3/4"	A	1	MFR	UNIT	4	1	H-CON	UNIT	S6	Y	Y	--	MAU-1
AD-1	AIR DRYER - 1	WEST BOILER FLOOR	2.27KW	480	3	MCC BUCKET	15A, 3P	(3)#12, (1)#12N, (1)#12G 3/4"	A	1	E-CON	UNIT	1	1	MFR	UNIT	S6	--	--	--	AD-1
TB-1	TEMPORARY BOILER 1			480	3	MDP	200A, 3P	(3)#4/0, (1)#4/0N, (1)#2G, 2 1/2"	B	3R									2	TB-1	
TB-2	TEMPORARY BOILER 2			480	3	MDP	200A, 3P	(3)#4/0, (1)#4/0N, (1)#2G, 2 1/2"	B	3R									3	TB-2	

NOTE: MANUAL AND MAGNETIC MOTOR CONTROLLERS FURNISHED BY H-CONTRACT, INSTALLED AND CONNECTED BY E-CONTRACT. SEE H-CONTRACT SPEC SECTION 262913.03 AND H-CONTRACT DRAWINGS FOR INFORMATION.

EQUIPMENT COMMENTS:

1 CONNECT TO SPARE, UNUSED BREAKER AT PANEL INDICATED.

2. EXISTING TEMP STEAM BOILER #1 IS FED FROM A 200 AMP SWITCH IN THE EXISTING MDP. WHEN THE NEW ELECTRICAL SERVICE IS UP AND RUNNING, SWITCH OVER TEMP BOILER #1, TO BE FED FROM STAND-BY POWER. GENERATOR POWER. UPON INSTALLATION OF NEW ELECTRIC SERVICE, TEMPORARY STEAM BOILER #1 IS TO BE SWITCHED OVER TO BE FED FROM THE NEW MDP.

3. TEMP STEAM BOILER #2, TO BE FED FROM A 200 AMP TAP AHEAD OF 200A FUSED SWITCH SERVING TEMP BOILER #1. WHEN THE NEW ELECTRICAL SERVICE IS UP AND RUNNING, SWITCH OVER TEMPORARY STEAM BOILER #2 SO TO BE FED FROM STAND-BY POWER. GENERATOR POWER. UPON INSTALLATION OF NEW ELECTRIC SERVICE, TEMPORARY STEAM BOILER #2 IS TO BE SWITCHED OVER TO BE FED FROM THE NEW MDP.

* - INDICATES NOT REQUIRED OR NOT APPLICABLE
*Y- INDICATES YES, REQUIRED
*MFR- INDICATES SUPPLIED/INSTALLED BY MANUFACTURER

1

PANEL: GEN1											
LOCATION: DAY TANK PEDESTAL						BUS/MAIN: 225A BUS / 200A MCB					
MOUNTING: PEDESTAL SURFACE						FEEDER: SEE ONE-LINE DIAGRAM					
VOLTAGE/PHASE: 208Y/120V 3ø4W						FED FROM: MDP VIA T-DTP1					
MIN AIC RATING: 22,000						ACCESSORIES: NEMA 4 ENCLOSURE WITH LOCK HASP					
CKT #	BRANCH CIRCUIT			TRIP POLE#	PHASE	LOAD (W)			TRIP POLE#	PHASE	CKT #
	LOAD DESCRIPTION	A	B	C		A	B	C			
1	DAY TANK SUPPLY PUMP 1	1100			*20A,2P	A			*20A,2P	1100	2
3			1100			B					4
5	DAY TANK RETURN PUMP			1100	*20A,2P	C			*40A,2P	1100	6
7		1100				A					8
9	DAY TANK HEATER 2		1200		*40A,2P	B			*20A,1P	1200	10
11				1200		C			*20A,1P	0	12
13	SPARE	0			*40A,2P	A			*20A,1P	200	14
15	SPARE		0			B			*20A,1P	0	16
17	DAY TANK PIPING - HEAT TRACE			1750	*20A,1P	C			*20A,1P	0	18
19	DAY TANK PIPING - HEAT TRACE	1750			*20A,1P	A			*20A,1P	1750	20
21	DAY TANK PIPING - HEAT TRACE		1750		*20A,1P	B			*20A,1P	1750	22
23	SPARE			0	*20A,1P	C			20A,1P	0	24
25	SPARE	0			*20A,1P	A			*20A,1P	0	26
27	SPARE		0		*20A,1P	B			*20A,1P	0	28
29	SPARE			0	*20A,1P	C			*20A,1P	856	30
31		2650				A			*20A,1P	0	32
33	GENERATOR FUEL OIL PUMP SKID		2650		*30A,3P	B			*20A,1P	0	34
35				2650		C			*20A,1P	0	36
37		5354				A			5354		38
39	PANEL GEN1		1800		100A,3P	B			1800		40
41				3300		C				3300	42

PANEL: GEN1												
LOCATION: GENERATOR 1 ENCLOSURE				BUS/MAIN: 100A, 3P								
MOUNTING: INTERIOR SURFACE				FEEDER: SEE ONE-LINE DIAGRAM								
VOLTAGE/PHASE: 208Y, 120V, 3ø4W				FED FROM: DTP1								
MIN AIC RATING: 22,000				ACCESSORIES: NEMA 4 ENCLOSURE WITH LOCK HASP								
CKT #	BRANCH CIRCUIT	LOAD (W)			TRIP POLE#	PHASE	TRIP POLE#	LOAD (W)			BRANCH CIRCUIT	CKT #
	LOAD DESCRIPTION	A	B	C			A	B	C	LOAD DESCRIPTION		
1	LTS - GEN ENCLOSURE	500			*20A,2P	A	*20A,2P	1554			GEN BATTERY CHARGER	2
3	RECPTS - GEN ENCLOSURE		400		*20A,2P	B	*20A,2P		1600		GEN WATER JACKET HEATER	4
5	GEN ALTERNATOR - HEATER STRIP			1650	*20A,2P	C	*40A,2P		1650	1650	HEATER STRIP - GEN ENCLOSURE	6
7		1650				A		1650				8
9	SPARE		0		*20A,2P	B	*40A,2P		0		SPACE	10
11	SPARE			0	*20A,2P	C			0			12
13	SPARE	0			-	A	-	0			SPACE	14
15	SPARE		0		-	B	-		0		SPACE	16
17	SPACE			0	-	C	-			0	SPACE	18
19	SPACE	0			-	A	-	0			SPACE	20
21	SPACE		0		-	B	-		0		SPACE	22
23	SPACE			0	-	C	-			0	SPACE	24