



PRESSURE SOLUTIONS

P205: Liquid Filling

Liquid filling of the gauge case is extensively used to prolong the life of pressure gauges. The matter is not as well understood as it might be, and is explained below.

As we know, the vast majority of pressure gauges use a rotary movement to translate the arcuate movement of the bourdon tube into a rotary movement of the pointer. The pointer spindle includes a gear pinion, which meshes with a rack or quadrant on the movement. This is connected to the bourdon tube by a link, attached at each end with shoulder screws which allow free rotation at both ends.

Oscillation of the bourdon tube causes wear on the gears and on the shoulder screws.

Strengths:

Liquid filling of the case has three beneficial effects:-

- It damps the movement of the bourdon tube.
- It lubricates the moving parts.
- It protects the delicate movement from difficult atmospheres.

Weaknesses:

There is a downside to this:-

The case must be sealed to prevent the liquid filling from leaking out.

The gauge must be drained and rinsed before any adjustments can be done. This is why we charge more to calibrate a filled gauge.

Temperature errors occur inside sealed cases.

If we consider a change from 0 to 30°C in a sealed case, this, in absolute terms, is a change from 273 to 303°K, or 11%. If the case has been sealed at the coast, it would have an internal pressure of about 100 kPa, and thus a possible pressure change of 11 kPa, say ± 5 kPa from true. We must therefore ensure that accuracy is not degraded by liquid filling. This means that gauges below about 1 600 kPa must not remain sealed, if they have been sealed for transport. They should have some means of venting the case to eliminate such errors. Various mechanisms are used. The commonest is a rubber plug with a little nipple or spike on top. This nipple should be cut off to vent the gauge. The earlier Blanes designs had a screw-in blow-out valve with a vent which was sealed with a cork gasket under the hex. This gasket had to be removed to vent the case. The Stronga gauges have a steel pin, which seals the vent hole, and has to be extracted when commissioning the gauge. All liquid filled gauges have some variant of this, and all low pressure gauges must be vented on installation. Our first response when people report a zero error on a new gauge is to check this point.

Some pressure media react with the case fill. This of course would only occur if the tube were to leak, but this does happen. Examples which cause explosions are Oxygen, chlorine and peroxide, and nitric acid with glycerine. Such applications should preferably have no fill, as inert oils are very expensive. Our Vibragauge is a good solution to this problem.

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Products for Pressure Professionals

Choice of Fill:

The commonest fill fluid is glycerine. It is clear, non-corrosive and viscous. It loses viscosity quickly with rising temperature. Above 60°C it starts to carbonise and turn black. Silicone Oil is more expensive, but has better lubrication properties and withstands temperatures to well in excess of what the gauge should be subjected to.

Electric Contacts:

Liquid fills interfere with electric contacts. Where they are essential, a contact monitoring relay like the Wiebrock MSR range should be used, which will create a short high voltage spike to penetrate the coating on the contact surfaces.

Case Sealing:

There are three areas of concern:- the window, the stem, and the case fixing. The window is sealed with an elastomer seal between the window and the case. In utility gauges the bezel is often permanently rolled into position, and leaks are rare. In process gauges, bayonet bezels are often used, and these must be tight.

Where the stem is attached to the case by fixing screws, these must be sealed with soft washers, usually nylon. The stem itself will have an elastomeric seal. These two sealing points can be eliminated by welding the stem to the case.

Leakage:

The first thing to check is case venting. If a gauge has been filled at low temperature, then exposed to higher temperatures in transit or storage, this can cause a build-up of internal case pressure sufficient to force fill-liquid past the seals.

If this is not the case, identify the problem area and replace the seals, after checking that the case itself is not deformed.

Supply of Liquid:

We supply both glycerine and silicone oil in both 500ml and 2,5l bottles.