

SAFETY RELIEF VALVES FOR HOT WATER HEATING BOILERS

1. GENERAL

1.01 This section suggests recommendations for the selecting of spring loaded safety relief valves for installation on hot water heating boilers. The function of these valves is to prevent an overpressure condition from existing in the boiler shell. This section also lists some recommendations for the type, size, capacity, inspection, installation, testing and manufacturers of relief valves.

1.02 This section is revised and reissued to bring attention to some new concepts on relief valves and outline, in general, some test procedures for hot water heating boilers. Arrows are not used because of the extensive change in the text.

1.03 In addition to this section the following P.E.L. and its supplements have a direct bearing on the selection and installation of relief valves for hot water heating boilers:

P.E.L. 7129 — Safety and Relief Valves for Low Pressure Heating Boilers.

1.04 This section applies to new and existing installations. All new valves shall be selected from the approved list of manufacturers and model numbers which is attached to P.E.L. 7129 and its supplements. All existing valves shall be replaced unless they meet the following requirements:

(1) They are stamped with the A.S.M.E. cloverleaf and have their ratings certified by the National Board of Boiler and Pressure Vessel Inspectors.

(2) Demonstrate their relieving capacity by testing in accordance with 7.03 of this section.

1.05 The following definitions apply to the terms used in this section:

A.S.M.E.: American Society of Mechanical Engineers. United Engineering Center, 345 East Forty-Seventh Street, New York, N. Y. 10017.

The Code: A.S.M.E. Boiler and Pressure Vessel Code, Section IV, Rules for Construction of Heating Boilers.

Safety Relief Valve: An automatic pressure relieving device actuated by pressure upstream of the valve and characterized by opening pop action with further increase in lift with an increase in pressure over popping pressure.

Set Pressure: That pressure at which the valve is factory set to open normally at or below the maximum allowable working pressure of the boiler.

Set Pressure Tolerances: The allowable range, above or below the set pressure, at which the valve may open.

Relieving Pressure: That pressure at which the valve's relieving capacity is determined.

Closing Pressure: That pressure at which the valve closes, normally 20-30% below set pressure. Section IV SRVs have no blowdown (closing pressure) requirements.

Maximum Allowable Working Pressure: The maximum pressure at which the heating boiler may be operated. For hot water heating boilers, it is the range from 30-160 psig.

1.06 Where local and/or state codes, rules, and regulations call for other or higher requirements than these indicated or implied in this section, such authority takes precedence and its requirements are lower than these in this section, compliance with the provisions of this section is recommended.

2. RECOMMENDED TYPE

2.01 Each hot water heating boiler shall have at least one officially rated safety relief valve set to relieve at or below the maximum allowable working pressure of the boiler. Relief valves are to be of the spring loaded pop type; without disc guides on the pressure side of the valve, factory set and sealed with visual seal or nonadjustable setting; side outlet; disc, seat and stem constructed of corrosion resistant

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material; stainless steel or cadmium plated spring, top guided; with drain hole in body below level of disc; rated by the National Board of Boiler and Pressure Vessel Inspectors and marked in accordance with the Code. When more than one safety relief valve is used, the additional valve(s) shall be officially rated and may be set within a range not to exceed 6 psi above the maximum allowable working pressure of the boiler up to and including 60 psig and 10 percent for those having a maximum allowable working pressure exceeding 60 psig.

2.02 Relief valves shall be so arranged that they cannot be reset to relieve at a higher pressure than the maximum permitted by 2.01.

2.03 Each safety relief valve shall have a substantial device which will positively lift the disc from its seat at least 1/16 in. when there is no pressure on the boiler.

2.04 Seats and discs of safety relief valves shall be of material suitable to resist corrosion. No materials liable to fail due to deterioration or vulcanization when subject to saturated steam temperatures corresponding to capacity test pressure shall be used for any part.

3. CAPACITY

3.01 The relieving capacity of the safety relief valve(s) shall be certified by the National Board of Boiler and Pressure Vessel Inspectors and shall conform to the A.S.M.E. Code which states:

3.02 The minimum size of valve or valves shall be governed by the capacity marking on the boiler called for in HG-400.2 of the Code, or,

3.03 The minimum valve capacity in pounds per hour shall be determined by dividing the maximum btu output at the boiler nozzle obtained by the firing of any fuel for which the unit is designed by 1000, or, in the case of steel boilers, by multiplying the square feet of heating surface by 5. In many cases a greater relieving capacity of valves will have to be provided than the minimum specified by these rules. In every case the following requirements shall be met:

3.04 The safety relief valve capacity for each boiler shall be such that with the fuel burning equipment installed and operated at

maximum capacity, the pressure cannot rise more than 6 psi above the maximum allowable working pressure for pressures up to and including 60 psig and 10 percent for maximum allowable working pressure above 60 psig.

3.05 When operating conditions are changed or additional boiler heating surface is installed, the valve capacity shall be increased, if necessary, to meet the new conditions and be in accordance with 3.04.

4. MINIMUM AND MAXIMUM INLET SIZE

4.01 Size of safety relief valves is determined by inlet pipe size. The discharge opening may be one or two pipe sizes larger. Sizes of safety relief valves shall be the minimum allowable by the Code, presently 3/4 in., to a maximum of 4 in. IPS (Iron Pipe Size).

4.02 Where the capacity requirements exceed the relieving capacity of all approved 4 in. valves, two or more shall be installed to provide the required capacity. It is suggested that they be of the same manufacture and they shall all be mounted on the boiler shell. A manifolded arrangement of two or more safety relief valves will be acceptable if the manifold provides an unrestricted inlet area of adequate size so that the capacity of the valves is not reduced.

5. MARKINGS

5.01 Each standard relief valve is plainly labeled with the manufacturer's name or registered trade-mark, the letters "A.S.M.E. Standard," and with the pressure in pounds per square inch at which it is set to blow, and the capacity in lb/hr or btu/hr. *Lb/hr refers to pounds of steam per hour.* These data are usually stamped or cast on a plate securely attached to the casing so as not to be obliterated in normal service.

6. INSTALLATION

6.01 Installation shall conform to HG-701 of the A.S.M.E. Code, Section IV.

6.02 No shutoff of any description shall be placed between the safety relief valve and the boiler. Safety relief valves shall not be connected to an internal pipe in the boiler.

6.03 The valve or valves shall be installed on the boiler shell wherever possible. Screw-end valves shall be mounted on a pipe flange to reduce the possibility of damaging the valve during installation. The valve should be bench mounted to its flange and the other half of the flange attached to the boiler with a nipple. A wrench shall not be applied to the valve body nor shall any lever be inserted in the valve outlet. A minimum amount of pipe threading compound shall be used on threaded valves and then only on the male threads.

6.04 Valve bodies or markings shall not be painted.

6.05 Valve shall not be used as a pipe support.

6.06 Discharge piping shall be run full size from the safety relief valve discharge to the floor or near a funnel drain. This piping shall be adequately supported or fixed so that there will be no stress on the valve, and it shall be terminated so that any discharge from the valve can be seen. If, during a capacity test of the valve, temporary piping is connected to the valve in order to vent the steam outside the building, it shall be removed after the test and the valve discharge piped as above. This temporary piping shall be sized at least as large as the discharge of the valve. If more than 20 feet of temporary piping is to be used, it shall be increased at least one pipe size.

6.07 All safety relief valves shall have a chain attached to their lifting levers so that testing in this manner can be performed from a safe and convenient location.

6.08 Safety relief valves are to be installed on boilers by steamfitters or telephone company building mechanics qualified to do so.

7. TESTS

7.01 Periodic tests of all boiler plants are required to maintain them in good working condition and to assure complete safety. Safety precautions should be exercised at all times to protect both personnel making the test and other occupants of the building. Suggested frequencies for tests and inspections along with needed tools are outlined in detail in Section 770-210-301, Issue 2, Low Pressure Hot Water Heating Boilers.

7.02 The safety relief valve (or valves) is the final line of protection against overpressure and is the most important single safety device on any boiler. In testing safety relief valves, care must be exercised to protect personnel from escaping steam.

7.03 As a precautionary measure, all personnel concerned with conducting a pop or capacity test should be briefed in the location of all shutdown controls in the event of an emergency. The following tests shall be performed on safety relief valves:

(a) **Try Lever Test:** Every 30 days that the boiler is in operation or after any period of inactivity, a try lever test shall be performed as follows: Lift the try lever to the open position with the chain and hold it open for about 5 seconds. Release the chain and allow the spring to snap the disc to the closed position. If the valve leaks, operate the try lever two or three times to allow the disc to seat properly. If the valve continues to leak, it must be replaced. **Do not attempt to adjust the spring setting or disassemble the valve.**

(b) **Pop (Pressure Relief) Test:**

(1) A Pop (Pressure Relief) Test shall be performed once annually.

(2) Establish necessary general trial conditions at particular location. Review preparation for test with personnel involved.

(3) Calibrated test gauges should be temporarily installed to check accuracy of the boiler pressure gauge and thermometer during the test.

(4) Isolate the boiler from the supply and return piping to expedite the test. Do not isolate the boiler from the expansion tank so that pop action of the valve may be obtained. Drain the expansion tank before the test to make sure that there is an adequate air cushion.

(5) Temporarily place test leads across the appropriate terminals on the operating control to demonstrate the ability of the high temperature cutout to function properly. After this has been checked, place test leads across the high temperature control

terminals also to permit continuous operation of the burner.

Note: If the boiler is limited to 30 psig maximum working pressure and has been provided with a high limit temperature cut-out with a range up to 290°F, it will not be necessary to use test leads on this device. It can be left in the circuit by setting it temporarily at its highest temperature.

(6) Observe that the safety relief valve operates satisfactorily when the maximum design working pressure of the boiler is reached, ie, the set pressure of the relief valve ± 2 psi for set pressures up to 70 psig and $\pm 3\%$ of the set pressure for pressures above 70 psig. The valve should open within this range and discharge a mixture of water and vapor.

(7) If the valve does not open at the set pressure marked on the valve or the allowable range stated in 7.03(b)(6), immediately shut off the burner and make boiler inoperative until a new valve is installed and tested as provided herein.

(8) If the valve does operate satisfactorily, remove the test leads from the high limit control and allow it to cycle once to determine that it is functioning properly.

(9) Next, remove the test lead from the operating control to allow it to cycle the boiler to assure proper operation.

(10) In the event the burner continues to fire after the test leads are removed, shut off the main fuel valve and open the main electrical disconnect switch. Check the entire control system. Locate and correct trouble before attempting to operate the burner.

(c) **Capacity Test:** Capacity test must be performed on relief valves on all new boiler installations or on existing boilers when any modification that affects the water heating capacity of the boiler, such as: changing the size of the burner, changing the rate of fuel flow to the burner, or changing to a grade or type of fuel not previously fired. **A capacity test should also be made after replacing a relief valve.** All such tests shall be made in the presence of a Telephone Company representative and/or the Architect's superintendent or

the Consulting Engineer with results recorded and submitted to the owner. Hydrostatic testing is not to be considered as an acceptable test to check set pressure or capacity of a safety relief valve.

(1) Establish necessary general trial conditions at particular location, review preparation for test with personnel involved.

(2) If possible, calibrated test gauges should be temporarily installed to check accuracy of the boiler pressure gauge and the thermometer during the test.

(3) Set burner to operate at its maximum capacity if it has not already been done. Make sure that combustion is complete with proper overfire draft, cutting back on fuel supply, if necessary, to accomplish this.

(4) Isolate the boiler from the rest of the system (supply and return piping and the expansion tank) making sure, however, that the water feeder at city pressure can feed water to the boiler if it is necessary to do so during the test.

(5) Temporarily place test leads across the appropriate terminals on the operating control to demonstrate the ability of the high temperature cutout to function properly. After this has been done, place test leads across high limit terminals also to permit continuous operation of the burner.

Note: If the boiler is limited to 30 psig maximum working pressure and has been provided with a high limit temperature cut-out with a range up to 290°F, it will not be necessary to use test leads on this device. It can be left in the circuit by setting it temporarily at its maximum temperature. The relief valve discharging at capacity should prevent the boiler water temperature from rising above 282°F. If this cutout does operate to shut off the burner, it is a good indication that the safety relief valve is allowing the boiler pressure to exceed that called for in the Code.

(6) Observe that the safety relief valve opens at the proper pressure, ie, ± 2 psi of the set pressure for set pressures up to 70 psi and $\pm 3\%$ of the set pressure for set pressures above 70 psi.

(7) If valve does not operate within its set pressure tolerances, immediately shut off burner and make the boiler inoperative until a new valve is installed and tested as provided herein.

(8) If valve opens at proper set pressure, keep burner running until maximum pressure is reached and then hold it for one to two minutes. Maximum pressure rise should not exceed 6 psi of the maximum allowable working pressure of the boiler for pressures up to and including 60 psi and 10 percent of the maximum allowable working pressure for pressures above 60 psi.

(9) If test conditions in (6) and (8) are met satisfactorily, turn off fuel supply and observe pressure gauge to see that closing pressure is approximately 20-30% below the set pressure. This will vary because of different disc and seat design.

(10) After confirmation of capacity, the energy stored in the boiler should be dissipated. This can be done in the following manner:

- a. Shut off automatic water feeders.
 - b. Actuate try lever of safety relief valve until boiler pressure approximates normal operating pressure.
 - c. Slowly open supply (leader) valve.
 - d. Slowly open return valve.
 - e. Start circulating pump.
 - f. Open line to expansion tank.
 - g. Open automatic water feeders.
- (11) Remove the test lead from the high limit control and allow it to cycle once to determine that it is functioning properly.
- (12) Next, remove the test lead from the operating control and allow it to cycle the boiler to assume proper operation.
- (13) Suitable arrangements should be provided to dissipate the steam created by this test.