

DEPARTMENT OF VETERANS AFFAIRS BAY PINES VA MEDICAL CENTER
BOILER PLANTS
STATEMENT OF WORK
Inspection, Safety Device Testing and Calibration
Boiler Plant Burners, Controls, Instruments, and Data Management

1. Introduction:

- A. Bay Pines VHA has a central boiler plant that houses Cleaver Brooks 500 hp boilers 1, 2, and 3 in Bldg. 100 VA Medical Center, Bay Pines, Florida to provide steam for heating and air conditioning, domestic hot water, kitchens and sterilization. Bay Pines VHA also has Cleaver Brooks (water tube) Flex 200 boilers 1 and 2 in Bldg. 13 that provide steam for laundries that serve most of VISN 8 Facilities.
- B. Boiler plant safety, reliability, efficiency and equipment longevity are paramount concerns of Bay Pines VHA management. Malfunctioning burners or controls can cause catastrophic events resulting in injuries and death and massive property damage. Inaccurate or inadequate data management and monitoring systems can fail to warn of unsafe or inefficient performance. Regular inspections, testing and calibration by expert technicians are an essential part of a program to address these concerns.
- C. This Statement of Work describes following:
 - 1. The requirements for the inspection, testing and calibration of the boiler plant burners, controls and instruments by a “Qualified Technician” as defined in Section 2
 - 2. The requirements for the boiler inspections and feedwater deaerator inspections to be performed by “Qualified Professional Inspectors” as defined in Section 3.
- D. The vendor whom performs the below scope shall be able to program GEIP PAC8000 controls and cannot be the same vendor who performs the annual cleaning of the boilers.

2. Technician Qualifications:

- A. Technicians shall have completed at least a one-year trade school and have five years successful experience in this field. The experience shall be largely with institutional and industrial boiler plants similar in design to VAMC plants. The VAMC COR may define and accept equivalent qualifications.
- B. Technicians shall demonstrate familiarity with and ready access to the current versions of the following references:

NFPA 85, Boiler and Combustion Systems Hazards Code.

VHA Boiler Plant Safety Device Testing Manual, 3rd Edition.
- C. Technicians shall be equipped with portable electronic flue gas analyzers and other test instruments necessary for the required tests and calibrations, all calibrated within one month of the site visits. At facilities with programmable digital controls, the technicians shall be capable of programming the controls **GEIP PAC8000** and have the appropriate hardware and software for this.
- D. The contractor shall have, at a minimum, five years of experience working with GEIP PAC8000, and can provide the government with the latest information on upgrading each control if this should be necessary.

3. Qualified Profession Inspectors Qualifications: One or any combination of the following.

- A. A boiler inspector who has a valid and current certificate from the National Board of Boiler and Pressure Vessel Inspectors;
- B. A boiler inspector who has qualified for licensure by passing a written examination under the laws, rules, and regulations of a jurisdiction of the State and holds a current State license
- C. A boiler inspector who is currently employed as a boiler inspector/testing by a jurisdiction that has adopted and administers one or more sections of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code as a legal requirement, and has a representative serving as a member of the ASME Conference Committee; or
- D. A boiler inspector who is currently employed by an insurance company that has been licensed or registered by the appropriate authority of a State to write boiler and pressure vessel insurance.
- E. The “Qualified Professional Inspector” shall demonstrate familiarity with and ready access to the current versions of the following codes and manuals:
 - a. ASME Boiler and Pressure Vessel Code:
 - i. Section I - Power Boilers
 - ii. Section IV - Heating Boilers
 - iii. Section VI - Care and Operation of Heating Boilers
 - iv. Section VII - Care of Power Boilers
 - b. ASME B31.1, Power Piping Code
 - c. ASME CSD-1, Controls and Safety Devices for Automatically Fired Boilers
 - d. ANSI/NB-23, National Board Inspection Code
 - e. NFPA 85, Boiler and Combustion Systems Hazards Code
 - f. VHA Boiler Plant Safety Device Testing Manual, 3rd Ed.

4. Inspection of Boilers, Feedwater Deaerators

- A. Annual internal and external inspections are required for each boiler. Internal inspections of the feedwater deaerator pressure vessel are required every six years (or more frequently if welding repairs have been performed).
- B. Inspections shall be coordinated to fall immediately after cleaning has been completed. VAMC will notify the testing contractor at least 2 weeks in advance of expected inspection date. Also, the inspection shall be scheduled for periods when VAMC determines that the boilers will be inspected internally, will not be needed for steam supply, and when the Contracting Officer's Representative (COR) or his/her designate is available on site to monitor the inspections. To maintain steam service, only one boiler at a time shall be scheduled for internal inspections per inspection visit. Thus, multiple visits per VAMC facility shall be necessary every year to inspect all the boilers internally.
- C. Feedwater deaerator pressure vessel inspections shall be scheduled during periods of low steam demand.
- D. Coordinate the inspection schedule with the COR so that VAMC can prepare the boilers and feedwater deaerator for the inspections in advance and have personnel available to monitor the inspections.

- E. Boilers scheduled for internal inspection shall be prepared for the inspection by VAMC prior to the scheduled arrival of the inspector. This includes cooling the boilers to near ambient temperature and having all manways, handholes and furnace access doors open; the boilers cleaned of loose materials waterside and fireside; electrical “lock-out, tag-out” in place; connecting piping isolated; proper illumination provided; compliance with “confined space” access requirements including having safety personnel present in the boiler plant. Similar advance preparations shall be made to the feedwater deaerator when it is scheduled for internal inspection.
- F. VAMC shall comply with any other requirements of the inspector that are considered reasonable by VAMC and have been presented in writing at least two weeks prior to the scheduled inspection.
- G. The boiler and feedwater deaerator inspections shall comply with the guidelines in the current issue of the *NATIONAL BOARD INSPECTION CODE, Part RB, Inservice Inspection of Pressure-Retaining Items*, and *ASME Boiler and Pressure Vessel Code, Section VI or VII* as applicable. In addition to those guidelines, the inspections shall comply with all VAMC requirements as listed in this document.
- H. The inspector shall completely enter the internal spaces of the boiler or feedwater deaerator and visually inspect all internal surfaces that can be accessed.
- I. Methods for testing safety devices shall comply with *VHA Boiler Plant Safety Device Testing Manual, 3rd Edition*.
- J. Summary of the minimum inspection requirements for boilers:
 - 1) Review the boiler history including: operating conditions, date of last inspection, current inspection certificate, ASME stamping on boiler, National Board registration number, history of repairs and modifications. Review boiler logs, water test reports, and reports on tests performed on the burner controls and interlocks.
 - 2) Assess the external parts of the boilers and boiler accessories and piping and valves for safety, accessibility, proper maintenance and operation, cleanliness, and compliance with codes.
 - 3) Inspect for evidence of leakage of combustion gases or fluids, externally and internally, including all gaskets.
 - 4) Inspect foundations for signs of stress such as cracking or movement.
 - 5) Inspect boilers externally and internally for defects including bulges, blisters, cracks, wasted or eroded material, warping, general corrosion, grooving and pitting, damaged insulation.
 - 6) Inspect all accessible internal surfaces for waterside and fireside deposits, including scaling, sediment, debris, carbon deposits.
 - 7) Examine all stays and stayed plates.
 - 8) Inspect gas side baffles.
 - 9) Inspect internal drum surfaces and steam separating internals.
 - 10) Inspect soot blowers and verify proper alignment.

- 11) Inspect tubes, tube ends and tube alignment. Check for sagging tubes.
- 12) Verify that all nozzles of internal piping such as feedwater admission and bottom blow off collection are clear with no obstructions.
- 13) Inspect seating surfaces of manways and handholes.
- 14) Check that boiler structure is plumb and level with no excessive deformations.
- 15) Check for missing items such as bolts and nuts.
- 16) Examine all valve and pipe connections to the pressure vessel.
- 17) Inspect refractory including burner throat, expansion joint, bull ring, furnace seals, furnace walls and floor.
- 18) Verify proper alignment of burner assembly.
- 19) Inspect furnace for evidence of flame impingement.
- 20) Test operation of water level gage glass.
- 21) Perform mechanical and electrical inspection of disassembled low water cutouts (disassembly by VA). After reinstallation, test operation to the extent possible. Test low water cutouts on hot boilers by lowering water level gradually.
- 22) Verify that steam pressure gage is properly calibrated.
- 23) Test operation of high steam pressure cutouts on hot boilers by raising steam pressure.
- 24) Inspect safety valve installations and verify that the valves have proper capacity and set pressure and valves, drains and vents are properly installed. Verify that valve locking seals are not broken. On boilers that are hot, perform an operation test under pressure to confirm operation at proper set pressures. Operate boiler with burner at high fire to verify adequate steam flow capacity of the safety valves ("accumulation test").
- 25) Inspect piping connected to the boilers for evidence of leakage, provision for expansion, provision of adequate support, proper alignment, evidence of detrimental conditions.
- 26) Inspect piping to the water column, low water cutoffs and alarms, gage glass. Verify that interior of piping is clear of obstructions.
- 27) Inspect valves on boiler feedwater, blowdown, drain and steam systems.
- 28) Provide recommendations for non-destructive testing when the inspections indicate that this is necessary to assure continued safety and reliability under current operating conditions.

L. Summary of the minimum inspection requirements for feedwater deaerators:

- 1) Review the feedwater deaerator history including: operating conditions, date of last inspection, current inspection certificate, ASME stamping, National Board

registration number, materials of construction, extent of post weld heat treatment, history of repairs and modifications.

- 2) Assess the external parts of the feedwater deaerator and accessories and piping for safety, accessibility, cleanliness. proper operation, and compliance with codes.
- 3) Inspect for evidence of leakage.
- 4) Note feedwater deaerator pressure gage and thermometer readings and verify gage and thermometer accuracy.
- 5) Inspect safety valve installation and verify that the valves have proper set pressure and capacity and are properly installed. Perform an operation test under pressure to confirm operation at proper set pressures. Verify that the deaerator can safely withstand the test pressure prior to testing the valve(s) in-situ.
- 6) Verify that non-condensable gas vent line is open and proper orifice is provided to permit venting of gases.
- 7) Inspect support structures for proper integrity and allowance for thermal expansion.
- 8) Internal inspections (6 year intervals unless otherwise recommended because of welding repairs):
 - a. Visually inspect all visible pressure vessel surfaces for corrosion, material thinning, deposits, and weld cracking.
 - b. Inspect spray nozzles and trays.
 - c. Certified American Society for Non-Destructive Testing (ASNT) Level II technicians shall perform non-destructive tests using the wet fluorescent magnetic particle (WFMT), ultrasonic testing (UT), and any other necessary non-destructive tests.
 - Completely examine all accessible welds utilizing the WFMT test method. Properly prepare the surfaces before testing.
 - Determine pressure vessel material thickness by UT. Thickness measurement locations shall be selected by dividing the storage tank heads into quadrants and taking measurements at each quadrant on two imaginary rings in each head (eight measurements total). Measurement locations on the shell shall be on each of the quadrants, on four to six locations along the length of the shell (16 to 24 measurements total). The technician may recommend fewer or more tests to the owner, providing justification.
 - Typically, the pressure vessel section containing the deaerator trays and sprays is not accessible for non-destructive testing. The experience is that this section, which is mainly exposed to steam, is less vulnerable to weld failures and material thinning than the storage section which contains condensate and make-up water.

- d. Calculate maximum allowable working pressure rating of vessel based on thickness measurements. Calculate depletion rate of material thickness.

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5. Safety Device Inspection, Testing and Calibration Requirements:

- A. Safety Device Inspection, Testing, and Calibration must be done by a Qualified Technician as defined in Section 2 and shall have rights to program the GEIP PAC8000. Technicians shall provide all tools and labor necessary to perform inspection, tuning, testing, calibrating, and adjustments of burners and boiler and boiler plant controls as specified below. This shall be done every six months in accordance with a schedule provided by VAMC.
- B. Instrumentation, monitoring and data management systems as listed below shall be calibrated every six months.
- C. Inspections shall be coordinated to fall immediately after cleaning has been completed. VAMC will notify the testing contractor at least 2 weeks in advance of expected inspection date. Work cannot be scheduled during heavy steam load periods. Only one boiler at a time can be out of service for the inspection, testing and calibration procedures. Work must be conducted when the COR or his/her designate is available on site to monitor the work.
- D. Cleaning contractor, in collaboration with the VAMC staff, will have the boilers that are to be serviced prepared for the technicians upon their scheduled arrival. This includes having the boilers clean of soot and loose scale; fully warmed and at normal steam pressure; steam exhaust silencer system operable; all boiler, burner and fuel train pressure gages and thermometers calibrated; fuel meters in accurate operation (pressure/temperature correction factors provided, if applicable); boiler steam flow, stack temperature and flue gas oxygen instruments operating.
- E. VAMC will comply with any other requirements of the test personnel that are considered reasonable by VAMC and have been presented in writing at least two weeks prior to the scheduled testing.
- F. The inspections, testing and calibrations shall comply with:

- 1) The recommendations and requirements of *VHA Boiler Plant Safety Devices Testing Manual, 3rd Edition*.



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- 2) The written recommendations of the equipment manufacturers.
 - 3) The requirements and recommendations of NFPA 85 *Boiler and Combustion Systems Hazards Code* including applicable appendices.
 - 4) Burner performance requirements in this document.
- G. A summary of the work is as follows:
- 1) Review boiler plant log sheets and alarm and trouble reports.

- 2) Review records that show combustion performance (flue gas oxygen and carbon monoxide).
 - 3) Perform overall visual inspection of systems. Verify that systems comply with referenced codes and VAMC requirements stated in this contract.
 - 4) Test and record the operation and set points of all burner/boiler safety interlock devices. Refer to list below. Verify that the set points and operating points are within approximately 20% of normal operating parameters. Make adjustments as necessary and record the new settings. The operation of a device must result in burner shutdown and/or proper alarm operation.
 - 5) Operate burner(s) on each fuel from low fire to high fire and back to low fire in at least six increments and record combustion performance (flue gas oxygen, carbon monoxide, NO_x where applicable), fuel train pressures, atomizing train pressures, burner pressures, stack temperatures, boiler steam output.
 - 6) Compare the combustion performance data with VAMC requirements (see below) and previous readings. If necessary, make adjustments to the fuel flow and combustion air controllers, control valves and dampers to obtain the required performance. Record the new performance data.
 - 7) Verify accuracy of instrumentation listed below. Verify that all devices are properly selected for the application in terms of type, size, set point range, performance, code approval. Calibrate all instruments that are not within manufacturer's specifications for accuracy.
 - 8) Immediately inform COTR of any recommended repairs or modifications.
- H. All of interlocks and safety devices to be inspected and tested on each boiler/burner/equipment, are contained in the *VHA Boiler Plant Safety Devices Testing Manual, 3rd Edition*, along with testing procedures.
- I. Required burner performance (natural gas and fuel oil):
- 1) Turndown (ratio of maximum and minimum firing rates): 10/1 8/1 5/1 4/1
(Refer to original burner specification).
 - 2) Achieve, but do not exceed, boiler maximum steam flow output rating. Measure fuel input at minimum and maximum firing rates.
 - 3) Maximum carbon monoxide: 200 parts per million (ppm)
 - 4) Maximum NO_x: _____ (Refer to original burner specification).
 - 5) Flue gas oxygen: 2.5 – 4.2% (Up to 5.2% at loads below 40% of maximum steam output; no upper limit at minimum firing rate; oxygen can be one percentage point higher on oil firing on single-point positioning systems).
 - 6) Flue gas oxygen (low excess air burners): 1.0 – 2.0% (Up to 2.5% at loads below 40% of maximum steam output; no upper limit at minimum firing rate; oxygen can be one percentage point higher on oil firing on single point positioning systems).
 - 7) No visible smoke, except on heavy oil fuel maximum opacity is 20%. Comply with local emissions regulations.

- 8) Flames shall be stable with no pulsations, shall be retained near burner, no blowoff or flashbacks, no constant flame impingement on refractory or waterwalls.
- J. List of instrumentation and controls to be inspected and calibrated:
 - 1) Steam flow transmitters (all).
 - 2) Steam flow recorders/computer readout.
 - 3) Flue gas oxygen sampling, analyzing and recorder/computer readout.
 - 4) Boiler and economizer stack temperature transmitters and recorder/computer readout.
 - 5) Master steam pressure and combustion controllers.
 - 6) Boiler outlet draft controllers.
 - 7) Boiler water level controllers.
 - 8) Feedwater deaerator and condensate storage tank water level controllers including overflow.
 - 9) All pressure and temperature sensors and transmitters.
 - 10) All signal processing and readout devices.

4. Report Requirements:

Boilers, Feedwater Deaerators

- A. Provide complete written report fully describing all inspections and tests performed, findings, and recommendations. The condition of all items inspected shall be stated whether acceptable or deficient. All deficiencies shall be fully described along with recommendations for methods of correction. Utilize National Board Forms NB-6 and NB-7, or other similar forms acceptable to owner.
- B. Provide sketches and photographs as necessary and as requested by owner to show areas identified as not acceptable for continued service or requiring repair.
- C. Include test data and calculations. Show locations and extent of all non-destructive testing by sketches.
- D. Furnish report within one week of each facility inspection in "Microsoft Word" format by email to the COTR and to the VA Headquarters office designated in the attachment.
- E. All safety-related deficiencies shall be immediately reported to the COTR during the inspection visit.
- F. Provide recommendations on need for re-inspections after correction of deficiencies. Cost of re-inspections shall be extra cost negotiated with VA Contracting Officer.

Safety Device Inspection, Testing and Calibration

- A. Provide complete written report of the inspection fully describing all tests performed, all findings, and recommendations. The report shall have two sections the first section will be in a table form that with four columns:
 - a. The first column labeled "FUNCTION" did the device pass or fail.

- b. The second column labeled “Device” list the device number and description in accordance with the *VHA Boiler Plant Safety Devices Testing Manual, 3rd Edition*.
- c. The third labeled “Deficiencies-Recommendations”
- d. The fourth column labeled “corrective actions” list any corrective actions taken during the inspection.

The next section shall be in paragraph/bulleted form and list each device individual in accordance to the *VHA Boiler Plant Safety Devices Testing Manual, 3rd Edition*. Plus the section must reference the correct Master Specification and Standard Detail for that device. See sample below.

5.1. Condensate Storage Tank High Water Alarm

Purpose: High water level may be an indication of condensate transfer pump failure that could lead to low water condition in the feedwater deaerator and in the boilers. There may be a failure of make-up water controls.

Recommended set point: 4 inches below overflow level and 2/3 of tank height.

Potential hazards due to failure of high water alarm: Feedwater deaerator running dry and, consequently, boiler feed pumps running dry will cause overheating and damage to pumps and potential for plant shut down. Failure of make-up water controls (in open position) could lead to significant cost from waste of water and condensate from the tank overflow if this occurs over a long time period.

Recommended type of device: Conductivity probe type switch. Float type switches have high failure rate in this application where they are exposed to flash steam that causes seals to harden and prevent float movement.

VA Master Specification section: 23 50 11 (old 15625).

www.va.gov/facmgt/standard/

VA Standard Detail: SD232111-05.pdf www.va.gov/facmgt/standard/

Failure rate of float types: 48% (BEI study of VA boiler plants).

Make and Model: Mercoid Float

Did it function properly: No

Category & Action Time Limit: Upon Failure or Within 5 Years

Comments: Float type switches are not allowed for high water alarms. The VA recommended switch type is a conductivity probe type switch. Install the VA recommended switch and set to alarm at 2/3 of the tank height. There are valves that can isolate this alarm. These valves must be made lockable only in the operating position.

- B. Furnish report within one week of each facility inspection in “Microsoft Word” format by email to the COTR. Provide hard copies of data sheets and flue gas analyzer “strip” printouts to the COTR within one week of visit.
- C. All safety-related deficiencies shall be immediately reported to the COTR, Boiler Plant Supervisor and/or Assistant Chief Engineer during the inspection visit.