



Pipe Flange Connections

Flange Washers - Application Notes

Solon Flange Washers are specifically tempered for flange connections. Solon Flange Washers must be installed correctly to maximise their benefits. There are several important points to remember when installing them.

- A. Be sure that the bolts or studs are long enough to account for the thickness of the flange washer.
- B. The OD of the flange washer should contact the flange joint and the ID of the flange washer should contact the bolt head or nut. (Figure 1)

If the crown of the flange washer is allowed to extend into the bolt hole, then its loading characteristics will be altered. The same is true for a nut that contacts the spring's bottom surface. Since deflections are relatively small, it can be difficult for the installer to see which side is up. Solon's H-13 Tool Steel Flange Washers are chamfered at the top of the OD to help the installer to identify the spring's top surface.

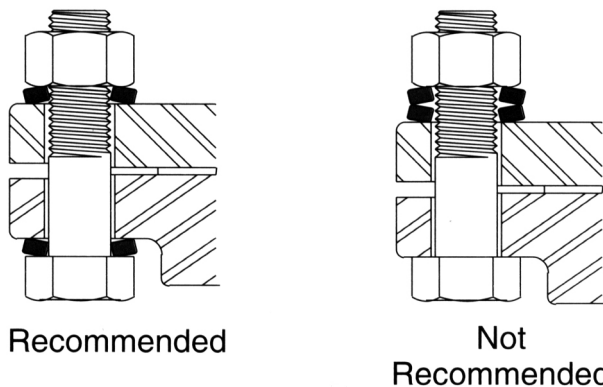


Figure 1

- C. If a tensioner is used to preload the bolts, then the flange washer must be on the opposite side of the joint.
- D. Flat washers are not normally required for the flange washer's bearing surface. Soft flange materials, such as aluminium, may warrant the use of hardened flat washers to prevent the Bellevilles from embedding in the material.
- E. If they are properly applied, flange washers may be reused. Since Belleville springs are highly stressed parts, they should not be reinstalled if corrosion pitting is observed on the surface. If cracking occurs, it may be necessary to specify a different material or coating. Contact Thew & McCann's engineering staff for assistance.



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Live Loading with Solon Flange Washers

It is estimated that 50% to 80% of all flange leaks are caused by insufficient bolt preload. Typically, the bolts are all tightened to a nominated preload. At this original load the bolt has a certain amount of stretch and the gasket yields (takes a set). At start-up, the process fluid heats up the flange and gasket causing them to expand more than the bolts. This leads to an increase in gasket stress causing more yielding. As the bolt temperature rises, preload may fall substantially. This is because the bolt stretch is insufficient to “make up” for what is lost when the gasket yields. For example, if the bolt stretch was .005” and the gasket yield is .005”, then all of the original preload will be lost.

Solon Flange Washers are effective because they add deflection to the fastening system. This is known as “Live Loading”. Flange washers are Belleville springs that are typically very elastic compared to the bolts they are used with. The increase in elasticity leads to dramatically less loss of preload when joint components yield. Using the previous example, if the joint employed two flange washers with .025” of deflection each, then preload would fall by only 9% rather than 100%.

Examples of candidates for live loading using flange washers are:

- A. Flanges where failure could cause a safety problem.
- B. Joints that see large temperature fluctuations.
- C. The length to diameter ratio of the bolt is less than three.
- D. One or more of the flange components are subject to yielding such as gasket creep, bolt creep, vibration, or elastic interaction.
- E. The flange has a history of maintenance problems.

Live loading will not correct all flange leaks. However, maintaining more of the original preload will significantly reduce the risk of failure. It has been shown through various studies by a number of petrochemical companies, that the use of flange washers has a positive overall impact of the performance of a live loaded flange joint.
