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Matching To The Pipe Bore

A standard in gasket design for GPT is to match the gasket inside diameter to the pipe bore that the gasket is being put into. This is the appropriate sizing for most of GPT's gaskets, and this article will dive into how the precise gasket inside diameter is found, along with why this is standard for GPT to do.

When designing the dimensions of the gasket, the dimensions of the flange are inspected closely, as it is the flange face that the gasket will be sealing on. The flange bore will directly depend on how the flange connects to the pipe. In general, there are two ways that a flange will connect to the pipe: Weld Neck and Slip-On. The first of these, weld neck (see Figure 1), typically means that the flange is butt-welded straight to the pipe. In this case, the flange bore will match the pipe bore. The second general type of connection, a slip-on (see Figure 2), means that the flange is designed to slip over the outside of the pipe, where it is then welded in place. For this, the flange bore will be slightly bigger than the outside diameter of the pipe. Knowing what type of connection the flange has is the first step in understanding what the inside diameter of the gasket needs to be.

Image 1: Example of a Weld Neck Flange

Image 2: Example of a Slip-on Flange

With the goal being for the gasket inside diameter to match the flange bore, and the flange bore being dependent on how the flange connects to the pipe, then in turn the pipe will give us all the information needed to determine the gasket inside diameter. The information about standard pipe can be found in a pipe bore chart, which is a chart that highlights four dimensions of the pipe: outside diameter, schedule, wall thickness, and inside diameter. For a given nominal pipe size, the outside diameter is standard and does not change. The pipe schedule relates to the pipe wall thickness for each nominal pipe size; the higher number the schedule is, the thicker the walls of the pipe, and in turn smaller the bore of the pipe. So a schedule 10 will have thinner walls and a larger pipe bore than schedule 160.

This information can be tied back to the different flange to pipe connections. For a slip-on flange, the flange needs to fit over the outside of the pipe, so the bore of the flange will be slightly bigger than the outside diameter of the pipe. Thus, the gasket inside diameter with a slip-on flange will also be slightly bigger than the standard outside diameter of a given nominal pipe size. For a weld neck flange, the flange bore is the same as the pipe bore. To find what this flange bore/gasket inside diameter would be, the pipe bore chart is used. As long as the nominal pipe size and schedule are specified, then the wall thickness will be known, and the pipe inside diameter can be found by:

$$Pipe\ Bore = Pipe\ Outside\ Diameter - Wall\ Thickness - Wall\ Thickness$$

and as we stated before, for weld neck flanges:

$$Pipe\ Bore = Flange\ Bore = Gasket\ Inside\ Diameter$$

This is *how* the inside diameter of the gasket is found, ensuring that it is matched to the bore of the flange.

Image 3: A look down the flange bore with a properly sized gasket

Now it is important to understand *why* the gasket inside diameter is required to be equal to the flange bore. The reason that this is standard for GPT is for protection of both the gasket and the flanges. If it were the case that the gasket ID was sized larger than the flange ID, the flange face and electrical isolation will be at increased risk. The gap that would be left from flange to flange, where the gasket is void, would cause increased turbulent flow of the media. An increase of turbulent flow leads to elevated rates of corrosion and erosion, which would take place on the flange faces. To go along with this problem, there would be an increase of unwanted media build-up, or fluid trap in this void. Some media can act as an electrical conductor between the flanges, creating a shorter path of isolation from which arcing and current migration beyond the isolation boundary can occur.

If the gasket ID were sized smaller than the flange ID, problems would stem from this as now the gasket will be protruding into the pipe. It is critical that the sealing element of the gasket is landing on the flange face for the sake of proper sealing. If the gasket is too undersized, there is a risk that the sealing element will be landing inside the flange bore and not sealing against the flange face. Even if the seal is landing on the flange face, but the gasket is protruding into the flange bore, the gasket will now be in the direct path of both the media, and of pipeline cleaning pigs. Both of these will put the gasket at increased risk of being damaged. Again, this would cause turbulent flow which increases the effects of flow induced corrosion, erosion, and media induced corrosion on the gasket face and flange faces. Pigs and turbulent flow will quickly cause great wear and tear on both.

In all, matching the gasket ID to the pipe bore is the most effective way to mitigate corrosion and maintain electrical isolation in piped flange connections. If it is the case that two flanges are being mated together with different bores, or using different pipe schedules, it is GPT’s practice to match the gasket inside diameter with the larger flange bore, as keeping the gasket out of the direct flow path of the media along with the sealing element landing on both flange faces normally takes priority. As is always the case, variations and exceptions happen, but in general GPT will try to match the gasket ID to the pipe bore when designing a gasket.