PIPING SYSTEMS


PROCESS PIPEWORK

Pipework

Aims

To gain an understanding of the various considerations involved in the design, construction and maintenance of piping systems.

Pipework

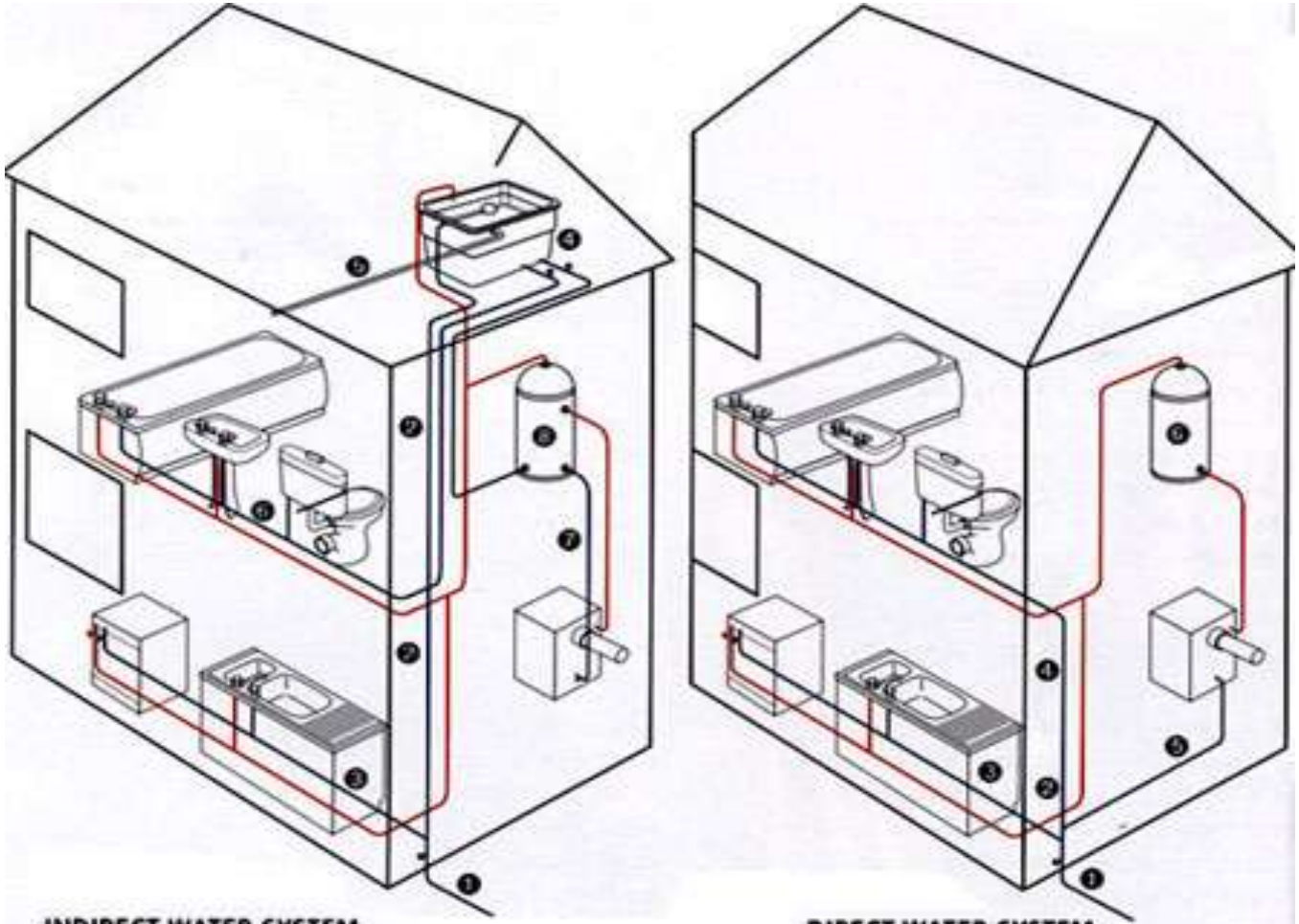
- Materials
- Flanges (Types & Classifications)
- Gaskets (seals)
- Bolts & Studs (fasteners)
- Pipeline referencing
- Pipeline specifications
- Handling of Pipework
- Pipework Construction
- Testing
- Safe Dismantling

Pipework

Introduction

Domestic piping systems are made from materials such as copper and plastic for handling mainly clean products around the home.

Q, What are the products normally transported around the home?

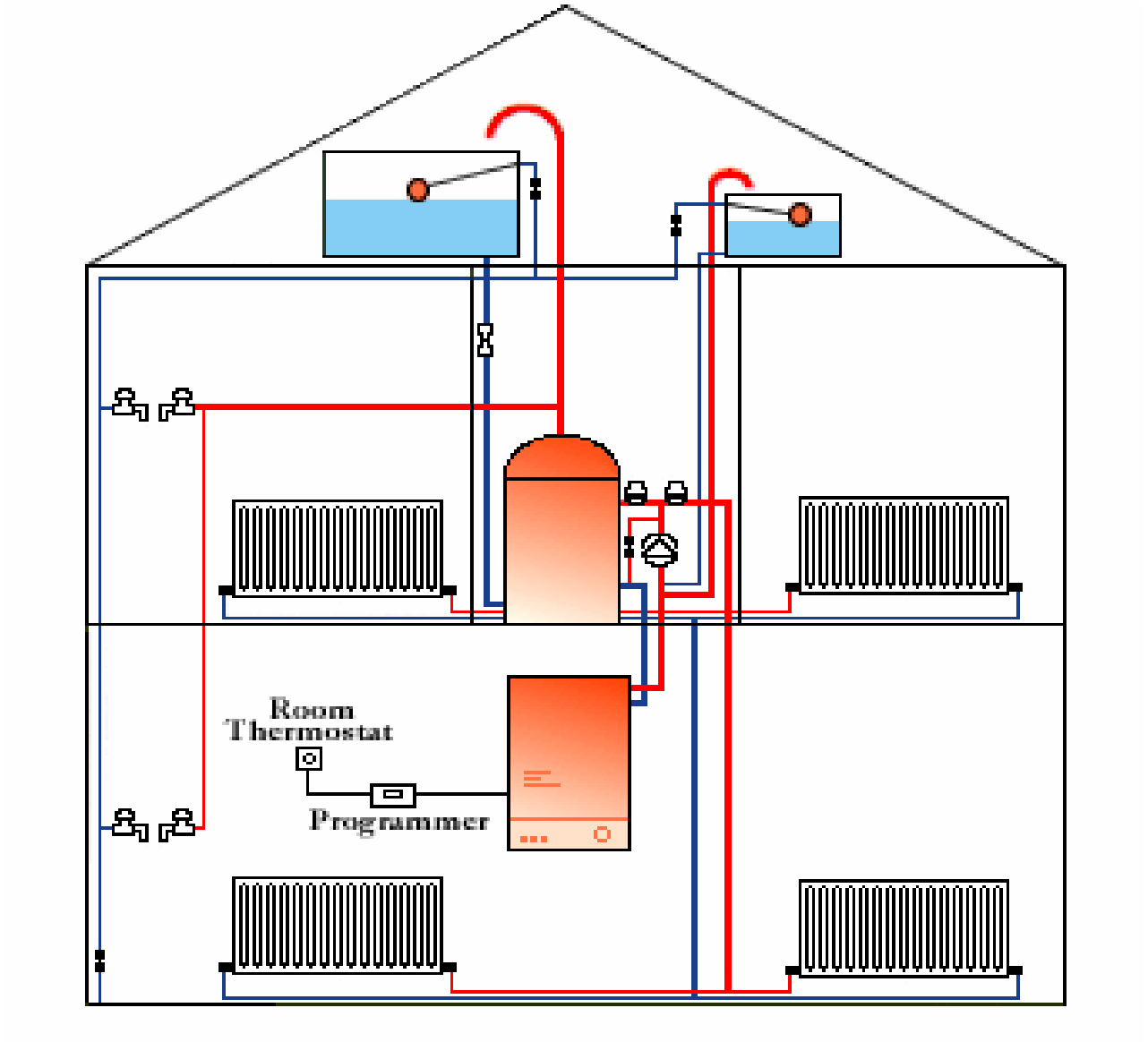


INDIRECT WATER SYSTEM

1 service pipe from water company
2 rising main
3 drinking water from rising main
4 cold-water storage tank
5 overflow pipe
6 cold feed pipe to bathroom
7 cold feed pipe to boiler
8 hot-water cylinder

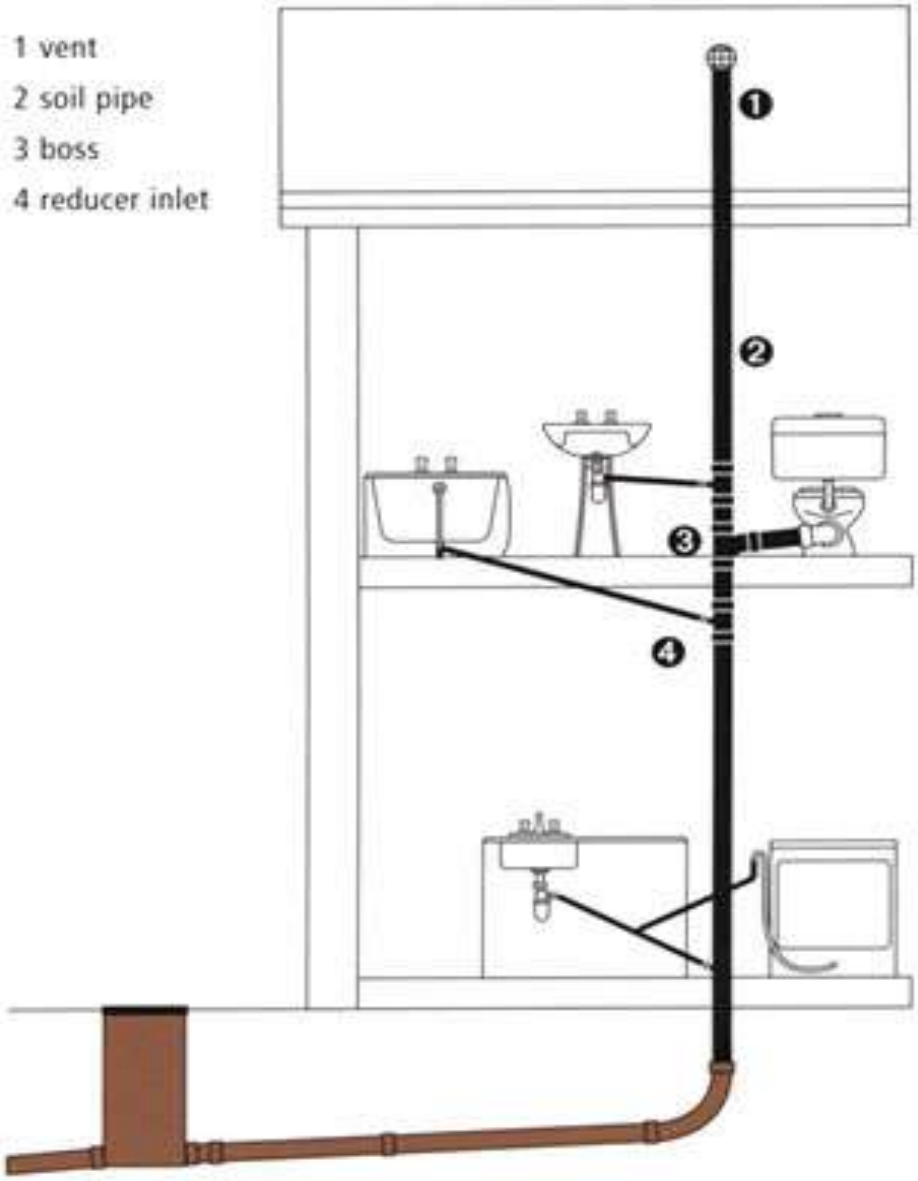
DIRECT WATER SYSTEM

1 service pipe from water company
2 rising main
3 drinking water to kitchen
4 drinking water to bathroom
5 cold feed pipe to to boiler
6 hot-water cylinder


Room
Thermostat
Programmer

SINGLE-STACK SYSTEM

1 vent
2 soil pipe
3 boss
4 reducer inlet



However pipework on chemical plants is used to transport large amounts and types of chemicals and other products from one point to another, efficiently and safely.

Therefore a wider range of materials are used.

Why such a range of materials?

To accommodate a wide variety of conditions and chemicals, pipework is made from different materials to particular standards and specifications, for example:

(a) Safety - to withstand pressures, temperatures and to be compatible with the various chemicals passing through them.

(b) Cost - i.e.. Chromium alloys (expensive) carbon steel may be adequate.

Materials:

- Mild Steel
- Stainless Steel
- Cast Iron
- Copper
- Titanium
- Monel
- Inconel
- Hastelloy
- Glass
- PVC
- PTFE
- Glass reinforced plastic
- Rubber
- Lead
- Resin

Pipeline material selection criteria

Product type

Temperature

Pressure

Working environment

Manufacture

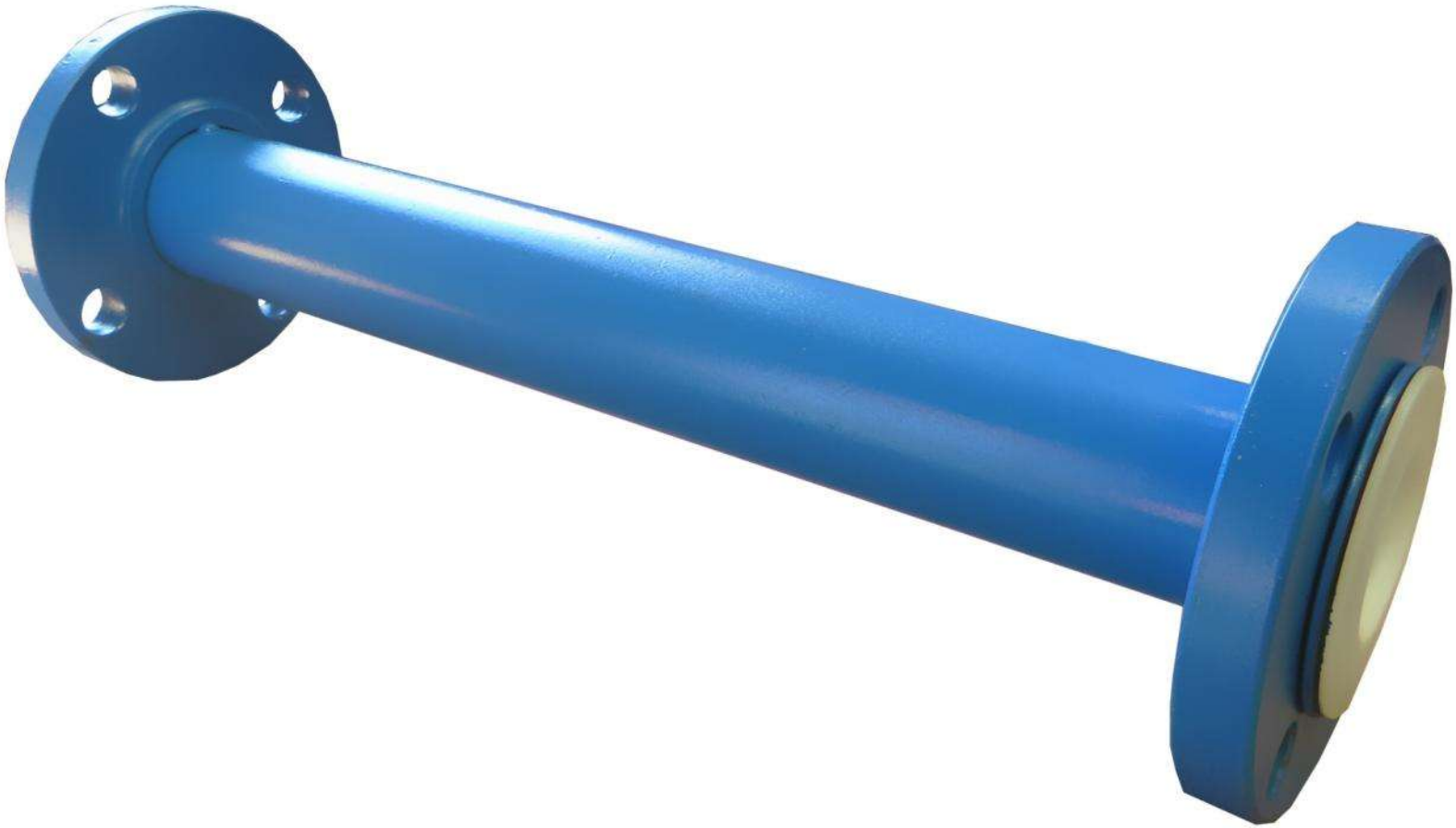
Cost

Metals are strong and rigid, capable of withstanding high pressures and temperatures.

However the same cannot always be said for the non-metallic materials.

How can this be overcome?

Lined pipe

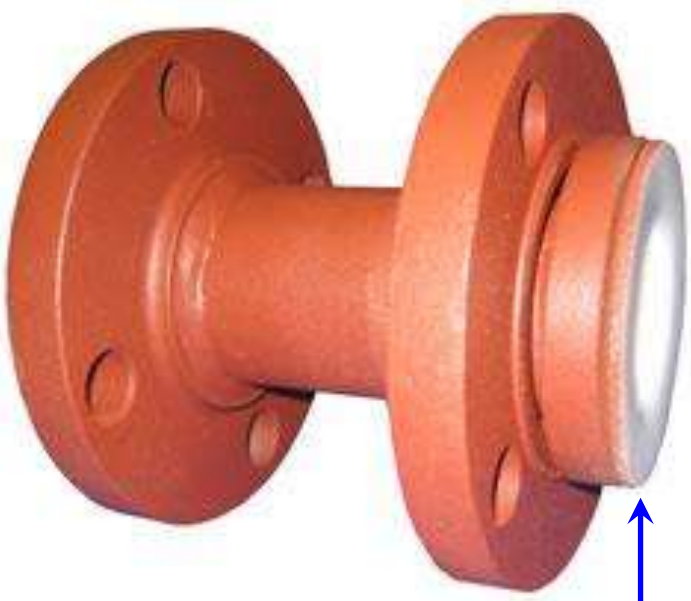


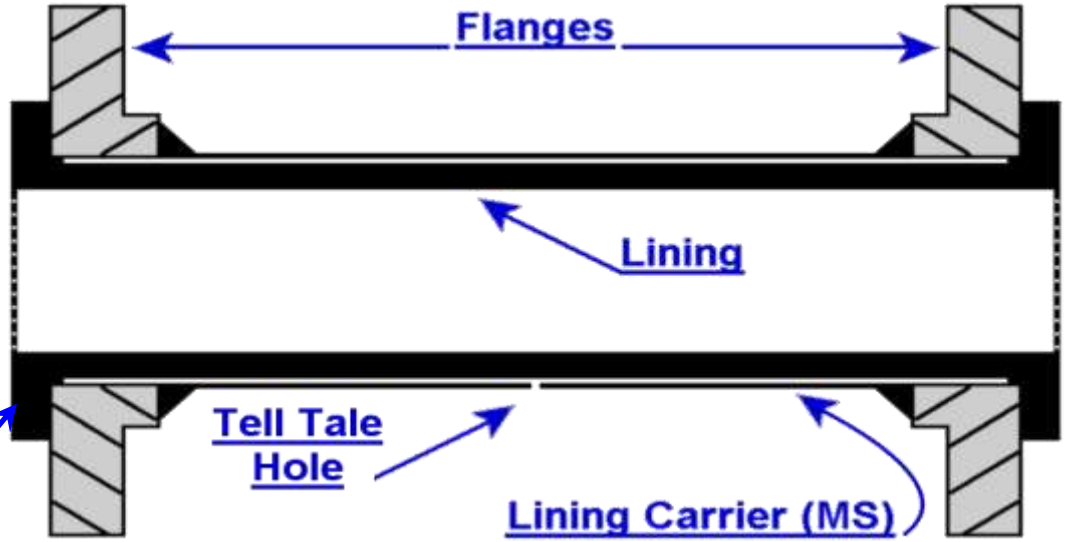
Why Are Pipes Lined?

It may be cheaper or more practical to produce a lined pipe than a complete pipe made from more expensive materials for particular applications.

e.g. Brittle materials like glass or resins cannot withstand high pressure or shock.

Lined Pipework





The Lining will cover the Flange Faces

Types of Linings

- Rubber
- PTFE
- PVDF
- Alkathene
- Bitumen
- Lead
- Glass

How are pipes sized ?

Pipe sizing

Pipe work is sized or identified by its Nominal Bore (average internal diameter) and wall thickness

Common NB sizes:

1/4” NB
3/8” NB
1/2” NB
3/4” NB
1” NB
1.1/2” NB
2” NB
3” NB
4” NB
5” NB
6” NB
8” NB
10” NB

Pipework Schedules

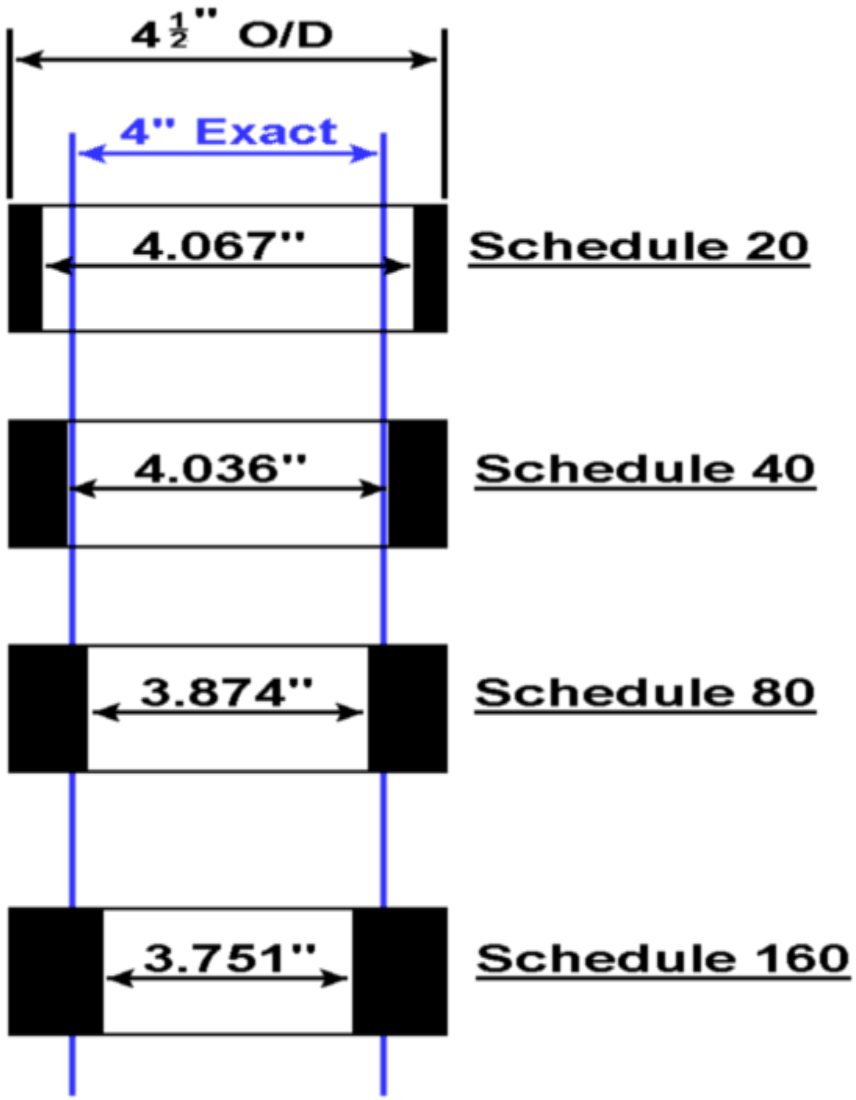
Refer to the wall thickness of schedule 20, 40, 80 and 160 pipe, as the number increases so does the wall thickness.

The outside diameter remains constant, the bore diameter changes as the thickness increases.

Q. Why does the bore change and not the outside diameter?

A. To enable standard fittings to be used.

Pipe Schedules



How and why are pipes joined together?

PIPE FLANGES

Flanges are devices used to connect sections or lengths of pipe together.

For ease of installation pipe is normally supplied in 6mtr lengths, but many pipe configurations require many variations in length.

Also to allow items such as valves, pumps, filters etc to be fitted into the system.

All Flanges Are Selected By Meeting Two Criteria:

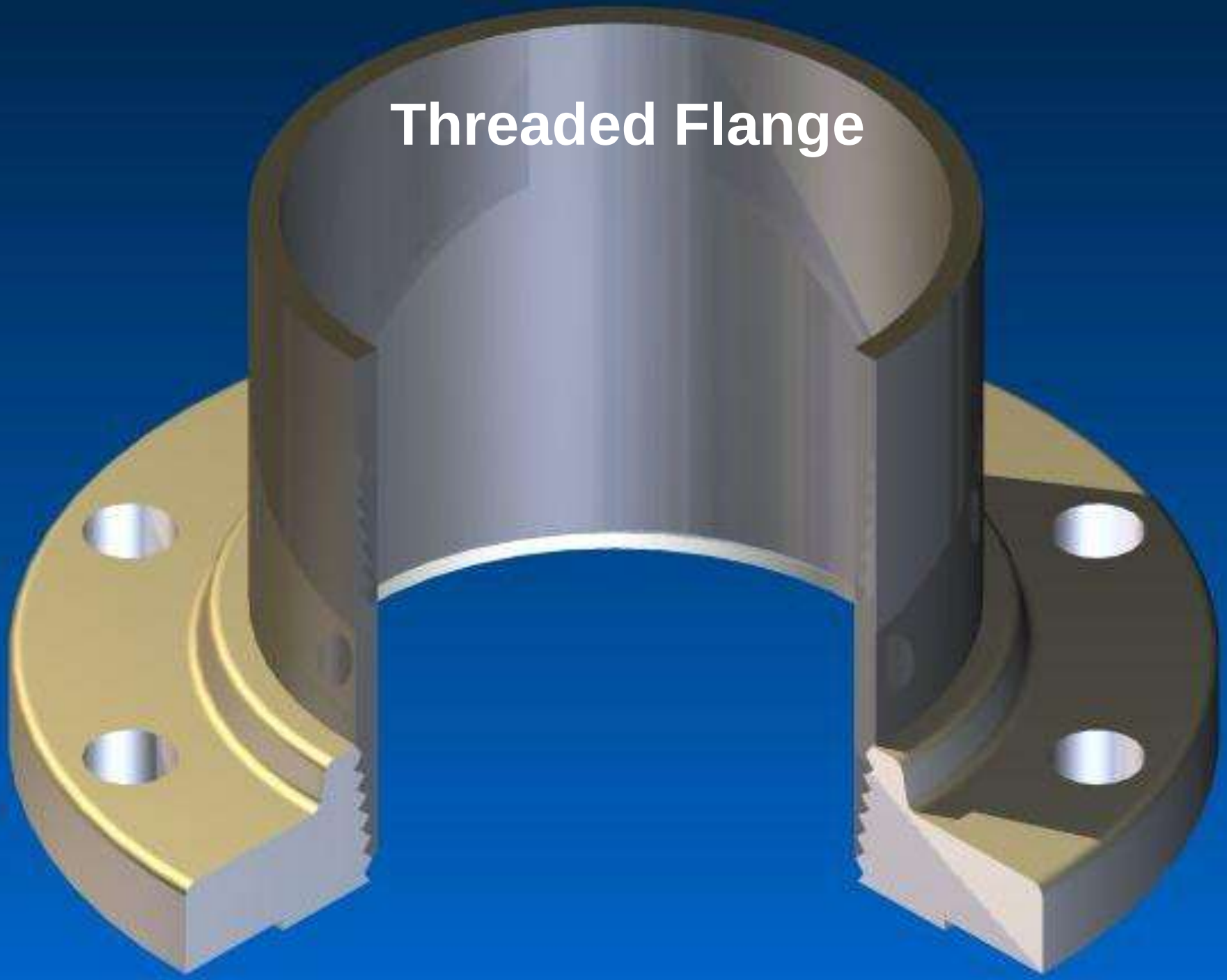
Safety

(Pipe material, size, process product, temperature, pressure)

Cost

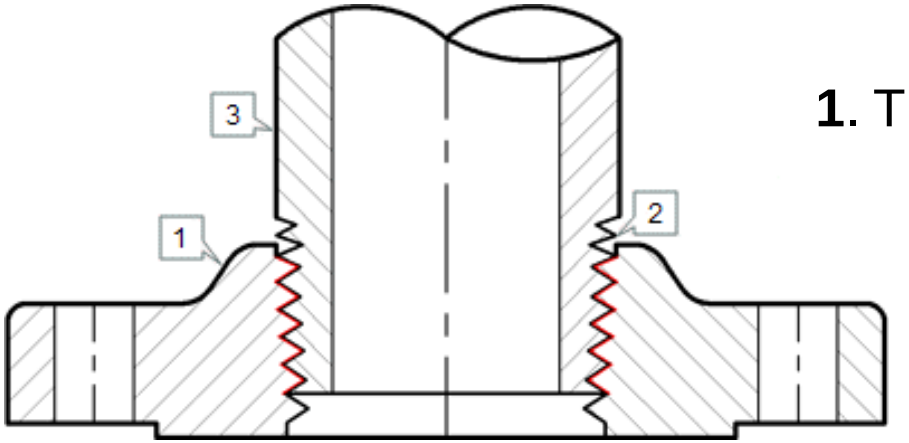
Flange Types

Threaded Flange



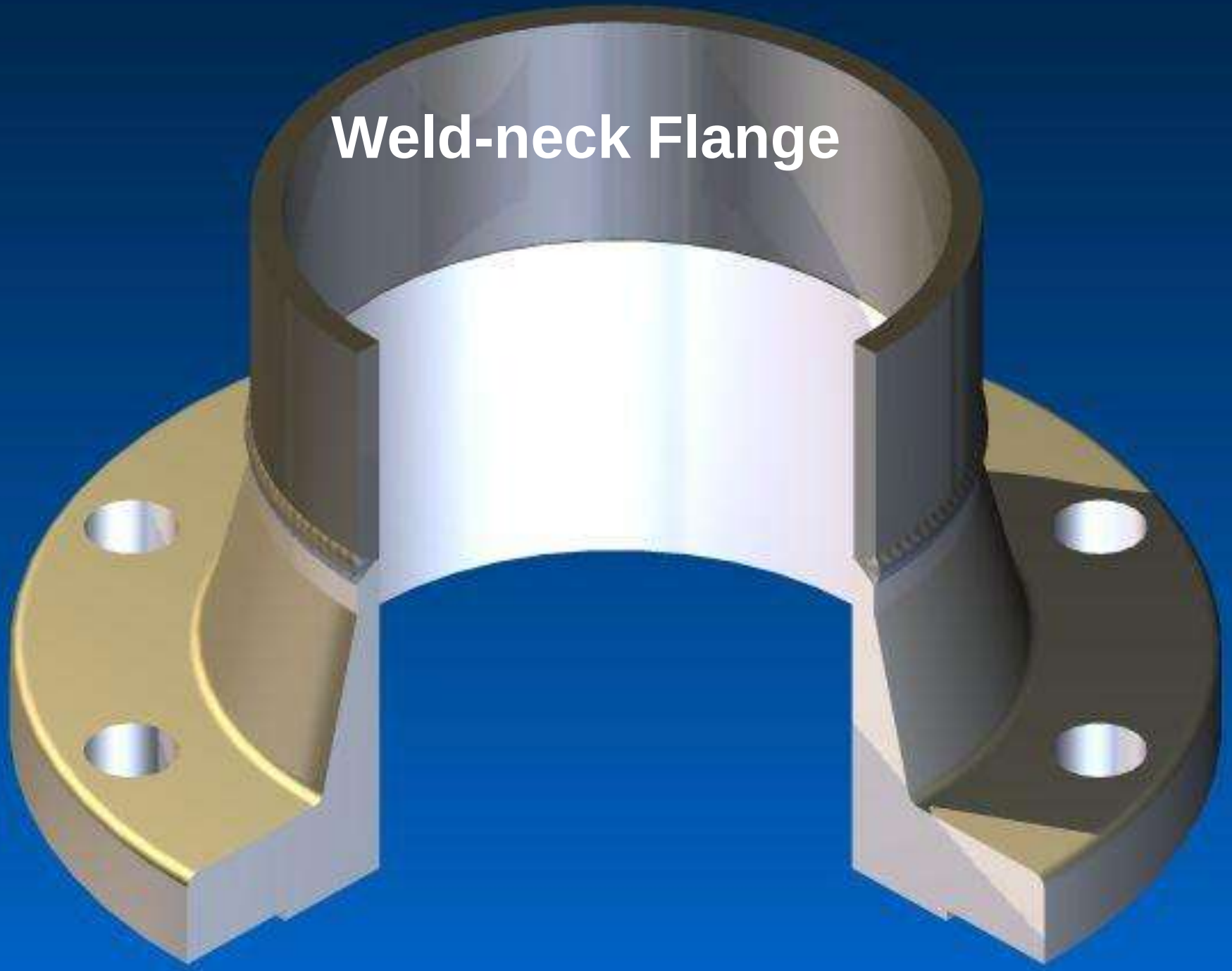
Threaded Flanges are used for special circumstances with their main advantage being that they can be attached to the pipe without welding. Sometimes a seal weld is also used in conjunction with the threaded connection.

A threaded flange or fitting is not suitable for a pipe system with thin wall thickness, because cutting thread on a pipe is not possible. Thus, thicker wall thickness must be chosen



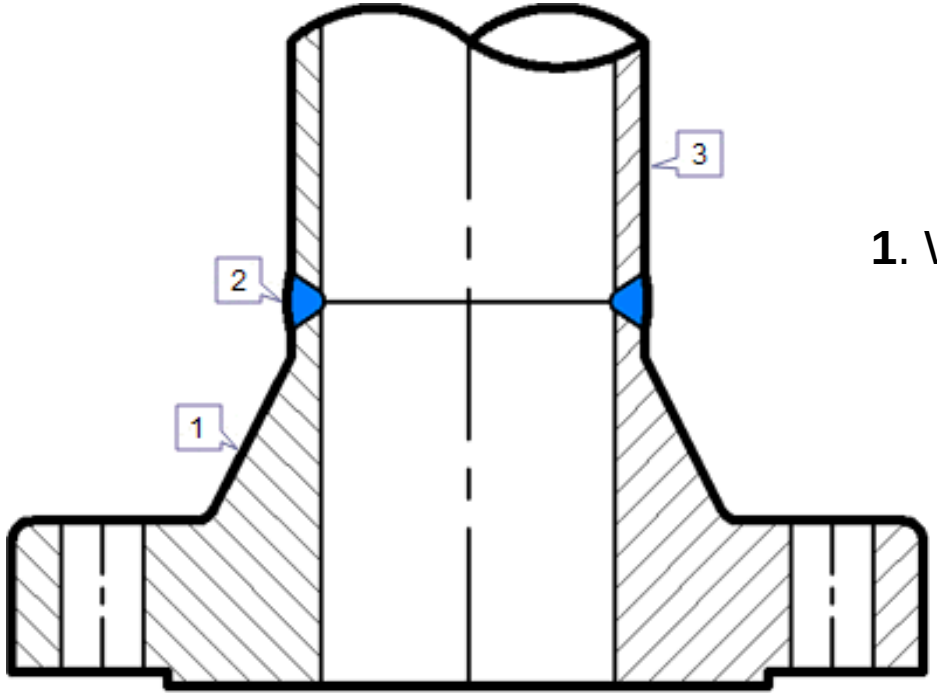
1. Threaded flange **2**. Thread **3**. Pipe or Fitting

Weld-neck Flange



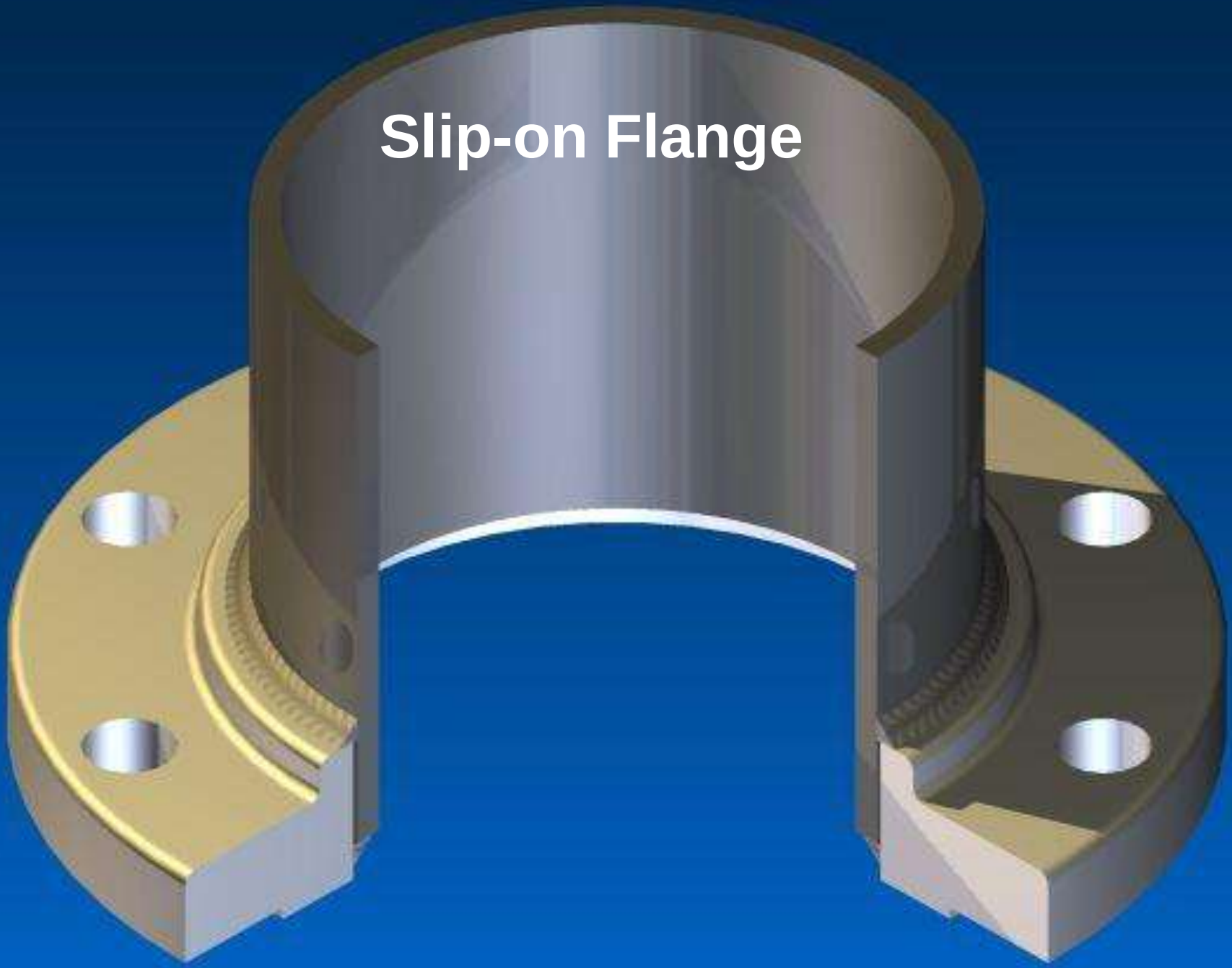
These flanges are bored to match the inside diameter of the mating pipe or fitting so there will be no restriction of product flow. This prevents turbulence at the joint and reduces erosion. They also provide excellent stress distribution through the tapered hub and are easily radiographed for flaw detection.

This flange type will be welded to a pipe or fitting with a single full penetration, V weld (Buttweld).



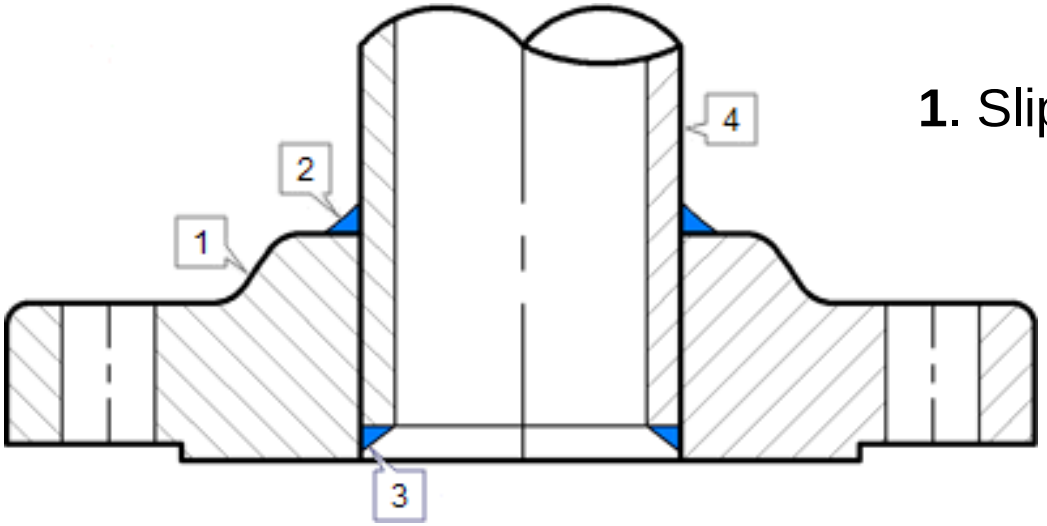
1. Weld Neck flange **2**. Butt Weld
3. Pipe or Fitting

Slip-on Flange



The connection with the pipe is done with 2 fillet welds, as well at the outside as also at the inside of the flange.

A disadvantage of the flange is, that principle always firstly a pipe must be welded and then just a fitting. A combination of flange and elbow or flange and tee is not possible, because named fittings have not a straight end, that complete slid in the Slip On flange.



1. Slip On flange **2**. Filled weld outside
3. Filled weld inside **4**. Pipe

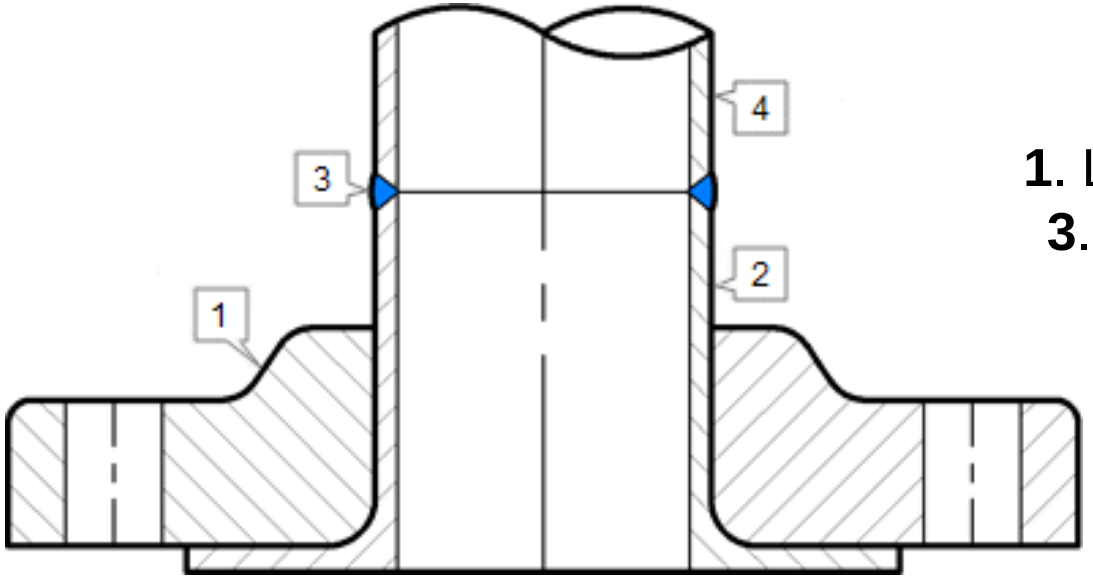
“Van-stone” Lap Flange

Lap Joint Flanges have all the same common dimensions as any other flange named on this page however it does not have a raised face, they used in conjunction with a "Lap Joint Stub End“.

Lap Joint flanges have certain special advantages:

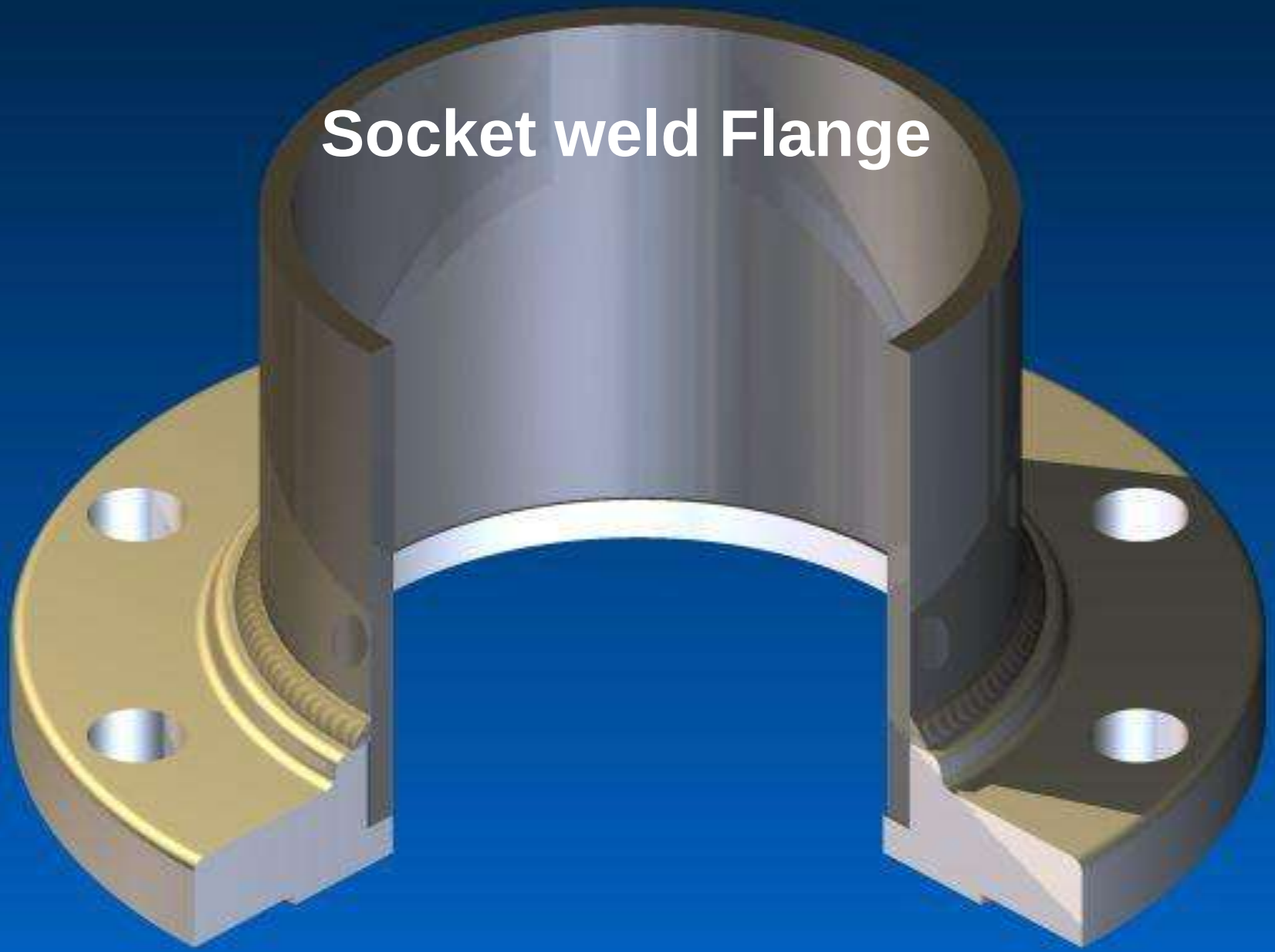
Freedom to swivel around the pipe facilitates the lining up of opposing flange bolt holes.

Lack of contact with the fluid in the pipe often permits the use of inexpensive carbon steel flanges with corrosion resistant pipe.



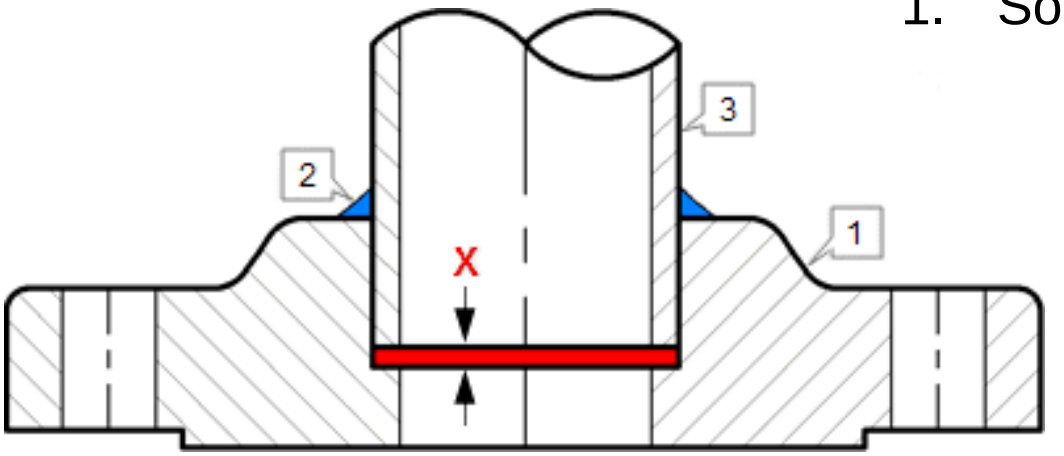
1. Lap Joint flange **2**. Stub End
3. Butt weld **4**. Pipe or Fitting

Socket weld Flange



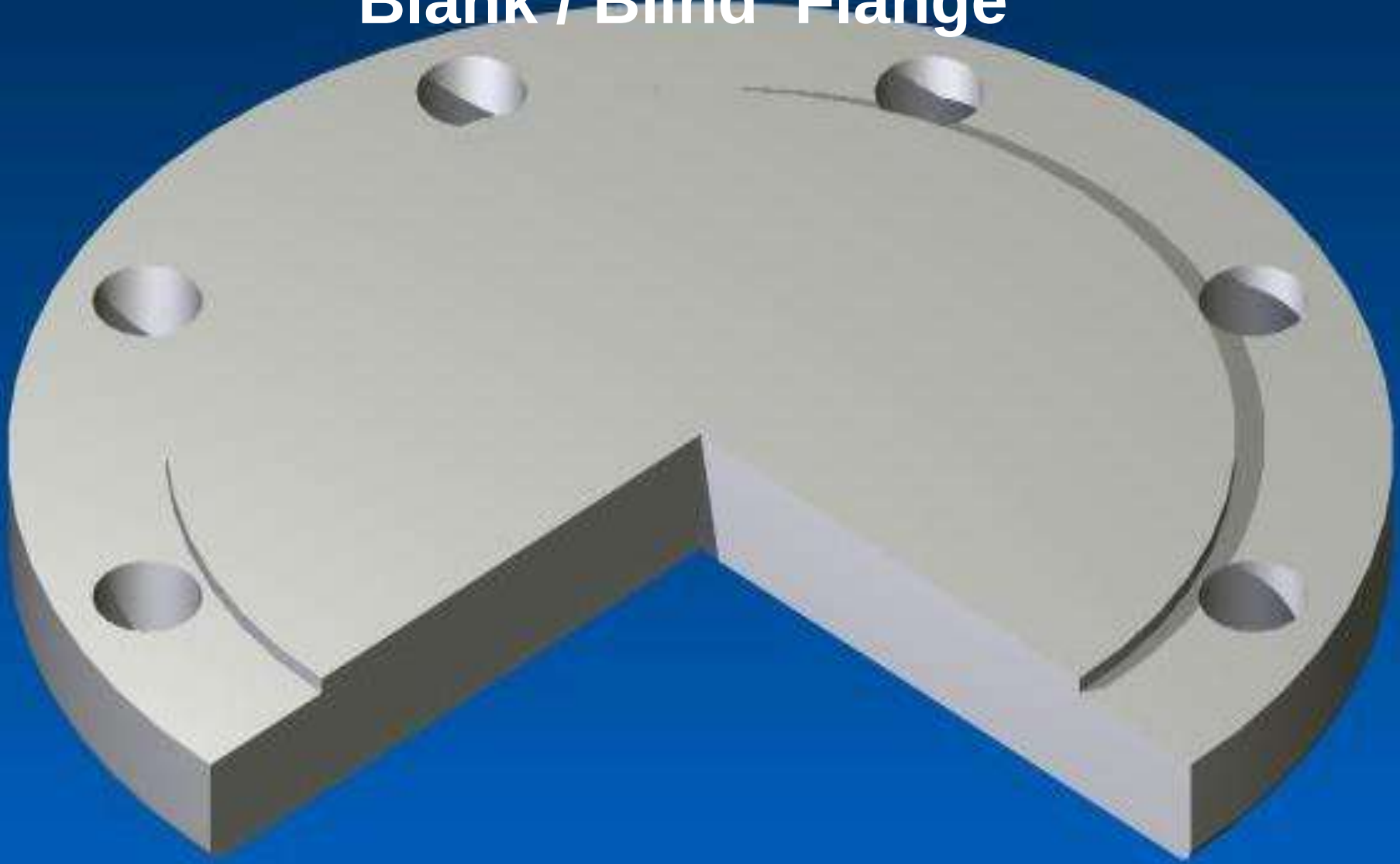
Socket Weld flanges were initially developed for use on small-size high pressure piping.
The connection with the pipe is done with 1 fillet weld, at the outside of the flange. But before welding, a space must be created between flange or fitting and pipe.

The disadvantage of this flange is right the gap, that must be made. By corrosive products, and mainly in stainless steel pipe systems, the crack between pipe and flange can give corrosion problems. In some processes this flange is also not allowed

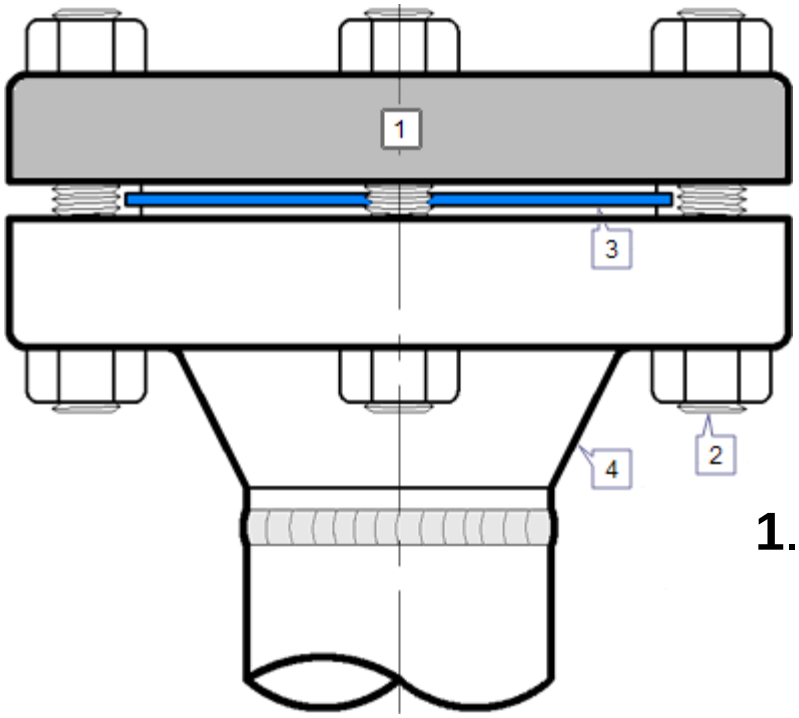


1. Socket Weld flange **2**. Filled weld
3. Pipe
X = Expansion gap

Blank / Blind Flange



Blind Flanges are manufactured without a bore and used to blank off the ends of piping, Valves and pressure vessel openings.
From the standpoint of internal pressure and bolt loading, blind flanges, particularly in the larger sizes, are the most highly stressed flange types.

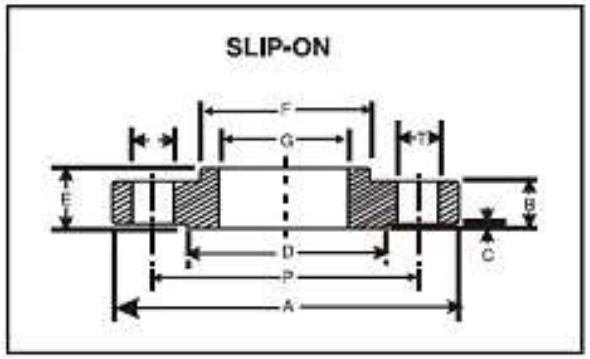


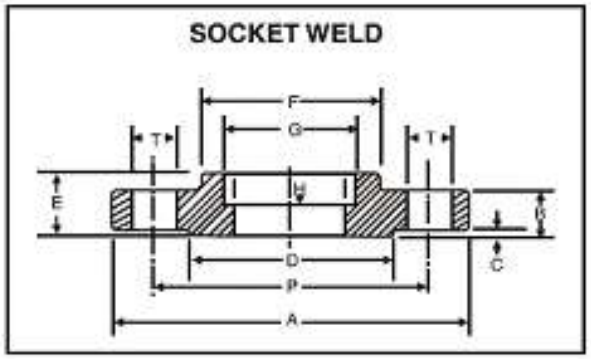
1. Blind flange **2**. Stud Bolt **3**. Gasket **4**. Other flange

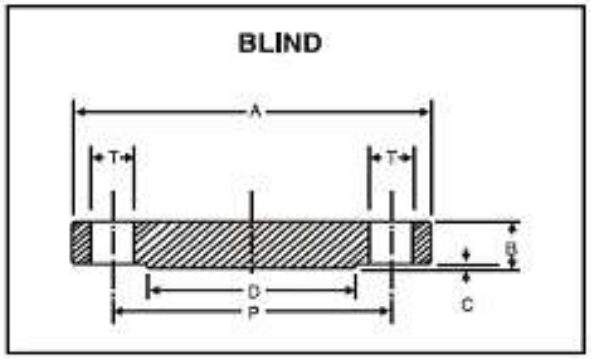
Flanges

Flanges, like pipes, operate under varying conditions of temperature and pressure.

Standard maximum operating pressure and temperature ratings have been established for flanges and are expressed in pounds per square inch.

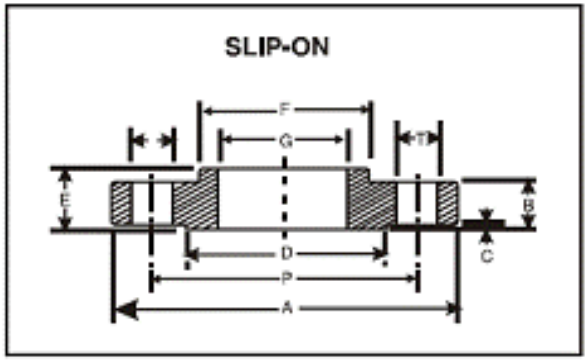


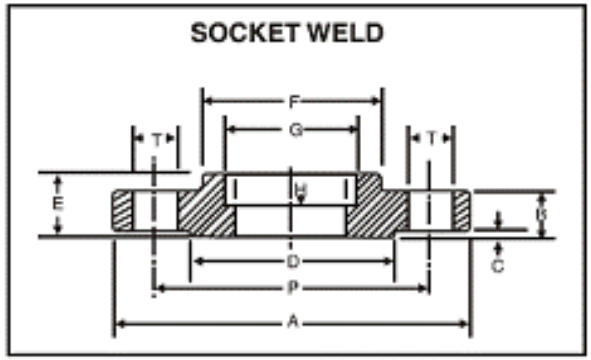


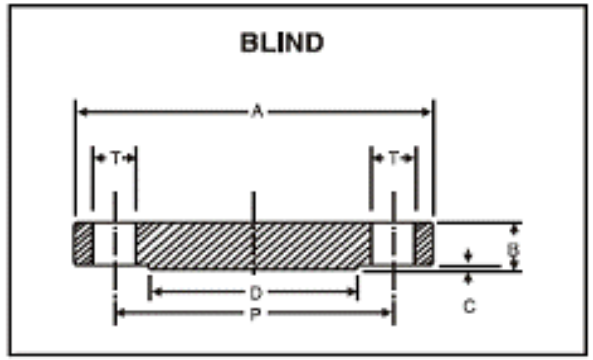


DIMENSIONS OF CLASS 150 FLANGES AS PER ANSI B 16.5

N.B.	A	B	C	D	E	F	G	H	J	K	L	M	N	O	P	R	T	No.of Holes
15	89	11.1	1.6	35	16	30	22.4	9.5	21.3	-	48	16	16	23.0	60.3	3.0	15.9	4
20	98	12.7	1.6	43	16	38	27.7	11.0	26.7	-	52	16	16	28.0	69.8	3.0	15.9	4
25	108	14.3	1.6	51	17	49	34.5	12.5	33.4	-	56	17	17	35.0	79.4	3.0	15.9	4
32	117	15.9	1.6	64	21	59	43.2	14.5	42.2	-	57	21	21	43.5	88.9	5.0	15.9	4
40	127	17.5	1.6	73	22	65	49.5	16.0	48.3	-	62	22	22	50.0	98.4	6.5	15.9	4
50	152	19.0	1.6	92	25	78	62.0	17.5	60.3	-	64	25	25	62.5	120.6	8.0	19.0	4
65	178	22.2	1.6	105	29	90	74.7	19.0	73.0	-	70	29	29	75.5	139.7	8.0	19.0	4
80	190	23.8	1.6	127	30	108	90.7	20.5	88.9	-	70	30	30	91.5	152.4	9.5	19.0	4
90	216	23.8	1.6	140	32	122	103.4	-	101.6	-	71	32	32	104.0	177.8	9.5	19.0	8
100	229	23.8	1.6	157	33	135	116.1	-	114.3	-	76	33	33	117.0	190.5	11.0	19.0	8
125	254	23.8	1.6	186	37	164	143.8	-	141.3	-	89	37	37	145.0	215.9	11.0	22.2	8
150	279	25.4	1.6	216	40	192	170.7	-	168.3	-	89	40	40	171.0	241.3	12.5	22.2	8
200	343	28.6	1.6	270	44	246	221.5	-	219.1	-	102	44	44	222.0	293.4	12.5	22.2	8
250	406	30.2	1.6	324	49	305	276.4	-	273.0	-	102	49	49	277.0	362.0	12.5	25.4	12
300	483	31.8	1.6	381	56	365	327.2	-	323.9	-	114	56	56	328.0	431.8	12.5	25.4	12
350	533	34.9	1.6	413	57	400	359.2	-	355.6	-	127	57	79	360.0	476.2	12.5	28.6	12
400	597	36.5	1.6	470	64	457	410.5	-	406.4	-	127	64	87	411.0	539.8	12.5	28.6	16
450	635	39.7	1.6	533	68	505	461.8	-	457.2	-	140	68	97	462.0	577.8	12.5	31.8	16
500	698	42.9	1.6	584	73	559	513.1	-	508.0	-	144	73	103	514.0	635.0	12.5	31.8	20
600	813	47.6	1.6	692	83	664	616.0	-	609.6	-	152	83	111	616.0	749.3	12.5	34.9	20

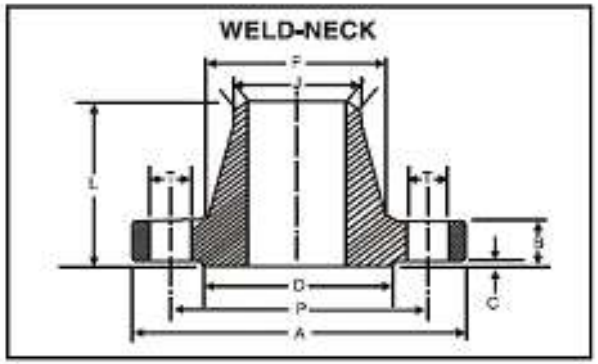


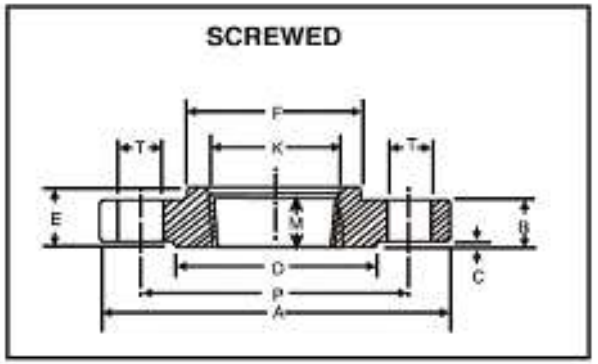


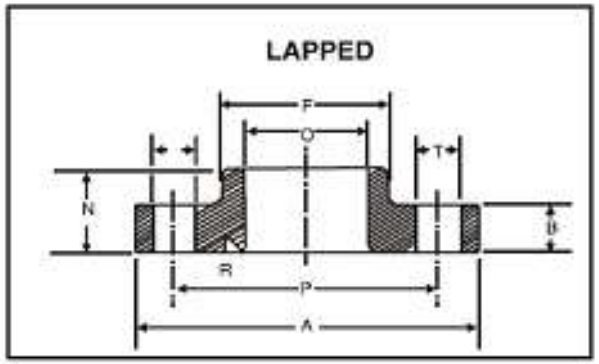


DIMENSIONS OF CLASS 300 FLANGES AS PER ANSI B 16.5

N.B.	A	B	C	D	E	F	G	H	J	K	L	M	N	O	P	R	T	No.of Holes
15	95	14.3	1.6	35	22	38	22.4	9.5	21.3	23.5	52	16	22	23.0	66.7	3.0	15.9	4
20	117	15.9	1.6	43	25	48	27.7	11.0	26.7	29.0	57	16	25	28.0	82.6	3.0	19.0	4
25	124	17.5	1.6	51	27	54	34.5	12.5	33.4	36.0	62	17	27	35.0	88.9	3.0	19.0	4
32	133	19.0	1.6	64	27	64	43.2	14.5	42.2	44.5	65	21	27	43.5	98.4	5.0	19.0	4
40	156	20.6	1.6	73	30	70	49.5	16.0	48.3	50.5	68	22	30	50.0	114.3	6.5	22.2	4
50	165	22.2	1.6	92	33	84	62.0	17.5	60.3	63.5	70	29	33	62.5	127.0	8.0	19.0	8
65	190	25.4	1.6	105	38	100	74.7	19.0	73.0	76.0	76	32	38	75.5	149.2	8.0	22.2	8
80	210	28.6	1.6	127	43	117	90.7	20.5	88.9	92.0	79	32	43	91.5	168.3	9.5	22.2	8
90	229	30.2	1.6	140	44	133	103.4	-	101.6	105.0	81	37	44	104.0	184.2	9.5	22.2	8
100	254	31.8	1.6	157	48	146	116.1	-	114.3	118.0	86	37	48	117.0	200.0	11.0	22.2	8
125	279	34.9	1.6	186	51	178	143.8	-	141.3	145.0	98	43	51	145.0	235.0	11.0	22.2	8
150	318	36.5	1.6	216	52	206	170.7	-	168.3	171.0	98	46	52	171.0	269.9	12.5	22.2	12
200	381	41.3	1.6	270	62	260	221.5	-	219.1	222.0	111	51	62	222.0	330.2	12.5	25.4	12
250	444	47.6	1.6	324	67	321	276.4	-	273.0	276.0	117	56	95	277.0	387.4	12.5	28.6	16
300	521	50.8	1.6	381	73	375	327.2	-	323.9	329.0	130	60	102	328.0	450.8	12.5	31.8	16
350	584	54.0	1.6	413	76	425	359.2	-	355.6	360.0	143	64	111	360.0	514.4	12.5	31.8	20
400	648	57.2	1.6	470	83	483	410.5	-	406.4	411.0	146	68	121	411.0	571.5	12.5	34.9	20
450	711	60.3	1.6	533	89	533	461.8	-	457.2	462.0	159	70	130	462.0	628.6	12.5	34.9	24
500	775	63.5	1.6	584	95	587	513.1	-	508.0	513.0	162	73	140	514.0	685.8	12.5	34.9	24
600	914	69.8	1.6	692	106	702	616.0	-	609.6	614.0	168	83	152	616.0	812.8	12.5	41.3	24

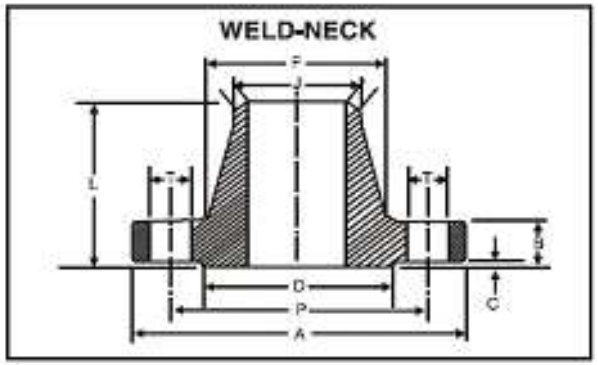


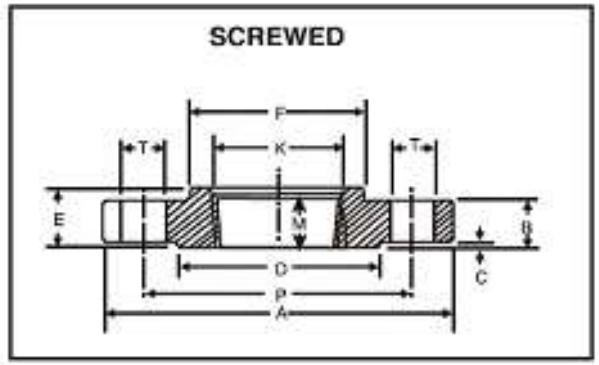


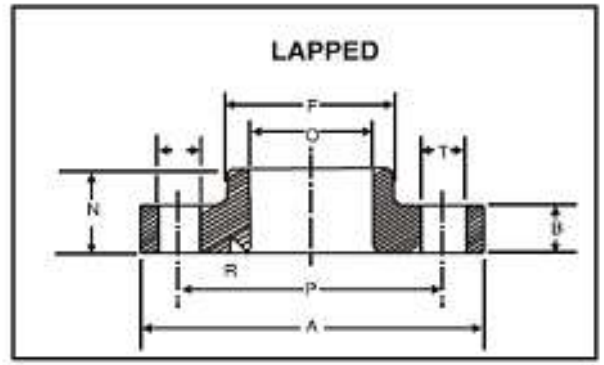


DIMENSIONS OF CLASS 600 FLANGES AS PER ANSI B 16.5

N.B.	A	B	C	D	E	F	G	H	J	K	L	M	N	O	P	R	T	No.of Holes
15	95	14.3	6.4	35	22	38	22.4	9.5	21.3	23.5	52	16	22	23.0	66.7	3.0	15.9	4
20	117	15.9	6.4	43	25	48	27.7	11.0	26.7	29.0	57	16	25	28.0	82.6	3.0	19.0	4
25	124	17.5	6.4	51	27	54	34.5	12.5	33.4	36.0	62	17	27	35.0	88.9	3.0	19.0	4
32	133	20.6	6.4	64	29	64	43.2	14.5	42.2	44.5	67	21	29	43.5	98.4	5.0	19.0	4
40	156	22.2	6.4	73	32	70	49.5	16.0	48.3	50.5	70	22	32	50.0	114.3	6.5	22.2	4
50	165	25.4	6.4	92	37	84	62.0	17.5	60.3	63.5	73	29	37	62.5	127.0	8.0	19.0	8
65	190	28.6	6.4	105	41	100	74.7	19.0	73.0	76.0	79	32	41	75.5	149.2	8.0	22.2	8
80	210	31.8	6.4	127	46	117	90.7	20.5	88.9	92.0	83	35	46	91.5	168.3	9.5	22.2	8
90	229	34.9	6.4	140	49	133	103.4	-	101.6	105.0	86	40	49	104.0	184.2	9.5	25.4	8
100	273	38.1	6.4	157	54	152	116.1	-	114.3	118.0	102	41	54	117.0	215.9	11.0	25.4	8
125	330	44.4	6.4	186	60	189	143.8	-	141.3	145.0	114	48	60	145.0	266.7	11.0	28.6	8
150	356	47.6	6.4	216	67	222	170.7	-	168.3	171.0	117	51	67	171.0	292.1	12.5	28.6	12
200	419	55.6	6.4	270	76	273	221.5	-	219.1	222.0	133	57	76	222.0	349.2	12.5	31.8	12
250	508	63.5	6.4	324	86	343	276.4	-	273.0	276.0	152	65	111	277.0	431.8	12.5	34.9	16
300	559	66.7	6.4	381	92	400	327.2	-	323.9	329.0	156	70	117	328.0	489.0	12.5	34.9	20
350	603	69.8	6.4	413	94	432	359.2	-	355.6	360.0	165	73	127	360.0	527.0	12.5	38.1	20
400	686	76.2	6.4	470	106	495	410.5	-	406.4	411.0	178	78	140	411.0	603.2	12.5	41.3	20
450	743	82.6	6.4	533	117	546	461.8	-	457.2	462.0	184	79	152	462.0	654.0	12.5	44.4	20
500	813	88.9	6.4	584	122	610	513.1	-	508.0	513.0	190	83	165	514.0	723.9	12.5	44.4	24
600	940	101.6	6.4	692	140	718	616.0	-	609.6	614.0	203	92	184	616.0	838.2	12.5	50.8	24





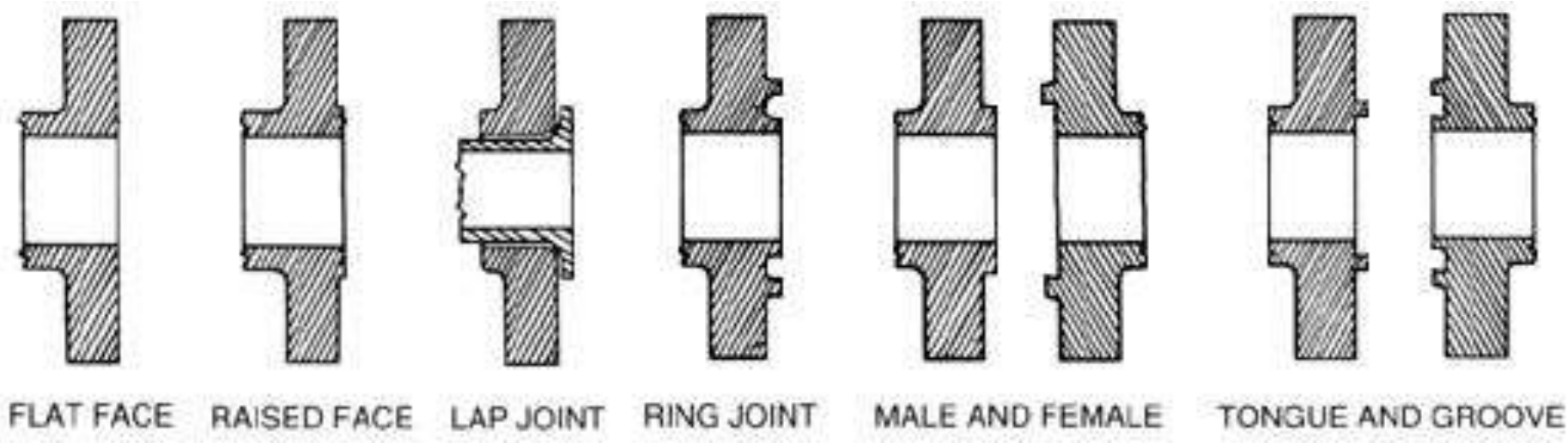


DIMENSIONS OF CLASS 1500 FLANGES AS PER ANSI B 16.5

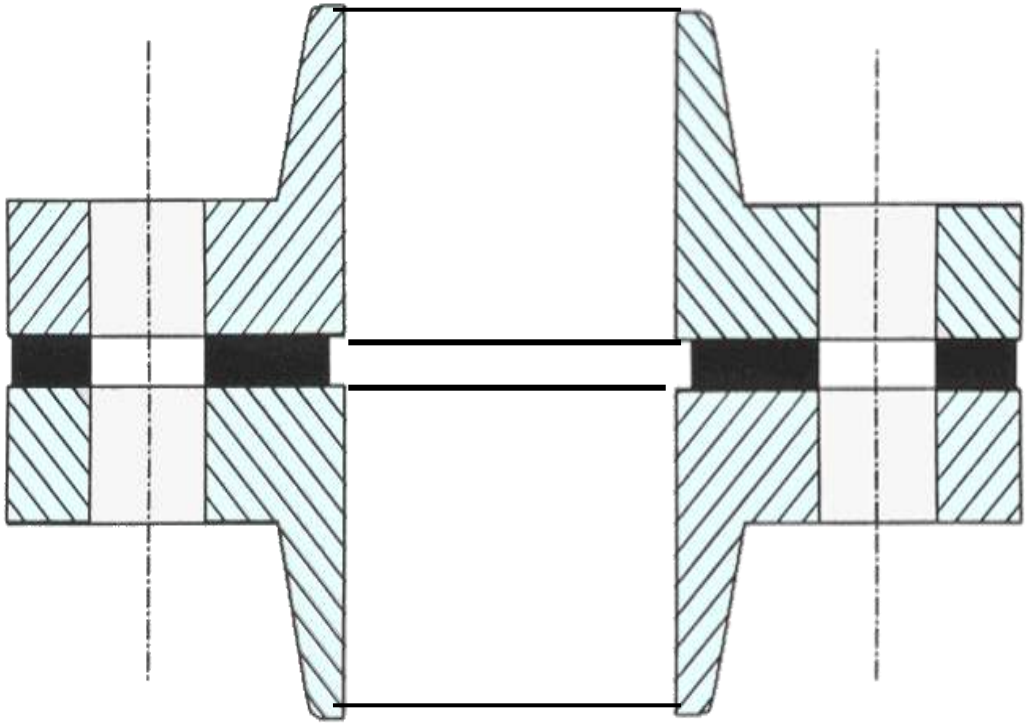
N.B.	A	B	C	D	E	F	G	H	J	K	L	M	N	O	P	R	T	No.of Holes
15	121	22.2	6.4	35	32	38	22.4	9.5	21.3	23.5	60	22	32	23.0	82.6	3.0	22.2	4
20	130	25.4	6.4	43	35	44	27.7	11.0	26.7	29.0	70	25	35	28.0	88.9	3.0	22.2	4
25	149	28.6	6.4	51	41	52	34.5	12.5	33.4	36.0	73	29	41	35.0	101.6	3.0	25.4	4
32	159	28.6	6.4	64	41	64	43.2	14.5	42.2	44.5	73	30	41	43.5	111.1	5.0	25.4	4
40	178	31.8	6.4	73	44	70	49.5	16.0	48.3	50.5	83	32	44	50.0	123.8	6.5	28.6	4
50	216	38.1	6.4	92	57	105	62.0	17.5	60.3	63.5	102	38	57	62.5	165.1	8.0	25.4	8
65	244	41.3	6.4	105	64	124	74.7	19.0	73.0	76.0	105	48	64	75.5	190.5	8.0	28.6	8
80	267	47.6	6.4	127	73	133	-	-	88.9	92.0	117	51	73	91.5	203.2	9.5	31.8	8
100	311	54.0	6.4	157	91	162	-	-	114.3	118.0	124	57	91	117.0	241.3	11.0	34.9	8
125	325	73.0	6.4	186	105	197	-	-	141.3	145.0	156	64	105	145.0	292.1	11.0	41.3	8
150	394	82.6	6.4	216	119	229	-	-	168.3	171.0	171	70	119	171.0	317.5	12.5	38.1	12
200	483	92.1	6.4	270	143	292	-	-	219.1	222.0	213	75	143	222.0	393.7	12.5	44.4	12
250	584	108.0	6.4	324	159	368	-	-	273.0	276.0	254	84	178	277.0	482.6	12.5	50.8	12
300	673	123.8	6.4	381	181	451	-	-	323.9	329.0	283	92	219	328.0	571.5	12.5	54.0	16
350	749	133.4	6.4	413		495	-	-	356.6	-	298	-	241	360.0	635.0	12.5	60.3	16
400	826	146.1	6.4	470		552	-	-	406.4	-	311	-	260	411.0	704.8	12.5	66.7	16
450	914	161.9	6.4	533		597	-	-	457.2	-	327	-	276	462.0	774.7	12.5	73.0	16
500	984	178.0	6.4	584		641	-	-	508.0	-	356	-	292	514.0	831.8	12.5	79.4	16
600	1168	203.0	6.4	692		762	-	-	609.6	-	406	-	330	616.0	990.6	12.5	92.0	16

Flange joint face

The flange faces are also made to standardized dimensions and are typically "flat face", or "raised face" but other types are available.

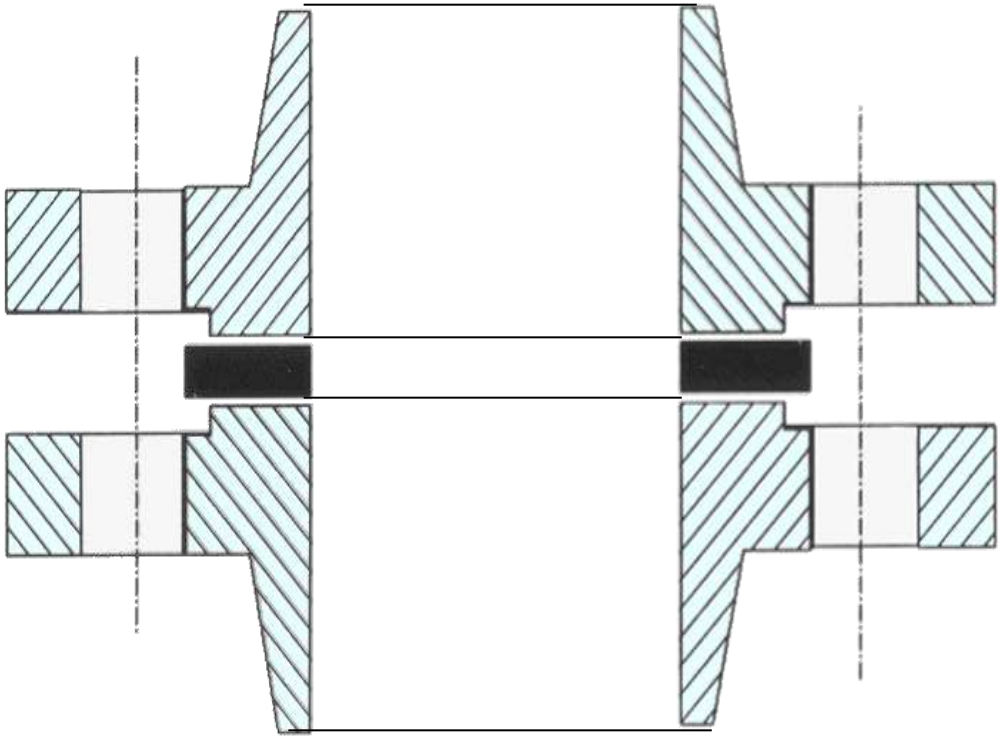


Flat Face



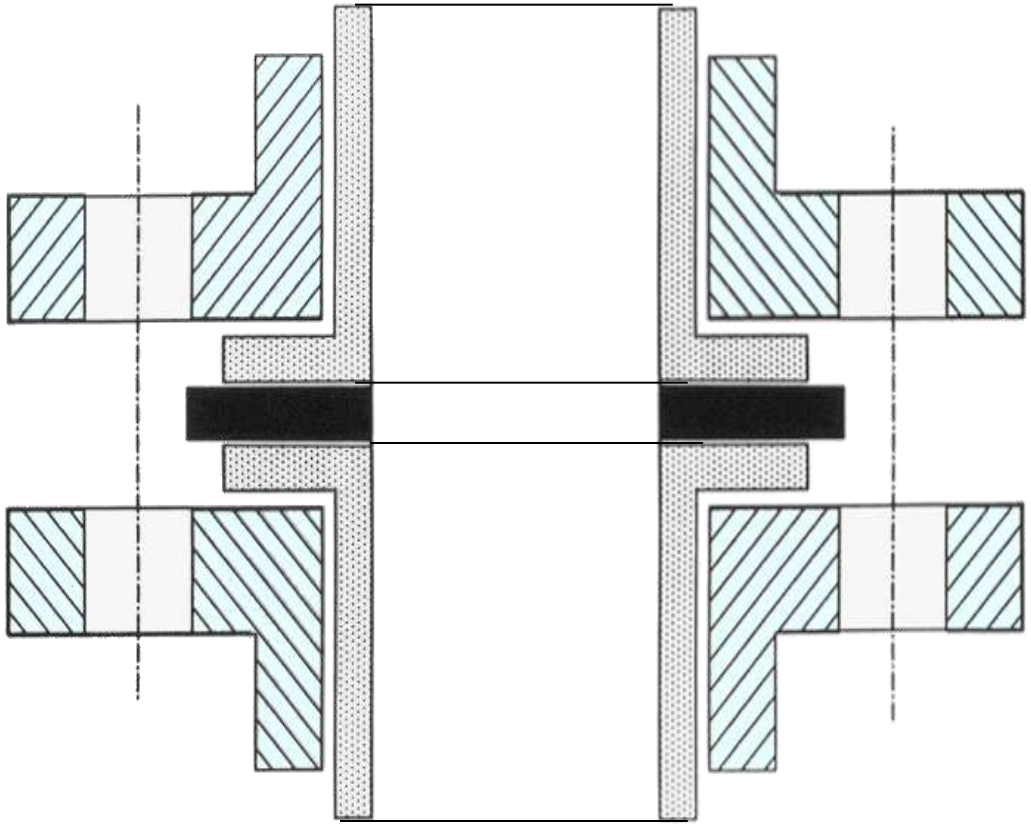
Flat Face (FF) – Sealing is also by compression of a flat non-metallic gasket (very rarely a flat metallic gasket), between the phonographic/ concentric grooved surfaces of the mating FF flanges. The gasket fits over the entire face of the flange. FF flanges are normally used on the least arduous of duties such as low pressure water drains and in particular when using cast iron, cunifer or bronze alloy,

Raised Face



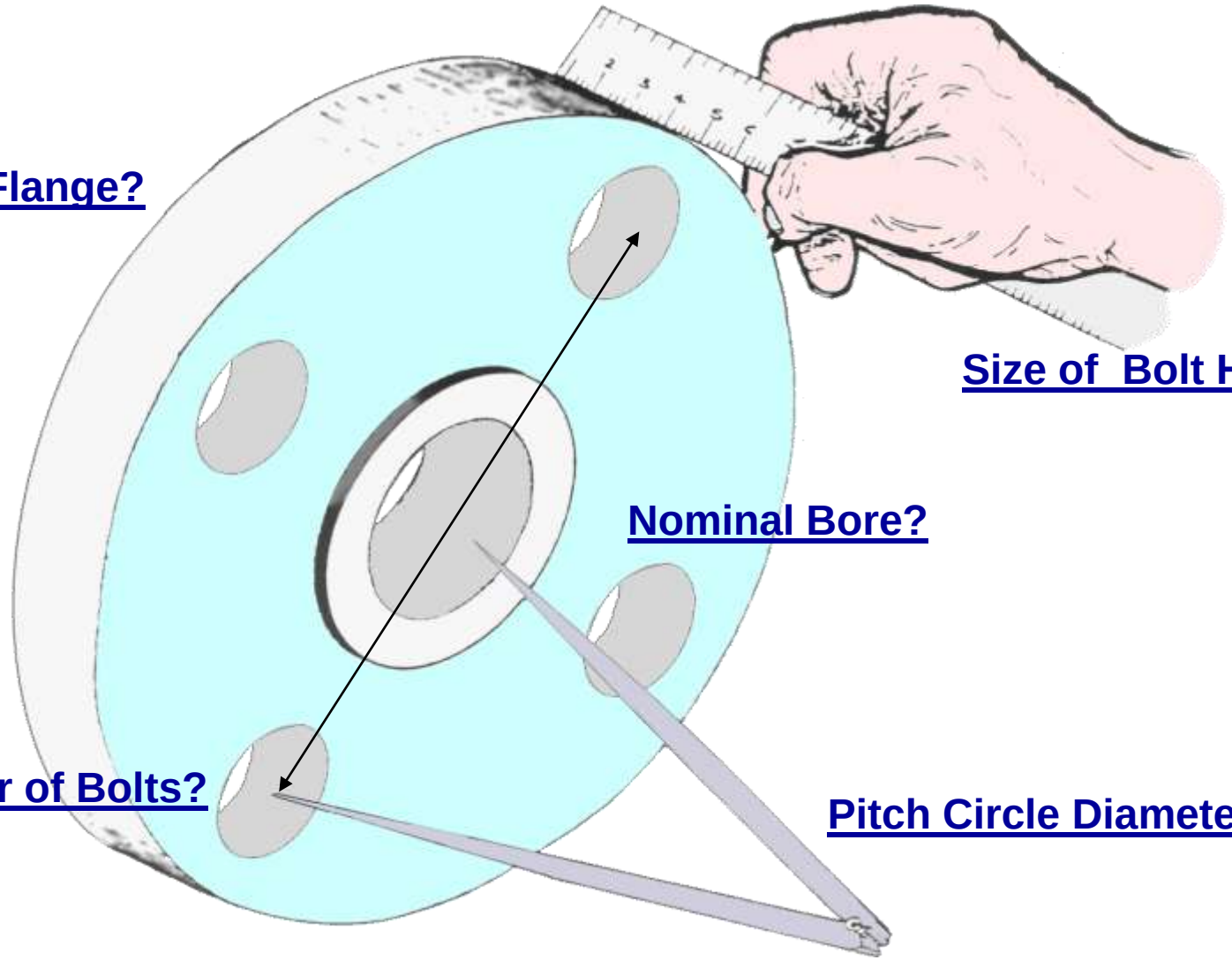
Raised Face (RF) – Sealing on a RF flange is by a flat non-metallic gasket (or a flat metallic gasket for special applications), which fits within the bolts of the flange. The facing on a RF flange has a concentric or phonographic groove with a controlled surface finish. If the grooves are too deep (or a rough surface finish), then high compression is required to flow the relatively soft gasket material into the grooves.

Lapped



Sealing on a Lap flange is by a flat non-metallic gasket, which fits within the bolts of the flange. A full face or IBC gasket can be used dependant on the application.

Flange measurements



Diameter of Flange?

Size of Bolt Holes?

Nominal Bore?

Number of Bolts?

Pitch Circle Diameter?

Gaskets

A gasket of soft compressible material is fitted between two flanges to ensure a leak tight joint.

It is placed between the joint surfaces of the flanges and forms a seal when the joint is tightened.

Different types of gaskets, and materials from which gaskets may be made, are available to suit specified joint requirements.

Gaskets - Materials and Types

Gasket

A gasket is a compressible material, or a combination of materials, which when clamped between two stationary members prevents the passage of the fluid across these members.

To prevent passage of fluid, the gasket must be able to flow into (and fill) any irregularities in the mating surfaces being sealed, while at the same time be sufficiently resilient to resist extrusion and creep under operating conditions.

The seal is effected by the action of force upon the gasket surface (usually by bolts), which compresses the gasket, causing it to flow into any surface imperfections.

Depending on the application, the main requirement of a gasket may be any or all of the following:

Hardness and Compressibility

Resistance to Heat

Resistance to Pressure

Resistance to Corrosive Action

It is important that only the gasket specified is fitted otherwise the joint may fail after tightening.

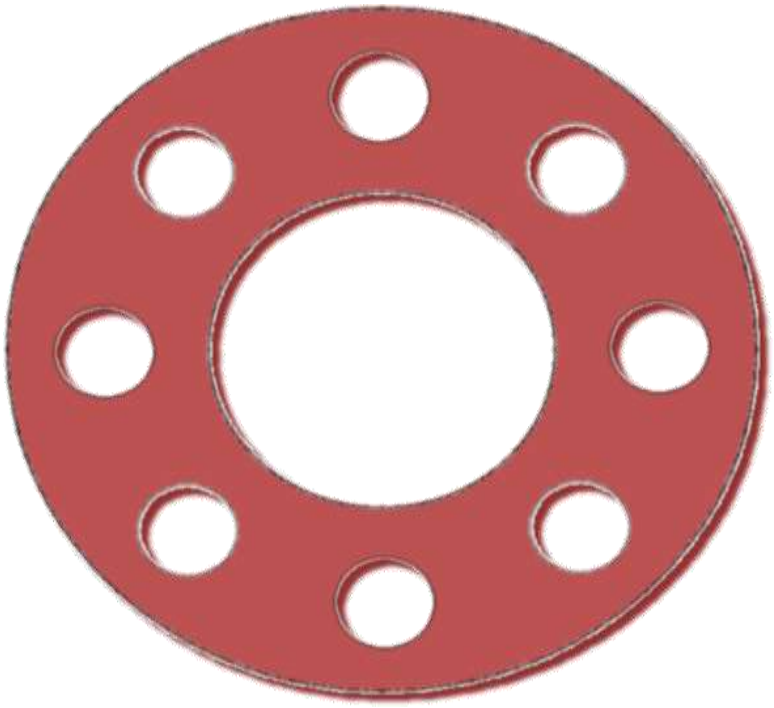
A gasket fills the microscopic spaces and irregularities of the flange faces, and then it forms a seal that is designed to keep liquids and gases.

Materials for gaskets can typically be divided into three main categories: Non-metallic types, Semi-metallic types, Metallic types.

Design Considerations When Selecting Joints

- Line Product
- Temperature
- Pressure
- Pipline Materials
- Pipe Capacity
- Corrosion / Erosion
- Insulation Against Thermal Losses
- Friction
- Pipe Fittings
- Pipe Stresses i.e. Supports
- Pressure Drop

Gaskets



Full-Face Gaskets

The full-face gasket is used with full-face flanges.

The connecting bolts pass through holes in the flanges and gasket.

Full-face gaskets are made from compressed fibre*, or compressed fibre* on a wire mesh or synthetic rubber.

*** Asbestos is now being replaced with a safe alternative material.**

Joints

The type of joint to be used depends on certain things:

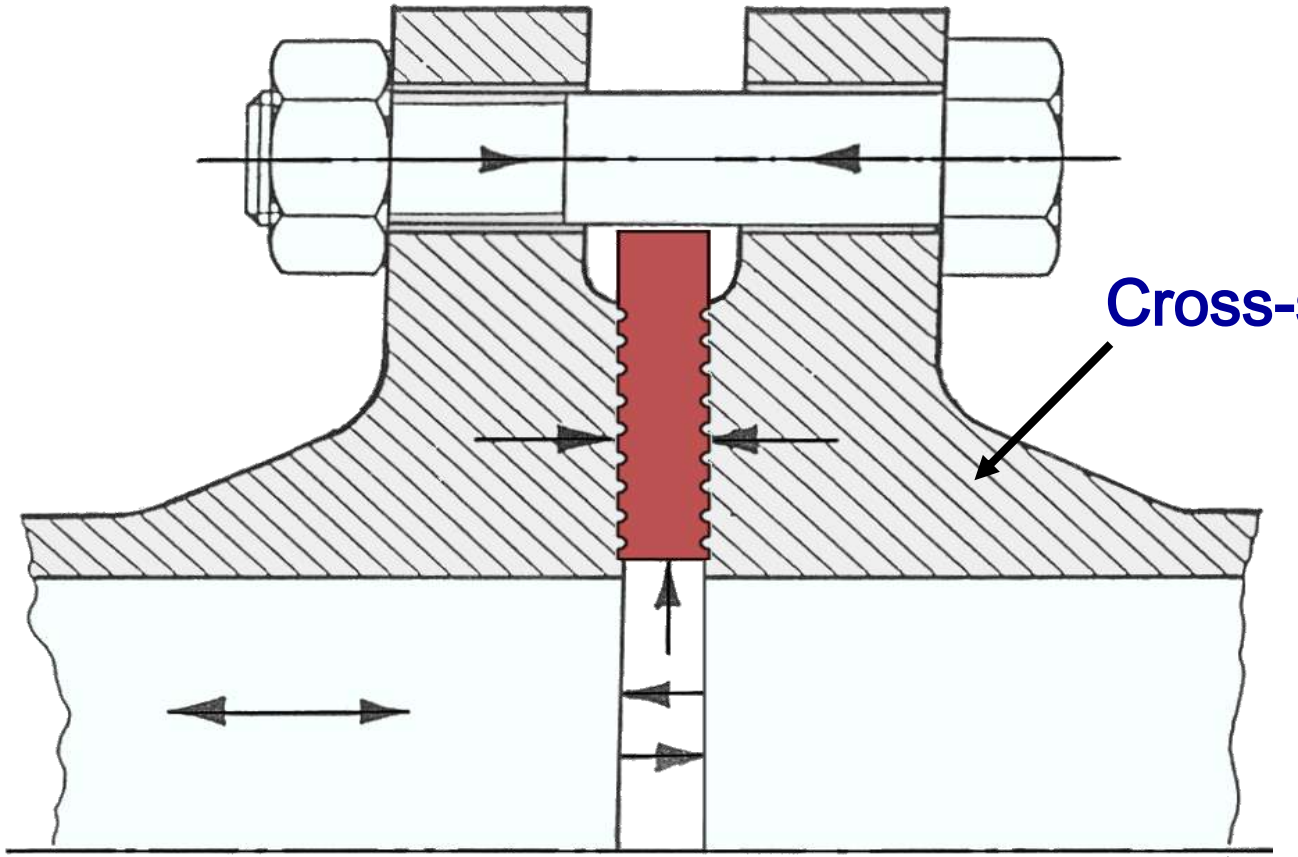
1. **Product.**
2. **Temperature.**
3. **Pressure.**
4. **Type of Flange Connection.**

Here Are Some Examples:

Product	Max (operating) Temp	Type of Flange	Type of Gasket
Hydrocarbons Non Corrosive Liquids and Gases (Except - LPG. Ethylene, Fuel Gas, Natural Gas.)	340	ASA 150/300 Raised Face	CAF Jointing Oil Resistant
	675	ASA 300/600 900/1500 Raised Face	Spiral Wound 316/CAF Fill
Steam Up to 35 kg/cm2	340	ASA 150/300 Raised Face	CAF Jointing Oil Resistant
Steam Up to 50 kg/cm2	400	ASA 300/600 Raised Face	Spiral Wound 316/CAF Fill

Joints

Forces being applied to a flanged joint

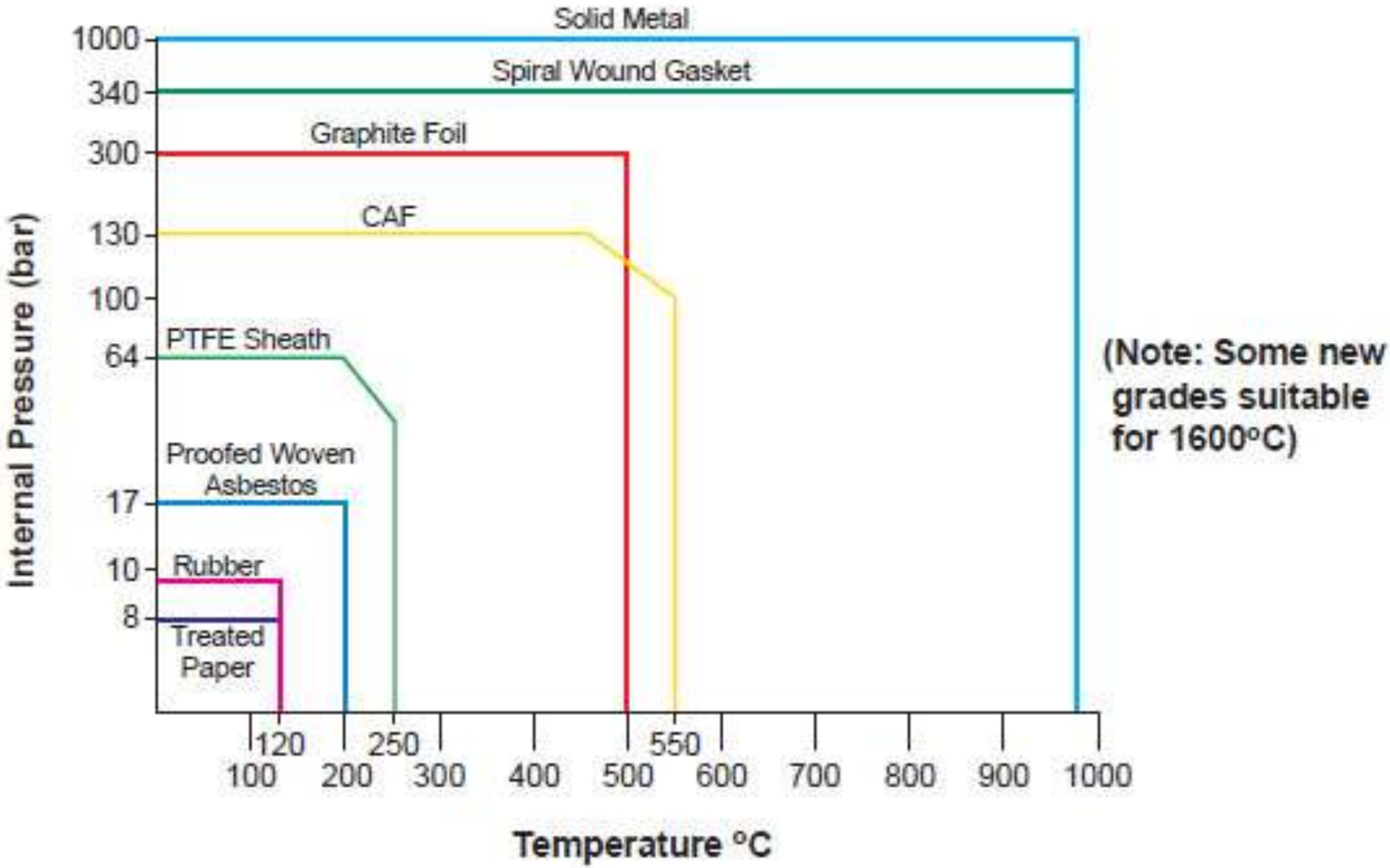


Gasket Categories (Types)

Depending on construction, gaskets can be classified into three main categories (types):

- soft (non-metallic)
- semi-metallic
- metallic

The mechanical characteristics and performance capabilities of these categories will vary extensively depending on the type of gasket selected and the materials from which it is manufactured.


Solid Metal
Spiral Wound Gasket
Graphite Foil
CAF
PTFE Sheath
Proofed Woven Asbestos
Rubber
Treated Paper
1000
340
300
130
100
64
17
10
8
120
250
550
100
200
300
400
500
600
700
800
900
1000
Internal Pressure (bar)
Temperature °C
(Note: Some new grades suitable for 1600°C)

Elastomeric materials

They are the “entry level” to sheet sealing products. More commonly, they act as the binder when compounded with various fibres and fillers.

They are made in various composition (hence performance) and are available in specification grade and commercial quality.

Butyl rubber (IIR, also known as isobutylene,isoprene)
An elastomer offering good resistance to ozone and gas permeation. Suitable for mild acids, alkalis and esters, but little resistance to oils and fuels.
BS 3227 Grades B60, B70.

Chlorosulphonated polyethylene
An elastomer with excellent chemical resistance against acids and alkalis. Good oil resistance. Outstanding fire protection properties.

Ethylene propylenediene (EPDM)
Elastomer which offers good resistance to ozone, steam, strong acids and alkalis, but is not suitable for solvents and aromatic hydrocarbons.
BS 6014 Grades EP60S, EP70S, EP80S.

Fibrous materials

Aramid

Aromatic amide fibre, offering high strength and stability, with medium temperature suitability. Raw fibres can fibrillate.

Asbestos

Since the 1890’s, the most common material used for sealing flanges, because of its ability to seal effectively over a broad range of service conditions. Now increasingly replaced by asbestos-free substitutes (mandatory in many locations).

Carbon fibre

High thermal conductivity ensures rapid heat dissipation and allows high temperature capability (except in oxidizing atmospheres). It has wide chemical resistance and may be used in the pH range 0 – 14. It is not suitable for oxidizing environments.

Cellulose

Natural fibre, suitable for low temperature and medium pressure applications. Raw fibres can fibrillate.

Glass

Inorganic complex of metal silicates. It offers good strength and moderate chemical resistance. Suitable for medium to high temperature applications. The fibres do not fibrillate.

Other materials

Flexible graphite

Following processing into its exfoliated form, the material is essentially pure graphite, typically over 95% elemental carbon. The material has a wide chemical resistance. It is suitable for exceptionally wide temperature range from up to 400 deg. C in oxidizing environments and under certain circumstances, to 2500° deg. C in inert conditions. It has excellent resistance to stress relaxation, even at elevated temperatures.

PTFE

Extremely wide chemical resistance (PTFE is attacked only by molten alkali metals and fluorine gas), with excellent anti-stick and dielectric properties. Material has high compressibility, which allows it to conform well to flange surface irregularities. Easy to handle. Low permeability. Extremely low coefficient of friction. Susceptible to degradation by radiation. It can be prone to relaxation and creep

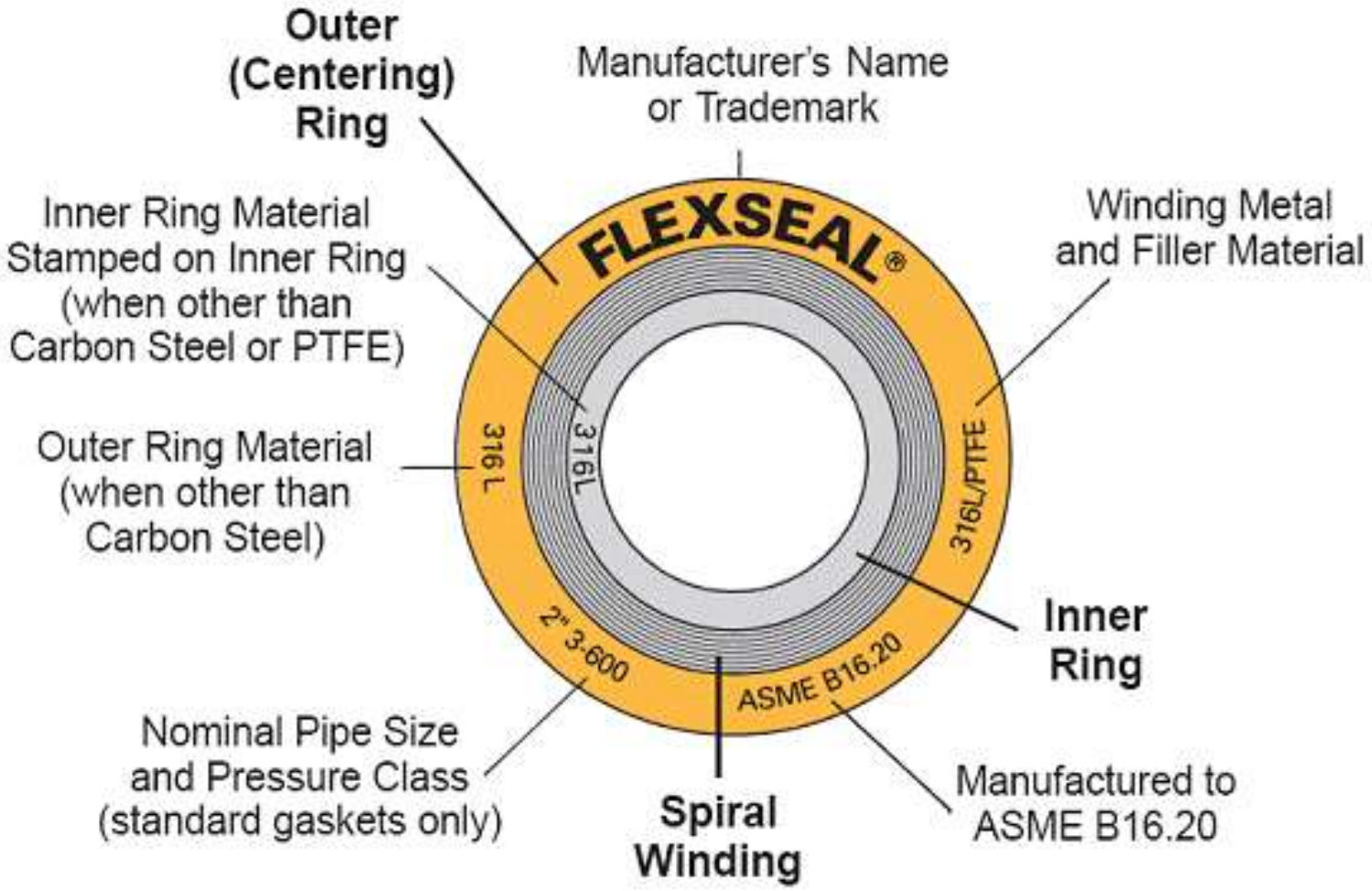
Semi-metallic gaskets:

They are composite gaskets consisting of both metallic and non-metallic materials. The metal generally provides the strength and resilience to the gasket.

They are suitable for both low and high temperature and pressure applications.

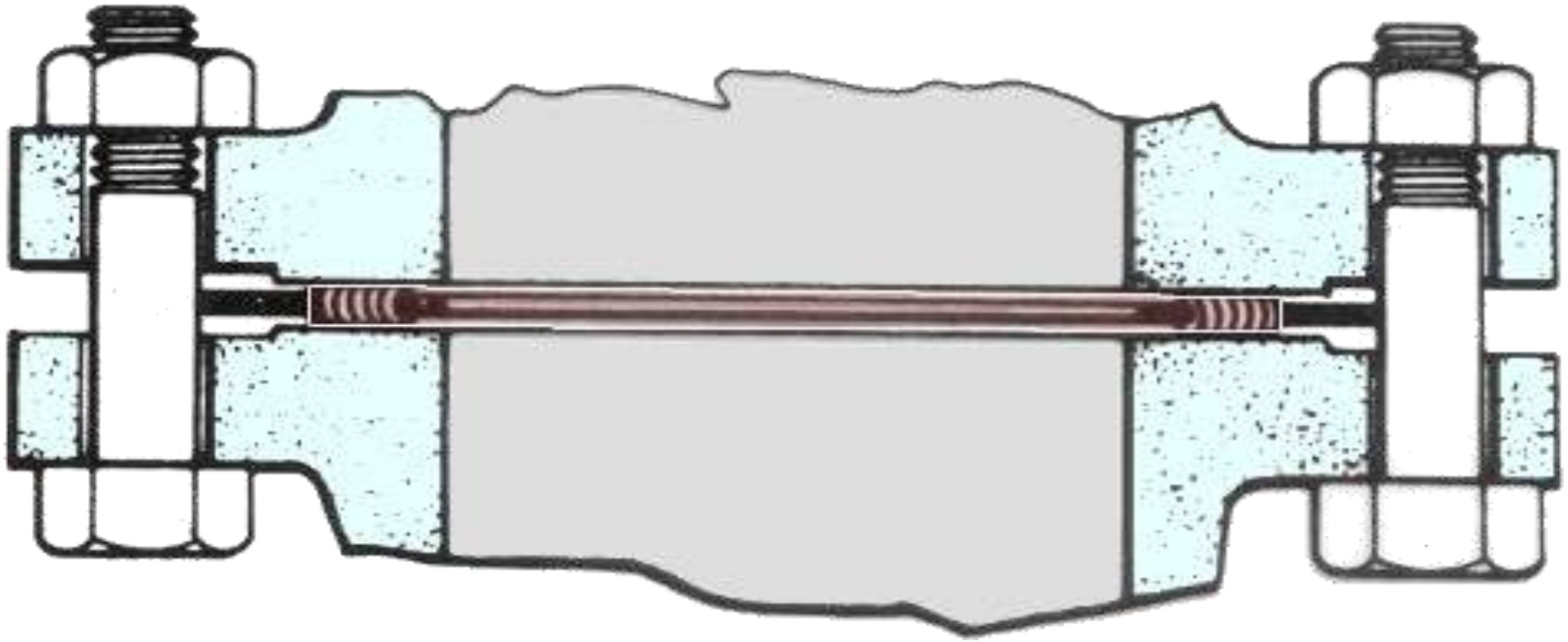
Types include: Kammprofile, metal eyelet, metal jacketed, metal reinforced soft gaskets (tanged graphite, wire reinforced compressed asbestos fibre materials, etc.), corrugated metallic and spiral wound gaskets.

Spiral wound gaskets



2) Spiral-wound gaskets

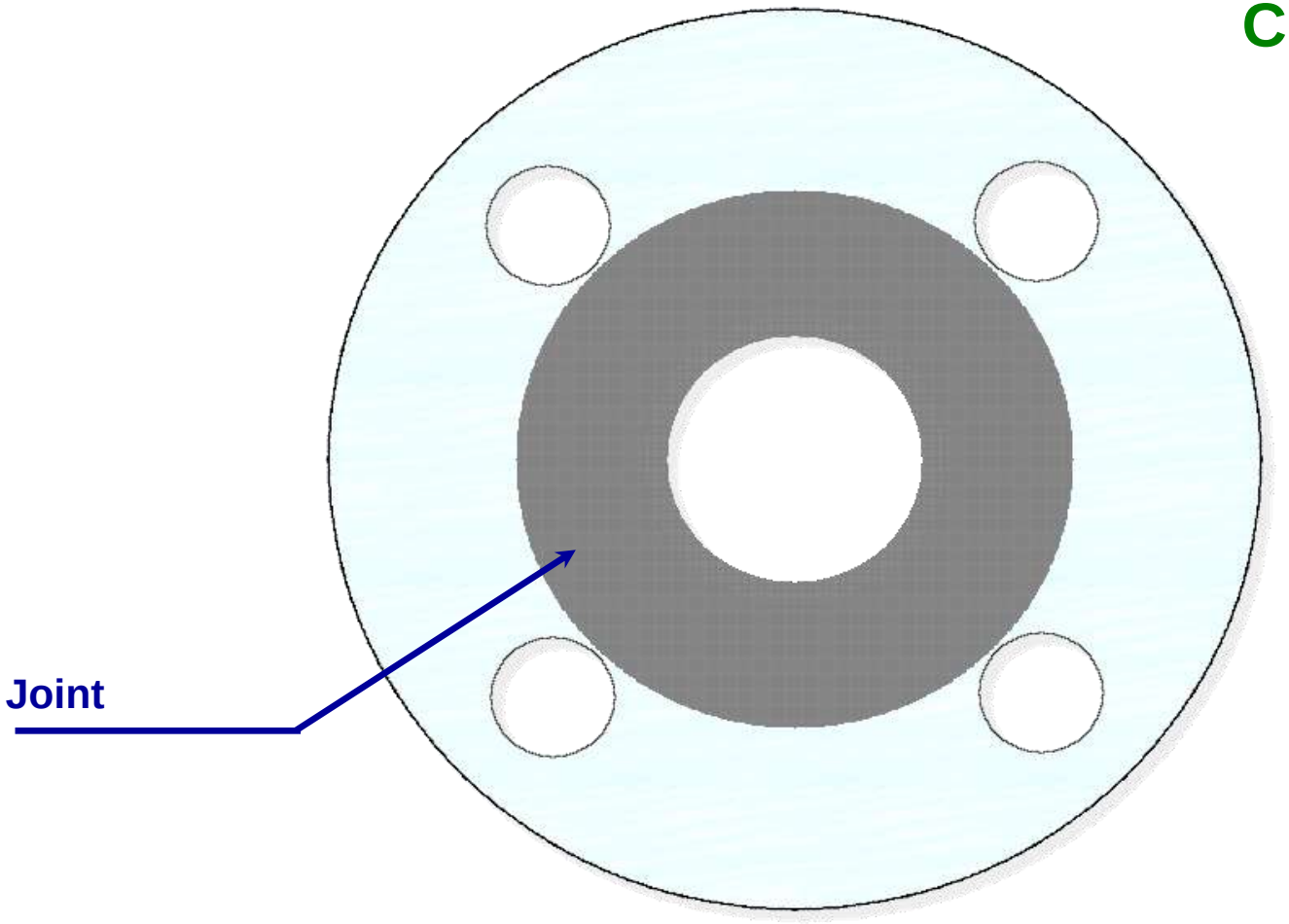
These gaskets are made from spiral-wound metal and fibre tapes which are supported in a metal frame.



Joints & Jointing

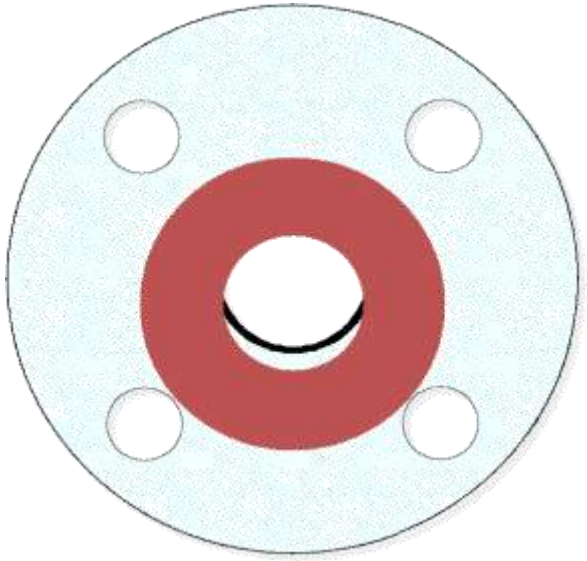
What Size Gasket?

Correct size joint



Offer the Joint up to the Flange Face it should look like this. With the outside of the joint just touching the bolt holes. The inside of the joint must not protrude into the Pipe Bore.

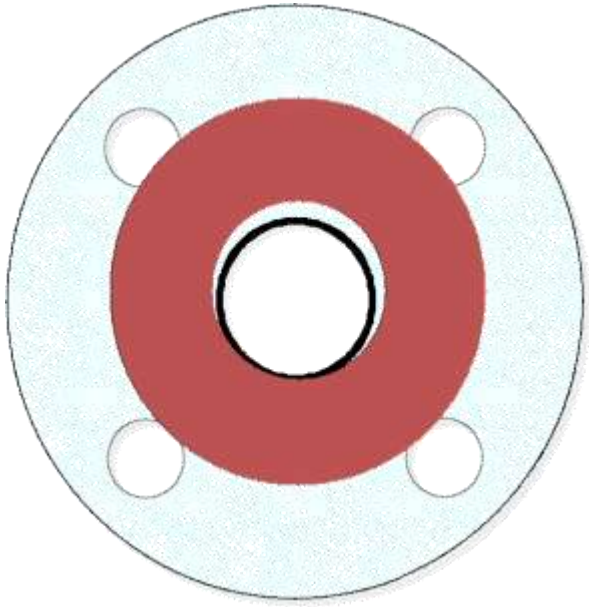
Joints & Jointing



Wrong

Joint is too small, therefore, it is not central.

Can obstruct the pipe bore and not cover the jointing face effectively.

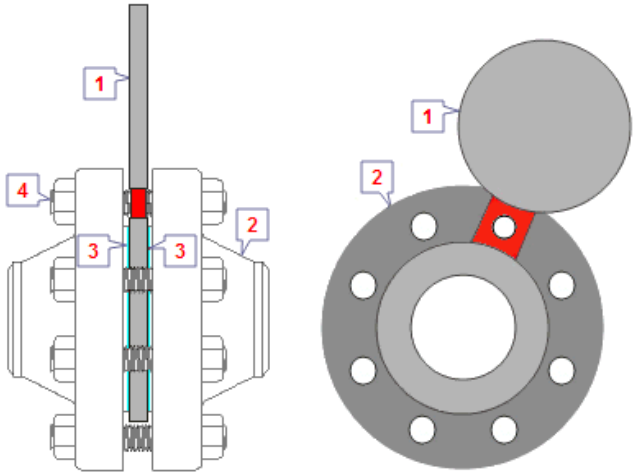


Wrong

Joint is too large and is obstructing the bolt holes.

Service	Flange Design Conditions			
	Pressure Class	Temp. °C	Flange Facing	Gasket Selection
General Hydrocarbon	150 300	-196/500*	RF	Tanged Graphite Sheet or Spiral Wound with Flexible Graphite or Spiral Wound with Non Graphite Filter
Steam/Condensate, Boiler Feed Water		-196/+500 -196/350		
General Utilities		-40/+250	RF	Nitrile Rubber Based Reinforced Sheet
General Hydrocarbon, Steam/ Condensate, Boiler Feed Water	600 900	-196/+500	RF	Spiral Wound with Flexible Graphite
General Hydrocarbon, Steam, Boiler Feed Water	1500 2500	As per flange material	RTJ	Metal Joint Ring
Hydrogen	150 300 600	-196/+500	RF	Spiral Wound with Flexible Graphite
	900 1500 2500	As per flange material	RTJ	Metal Joint Ring
Chemical Oxidisers/ HF Acid	150	-40/+200	RF	PTFE (reinforced or envelope)
	150 300 600	-40/+200	RF	Spiral Wound PTFE Filler

Spectacle Blanking



1. Spectacle blind 2. Flanges 3. Gaskets 4. Stud bolts

It is generally a piece of metal that is cut to fit between two pipe flanges and usually sandwiched between two gaskets. a spectacle blind is often made from two metal discs that are attached to each other by a small section of steel. The shape is similar to a pair of glasses or “spectacles” – hence the name spectacle blind.

One end of the blind will have an opening to allow flow through the pipe during operation and the other end is solid to block flow during maintenance. They are generally installed as a permanent device to separate process piping systems.

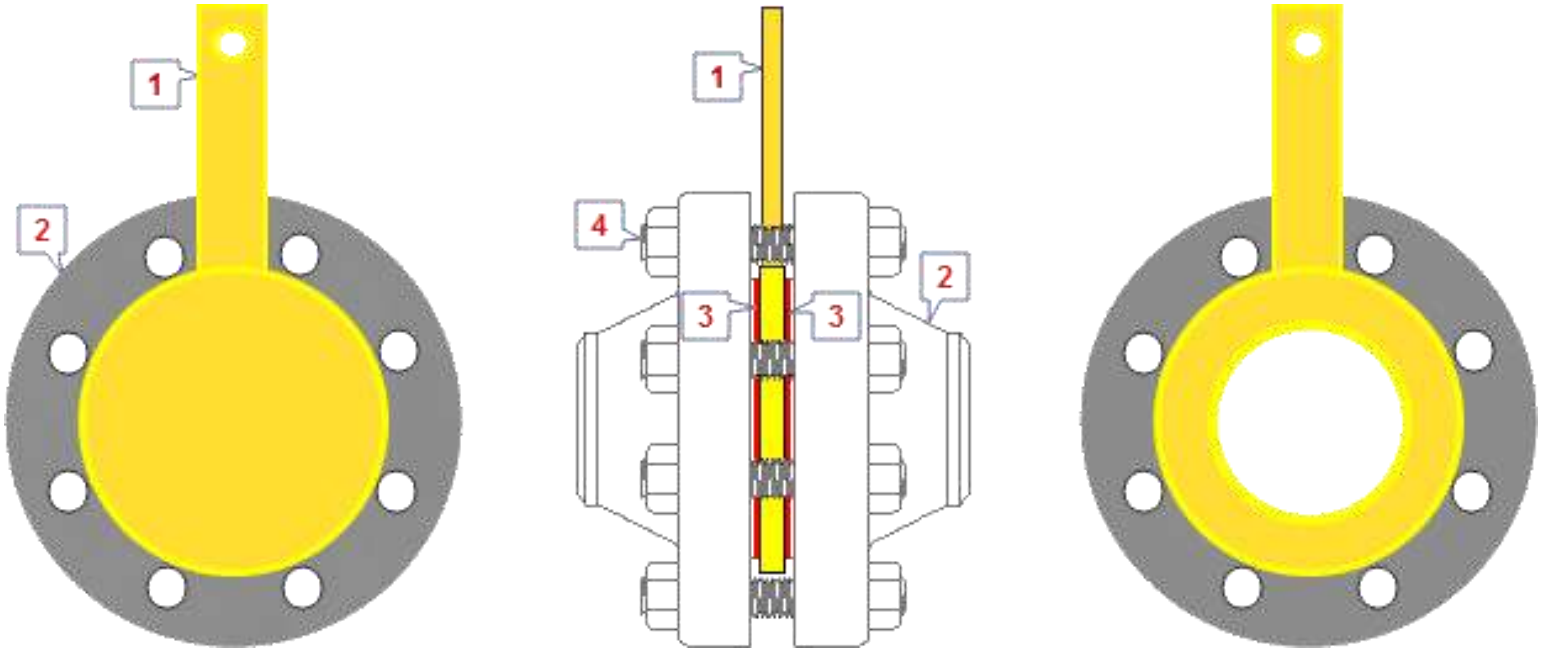
The whole idea of a spectacle blind is so that one can be absolutely sure that an item of equipment is properly and securely blanked off with no possibility of any flow or leakage through a valve during maintenance. The flow can be diverted to other items of equipment but not just bypassed around the blank as this would compromise the safety function of the spectacle blind. The flow has to valved off and pressure relieved prior to loosening flange bolts and swinging the blind.

Spectacle blind in open position

Spectacle blind in closed position

Spacer Ring / Spade Flanges

In the oil and chemical process industries, a spade is a round piece of metal with a small tab that is placed in between two pipe flanges to give positive isolation from the centre; usually to prevent cross contamination between fluids or to allow work on the line.

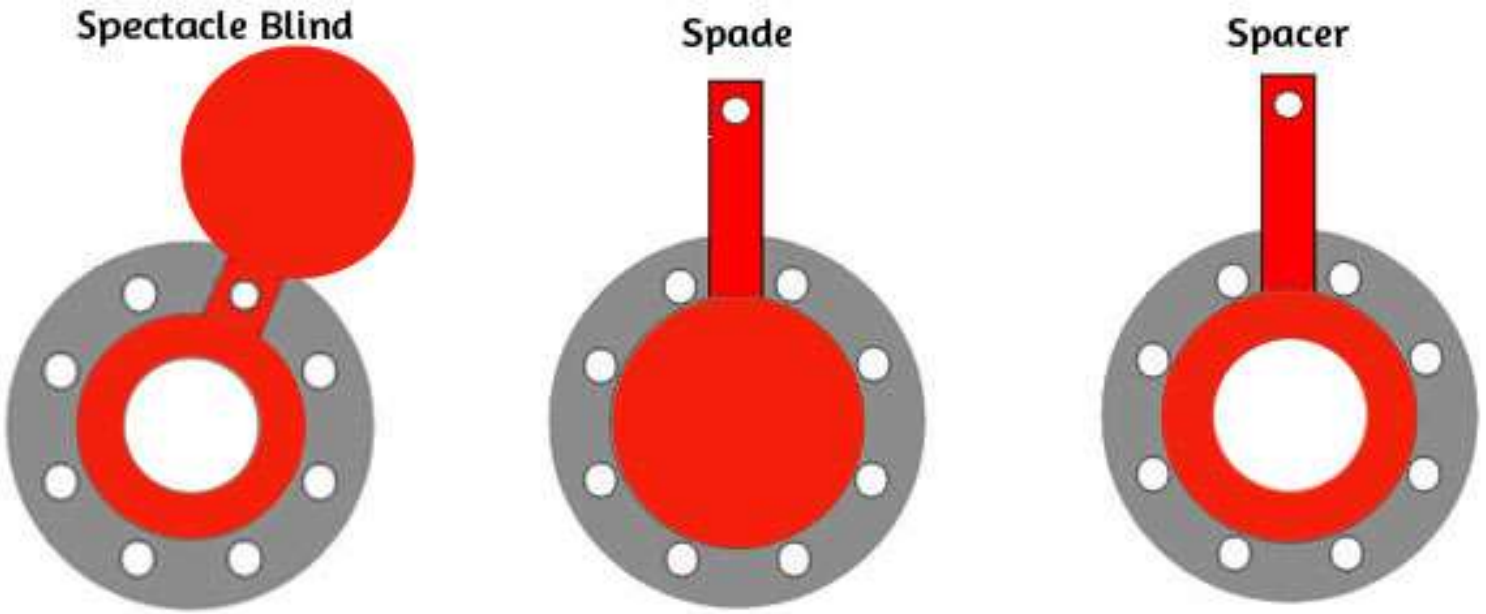


1. Spade 2. Flanges
3. Gaskets 4. Stud Bolts

Obviously the length of bolt will be longer when a spade needs to be inserted. Always remember full nuts on each side of the bolt.

<u>Inserting a Spade or Spectacle:</u>

When a spade needs inserting or removing, it is not necessary to remove all the bolts.



Only remove one less than half the amount of bolts in the flange.

E.g. Flange with 4 bolts - Remove 1 Bolt

Flange with 8 bolts - Remove 3 Bolts

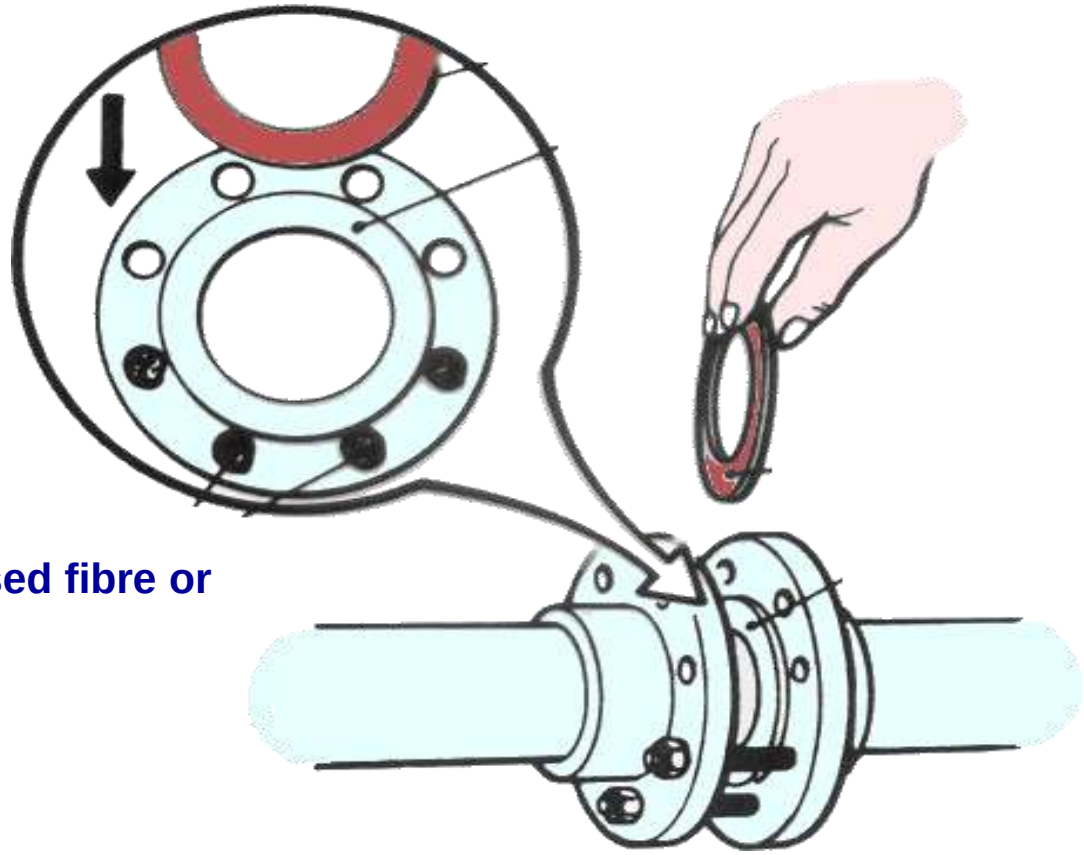
Joints & Jointing

Inside-Bolt Gaskets

Inside-bolt circle gaskets are used with raised-face flanges.

These gaskets fit inside the ring of connecting bolts and against the raised faces of the flanges.

There are two main types of inside-bolt circle gaskets.

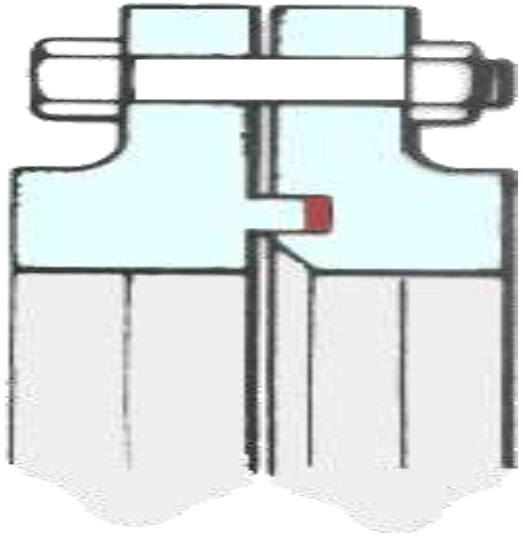


1) Raised-Face plain gaskets

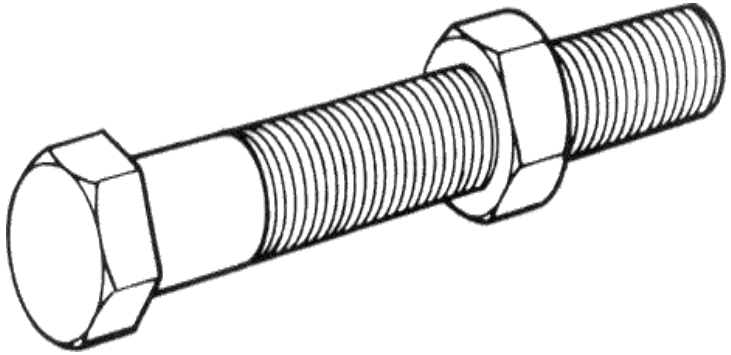
These gaskets are made from compressed fibre or compressed fibre on wire mesh.

3) Flat Ring gaskets

This type of gasket is used with tongue and groove flanges. The gasket is made of aluminium, copper or soft steel depending upon its application.

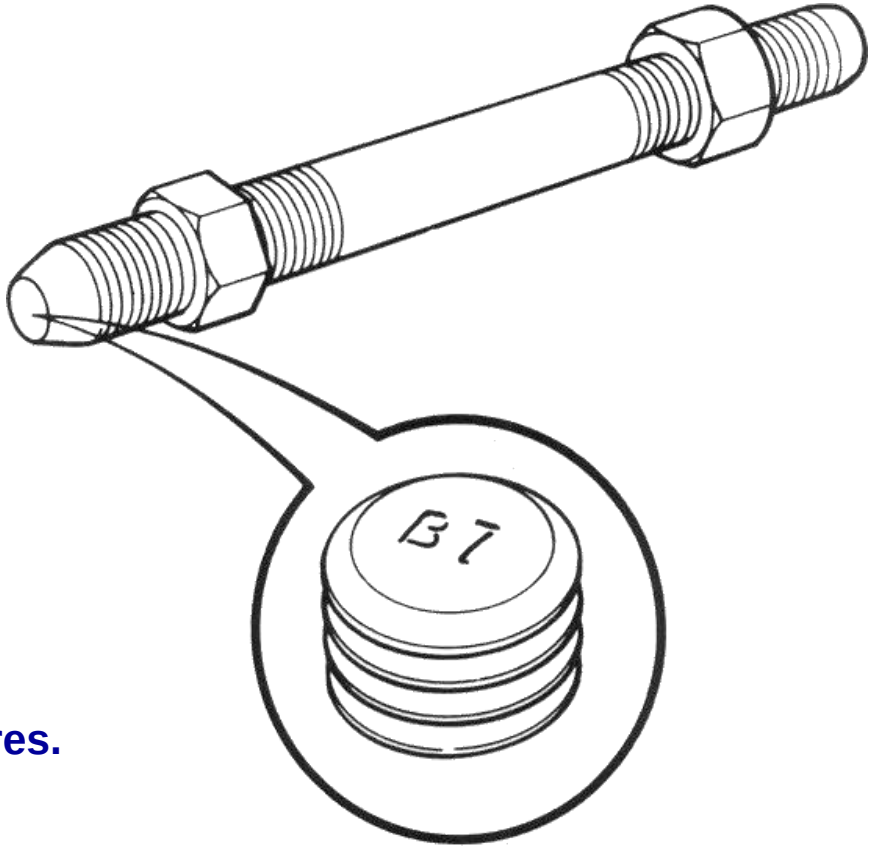


Bolting



Bolts

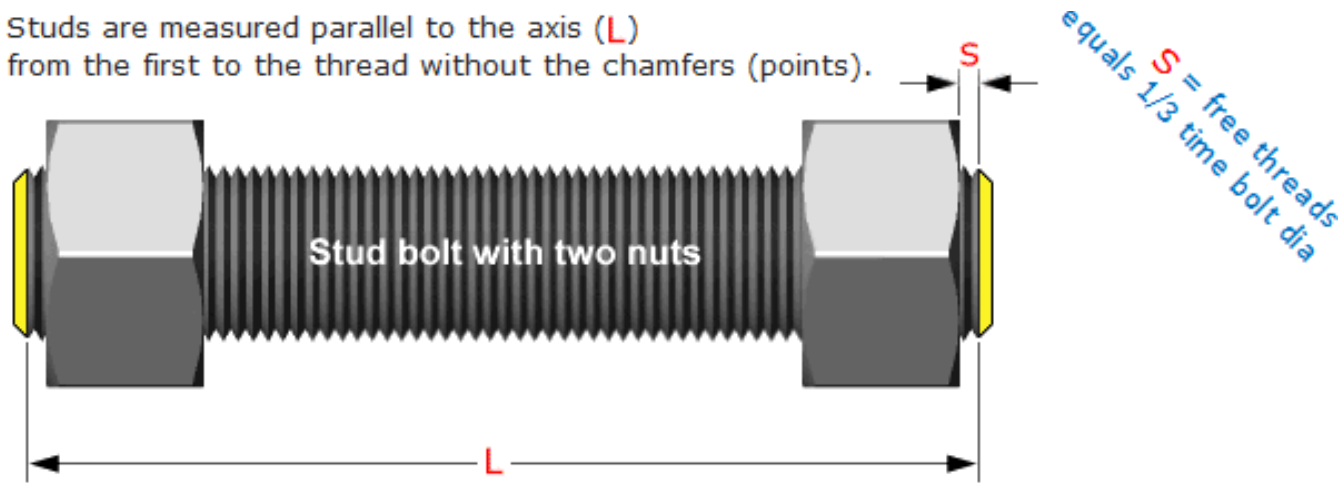
Bolts and nuts are made from mild steel and have limited qualities of strength and durability. The use of bolts is therefore limited to low pressure lines.

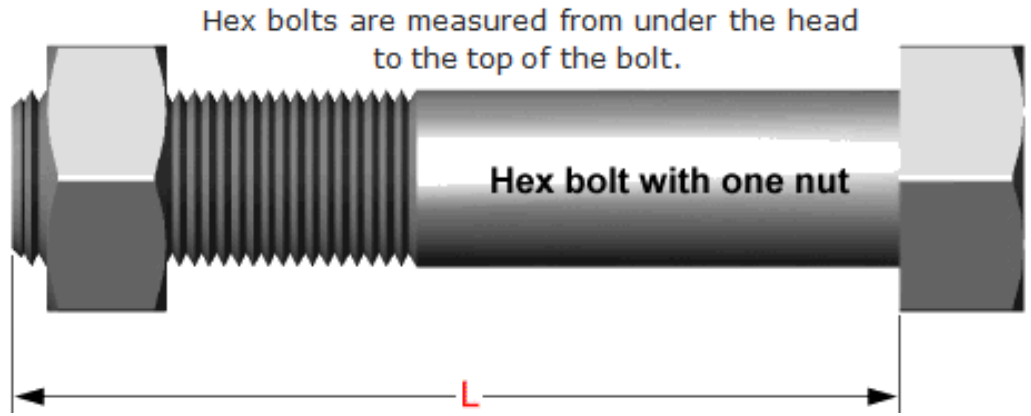


Stud Bolts

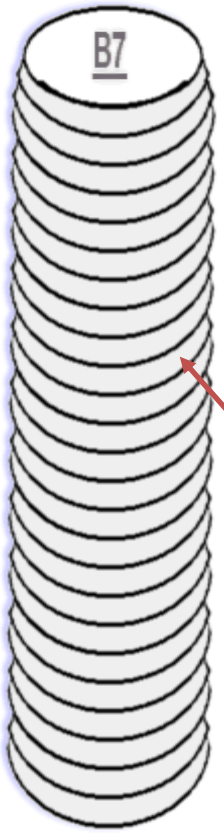
These are made from higher quality steel than machined bolts and are used at higher pressures.

Bolting


Studs are measured parallel to the axis (L)
from the first to the thread without the chamfers (points).
S
S = free threads
equals 1/3 time bolt dia
Stud bolt with two nuts
L

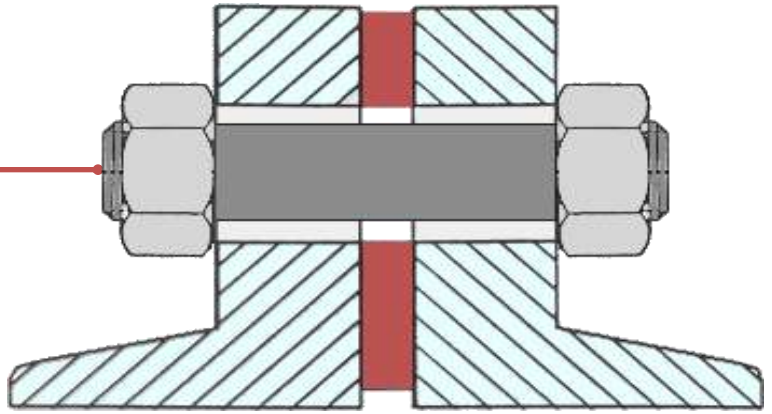

Hex bolts are measured from under the head
to the top of the bolt.
Hex bolt with one nut
L

Bolting



Because of the different ranges in temperature and pressure it is important that the correct bolt is used. The most commonly used stud on site is the 'B7'.

The temperature range for this is approximately - 15 to 400º C. The identification mark is stamped on the end of the bolt.



Stud Sizes Given Without Spade

RATING	150		300		600	
Pipe Size	No of Bolts	Bolt Size	No of Bolts	Bolt Size	No of Bolts	Bolt Size
½	4	½ x 2 ¼	4	½ x 2 ½	4	½ x 3
¾	4	½ x 2 ¼	4	5/8 x 2 ¾	4	5/8 x 3 ¼
1	4	½ x 2 ½	4	5/8 x 3	4	5/8 x 3 ½
1 ½	4	½ x 2 ¾	4	¾ x 3 ½	4	¾ x 4
2	4	5/8 x 3	8	5/8 x 3 ¼	8	5/8 x 4
3	4	5/8 x 3 ½	8	¾ x 4	8	¾ x 4 ¾
4	8	5/8 x 3 ½	8	¾ x 4 ¼	8	7/8 x 5 ½
6	8	¾ x 3 ¾	12	¾ x 4 ¾	12	1 x 6 ½
6	8	¾ x 4	12	7/8 x 5 ¼	12	1 1/8 x 7 ½
10	12	7/8 x 4 ½	16	1 x 6	16	1 ¼ x 8 ¼
12	12	7/8 x 4 ½	18	1 1/8 x 6 ½	20	1 ¼ x 8 ½
14	12	1 x 5	20	1 1/8 x 6 ¾	20	1 5/8 x 9
16	16	1 x 5 ¼	20	1 ¼ x 7 ¼	20	1 ½ x 9 ¾
18	16	1 1/8 x 5 ¾	24	1 ¼ x 7 ½	20	1 5/8 x 10 ½
20	20	1 1/8 x 6	24	1 ¼ x 8	24	1 5/8 x 11 ¼
24	20	1 ¼ x 6 ¾	24	1 ½ x 9	24	1 7/8 x 12 ¾

Joints & Jointing

Joint Making Procedure

Ensure joint faces are clean, flat and have the correct surface finish.

Ensure that joint faces are aligned within specified limits.

External pressures should not be applied to align faces prior to bolting and joint face gap should be within specified limits.

Always use the specified jointing material.

Only use specified jointing compound and bolt lubrication.

Bolts should be of the correct specification and fitted in the correct sequence / procedure.

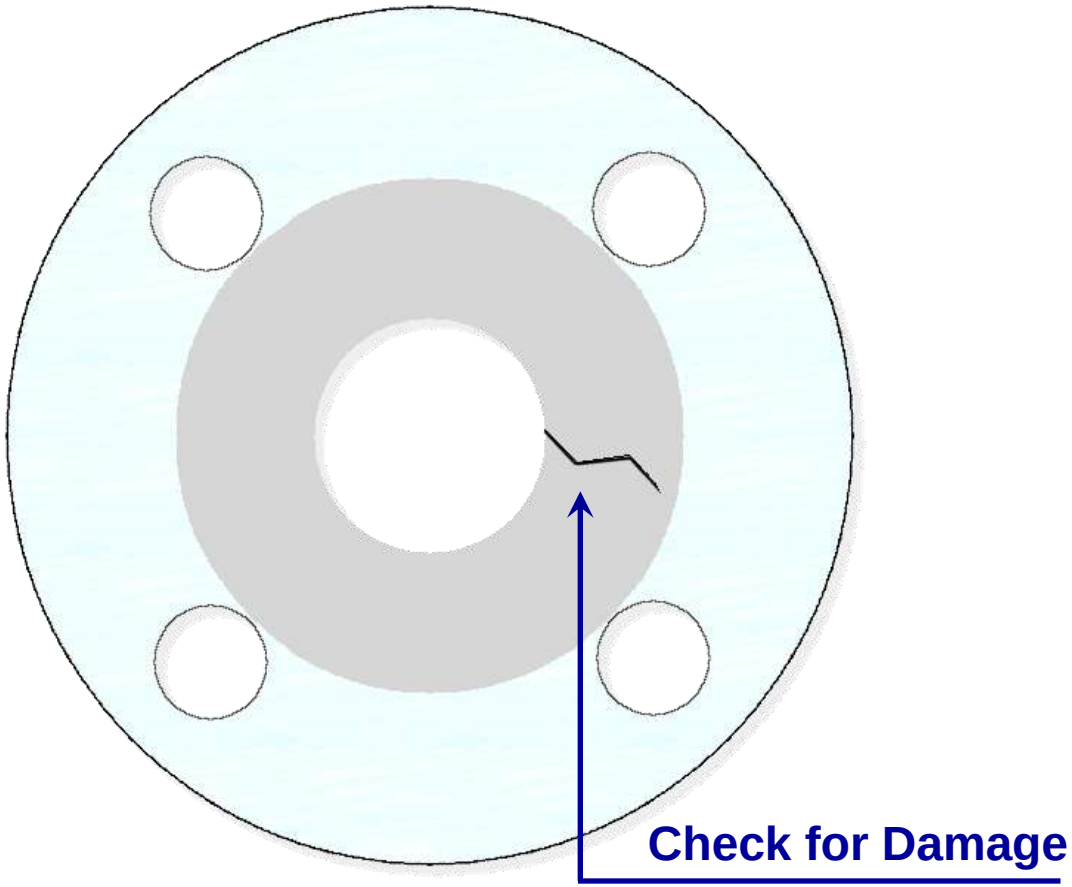
Bolt tension should be applied as specified.

Bolts should be the correct length.

No thread protrusion.

‘Washering up’ should be avoided.

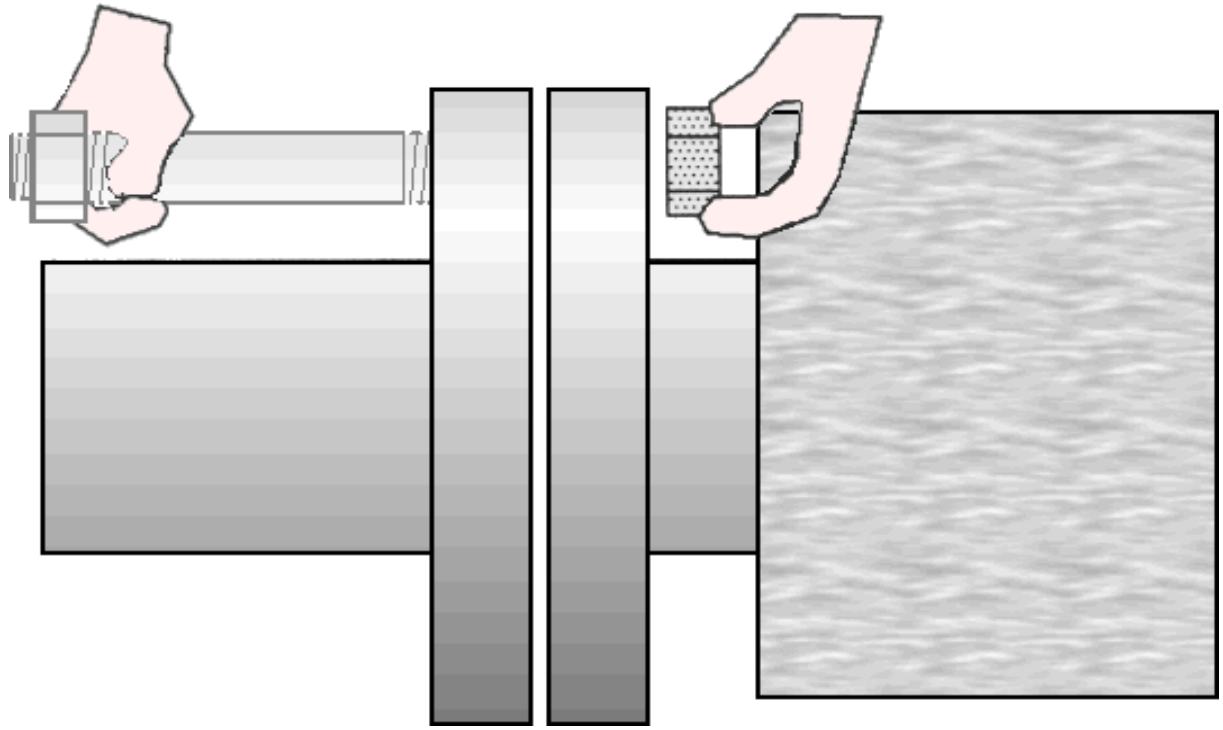
Joints & Jointing



Joints & Jointing

Anti - Seize

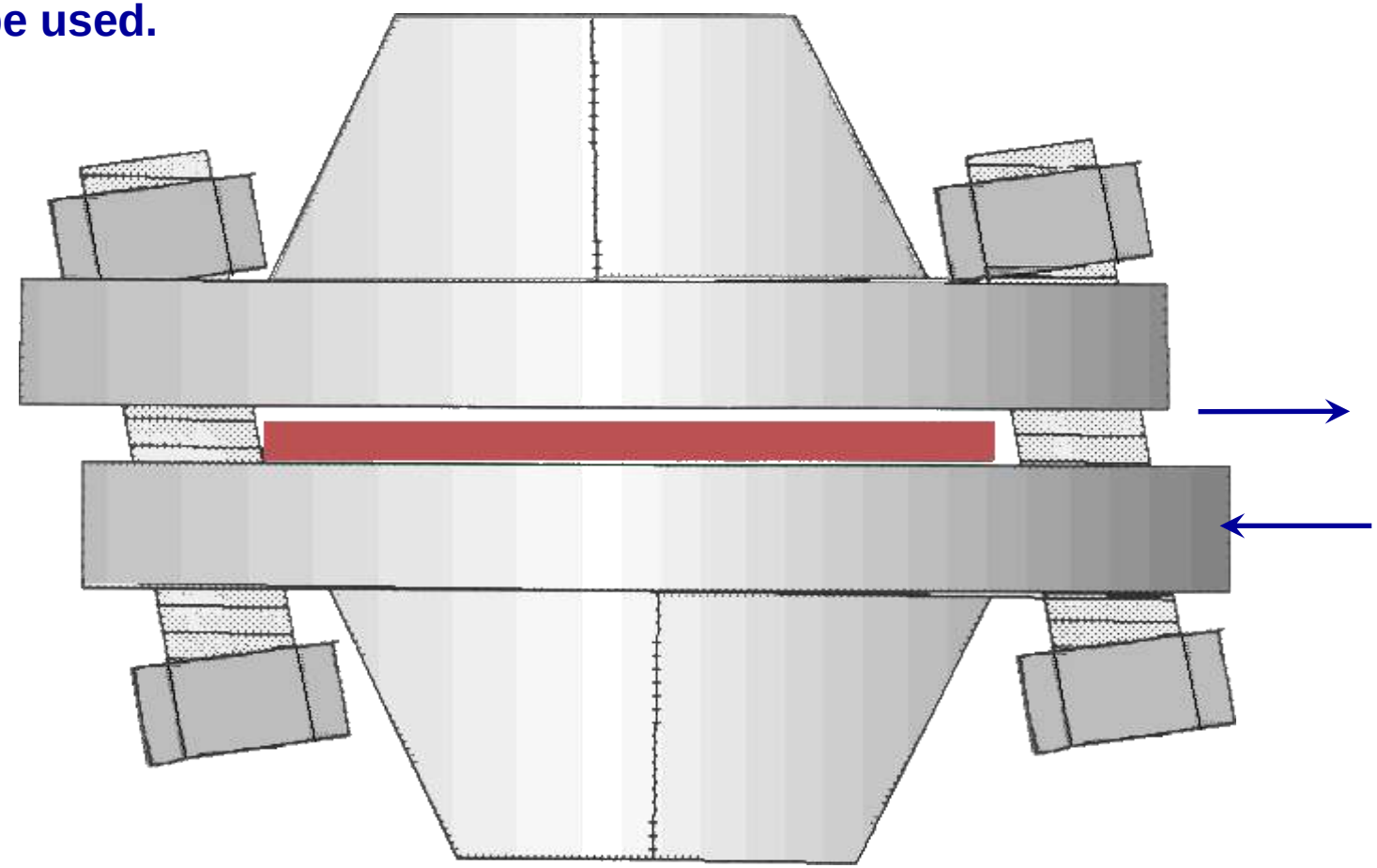
Always use anti-seize it saves time in the long run. It is recommended that you only put anti-seize on one side of the bolt. The reason for this is, when the bolt is undone next time, only one nut will come off and this will save you time and effort.



Joints & Jointing

Alignment of Flanges

It is important to align the flanges with each other. If they are not, all of the gasket surface will not be used.



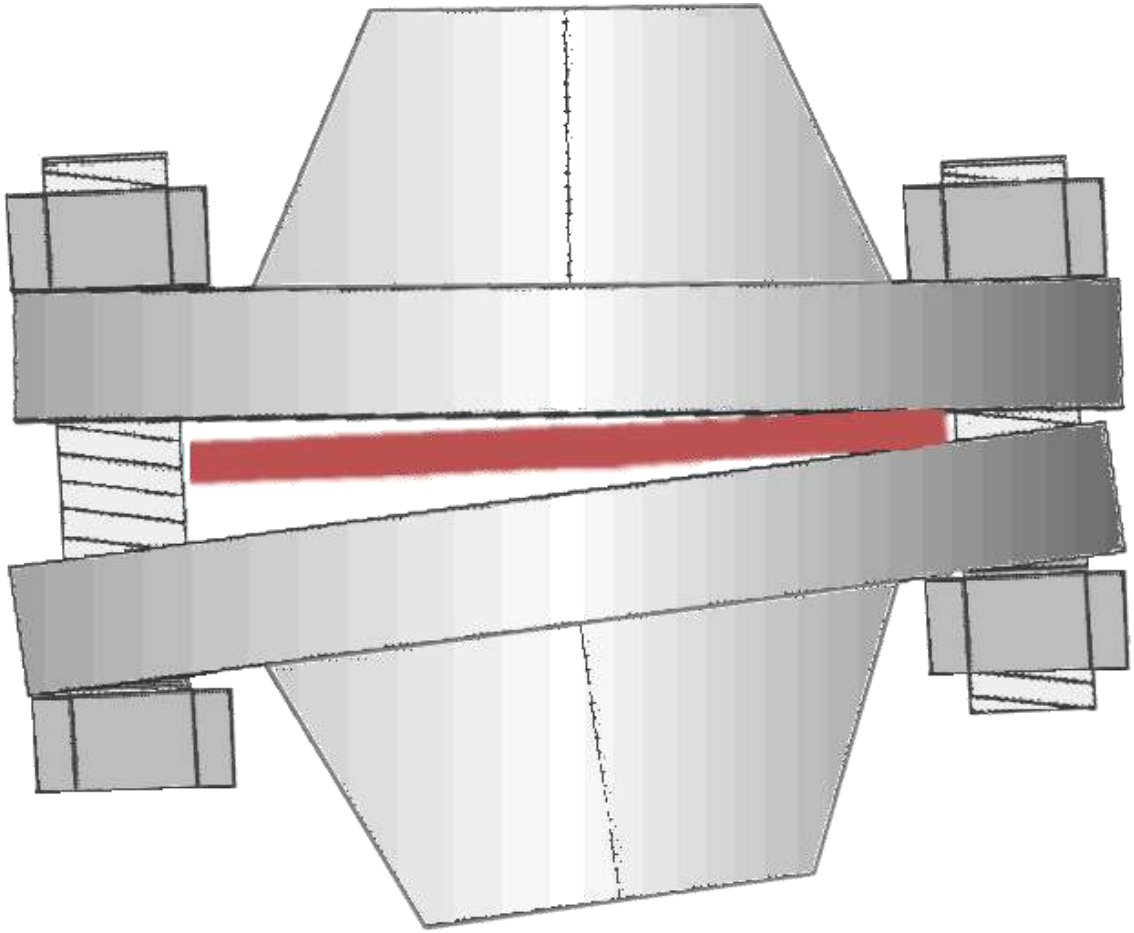
It is most critical that the male and female type of flanges are aligned so that they locate.

Joints & Jointing

Pulling Up The Flange

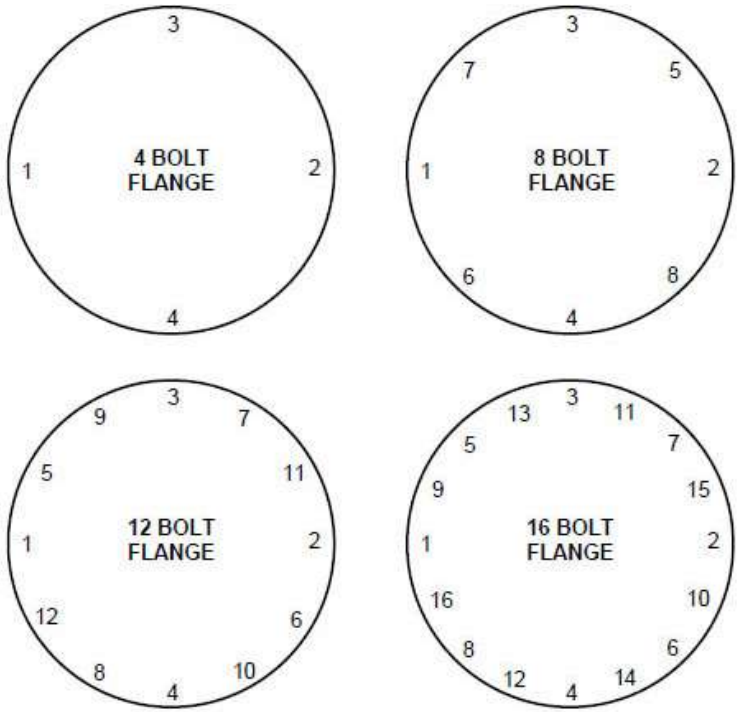
The gasket must be compressed all the way round. It is important that the flange is pulled up squarely.

Pull up Gap



Bolt Tightening

To obtain a leak-free flange connection, a proper gasket installation is needed, the bolts must be assign on the correct bolt tension, and the total bolt strength must be evenly divided over the whole flange face.
The first pass, lightly tighten the first bolt then move directly across or 180 degrees for the second bolt, then move 1/4 turn around the circle or 90 degrees for the third bolt and directly across for the fourth. Continue this sequence until all bolts are tightened.



Pipeline Specifications

On site there are many pipeline systems and they may look the same, so how do we identify them.

For example, a car has a registration plate, from that, reference to it's Make, Model, Year of manufacture, engine type etc can be Obtained.

Likewise with pipelines we need reference to identify its duty, situation, material spec, test and working pressures etc.

Each pipeline is given its own unique reference (number or letters) This is called a **PIPELINE SPECIFICATION**

Fluid Description	Main Pipe Material	Pressure Bar.G	Temperature	SPEC Reference
Air Compressed	C.S	10	50	AMA 004 A
Air Instrument	C.S	10	80	AGB 001 A
Air Instrument	ST.ST. 304L	10	80	SGB 003 A
Air Instrument	ST.ST. 316	10	80	SGD 003 A
Air Mask (Upto Receiver)	C.S	10	80	AMA 025 A
Air Mask (After Receiver)	ST.ST. 304L	7	60	SGB 017 A
Air Mask (After Receiver)	ST.ST. 316	7	60	SGD 017 A
Brine Refrigerated	CS	13.8	+150 -20	AGU 164 A
Dry Risers	CS	7	80	AMA 084 A
Natural Gas	C.S.	10	186	AMA 006 A
Nitrogen	C.S.	10	80	AGB 001 A
Steam Tracing for Wrapping Valves and Fittings	Small Bore Copper (Comp Fittings)	10	186	CZA 001 A
Steam Tracing Direct Clip On	CS	10	186	AMS 001 A
Steam Tracing Spacer	CS	10	186	AMS 002 A
Steam & Condensate L.P. (ANSI 150 Class 3)	CS	10	186	AMA 007 A
Steam & Condensate I.P. (ANSI 300 Class 2)	CS			AHB 007 A
Steam & Condensate H.P. (ANSI 600)	CS			ACB 002 A

PIPELINE REFERENCE NUMBER

This would be located on site drawings (construction drawings, Line diagrams) Stencilled or tabbed on the pipeline

EXAMPLE

Engineering	**Piping Systems Specification Index** Sheet 1 of 4	Project No. T10009 Project Title. Standards Pipe Issue Note No. 3117	Issue A

See Record Of Modifications Sheet Index For Details Of Any Changes To Index

Spec. Ref.	Duty	Fluid Ref.	Main Piping Material.	Pipe.	Flange.	Gaskets.	Shop Test.	Radiography.	Heat Treatment.	Galvanising.	Tracing.	Jacketing.	Insulation.	Painting.
ACB002 A	Steam and Condensate H.P. Up To 400° C		CS	A106 GR.B	ANSI 600	SP. WND.		100%					Yes	
AGB001 A	Air - Instrument		CS	API5L GR.B	ANSI 150	CAF		10%						Yes
	Nitrogen													
AGU164 A	Brine - Refrigerated		CS	API5L GR.B	ANSI 150	CAF		10%	See Fab. Spec.				Yes	Yes
AHB007 A	Steam and Condensate I.P.		CS	API5L GR.B	ANSI 300	CAF		10%					Yes	Yes
	Water - Hot - High Pressure													
AMA004 A	Air - Compressed		CS	API5L GR.B	ANSI 150	CAF								Yes
AMA005 A	Water: General Works After Break Tank - Non Potable		CS	API5L GR.B	ANSI 150	CAF							Yes	Yes
AMA006 A	Natural Gas		CS	API5L GR.B	ANSI 150	CAF								Yes
AMA007 A	Steam and Condensate L.P.		CS	API5L GR.B	ANSI 150	CAF							Yes	Yes
AMA025 A	Air Mask - Up To Receiver		CS	API5L GR.B	ANSI 150	Rub--ber								Yes

Issue	A
Date	3 Sept 1990

Engineering	Piping System Specification	Project No.	10009	Project Title	Standards	Spec. Ref.	ACB002	Page 3 of 3

Material / Lining	Carbon Steel /	Limitations Of Components *On This Page Only*	1/2" NS - 4" NS ANSI Class 600 Flange Rating 6" NS - 24" NS Limited By Pipe Wall Thickness	Remarks: For Other Fabrication Details See Page 2 Of This Specification
Fabrication Spec	Spec. EDS.PIP.51.01	Fabrication Class	Class 1 Piping System	
Inspection And N.D.T.	Spec. EDS.PIP.51.01	Heat Treatment	None	

	N.S. Range (in) Min	N.S. Range (in) Max	Description	Standard Number	PCR (Item Code)
Pipe	½	4	Pipe, Seamless, Dimensions to ANSI B36. 10 Material Carbon Steel ASTM A106 Grade B, Sched.80 THK.		PAM80
	6	24	Pipe, Seamless, Dimensions to ANSI B36. 10 Material Carbon Steel ASTM A106 Grade B, Sched.80 THK.		*PAM
Flanges / Pipe Joints / Caps	½	24	**Pipe Joints / Caps** Cap, Butt Welding, Dimensions To ANSI B16.9 Material - Carbon Steel ASTM A234 Grade WPB, As Per THK.	04 4085	*KAM
	½	24	Butt Weld Type 'A'. ICI Spec. EDS.PIP.51.01		WBA51.01
	½	24	**Flanges** Flange, Blank, Dimensions To ANSI B16.5, Class 600, Material: Carbon Steel ASTM A105.	04 2082	*FAM600B
	½	24	Flange, Welding Neck, Dimensions To ANSI - - B16.5, Class 600, Material: Carbon Steel ASTM A105, As Pipe THK	04 2218	*FAM600WN
			ASSEMBLY	04 2619	
Reducers	¾	24	Reducer, Butt Welding, Eccentric Dimensions To ANSI B16. 9, Material: Carbon Steel ASTM A234 Grade WPB. Large End As Pipe, Small End As Pipe THK.	04 4094	*RAME

	N.S. Range (in) Min	N.S. Range (in) Max	Description	Standard Number	PCR (Item Code)
BENDS	½	4	FIRST CHOICE Cold Formed Bends With 5D Bend Radius		B-5D
	6	24	Elbow, Butt Welding, 45 Deg. Long Radius, Dimensions To ANSI B16. 9, Material: Carbon Steel ASTM A234 Grade WPB, As Pipe THK	04 4093	*EAM45L
	6	24	Elbow, Butt Welding, 90 Deg. Long Radius, Dimensions To ANSI B16. 9, Material: Carbon Steel ASTM A234 Grade WPB, As Pipe THK	04 4093	*EAM90L
	½	4	SECOND CHOICE Elbow, Butt Welding, 45 Deg. Long Radius, Dimensions To ANSI B16. 9, Material: Carbon Steel ASTM A234 Grade WPB, SCHED.80 THK	04 4093	EAM45L80
	½	4	Elbow, Butt Welding, 90 Deg. Long Radius, Dimensions To ANSI B16. 9, Material: Carbon Steel ASTM A234 Grade WPB, SCHED.80 THK	04 4093	EAM90L80
BRANCHES	½	24	Equal Tee, Butt Welding, Dimensions To ANSI B16. 9, Material: Carbon Steel ASTM A234 Grade WPB, As Pipe THK.	04 4092	*TAME
	¾	24	Reducing Tee, Butt Welding, Dimensions To ANSI B16. 9, Material: Carbon Steel ASTM A234 Grade WPB. Run As Pipe, Branch As Pipe THK.	04 4095	*TAMR
	½	24	REINFORCED BRANCH CONNECTIONS Nipolet, Plain End. Class 3000 Rating. Material: Carbon Steel ASTM A105.		*LAN3N
	½	24	ELBOLET, Butt Welding. Carbon Steel ASTM A105		*LANE
	½	24	LATROLET, Butt Welding. Carbon Steel ASTM A105		*LANL
	½	24	WELDOLET, Material: Carbon Steel ASTM A105		*LANW

Prelim Issue No.							Approved Issue No.						Date STD Copied
Date.							Date.						21-6-90

Note: For Items Outside The Scope of This Specification Consult Piping Section *PCR = Short Code

Engineering	Piping System Specification	
Material / Lining	Carbon Steel /	**Limitations Of Components** ***On This Page Only***	1/2" NS 6" NS
Fabrication Spec	Spec. EDS.PIP.51.01	**Fabrication Class**	Class 1 Piping System	**Inspe And N**

	N.S. Range (in) Min	N.S. Range (in) Max	Description	Standard Number	PCR (Item Code)
Pipe	½	4	Pipe, Seamless, Dimensions to ANSI B36. 10 Material Carbon Steel ASTM A106 Grade B, Sched.80 THK.		PAM80
	6	24	Pipe, Seamless, Dimensions to ANSI B36. 10 Material Carbon Steel ASTM A106 Grade B, Sched.80 THK.		*PAM
Flanges / Pipe Joints / Caps	½	24	**Pipe Joints / Caps** Cap, Butt Welding, Dimensions To ANSI B16.9 Material - Carbon Steel ASTM A234 Grade WPB, As Per THK.	04 4085	*KAM
	½	24	Butt Weld Type 'A'. ICI Spec. EDS.PIP.51.01		WBA51.01
	½	24	**Flanges** Flange, Blank, Dimensions To ANSI B16.5, Class 600, Material: Carbon Steel ASTM A105.	04 2082	*FAM600B
	½	24	Flange, Welding Neck, Dimensions To ANSI - - B16.5, Class 600, Material: Carbon Steel ASTM A105, As Pipe THK	04 2218	*FAM600WN
			ASSEMBLY	04 2619	
Reducers	¾	24	Reducer, Butt Welding, Eccentric Dimensions To ANSI B16. 9, Material: Carbon Steel ASTM A234 Grade WPB. Large End As Pipe, Small End As Pipe THK.	04 4094	*RAME

Engineering	Piping System Specification	Project No.	10009	Project Title	Standards	Spec. Ref.	ACB002	Page 2 of 3

Design Code	ANSI B31.3 Spec. EDS. PIP. 50.01	Thermal Insulation	Spec. M5000 STD. 18 1620	Specification Limitations	ANSI Class 600 Flange Rating Restricted to 400 Deg. C (B7 Bolts)
Fab / Erect Specification	Spec. EDS. PIP. 51.01	Tracing	Nil	Electrical Earthing	Not Required
Cleaning & Protection Internal	Spec. EDS. PIP. 51.01	Testing Shop	Nil	General Remarks	
Cleaning & Protection External	Spec. EDS. PIP. 57.01	Testing Site	Spec. EDS. PIP. 64.01 Hydrostatic		

	N.S. Range (in) Min	N.S. Range (in) Max	Description	Standard Number	PCR (Item Code)
Valves			Situation - A		
	1/2	1. 1/2	Parallel Slide Valve, Outside Screw, Rising Stem, Flanged Ends, Class ANSI 600, Handwheel Operated, Forged Steel Body.		VS087
	3	12	Parallel Slide Valve, Rising Stem, Flanged Ends, Class ANSI 600, Handwheel Operated, Cast Steel (Hytemp) Body		VS047
			Situation B+C		
	3/4	2	Parallel Slide Valve, Rising Stem, Flanged Ends, Class ANSI 600, Handwheel Operated, Forged Steel Body.		VS059
	3	3	Parallel Slide Valve, Rising Stem, Flanged Ends, Class ANSI 600, Handwheel Operated, Cast Steel (Hytemp) Body.		VS047
	4	12	Parallel Slide Valve, Rising Stem, Flanged Ends, Class ANSI 600, Handwheel Operated, Cast Steel Body.		VS048
	1/2	2	Check Valve, Ball Type, B.Cover,Horiz., To BS5352, Flanged Ends, Class ANSI 600, Carbon Steel Body.		VC218
	3/4	1. 1/2	Uniflow Slide Valve, Flanged Ends, Class ANSI 600, Wrench Operated, Carbon Steel Body.		VS043
	3	24	Check Valve, Swing Type, Bolted Cover, To BS1868, Flanged Ends, Class ANSI 600, Cast Carbon Steel Body.		VC156
			Note:- Use VS043 For Drain Purposes Only.		
Gaskets	1/2	24	Gasket, Spiral Wound, Inside Bolt Circle To BS3381, Class 600, S/Steel 321 Strip, CAF Filler, Stainless Steel Inner Guide Ring, Carbon Steel Outer Guide Ring.		GSGSAC600R
Bolts	1/2	24	Stud Bolt BS4882 Inch With Nuts, Material 1% Cro. Mo. Steel Grade B7 Bolt, Grade 2H Nut.	08 0589	*BBAS
Notes	Valve Selection Based On STD 02 0113 Steam Traps: Select in Accordance With EDG. PiP. 30. 01				

	N.S. Range (in) Min	N.S. Range (in) Max	Description	Standard Number	PCR (Item Code)
Notes					

Prelim Issue No.							Approved Issue No.						Date STD Copied
Date.							Date.						21-6-90

Note: For Items Outside The Scope of This Specification Consult Piping Section *PCR = Short Code

Engineering	Piping System Specification		
Design Code	ANSI B31.3 Spec. EDS. PIP. 50.01	Thermal Insulation	Spec. M5000 STD. 18 1620
Fab / Erect Specification	Spec. EDS. PIP. 51.01	Tracing	Nil
Cleaning & Protection Internal	Spec. EDS. PIP. 51.01	Testing Shop	Nil
Cleaning & Protection External	Spec. EDS. PIP. 57.01	Testing Site	Spec. EDS. PIP. 64.01 Hydrostatic

	N.S. Range (in)		Description	Standard Number	PCR (Item Code)
	Min	Max			
Valves			Situation - A		
	1/2	1. 1/2	Parallel Slide Valve, Outside Screw, Rising Stem, Flanged Ends, Class ANSI 600, Handwheel Operated, Forged Steel Body.		VS087
	3	12	Parallel Slide Valve, Rising Stem, Flanged Ends, Class ANSI 600, Handwheel Operated, Cast Steel (Hytemp) Body		VS047
			Situation B+C		
	3/4	2	Parallel Slide Valve, Rising Stem, Flanged Ends, Class ANSI 600, Handwheel Operated, Forged Steel Body.		VS059
	3	3	Parallel Slide Valve, Rising Stem, Flanged Ends, Class ANSI 600, Handwheel Operated, Cast Steel (Hytemp) Body.		VS047
	4	12	Parallel Slide Valve, Rising Stem, Flanged Ends, Class ANSI 600, Handwheel Operated, Cast Steel Body.		VS048
	1/2	2	Check Valve, Ball Type, B.Cover,Horiz., To BS5352, Flanged Ends, Class ANSI 600, Carbon Steel Body.		VC218
	3/4	1. 1/2	Uniflow Slide Valve, Flanged Ends, Class ANSI 600, Wrench Operated, Carbon Steel Body.		VS043
	3	24	Check Valve, Swing Type, Bolted Cover, To BS1868, Flanged Ends, Class ANSI 600, Cast Carbon Steel Body.		VC156
			Note:- Use VS043 For Drain Purposes Only.		
Gaskets	1/2	24	Gasket, Spiral Wound, Inside Bolt Circle To BS3381, Class 600, S/Steel 321 Strip, CAF Filler, Stainless Steel Inner Guide Ring, Carbon Steel Outer Guide Ring.		GSGSAC600R
Bolts	1/2	24	Stud Bolt BS4882 Inch With Nuts, Material 1% Cro. Mo. Steel Grade B7 Bolt, Grade 2H Nut.	08 0589	*BBAS

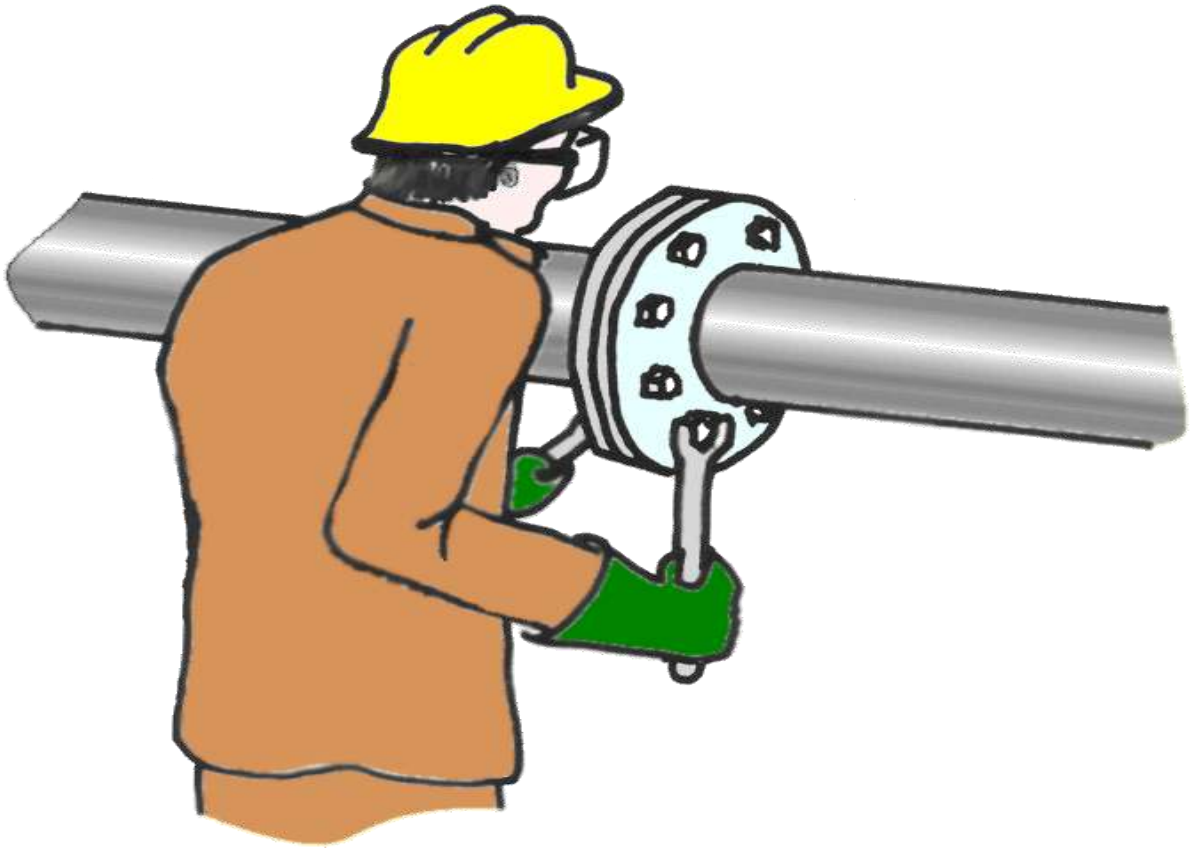
Pipeline - Maintenance

Check List

Pipeline Hazards Are Not Always Obvious

1. Make sure you know what a pipeline contains before starting work on it.
2. Ascertain the direction of flow in the pipe
3. Check where the pipe is coming from and where it is going to.
4. See that all pipelines are safely anchored.
5. Be sure you can identify all pipelines and their contents.
6. Learn to recognise dangerous leakages, and:
7. How to act in an Emergency.
8. Note where all the stop valves are.
9. Get to know the supervisors responsible for the various pipelines.
10. Arrange for the regular emptying of drip-trays under leaks.
11. Avoid tripping hazards - never leave loose pipes on the floor.
12. Make full use of the permit to work system.

Pipework

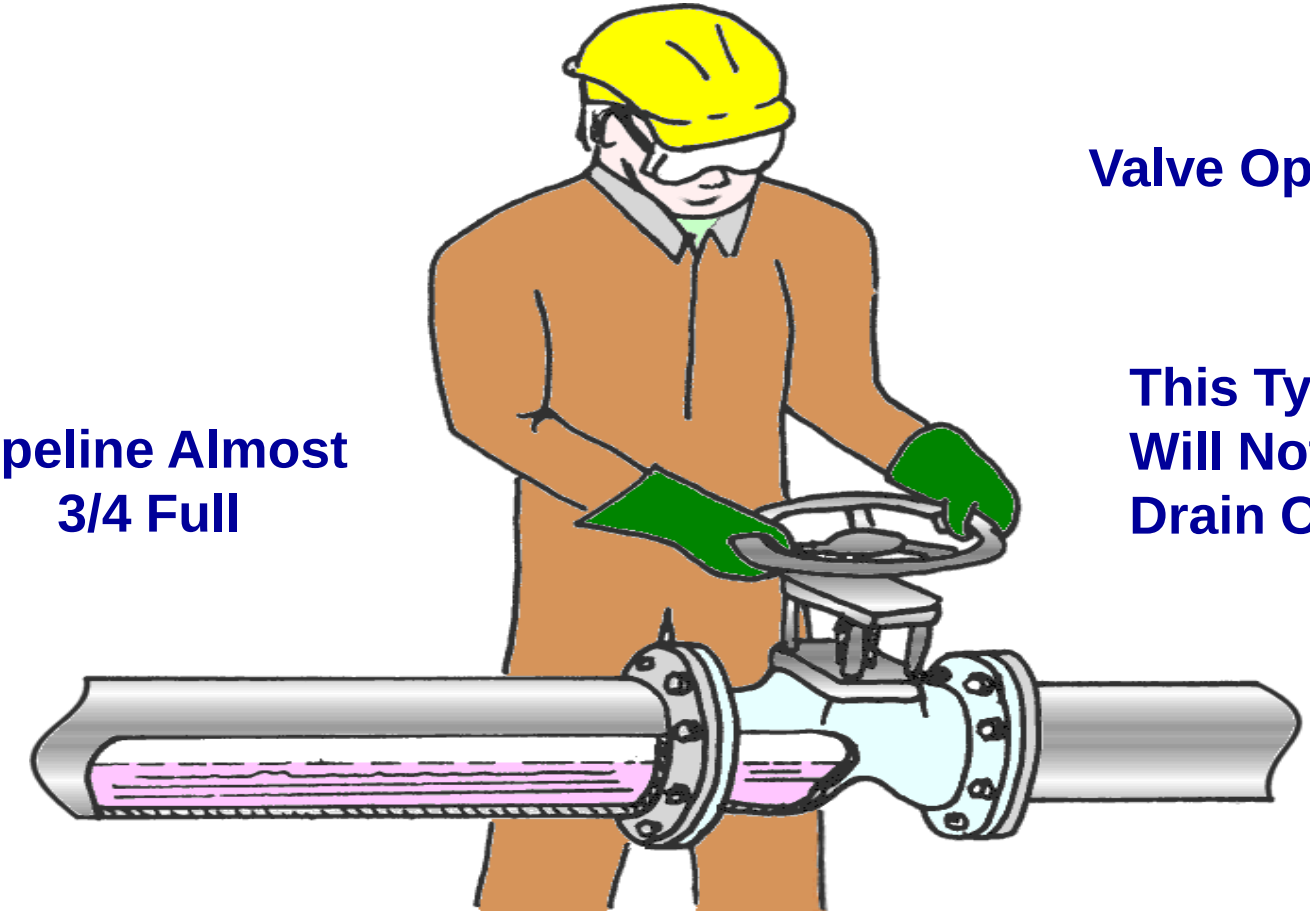


Follow these simple precautions

Before any work can commence, any or all of the following may be required:

- Permit to work
- Clearance certificate
- Isolation documents
- Entry permit
- Hot work permit
- Scheme of work
- Method statement
- PPE requirements
- Breathing apparatus
- Access request (scaffold)
- Barriers or guards
- Lifting equipment
- Lagging / trace heating removal
- Cleaning

Before Breaking A Joint



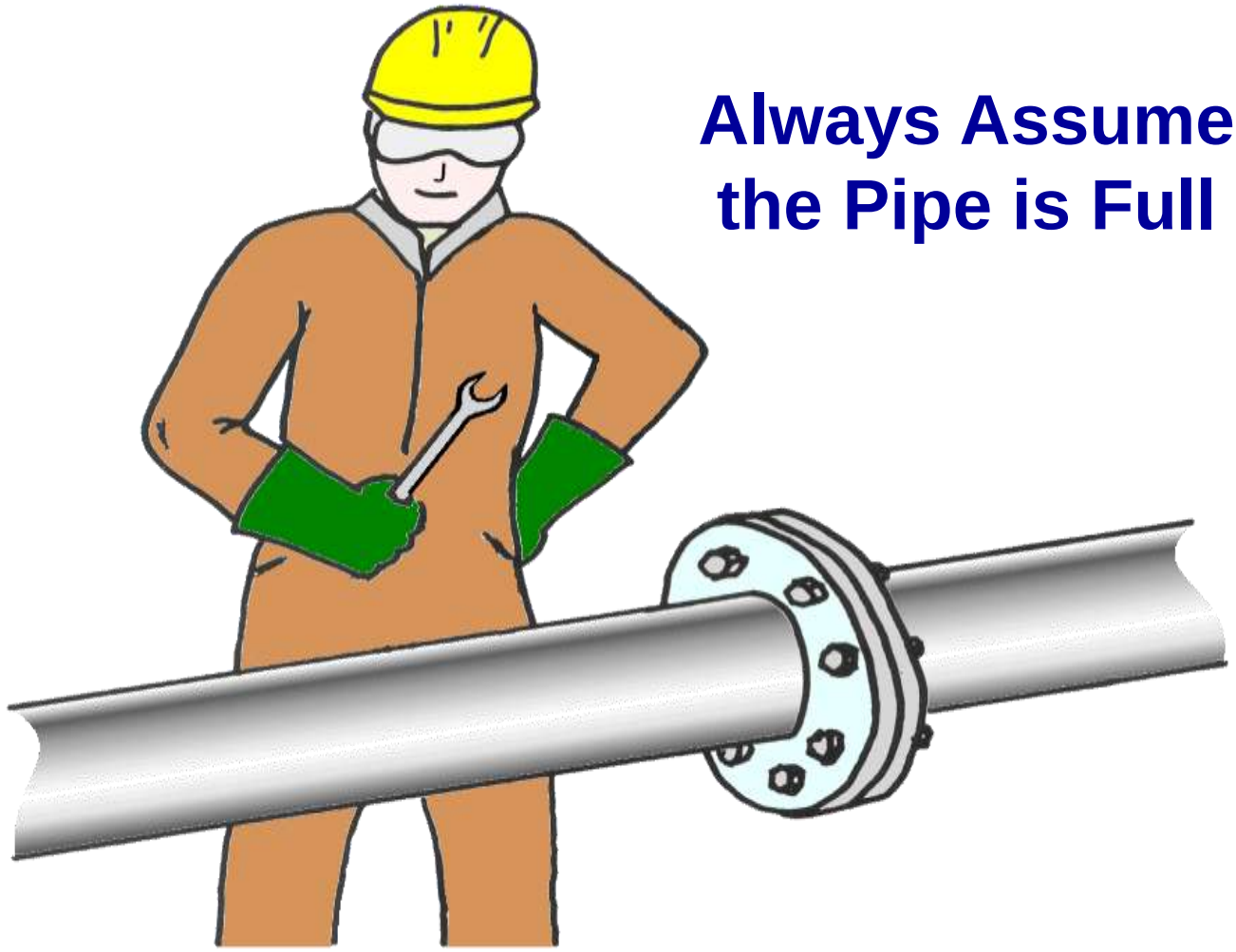
Valve Open

This Type of Valve
Will Not Allow Line to
Drain Completely

Pipeline Almost
3/4 Full

Check that the line is completely drained

When Breaking a Pipe-Joint

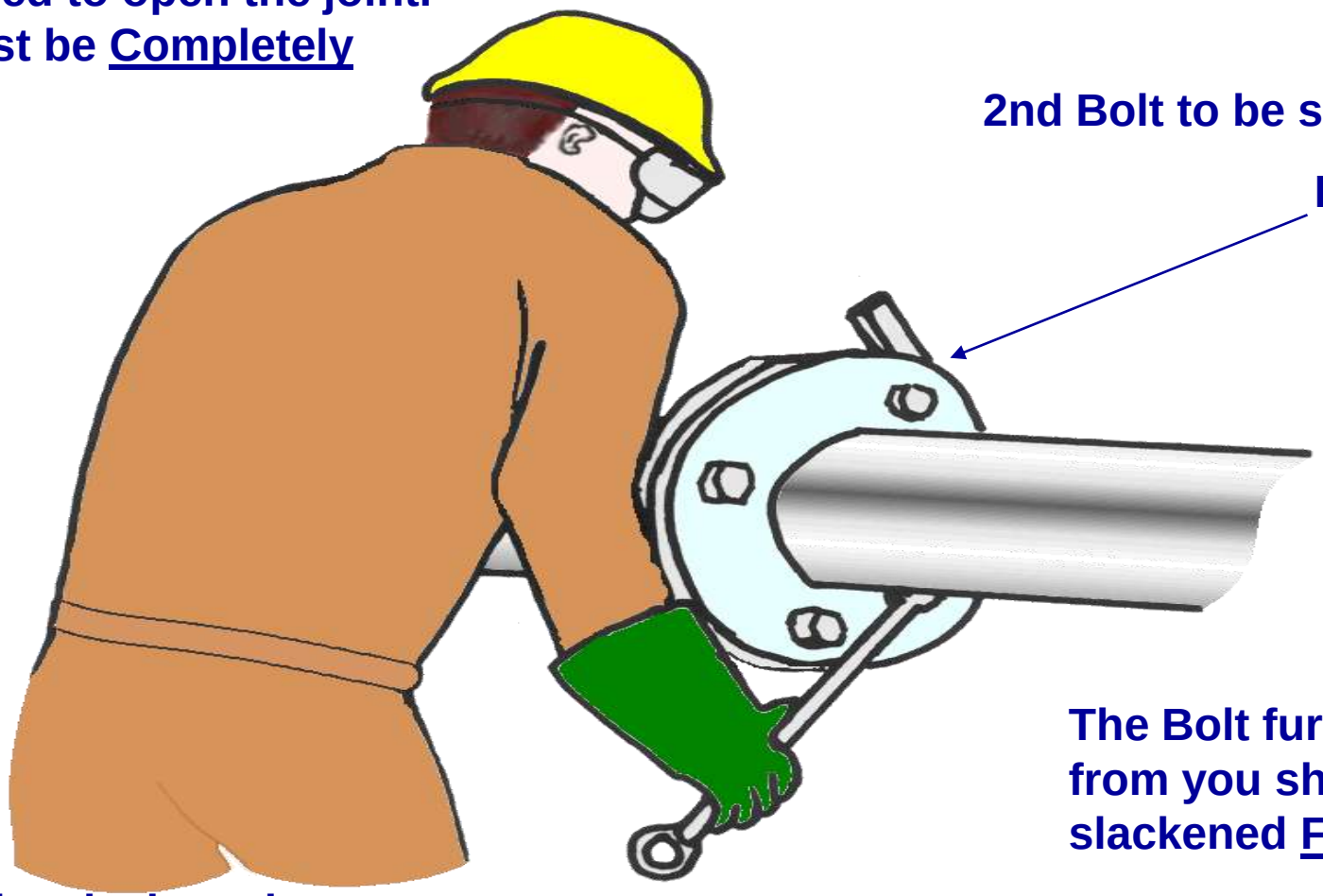


Always Assume the Pipe is Full

Proceed with the Utmost Caution

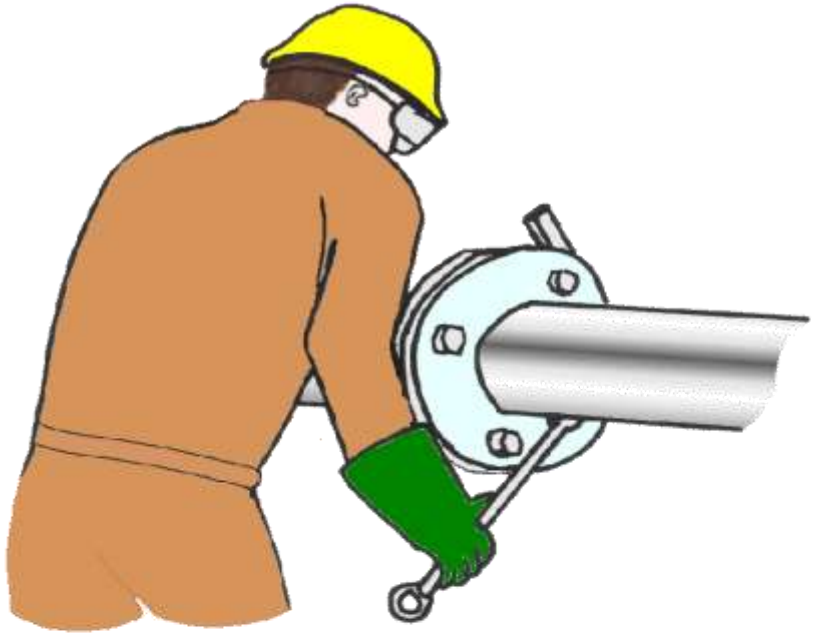
When Breaking a Joint

The last bolt should not be slackened until the fox-wedge has been used to open the joint. The line must be Completely Drained.

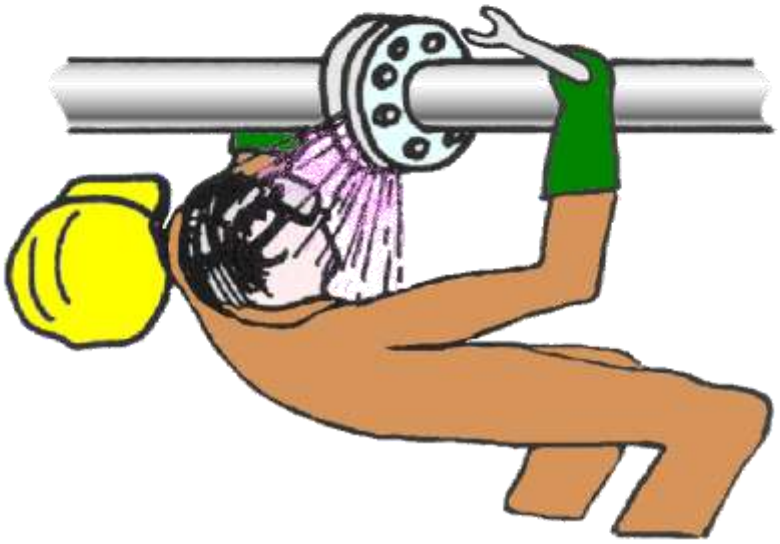


DO IT THE SAFE WAY

When Breaking a Joint



Work From Above

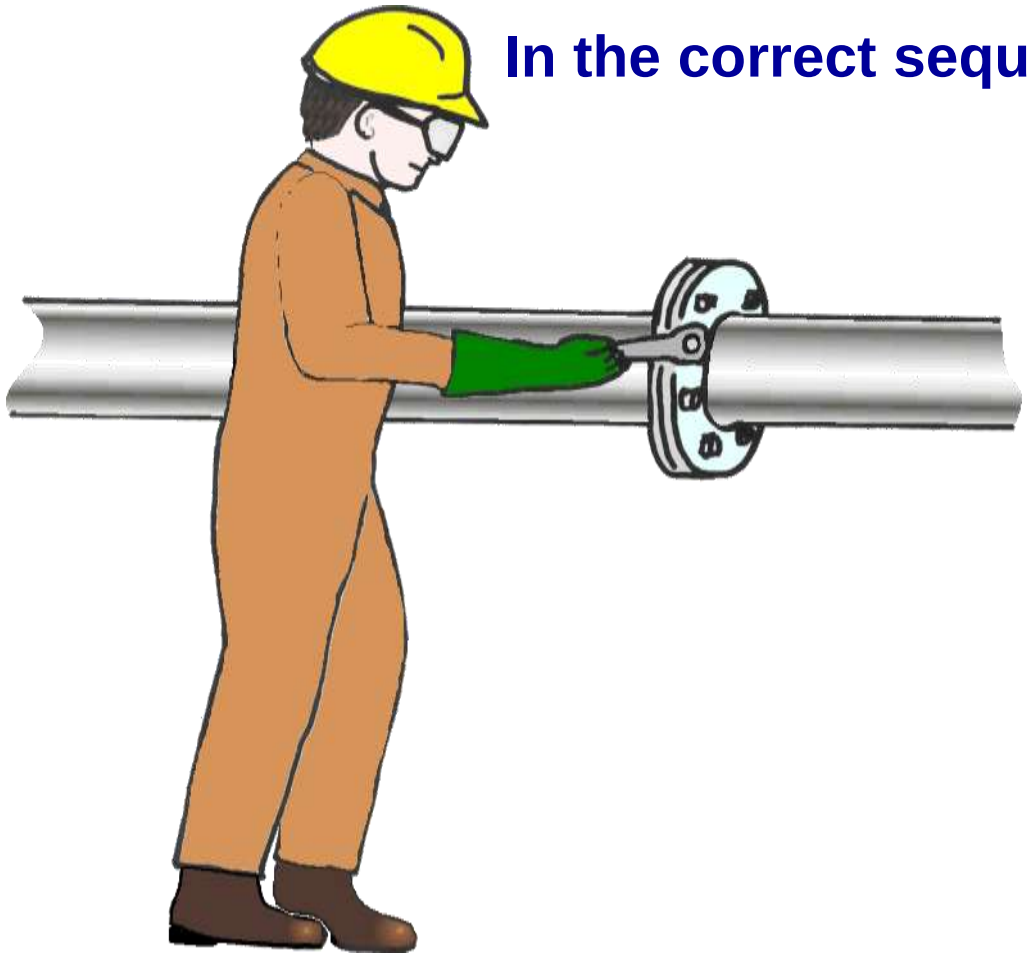


Never Below

If The Bolts Are ‘Bad’

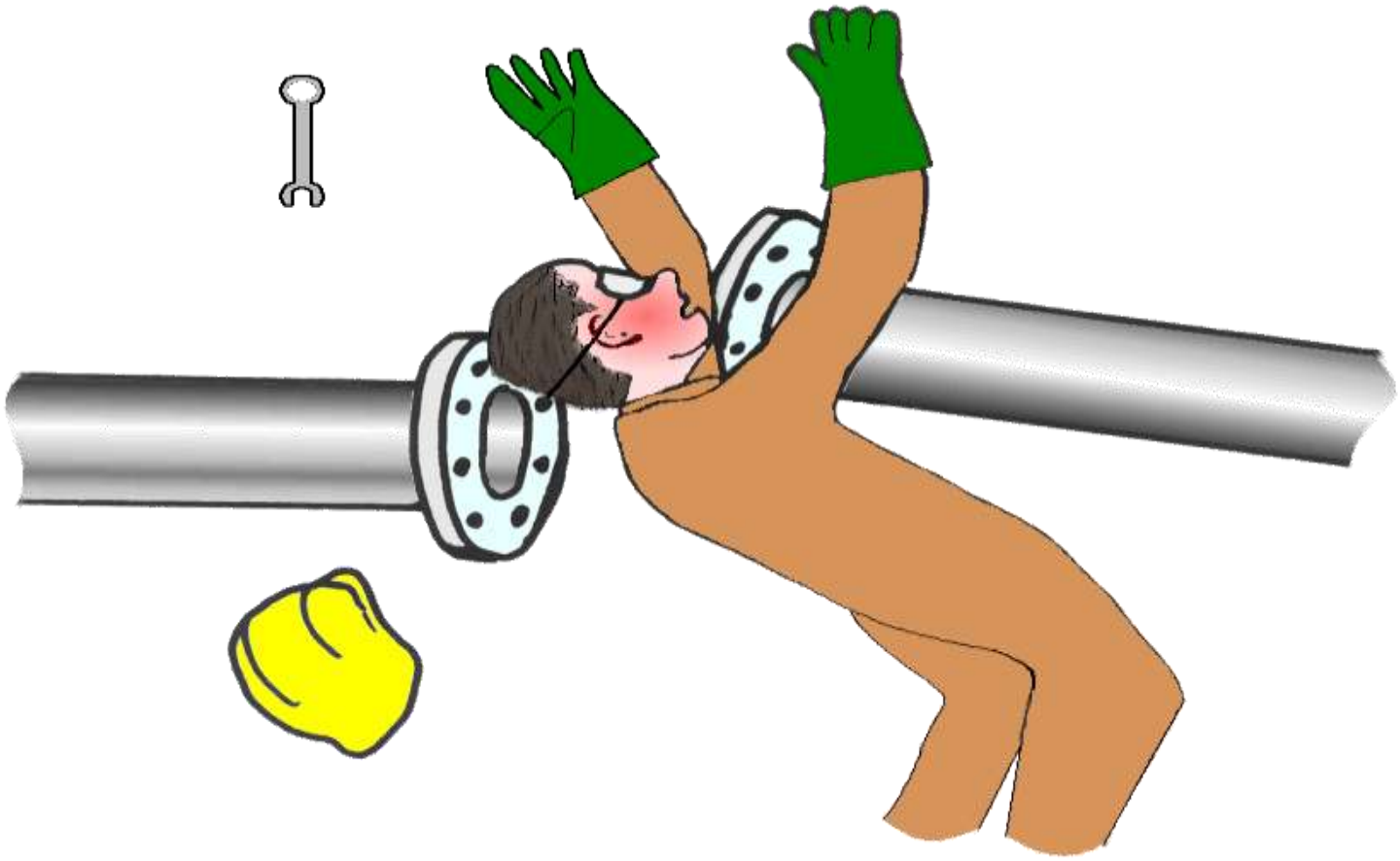
Renew them one at a time.

In the correct sequence.



BEFORE THE JOINT IS BROKEN

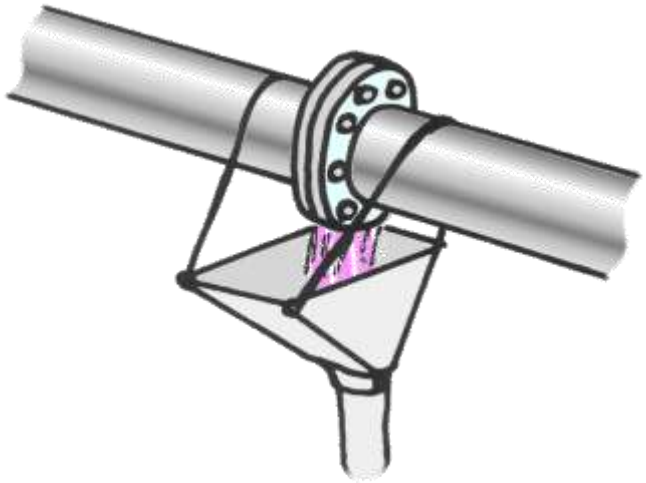
When Breaking a Joint



Watch Out For Pipe-Spring ‘It Happens’
When You Least Expect It..

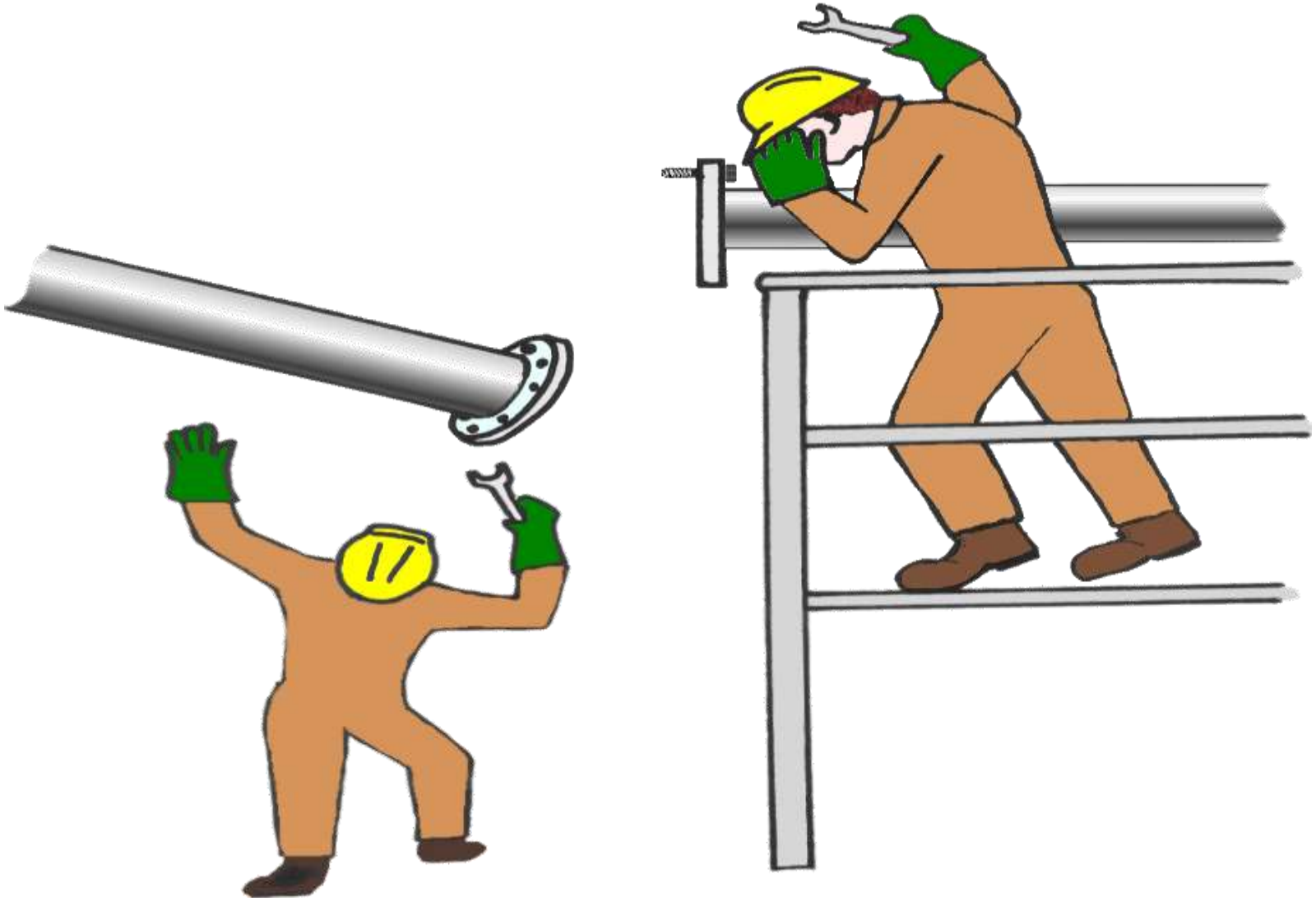
When breaking joints on liquid lines

Always Use a Tundish to Drain Away Residue



Keep Floors Clear of Corrosive Liquids You Could Get Splashed

Before Breaking a Joint



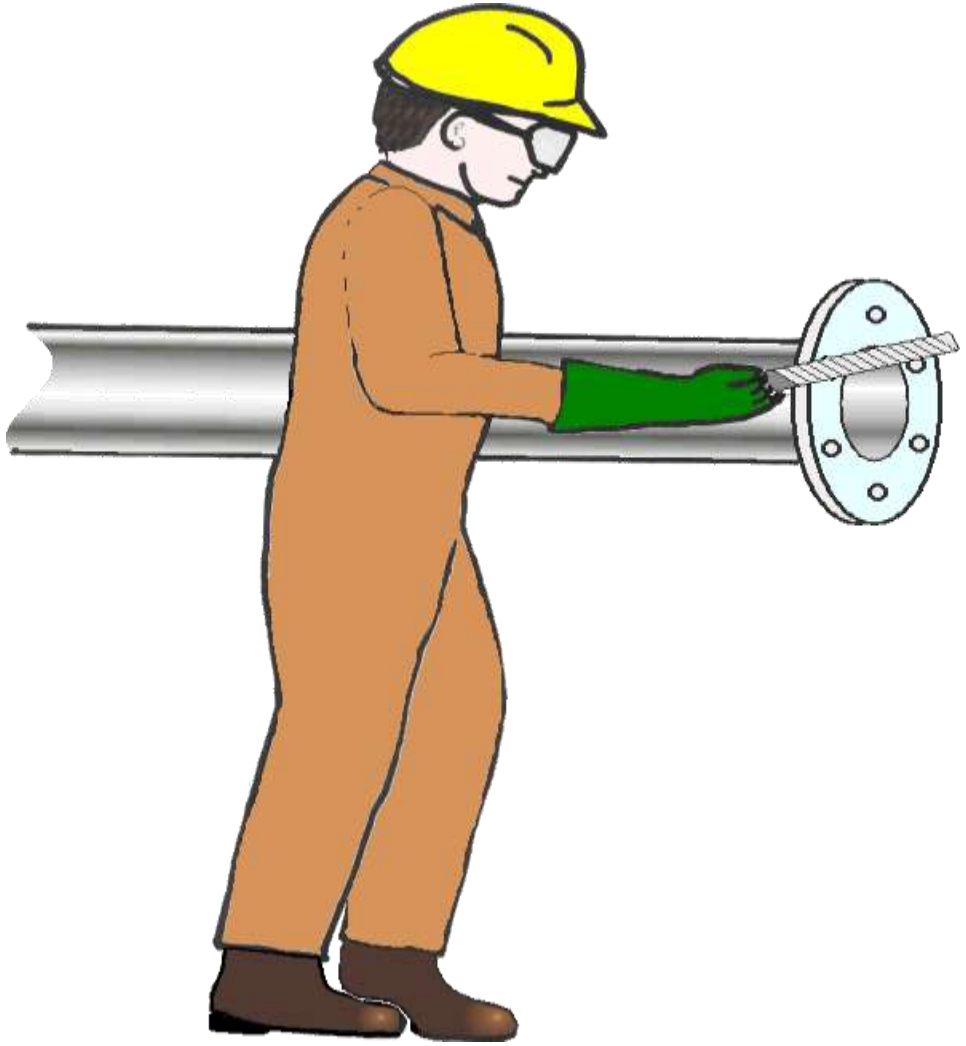
Always Make Sure The Pipe-Line is Adequately Supported

When Dismantling Pipes

Do Not
Leave Them
Under Your Feet

You Will
Fall Over
Them.

Before Re-making A Joint



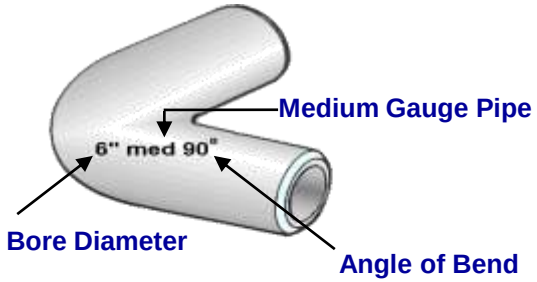
Clean The Faces Properly

“If You Don’t It Will Almost Certainly Leak”

Identification of Flanges,Fittings and Valves

Pipe Fittings

Pipes and pipe fittings are marked with the same details



Flanges

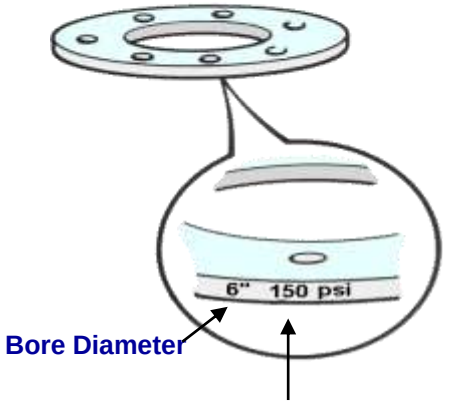
The rims of flanges are marked to show:

Nominal Size.

Design Working Pressure in *lbs per sq in*.

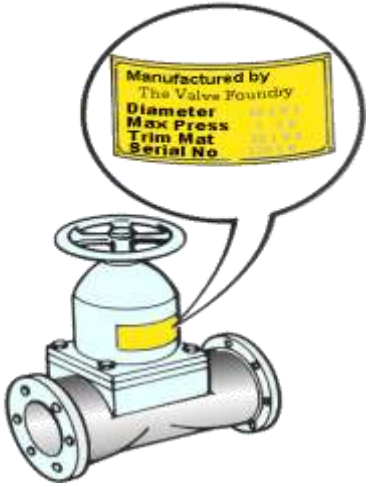
Material Type Number.

Weight.



Valves

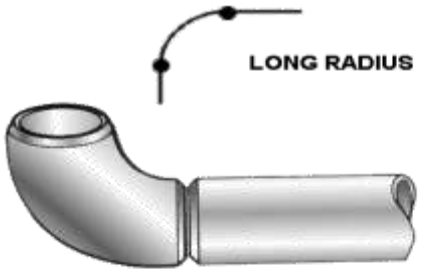
Valve Bodies carry the following information:
Name of Manufacturer.
Nominal Size.
Design Working Pressure in *lbs per sq in*.



Recognition of Pipe Fitting

Butt-welding Fittings

Fitting of this type have bevelled ends for butt welding onto pipes and flanges.

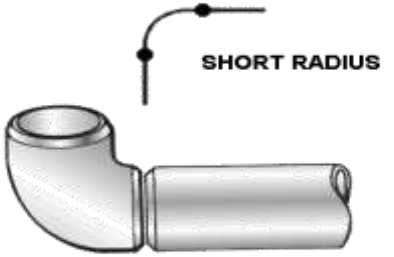


Elbows and bends provide deviations of 90° or 45° in pipework systems.

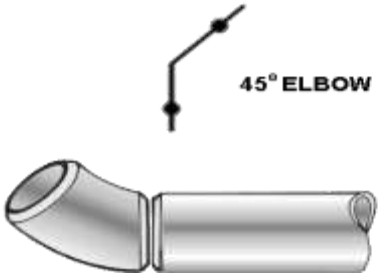
Elbows

Long radius elbows have a radius equal to 1½ times the bore of the pipe.

Short radius elbows have a radius equal to the bore of the pipe



45° elbows allow a pipe deviation of that amount.



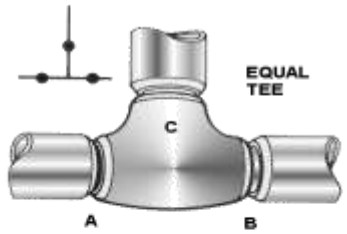
Pipework

Tee Branch

A tee branches the pipe line at 90°. The branches may be equal in diameter or there may be one reducing branch.

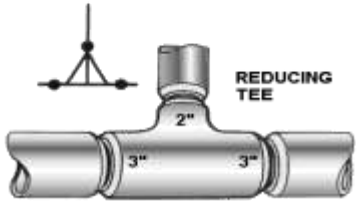
The dimensions of a branch are always quoted as:

AxBxC



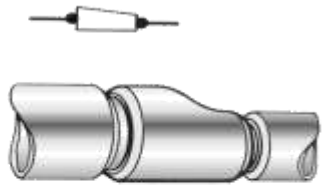
Reducing Tee Branch

Reducers are fitted where a change in pipe diameter is required.



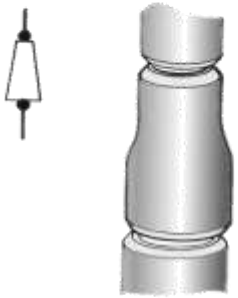
Eccentric Reducer

Used mainly in horizontal position.



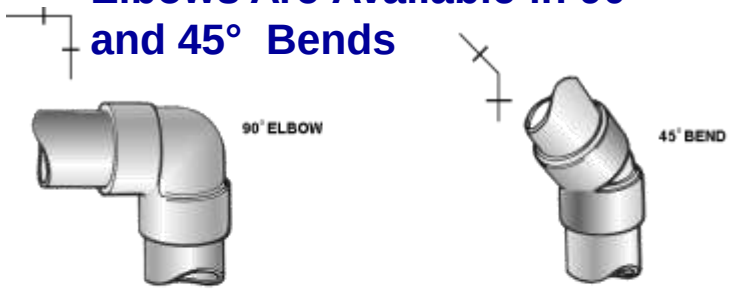
Concentric Reducer

Used mainly in the vertical position.

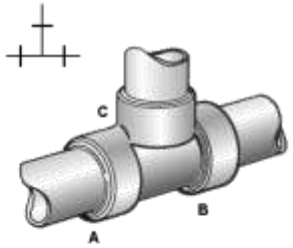


Pipework fittings

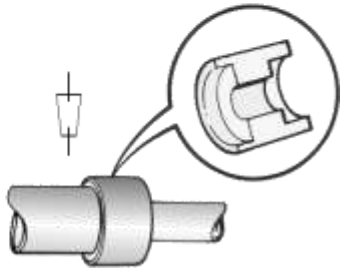
Elbows Are Available in 90° and 45° Bends



Tees are available With Equal Branches or With a Reducing Branch.



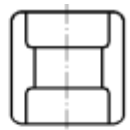
Remember the Branch Dimensions Are Always Quoted in a Particular Sequence:
A X **B** X **C**.

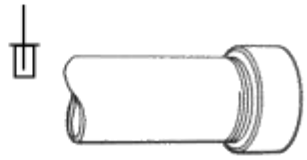


A Reducer Coupling Is Used Where Change in Pipe Diameter Is Required.

Pipework

Socket Weld Couplings Are Used for Making a Permanent Joint in a Pipe.

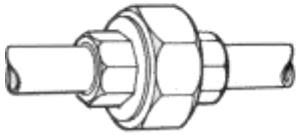


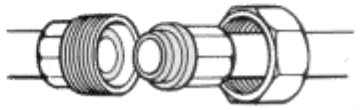


Screwed Fittings

The Cap Is Used for Permanently Blanking off a Pipe.

Unions Are Inserted in a Pipeline Where a Break in the Line Is Required.

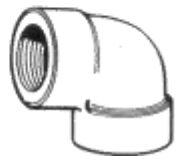




American Petroleum Institute Standards for Screw Threads on Pipework Are Adopted for All Screwed Connections.

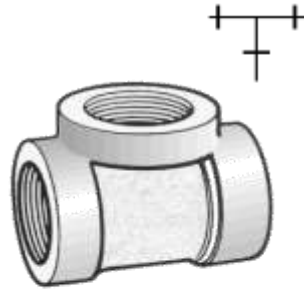
Other Standards are also in common use:

BSPT – British Standard Pipe Thread

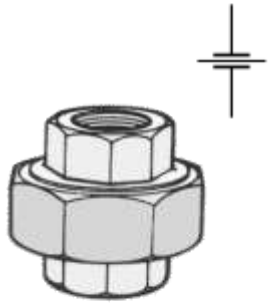


Pipework fittings

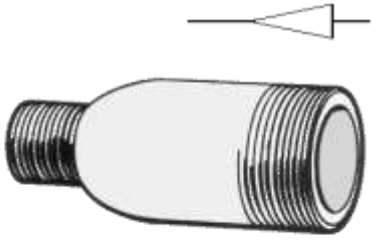
45° ELBOW



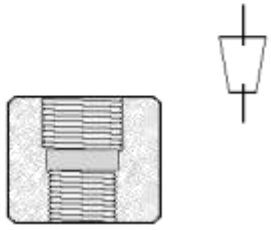
TEE



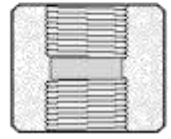
UNION



SWAGE REDUCER



REDUCER



COUPLING

Effects on Pipework

Pipework systems need to have flexibility to overcome:

- **Water Hammer**
- **Temperature Changes**
- **Vibration From Machines**

How Is This Achieved?

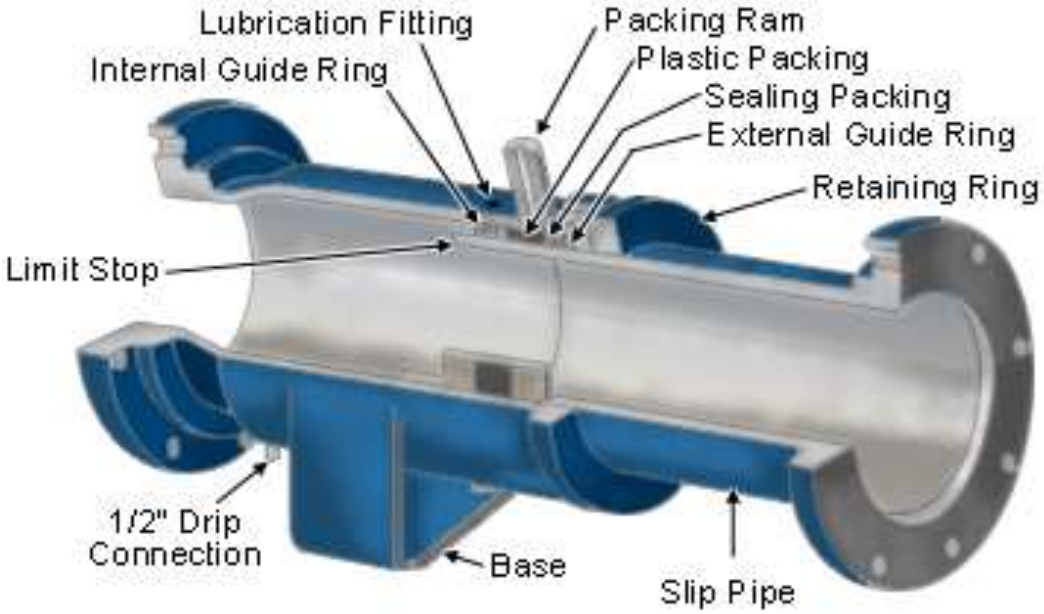
Bellows

- Expand and contract to overcome the movement of the pipework.

Expansion Loop

- The loop takes up any movement along the pipeline by increasing or decreasing its diameter.

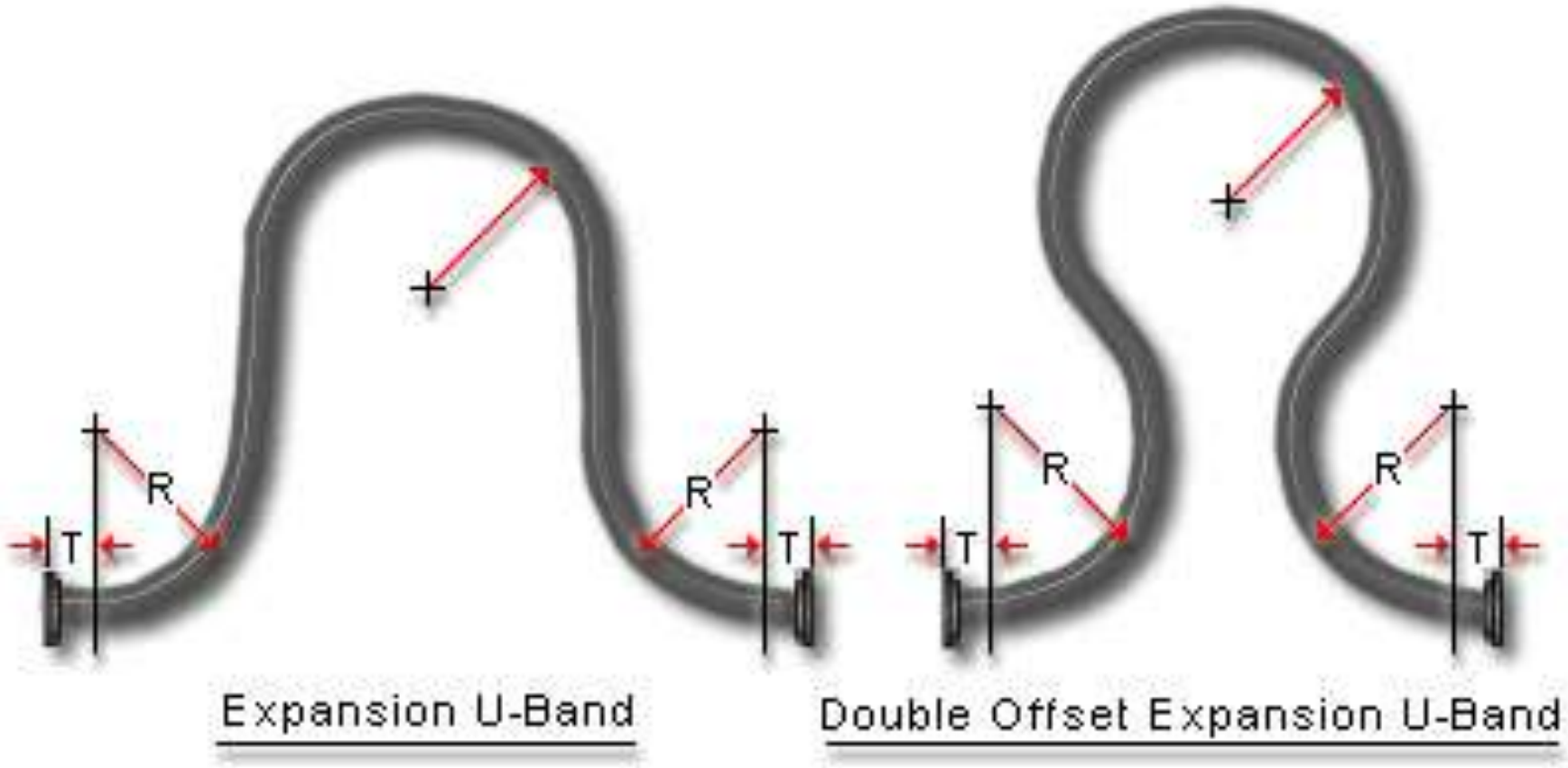
Bellows

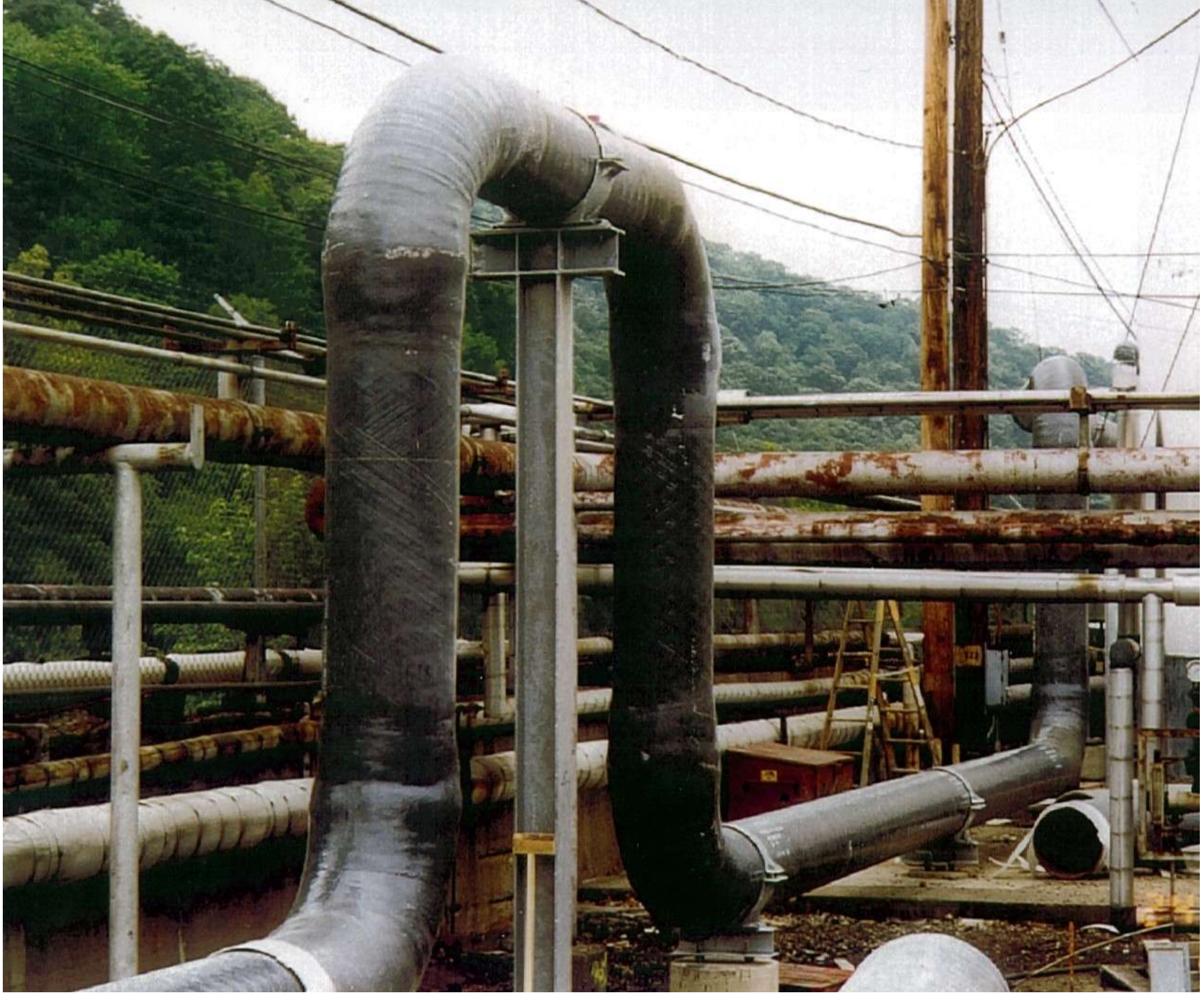


Slip Expansion Joint (CutawayView

A corrugated expansion joint consists of a flexible corrugated section which is able to absorb a certain amount of endwise movement of the pipe

Expansion bands make use of pipe fabricated with special bends. The increase in the length of pipe due to expansion is taken up by flexing or springing of the bends. Below are some typical shapes of expansion bends.





Pipeline Cleaning

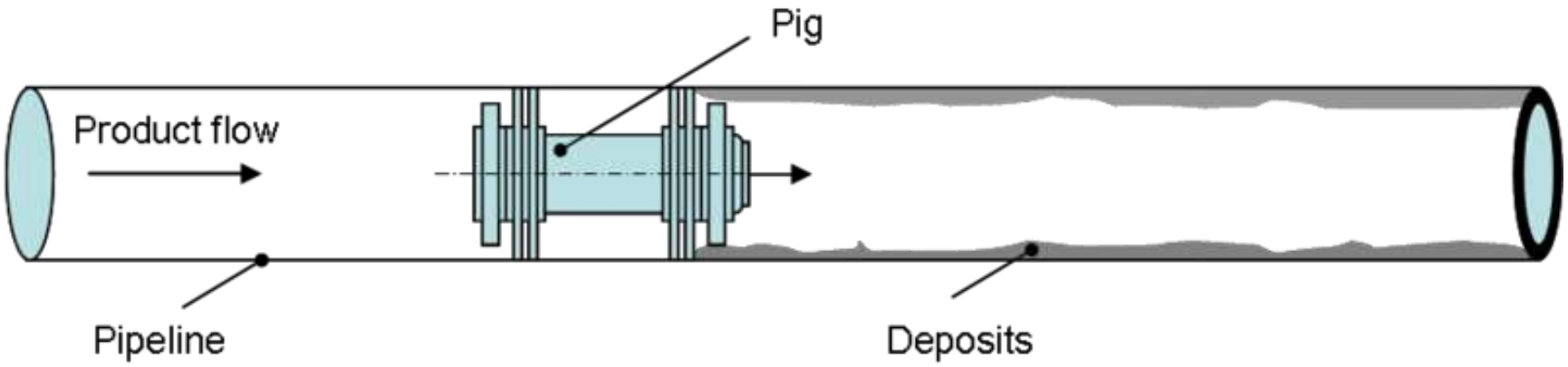
Debris and deposits in pipelines reduce product flow and if left unchecked can result in pipelines becoming blocked. A planned cleaning programme for pipelines can prevent the build-up of debris or deposits and therefore help ensure continuous product throughput is achieved.

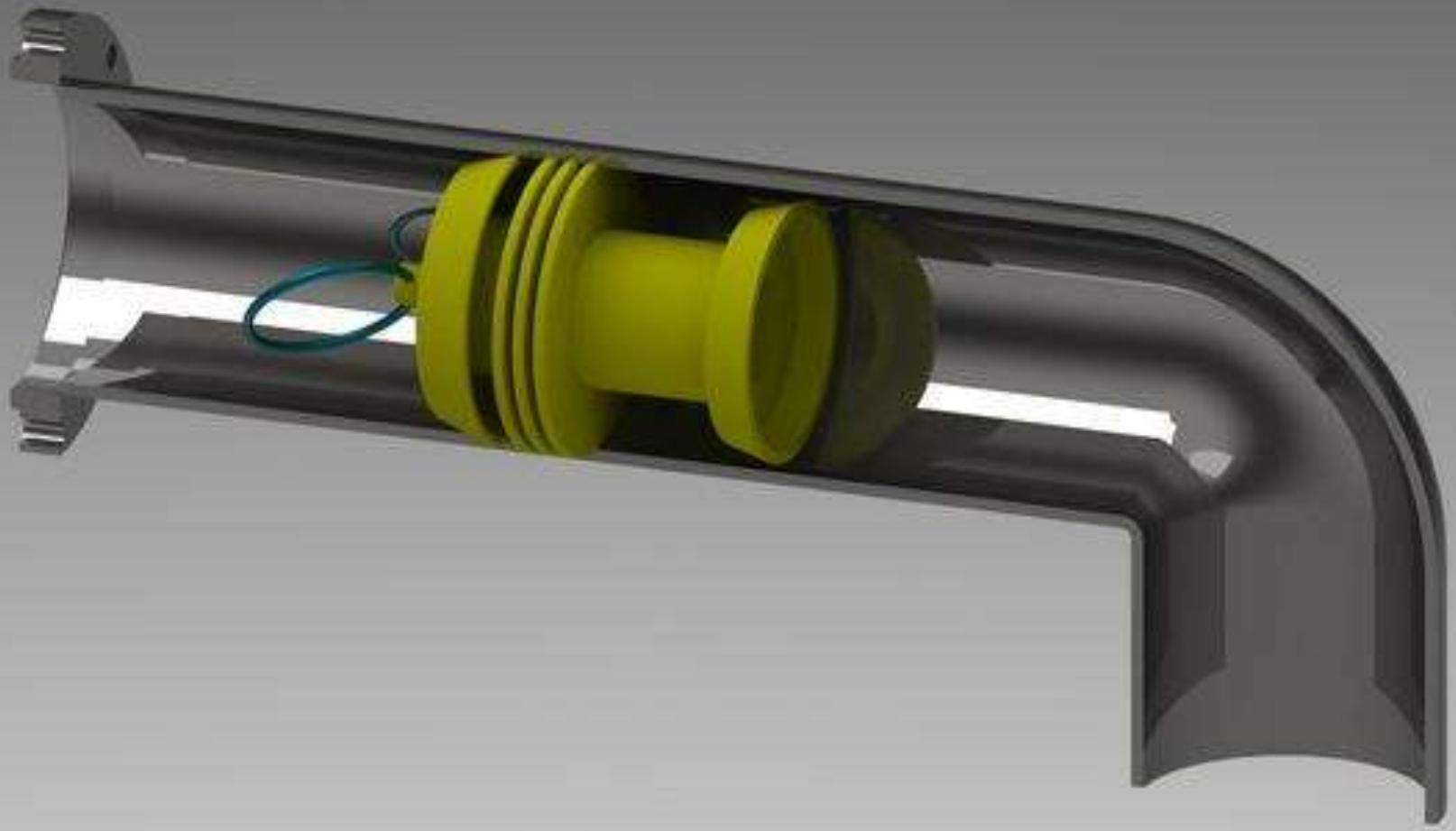
Pipeline Jetting

hydro jetting services which are also known as high pressure water jetting service. The process uses highly pressurized water from 3,000psi to 40,000psi to clean and remove any unwanted construction debris, rust, mill-scale from newly installed pipeline and even cold cut materials in any open or enclosed areas that are difficult to access. At 4,000psi, hydro jetting systems has the power to burst open the toughest blockages and at the same time scours the full diameter of the pipe, flushing debris, leaving a clear surface.

Pipeline Pigging

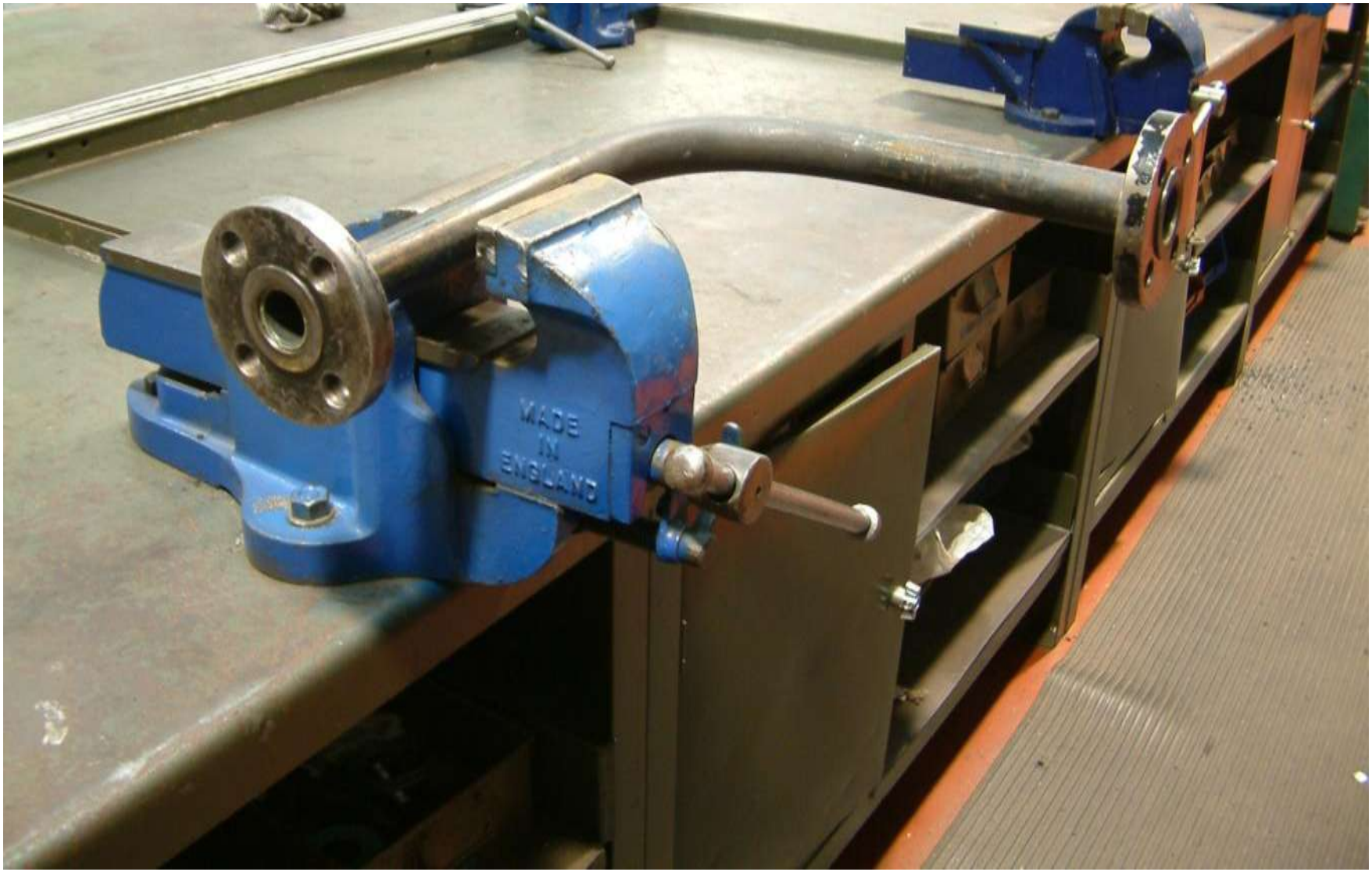
Pigging in the context of pipelines refers to the practice of using pipeline inspection gauges or 'pigs' to perform various maintenance operations on a pipeline.
This is done without stopping the flow of the product in the pipeline. These operations include but are not limited to cleaning and inspecting of the pipeline.






CAUTION

Pipe bending exercise



Pipe rig exercise – Build, test, dismantle