

Cylinder Valves - Design Considerations

EIGA companies have historically encountered safety issues with the use of cylinder valves. The introduction of standards, such as EN ISO 10297, *Gas cylinders -- Cylinder valves -- Specification and type testing*, has made significant improvements to mitigate the risk of in-service issues.

Historically, some basic design defects have occurred amongst valves from various manufacturers. These defects are not necessarily limited to valves that have been recently introduced into the market, but also those that have been long established.

These valves could have already passed type approval testing in accordance with the relevant standards; however, these standards may not highlight all potential defects. This Safety Information identifies additional failure modes and items that should be considered when selecting new valve designs and can also apply to other accessories including pressure regulator or filling connectors.

1. Overstressing

Components that are exposed to high stresses due to gas pressure, including the valve body, gland nut and lower spindle are at risk of deformation or cracking. In addition, repetitive torque stresses / mechanical fatigue, for example, of the lower spindle and upper spindle, or high assembly stresses, (valve stem threads) are also at risk of deformation or cracking. For components potentially subject to stress corrosion, see Sections 3 and 4.

A typical instance of this effect is the failure of the lower spindle soft seal retention skirt, as illustrated in Figure 1.

Individual components except the valve inlet, that is the threads that connect the valve to the cylinder, should be designed to operate at a combined stress level due to pressure and assembly torque with a safety factor of at least 4. Particular care needs to be taken to prevent stress concentration areas in the design such as sharp internal corners. Whatever the safety factor, the assembly should comply to fail safe requirement as described in Section 5.

Additionally, threads that connect the valve to the cylinder (both taper and parallel types) should be tested during type approval to prove there is no visible (external) deformation or cracking when assembled to a torque of 1.5 times the maximum recommended in EN ISO 13341, *Gas cylinders -- Fitting of valves to gas cylinders*.



Figure 1: broken lower spindle seal retention skirt

2. Stress corrosion cracking

Tensile stress in brass, especially in non-stress relieved, thin-section components, and in the presence of moisture, can lead to failure by stress corrosion cracking. Typical examples of this effect are residual pressure valve (RPV) back plugs, See Figures 2 and 3.

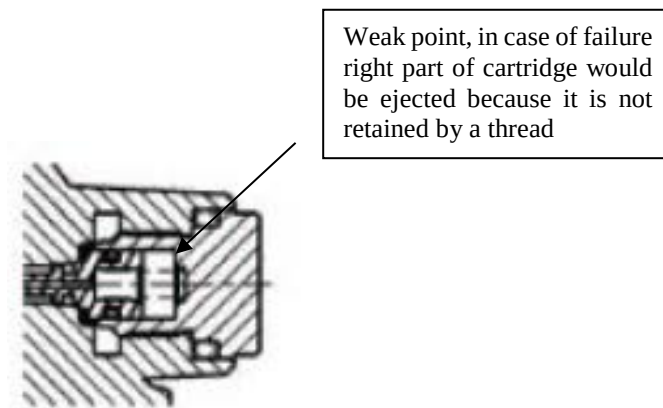


Figure 2: Inadequate design of residual pressure valve back plug



Figure 3: defective residual pressure valve plug