PROCESS PIPEWORK

Pipework

Aims

At the end of this session the student will have an understanding of the various considerations involved in the design and construction of pipelines.

Pipework

- Materials
- Pipe specifications
- Handling of Pipework
- Pipe Bending
- Threading of Pipework
- Flanges (Types & Classifications)
- Gaskets
- Bolts & Studs
- Pipework Erection
- Testing
- Safe Dismantling

Pipework

Introduction

Domestic pipes are made from copper, plastic etc for clean products.

Pipework on chemical plants is used to transport large amounts of chemicals safely from one point to another.

Why?

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

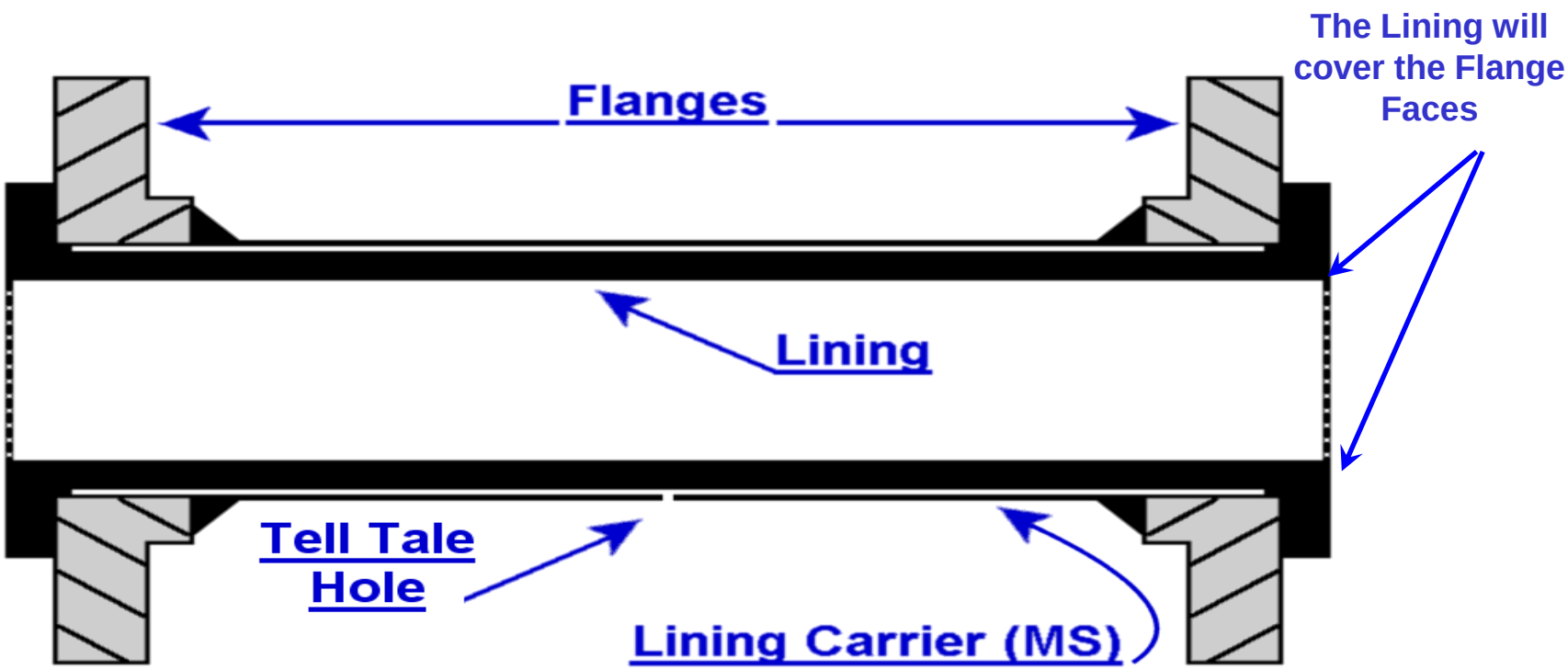
(a) Safety - to withstand pressures, temperatures and to be compatible with the various chemicals passing through them.

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

Materials:

- Mild Steel
- Stainless Steel
- Cast Iron
- Copper
- Titanium
- Monel
- Inconel

Lined Pipework



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.

Types of Linings

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

Pipe sizing

Pipe work is sized or identified by its Nominal Bore 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

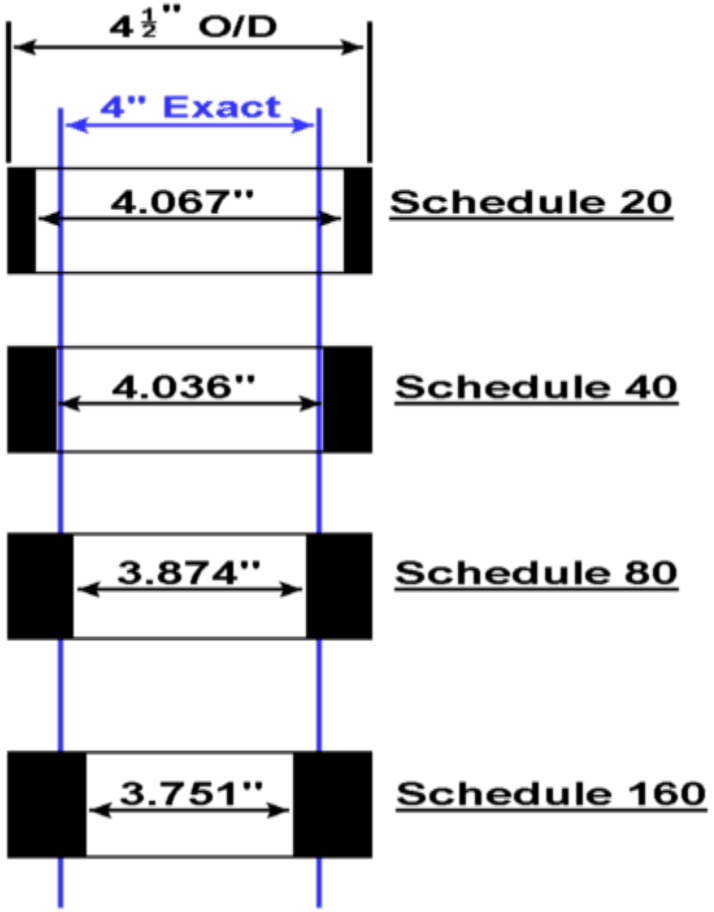
Refer to the wall thickness of schedule 20, 40, 80 and 160 pipe, as the number increases so does the wall thickness.

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



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.

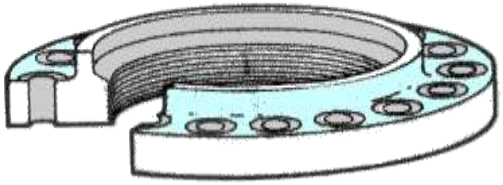
All Flanges Are Selected By Meeting Two Criteria:

Safety

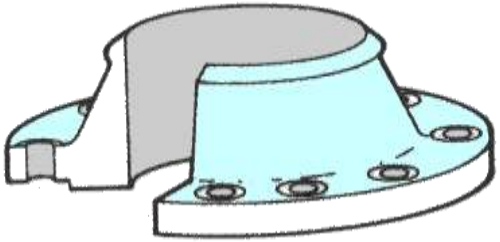
(Pipe material, size, process product, temperature, pressure)

Cost

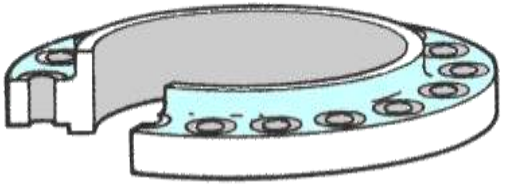
Types of Flange



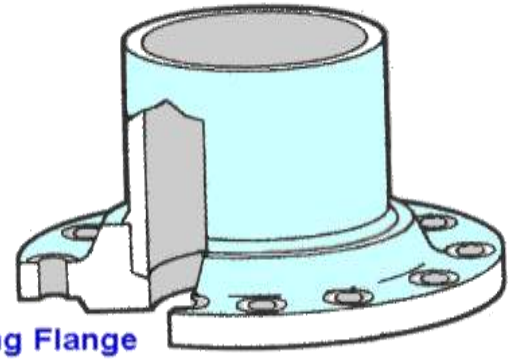
A. Threaded Flange



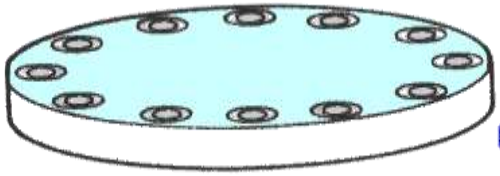
B. Welding Neck Flange



C. Slip-on Welding Flange



D. Socket Welding Flange



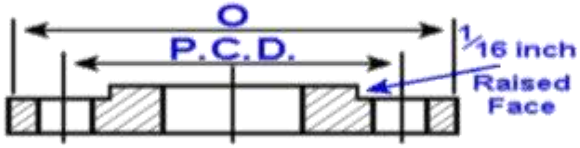
E. Blind Flange

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.

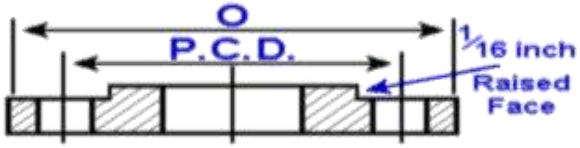
FLANGE DRILLING B.S.10 TABLE H



All Dimensions in Inches

Nom Size	O	Bolt Holes		
		No.	Dia.	P.C.D.
½	4½	4	11/16	3¼
¾	4½	4	11/16	3¼
1	4¾	4	11/16	3 7/16
1¼	5¼	4	11/16	3 7/8
1½	5½	4	11/16	4 1/8
2	6½	4	11/16	5
3	8	8	11/16	6½
4	9	8	11/16	7½
6	12	12	7/8	10¼
8	14½	12	7/8	12¾
10	17	12	1	15
12	19¼	16	1	17¼
14	21¾	16	1 1/8	19½
16	24	20	1 1/8	21¾
18	26½	20	1¼	24
20	29	24	1¼	26½
21	30	24	1¼	27½
24	33½	24	1 3/8	30¾

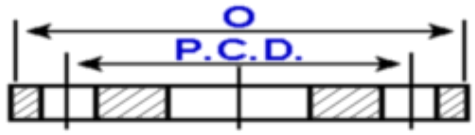
FLANGE DRILLING B.S.10 TABLE J



All Dimensions in Inches

Nom Size	O	Bolt Holes		
		No.	Dia.	P.C.D.
½	4½	4	11/16	3¼
¾	4½	4	11/16	3¼
1	4¾	4	11/16	3 7/16
1¼	5¼	4	11/16	3 7/8
1½	5½	4	11/16	4 1/8
2	6½	4	7/8	5
3	8	8	7/8	6½
4	9	8	7/8	7½
6	12	12	1	10¼
8	14½	12	1	12¾
10	17	12	1 1/8	15
12	19¼	16	1 1/8	17¼
14	21¾	16	1¼	19½
16	24	20	1¼	21¾
18	26½	20	1 3/8	24
20	29	24	1 3/8	26½
21	30	24	1 3/8	27½
24	33½	24	1½	30¾

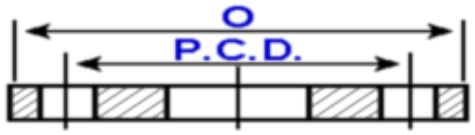
FLANGE DRILLING B.S.10 TABLE D



All Dimensions in Inches

Nom Size	O	Bolt Holes		
		No.	Dia.	P.C.D.
½	3¾	4	9/16	2 5/8
¾	4	4	9/16	2 7/8
1	4½	4	9/16	3¼
1¼	4¾	4	9/16	3 7/16
1½	5¼	4	9/16	3 7/8
2	6	4	11/16	4½
3	7¼	4	11/16	5¾
4	8½	4	11/16	7
5	10	8	11/16	8¼
6	11	8	11/16	9¼
8	13¼	8	11/16	11½
9	14½	8	11/16	12¾
10	16	8	7/8	14
12	18	12	7/8	16
14	20¾	12	1	18½
15	21¾	12	1	19½
16	22¾	12	1	20½
18	25¼	12	1	23
20	27¾	16	1	25¼
21	29	16	1	26½
24	32½	16	1 1/8	29¾

FLANGE DRILLING B.S.10 TABLE E



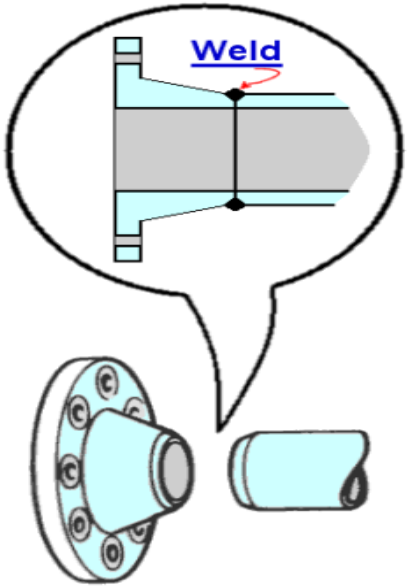
All Dimensions in Inches

Nom Size	O	Bolt Holes		
		No.	Dia.	P.C.D.
½	3¾	4	9/16	2 5/8
¾	4	4	9/16	2 7/8
1	4½	4	9/16	3¼
1¼	4¾	4	9/16	3 7/16
1½	5¼	4	9/16	3 7/8
2	6	4	11/16	4½
3	7¼	4	11/16	5¾
4	8½	8	11/16	7
5	10	8	11/16	8¼
6	11	8	7/8	9¼
8	13¼	8	7/8	11½
9	14½	12	7/8	12¾
10	16	12	7/8	14
12	18	12	1	16
14	20¾	12	1	18½
15	21¾	12	1	19½
16	22¾	12	1	20½
18	25¼	16	1	23
20	27¾	16	1	25¼
21	29	16	1 1/8	26½
24	32½	16	1 ¼	29¾

Welding neck flanges

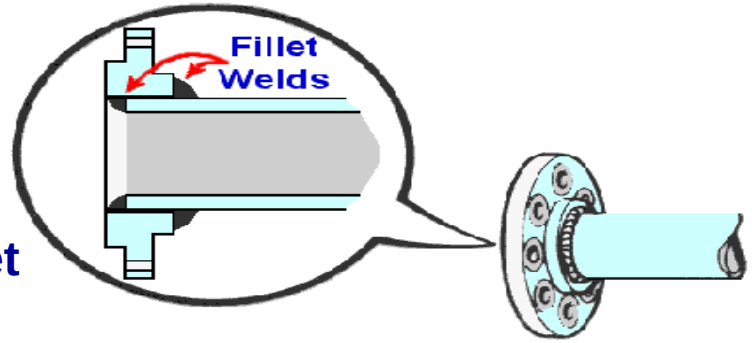
Are identified by their tapered hubs which connect the flange to the pipe.

Usually used on high pressure installations



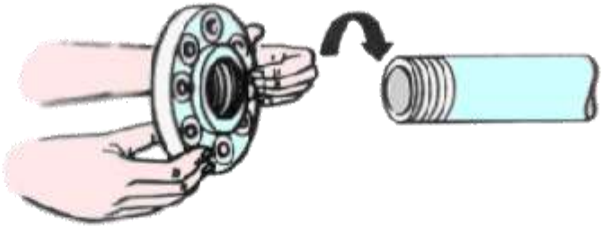
Slip on flanges

Fit onto the end of the pipe and are Fillet Welded into position, back and front.



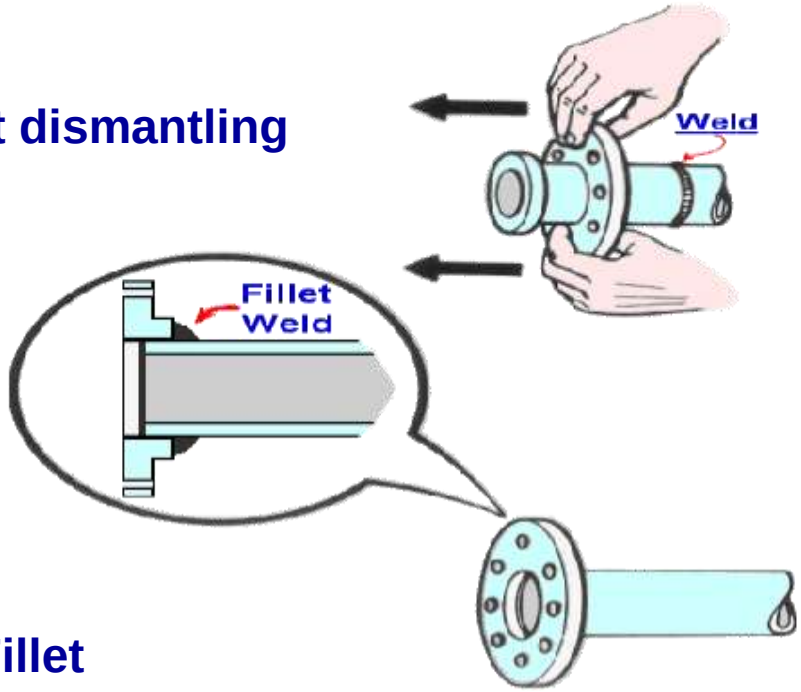
Screwed or Threaded Flanges

Screwed onto the end of the pipe.



Backing Flanges

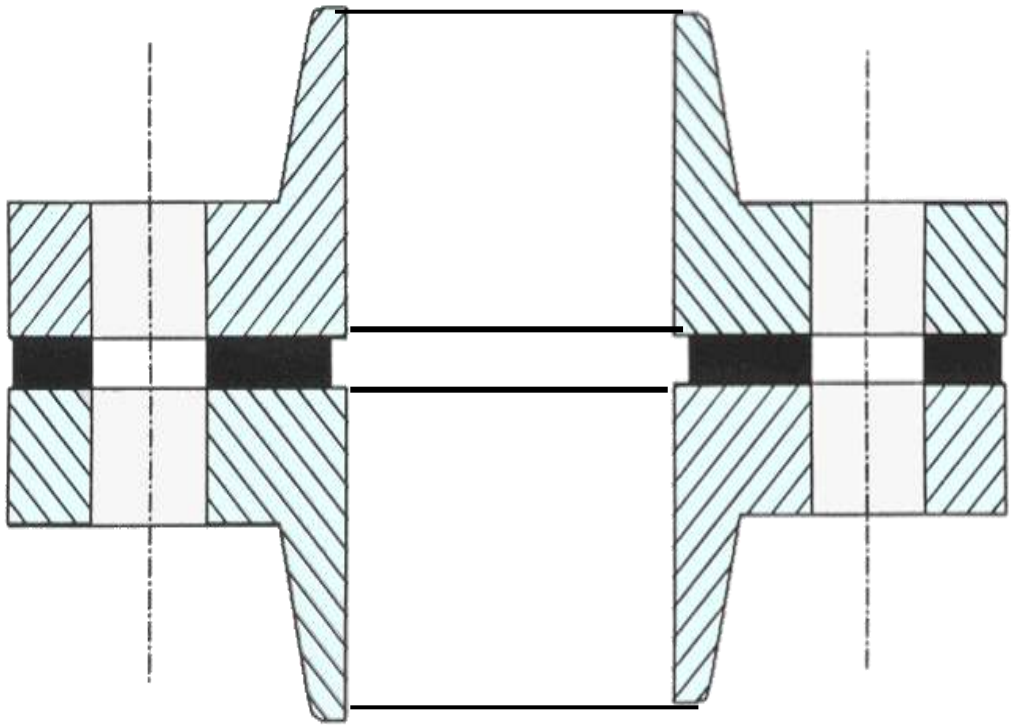
Used with lap joints stubs where frequent dismantling for inspection and cleaning is necessary.



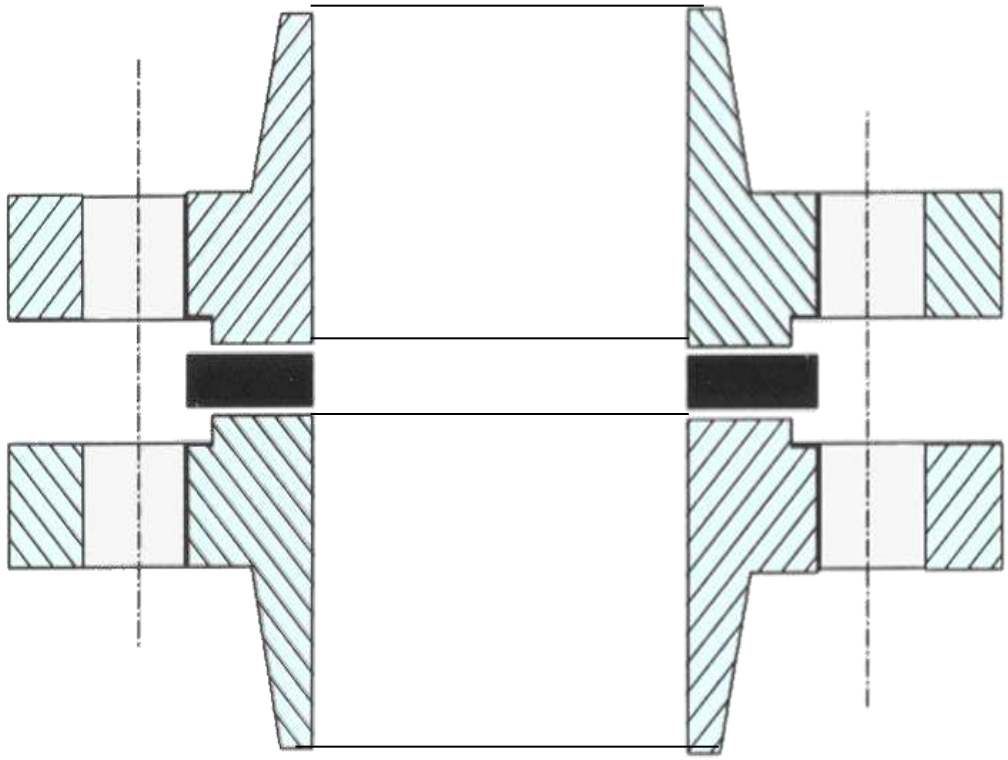
Socket Weld Flanges

Are slipped onto the ends of pipes and Fillet Welded in position.

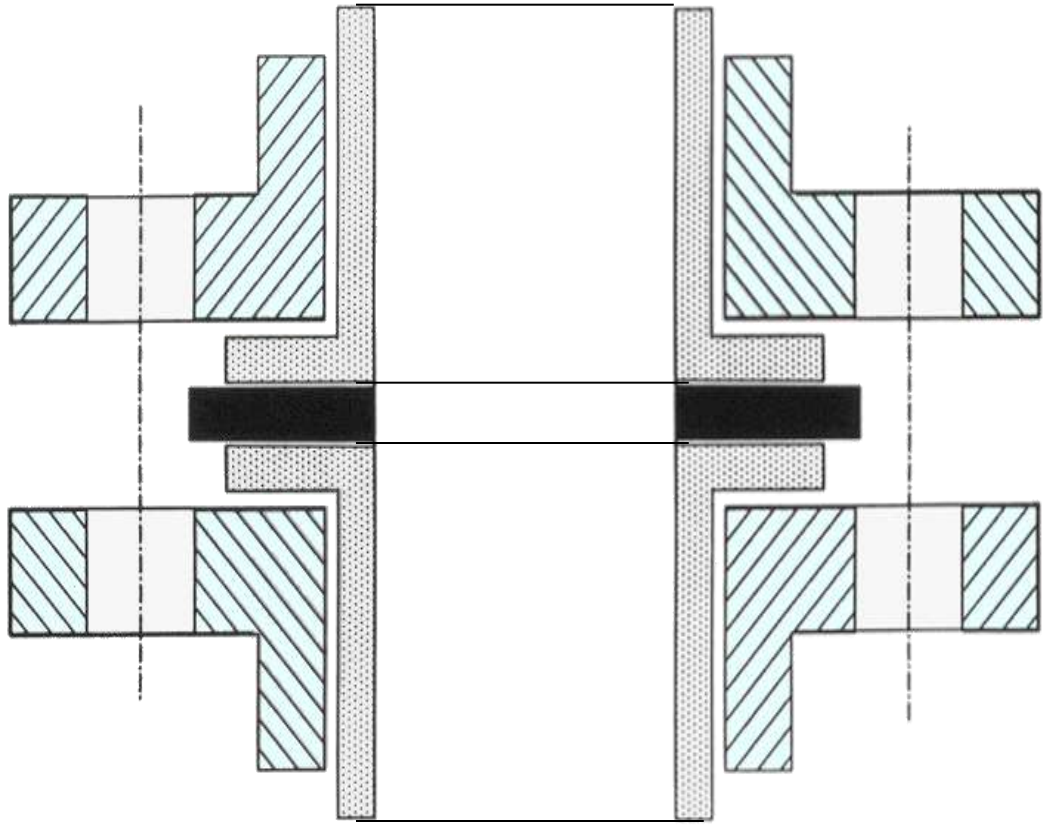
Flat Face



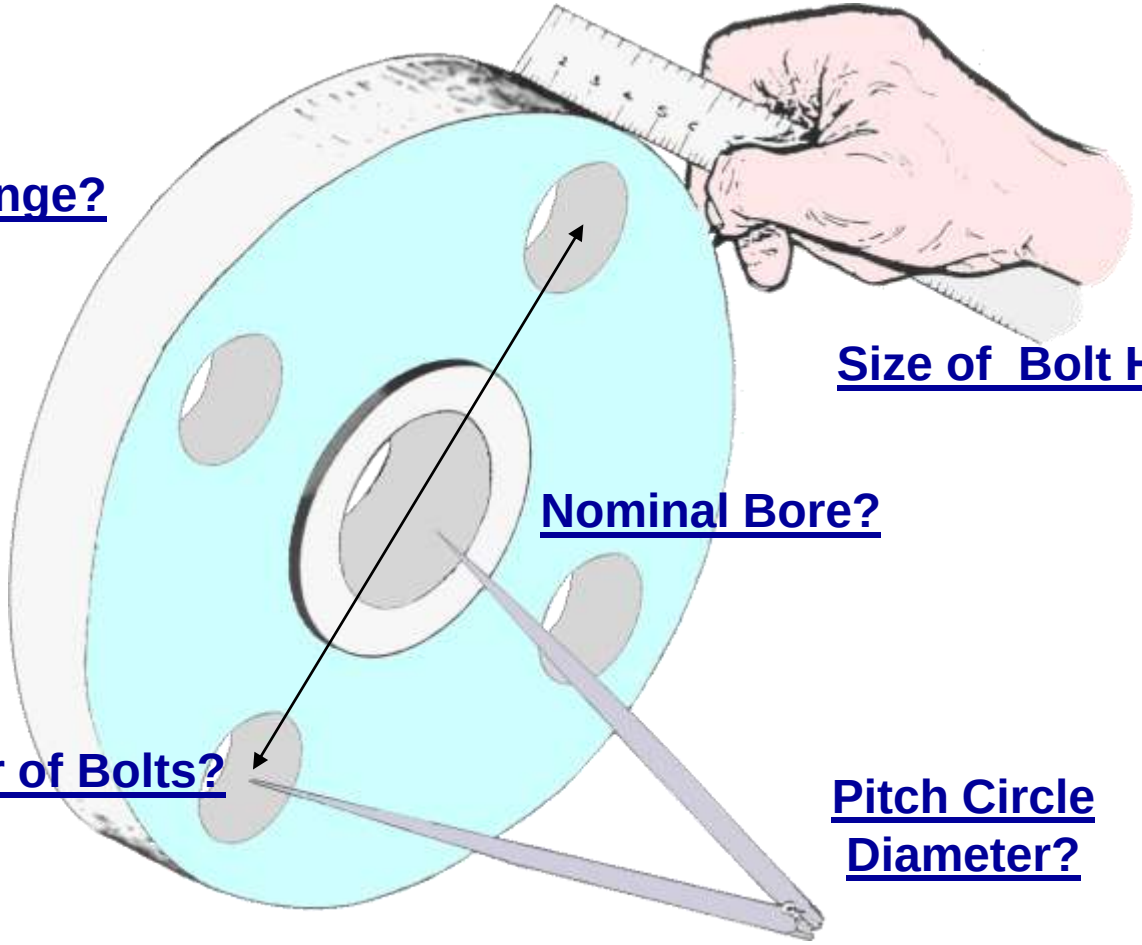
Raised Face



Lapped



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.

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

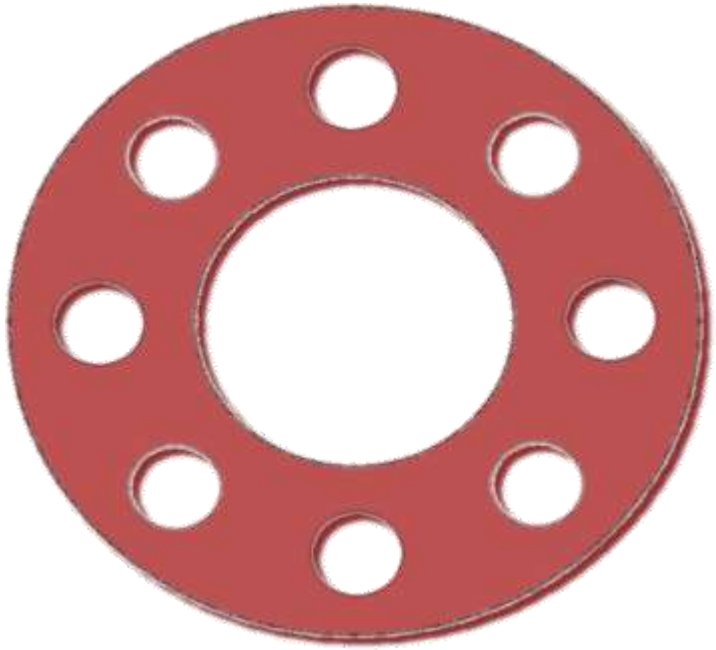
Resistance to Corrosive Action

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

Design Considerations When Selecting Joints

- Line Product
- Temperature
- Pressure
- 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 asbestos fibre*, or compressed asbestos 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:

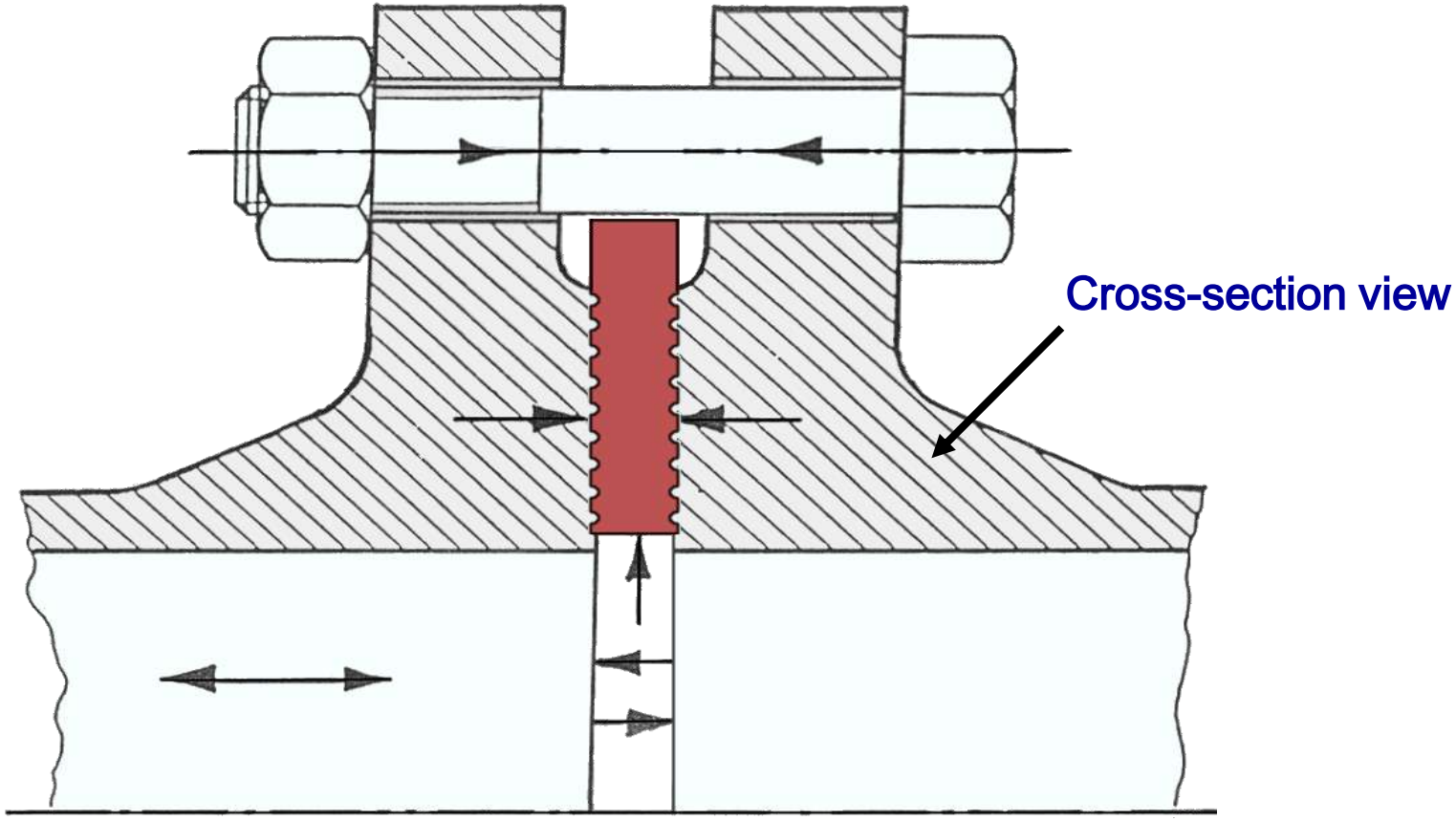
1. **Product.**
2. **Temperature.**
3. **Pressure.**
4. **Type of Flange Connection.**

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



Joints & Jointing

Rubber

Applications - Low pressure systems, water, air, uneven flanges.

Advantages -

- **Versatile.**
- **Good Resilience.**
- **Highly Impermeable.**

Joints & Jointing

CAF(compressed asbestos fibre)

Because of the asbestos content, care should be taken to avoid any dust, never file or grind.

Thickness

CAF has little tensile strength. At high pressures a wide joint is more likely to blow than a narrower one.

Will tolerate a wide range of chemicals, ie, Nitrogen, Chlorine, Hydrogen, some solvents, Steam and Oil

They will withstand temperatures of up to 510°C and pressures of up to 100-bar

All CAF joints should be marked with: a) The Makers Logo.

b) The Flange Rating.

c) Standard Number.

NOTE: Asbestos is an extremely hazardous material and has been replaced by safe alternatives However there are still old flanged joints in situ that may have a CAF gasket fitted

Joints & Jointing

SPIRAL WOUND JOINTS

Work through construction:

Windings - Carbon Steel, Monel, Titanium, Nickel, Stainless Steel.

Fillers - Asbestos, Lead, PTFE, Masterite, Ceramic Fibres and Carbon.

Function of the Rings

1) **Gives strength against line pressure.**
2) **Assists in centralising the joint.**
3) **Limits the amount of compression.**

Joints & Jointing

PTFE

Advantages:

- **Chemically inert**
- **Easy to cut**
- **No dangerous particles**

Disadvantages:

- **Low co-efficient of friction**
- **Poor resilience (flows under load)**
- **Maximum temperature 300°**

PTFE can be strengthened by:

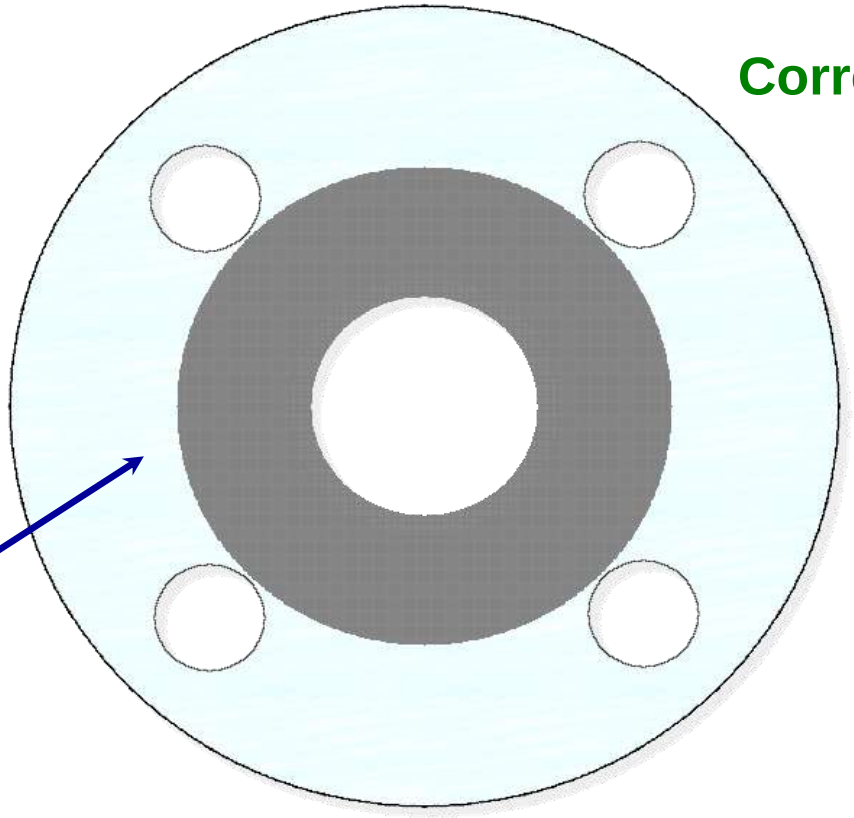
a) Enclosing a steel mesh inside the gasket.

b) Reinforcing the PTFE with glass, metal, etc.

Joints & Jointing

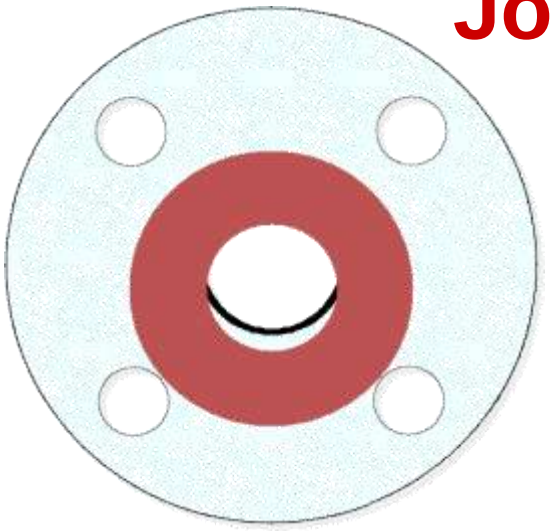
What Size Gasket?

Correct size joint



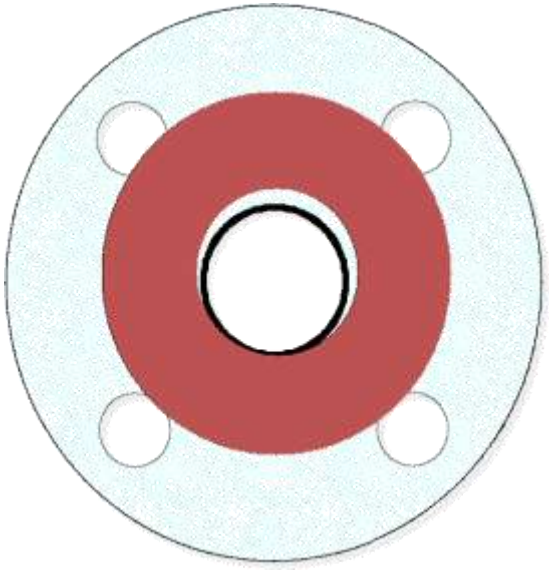
Offer the Joint up to the Flange Face it should look like this. With the outside of the joint just touching the bolt holes. The inside of the joint must not protrude into the Pipe Bore.

Joints & Jointing



Wrong

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



Wrong

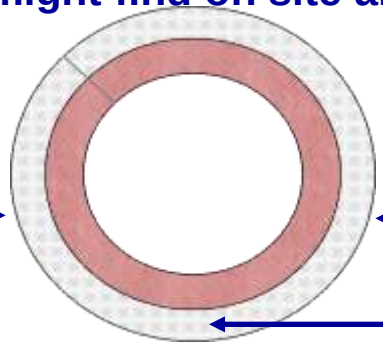
Joint is too large and is obstructing the bolt holes.

Joints & Jointing

Some of the gaskets that you might find on site are:

Spiral Wound Gaskets

1)Type with guide ring.



Size & Rating Stamped on Guide Ring

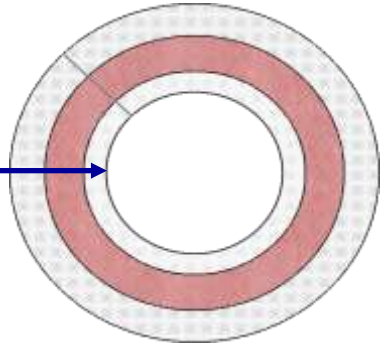
Guide Ring

Gasket Face

The type with the guide ring should be used between flat or raised face flanges to ensure true centering and to limit the compression of the gasket.

In addition the guide ring provides extra radial strength and prevents the possibility of a gasket 'blow-out'.

Inner Guide Ring

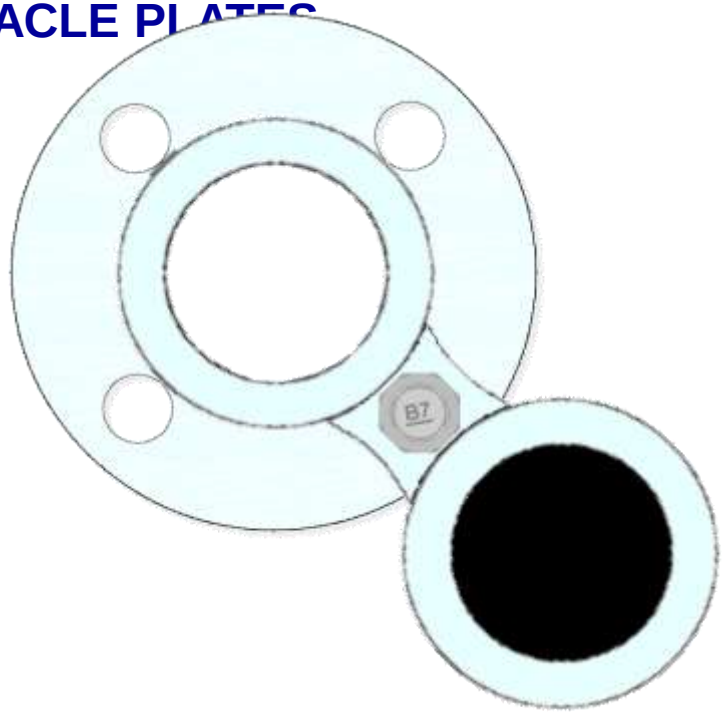


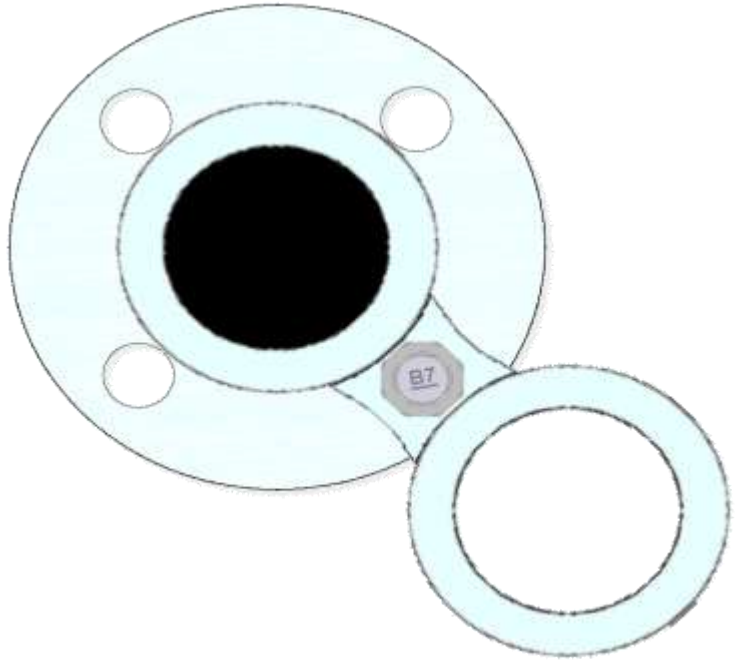
The type with an inner guide ring is used on vacuum service.

Joints & Jointing

Spades

SPECTACLE PLATES





When a spade is in place and needs turning you will have to remove more bolts to allow the spectical blind to rotate.

Joints & Jointing

Spades

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.

Inserting a Spade:

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

Remember This:

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

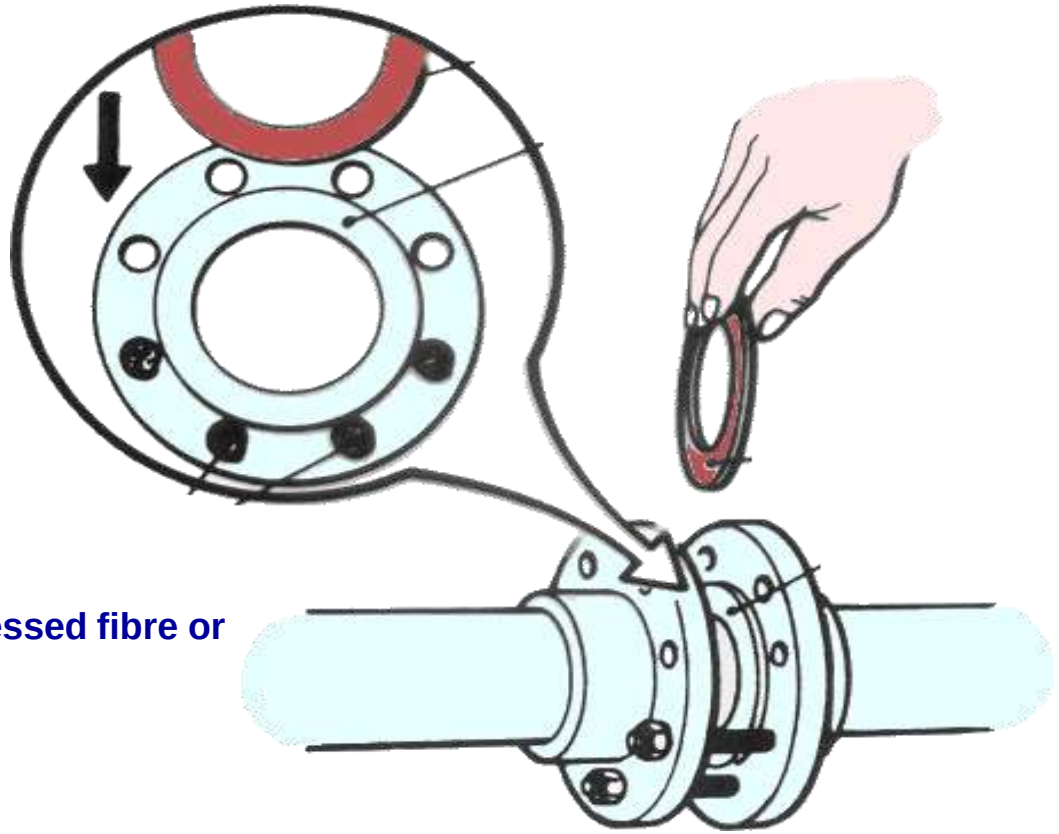
Joints & Jointing

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.

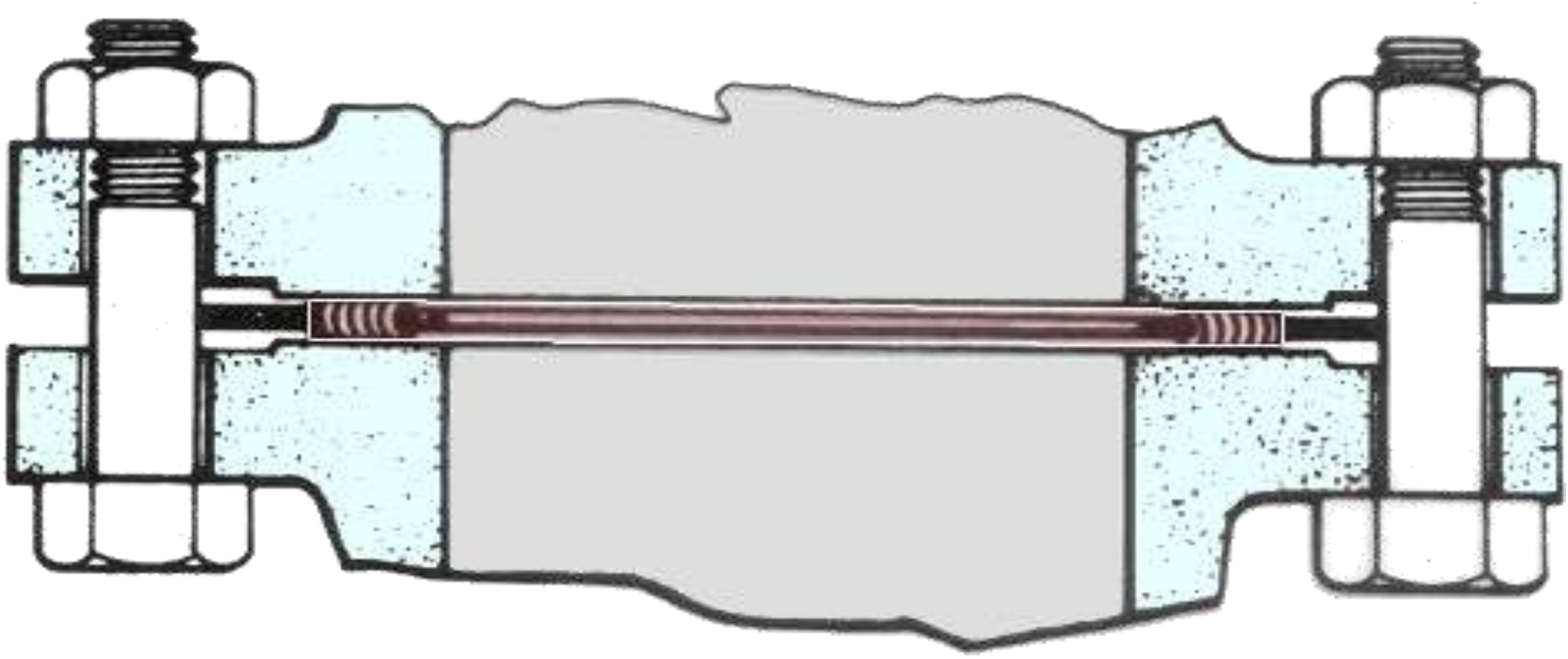


1) Raised-Face plain gaskets

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

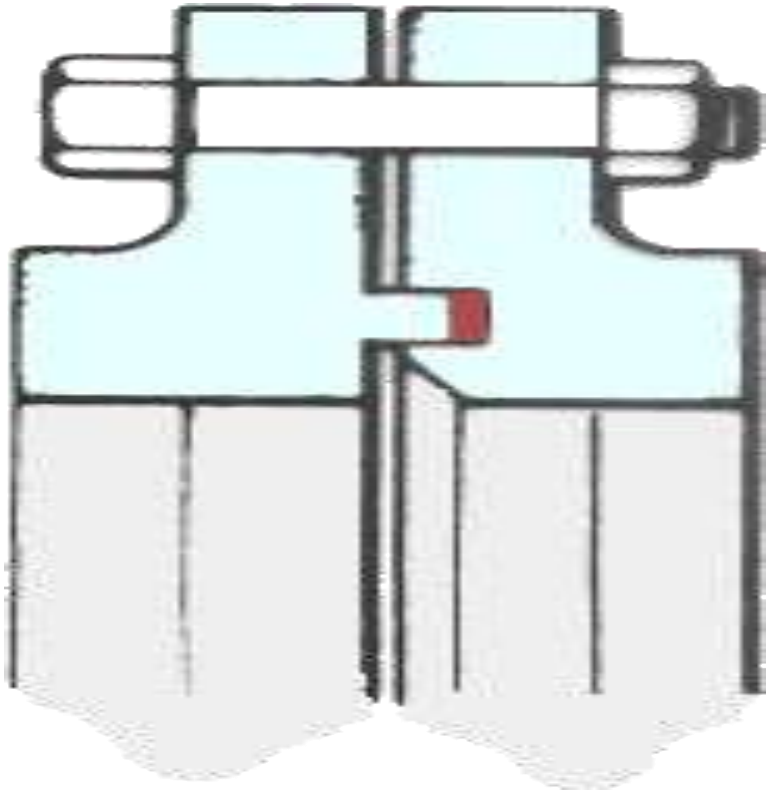
2) Spiral-wound gaskets

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

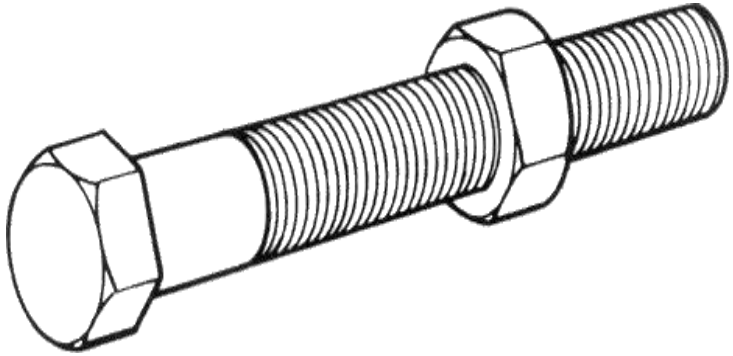


3) Flat Ring gaskets

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.

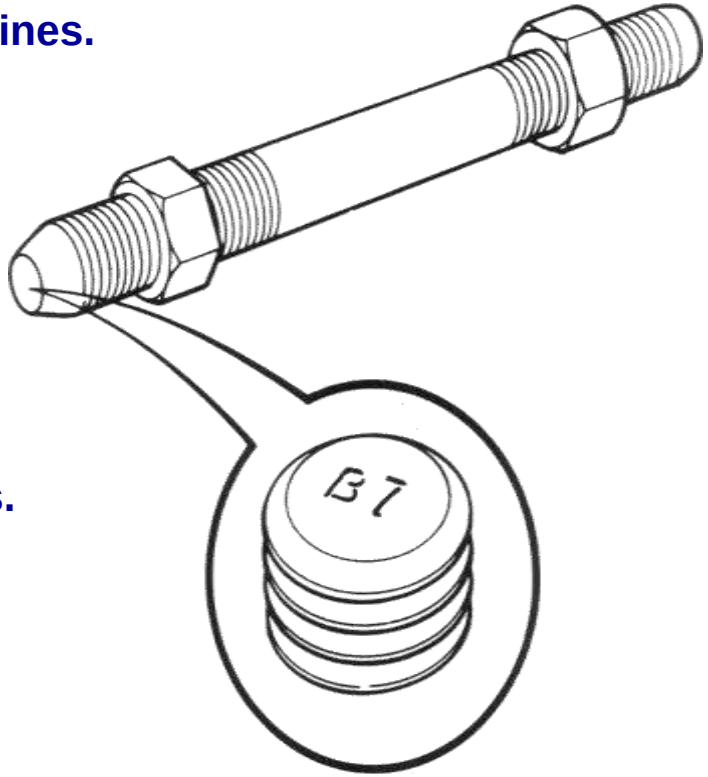


Joints & Jointing



Bolts

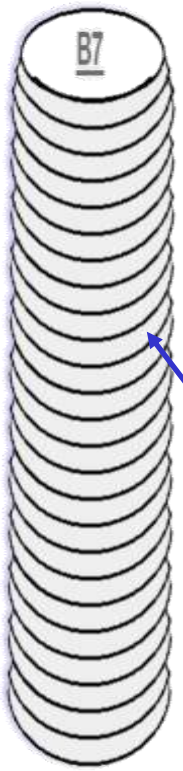
Bolts and nuts are made from mild steel and have limited qualities of strength and durability.
The use of bolts is therefore limited to low pressure lines.



Stud Bolts

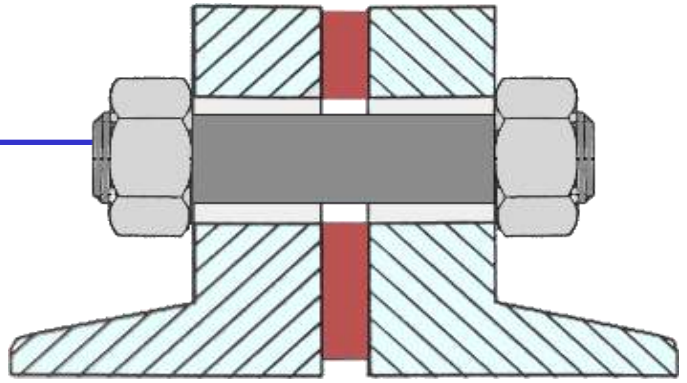
These are made from higher quality steel than machined bolts and are used at higher pressures.

Joints & Jointing



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.

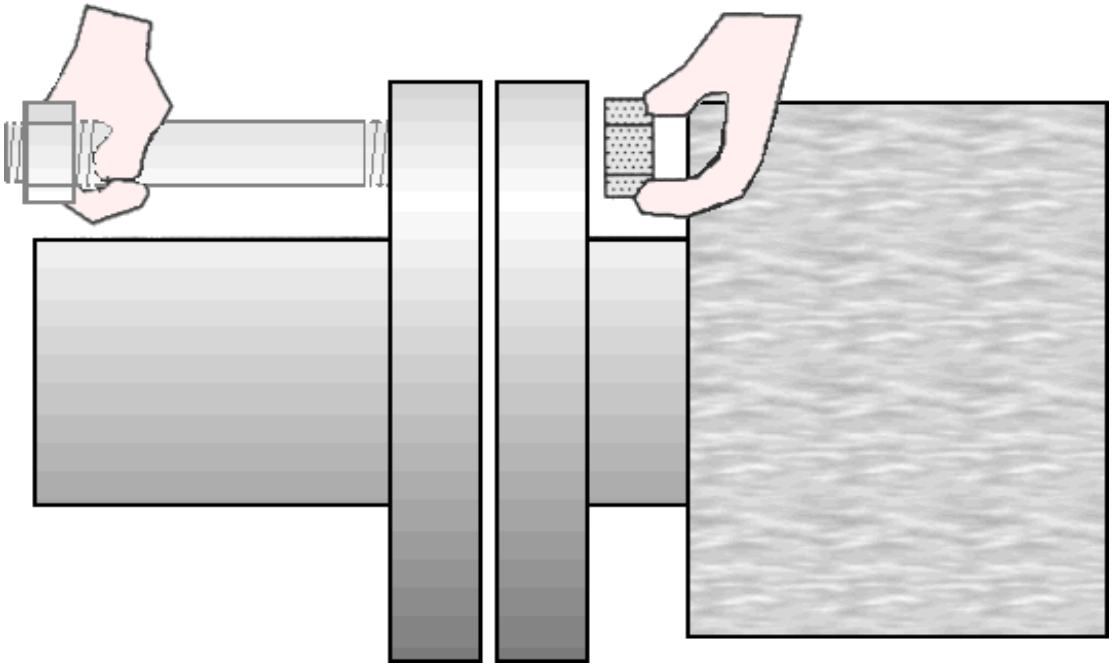
No thread protrusion.

‘Washering up’ should be avoided.

Joints & Jointing

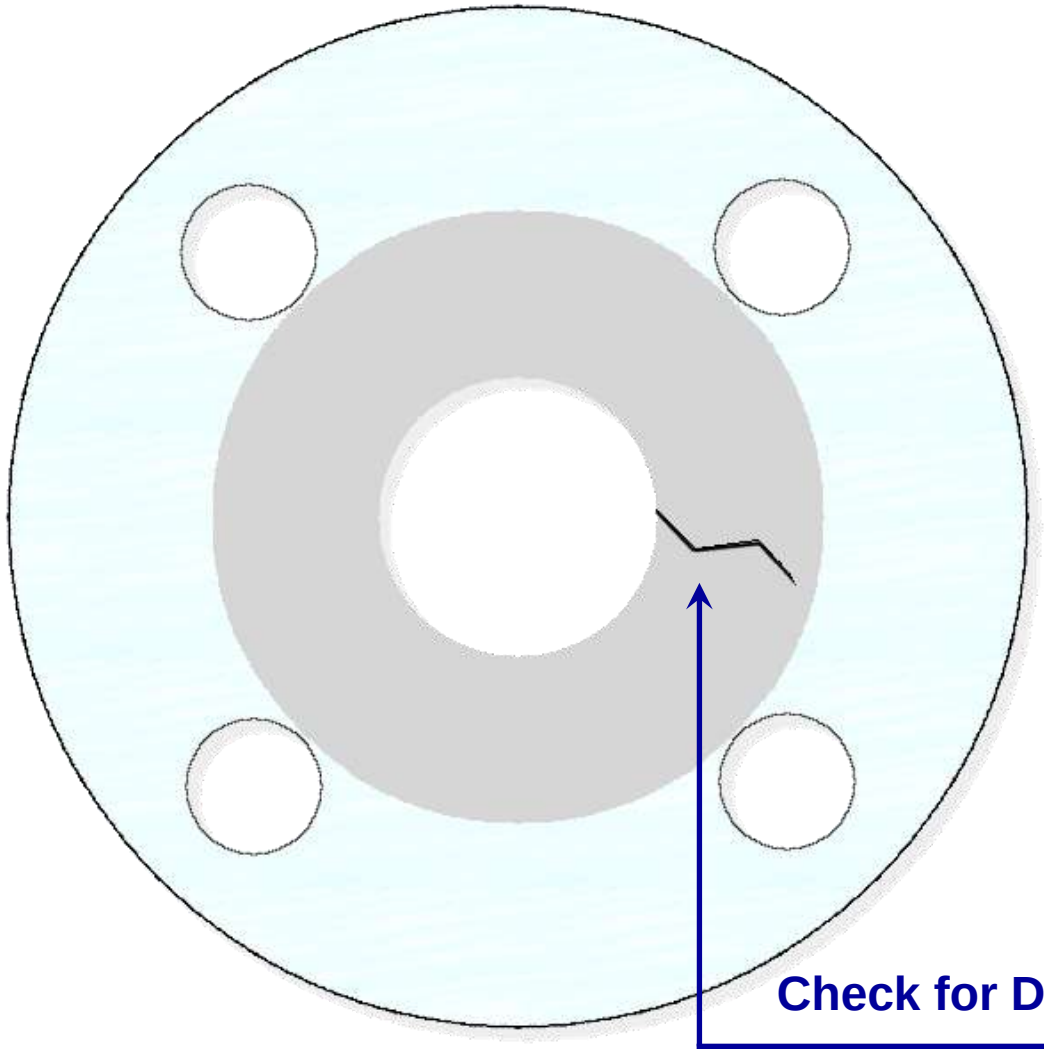
Anti - Seize

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.



Because of the lagging put the anti-seized part of the bolt next to the obstruction.

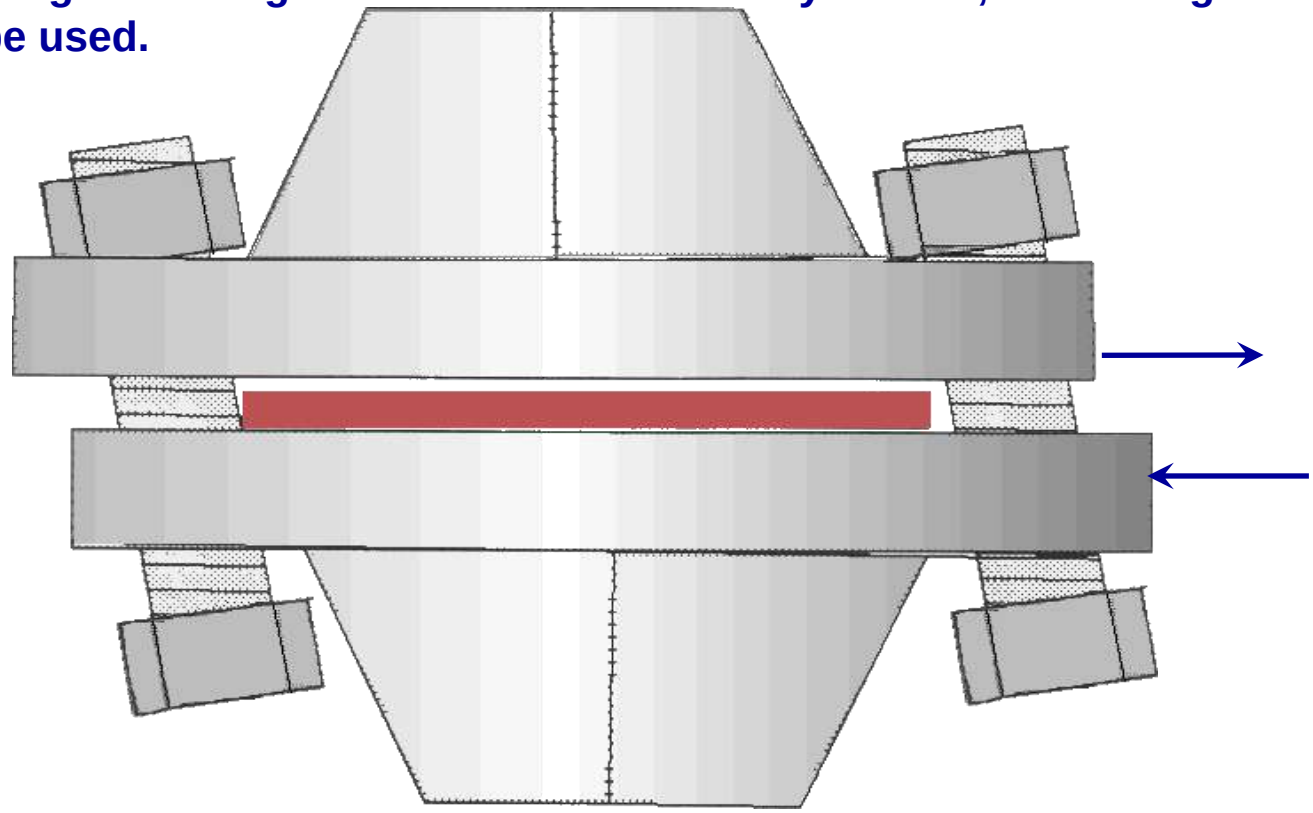
Joints & Jointing



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.



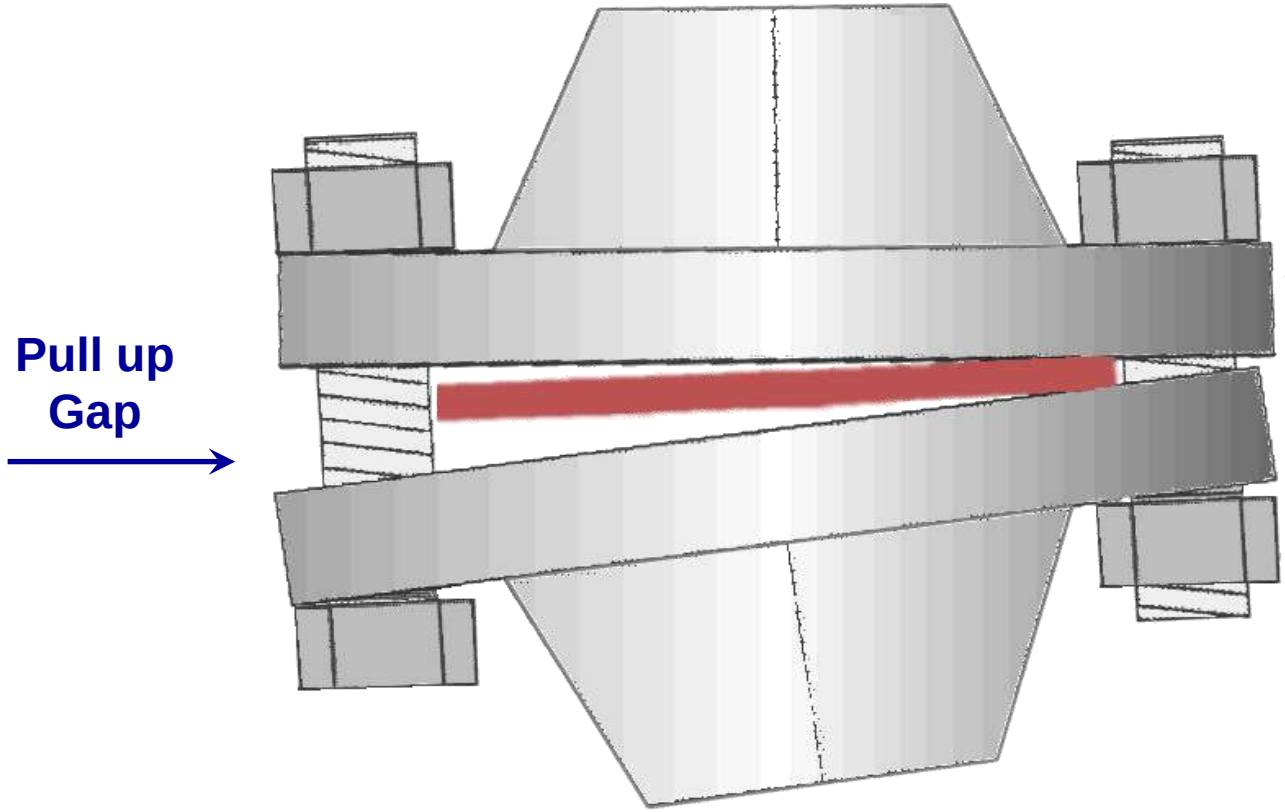
It is most critical that the male and female type of flanges are aligned so that they locate.

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



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

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		Fluid Ref.	Main Piping Material.	Pipe.	Flange.	Gaskets.	Shop Test.	Radiography.	Heat Treatment.	Galvanising.	Tracing.	Jacketing.	Insulation.	Painting.
Spec. Ref.	Duty													
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								

EXAMPLE

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

Note: For Items Outside The Scope of This Specification Consult Piping Section

*PCR = Short Code

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

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) 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. Note:- Use VS043 For Drain Purposes Only.		VC156
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

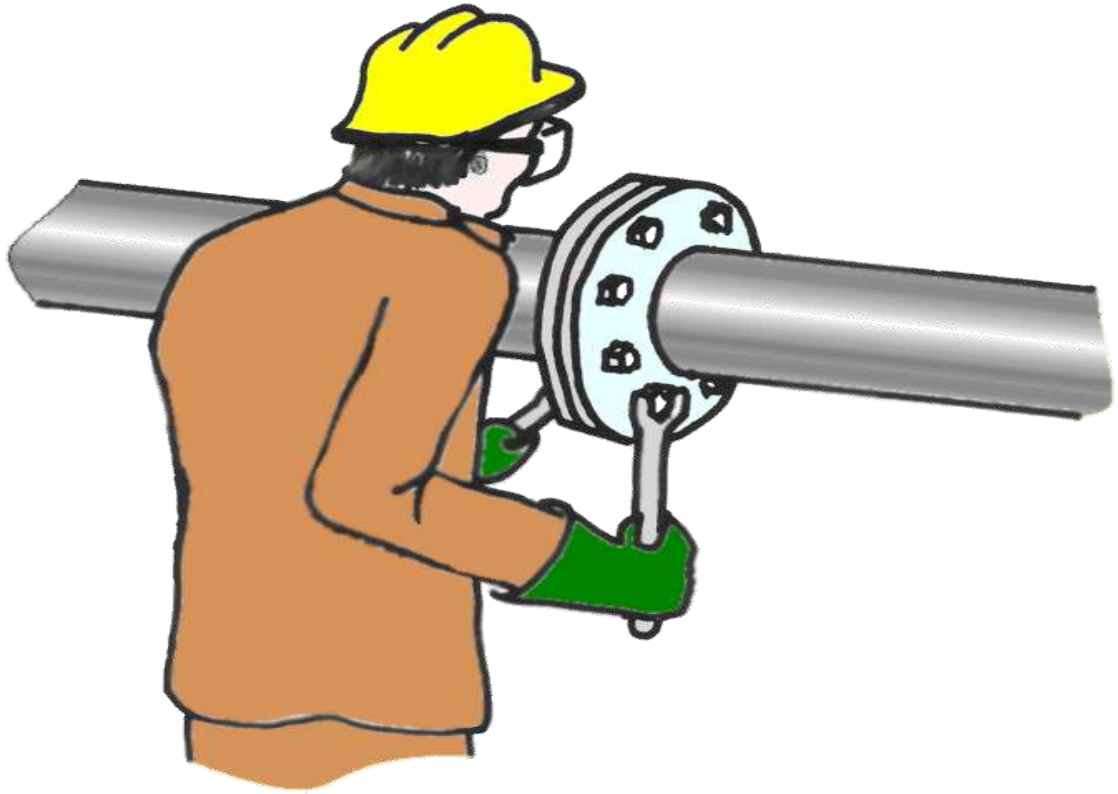
Pipeline - Maintenance

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

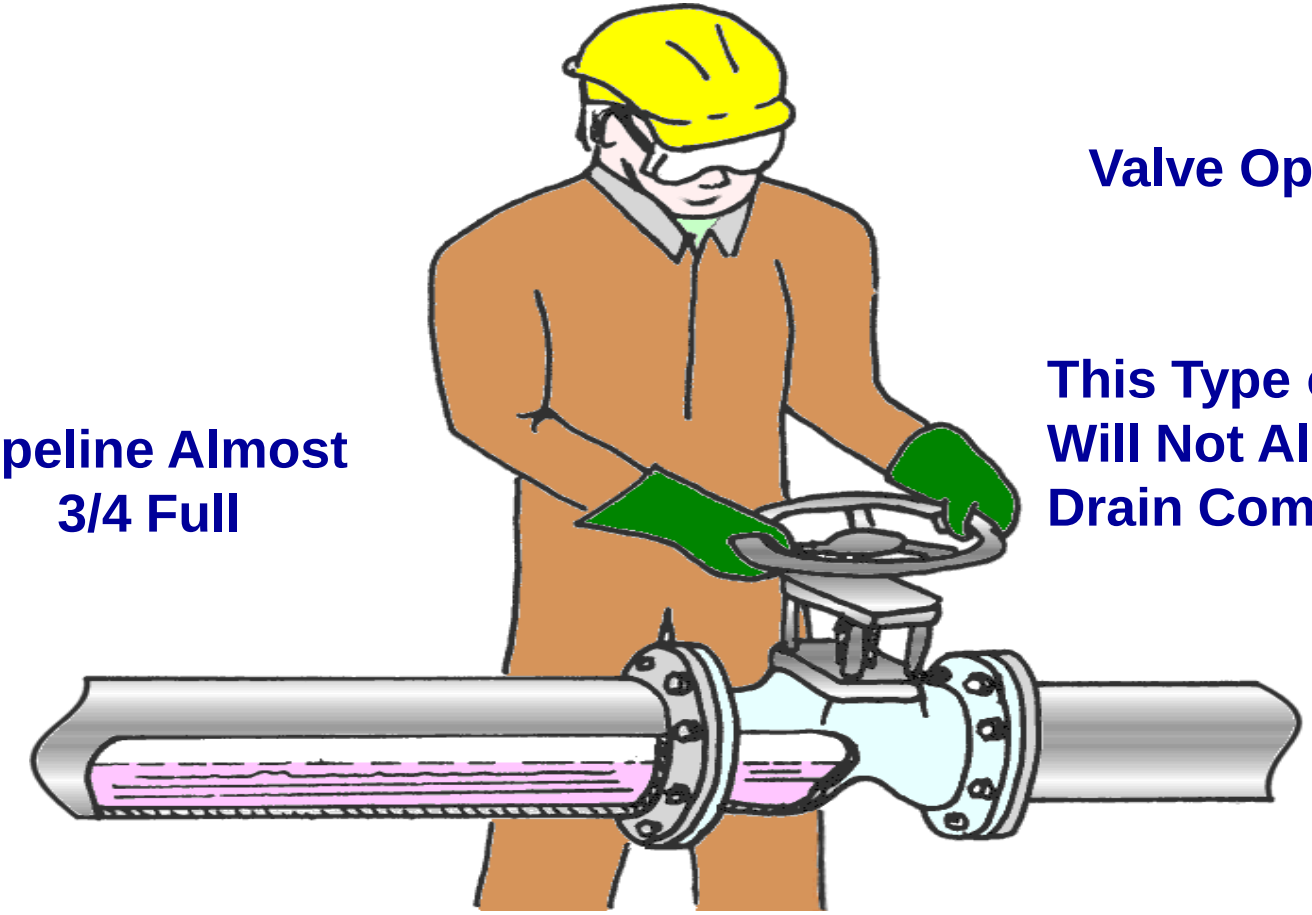


Follow these simple precautions

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



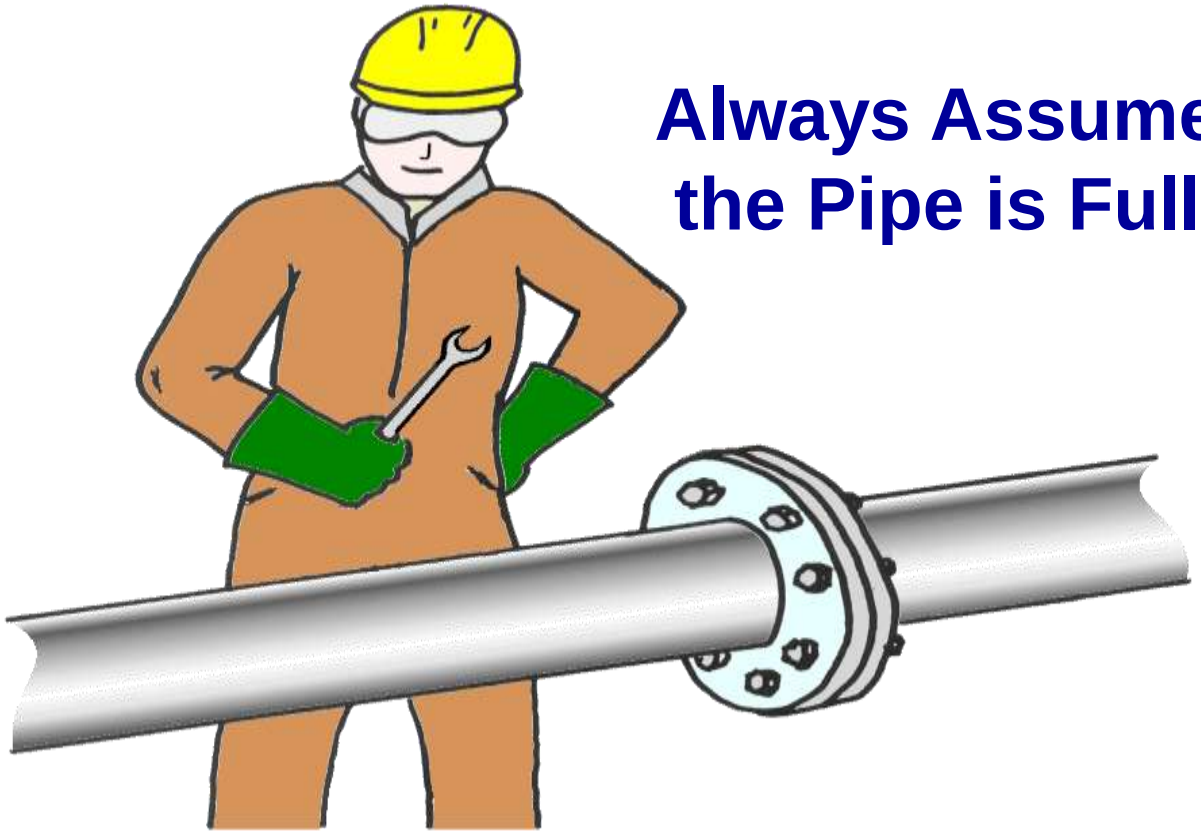
Valve Open

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

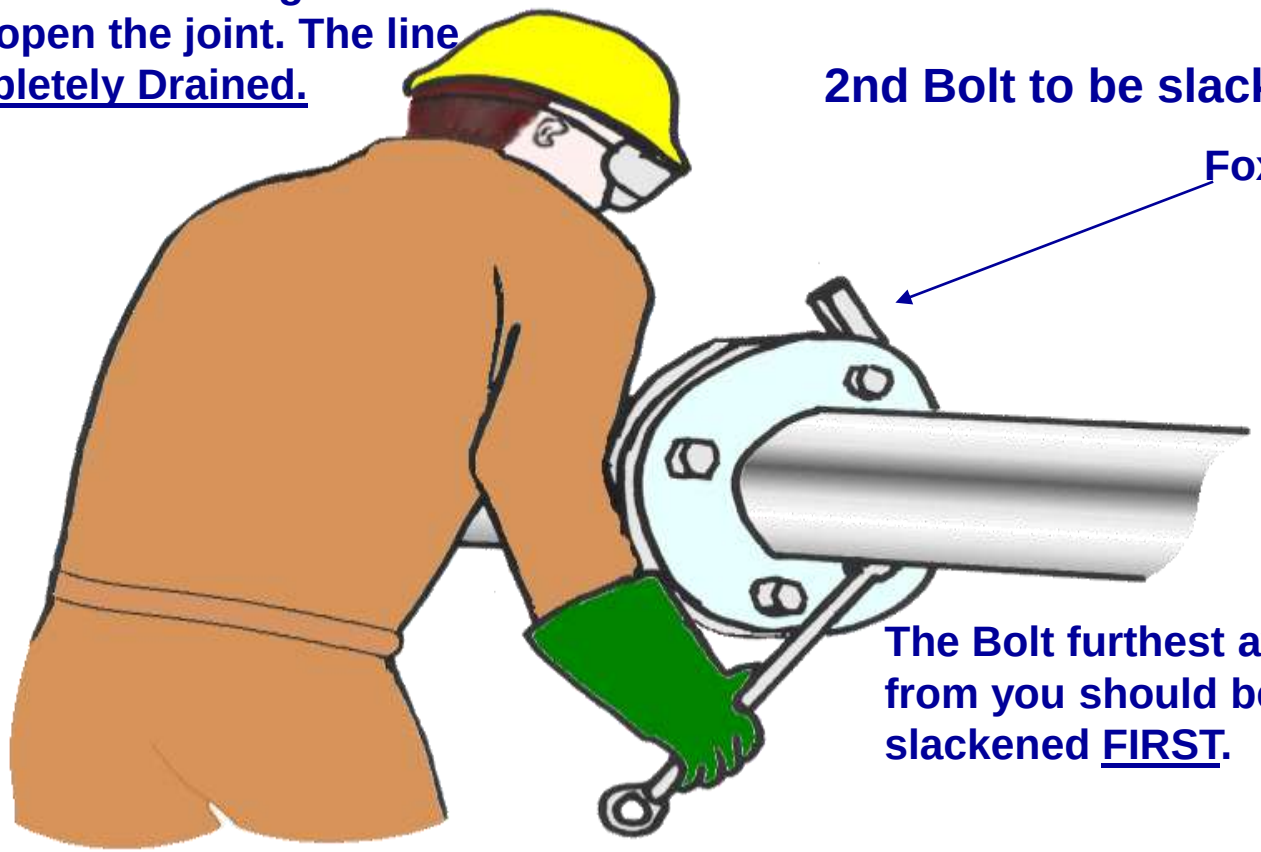
Proceed with the Utmost Caution

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 <u>Completely Drained.</u>

2nd Bolt to be slackened.

Fox-Wedge

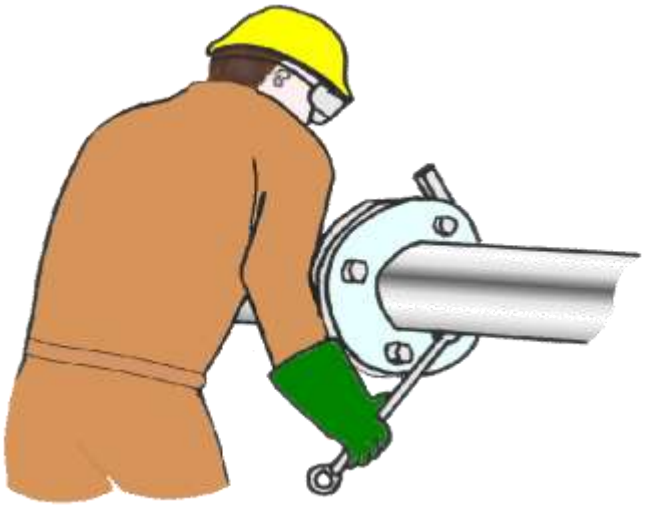


3rd Bolt to be slackened.

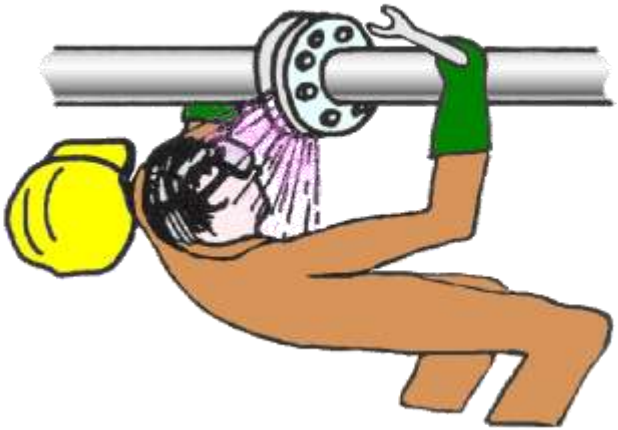
The Bolt furthest away from you should be slackened <u>FIRST</u>.

<u>DO IT THE SAFE WAY</u>

When Breaking a Joint

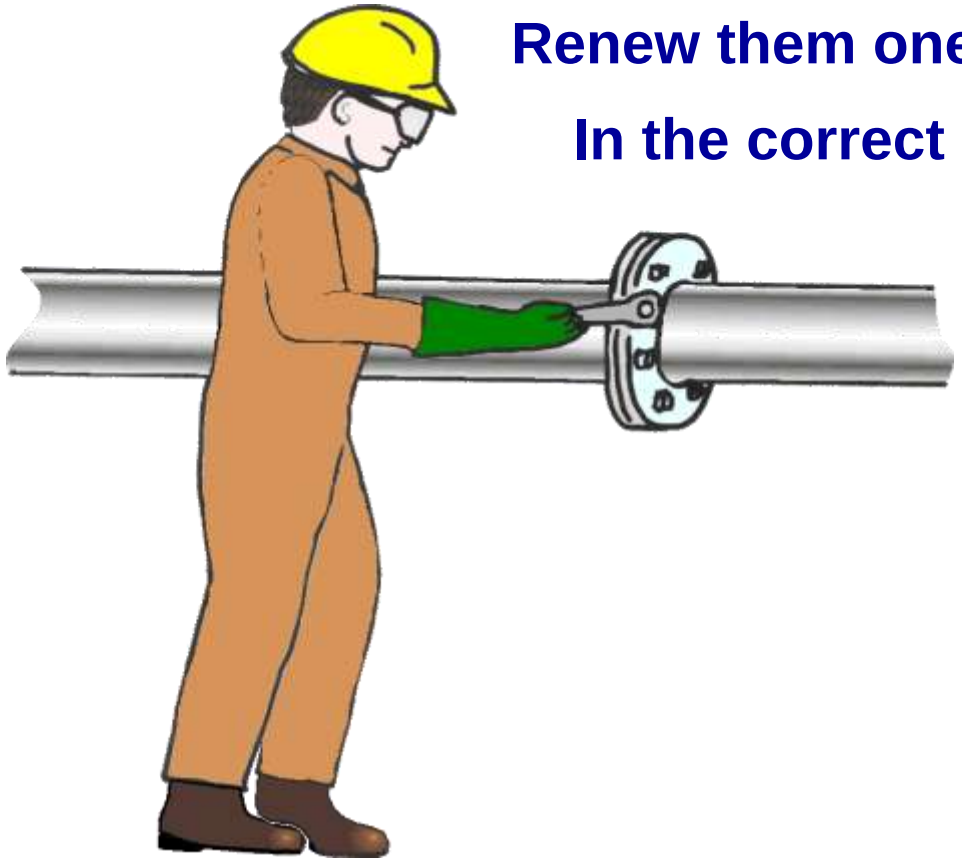


Work From Above



Never Below

If The Bolts Are 'Bad'

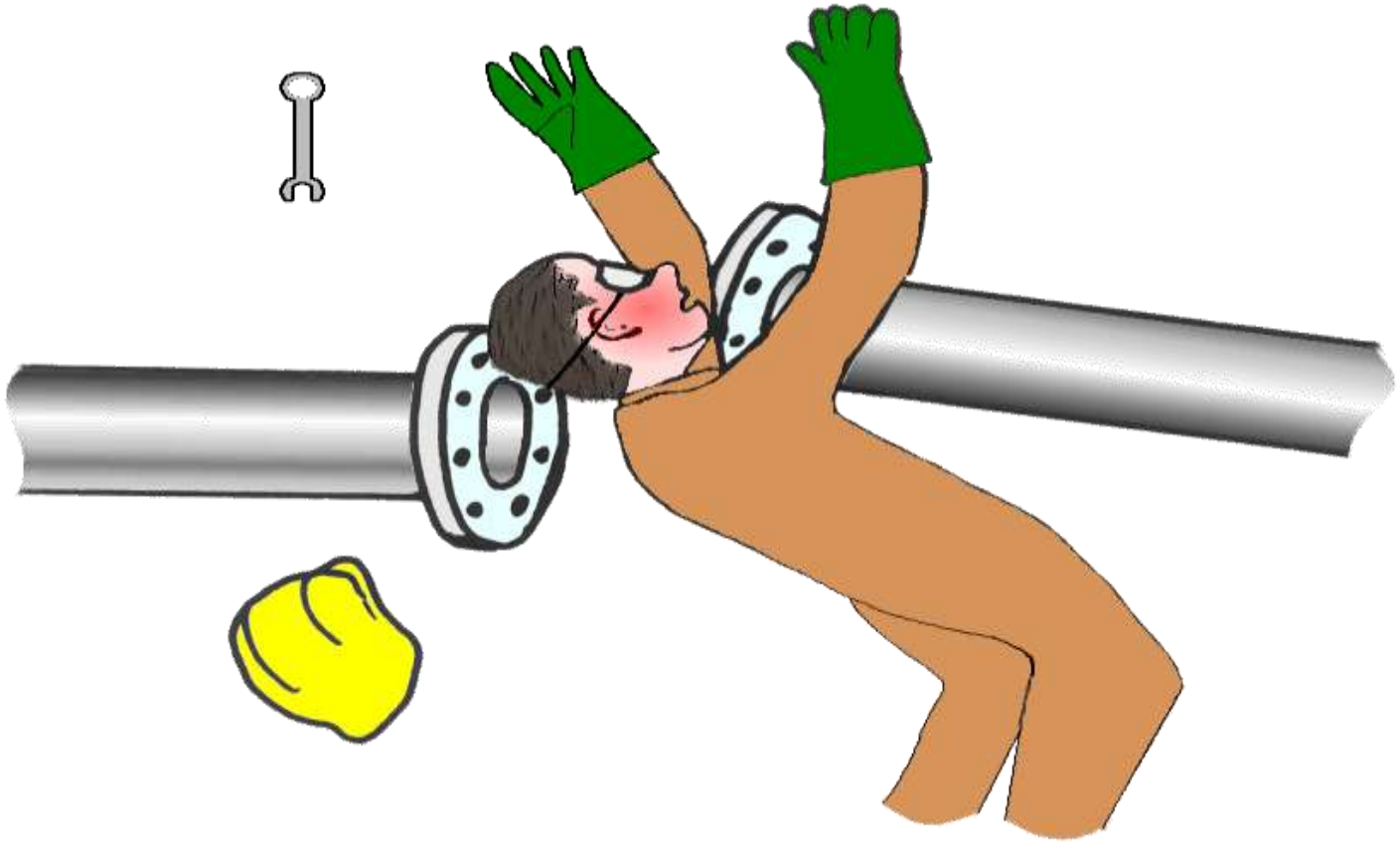


Renew them one at a time.

In the correct sequence.

BEFORE THE JOINT IS BROKEN

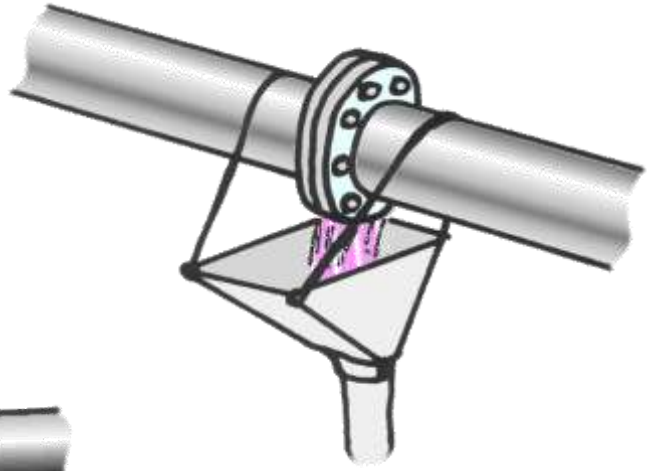
When Breaking a Joint



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

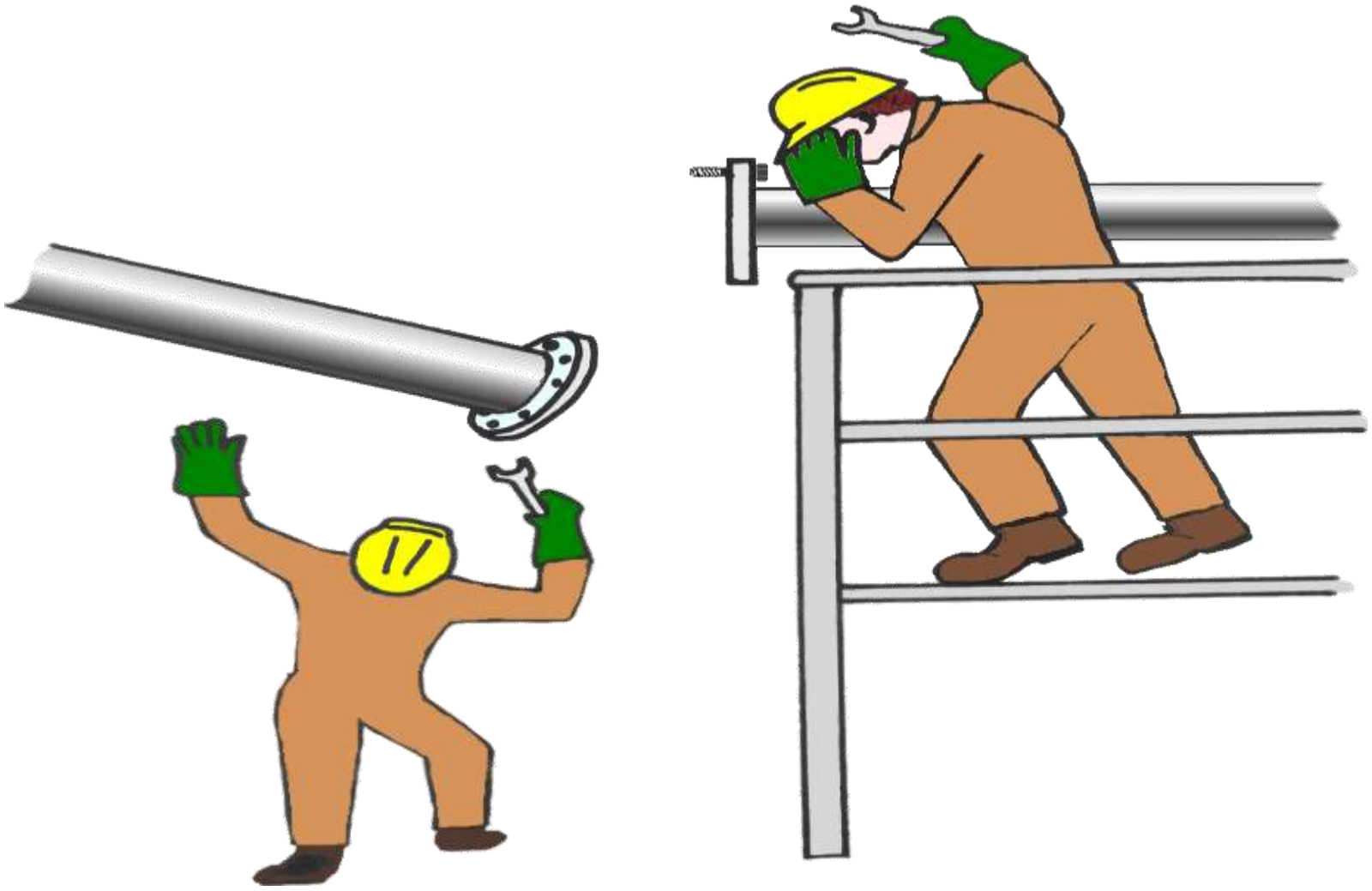
When breaking joints on liquid lines

Always Use a Tundish to Drain Away Residue



Keep Floors Clear of Corrosive Liquids You Could Get Splashed

Before Breaking a Joint



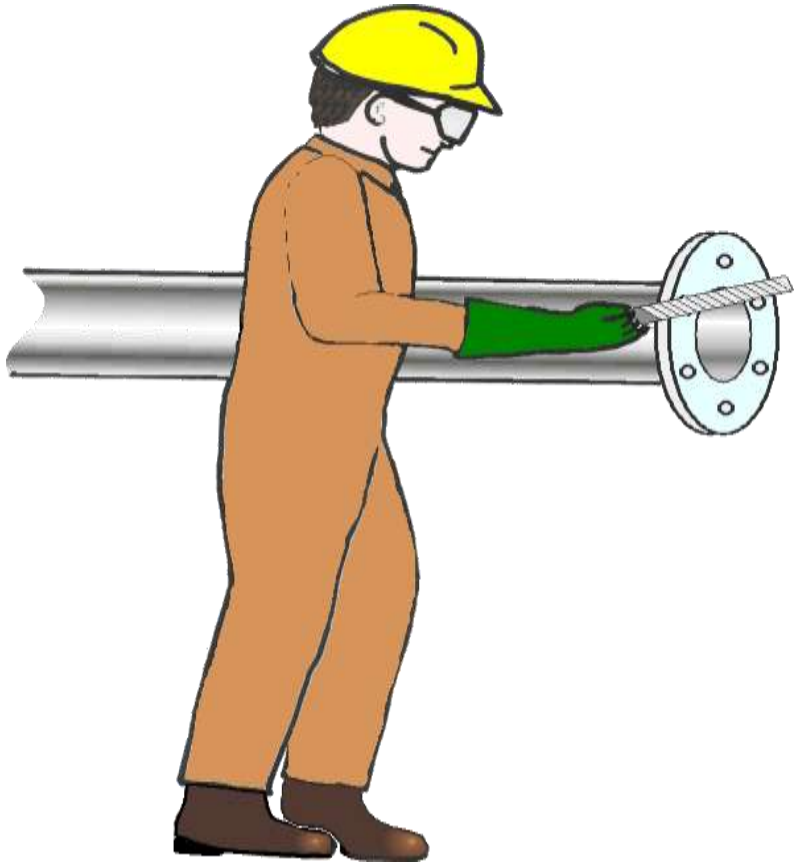
Always Make Sure The Pipe-Line is Adequately Supported

When Dismantling Pipes

Do Not Leave Them Under Your Feet

You Will Fall Over Them.

Before Re-making A Joint

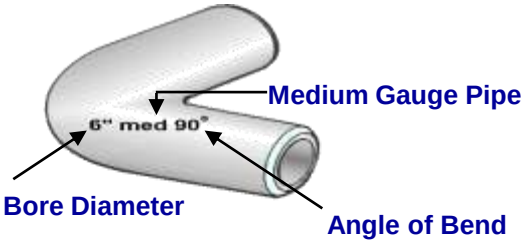


Clean The Faces Properly
“If You Don’t It Will Almost Certainly Leak”

Identification of Flanges, Fittings and Valves

Pipe Fittings

Pipes and pipe fittings are marked with the same details. Frequently other information is included, e.g. on an elbow, the angle of the elbow is shown.



Flanges

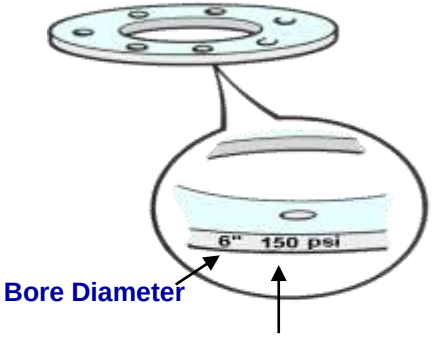
The rims of flanges are marked to show:

Nominal Size.

Design Working Pressure in *lbs per sq in*.

Material Type Number.

Weight.



Valves

Valve Bodies carry the following information:

Name of Manufacturer.

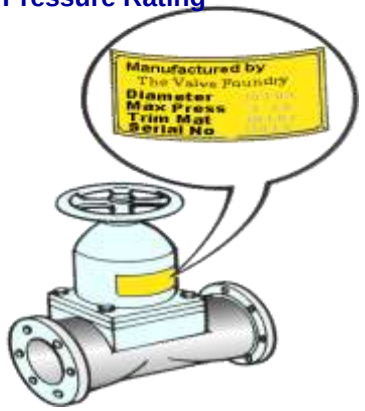
Nominal Size.

Design Working Pressure in *lbs per sq in*.

A metal disc with the company specification number is attached to the valve.

On the disc are the details of the materials used for the trim of the valve.

'Trim' is the term used for certain working parts of a valve including the stem, seat disc and disc facings.



Screwed and Socket Weld Fittings

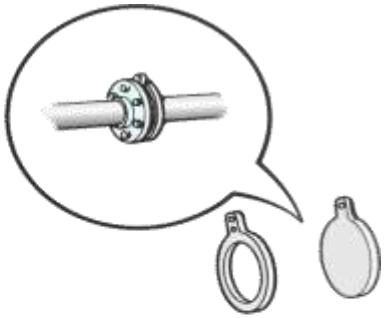
These fittings are marked with the same information as valves, i.e.

Name of Manufacturer.

Nominal Size (bore).

Design Pressure (*lbs per sq in*).

Blinds & Spacers



Blinds and Spacers

When it is necessary to blind-off a line for lengthy periods, a blind is fitted in the line between a pair of pipe flanges.
To make allowances for the blind, a spacer is fitted between the flanges. This is removed when the blind is fitted.

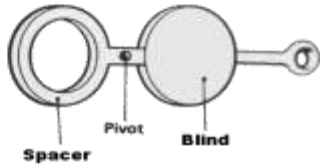
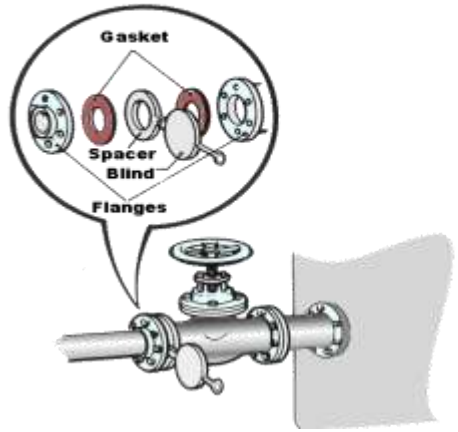
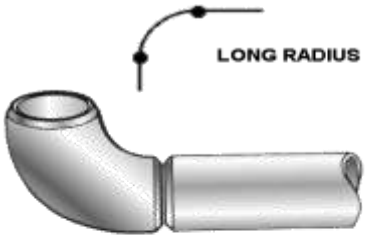


Figure of 8 (spectacle) Blinds and Spacers

The figure of 8 blind may be fitted between the flanges of a pipe and a valve connected to a vessel, tank or tower.
When maintenance is necessary and the line is to be closed down without emptying the vessel or tank, the blind side of the figure 8 is swung between the pipe and the valve.
After maintenance, all pipe lines must be pressure tested. The figure 8 blind is used to blank off the valve to prevent it being pressurised and possibly damaged.



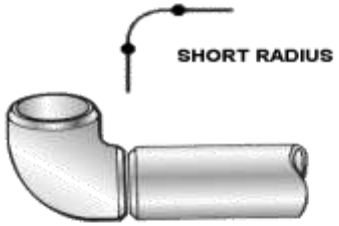
Recognition of Pipe Fitting



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.

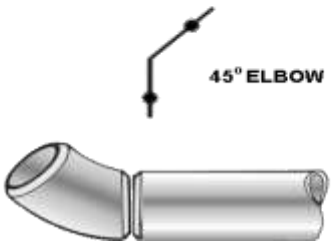


Elbows

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

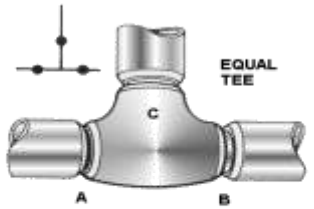
45° elbows allow a pipe deviation of that amount.



Note:

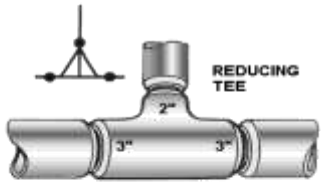
The symbols near the illustrations, are used in drawings to, specify the fittings to be used.

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.

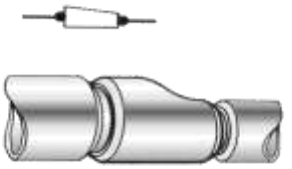


The dimensions of a branch are always quoted as:

AxBxC

Reducing Tee Branch

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

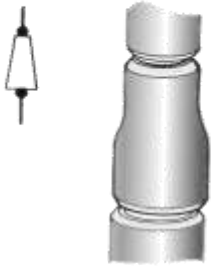


Eccentric Reducer

Used mainly in horizontal position.

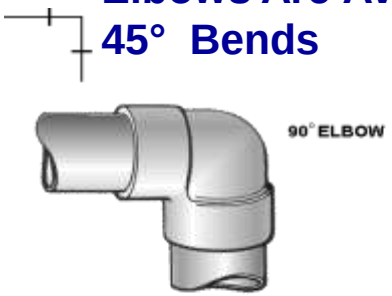
Concentric Reducer

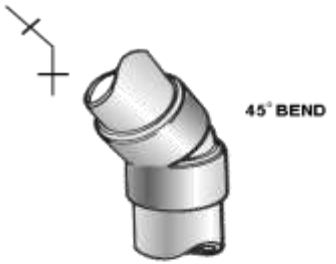
Used mainly in the vertical position.



Pipework Fittings

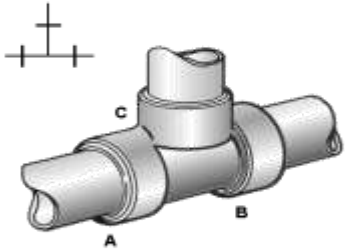
Elbows Are Available in 90° and 45° Bends



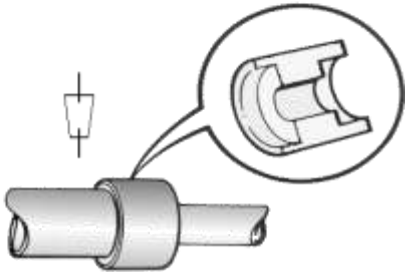


Tees are available With Equal Branches or With a Reducing Branch.

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

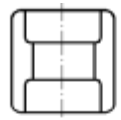


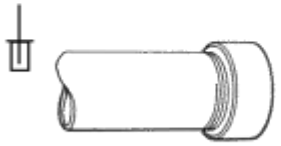
A Reducer Coupling Is Used Where Change in Pipe Diameter Is Required.



Pipework

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

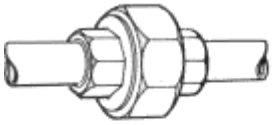


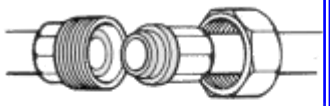


Screwed Fittings

The Cap Is Used for Permanently Blanking off a Pipe.

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





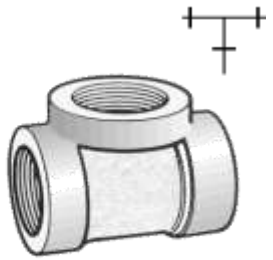
American Petroleum Institute Standards for Screw Threads on Pipework Are Adopted for All Screwed Connections.

Other Standards are also in common use:

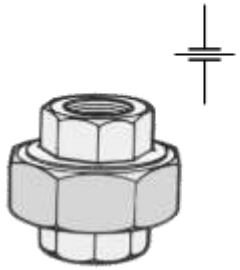
BSPT – British Standard Pipe Thread

Pipework Fittings

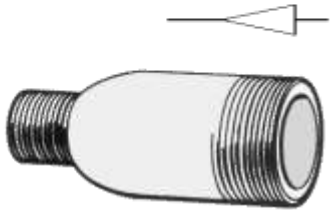
45° ELBOW



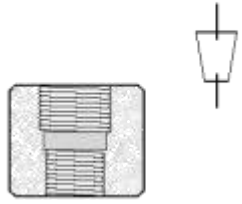
TEE



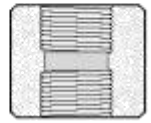
UNION



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?

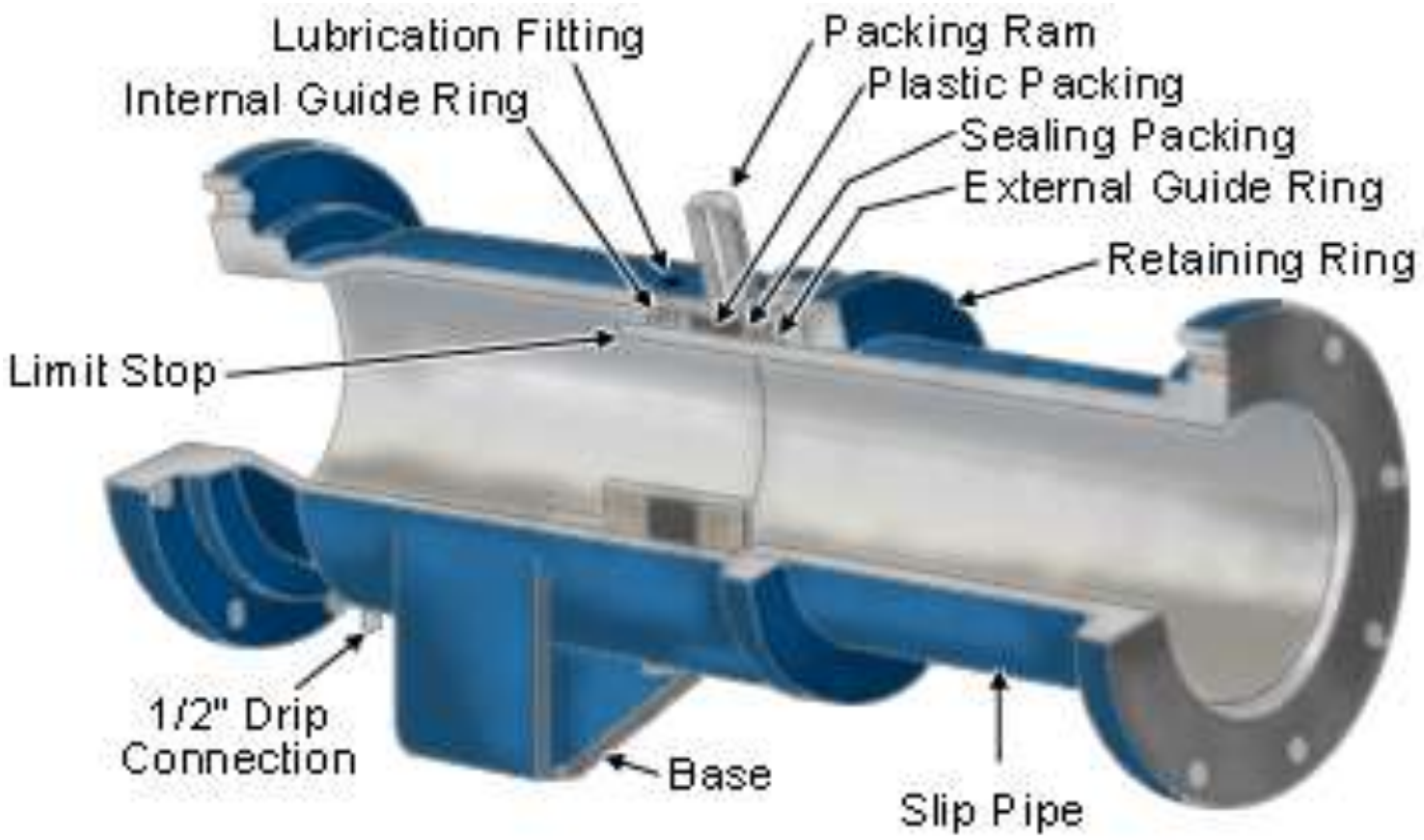
Bellows

- 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.

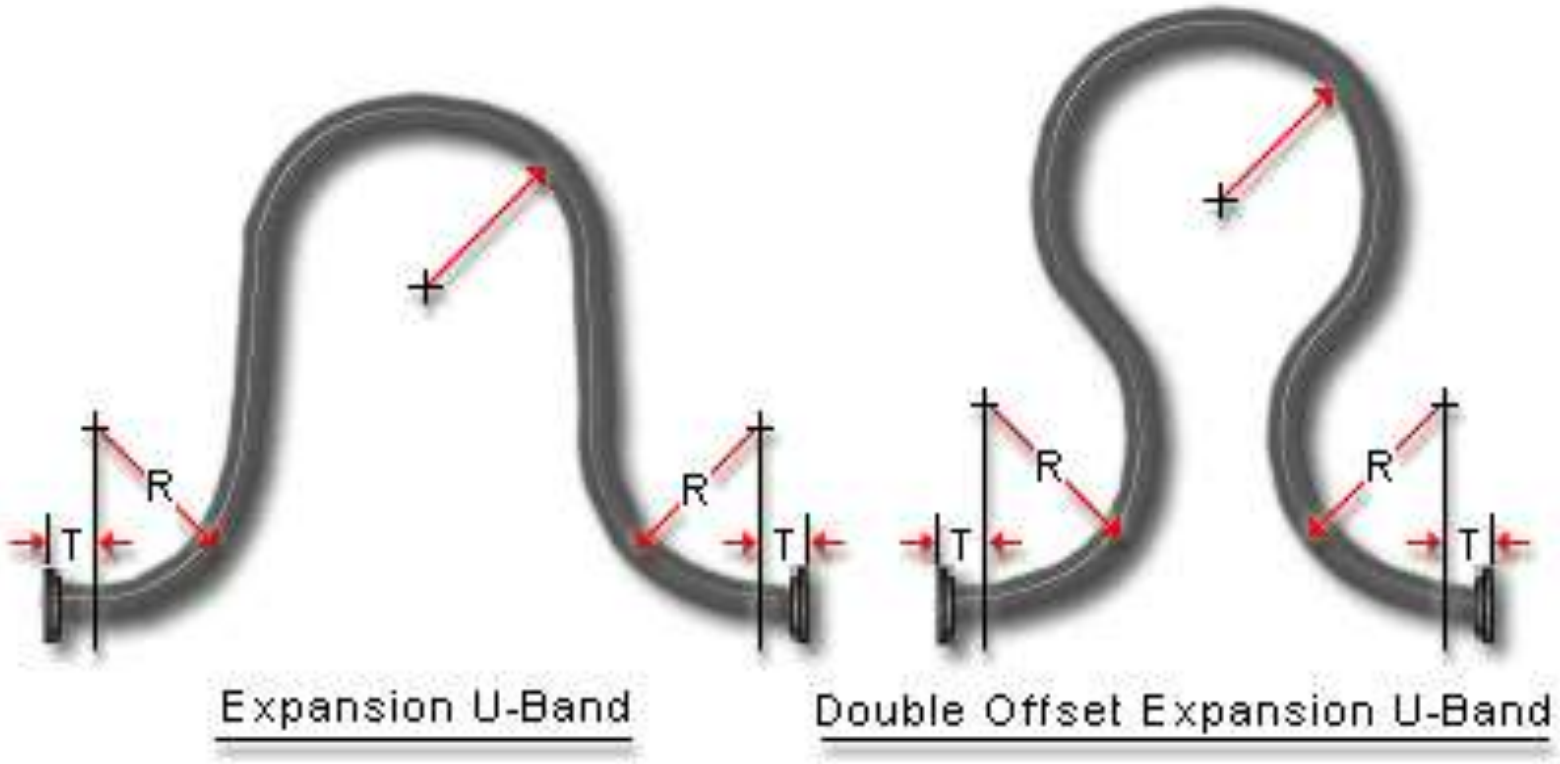
Bellows



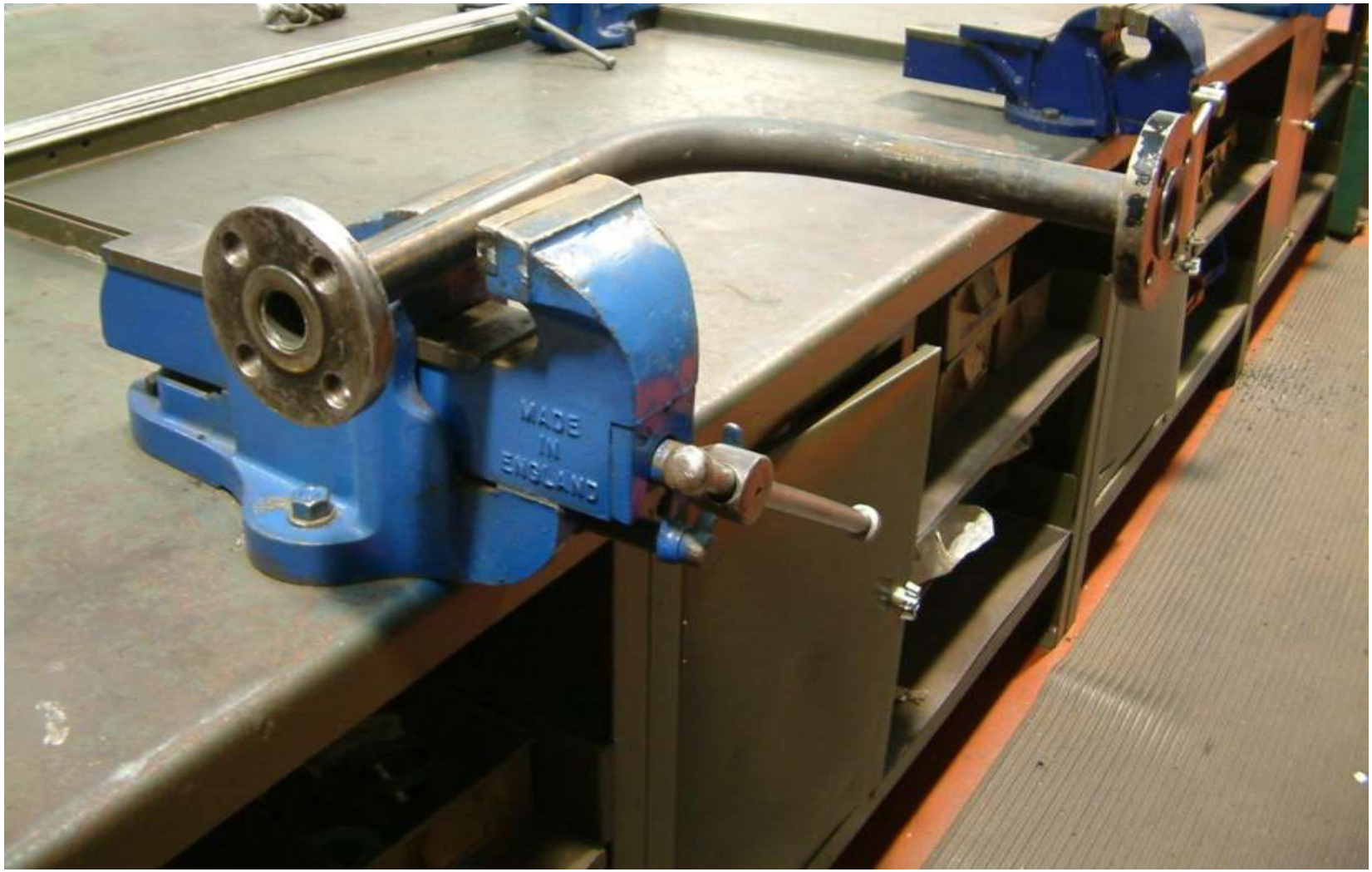
Slip Expansion Joint (CutawayView

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.



Pipe bending exercise



Pipe rig exercise – Build, test, dismantle