



Pressure Relief Devices for Feedwater Heaters

The ASME Code (and other design codes) requires that pressure vessels and heat exchangers have provisions for over-pressure protection. For ASME Section VIII Div. 1 vessels, as per Para. UG-125(a)(3), it is the responsibility of the user or his/her designated agent to size and select the pressure relief device(s) based on its intended service.

HEI Standards for Closed Feedwater Heaters provide suggestions for determining the size of pressure relief valves for feedwater heaters. Feedwater heaters typically use spring loaded pressure relief valves and pressure safety valves for this over-pressure protection. The required design information for sizing the relief valve can be found on the Closed Feedwater Heater Specification Sheet.

Once the sizing parameters are determined, the design relieving capacity for a shell side relief valve can be established based on the broken tube rule or the 10% rule per HEI Standards for Closed Feedwater Heaters. The sizing calculations for the valve determine the required minimum area of the valve orifice to pass the larger of the calculated flows. Then determine any back-pressure considerations in the system and account for this back pressure when sizing the relief valve. Back pressure is the pressure on the outlet side of the relief valve. Without proper consideration, back pressure may adversely affect the valve by changing set or closing pressure, decreasing discharge capacity, or creating dynamic instability. The sizing calculations for the valve determine the required minimum area of the valve orifice to pass the larger of the calculated flows.

The next step is to take the larger calculated flow, enter the orifice capacity charts and valve selection charts provided by safety relief valve manufacturers, and select an appropriate valve for the application.

Blowdown, also known as reseating pressure, is the difference between the actual lifting pressure and actual reseating pressure and results from spring force not being able to counteract inherent forces within the valve. The valve manufacturer will generally adjust the valve to provide consistent opening and closing pressure values.

In conventional relief valves the set point of the valve adds the backpressure into the set-point of the relief valve. Typically, bellows style valves are recommended in situations where the back pressure exceeds 10% of the cold differential set pressure. Bellows style valves also protect the spring, bonnet, and sliding surfaces from the process fluids. In liquid applications, a liquid trim is typically used and can achieve high capacity at 10% over pressure.

A less commonly used valve is a piloted valve where the major relieving valve is combined with, and controlled by, a self-actuated auxiliary valve, or has a diaphragm or piston that actuates when set pressure is reached. A

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piloted valve can be smaller than a conventional valve and it can control minor overpressure situations without fully opening and be designed for 2% blowdown.

The purchaser should also consider what type of connection is preferred, what materials should be used, and whether a lift lever and/or test gag is needed. Typically, in feedwater heaters the shell side relief valve is flanged and the tube side relief valve is a threaded or socket weld connection. Also, the valves should be stamped, tested, and certified in accordance with the appropriate Code of construction, such as ASME Section VIII Division 1.

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