

FLANGES

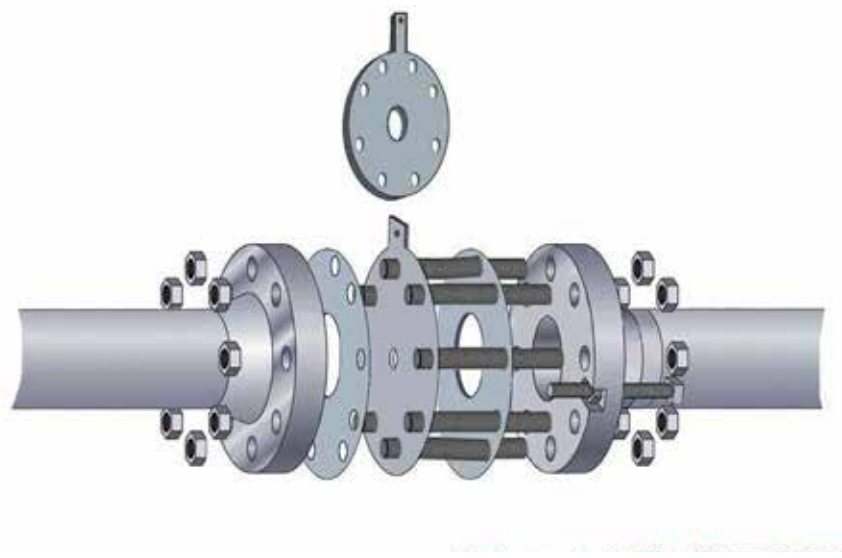


The flange, also known as a plate due to its shape, is a piece whose function is to join one tube to another in piping systems.

In the same way, it is also used to connect two different tubular devices (tubes to valves, or tubes to equipment).

The connection between two tubes can be made by welding directly across a seam, but connecting two tubes together without welding is a difficult task. Furthermore, when this type of connection presents problems, it becomes difficult to repair them. The same problems can appear between a tube and a valve connection.

Generally, flanges are used to connect pipes or valves, so the above-mentioned problems can be easily solved.



Example in restriction hole.

How many parts are used in a flange connection?

The flanged connection normally uses two pieces, a gasket, and some union bolts, which allow the pieces to be connected together. (First, the pipes are welded to the flanges, then the valves and any other equipment can be installed on the flanges.)

When these parts are connected, the gasket is placed between both flanges, then it is tightened with bolts so that both are tightened tightly.

The flange connection is practical, flexible and requires less labor.

In case of maintenance, it is only necessary to remove the flange bolts, remove the corresponding tubes or valves, and replace them with new tubes and valves.

Depending on the type of connection between the tube and the flange, these can be divided into the following basic types:



Weld Neck Flange(WN)



Lap Joint Flange(LJ)



Slip-On Flange(SO)



Blind Flange(BLD)



Threaded Flange(THR)



Socket Weld Flange(SW)



Expanding Flange



Reducing Flange

Slip Flange

The Slip-on Flange, also known as an SO Flange, is installed by inserting the tube into the internal hole of the flange, since the internal diameter of the flange is slightly larger than the external diameter (OD) of the tube. The pieces can be connected by means of a double weld at the top and bottom of the flange. Typically, the steel slip-on flange uses a Raised Face (RF) or Flat Face (FF) seal; although they are also available in tongue face (TG, Tongue & Groove Face) and male-female face (MF, Male/Female)



The slip on flange is ideal for pipelines with low pressure, general temperature, and normal conditions. It is easy to install and low cost, which is why it has become the type of flange most widely used by industries.

Weld Neck Flange

Weld neck flange (WN flange) usually has two types of design: high taper neck flange and narrow taper neck flange; the first is the most common and used in pipe connections. As its name explains, the weld neck flange can be welded directly to the pipe end. The WN flange has the advantage of being useful in construction, it has high resistance and good sealing. It is also widely used in multiple pressure pipelines.



Threaded Flange

The threaded flange is one with threads on its inner surface, whose function is to screw onto the pipe. The advantage of this type of connection is that it does not require welding, so its installation is very easy, and it also allows for quick maintenance and repairs. The threaded flange can be made of alloy steel, which has high pressure resistance, but poor welding performance. Its disadvantage is that it cannot be used in extreme conditions, with temperatures no higher than 260 °C and no lower than -45 °C, to avoid leakage.



Socket Weld Flange

The Weld Seated Flange (SW Flange) is similar to the Slip On Flange, but differs in that the Seated Flange only requires fillet welding on one end of the steel pipe, while the other end is bolted. SW flange is generally used for small diameter pipes.



Flange for Lap Joint

The lap joint flange is one where the flange is fixed to the end of the tube by means of a steel ring or flange. The flange can be moved to the end of the pipe. The steel or flanged ring is the piece that seals the surface, with an additional flange that presses against each other. Thanks to this steel ring or flanged piece, the flange for lap joint will not come into contact with fluids. This makes it ideal for pipelines that require corrosion resistance.

Blind flange

The blind flange is similar to a rigid disk with no hole in the middle, and only has installation holes (in order to allow connection), whose function is to block the pipes and stop the flow.



Face Types

According to the different pressure levels of the pipes and the types of joints, we can find various faces (sealing surfaces) for the steel flanges.



Flat Face



Raised Face

Flat Face Flange (FF)

It is suitable for pipelines where the pressure is lower ($PN \leq 1.6 \text{MPa}$).

Raised Face (RF) Flange

The sealing surface is simple and smooth, easy to manufacture. In addition, it is ideal for installing in tubes with anticorrosive coating.

However, the contact area is larger, so the gasket must be tightened at both ends prior to installation. Otherwise, it won't take the pressure.

Flange with Male-Female Face (M/F)

It is composed of a convex and a concave surface, placing the gasket on the concave side. This is done to prevent the gasket from being pushed out by pressure, so male-female faced flanges are excellent for high-pressure pipelines.

Flange with Tongue and Groove Face (TG)

The outer surface consists of a tongue and a grooved part. The gasket is placed in the channel or groove, and cannot be tightened on the inside.

Comparing its performance with RF flange and MF flange, TG flange can have a good sealing effect, although the structure and manufacture of this flange is much more complex. Because of this, it is difficult to replace the gasket that goes in the channel. The tongue and groove face is suitable for pipes carrying flammable, explosive, toxic materials and under high pressure conditions.

Standards for steel flanges

Standards for steel flanges include European and American standards. Due to the different dimensions, these two systems are not interchangeable. In American countries and most of China, ASME or ANSI standards apply. The flange pressure rating under ASME can be classified into grades 150, 300, 600, 900, 1500 and 2500.

Common ASME Standards for Flanges:

ASME B16.5

Standard for flanges for tubes and tubular accessories. Covers sizes from NPS 1/2 to NPS 24, metric/inch, including pressure and temperature ratings, materials, dimensions, strengths, markings, inspections, and methods for designating flange openings for tubes and tubular fittings.

ASME B16.48

Standard for Blind Discs. Includes the specifications for operating blind discs with sizes NPS 1/2 through NPS 24 for installation between ASME B16.5 flanges, within the nominal pressure classification of 150, 300, 600, 900, 1500 and 2500.

ASME B16.47

Long diameter steel flanges, ranging from NPS 26 through NPS 60 (covers all specifications for flanges in sizes NPS 26 through NPS 60, and with index ratings of 75, 150, 300, 400, 600, and 900).

Pipe Flange Material Specification

Flanges are commonly used on carbon steel, alloy steel, and stainless steel pipes. Commonly used materials are as follows:

Carbon Steel: ASTM A105

Stainless Steel: ASTM A182 304/304L, 316/316L

150 Lbs. Class Kg./pc.

Table of Weights (Kg/pc) of Stainless Forged Flange						
Nominal Diameter	SO	WN	THR	BLD	SW	LJ
1/2"	0.47	0.51	0.47	0.47	0.4	0.5
3/4"	0.58	0.73	0.58	0.63	0.7	0.9
1"	0.86	1.07	0.86	0.94	0.9	0.9
1-1/4"	1.08	1.40	1.08	1.23	1.2	1.4
1-1/2"	1.41	1.81	1.41	1.62	1.5	1.4
2"	2.26	2.59	2.26	2.64	2.3	2.3
2-1/2"	3.43	4.28	3.43	4.06	3.7	3.2
3"	3.87	5.18	3.87	4.90	4.2	3.6
3-1/2"	4.99	5.45	4.99	5.90	5.3	5
4"	5.75	7.32	5.75	7.41	5.9	5.9
5"	6.22	8.91	6.22	8.76	7	6.8
6"	7.38	11.26	7.38	11.31	8.4	8.6
8"	12.36	17.68	12.36	19.92	13	13.6
10"	17.10	24.79	17.10	29.39	19.5	19.5
12"	27.68	38.98	27.68	43.70	29.5	29
14"	35.20	51.71	35.20	59.42	41	47.6
16"	42.18	64.41	42.18	77.11	44.5	63.5
18"	49.71	74.84	49.17	94.80	59	72.6
20"	65.50	89.36	65.50	123.38	75	88.5
24"	90.50	119.66	90.50	188.24	100	125

300 Lbs. Class Kg./pc.

Table of Weights (Kg/pc) of Stainless Forged Flange						
Nominal Diameter	SO	WN	THR	BLD	SW	LJ
1/2"	0.62	0.78	0.62	0.62	0.7	0.9
3/4"	1.15	1.34	1.15	1.16	1.2	1.4
1"	1.39	1.64	1.39	1.42	1.4	2.4
1-1/4"	1.67	2.06	1.67	1.79	1.9	1.8
1-1/2"	2.53	3.06	2.53	2.68	2.8	2.7
2"	2.80	3.40	2.80	3.09	3.3	3.2
2-1/2"	4.25	5.31	4.25	4.75	4.6	4.5
3"	5.81	7.32	5.81	6.79	6.3	5.9
3-1/2"	7.72	8.17	7.72	9.53	7.8	7.7
4"	10.13	11.30	10.13	12.00	10.2	10
5"	12.58	15.12	12.58	15.96		12.7
6"	16.40	19.68	16.40	21.20		17.7
8"	24.50	30.48	24.50	34.60		26.3
10"	34.16	43.74	34.16	55.34		41.3
12"	51.26	64.41	51.26	78.90		63.5
14"	72.12	88.30	72.12	107.95		86.2
16"	90.40	112.94	90.40	139.25		113
18"	109.00	138.34	109.00	176.90		134
20"	136.00	167.37	136.00	223.17		168
24"	204.00	235.41	204.00	342.00		249

600 Lbs. Class Kg./pc.

Table of Weights (Kg/pc) of Stainless Forged Flange						
Nominal Diameter	SO	WN	THR	BLD	SW	LJ
1/2"	0.91	0.91	0.91	0.91	1	0.9
3/4"	1.40	1.59	1.40	1.40	1.6	1.4
1"	1.70	1.90	1.70	1.81	1.8	1.8
1-1/4"	2.27	2.49	2.27	2.40	2.6	2.3
1-1/2"	3.10	3.63	3.10	3.40	3.3	3.2
2"	3.63	4.54	3.63	4.40	3.9	4.1
2-1/2"	5.44	6.35	5.44	6.80	6	5.4
3"	7.26	8.10	7.26	8.90	7.4	6.8
3-1/2"	9.53	11.80	9.53	13.67	9.5	9.1
4"	10.89	13.61	10.89	14.40		16.3
5"	14.07	17.69	14.07	19.50		27.7
6"	19.98	22.23	19.98	27.67		35.4
8"	30.40	35.38	30.40	45.36		49.9
10"	41.28	49.89	41.28	68.00		77.1
12"	59.02	72.57	59.02	98.00		90.7
14"	81.72	105.69	81.72	131.66		113
16"	106.69	133.36	106.69	167.00		166
18"	129.39	158.90	129.39	206.57		197
20"	152.00	193.00	152.00	261.00		259
24"	231.54	281.48	231.54	395.00		367

900 Lbs. Class Kg./pc.

Table of Weights (Kg/pc) of Stainless Forged Flange						
Nominal Diameter	SO	WN	THR	BLD	SW	LJ
1/2"	1.80	2.10	1.80	1.90	1.8	1.71
3/4"	2.27	2.72	2.27	2.72	2.41	2.30
1"	3.40	3.86	3.40	4.80	3.55	3.40
1-1/4"	4.10	4.54	4.10	4.30	4.02	3.85
1-1/2"	4.45	5.90	5.45	5.90	5.45	5.28
2"	10.50	10.89	10.50	11.30	10.2	9.78
2-1/2"	11.80	15.00	11.80	13.17	13.9	13.6
3"	15.80	16.34	15.80	16.00		11.3
3-1/2"	19.50	19.74	19.50	20.25		
4"	23.20	23.13	23.20	24.50		19.2
5"	37.65	38.50	37.65	39.46		31.2
6"	48.30	49.89	48.30	51.50		40.5
8"	75.00	79.45	75.00	89.00		71.5
10"	111.13	118.04	111.13	131.54		104
12"	146.00	157.00	146.00	187.00		139
14"	172.36	181.60	172.36	224.07		161
16"	192.95	224.73	192.95	272.40		194
18"	272.40	308.72	272.40	385.90		267
20"	331.42	376.82	331.42	488.00		334
24"	632.00	685.00	632.00	905.00		618

Conversion Tables

Weight Conversion Table					
	Kilogram	Ton	Ounce	Pound	Slug
Kilogram	1	0.001	35.27	2.2	0.0685
Ton	1000	1	35274	2204.62	68.58
Ounce	0.028349	0.000028	1	0.0625	0.00194
Pound	0.45359	0.000454	16	1	0.03111
Slug	14.59	0.01459	514.82	32.136	1

Length Conversion Table					
	Meter	Kilometer	Inch	Foot	Mile
Meter	1	0.001	39.37	3.28084	0.000621
Kilometer	1000	1	39370.1	3280.84	0.62137
Inch	0.0254	0.0000254	1	0.08333	0.000015
Foot	0.3048	0.000348	12	1	0.000189
Mile	1609.34	1.609	63.346	5280	1

Formulas

Linear weight formula for smooth end pipe	
P	$(D - e) * e * 0.02466$

Where:

P	Weight in Kg/m
D	Exterior Diameter in mm
e	Wall Thickness in mm

Hydrostatic Formula (Barlow's Formula)	
P(Psi)	$(2Se)/D$

Where:

P	Pressure in Psi
D	Exterior Diameter in inch
e	Wall Thickness in inch
S	Yield strength (Ys) in Psi

Hydrostatic Formula (Barlow's Formula)	
P(MPa)	$(2Se)/D$

Where:

P	Pressure in MPa
D	Exterior Diameter in mm
e	Wall Thickness in mm
S	Yield strength (Ys) in MPa

Conventional Terms	
API	American Petroleum Institute
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society of Testing Materials
NACE	National Association of Corrosion Engineers
AWWA	American Water Works Association
SSAW	Spiral / helical Seam Submerged Arc Welded pipe
DSAW	Double seam Submerged Arc Welded pipe
LSAW	Longitudinal seam Submerged Arc Welded pipe (one seam)
ERW-HFI	Electric Resistance Welded High Frequency Induced
EFW	Electric Fusion Welded Tube
SRL	Single Random Lengths: minimum average Lengths 17'6" - shortest length permissible is 9".
DRL	Double Random Lengths: minimum average Lengths 35" - shortest length permissible is 14".

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