

HAWAII ADMINISTRATIVE RULES

TITLE 12

DEPARTMENT OF LABOR AND INDUSTRIAL RELATIONS

SUBTITLE 8

HAWAII OCCUPATIONAL SAFETY AND HEALTH DIVISION

PART 10

BOILER AND PRESSURE VESSELS

CHAPTER 222.1

POWER BOILERS

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Historical Note: This chapter is based substantially upon chapter 222. [Eff 7/11/74; am 12/30/76; am 8/22/78; am 8/1/78; am 12/6/82; R DEC 21 2019 ]

**\$12-222.1-1 Scope.** Unless exempt under section 12-220-2.1(c), the requirements in this section shall apply to power boilers and high-temperature water boilers, but not limited to the following:

- (1) Boilers in which steam or other vapor is generated at a pressure of more than fifteen (15) psig for use external to itself;
- (2) High-temperature water boilers intended for operation at pressures exceeding one hundred sixty (160) psig or temperatures exceeding two hundred fifty (250) degrees Fahrenheit; and
- (3) Unfired steam boilers designed in accordance with ASME BPVC Section I. [Eff and comp DEC 21 2019 ] (Auth: HRS §397-4) (Imp: HRS §397-4)

**\$12-222.1-2 General requirements for power boilers.** (a) The following shall apply to all power boilers:

- (1) All power boilers in operation in this jurisdiction shall have a valid and current operating permit issued for a specific location by the department;
- (2) Changes in location or ownership shall require notification of the department and may require re-inspection;
- (3) Power boilers shall bear the ASME BPVC symbol stamp "S", "E", "M", or ASME

certification mark with "S", "E", or "M" designator and the National Board registration number;

- (4) ASME and NB stamping shall be legible and not be concealed by insulation or paint; and
- (5) Upon completion of the installation of a new power boiler, each power boiler shall be marked by an inspector employed by the department with a state serial number, consisting of letters and figures to be not less than five sixteenths (5/16) of an inch in height and arranged as HAW####-Year.

(b) The age limit of boilers of standard construction installed prior to the date these rules become effective shall be dependent on thorough internal and external inspection, and where required by the inspector, a pressure test not exceeding one and one-half times (1.5) the maximum allowable working pressure. If the boiler, under these test conditions, exhibits no distress or leakage, it may be continued in operation at the working pressure determined by the applicable provisions of the edition of the ASME BPVC under which they were constructed and stamped.

(c) The age limit of any boiler of nonstandard construction without a lap-riveted longitudinal joint, installed prior to the date these rules become effective, shall be thirty (30) years, unless the department determines it may continue in operation at a pressure determined by the department as long as the following apply:

- (1) The boiler passes a thorough internal and external inspection; and
- (2) If required by an inspector, it passes a pressure test not exceeding one and one-half (1.5) times the maximum allowable working pressure, held for a period of at least thirty (30) minutes during which no distress or leakage develops.

(d) The age limit of any existing nonstandard boiler having lap-riveted longitudinal joints and

operated at a pressure in excess of fifty (50) psig shall be twenty (20) years. This type of boiler, when removed from an existing setting, shall not be reinstalled and used at a pressure in excess of fifteen (15) psig. A reasonable time for replacement, not to exceed one (1) year, may be given at the discretion of the department. Lap seam riveted boilers are not allowed in this jurisdiction.

(e) Power boilers designed and stamped in accordance with ASME BPVC Section I, if trimmed for use as low pressure steam boilers, shall be inspected internally and externally on a power boiler frequency, if any of the following is exceeded:

- (1) Heating surface greater than 100 square feet;
- (2) Heat input greater than 400,000 Btu/hr; or
- (3) Power boilers with manways.

(f) The following shall be considered new boiler installations:

- (1) Replacement of an existing power boiler;
- (2) Replacement of boilers at an existing location with a used or second-hand boiler; and
- (3) Used or second-hand power boilers when installed in this jurisdiction, shall be equipped with fittings and appurtenances that comply with new installations.

(g) Replacement or repairs to boiler fittings, appurtenances or appliances, controls, and safety devices, shall comply with the applicable ASME BPVC and National Board Inspection Codes.

(h) Weld repairs, alterations, and inspection records shall be submitted with the installation application.

(i) All boiler piping shall be designed and installed in accordance with ASME BPVC Section I and ASME B31.1 for used or second-hand boilers. The use of galvanized piping is prohibited for power boiler pressure piping. [Eff and comp ]

(Auth: HRS §397-4) (Imp: HRS §397-4)

**§12-222.1-3 Responsibilities of owners and users.** (a) The following are requirements of owners and users:

- (1) The owner or user of the power boiler is responsible for ensuring that all equipment meets all the requirements of the jurisdiction at the point of installation, including licensing, registration, and certification of those performing installations;
- (2) Owners or users shall ensure operating permit renewal inspections are completed prior to the permit expiration date;
- (3) Owners or users shall schedule boiler permit renewal internal inspections. Permit renewal inspections shall include boiler shutdown, dismantling, an internal inspection by an inspector, testing of controls and safety devices, and any additional inspection requirements at the discretion of the inspector;
- (4) Operation of power boilers with expired operating permits is not allowed and may be subject to citation with penalties of up to \$10,000 per day pursuant to section 12-220-22;
- (5) When a boiler task is required, it is the owner or the owner's designee that is expected to perform the task, however, the owner retains responsibility for compliance; and
- (6) Owners or users are responsible to ensure compliance with the preventive maintenance requirements as specified in 12-222.1-14.

(b) Permit extensions. The following shall apply to permit extensions:

- (1) Requests for the extension of operating permits may be considered for valid reasons by submitting a written request to the chief boiler inspector; and
- (2) The unavailability of special inspectors to conduct inspections is not a valid reason

for requesting permit extensions as deputy boiler inspectors may perform the inspections in the absence of special inspectors; [Eff and comp DEC 21 2019 ]  
(Auth: HRS §397-4) (Imp: HRS §397-4)

**§12-222.1-4 Inspections.** (a) Initial power boiler acceptance inspections shall be conducted and witnessed by an inspector employed by the department. The initial inspection shall include internal inspection, post installation pressure test in accordance with the original code of construction, and operational testing of controls and safety devices by the installer, contractor, or owner. The tests shall conform to the procedures set forth in the ASME BPVC, NBIC, and this section.

(b) All power boilers require annual inspection, including an internal inspection, and if approved by the department, the owner or user shall receive an operating permit. Approximately six (6) months after an initial or annual inspection, power boilers shall be externally inspected and operationally tested. The owner or user or designee shall perform the operational testing with an inspector witnessing the testing.

(c) The owner or user or designated agent shall prepare each boiler for internal inspection prior to the expiration date of the operating permit and shall apply a hydrostatic or pressure test, whenever necessary, at a time mutually agreeable to the inspector and owner or user. The owner or user of a boiler, or designated agent, shall prepare the boiler or pressure vessel for internal inspection to include, but not limited to the following, at the discretion of the inspector:

- (1) Drawing off the water and thoroughly washing the boiler;
- (2) Removing plates for a manhole or handhole, washout plugs, and inspection plugs in the connections of the water column, and in

- internally fired boilers all grates;
- (3) Ensuring the furnace and combustion chambers are thoroughly cooled and cleaned;
  - (4) Removing brickwork or installation as required by the inspector to determine the condition of the boiler, headers, furnace, supports, and other parts;
  - (5) Testing the pressure gage at the discretion of the inspector;
  - (6) Preventing any leakage of steam or hot water into the boiler by disconnecting the pipe or valve at the most convenient point, or by any method approved by the inspector;
  - (7) Closing, tagging, and padlocking the non-return valve, steam stop valves, blowoff valves, and feed valves before opening the cover for a manhole or handhole and entering any parts of the boiler or pressure vessel that connect to a common header with other boilers. In addition, opening the drain valves or cocks located between valves, disconnecting blowoff lines where practical between pressure parts and valves, and opening all drains and vent lines; and
  - (8) Any additional requirements at the discretion of the inspector.
- (d) The following shall apply to these specific types of boilers or pressure vessels:
- (1) Miniature boilers shall be externally inspected and operationally tested biannually; and
  - (2) Miniature and electric steam boilers providing steam for sterilizing chambers shall be inspected and permitted separately from the steam chamber.
- (e) Additional inspection requirements:
- (1) The inspector may require any additional inspections at their discretion when deemed necessary for continued safety;

- (2) The owner or user shall develop safety policies and procedures for entering boiler confined space before any inspection, testing, or operation; and
- (3) The owner or user shall enforce a lockout tagout safety procedure as approved by the inspector when any person enters any confined space [Eff and comp ] (Auth: HRS §397-4) (Imp: HRS §397-4)

**§12-222.1-5 Technical installation requirements.** (a) General requirements. The following shall apply to all power boilers:

- (1) Power boilers shall be installed pursuant to section 12-220-2.1 and this chapter;
- (2) Owners and users shall adhere to the power boiler installation requirements as specified in NBIC Part 1, and this chapter;
- (3) An application for installation permit shall be submitted to the department prior to commencement of work;
- (4) Boilers installed without an installation permit may be subject to citation and penalties of up to \$10,000 per day pursuant to section 12-220-22;
- (5) Only contractors holding a valid Hawaii C-4 contractor license issued by the contractors license board of the department of commerce and consumer affairs shall install power boilers; and
- (6) All power boilers shall be equipped with controls and safety devices based upon the Btu/hr burner input, as specified in the original code of construction, and in accordance with the following codes and standards:



- (A) Boilers with energy input ratings of less than 12,500,000 Btu/hr shall meet the requirements of ASME CSD-1-2012;
- (B) Boilers with energy input ratings of 12,500,000 Btu/hr and above shall meet the requirements of NFPA-85-2015;
- (C) All atmospheric fluidized bed boilers, boilers with pulverized fuel systems, and boilers that are stoker fired shall meet the requirements of NFPA-85-2015; and
- (D) No new miniature boiler shall be installed unless it has been constructed and inspected to ASME BPVC standards, bears the ASME certification mark with the "S", "M", or "E" designator in accordance with the requirements of Part PMB of ASME BPVC Section I, and when required, has controls and safety devices installed that are in accordance with ASME CSD-1-2012.

(b) First acceptance inspection and certification requirements shall include the following:

- (1) The owner, user, and contractor shall comply with section 12-220-2.1, and upon completion of the installation shall arrange for an acceptance inspection by the department;
- (2) The installing contractor shall operationally test the boiler controls and safety devices prior to scheduling the first acceptance inspection with the department and record the results on form CG-500, ASME CSD-1 2012, and file a copy with the department;
- (3) First inspections for power boilers shall include internal inspection, pressure test in accordance with the original code of construction, and operational testing of the controls and safety devices;

- (4) The installing contractor shall test the boiler as directed and witnessed by an inspector employed by the department;
  - (5) An inspector employed by the department shall conduct the first data inspection, acceptance, and mark the state serial number on the power boiler pursuant to section 12-220-29.1; and
  - (6) The installer shall complete and certify the NBIC Boiler Installation Report I-1 (NB-365, see Exhibit 3), found at the end of this chapter, after the completion, inspection, and acceptance of the installation. The Boiler Installation Report I-1 (NB-365, see Exhibit 3) shall be submitted to the owner and the department.
- (c) The following shall apply to power boiler clearances:
- (1) Boiler installations shall allow for normal operation, maintenance, and inspections. There shall be at least thirty-six (36) inches of clearance on each side of a boiler to enable access for maintenance and inspection activities. Boilers operated in battery shall not be installed closer than forty-eight (48) inches from each other. The front or rear of any boiler shall not be located closer than thirty-six (36) inches from any wall or structure;
  - (2) Alternative clearances in accordance with the manufacturer's recommendations are subject to acceptance by the department;
  - (3) Boilers shall be installed to allow for removal and installation of tubes;
  - (4) Boilers with a top-opening manhole shall have at least eighty-four (84) inches of unobstructed clearance above the manhole to the ceiling of the equipment room; other manhole openings shall have at least five (5) feet; and

- (5) Boilers with a bottom opening used for inspection or maintenance shall have at least twelve (12) inches of unobstructed clearance.
- (d) The following shall apply to electric and miniature boiler clearances:
  - (1) Electric and miniature boilers shall be installed at an accessible location for inspection and maintenance;
  - (2) Electric and miniature boilers shall not be installed in ceilings unless provided with permanent ladders, floors, and height clearance for safe access;
  - (3) Control sides and door openings shall have three (3) feet clearance from any type of interference;
  - (4) All other sides shall have eighteen (18) inches of clearance; and
  - (5) Alternative clearances in accordance with the manufacturer's recommendations are subject to acceptance by the department.  
[Eff and comp DEC 21 2019 ] (Auth: HRS §397-4) (Imp: HRS §397-4)

**§12-222.1-6 Pressure relief valves for power boilers.** (a) General requirements. The following shall apply to all power boilers:

- (1) Each power boiler, miniature boiler, electric boiler, and high-temperature water boiler shall have at least one ASME and NB certified pressure relief valve marked with the ASME certification mark and "V" designator, and National Board NB symbols;
- (2) When a new boiler is installed, ASME Form P-7 Manufacturer's Data Report for Pressure Relief Valves, or ASME Form P-8 Manufacturer's or Assembler's Certificate of Conformance for Pressure Relief Valves, as required by the ASME BPVC, shall be

- submitted along with the manufacturer's data on the power boiler;
- (3) Only direct spring-loaded pressure relief valves or pilot operated pressure relief valves designed to relieve steam shall be used for steam service;
  - (4) Safety relief valves are valves designed to relieve either steam or water, depending on the application;
  - (5) Deadweight or weighted-lever pressure relief valves shall not be used;
  - (6) For high-temperature water boilers, safety relief valves shall have a closed bonnet, and valve bodies shall not be constructed of cast iron;
  - (7) At least one NB capacity certified pressure relief valve shall be installed on the boiler. If the boiler has more than 500 square feet of heating surface, or if an electric boiler has a power input of more than 1,100 kilowatts, two or more NB capacity certified pressure relief valves shall be installed;
  - (8) The pressure relief valve capacity for each boiler shall be so that the valve or valves will discharge all the steam that can be generated by the boiler without allowing the pressure to rise more than six per cent (6%) above the highest pressure to which any valve is set, and in no case to more than six per cent (6%) above the maximum allowable working pressure of the boiler. In no case shall the minimum relieving capacity be less than the maximum designed steaming capacity as determined by the manufacturer;
  - (9) One or more pressure relief valves on the boiler proper shall be set at or below the maximum allowable working pressure. If additional valves are used, the highest pressure setting shall not exceed the maximum allowable working pressure by more

than three per cent (3%). The complete range of pressure settings of all the pressure relief valves on a boiler shall not exceed ten per cent (10%) of the highest pressure to which any valve is set;

- (10) Adjustments, repairs, and reconditioning of pressure relief valves shall be done by a National Board authorized "VR" repair company. The "VR" repair company shall affix a "VR" nameplate to the valve and provide repair documentation and the owner and user shall ensure that the nameplate identification plates remain legible; and
- (11) The owner and user shall maintain all pressure relieving devices in good operating condition. When the valves cannot be tested in service, the user shall maintain and make available to the inspector records showing the test dates and set pressure for the valves.

(b) Installation of pressure relief valves. The following shall apply to the installation requirements of pressure relief valves:

- (1) Every boiler shall have outlet connections for the pressure relief valve, or valves, independent of any other outside steam connection, and the area of opening shall be at least equal to the aggregate areas of inlet connections of all the attached pressure relief valves. An internal collecting pipe, splash plate, or pan should be used, provided the total area for inlet of steam is not less than twice the aggregate areas of the inlet connections of the attached pressure relief valves. The holes in such collecting pipes shall be at least 1/4 inch in diameter, and the least dimension in any other form of opening for inlet of steam shall be 1/4 inch. If pressure relief valves are attached to a separate steam drum or dome, the opening between the boiler proper and the steam

- drum or dome shall be not less than ten (10) times the total area of the pressure relief valve inlet;
- (2) Every pressure relief valve shall be connected to stand in an upright position with spindle vertical;
  - (3) The opening or connection between the boiler and the pressure relief valve shall have at least the area of the valve inlet and the inlet pipe to the pressure relief valve shall be as short and straight as possible, no longer than twice the center-to-end (face) dimension of a corresponding tee fitting of the same diameter, pressure class, and connection type. When a discharge pipe is used, the cross-sectional area shall not be less than the full area of the valve outlet or of the total of the areas of the valve outlets. It shall be as short and straight as possible and arranged to avoid undue stresses on the valve or valves;
  - (4) When a pressure relief valve is exposed to outdoor elements that may affect operation of the valve, the valve may be shielded with a cover. The cover shall be properly vented and arranged to permit servicing and normal operation of the valve;
  - (5) No valves of any type except a changeover valve as defined below, shall be placed between the pressure relief valves and the boiler, nor on the discharge pipe between the pressure relief valves and the atmosphere. A changeover valve, which allows two redundant pressure relief valves to be installed for the purpose of changing from one pressure relief valve to the other while the boiler is operating, may be used provided the changeover valve is in accordance with the original code of

construction. It is recommended that the department be contacted to determine the acceptability of changeover valves on boiler applications. The changeover valve shall be designed such that there is no intermediate position where both pressure relief valves are isolated from the boiler;

- (6) When two or more pressure relief valves are used on a boiler, they should be mounted either separately or as twin valves made by placing individual valves on Y-bases, or duplex valves having two valves in the same body casing. Twin valves made by placing individual valves on Y-bases or duplex valves having two valves in the same body shall be of equal size;
- (7) When two valves of different sizes are installed singly, the relieving capacity of the smaller valve shall not be less than fifty per cent (50%) of that of the larger valve; and
- (8) When a boiler is fitted with two or more pressure relief valves on one connection, this connection to the boiler shall have a cross-sectional area not less than the combined areas of inlet connections of all the pressure relief valves with which it connects.

(c) Discharge pipe. The following shall apply to pressure relief valve discharge piping requirements:

- (1) All pressure relief valves shall be piped to a safe point of discharge so located or piped as to be carried clear from running boards or platforms. Provision for an ample gravity drain shall be made in the discharge pipe at or near each pressure relief valve, and where water or condensation may collect. Each valve shall have an open gravity drain through the

casing below the level of the valve seat. For iron and steel-bodied valves exceeding NPS 2, the drain hole shall be tapped not less than NPS 3/8;

- (2) Discharge piping from pressure relief valves on high-temperature water boilers shall have adequate provisions for water drainage as well as steam venting;
- (3) If a muffler is used on a pressure relief valve, it shall have sufficient outlet area to prevent back pressure from interfering with the proper operation and discharge capacity of the valve. The muffler plates or other devices shall be so constructed as to avoid a possibility of restriction of the steam passages due to deposits. Mufflers shall not be used on high-temperature water boiler pressure relief valves; and
- (4) When a discharge pipe is used, it shall be at least the same size of the safety valve discharge port and fitted with an open drain to prevent water lodging in the upper part of the safety valve or in the discharge pipe. Sectional areas of a common discharge pipe shall not be less than the same size of the combined multiple valve outlets discharging into the common discharge pipe. The discharge pipe shall be as short and straight as possible and arranged to avoid undue stresses on the valve or valves. Discharge pipe elbows shall be placed close to the safety valve outlet, or the discharge pipe shall be anchored and supported securely. If umbrella type drip pan connection is used, the discharge piping shall be designed to prevent binding due to expansion. [Eff and comp **DEC 21 2019** ] (Auth: HRS §397-4) (Imp: HRS §397-4)



**§12-222.1-7 Power boiler appurtenances.** (a)

Water level indicators. The following shall apply to all water level indicators:

- (1) Each boiler shall have at least one water gage glass, except forced-flow steam generators with no fixed steam and waterline and high-temperature water boilers of the forced circulation type that have no steam and waterline;
- (2) The lowest visible water level in a gage glass shall be at least two inches above the lowest permissible water level as determined by the manufacturer;
- (3) Gage glasses shall be connected directly to the shell or drum of the boiler or to an intervening water column;
- (4) The lower edge of the steam connection between a water column, gage glass, or water level sending device in the boiler, shall not fall below the highest visible water level in the gage glass. In addition, there shall be no sag or offset in the piping that will permit accumulation of water;
- (5) The upper edge of the water connection between water column, gage glass, or water level sensing device in the boiler, shall not be above the lowest visible water level in the gage glass. In addition, no part of the pipe connection shall be above the point of connection at the water column;
- (6) Boilers having a maximum allowable working pressure of 400 psi or less shall always have at least one gage glass in service;
- (7) Boilers having maximum allowable working pressure greater than 400 psi shall always have two gage glasses in service:
  - (A) When two gage glasses are required, both may connect to a single water column;
  - (B) Instead of one of the two required gage glasses, two independent remote water

- level indicators (two discrete systems that continuously measure, transmit, and display water level) may be provided. In addition, minimum water levels shall be clearly marked;
- (C) When both remote level indicators are in reliable operation, the remaining gage glass may be shut off, but shall be maintained in serviceable condition; and
  - (D) When the water level in at least one gage glass is not readily visible to the operator in the area where control actions are initiated, either a fiber optic cable (with no electrical modification of the optical signal) or mirrors shall be provided to transfer the optical image of the water level to the control area. Alternatively, any combination of two of the following shall be provided:
    - (i) An independent remote water level indicator; and
    - (ii) An independent continuous transmission and display of an image of the water level in a gage glass. The display of a remote water level indicator shall have a clearly marked minimum water level reference at least two (2) inches above the lowest permissible water level, as determined by the manufacturer;
- (8) Gage glass assemblies with multiple sections, whether of tubular or other construction, shall:
- (A) Ensure a one-foot overlap of all adjoining sections so the water level is visible; or
  - (B) Ported or reflex gages using refractive light to aid determination of water

level may omit the requirement of overlapping sections;

- (9) The gage glass cock connections shall not be less than one-half (1/2) of an inch NPS;
- (10) Each gage glass, externally mounted water level, or water level controlling device shall be fitted with a drain cock or valve having an unrestricted drain opening of not less than one-fourth (1/4) of an inch in diameter to facilitate cleaning;
- (11) No outlet connections, except for damper regulators, feedwater regulators, drains, steam gages, or apparatus of a form that does not permit the escape of an appreciable amount of steam or water therefrom, shall be placed in the pipes connecting a water column or gage glass to a boiler;
- (12) The water column shall be fitted with a drain cock or drain valve of at least three-fourths (3/4) of an inch nominal pipe size and shall be piped to a safe point of discharge;
- (13) Connections from the boiler to the water column shall be at least NPS 1;
- (14) Connections for gage glasses connected directly to the boiler or to an intervening water column shall be at least NPS one-half (1/2);
- (15) Connections from the boiler to a remote water level indicator shall be at least NPS three-fourths (3/4), including the isolation valve; and from there to the remote level indicator at least one-half (1/2) of an inch in OD tubing;
- (16) Water level connections shall be completely independent of other connections for any function other than water level indication;
- (17) The steam and water connections to a water column or a water gage glass shall be readily accessible for internal inspection and cleaning; and

- (18) Shutoff valves shall not be used in the pipe connections between a boiler and a water column, or between a boiler and the shutoff valves required for the gage glass, except:
- (A) Outside screw-and-yoke or lever-lifting-type gate valves or stopcocks with lever permanently fastened thereto and marked in line with their passage; and
  - (B) Another through-flow construction that prevents stoppage by deposits of sediment, and to indicate by the position of the operating mechanisms whether they are in open or closed position. These valves or cocks shall be locked or sealed open. Where stopcocks are used, they shall be of a type with the plug held in place by a guard or gland.
- (b) Low-water fuel cutoffs and water feeding devices. The following shall apply to low-water fuel cutoffs and water feeding devices:
- (1) Each automatically fired, high pressure steam boiler, except miniature boilers, shall have at least two automatic low water fuel cut-off devices. When installed external to the boiler, each device shall be installed in individual chambers (water columns), which shall be attached to the boiler by separate pipe connections below the waterline. A common steam connection is permissible. Each cut-off device shall be installed to prevent startup and cut off the boiler fuel or energy supply automatically when the surface of the water falls to a level not lower than the lowest visible part of the gage glass. One control shall be set to function ahead of the other;
  - (2) Functioning of the lower of the two controls shall cause safety shutdown and

lockout. The manual reset may be incorporated in the lower cut-off control. Where a reset device is separate from the low-water fuel cutoff, a means shall be provided to indicate actuation of the low water fuel cutoff. The manual reset device may be of the instantaneous type or may include a time delay of not more than three (3) minutes after the fuel has been cut off;

- (3) The fuel cut-off device may be inserted internally or attached externally to the boiler. An external cut-off device may be attached on piping connecting a water column to the boiler or combined with a water column;
- (4) Water column piping and connections shall be at least NPS 1 (DN 25). If the low-water fuel cutoff is connected to the boiler by pipe or fittings, no shutoff valves of any type shall be placed in such piping. The steam and water connections to a water column shall be readily accessible for internal inspection and cleaning. Some acceptable methods of meeting this requirement are by providing a cross-fitting with a back outlet at each right-angle turn to permit inspection and cleaning in both directions or by using pipe bends or fittings of a type that does not leave an internal shoulder or pocket in the pipe connection and with a radius of curvature that will permit the passage of a rotary cleaner. Fuel cut-off devices embodying a separate chamber shall have a vertical drainpipe and blowoff valve, not less than NPS 3/4, located at the lowest point of the chamber or water-equalizing pipe connections, so that the chamber and the

- equalizing pipe can be flushed and the device tested;
- (5) Each miniature boiler, except electric boilers of the electrode type, shall have at least one low water fuel cut-off device;
  - (6) These devices shall be installed in such a manner that they cannot be rendered inoperative by the manipulation of any manual control or regulating apparatus;
  - (7) In boilers with a fixed water line, the low-water fuel cutoff devices shall be tested regularly by lowering the water level sufficiently to shut off the fuel supply to the burner when the water level reaches the lowest safe level for operation. Boilers that do not have a fixed water line shall be equipped with a flow sensing device, thermal couple or expansion ring that is listed by a nationally recognized testing agency to prevent burner operation at a flow rate inadequate to protect the boiler unit against overheating;
  - (8) Boilers with single drain electronic solenoid valve shall be fitted with a manual by-pass drain line to facilitate testing of the low water cutoff safety device;
  - (9) The low-water cutoff shall be rated for a pressure and temperature equal to or greater than the MAWP and temperature of the boiler;
  - (10) For high-temperature water boilers requiring forced flow circulation, an approved flow sensing device shall be installed on the outlet, as close to the boiler as possible;
  - (11) When a low-water fuel cutoff and feedwater pump control is combined in a single device, an additional separate low-water fuel cutoff shall be installed. The additional control shall be wired in series

- electrically with the existing low-water fuel cutoff;
- (12) When a low-water fuel cutoff is housed in either the water column or a separate chamber it shall be provided with a blowdown pipe and valve not less than 3/4 inch NPS. The arrangement shall be such that when the water column is blown down, the water level in it will be lowered sufficiently to activate the lower-water fuel cutoff device; and
- (13) If a water feed device is utilized, it shall be constructed to prevent feedwater from entering the boiler through the water column or separate chamber of the low-water fuel cutoff. [Eff and comp **DEC 21 2019** ]  
(Auth: HRS §397-4) (Imp: HRS §397-4)

**§12-222.1-8 Boiler external and non-boiler external piping.** Boiler external piping (BEP).

- (1) BEP shall be designed, fabricated, installed and stamped in accordance with ASME BPVC Section I and ASME B31.1;
- (2) Manufacturers of BEP shall possess an ASME certificate of authorization to use the certification mark with the "S" or "PP" designator;
- (3) BEP may be installed by a manufacturer or contractor other than the manufacturer of the boiler, provided the organization has been issued a certificate of authorization to use the certification mark with the "S", "PP" or "A" designator; and in possession of a current and valid Hawaii contractors license as required in section 12-220-15;
- (4) Prior to starting BEP installation, an application for installation shall be submitted to the department for an installation permit; and

- (5) Welded repairs or alterations to boiler external piping shall be done by a company in possession of a valid NB "R" certificate of authorization.
- (b) Non-boiler external piping (NBEP).
  - (1) NBEP design, fabrication, installation, alteration, or repair shall be done in accordance with the applicable provisions of the ASME BPVC, ASME B31.1, NBIC and this part;
  - (2) NBEP may be designed, fabricated, installed, altered, or repaired by organizations with valid ASME "S", "PP", or "A" designators or a NB "R" certificate of authorization, or organizations with a valid Hawaii NBEP certificate of authorization;
  - (3) Applicants whose quality control program have been reviewed, approved, and issued an NBEP certificate of authorization by the department shall be qualified to design, fabricate, install, alter, or repair NBEP within the provisions of ASME B31.1 and NBIC Part 3; and
  - (4) Application for authorization for design, fabrication, installation, alteration, or repair shall be submitted to the department as prescribed in section 12-220-9.1. [Eff and comp DEC 21 2019] (Auth: HRS §397-4) (Imp: HRS §397-4)

**§12-222.1-9 Electric and miniature boilers. (a)**

In accordance with ASME BPVC Section 1, new miniature boilers shall be constructed, inspected, and bear the ASME certification mark with the "S", "M", or "E" designator. The controls and safety devices shall be installed in accordance with ASME CSD-1. New miniature boiler installations shall comply with section 12-222.1-5.



(b) Miniature boilers used in generating steam for autoclave sterilizers shall be registered separately from the autoclave. The autoclave shall be registered as a pressure vessel if size and pressure is within limits unless exempted by section 12-220-2.1(c).

(c) The maximum allowed working pressure is 100 psi in accordance with the ASME BPVC section 1.

(d) Each miniature boiler shall be equipped with a sealed spring-loaded pop safety valve of not less than one-half (1/2) inch NPS.

(e) Each steam line from a miniature boiler shall be provided with a steam rated stop valve located as close to the boiler shell or drum as is practicable, except when the boiler and steam receiver is operated as a closed system.

(f) Miniature boilers for operation with a definite water level shall be equipped with a glass water gage for determining the water level. The lowest permissible water level for vertical boilers shall be at a point one-third (1/3) of the height of the shell above the bottom head or tube sheet. The following shall apply:

- (1) Tubular gage glasses on electric boilers shall be equipped with protective rods or shields; and
- (2) Each gage glass shall be fitted with a drain cock and valve having an unrestricted drain opening of not less than one-fourth (1/4) inch diameter to facilitate water flush draining of the gage glass.

(g) Where the boiler is equipped with an internal furnace, the water level shall not be less than one-third (1/3) of the length of the tubes above the top of the furnace tube sheet.

(h) In the case of small boilers operated in a closed system where there is insufficient space for the usual glass water gage, water level indicators of the glass bull's eye type may be used.

(i) Miniature boilers shall be provided with at least one feed pump or other feeding device, except where it is connected to a water main carrying sufficient pressure to feed the boiler or where it is

operated with no extraction of steam (closed system). In the latter case, in lieu of a feeding device, a suitable connection or opening shall be provided to fill the boiler when cold. Such connection shall be no less than one-half (1/2) inch NPS for iron or steel pipe and one-fourth (1/4) inch NPS for brass or copper pipe.

(j) The feed pipe shall be provided with a check valve and a stop valve of a size not less than that of the pipe. The feedwater may be delivered through the blowoff opening if desired.

(k) Miniature boilers shall be equipped with a blowoff connection, not less than one-half (1/2) inch NPS, located to drain from the lowest water space practicable. The blowoff piping shall be equipped with a stop valve not less than one-half (1/2) inch NPS.

(l) Miniature boilers solely equipped with an automatic/timed blowoff valve shall be equipped with a manual bypass loop which bypasses automatic valve to facilitate testing of the low water cutoff controls.

(m) Miniature boilers exceeding twelve (12) inches internal diameter or having more than ten (10) square feet of heating surface shall be fitted with not less than three (3) brass washout plugs of one-inch NPS which shall be screwed into openings in the shell near the bottom. In miniature boilers of the closed type system heated by removable internal electric heating elements, the openings for these elements, when suitable for cleaning purposes, may be substituted for washout openings.

(n) Boilers not exceeding twelve (12) inches internal diameter and having less than ten (10) square feet of heating surface need not have more than two (2) one-inch openings for clean-outs, one of which may be used for the attachment of the blow-off valve. These openings shall be opposite to each other where possible. The following shall apply:

- (1) All threaded openings shall be opposite to each other where possible; and
- (2) All threaded openings in the boiler shall be

provided with a riveted or welded reinforcement to give four (4) full threads therein.

(o) Electric boilers of a design employing a removable top cover flange for inspection and cleaning need not be fitted with washout openings.

(p) All valves, pipe fittings, and appliances connected to a miniature boiler shall be equal to at least the requirements of Class 125 or Class 150 of the appropriate ASME Standard as listed in ASME BPVC Section I.

(q) All welded repairs and alterations to miniature boilers must comply with the rules in this part as defined in NBIC Part 3. [Eff and comp **DEC 21 2019** ] (Auth: HRS §397-4) (Imp: HRS §397-4)

**§12-222.1-10 Attendance.** (a) An unattended power boiler log (Exhibit 4) shall be maintained by owners or operators at the boiler operating area to record daily checks and inspections and the following shall apply:

- (1) Boiler operation log entries shall be updated; daily, not to exceed twelve (12) hours for a single entry; and
- (2) The daily operating log shall be available to the inspector of record for a period of not less than six (6) months.

(b) Power boilers, waste heat boilers, and high-temperature water boilers subject to this chapter shall not be left in operation unattended by a competent attendant for a period of time longer than it will take the water level to drop from a normal operating level to the lowest permissible water level, as indicated by the water gage glass, or by indicating devices or recorders, when the feed water is shut off and the boiler is forced to its maximum capacity, unless all of the following are complied with where applicable:

- (1) The boiler is equipped with a strobe or flashing light that will operate when the water reaches the lowest permissible operating

level, or, for boilers having no fixed steam or water line, when the highest permissible operating temperature is reached. The strobe or flashing light shall be so located that can be plainly seen at the most remote point from the boiler at which the attendant is required to work. Audible alarms, when used, shall be distinctly audible above the ambient noise level;

- (2) The boiler is equipped with two low water safety devices with separate water connections to the boiler that will shut off the fuel to the burner or burners when the water reaches the lowest permissible operating level, or, for boilers having no fixed steam or water line, when the highest permissible operating temperature is reached. These devices shall require manual resetting unless the burner is equipped with a full safety pilot control;
- (3) A competent attendant personally checks the operation of the boiler, the necessary auxiliaries, and the water level of the boiler at such intervals, not exceeding sixty (60) minutes, as necessary to insure the safe operation of the boiler. The operation of the automatic water level controls shall be tested such that fuel to the burner will be shut off at the beginning of each daily period of operation and at intervals not to exceed twelve (12) operating hours. A record of each inspection and check of controls shall be maintained and available to an inspector for a period of six (6) months prior to the inspection;
- (4) There is a conspicuous and readily accessible safety disconnect switch located adjacent to the boiler room entrance or, in the situation where the boiler is located outside, in the immediate vicinity of the boiler which, when operated, will cut off all power to the boiler and cause it to shut down in a safe manner. Immediately adjacent to the disconnect device

there shall be posted a sign conspicuously directing the observer to use the device for shutting down the boiler in event of emergency, such as observing any unsafe condition or functioning of the boiler or its appurtenances or any condition or function of the boiler which is unusual, or which is, in the observer's opinion, potentially hazardous;

- (5) A competent attendant means a person who is familiar with the operation of the boiler and may be certified by a curriculum accredited college, university, technical school, or organization serving the boiler industry;
  - (6) The minimum standards to be met for an attendant to be competent include, but are not limited to the following, as detailed in the ASME BPVC Section VII:
    - (A) The ability to explain the function and operation of all controls and safety devices on the boiler and operate the boiler in a safe manner;
    - (B) The knowledge of all possible methods of feeding water to the boiler; and boiler blowoff/blowdown procedure; and
    - (C) Shutting down the boiler or boilers in a safe manner; and
  - (7) The attendant performs a recommended operation checklist schedule recorded at each regular shift not to exceed twelve (12) hours, and checks and records the following:
    - (A) Externally examine unit for leaks or unusual conditions;
    - (B) Check burner flame;
    - (C) Check gages, monitors, and indicators;
    - (D) Low water cutoff and alarm test; and
    - (E) Water column and gage glass blowdown.
- [Eff and comp DEC 21 2019 ] (Auth: HRS §397-4) (Imp: HRS §397-4)

**§12-222.1-11 Boiler room and operating area. (a)**

The following shall apply to the care of the boiler room:

- (1) The boiler room shall be free from accumulation of rubbish and materials that obstruct access to the boiler, its setting, or firing equipment;
- (2) The storage of flammable material or gasoline powered equipment in the boiler room is prohibited;
- (3) The roof over boilers designed for indoor installations, shall be free from leaks and maintained in good condition;
- (4) Adequate drainage shall be provided;
- (5) All exit doors shall open outward; and
- (6) It is recommended that the ASME BPVC Section VII be used as a guide for proper and safe operating practices.

(b) The following shall apply to boiler supports, foundations, and settings:

- (1) Each boiler and its associated piping shall be safely supported. Design of supports, foundations, and settings shall consider vibration, including seismic where necessary, movement including thermal expansion and contraction, and loadings including the weight of the fluid in the system during a pressure test in accordance with jurisdictional requirements, manufacturers recommendations, and other industry standards as applicable; and
- (2) If the boiler is supported by structural steel, the steel supporting members shall be so located or insulated that the heat from the furnace will not affect their strength. Structural steel shall be installed in accordance with jurisdictional requirements, manufacturer's recommendations, and other industry standards, as applicable.

(c) Exit. Two means of exit shall be provided for equipment rooms exceeding 500 square feet of floor area and containing one or more boilers having a combined

fuel capacity of 1,000,000 Btu/hr or more (or equivalent electrical heat input). Each elevation shall be provided with at least two means of exit, each to be remotely located from each other. A platform at the top of a single boiler is not considered an elevation.

(d) Ladders and runways. The following shall apply to ladders and runways:

- (1) All walkways, runways, and platforms shall be of metal construction or equivalent material;
- (2) Provided between or over the top of boilers that are more than eight (8) feet above the operating floor to afford accessibility for normal operation, maintenance, and inspection;
- (3) Constructed of safety treads, standard grating, or similar material and have a minimum width of thirty (30) inches; of bolted, welded, or riveted construction; and equipped with handrails forty-two (42) inches high with an intermediate rail and four (4) inch toe-board;
- (4) Stairways that serve as a means of access to walkways, runways, or platforms shall not exceed an angle of forty-five (45) degrees from the horizontal and shall be equipped with handrails forty-two (42) inches high with an intermediate rail;
- (5) Ladders that serve as a means of access to walkways, runways, or platforms shall:
  - (A) Be made of metal construction and not less than eighteen (18) inches wide;
  - (B) Have rungs that extend through the side members and are permanently secured;
  - (C) Have a clearance of not less than thirty (30) inches from the front of rungs to the nearest permanent object on the climbing side of the ladder;
  - (D) Have a clearance of not less than six and a half (6-1/2) inches from the back of rungs to the nearest permanent object; and

- (E) Have a clearance width of at least fifteen (15) inches from the center of the ladder on either side across the front of the ladder; and
- (6) There shall be at least two permanently installed means of exit from walkways, runways, or platforms that exceed six (6) feet in length.
- (e) Fuel. Fuel systems, whether firing coal, oil, gas, or other substance, shall be installed in accordance with departmental, environmental requirements, manufacturer's recommendations, and industry standards, as applicable.
- (f) Ventilation and combustion air. The following shall apply to ventilation and combustion air:
  - (1) The equipment room shall have an adequate air to permit clean, safe combustion, minimize soot formation, and maintain a minimum of nineteen and a half per cent (19.5%) oxygen in the air of the equipment room and sufficient to maintain ambient temperatures as recommended by the boiler manufacturer. The combustion and ventilation air should be supplied by either an unobstructed air opening or by power ventilation or fans. When combustion air is supplied to the boiler by an independent duct, with or without the employment of power ventilators or fans, the duct shall be sized and installed in accordance with the manufacturer's recommendations;
  - (2) When combustion air is supplied to the boiler, heater, or vessel by an independent duct, with or without the employment of power ventilators or fans, the duct shall be sized and installed in accordance with the manufacturer's recommendations;
  - (3) Unobstructed air openings shall be sized based on the manufacturer's recommendations, or as specified by the National Fire Protection Association (NFPA) standards for oil and gas burning installations for the



particular job conditions, or 1 square inch free area per 2000 Btu/hr maximum fuel input of the combined burners located in the equipment room. The equipment room supply openings shall be kept clear at all times;

- (4) Power ventilators or fans shall be sized on the basis of 0.2 cfm for each 1000 Btu/hr of maximum fuel input for the combined burners of all boilers and heaters located in the equipment room. Additional capacity may be required for other fuel burning equipment in the equipment room;
- (5) When power ventilators or fans are used to supply combustion air, they shall be installed with interlock devices so that burners will not operate without an adequate number of ventilators or fans in operation;
- (6) The size of openings specified in subsection (c) may be reduced when special engineered air supply systems approved by the jurisdiction are used; and
- (7) Care shall be taken to ensure that steam, water, and fluid lines are not routed across combustion air openings, where freezing may occur.

(g) Lighting. The equipment room shall be well lit and have an emergency light source for use in case of power failure.

(h) Chimneys or stacks shall be installed in accordance with jurisdictional, environmental requirements, manufacturer's recommendations, and industry standards, as applicable.

(i) Ash removal systems shall be installed in accordance with jurisdictional, environmental requirements, manufacturer's recommendations, and industry standards, as applicable.

(j) Water (cleaning). A convenient water supply shall be provided for flushing out the boiler and its appurtenances, adding water to the boiler while it is not under pressure, and cleaning the equipment room floor. [Eff and comp **DEC 21 2019** ] (Auth: HRS §397-4) (Imp: HRS §397-4)

**§12-222.1-12 Operating requirements. (a)**

Feedwater volume. The source of feedwater shall be capable of supplying a sufficient volume of water as determined by the boiler manufacturer to prevent damage to the boiler when all the safety relief valves are discharging at full capacity.

(b) Feedwater connection. The following shall apply to feedwater connection:

- (1) To prevent thermal shock, feedwater shall be introduced into a boiler in such a manner that the water will not be discharged directly against surfaces exposed to high temperature gases or to direct radiation from the flame;
- (2) For boiler operating pressures of 400 psig or higher, the feedwater inlet through the drum shall be fitted with shields, sleeves, or other suitable means to reduce the effects of temperature differentials in the shell or head;
- (3) Feedwater other than condensate return shall not be introduced through the blowoff;
- (4) Boilers having more than 500 square feet of water heating surface shall have at least two means of supplying feedwater. For boilers that are fired with solid fuel not in suspension, and boilers whose setting or heat source can continue to supply sufficient heat to cause damage to the boiler if the feedwater supply is interrupted, one such means of supplying feedwater shall not be subject to the same interruption as the first method. Boilers fired by gaseous, liquid, or solid fuel in suspension may be equipped with a single means of supplying feedwater, provided means are furnished for the immediate removal of heat input if the supply of feedwater is interrupted;
- (5) For boilers having a water heating surface of not more than 100 square feet, the feedwater piping and connection to the boiler shall not be smaller than NPS 1/2. For boilers having a

- water heating surface more than 100 square feet, the feedwater piping and connection to the boiler shall not be less than NPS 3/4;
- (6) Electric boiler feedwater connections shall not be smaller than NPS 1/2; and
  - (7) High-temperature water boilers shall be provided with means of adding water to the boiler or system while under pressure.
- (c) Pumps. The following shall apply to pumps:
- (1) Boiler feedwater pumps shall have discharge pressure more than the highest set pressure relief valve to compensate for frictional losses, entrance losses, regulating valve losses, and normal static head, etc. Each source of feedwater shall be capable of supplying feedwater to the boiler at a minimum pressure of three per cent (3%) higher than the highest setting of any pressure relief valve on the boiler proper. Detailed engineering evaluation of the pump selection shall be performed and available for review. Table 2.5.1.3 is a guideline for estimating feedwater pump differential;

**TABLE 2.5.1.3**

**GUIDE FOR FEEDWATER PUMP DIFFERENTIAL**

Boiler Pressure		Boiler Feedwater Pump Discharge Pressure	
psig	(MPa)	psig	(MPa)
200	(1.38)	250	(1.72)
400	(2.76)	475	(3.28)
800	(5.52)	925	(6.38)
1,200	(8.27)	1,350	(9.31)

- (2) For forced-flow steam generators with no fixed steam or water line, each source of feedwater shall be capable of supplying feedwater to the boiler at a minimum pressure equal to the expected maximum sustained

pressure at the boiler inlet corresponding to operation at maximum designed steaming capacity with maximum allowable pressure at the superheater outlet; and

- (3) Control devices may be installed on feedwater piping to protect the pump against overpressure.

(d) Feedwater valves. The following shall apply to feedwater valves:

- (1) The feedwater piping shall be provided with a check valve and a stop valve. The stop valve shall be located between the check valve and the boiler;
- (2) When two or more boilers are fed from a common source, there shall also be a globe or regulating valve on the branch to each boiler located between the check valve and the feedwater source;
- (3) When the feedwater piping is divided into branch connections and all such connections are equipped with stop and check valves, the stop and check valve in the common source may be omitted;
- (4) On single boiler-turbine unit installations, the boiler feedwater stop valve may be located upstream from the boiler feedwater check valve;
- (5) If a boiler is equipped with duplicate feedwater supply arrangements, each such arrangement shall be equipped as required by these rules;
- (6) A check valve shall not be a substitute for a stop valve;
- (7) A combination feedwater stop-and-check valve in which there is only one seat and disk and a valve stem is provided to close the valve when the stem is screwed down shall be considered only as a stop valve; a separate check valve shall also be installed;
- (8) Whenever globe valves are used on feedwater piping, the inlet shall be under the disk of the valve;



- (9) Stop valves and check valves shall be placed on the inlet of economizers or feedwater-heating devices; and
  - (10) The recirculating return line for a high-temperature water boiler shall be provided with the stop valve, or valves, required for the main discharge outlet on the boiler.
- (e) Electrical. A disconnecting means capable of being locked in the open position shall be installed at an accessible location at the boiler so that the boiler can be disconnected from all sources of potential. This disconnecting means shall be an integral part of the boiler or adjacent to it.
- (f) Wiring. All wiring for controls, heat generating apparatus, and other appurtenances necessary for the operation of the boiler or boilers should be installed in accordance with the provisions of national or international standards and comply with the applicable local electrical codes.
- (g) Remote emergency shutdown switches. The following shall apply to remote emergency shutdown switches:
- (1) A manually operated remote shutdown switch or circuit breaker shall be located just outside the equipment room door and marked for easy identification. Consideration should also be given to the type and location of the switch to safeguard against tampering. Where approved by the jurisdiction, alternate locations of remote emergency switches may be provided;
  - (2) For equipment rooms exceeding 500 square feet floor area, or containing one or more boilers having a combined fuel capacity of 1,000,000 Btu/hr or more, additional manually operated remote emergency shutdown switches shall be located at suitably identified points of egress acceptable to the jurisdiction;
  - (3) Where a boiler is located indoors in a facility and not in an equipment room, a remote emergency shutdown switch shall be located within fifty (50) feet of the boiler

- along the primary egress route from the boiler area;
- (4) For atmospheric-gas burners and for oil burners where a fan is on the common shaft with the oil pump, the emergency remote shutdown switches or circuit breakers must disconnect all power to the burner controls; and
  - (5) For power burners with detached auxiliaries, the emergency remote shutdown switches or circuit breakers need only shut off the fuel input to the burner. [Eff and comp **DEC 21 2019** ] (Auth: HRS §397-4) (Imp: HRS §397-4)

**§12-222.1-13 Controls and heat-generating apparatus.** (a) Oil and gas-fired and electrically heated boilers shall be equipped with suitable primary (flame safe-guard) safety controls, safety limit switches and controls, and burners or electric elements as required by a nationally or internationally recognized standard.

(b) The symbol of the certifying organization that has approved such equipment as having complied with a nationally recognized standard shall be affixed to the equipment and shall be considered as evidence that the unit was manufactured in accordance with that standard.

(c) These devices shall be installed in accordance with departmental, environmental requirements, manufacturer's recommendations, and industry standards, as applicable. [Eff and comp **DEC 21 2019** ] (Auth: HRS §397-4) (Imp: HRS §397-4)

**§12-222.1-14 Emergency valves and controls.** All emergency shut-off valves and controls shall be accessible from a floor, platform, walkway, or runway.

Accessibility shall mean within a six (6) foot elevation of the standing space and not more than twelve (12) inches horizontally from the standing space edge. [Eff and comp **DEC 21 2019** ] (Auth: HRS §397-4) (Imp: HRS §397-4)

**§12-222.1-15 Preventive maintenance.** The owner or user of the pressure retaining item is responsible for ensuring that all equipment is maintained as listed in Exhibits 1, 2 and 4 of this section. [Eff and comp **DEC 21 2019** ] (Auth: HRS §397-4) (Imp: HRS §397-4)

## RECOMMENDED PREVENTIVE MAINTENANCE SCHEDULE

(Operation and maintenance instructions in this safety standard are intended for general applications. For specific operating and maintenance instructions, consult the equipment manufacturer.)

### D-1 DAILY

- (a) Check gages, monitors, and indicators.
- (b) Check instrument and equipment settings.
- (c) For high-pressure boilers, test low-water fuel cut-off device and alarm.
- (d) Check burner flame.

### D-2 WEEKLY

- (a) For low-pressure boilers, test low-water fuel cut-off device and alarm.
- (b) Check igniter.
- (c) Check flame signal strength.
- (d) Check flame failure detection system.
- (e) Check firing rate control.
- (f) Make aural and visual check of pilot and main fuel valves.

### D-3 MONTHLY

- (a) Check flue, vent, stack, or outlet dampers.
- (b) Test low draft, fan air pressure, and damper position interlocks.
- (c) Check low-fire start interlock.
- (d) Test high and low oil pressure and temperature interlocks.
- (e) Test high and low gas pressure interlocks.

### D-4 SEMI-ANNUALLY

- (a) Recalibrate all indicating and recording gages.
- (b) For steam boilers, perform a slow drain test of the low-water fuel cut-off device.
- (c) Check flame failure detection system components.
- (d) Check firing rate control.
- (e) Check piping and wiring of all interlocks and shut-off valves.
- (f) Inspect burner components.

### D-5 ANNUALLY

- (a) Flame failure detection system, pilot turndown test.

- (b) Flame failure detection system, test for hot refractory hold in.
- (c) Check dual fuel change over control.
- (d) Test high-limit and operating temperature or steam pressure controls.
- (e) Replace vacuum tubes, scanners, or flame rods in accordance with manufacturer's instructions.
- (f) Conduct a combustion test.
- (g) Check all coils and diaphragms; test other operating parts of all safety shutoff and control valves.
- (h) Test fuel valve interlock switch in accordance with manufacturer's instructions.
- (i) Perform leakage test on pilot and main gas and/or oil fuel valves.
- (j) Test purge air switch in accordance with manufacturer's instructions.
- (k) Test air/steam interlock in accordance with manufacturer's instructions.
- (l) Test burner position interlock in accordance with manufacturer's instructions.
- (m) Test rotary cup interlock in accordance with manufacturer's instructions.
- (n) Test low-fire start interlock in accordance with manufacturer's instructions.

### D-6 AS REQUIRED

- (a) Recondition or replace low-water fuel cut-off device.
- (b) For oil-fired burners, clean atomizers and oil strainers.
- (c) For gas-fired burners, check sediment trap and gas strainers.
- (d) Flame failure detection system, pilot turndown test.
- (e) Flame failure detection system, test for hot refractory hold in.
- (f) Test safety/safety relief valves in accordance with ASME Boiler and Pressure Vessel Code, Sections VI and VII.



## EXHIBIT 2 September 1, 2019

**Table D-1 Periodic Testing Recommended Checklist (See Manufacturer's Instructions)**

Frequency [Note (1)]						Component/Item	Recommended Test	Accomplished By	
D	W	M	S/A	A	A/R			Boiler Operator	Service Technician
X	...	...	...	...	...	Gages, monitors, and indicators	Make visual inspection and record readings in boiler log.	X	...
...	...	...	X	...	...	Gages, monitors, and indicators	Recalibrate all indicating and recording gages.	...	X
X	...	...	...	...	...	Instrument and equipment settings	Make visual check against factory-recommended specifications.	X	...
X	...	...	...	...	...	Low-water fuel cut-off device (high-pressure boilers)	Test low-water fuel cut-off device according to manufacturer's instructions.	X	...
...	X	...	...	...	...	Low-water fuel cut-off device (low-pressure boilers)	Test low-water fuel cut-off device according to manufacturer's instructions.	X	...
...	...	...	X	...	...	Low-water fuel cut-off device (steam boilers)	For steam boilers, perform a slow drain test in accordance with ASME Boiler and Pressure Vessel Code, Section VI.	...	X
...	...	...	...	...	X	Low-water fuel cut-off device	Recondition or replace low-water fuel cut-off device.	...	X
...	...	...	...	X	...	Operating and/or limit controls	Test high-limit and operating temperature or steam pressure controls.	...	X
...	...	...	...	...	X	Safety/safety relief valves	Test safety/safety relief valves in accordance with ASME Boiler and Pressure Vessel Code, Sections VI and VII.	...	X
...	...	X	...	...	...	Flue, vent, stack, or outlet dampers	Make visual inspection of linkage, and check for proper operation.	X	...
X	...	...	...	...	...	Burner flame	Make visual inspection of burner flame [Note (2)].	X	...
...	X	...	...	...	...	Igniter	Make visual inspection, and check flame signal strength if meter-fitted.	X	...
...	X	...	...	...	...	Flame signal strength	If flame signal meter is installed, read and log. For both pilot and main flames, notify service organization if readings are very high, very low, or fluctuating (refer to manufacturer's instructions).	X	...
...	X	...	...	...	...	Flame failure detection system	Close manual fuel supply for (1) pilot, (2) main fuel cock, and/or (3) valve(s). Check safety shutdown timing, and log.	X	...

**Table D-1 Periodic Testing Recommended Checklist (Cont'd)**

Frequency [Note (1)]						Component/Item	Recommended Test	Accomplished By	
D	W	M	S/A	A	A/R			Boiler Operator	Service Technician
...	...	...	X	...	...	Flame failure detection system	Check flame failure detection system components, such as vacuum tubes, amplifier, and relays.	...	X
...	...	...	...	X	...	Flame failure detection system	Replace vacuum tubes, scanners, or flame rods in accordance with manufacturer's instructions.	...	X
...	...	...	...	X	X	Flame failure detection system (pilot shutdown test)	Conduct pilot shutdown test according to manufacturer's instructions. This test is required annually and after any adjustments to flame scanner mount or pilot burner.	...	X
...	...	...	...	X	X	Flame failure detection system (hot refractory hold in test)	Test for hot refractory hold in. This test is required annually and after any adjustments to the flame scanner mount or pilot burner.	...	X
...	X	...	...	...	...	Firing rate control	Check firing rate control, and verify factory settings (refer to manufacturer's instructions).	X	...
...	...	...	X	...	...	Firing rate control	Check firing rate control, and verify factory settings (refer to manufacturer's instructions).	...	X
...	...	...	...	X	...	Firing rate control	Conduct a combustion test, and verify settings are in accordance with manufacturer's instructions.	...	X
...	X	...	...	...	...	Pilot and/or main fuel valves	Open limit switch, and make aural and visual check. Check valve position indicators, and check fuel meters if so fitted.	X	...
...	...	...	...	X	...	Pilot and/or main fuel valves	Check all coils and diaphragms. Test other operating parts of all safety shutoff and control valves.	...	X
...	...	...	...	X	...	Pilot and/or main fuel valves	Test fuel valve interlock switch in accordance with manufacturer's instructions.	...	X
...	...	...	...	X	...	Pilot and/or main fuel valves	Perform leakage test on pilot and main gas and/or oil fuel valves, in accordance with manufacturer's instructions.	...	X
...	...	X	...	...	...	Low draft, fan, air pressure, and damper position interlocks	Test low draft, fan, air pressure, and damper position interlocks according to manufacturer's instructions.	X	...
...	...	...	...	X	...	Low draft, fan, air pressure, and damper position interlocks	Test purge switch in accordance with manufacturer's instructions.	...	X

## EXHIBIT 2 Continued

**Table D-1 Periodic Testing Recommended Checklist (Cont'd)**

Frequency [Note (1)]						Component/Item	Recommended Test	Accomplished By	
D	W	M	S/A	A	A/R			Boiler Operator	Service Technician
...	...	X	...	...	...	Low-fire start interlock	Check low-fire start interlock according to manufacturer's instructions.	X	...
...	...	...	...	X	...	Low-fire start interlock	Test low-fire start interlock in accordance with manufacturer's instructions.	...	X
...	...	X	...	...	...	Oil pressure and temperature interlocks	Test high and low oil pressure and temperature interlocks according to manufacturer's instructions.	X	...
...	...	X	...	...	...	Gas pressure interlocks	Test high and low gas pressure interlocks according to manufacturer's instructions.	X	...
...	...	...	X	...	...	Interlocks and valves	Check piping and wiring of all interlocks, and shutoff valves.	...	X
...	...	...	...	X	...	Atomizing air/steam interlock	Test air/steam interlock in accordance with manufacturer's instructions.	...	X
...	...	...	...	X	...	Burner position interlock	Test burner position interlock in accordance with manufacturer's instructions.	...	X
...	...	...	...	X	...	Rotary cup burner interlock	Test rotary cup interlock in accordance with manufacturer's instructions.	...	X
...	...	...	X	...	...	Burner components	Inspect burner components according to manufacturer's instructions.	...	X
...	...	...	...	X	X	Burner components	Check dual fuel change over control. If automatically controlled by gas utility, perform test under the supervision of gas utility.	...	X
...	...	...	...	...	X	Burner components	For oil-fired burners, clean atomizers and oil strainers.	...	X
...	...	...	...	...	X	Burner components	For gas-fired burners, check sediment trap and gas strainer.	...	X

**NOTES:**

(1) D, daily; W, weekly; M, monthly; S/A, semi-annually; A, annually; A/R, as-required.

(2) Caution should be used when viewing burner flame. Personal protective equipment, such as filtered eyewear, may be necessary.

# EXHIBIT 3 September 1, 2019

## BOILER INSTALLATION REPORT I-1

INSTALLATION: <sup>(1)</sup> ☐ New ☐ Reinstalled ☐ Second Hand Date \_\_\_\_/\_\_\_\_/\_\_\_\_

<sup>(2)</sup> INSTALLER	<sup>(3)</sup> OWNER-USER	<sup>(4)</sup> OBJECT LOCATION
Name	Name	Name
Street	Street, PO Box, RR	Street
City, State, ZIP	City, State, ZIP	City, State, ZIP

Jurisdiction No. <sup>(5)</sup>	National Board No. <sup>(6)</sup>	Manufacturer <sup>(7)</sup>	Mfg. Serial No. <sup>(8)</sup>	Year Built <sup>(9)</sup>	Boiler Type <sup>(10)</sup>	Boiler Use <sup>(11)</sup>
Fuel <sup>(12)</sup>	Method of Firing <sup>(13)</sup>	Btu/kw input <sup>(14)</sup>	Btu/kw output <sup>(15)</sup>	Operating PSI <sup>(16)</sup>	Code Stamp(s) <sup>(17)</sup>	<input type="checkbox"/> A <input type="checkbox"/> S <input type="checkbox"/> U <input type="checkbox"/> HLW <input type="checkbox"/> M <input type="checkbox"/> E <input type="checkbox"/> H <input type="checkbox"/> Other
Stamped MAWP <sup>(18)</sup>	Heating Surface, Sq. Ft. <sup>(19)</sup>	Cast Iron <sup>(20)</sup>	Manhole <sup>(21)</sup>	Specific On-Site Location, i.e., Utility Room <sup>(22)</sup>		
Pressure Relief Valve Size <sup>(23)</sup>	Pressure Relief Valve Set Pressure <sup>(24)</sup>	Pressure Relief Valve Capacity <input type="checkbox"/> BTU/hr <input type="checkbox"/> Lb/hr <sup>(25)</sup>	Manufacturer <sup>(26)</sup>	Low-Water Fuel Cutoff Mfg. No. <sup>(27)</sup>		
1. _____ 2. _____ 3. _____ 4. _____	1. _____ 2. _____ 3. _____ 4. _____	1. _____ 2. _____ 3. _____ 4. _____	1. _____ 2. _____ 3. _____ 4. _____	Probe Type _____ Flow Switch _____ Float & Chamber _____ Other (Specify) _____		

PRESSURE/ALTITUDE GAGE: <sup>(28)</sup> Dial Graduation _____ Valve/Cock Size _____ MAWP _____ Pipe Connection Size _____ Siphon or Equivalent Device <input type="checkbox"/> Yes <input type="checkbox"/> No	EXPANSION TANK: <sup>(29)</sup> ASME Constructed <input type="checkbox"/> Yes <input type="checkbox"/> No Other _____ MAWP _____ No. Gallons _____	VENTILATION AND COMBUSTION AIR <sup>(30)</sup> Unobstructed Opening (sq. in.) _____ Power Ventilator Fan (CFM) _____
WATER LEVEL INDICATORS: <sup>(31)</sup> Number of Gage Glasses _____ Number of Remote Indicators _____ Size of Connection Piping _____	FEEDWATER SUPPLY: <sup>(32)</sup> Number of Feeding Means _____ Pipe Size _____ Stop Valve Size _____ MAWP _____ Check Valve Size _____ MAWP _____	
STOP VALVES: <sup>(33)</sup> Number of Valves _____ Valve Size _____	EXTERNAL PIPING ASME CODE: <sup>(40)</sup> <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Other _____	FUEL TRAIN: <sup>(34)</sup> <input type="checkbox"/> CSD-1 <input type="checkbox"/> NFPA-85 <input type="checkbox"/> Other _____
BOTTOM BLOWDOWN CONNECTIONS: <sup>(39)</sup> Number of Valves _____ Valve Size _____ MAWP _____ Piping Run Full Size <input type="checkbox"/> Yes <input type="checkbox"/> No	POTABLE WATER HEATER UNIQUE REQUIREMENTS <input type="checkbox"/> Yes <input type="checkbox"/> No Inlet Stop Valve Size _____ MAWP _____ Outlet Stop Valve Size _____ MAWP _____ Drain Valve Size _____ Thermometer <input type="checkbox"/> Yes	
Manufacturer's Certification Attached: <input type="checkbox"/> Yes <input type="checkbox"/> No <sup>(35)</sup> Does boiler replace existing one: <input type="checkbox"/> Yes <input type="checkbox"/> No <sup>(36)</sup>	Clearance from walls and floors: <sup>(36)</sup> Side _____ Bottom _____ Top _____	

Additional recommendations and remarks by installer:  <sup>(37)</sup>	
<sup>(38)</sup> Installer Name (PRINT) _____ Registration # _____	I HEREBY CERTIFY THAT THE INSTALLATION COMPLIES WITH APPENDIX I  <sup>(38)</sup> Installer Signature _____

This form may be obtained from The National Board of Boiler and Pressure Vessel Inspectors, 1055 Crupper Ave., Columbus, OH 43229

NB-365 Rev. 2

## EXHIBIT 4 September 1, 2019

### 8.1 Unattended Power Boiler Log

**UNATTENDED POWER BOILER LOG**

gW. No.	Year	Month	Company	Day	5am	6am	7am	8am	9am	10am	11am	Noon	1pm	2pm	3pm	4pm	5pm	Remarks (including date & time)
Ex-ample					1	3	√5	√	√	√	√	√	√	√2	√	√	√54	
1																		
2																		
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**C O D E**

1 Normal Operating Check (boiler in service)	3 Added Chemicals
2 Started Boiler & Tested Low Water Control	4 Blow-down
Tested LWC (required every 12 hours when the boiler is in service) Test with the Burner On, Test Must Extinguish Burner and Ring Low Water Alarm	5 Tested Safety Valve (first working day of the month hand raise spindle)
	6 Stepped Boiler

NOTE: The completed log must be available to the boiler inspector for at least six (6) months.

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