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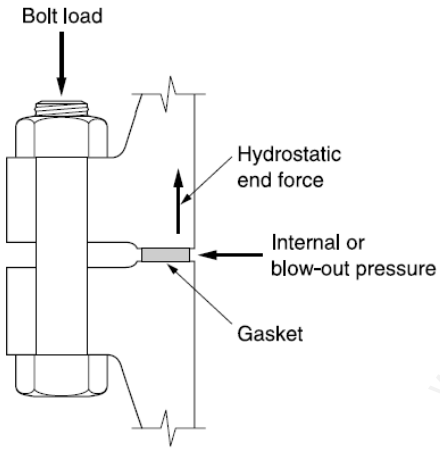
Flanged Joints

The most usual type of joint for easy assembly and disassembly used in process vessels and piping system is the bolted flanged connection.

A flange is defined as a plate type device, normally round, that is attached to the end of a pipe, fitting, valve or other object to facilitate the assembly and disassembly of the system. For many years the only practical method of joining steel pipe had been by connecting threaded pipe ends with couplings. In most present day piping systems, threaded joints are usually limited to pipe sizes 2" and smaller. Larger pipe (3" and larger) is normally joined by butt-welding of continuous pipe and fittings or by flanges at joints that may require dismantling. Flanges (3" and larger) are also the default standard for connecting to most equipment connections and valves.



The gasket, which is really the focal point of the bolted flange connection, is subjected to compressive force by the bolts. The flange stiffness in conjunction with the bolt preload provides the necessary surface constraint and the compressive force to prevent the leakage of the fluid contained in the pressure vessel. The fluid pressure tends to reduce the bolt preload, which reduces gasket compression and tends to separate the flange faces. The gaskets are therefore required to expand to maintain the leak proof boundary. Gaskets are made of nonmetallic materials with composite construction. The serrated surfaces of the flange faces help to maintain the leak-proof joint as the material expands to fill up the irregularities on the face of the flanges.

Flanges:

Specifications of standardard flanges are given in ASME B16.5. The most common material is forged steel, with the specification of ASTM A181 or A105. The dimensions of flanges vary according to the pressure rating. The higher the pressure, higher will be the dimensions. The most common pressure ratings are: 150, 300, 600, 900, 1500, 2500 psig

Flanges with raised face are extensively used because of the simplicity of design and they have been proved adequate for average service conditions. Raised face is machined with spiral or concentric grooves approximately 1/64 inch deep with 1/32 inch spacing. The edges of this grooves serve to deform and hold the gasket. The other types of flange facing are: tongue and groove facing, ring type joint etc.

Slip-on Raised Face (SORF) Flange:
This is the most common flange. It has greater ease in welding assembly.

Welding Neck Rasied Face (WNRF) Flange
This has a long tapered hub between the flange ring and the weld joint. This hub provides a more gradual transition from the flange ring thickness to the pipe wall thickness, thereby decreasing the discontinuity stresses and consequently increasing the strength of the flange. They are normally used for extreme service conditions such as high pressure, cold or hot temperature.

Lab-Joint Flange:
Lap-Joint Flanges are similar to slip-on flanges, the difference is it has a curved radius at the bore and face to accommodate a lap joint stub end. The lap joint flange and stub end assembly are normally used in systems requiring frequent dismantling for inspection.

Socket Weld Raised Face (SWRF) Flange:
This flange is similar to slip-on flange, except that a bore and a counter bore. The counter bore is slightly larger than the Outer Diameter of the matching pipe, allowing the pipe to be inserted. A restriction is built into the bottom of the bore, which acts as a shoulder for the pipe to rest on, and has the same ID of matching pipe. The flow is not restricted in any direction.

Threaded Flange:
Threaded Flanges are confined to special applications. Their chief merit lies in the fact that they can be assembled without welding this explains their use in extremely high pressure services, particularly at or near atmospheric temperature, when alloy steel is essential for strength and where the necessary post weld heat treatment is impractical. Threaded Flanges are unsuited for conditions involving temperature or bending stresses of any magnitude, particularly under cyclic conditions, where leakage through the threads may occur in relatively few cycles of heating or stress; sea welding is sometimes employed to overcome this, but cannot be considered as entirely satisfaction.