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a PCC Flow Technologies company

PenTech FAQ # 1 by Gary G. Sanders, Vice President - Engineering

The requirement for re-torquing glass liquid level gages:

In February 1995, Penberthy, like other companies in our industry, changed gasketing standards to graphite ribbon (U.C.C. trade name Grafoil) from non-asbestos which was an interim standard replacing the asbestos standard which prevailed from the early 1900's until the early 1990's.

For all practical purposes, graphite ribbon gasketing exceeds the properties of the fibrous/elastomeric gasketing (i.e. asbestos and non-asbestos, hereinafter called fibrous) in every characteristic that is important in the creation and maintenance of a seal, including but not limited to: sealability, leakage (about 250 times less in gage glass use), life, thermal capability, thermal and electrical conductivity, chemical compatibility, less creep relaxation, etc.

However, for all its pluses, it does require a different outlook on its use compared to the fibrous gasketing. Graphite is a natural lubricant, so compression surfaces needed to be altered, the Penberthy standard is > 63 A.A.R.H. nominal. Graphite is also a friable material, therefore, simply overtorquing to create a seal (or fix a leak as was common field practice with fibrous) is NOT possible without damaging or destroying the graphite gasket.

The requirement to re-torque a gage glass before placing it into service has always been a Penberthy policy and good maintenance practice as well as common sense.
Why?
The issue of gasket compressibility, recovery and compression set. All gaskets when placed under compressive load (read torque) will undergo some degree of compression (and elasticity - a.k.a. recovery), otherwise, they could not function as gasketing. These values are critical enough to have their own ASTM specification F36.

Specifically relating to fibrous gasketing vs. graphite ribbon:

	Lydell Nobestos D-7301 Duroid	U.C.C. Grafoil gr GHP
Compressibility:	11.4%	40%
Recovery:	67.5%	15%

All measured per ASTM F36
Fibrous reference is Lydell datasheet GP19
Graphite reference is Grafoil Engineering Design Manual, Union Carbide Corp.

Practically, if 31 mil thick gasketing is used:
fibrous would compress 3.5 mils and recover 2.4 mils
graphite would compress 12.4 mils and recover 2 mils.

Notice the difference: fibrous losses about 1 mil, while graphite losses about 10 mils in thickness (about 3% vs. 32% respectively) of free thickness.

Compression set is by definition that deformation that remains in gasketing after it has been subjected to [and released from] a specific compressive stress for a period of time at a prescribed temperature.

From a practical standpoint, extensive testing done at Penberthy has shown that to achieve full compression set, within a standard deviation, there are two realistic scenarios:

1) Torque - delay 24 hours
   Re-torque - delay 48 hours
   Re-torque - delay 72 hours
   Re-torque
   OR
2) Torque - delay 21+ days
   Re-torque

The first method is a value added service that Penberthy markets (although it does add a week to the shipping date), the second is what usually occurs when a gage glass is manufactured, tested, shipped and re-torqued BEFORE being placed into service.

One or the other is **essential** for the creation of a good seal with graphite gasketing. Fibrous gasketing benefits by the same practice, however, with compressibility ratios of about 1:10 vs. graphite, it was not as critical, also it was common practice to [slightly] over-torque fibrous gasketing, a practice that tends to destroy the friable graphite gasketing (this should suggest that a torque wrench really is required when working with graphite gasketing, not just any kind of convenient wrench such as has been common practice).

An interesting consequence of the foregoing is that gage glass which has been initially torqued and hydrotested at Penberthy will occasionally undergo sufficient gasket compression set during transit to a user that all axial bolt loading (read torque which causes the compression in a gage glass) is lost and the nuts may spin freely on the bolting. Consider a reflex gage with two pieces of graphite gasketing (the gasket and the cushion for a total loss using above F36 loading of 20 mils) while a transparent style will lose 40 mils (two gaskets and two cushions). This is far in excess of the torque generated axial bolt elastic deformation. Due to the smaller compressibility of fibrous gasketing, this was almost never observed when it was the standard material. Note that compressibility is seldom a significant factor in a flange seal due to the spiral grooving of the faces. Unfortunately, similar grooving would cause pressure risers that would cause glass breakage if used with gage glass.

Penberthy supplies all gage glass with a tape glass protector that cautions the user to re-torque the gage before placing it into service (part # 14934-009).

In summary, due to the higher compressibility of graphite gasketing, all gage sight glass **MUST** be re-torqued before being placed into service, else failure, either immediately noticeable by gross leakage or longer term by shortened life cycle is inevitable.