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BuildingName
The Description of the Project
P00000000 0000

SPECIFICATION DIVISION 23

NUMBER SECTION DESCRIPTION

DIVISION 23 HEATING, VENTILATING AND AIR CONDITIONING (HVAC)
SECTION 235240 – FIRE TUBE BOILERS (STEAM)

END OF CONTENTS TABLE

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SECTION 235240 – FIRE TUBE BOILERS (STEAM)

REVISIONS:
NOV.9,2004: CONSIDERABLE REVISIONS NOT FOR MASTER SPECIFICATIONS
MAR.7,2005: LAST REVISION.

APRIL 2018: REVISED TO LIST MFR.S FROM PML AND PER WAYNE GROTH. R BENEDEK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

INCLUDE PARAGRAPH 1.1.A AND B IN EVERY SPECIFICATION SECTION. EDIT RELATED SECTIONS 1.1.B TO MAKE IT PROJECT SPECIFIC.

A. Drawings and general provisions of the Contract, Standard General and Supplementary General Conditions, Division 1 Specification Sections, and other applicable Specification Sections including the Related Sections listed below, apply to this Section.

1.2 SCOPE OF WORK:

SPEC EDITOR: REVISE NUMBER OF BOILERS FOR THE PROJECT

A. The work includes furnishing and installing three (3) water back fire tube gas fired packaged boilers with capacities as scheduled on the plans.

B. Boiler package shall consist of a boiler, boiler fittings, burner equipment, forced draft fan, safety controls and accessories all piped, wired and assembled on a structural steel base.

C. Each unit shall be a complete package ready for connection of electrical, feed water, steam, blowdown, fuel and venting.

1.3 QUALITY ASSURANCE:

A. Codes and Standards:

1. UL Compliance: The complete boiler burner unit shall be approved and labeled as a unit by Underwriters Laboratories.
2. NFPA Compliance: Install gas-fired fire tube boilers in accordance with NFPA Code 54 "National Fuel Gas Code".
3. ASME Compliance: Construct fire tube boilers, receivers, blow down tank, etc. in accordance with ASME Boiler and Pressure Vessel Code, Section IV "Heating Boilers".
4. UL and NEMA Compliance: Provide fire tube boiler and ancillary electrical components which have been listed and labeled by UL and comply with NEMA standards.
5. FM Compliance: Provide control devices and control sequences in accordance with requirements of Factory Mutual System (FM).

6. NEC compliance: Provide control panels and assembly and wiring of all devices in accordance with requirements of latest edition of NEC. All control panels shall have a label indicating listing by a nationally recognized testing agency such as UL, ETL or MET.
7. Additionally, safeties for burner controls must comply with latest requirements of applicable township and state codes.
8. Gas train, including pilot gas train, must comply with current IRI requirements and township and state codes.

B. Pressure Vessel Warranty:

1. If, within fifteen (15) years from and after the date of acceptance of the boilers, the tube sheets, furnace and furnace throat, rear combustion chamber, or front and rear flue doors fail under normal use and service, the Company will repair the part or compartment as required for proper operation of the boiler. This also specifically includes all refractory at the front and rear of the boiler.

C. Complete package warranty:

1. The complete package shall be warranted for a period of 12 months from the date of acceptance of the installation by the University. Warranty shall include all labor, materials and associated costs.

1.4 ACCEPTABLE MANUFACTURERS:

A. Subject to compliance with the requirements, provide fire tube boilers by one of the following manufacturer(s):

1. Johnston Boilers
2. Easco Boilers
3. Burnham
4. Cleaver Brooks
5. Johnston

B. Subject to compliance with other requirements, provide burner manufactured by:

1. Webster Manufacturing Co.

1.5 COMMISSIONING:

A. Comply with commissioning as specified in Division 01. The boiler start up engineer and the installing contractor shall cooperate and coordinate their activities with the commissioning engineer.

SPEC EDITOR: VERIFY WITH UM PROJECT ENGINEER AND EDIT AS REQUIRED.

1.6 INSURANCE COMPANY:

A. The Owner's insurance company is Factory Mutual. The complete boiler and accessory installation shall meet all of the requirements of F.M., whether or not indicated in the plans and specifications, for each device and/or component.

PART 2 - PRODUCTS

2.1 BOILER - GENERAL REQUIREMENTS:

A. Each Steam boiler unit shall be AGA-certified, UL-labeled and constructed and tested in accordance with ASME Pressure Vessel Code, Section IV, for maximum working pressure of 15 psig. Each boiler assembly shall be hydrostatically pressure tested for 60 psig ASME working pressure. Each boiler must bear ASME stamp and be inspected under the National Board Rules.

B. Each steam boiler shall be provided with an ASME listed safety valve set at 15 PSIG and have a discharge capacity equal to or greater than the listed Gross Output of the boiler.

SPEC EDITOR: REVISE THE FOLLOWING PARAGRAPH FOR EACH PROJECT OR EDIT TO SUIT EXISTING CONDITIONS

C. The boiler support frame shall have a maximum width of X'-Y" to allow setting on existing housekeeping pad / or new housekeeping pads as shown on plans.

2.2 BOILER CONSTRUCTION:

A. Boiler shall be four (4) pass water back Scotch Marine type with a front or rear exhaust vent, listed and rated by the American Boiler Manufacturer's Association, Fire tube Section, designed and built to comply with the latest ASME Code rules for fifteen (15) lbs. per sq. inch steam working pressure and be inspected and stamped by an authorized boiler inspector. The boiler shall have not less than 5 sq. ft. of heating surface per boiler horsepower, measured on the fireside (ASME method), a furnace heat release of not more than 142,000 BTU/HR/CFT or as scheduled, whichever is lower, when operating at rating and the rear combustion chamber shall be submerged within the boiler water. The boiler shall have flanged and/or threaded openings for trimmings and external connections; sufficient hand holes and manhole for thorough inspection and cleaning; burner inspection sight ports ant front and rear; gas tight inspection doors; and dial stack thermometer.

B. The boiler shall be factory insulated with 2" fibrous insulation, covered by a sheet metal jacket, assembled with lock seam joints.

2.3 BOILER TRIM:

A. Boiler trim shall include the following items mounted and piped on boiler combination type water column with primary low water cut-off and pump control, auxiliary (manual reset) low water cut-off switch wired to prevent burner operation if water level falls below safe level, chain operated water gauge, gauge glass drain valve and water column drain valve piped into blow-off header; 6" diameter steam gauge mounted adjacent to water column and fitted with pigtail cock and test tee; main blow-off and surface blow-off valves and the main blow-off valves shall be piped into the blow-off header; bronze feed stop and check valves; ASME safety valve(s) sized to comply with Code Requirements and flue gas thermometer and high limit pressure switch wired to prevent burner operation if pressure exceed a set safe limit.

B. The boiler shall be furnished with compound pressure vacuum gauge to indicate the system pressure. The compound gauge shall be of rugged guarded type construction and the gauge dial shall be clearly marked and easy to read.

2.4 BOILER CONTROLS:

A. The operating limit pressure control shall be set according to the design requirements of the heating system. The high limit pressure control should be set approximately 2 psig higher than the low limit control setting (15 psig maximum allowable steam boiler pressure).

SPEC EDITOR: FILL IN DIMENTIONS BELOW, AND REVISE PARAGRAPH TO ACCOMMODATE EACH PROJECT. ENGINEER MUST VERIFY THESE SETTINGS WITH BOILER MANUFACTURER)

B. Each boiler shall have at least two independent automatic low water fuel cut-offs, one of which may be combined low water fuel cut off and pump control. One cut-off control shall be set to function ahead of the other. Functioning of the lower of the two cut-off controls shall cause a safety shutdown (lock out) requiring manual reset. The combination low water cut-off and pump control must be located on the boiler so the burner will become de-energized should the boiler water level fall to within _____ inches above the lowest visible point in the water gauge glass. The boiler feed pump will become energized with a boiler water level of approximately _____ inches above the lowest visible point in the water gauge glass

2.5 BURNERS:

A. The entire fuel burner system and its installation shall conform to the manufacturer's erecting instructions, with applicable codes. The burner fuel shall be natural gas.

B. Each gas burner shall be a retention ring type, with full flame retention, designed for natural gas with a heating value of 1020 BTU per cubic foot. The burner shall be complete with gas-electric ignition, main gas shut-off cock, characterized main gas pressure regulator, manual test cock, modulating valve, high and low gas pressure switches, dual motorized safety shut-off valves, one with proof of closure normally open vent valve and all other devices as required to satisfy the regulatory requirements specified.

SPEC EDITOR: REVISE PARAGRAPH FOR EACH PROJECT. REVIEW THE GAS PRESSURE AVAILABLE AND CORRECT AS REQUIRED

C. The burner heads shall be designed to insure flame retention, stability and quietness of operation. The gas pressure in the boiler room will be approximately _____ (60?) Inches water column at the gas meter outlet, _____ (48?) Inches at the inlet to the gas train and the relief valve at the gas company outlet set at 10 lbs. All the gas train components shall be selected for these operating conditions.

D. The burner shall be full modulation type, equipped with a fuel and airflow control. Burner shall have a turndown capability of 10:1. Please see the schedule for the maximum input to each boiler. Fuel air ratio control shall be achieved by the use of independent servomotors linkage-less control system.

E. The combustion air fan shall be direct drive forward curve design statically and dynamically balanced. Draft equipment shall include combustion air switch, air intake silencers, air dampers actuated by the modulating motor and electronically interlocked with the modulating fuel valves.

F. To ensure reliability, repetition and accuracy a gasketed louver box, capable of registering movement of 0.10”, is to be installed on each burner. The louver box shall be of a multiple, opposed, blade type. Each of the blades shall incorporate an EPDM seal on the front edge. The inside walls of the box itself shall have a gasketed seal against the edge of the damper blades. The entire assembly shall be capable of attaining air tightness in accordance with DIN 1946/4. The blades shall be coupled outside the frame using permanently attached drive bars with all adjustments being factory set to have zero play. Louver box shall also incorporate in its design, an air inlet silencer which shall limit the noise due to the sound of the combustion air entering for combustion.

G. Individual Gas Flow Control Valves shall be provided for on each burner. The use of Butterfly type gas valves is prohibited. The Gas Flow Control Valves shall be Honeywell Model: V5197A1003 for firing rates up to 6,300 MBH, V5197A1011 for firing rates up to 16,000 MBH. The appropriate N.P.T. pipe adapters, also manufactured by Honeywell, shall also be furnished. The Individual Servo-Motors shall be attached to the flow control valve in the following manner. The Servo-Motor shall be mounted, on the flow control valve using the adapter coupling and mounting bracket supplied by Fireye. The stems of the Servo-Motors and the stem of the Flow Control Valves shall, in addition to using the adapter coupling above, be permanently attached through the use of roller pins after combustion is set-up in the field.

H. Burner ring shall be designed, installed and adjusted so that the flame will not impinge on rear wall refractory in firebox.

I. Burner unit must meet UL, FM, IRI and the latest NFPA requirements.

J. The burner shall be tuned to achieve maximum firing rate with a noise level of less than 81 Db as measured on the A scale, at 3 feet and shall conform to MIOSHA requirements as well.

2.6 INTEGRATED BURNER CONTROL SYSTEM:

A. Each burner shall be equipped with a Micro-Processor Based Burner Management Flame Safeguard and Parallel Positioning Control System. The control shall fully integrate/provide all the required Flame Safeguard functions and Combustion Control functions into a single module.

B. The entire burner control system and its components shall be as manufactured by Fireye and the model numbers are as below.

C. The system shall consist of Fire eye integrated Nexus module.

D. In addition to providing the standard features as detailed by Fireye in their literature for the control modules specified, the following optional features shall be provided.

1. Servo positioning motors operating at the same voltage as the controller with torque ratings as selected by the burner manufacturer for proper operation with the gas pressure and air box specified.
2. Steam pressure and gas pressure sensors with full self-checking capability.
3. Remote communications capability using the Protocol Interface specified in section 230900 DDC Controls, and elsewhere in the specifications, provide all the necessary communications module, other hardware and software to enable communication between the Burner Control System and owners PC via the Ethernet.
4. O2 Trim capability utilizing zirconium oxide “in situ” fast response probe. The hardware and software for this function shall be provided under Alternate 1.

E. Codes and Standards: The Control shall be listed by Underwriters Laboratories carrying US and C designations for UL 372 Primary Safety Controls for Gas and Oil Fired Appliances.

F. System Hardware

1. Controller; The controller shall provide individual outputs for Burner damper, Ignition, Pilot Valve, Gas Valve , Vent Valve and Auxiliary Relay. In addition provide the manufacturer’s standard features as detailed by Fireye in their literature for the controller.
2. Display; The Display shall provide full text messaging and access to the Profile and Option Parameter Set points. The Display shall be cabinet mounted.
3. Sensors; Pressure sensor shall be provided for Steam Pressure indication and control. The Pressure Sensor shall be Fireye Model NX1025 for 0-28PSI. Gas Pressure Sensor shall be provided for gas pressure supervision. The Gas Pressure Sensor shall be Fireye Model NX1020 0 – 4.5 PS1 sensing range.
4. Provide auxiliary low pressure and high pressure switches in the gas train, manual reset type, wired to shut the burner off. The switches shall be model C6097 made by Honeywell. Provide a steam high pressure switch in each boiler, manual reset type, wired to shut the burner off. Switch shall be Honeywell model #L404C1147.
5. Servo Motors; Individual Servo Motors shall be supplied for each of the controlled elements, Air and Gas. These shall be Fireye model NX-series, torque rating to be selected for each project.
6. The wiring base shall provide individual terminal connections for the various inputs and outputs.

7. Expansion Interface; the expansion interface shall provide individual terminal connections for the various inputs and outputs. The expansion interface shall further provide power source and connections for dedicated zirconium oxide in situ probe, when O2 trim system is provided. The expansion interface shall further provide analogue input and output capability for control of a variable speed drives, if they are provided. The expansion interface shall further provide analogue input and output capability for input of external analogue signals and transmission of system variables.
8. Provide Fireye "Nexus Modbus Interface" module in the boiler panel of the 70 boiler HP boiler to map all the three Nexus modules and convert to Modbus protocol. In the same panel provide a E+ series Protocol Interface device as manufactured by Cimetrics to convert the Modbus protocol to BACnet/IP protocol. The University will install an Ethernet outlet next to the boiler control panel and wire the E+ converter to the Ethernet outlet.

2.7 O2 TRIM SYSTEM :(ALTERNATE 1)

A. The O2 values utilized for trim shall be measured by an in situ exhaust gas probe. This shall be a zirconium oxide device.

B. Reaction time of the O2 trim to changes in O2 level (measured at the device) shall be not greater than 5 seconds.

C. The O2 Trim Analyzer shall measure and display via the controller display, wet O2, dry CO2, exhaust temperature, combustion efficiency and applied trim action.

D. The O2 Analyzer shall have no moving parts, pumps or sample lines.

E. O2 trim system and all of its components shall be by Fireye and shall not be combined with equipment provided by other manufacturers.

2.8 CONTROL CABINET :

A. The burner unit shall have steel NEMA 1 control cabinet with a hinged door locked mounted on the boiler frame and shall incorporate the electronic burner sequencing equipment, main disconnect switch, fused, motor starter, relays and burner switch. All wiring in the panel and to the boiler shall be color coded with numbered terminal strip, numbered wiring and engraved plates. Provide five indicating lights to indicate safe water level, low water alarm, flame safety alarm, ignition and main fuel valve. All wiring in the panel and to the boiler and burner controls shall be completely numerically identified.

B. The power supply characteristics shall be 440/208/60/3. Control circuit to be 115 volt, 1 phase, supplied from panel mounted control transformer. There will be two independent power supplies from lockable breakers provided to the boiler control panel. One shall be used for normal boiler function and control transformer. The other shall be utilized to power two (2) optional relays, provided with the panel. The first relay, 3PST rated for 10 amps cont, shall be activated whenever the boiler goes under an alarm condition such as flame failure or low water level. The second relay, DPST rated for 10 amps cont, shall be activated whenever the steam header pressure falls below a set pressure. The pressure sensor shall be furnished, installed (by the mechanical contractor) and wired by the electrical contractor as shown in the plans. Identify the relay contacts terminal strip rows in the shop drawings. These relays will be wired to power a red light and a yellow light outside the boiler room.

SPEC EDITOR: REVISE FOR THE PROJECT. COORDINATE THE POWERING REQUIRMENT WITH THE EE

C. Provide a separate NO contact to open the mechanical room combustion air dampers on boiler start up or set the speed of the supply air fan to match the combustion air requirement. Power the damper operator, if used, from the burner control panel.

2.9 AUXILIARY EQUIPMENT:

A. Additional control sequences are indicated in the plans. All of the required optional additional contacts and devices shall be provided to achieve the specified control sequence, even if the required devices are not specifically noted in these specifications.

2.10 BURNER/BOILER EMISSIONS

A. At the time of start up a calibrated electronic flue gas analyzer shall be used. Provide a print out of the analysis to prove compliance with the following requirements.

B. At low fire, Carbon dioxide shall not exceed 9.50%, oxygen shall not exceed 7.00%, thermal nitrous oxide shall not exceed 75 PPM and no trace of carbon monoxide shall be present.

FILL IN THE CORRECT EMMISSIONS DATA IN THE BELOW PARAGRAPH. BELOW DATA IS SAMPLE ONLY.

C. At high fire, Carbon dioxide shall not exceed 8.00%, oxygen shall not exceed 4.5%, thermal nitrous oxide shall not exceed 75 PPM and no trace of carbon monoxide shall be present [vsml].

2.11 ELECTRICAL CONTROL PANEL LABELING:

A. All control panels provided with burner, boiler or feed water unit shall bear a label from UL, ETL or MET. All wiring including the control wiring shall be installed in a NEC compliant conduit system.

2.12 VALVES, MOTORS AND OTHER ITEMS SPECIFIED ELSEWHERE:

A. All motors shall meet requirements of Section 220513.

B. All valves shall meet requirements of Section 220523.

C. Thermometers and gauges shall meet requirements of Section 220519.

2.13 BOILER DESIGN NOTE:

A. The plans shown are based on Superior/Easco/Johnston Boilers and are intended to be schematic and may not be correct in all details (such as the location of all outlets and inlets) to the unit pre-purchased by the University or being provided by this contractor. The Contractor shall review the shop drawing available from the University or his vendor and allow sufficient funds in his base bid for any additional work required to suit the unit being supplied. All equipment shipped loose shall be installed and piped as directed by the manufacturer and/or owner, by this contractor.

PART 3 - EXECUTION

3.1 FACTORY TESTING

A. Each complete boiler/burner unit must be fire tested at the manufacturer’s plant prior to shipment. Owner has the option to witness the test. Provide at least six weeks' notice. Provide test report for field setup.

3.2 BOILER EFFICIENCY AND PERFORMANCE GUARANTEE:

A. The unit shall operate at minimum of 84.75% overall efficiency, based on higher heating value for natural gas. The following procedure shall be employed for determining the boiler's efficiency. If the indicated efficiency is not achievable, indicate with the bids, achievable efficiency.

B. Operation of the boiler shall be to establish efficient and stable fuel air ratio over the complete load range. Operation of the unit shall then be continued for testing and demonstration of the certified efficiency at rated capacity. This test is to take place on the factory fire test stand.

C. The efficiency test shall consist of the accurate measurements and recording of the following listed factors:

1. O2 and combustibles in stack gases
2. Ambient air temperature
3. Feed water temperature
4. Stack temperature
5. Steam pressure
6. Feed water flow

D. On completion of the test, the following listed heat losses shall be calculated as prescribed under "Heat Loss Efficiency" of the ASME TEST FORM ABBREVIATED EFFICIENCY per Power Test Codes PTC41:

1. Heat loss due to dry gas
2. Heat loss due to moisture in fuel
3. Heat loss due to moisture from combustion of hydrogen

E. The following data shall be utilized in conjunction with the calculation of the above listed heat losses to determine the certified efficiency.

1. Analysis of fuel fired
2. Unaccounted, radiation and convection loss as calculated for the model being tested. Calculated data taken from actual measured test results.

F. The test results shall be certified to the customer by the boiler manufacturer in a report which shall include all supporting data and appropriate calculations showing the resulting efficiency. In the event the test does not yield results which are at least as good as the attached required Minimum Efficiency stated above, the customer may refuse shipment of the unit until such time as the boiler manufacturer can demonstrate the required Minimum Efficiency.

3.3 MECHANICAL SPACE AND INSTALLATION:

A. The equipment shall be installed where shown on the drawings and in accordance with the manufacturer's written instructions.

B. Field installation of the boiler and boiler feed unit shall be done under the supervision of a trained representative of the boiler manufacturer.

C. Provide for connection to electrical service, gas service, steam outlet, condensate inlet, vents, etc., for a complete and operating system.

D. Pipe relief valves, boiler drains, boiler blow downs, etc., to nearest floor drain.

E. Installation shall be performed by a firm certified by the State of Michigan to install boilers of the type specified.

F. The installer shall construct a level concrete housekeeping pad for boiler foundation according to boiler manufacturer's erecting instructions and as shown in the plans.

G. Fill the boiler with water and pressure-test the boiler and system up to the rating of the relief valve. Clean the system per manufacturer's instructions; flush the system to remove all trash and dirt; and refill the system, including inhibitor as specified.

H. Bleed the gas line in a safe manner and energize the boiler controls.

I. All equipment, piping, valves and other components shipped loose shall be installed per manufacturer's instruction, whether indicated or not, in these plans and specifications.

3.4 START UP SERVICE:

A. After the boiler installation is completed, a factory trained technician shall supervise starting, boil out and adjusting the initial fire, schooling for the operators in the care and handling of the equipment and 12 months warranty service after initial firing to cover warranty service. Start-up services shall include all labor, materials and associated costs. The boiler manufacturer shall provide a letter stating the technician is factory trained to start-up their boilers.

3.5 BOIL OUT CHEMICALS:

A. The chemicals for periodic regular boiler water treatment will be by owners' chemical treatment contractor, **WATCON; contact Dave Russell, 419-283-4495.** This contractor shall provide initial chemicals, required for flushing and boil out of the boiler and boiler feed water unit. The chemicals shall be provided by WATCON and paid for by this contractor.

3.6 FIELD TEST:

A. Observe the ignition of the pilot and the main burner to make sure they are smooth and complete. Perform combustion efficiency test, provide a report on measured carbon monoxide, carbon dioxide and oxygen and measured efficiency. Check out the safety controls and verify that they are functioning properly. Set the operating controls for the proper pressure.

B. Submit a blank copy of the proposed start-up report form for review and approval by the Project Engineer at least two (2) weeks before start-up.

C. Start-up report shall include, but not necessarily be limited to the following:

1. Amperage and air flow on forced draft (combustion air) fan at low and high fire
2. Gas pressures prior to and after regulators
3. Gas pressure through gas train
4. Draft pressure at boiler outlet
5. Combustion efficiency test
6. Safety control check out
7. Operating control check out

D. Operate the boiler for no less than 2 hours. Provide a written report, through channels and on company letterhead, stating that ignition is proper, safety controls have been checked and operating controls are set and functioning properly. The system is not complete until this report has been received.

E. When the weather is cold enough for the boiler to be fully loaded perform proof of capacity test and burner modulation test. These tests will have to be performed during the month of December or January.

3.7 PROOF OF CAPACITY AND MODULATION:

A. The maximum capacity, turn down ratio and full modulation from low fire to high fire shall be proven by "clocking the meters".

B. The amount of gas burnt and the steam generated will be measured by clocking the existing gas meter and the existing flow meter in the boiler feed water line to each boiler. The meters shall be clocked by operating one boiler at a time.

C. The gas input will be calculated using the following formula:

$$\text{Input in cft/hr} = \frac{\text{CUFT X 3600 X PC1 X TC1}}{\text{TIME}}$$

Where CUFT is gas used in the measured TIME interval, PC1 is the pressure correction factor (check with Michcon 0.951?), TC1 is

temperature correction factor (check with Michcon 1.104?) and TIME is time interval in seconds for which CUFT was measured by reading the meter.

D. The steam output will be calculated using the following formula:

$$\text{Steam output in PPH} = \frac{\text{FLOW X 3600 X 8.33}}{\text{TIME}}$$

Where "FLOW" is the measured feed water volume in gallons per the given "TIME" interval in seconds.

E. The burner shall function properly at the maximum output, at part loads and at low fire start up demonstrating full modulation.

F. The commissioner and a representative from the Outlying Boiler Group shall be present during all the testing. Provide at least 7 days' notice prior to scheduling the tests. If the boilers cannot be loaded to the rated capacity, the contractor shall return to perform this work during the winter season; date and time will be scheduled by the Outlying Boiler Group from the University.

G. If the boilers fail the capacity and or modulation tests, the contractor shall remedy the situation and complete the test successfully within 30 calendar days. If the contractor fails to do so, the university will take whatever remedial actions the university sees necessary. The university will back charge the contractor for all the costs associated with the remedial actions.

END OF SECTION 235240