

## ASHCROFT PRESSURE GAUGES GENERAL SAFETY INFORMATION

**PIP #: ASH-PI-36**

Applicable to:

Pressure Gauges

This Product Information page explains the safety of solid front case pressure gauges, as well as large volume versus small volume pressure elements.

### ASME B40.100-2013 References

The following excerpts from ASME B40.100-2013 are helpful in understanding the problems (Solid front cases are defined in the standard).

4.3.6.1 “Cases, solid front. It is generally accepted that a solid front case... will reduce the possibility of parts being projected forward.... An exception is explosive failure...”

4.2.7.2 “Overpressure failure.... It is generally accepted that solid front cases with pressure relief back will reduce the possibility of parts being projected forward in the event of failure....”

4.2.7.1 “Fatigue failure. ... generally occurs... as a small crack.... Such failures are usually more critical with compressed gas media than with liquid media. Fatigue cracks usually release the media fluid slowly so case pressure build up can be averted by providing pressure relief openings in the gauge case. However, in high pressure elastic elements..., fatigue failure may resemble explosive failure.”

4.2.4 “Hazardous systems and/or conditions. The following systems are considered potentially hazardous.... Compressed gas systems... oxygen systems... systems containing hydrogen... pressure systems containing any explosive or flammable mixture or medium... systems where high overpressure could be accidentally applied...”

4.2.6 “Violent effects. Fire and explosions within a pressure system can cause pressure element failure with very violent effects, even to the point of completely disintegrating or melting the pressure gauge.... Failure in a compressed gas system can be expected to produce violent effects.”

### **Safety of Solid Front Cases**

These excerpts from ASME B40.100-2013 demonstrates that the standard recognizes there are some types of failure which cannot be contained within any case. It may only be stated that a solid front case has a better chance in protecting the gauge user.

A metal (stainless steel or aluminum) solid front case will survive an explosion that may fragment a thermoplastic or thermoset case. Open front gauges will not perform like a solid front design in the event of a violent failure. Solid front gauges are supplied with a pressure relief back. Open front gauges are supplied with a pressure relief plug. Both will safely relieve case pressure in the event of a slow leak in the pressure system.

There is no ASME standard test for cases. No test simulates a high pressure gas rupture of the Bourdon tube or an explosion inside the tube. Most tests merely introduce pressure into the case through the socket at a rate far slower than that which occurs during an explosive failure and therefore will not truly demonstrate the advantages of a solid front case.

### **Specifics of Small and Large Volume Pressure Elements**

One of the factors which determines the violence of an explosion, especially when caused by overpressure with gas, is the volume contained within the Bourdon tube. Just before rupture, the Bourdon tube generally is distorted to a shape containing a larger volume than its original volume, this volume of compressed gas contains energy proportional to the burst pressure and the larger the volume, the more energy is released when the Bourdon tube ruptures.

A more important consideration, however, is the pressure at which the Bourdon tube ruptures. If, by a design, a Bourdon tube is designed to rupture at a relatively low pressure, there is much less energy released. Conversely, a Bourdon tube designed to withstand very high overpressure before failure will release much more energy when failure does occur.

A higher pressure Bourdon tube will rupture at a much higher value, subjecting the case to a much higher pressure build up. Higher pressures, however, generally involve liquids, which result in much less violent failures than gasses, because liquids, being essentially non-compressible, do not store anywhere as much energy as gasses do.