

Safety Valve Design

Simple or mild pop.

SIMPLE type valves can be made to work quite well, if well designed but they are limited in their steam handling capacity. Even when well designed the accumulation will rise rapidly as steam flow increases. As a consequence they often have to be set to lift well below the normal working pressure to prevent the pressure rising above the allowable 10%, on performance boilers.

Spring Selection.

For SIMPLE type valve the spring 'rate' is very important and I would recommend that it should be approx 32 x the seat diameter. i.e. for a 5/32" bore valve the 'rate' should be 5lb / inch and for a 3/16" bore seat 6lb per inch etc. The 'solid' load (the force required to make the spring coil bound) should be 1.5 x the working force (that required to balance the steam pressure at the nominal working pressure). Never use a spring cut from a long length. It is very important that the spring is close wound and that the ends are ground square. Out of square end or cut springs with 'pig tails' ends will bias the ball to one side of its seat when the valve lifts and will make re-seating difficult. Out of square springs will also tilt the guide spindle to one side of the adjuster hole and create un-necessary friction, which will also impair the re-seating process.

For MILD POP design I select a spring having a rate approx 2 to 2.5 x the rate of the SIMPLE design i.e. approx 80 x the seat diameter. This is possible due to the extra lifting force provided by the action of the exhaust steam impinging on the shroud around the ball. The stiffer spring also enables the MILD POP design to be made shorter more in keeping with some of the more modern prototypes.

Adjuster Caps and Vent Holes.

The SIMPLE type valve cannot tolerate a build up within the valve body and to prevent this it requires a vent area approx 1.5 x the seat area. To achieve this I normally drill 6 vent holes $\frac{1}{2}$ the diameter of the valve seat. For MILD POP the vent area can be reduced to approx that of the valve seat, (again due to the added lift provided by the exhaust steam impinging on the shroud). This enables the diameter of the valve body to be reduced slightly which is sometimes desirable.

Reseating Problems

One of the most common problems with safety valves is that they are often very reluctant to re-seat after lifting. My experiments suggest that the most likely causes (as discussed earlier), are either an out of square spring, inadequate clearance between the guide spindle and the adjuster, sharp edges (no chamfer) in the adjuster guide hole, or a rough surface on the guide spindle. It is advisable to smooth out all turning marks on the guide spindle by polishing it along its length with fine emery axially. The above applies to both SIMPLE and MILD POP designs.

Gordon Smith - 4/7/2003

Polly Models / Bruce Engineering are now selling Gordon's designs page 55 of the PDF catalogue
www.pollymodelengineering.co.uk