

CH6511 Process Equipment Design - I

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Mechanical Design of Chemical Process Equipments Flanges

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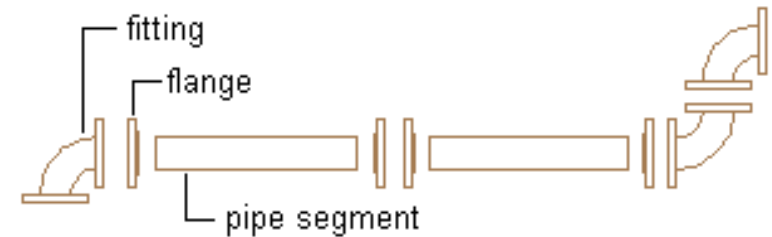


Piping Joints

➤ Threaded

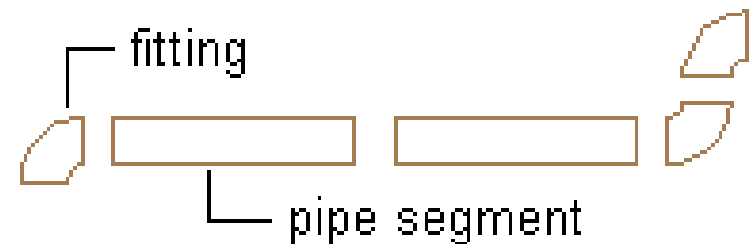
➤ Flanged

Industrial pipes, low/medium pressure and temperature. Metal/Plastic. Steam, oil, water,



➤ Welded

Permanent; High pressure and temperature. Industrial, Water, steam, oil, chemicals,



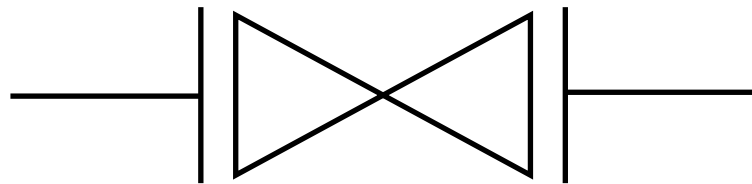
Piping Joints

Threaded / Flanged / Welded

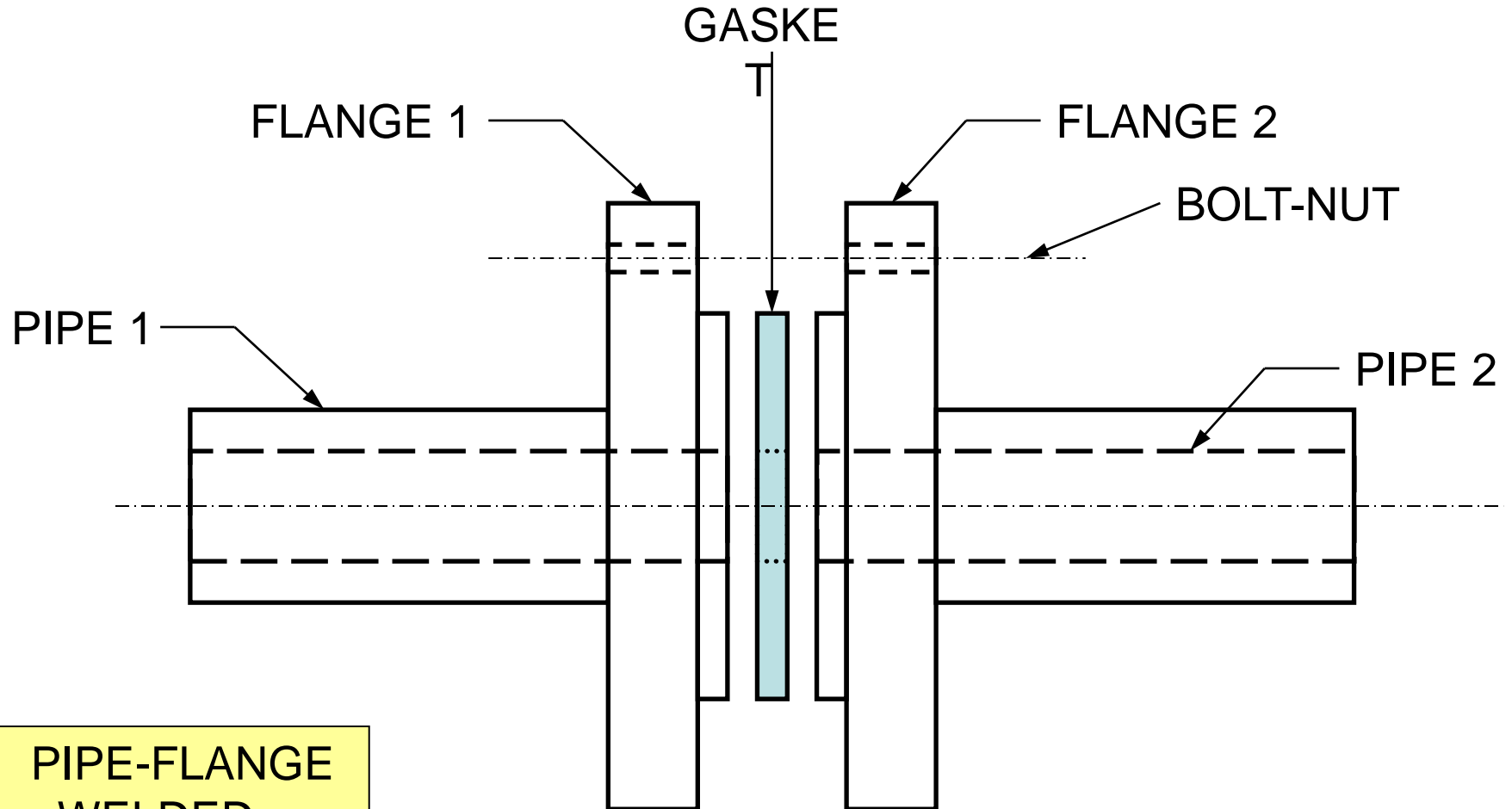


Piping Joints

Threaded / **Flanged** / Welded



Pipe - Flanged connection



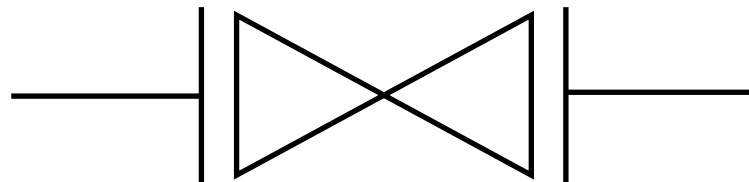
PIPE-FLANGE
WELDED or
SCREWED

Pipe - Flanged connection



Piping Joints

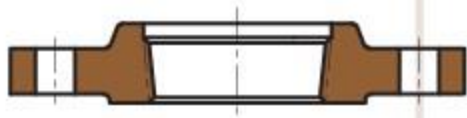
Threaded / Flanged / **Welded**



Flanged Joints



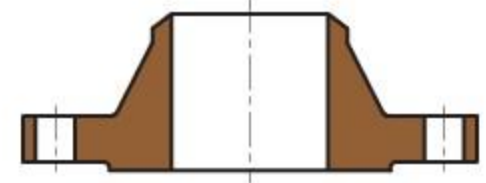
Flange Types



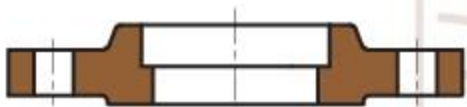
Threaded Flange



Slip On Flange



Welding Neck Flange



Socket Welding Flange



Lap Joint Flange

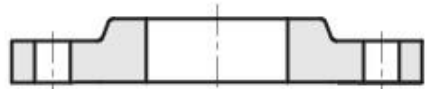


Blind Flange

Flange Face



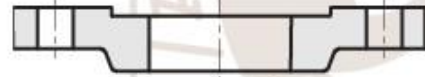
Raised Face



Flat Face



Male Face



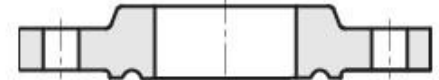
Female Face



Tongue Face



Groove Face



Ring Joint Face

Material

ASTM A105 – carbon steel forgings for piping

ASTM A182 – stainless steel high temperature service

ASTM A350 – low alloy steel forgings

Pressure Rating

Class 150

Class 300

Class 600

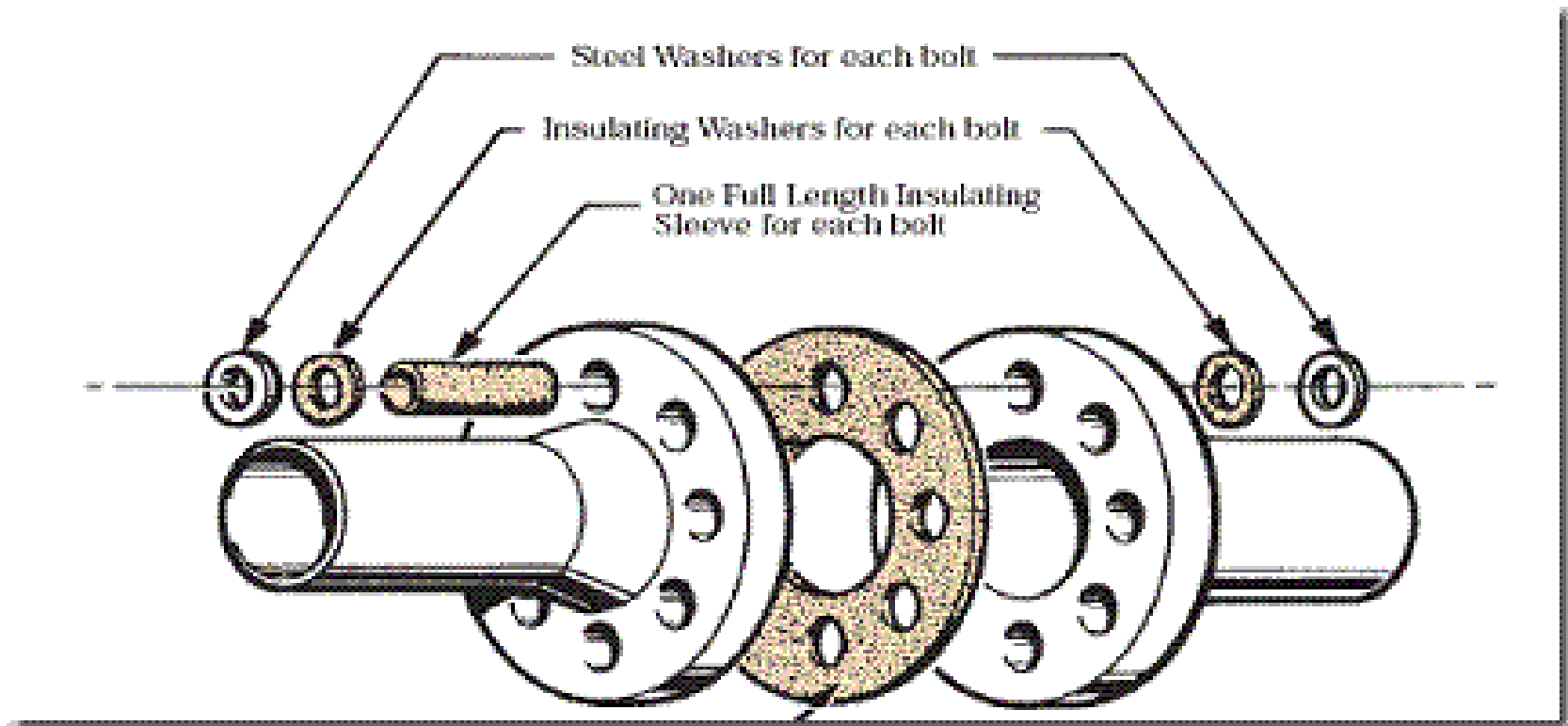
Class 900

Class 1200

Class 1500

Class 2500



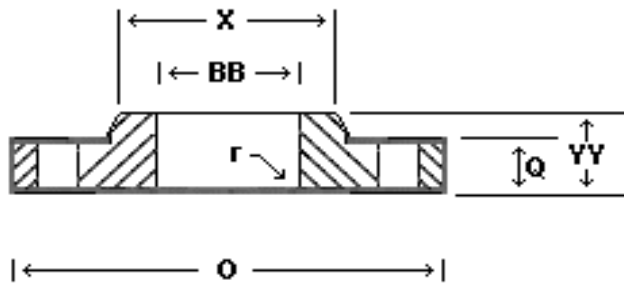




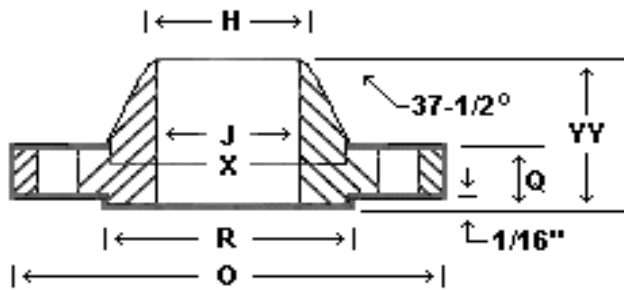
Types of Flanges

- Slip-on raised face
- Welding neck
- Lap-joint
- Stub-end
- Screwed

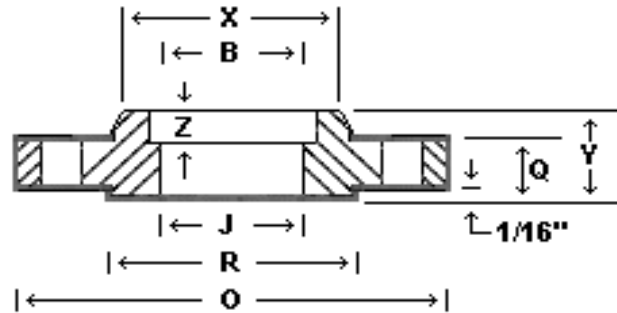




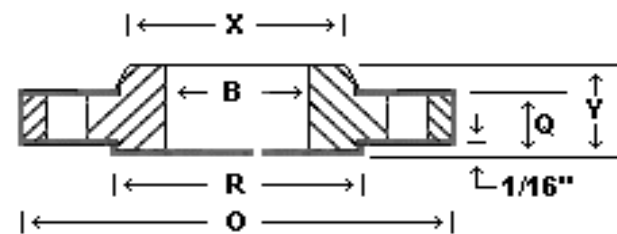
LAP JOINT



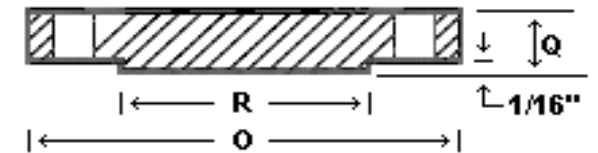
WELDING NECK



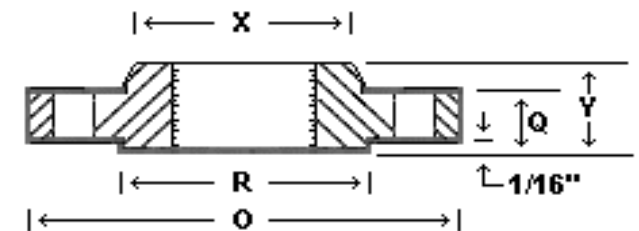
SOCKET



SLIP ON



BLIND

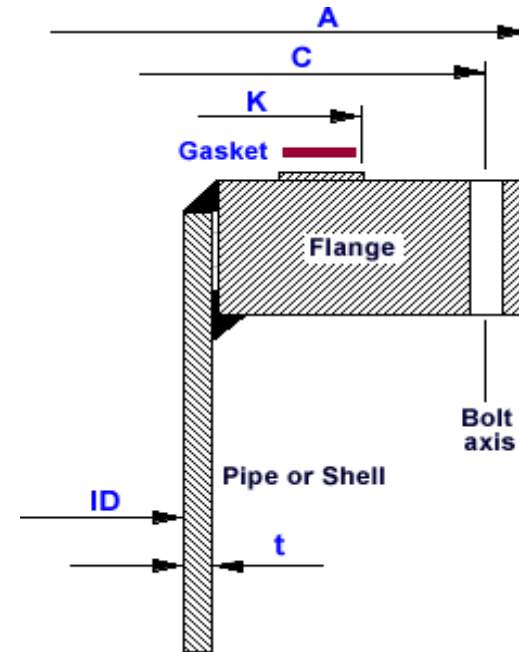
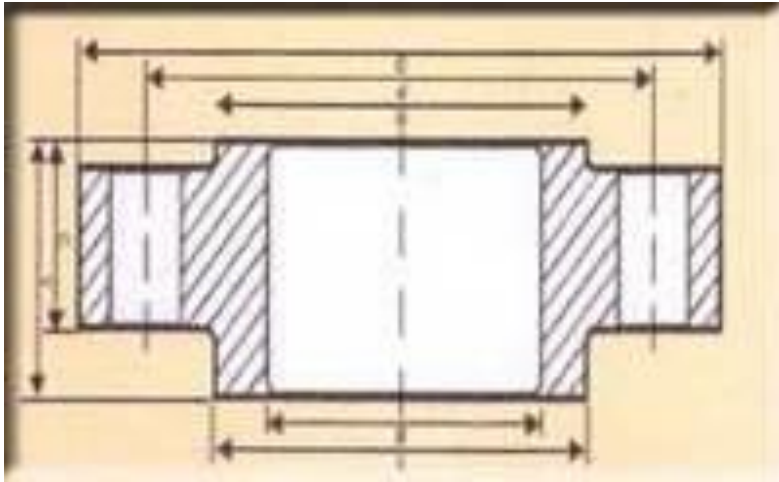


THREADED

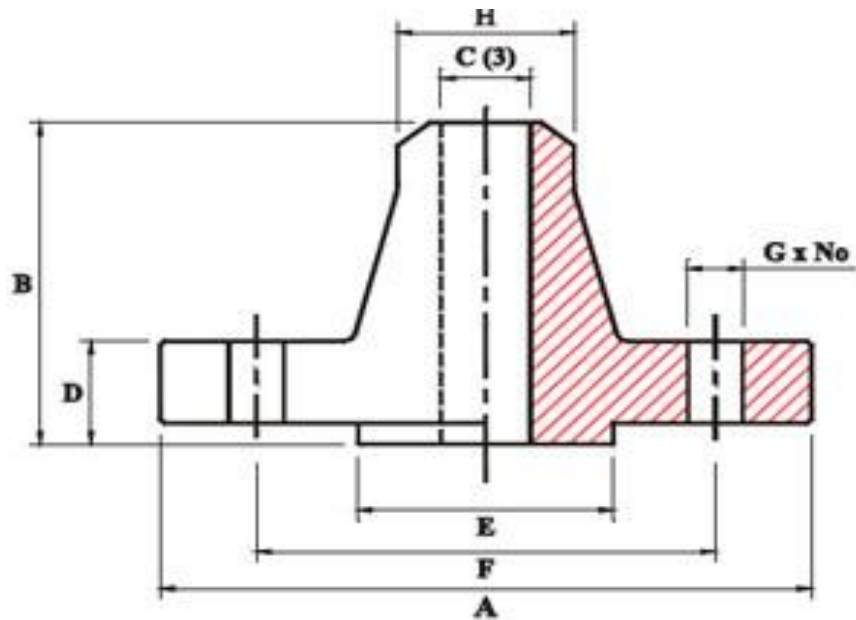
Material of Construction

- Forgings, castings, plates
- Forged Steel such as ASTM A 105

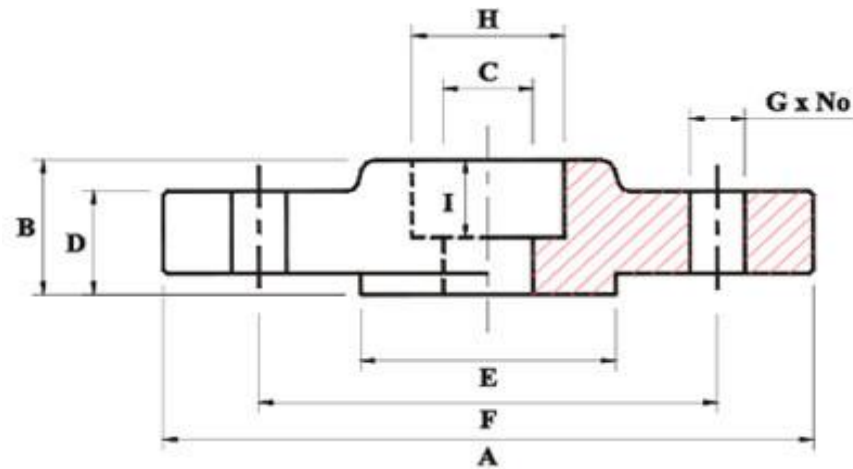
Slip-on Raised Face Flange



Welding Neck Flange

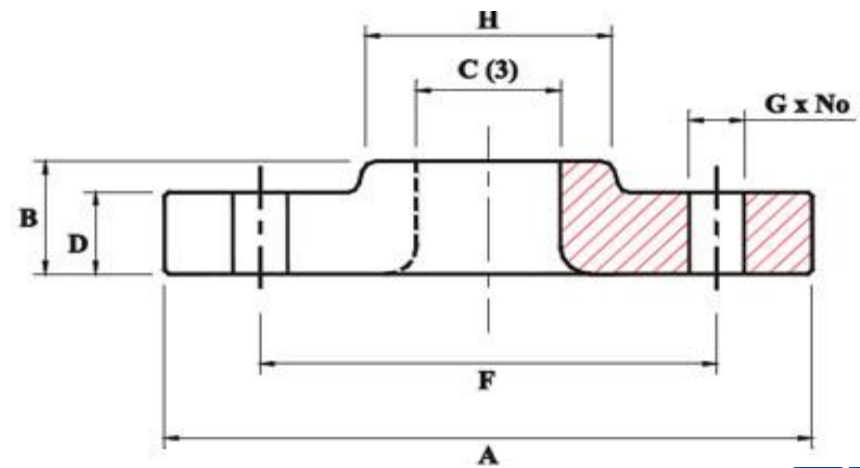
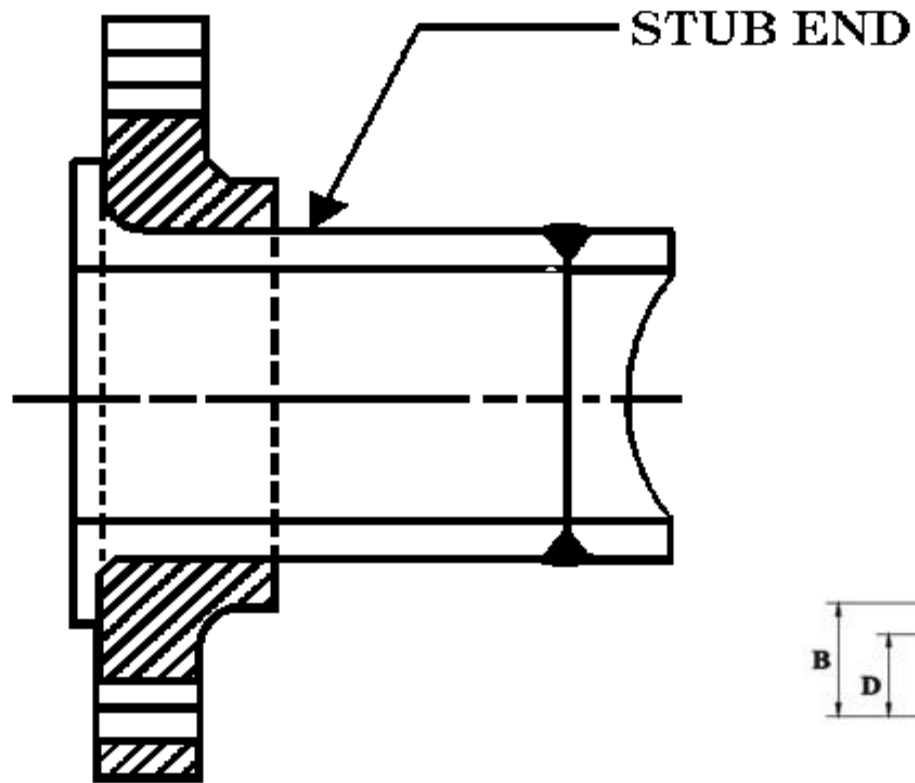


Socket Weld Flange

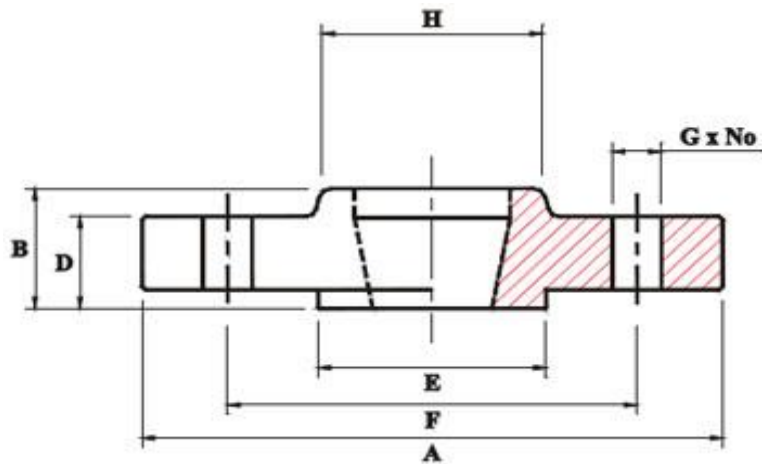


Lap joint

LAP-JOINT FLANGE (with Stub-end)



Screwed Flange



Blind flange



Standards Evolution

- ASA B16e, 1932
- ASA B16.5, 1953,
- ANSI B16.5, 1973
- ASME/ANSI B16.5, 1988
- ASME B16.5, 1996

ASME B16.5-1996
(Revision of ASME/ANSI B16.5-1988)

Rating of Flanges

- 150, 300, 600, 900, 1500, 2500 psig
- Pipe flanges and flanged fittings: NPS ½ through NPS 24.

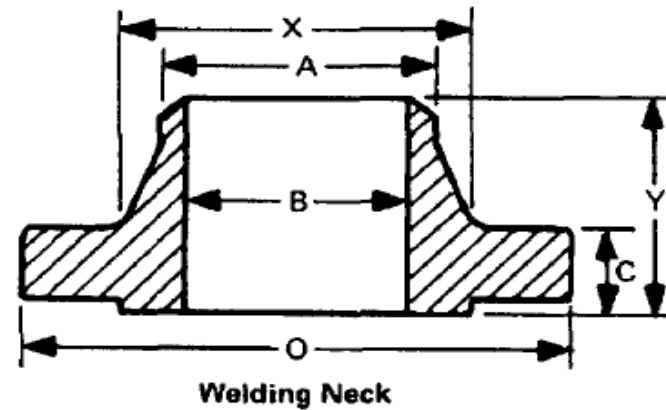
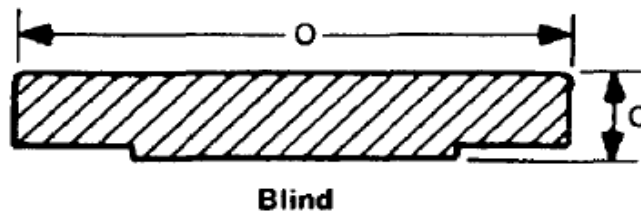
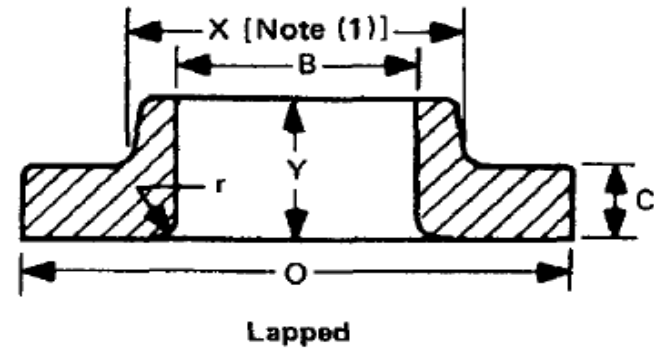
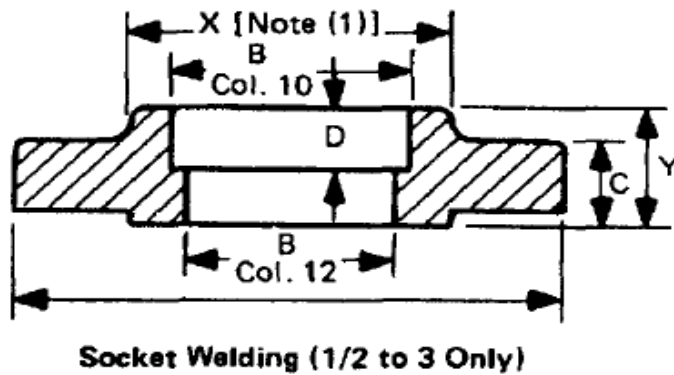
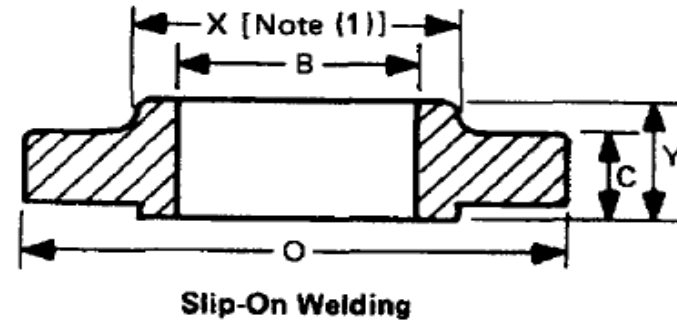
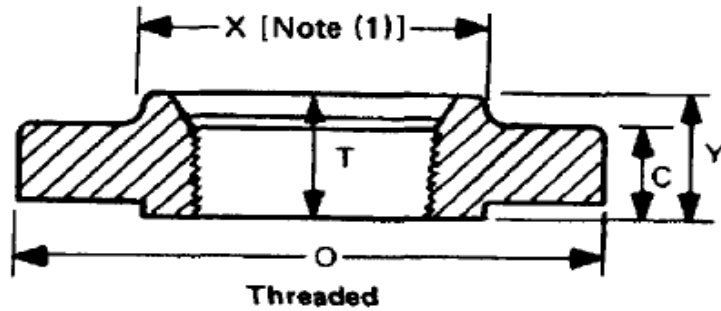
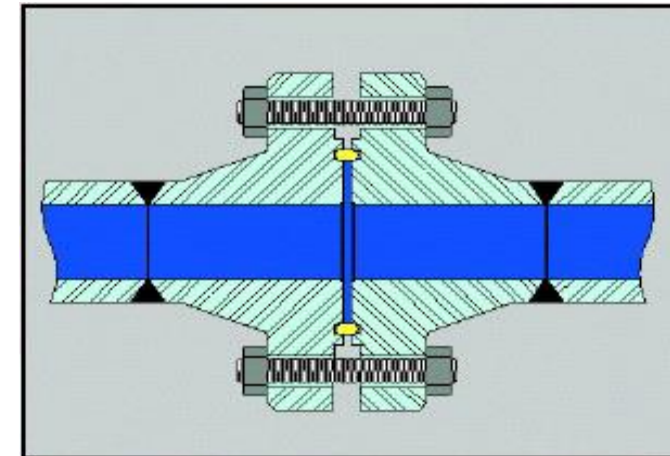
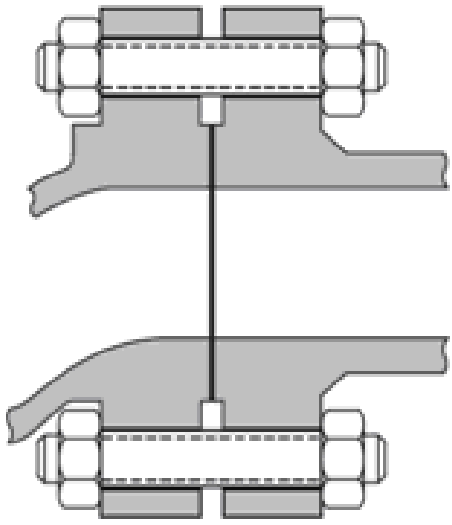
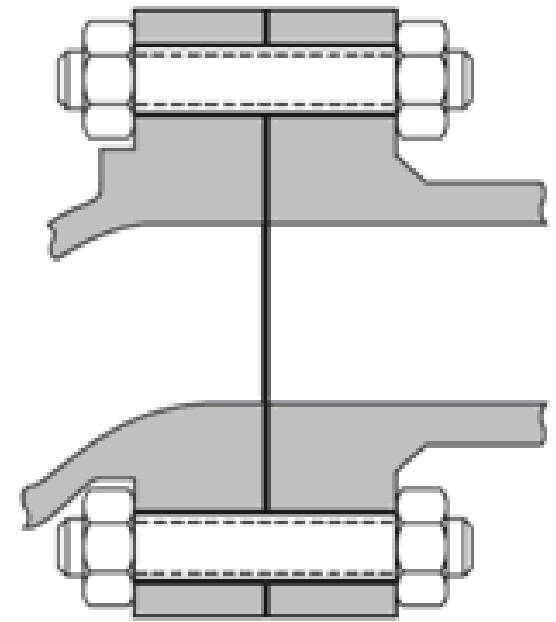


TABLE 9 DIMENSIONS OF CLASS 150 FLANGES²⁻⁸

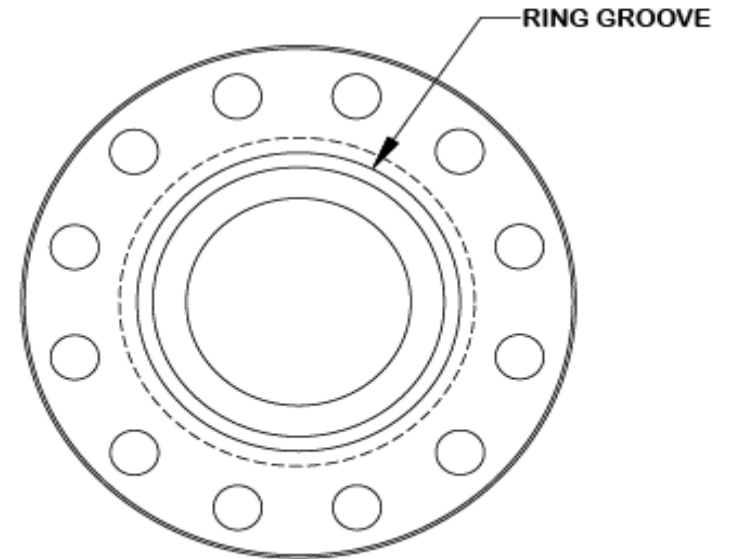
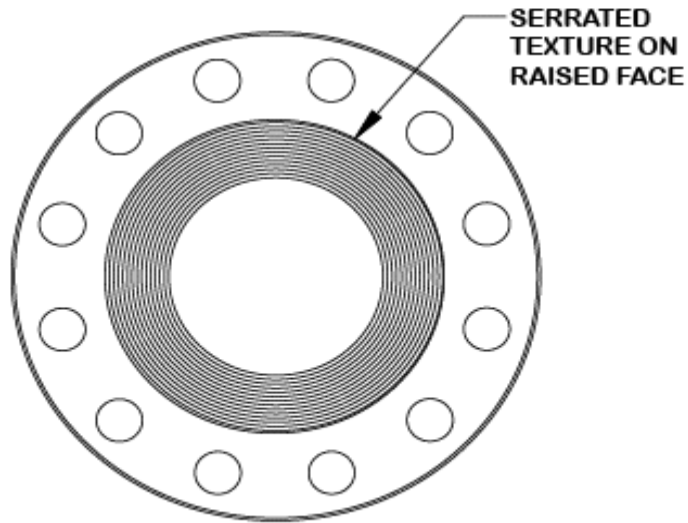
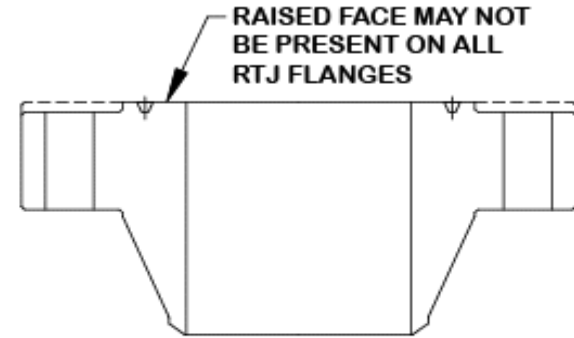
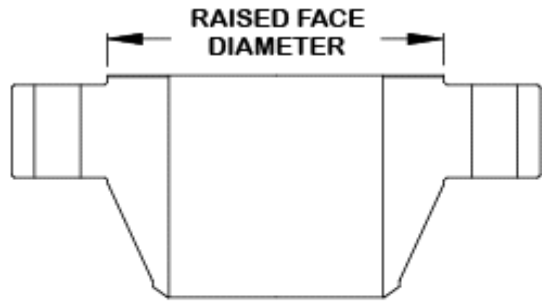
1	2	3	4	5	6			9	10			13	14
					Threaded Slip-On Socket Welding Y	Lapped Y	Welding Neck Y		Bore				
									Slip-On Socket Welding, Min. B	Lapped, Min. B	Welding Neck Socket Welding (14) B		
Nominal Pipe Size	Outside Diameter of Flange O	Thickness of Flange [(9)-(11)], Min. C	Diameter of Hub X	Hub Diameter Beginning of Chamfer Welding Neck (12) A	Thread Length Threaded Flange (13), Min. T	Length Through Hub						Corner Radius of Bore of Lapped Flange and Pipe r	Depth of Socket D
1/2	3.50	0.44	1.19	0.84	0.62	0.62	1.88	0.62	0.88	0.90	0.62	0.12	0.38
3/4	3.88	0.50	1.50	1.05	0.62	0.62	2.06	0.62	1.09	1.11	0.82	0.12	0.44
1	4.25	0.56	1.94	1.32	0.69	0.69	2.19	0.69	1.36	1.38	1.05	0.12	0.50
1 1/4	4.62	0.62	2.31	1.66	0.81	0.81	2.25	0.81	1.70	1.72	1.38	0.19	0.56
1 1/2	5.00	0.69	2.56	1.90	0.88	0.88	2.44	0.88	1.95	1.97	1.61	0.25	0.62
2	6.00	0.75	3.06	2.38	1.00	1.00	2.50	1.00	2.44	2.46	2.07	0.31	0.69
2 1/2	7.00	0.88	3.56	2.88	1.12	1.12	2.75	1.12	2.94	2.97	2.47	0.31	0.75
3	7.50	0.94	4.25	3.50	1.19	1.19	2.75	1.19	3.57	3.60	3.07	0.38	0.81
3 1/2	8.50	0.94	4.81	4.00	1.25	1.25	2.81	1.25	4.07	4.10	3.55	0.38	...
4	9.00	0.94	5.31	4.50	1.31	1.31	3.00	1.31	4.57	4.60	4.03	0.44	...
5	10.00	0.94	6.44	5.56	1.44	1.44	3.50	1.44	5.66	5.69	5.05	0.44	...
6	11.00	1.00	7.56	6.63	1.56	1.56	3.50	1.56	6.72	6.75	6.07	0.50	...
8	13.50	1.12	9.69	8.63	1.75	1.75	4.00	1.75	8.72	8.75	7.98	0.50	...
10	16.00	1.19	12.00	10.75	1.94	1.94	4.00	1.94	10.88	10.92	10.02	0.50	...
12	19.00	1.25	14.38	12.75	2.19	2.19	4.50	2.19	12.88	12.92	12.00	0.50	...
14	21.00	1.38	15.75	14.00	2.25	3.12	5.00	2.25	14.14	14.18	To be specified by purchaser	0.50	...
16	23.50	1.44	18.00	16.00	2.50	3.44	5.00	2.50	16.16	16.19		0.50	...
18	25.00	1.56	19.88	18.00	2.69	3.81	5.50	2.69	18.18	18.20		0.50	...
20	27.50	1.69	22.00	20.00	2.88	4.06	5.69	2.88	20.20	20.25		0.50	...
24	32.00	1.88	26.12	24.00	3.25	4.38	6.00	3.25	24.25	24.25		0.50	...

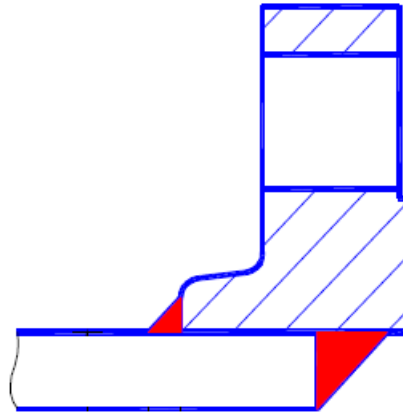
Flange Facings

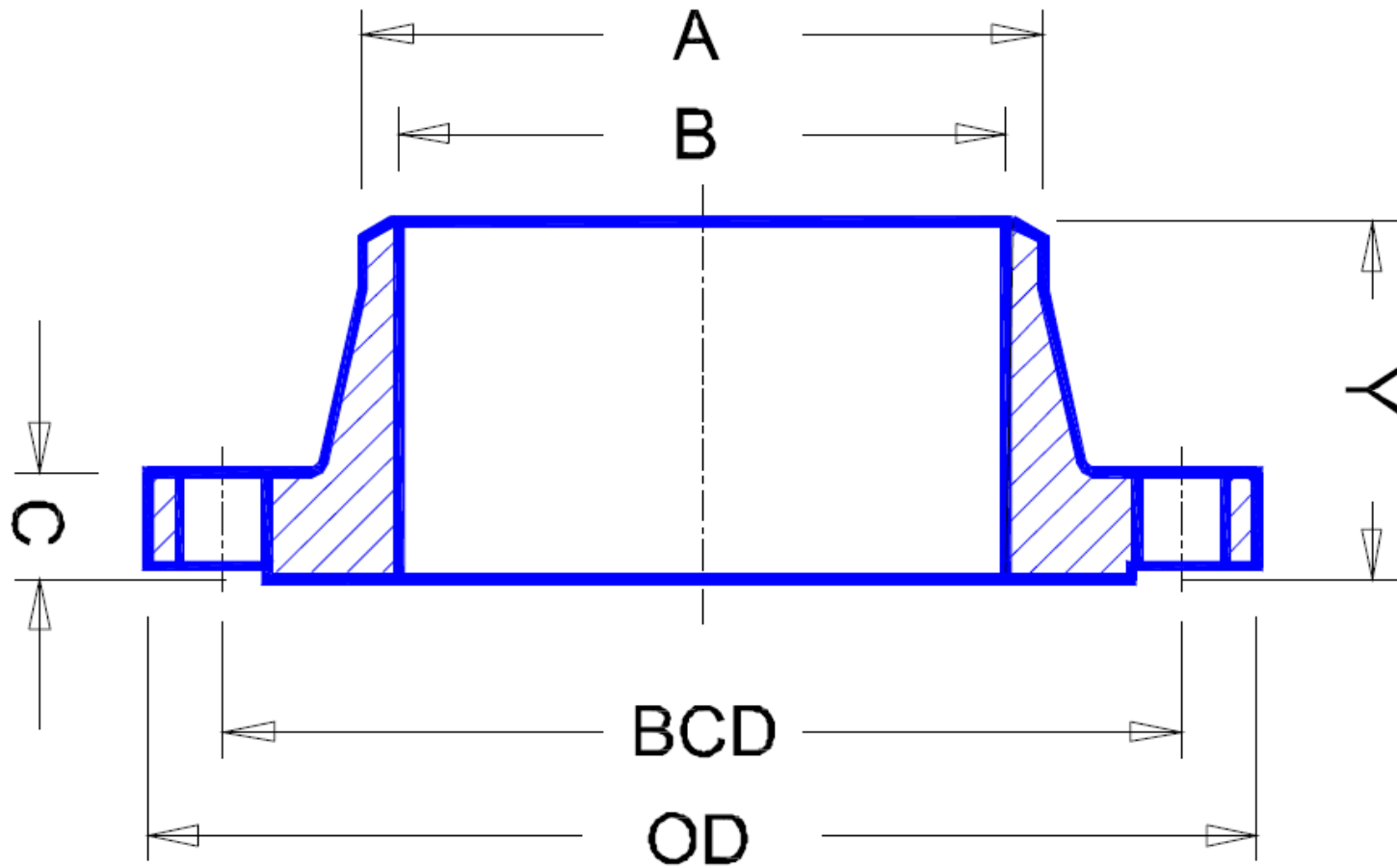
- Flat Facing (FF):
- Raised Facing (RF): The Raised face is the most common of all flange faces. The Raised face is named like this because the gasket surfaces are raised above the bolting circle face (the raised face is only a slight step). Raised face flanges are therefore not full contact flanges. As such, some flange stress may be created when the bolting is tightened. The raised face is finished with a series of concentric circular grooves for keeping the gasket in place and providing a better seal. Raised face flanges are specified for low, medium and high pressure-temperature applications.
- Ring type Joint Facing (RTJ)



R & RX ring standard







How to Order a Flange

1/2" - 24" – covered by ANSI B16.5

Quantity

Size (nominal pipe size)

Pressure Class (150-2500)

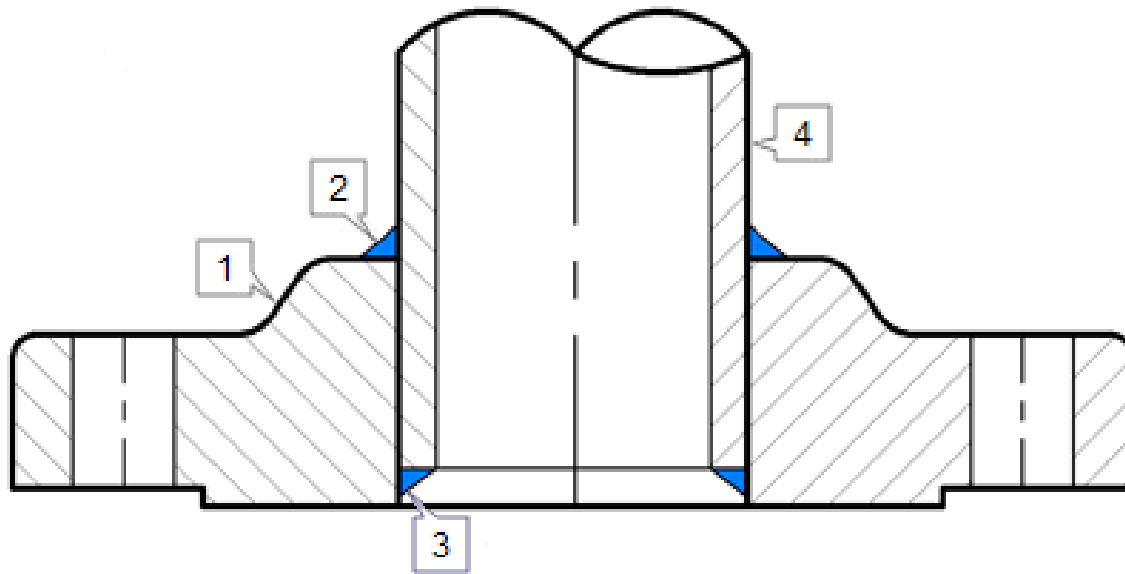
Facing (RF, FF, RTJ, ect.)

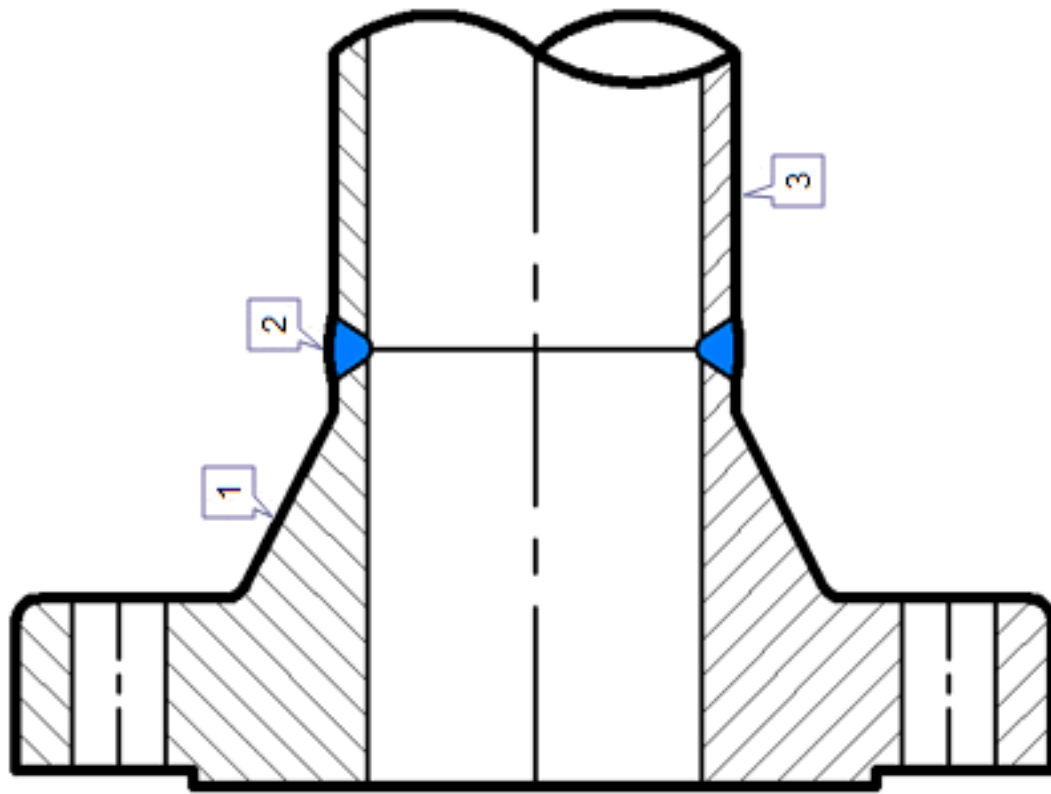
Type (WN, SO, Threaded, Blind, SW, LJ)

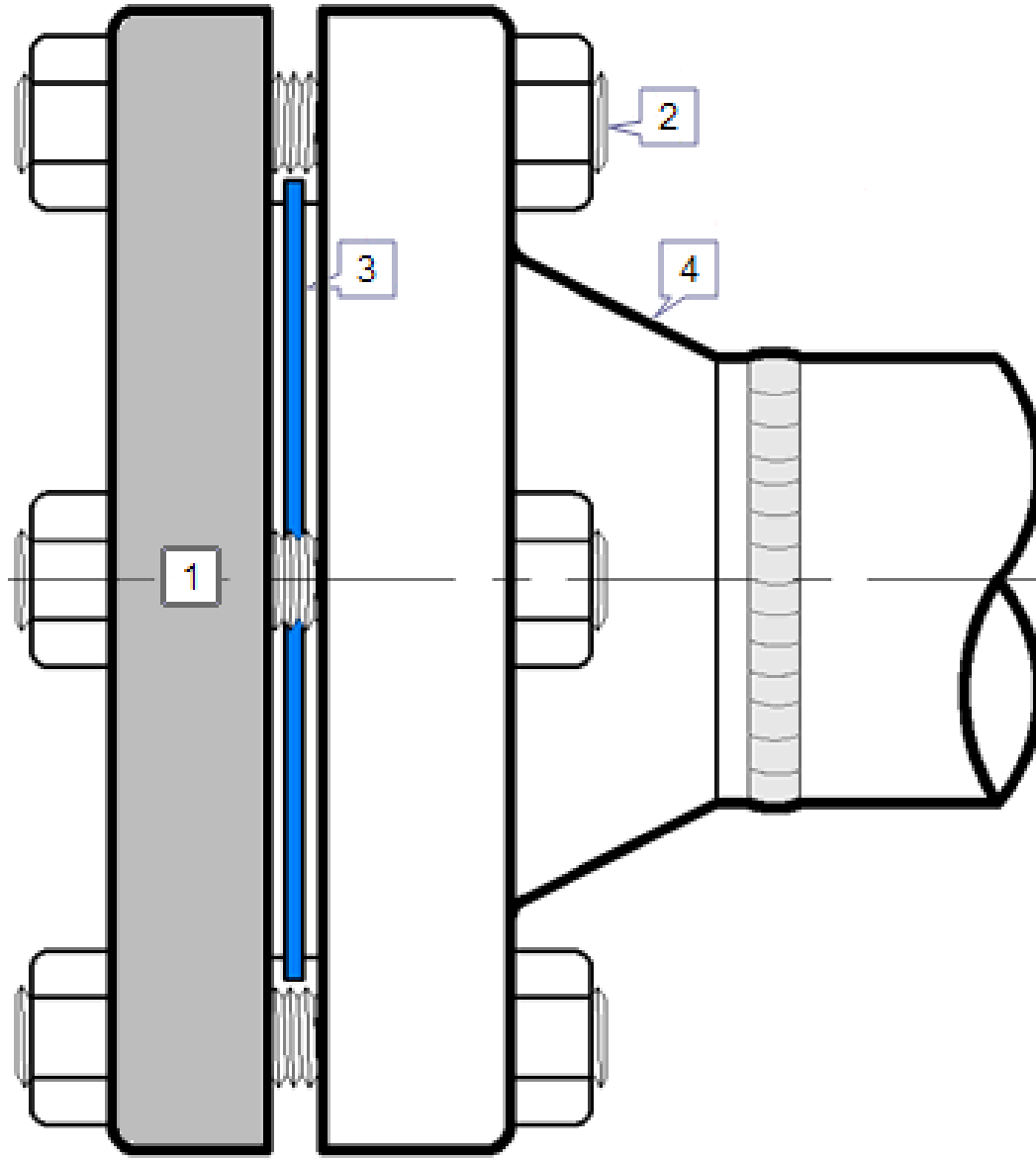
Bore (if SW or WN)

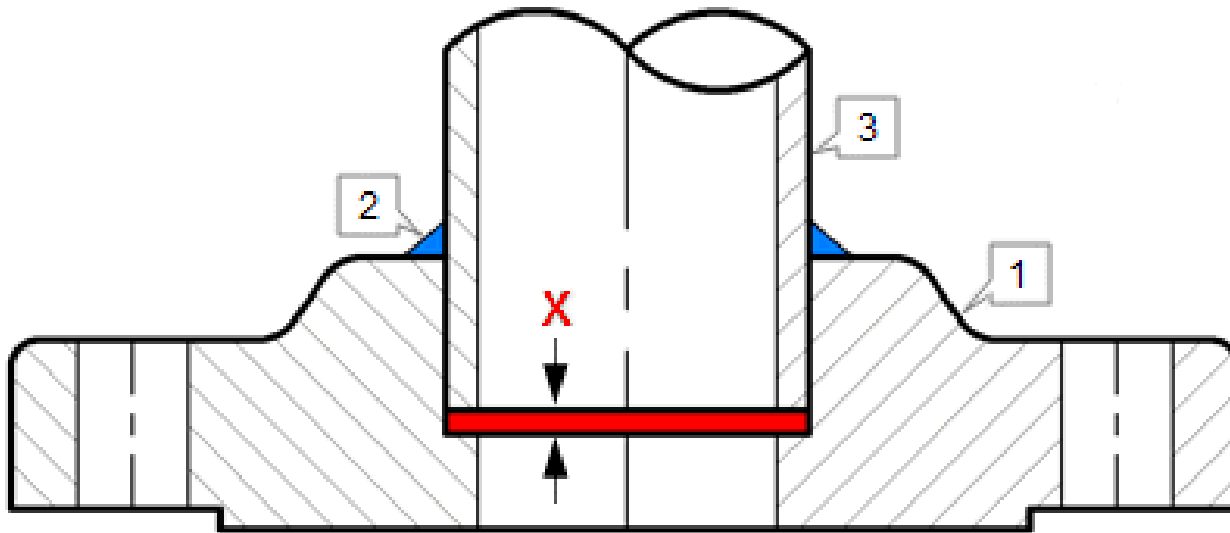
Material

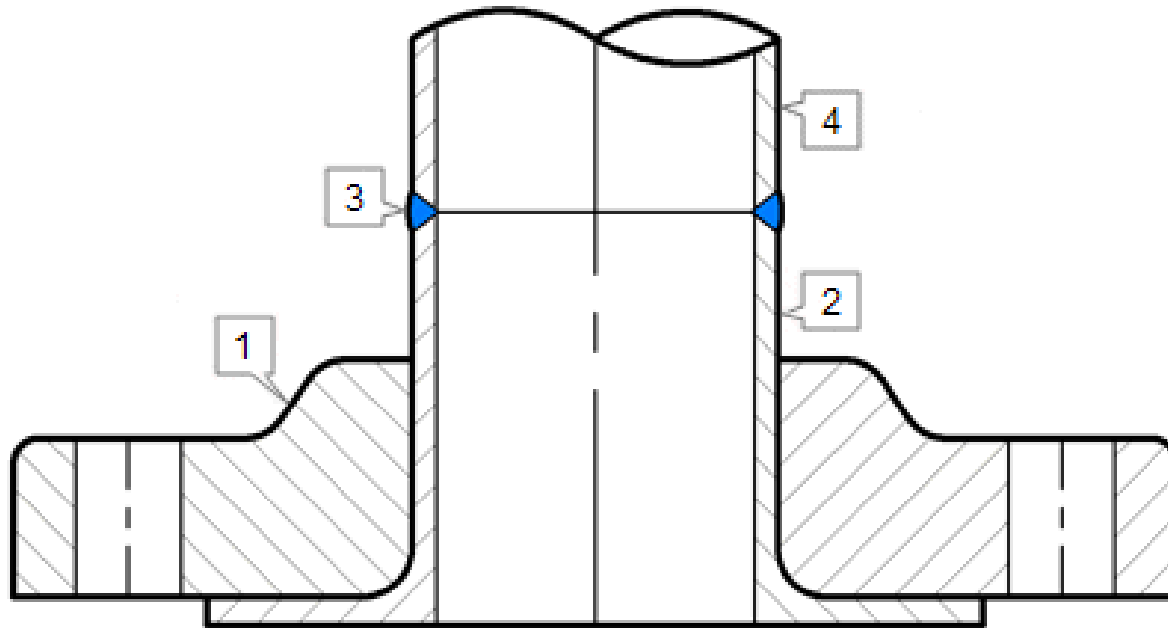
e.g. 2 – 4" 300# RFWN STD 304

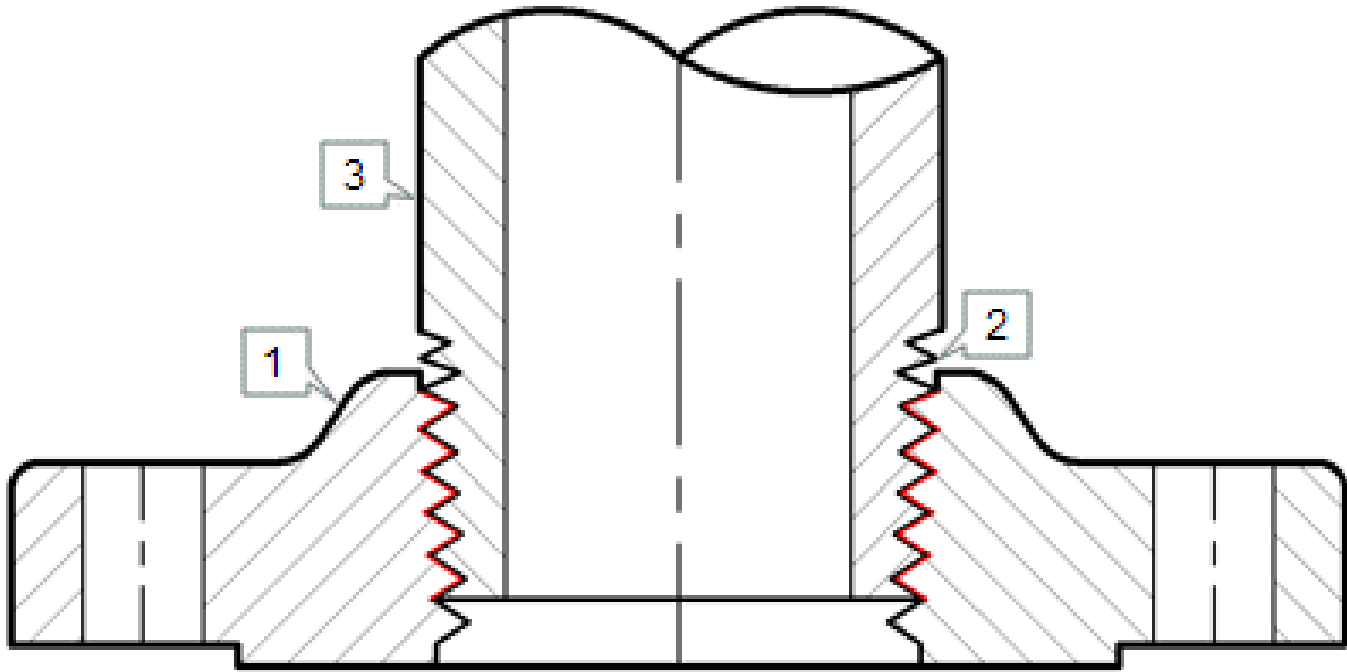


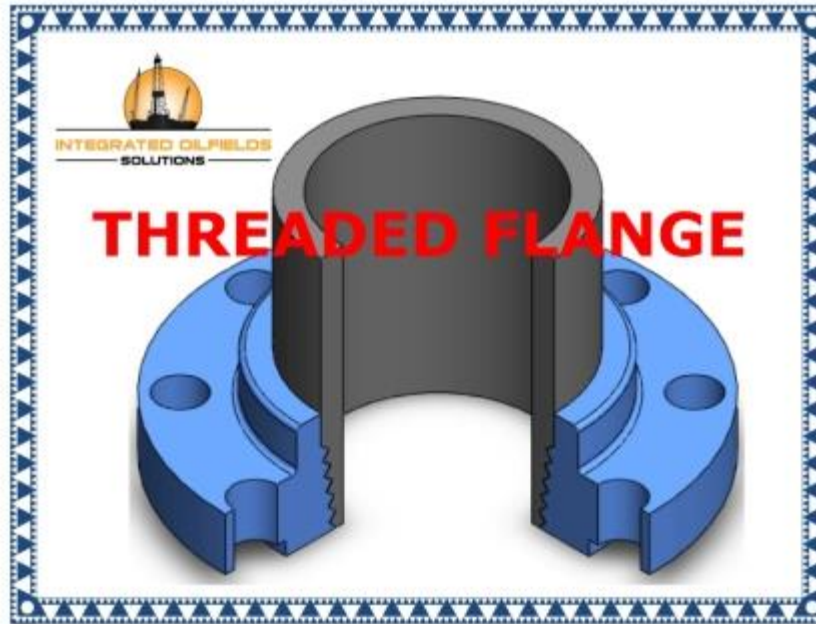


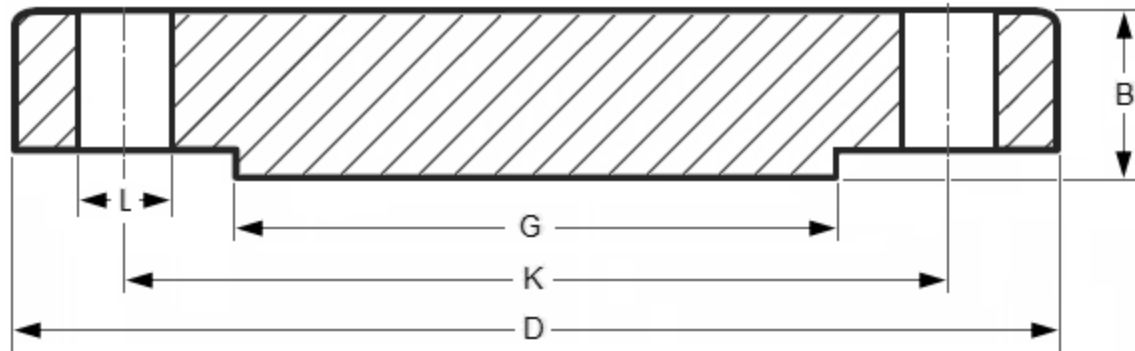


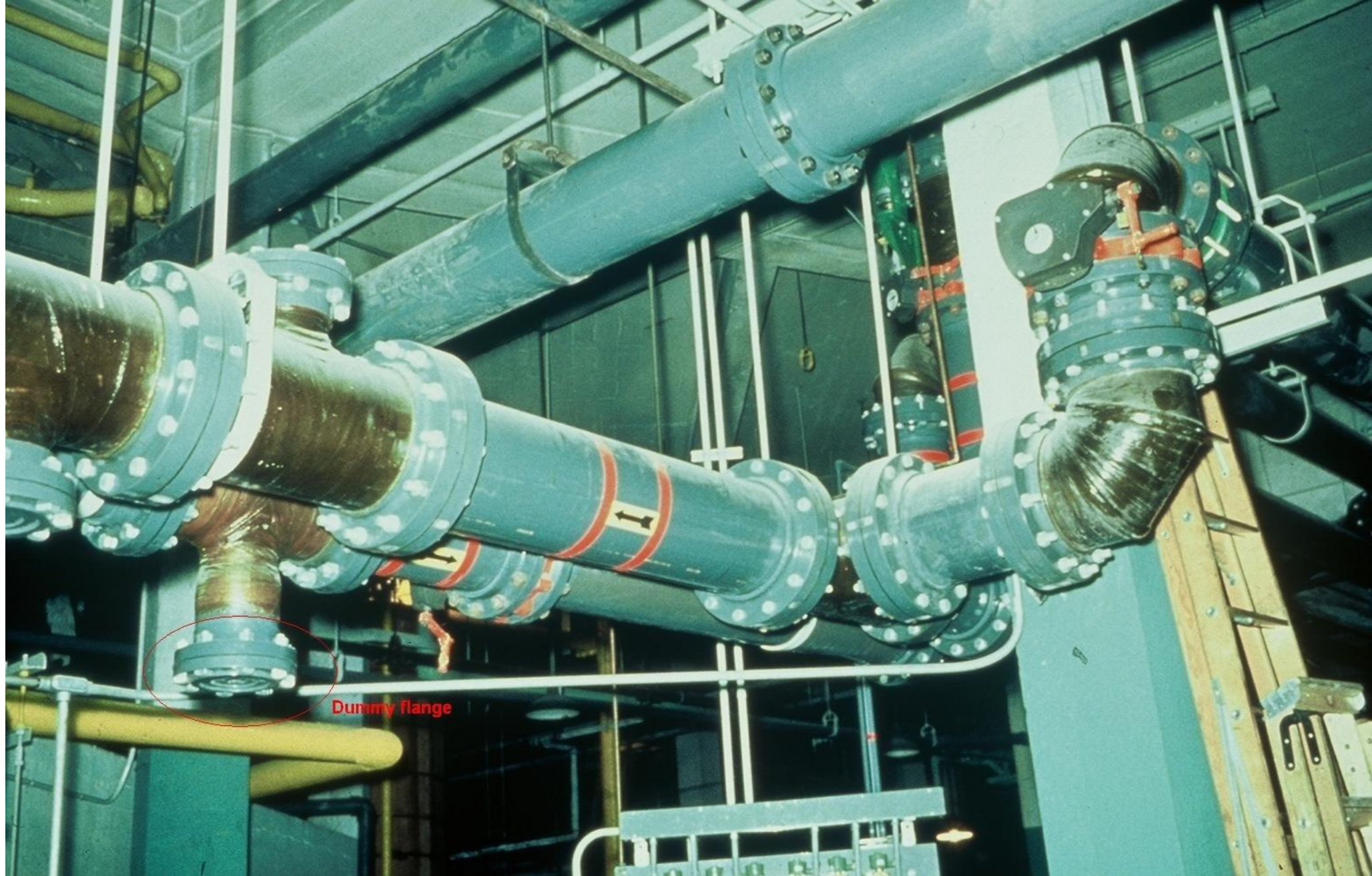












Dummy flange

FLANGED FITTINGS

