Anggerik Laksana (I) Pvt Ltd

We Speak Your Pipe Fitting's Language

CONTENTS

SR. NO.	TOPICS	PAGE NO.
01.	COMPANY INTRODUCTION	01
02.	GOALS, VISION & MISSION	02
03.	ANGGERIK PRODUCT RANGE	03
04.	CODES & STANDARDS	04
05.	MATERIAL SPECIFICATIONS	06
06.	CARBON STEEL & STAINLESS STEEL, PIPE THICKNESS & WEIGHT CHART	09
07.	BUTT WELD PIPE FITTINGS	10
08.	IS-1239 PART-II PIPE THICKNESS AND WEIGHT	18
09.	FORGED STEEL OUTLET FITTINGS	23
	09.1 NIPPOLETS	23
	09.2 SOCKOLETS	24
	09.3 THREADOLETS	25
	09.4 UNIONS	26
	09.5 REDUCER INSERTS	27
10.	FORGED FITTINGS SOCKET-WELD & THREADED	28
11.	WELDOLET REDUCING STD MSS SP97	32
12.	FLANGES ASME/ANSI 16.5 DIMENSION CHARTS	34
13.	FLANGES ASME/ANSI 16.5 WEIGHT CHARTS	37
	13.1 WELD NECK	37
	13.2 SLIP-ON FLANGES	38
	13.3 LAP JOINT FLANGES	39
	13.4 BLIND FLANGES	40
	13.5 THREADED FLANGES	41
14.	FLANGES B.S 3293	42
	14.1 WELD NECK FLANGES B. S. 3293	42
	14.2 WELD NECK FLANGES RING JOINT TYPE B. S. 3293	44
	14.3 SLIP-ON FLANGES B. S. 3293	46
	14.4 SLIP-ON FLANGES RING JOINT TYPE B. S. 3293	48
15.	FLANGES MSS SP-44	49
	15.1 WELD NECK FLANGE MSS SP-44	49
	15.2 WELD NECK FLANGES, RING JOINT TYPE MSS SP-44	54
16.	FLANGES API 605	56
17.	FLANGES TO AMERICAN STANDARD	58
18.	STANDARD FINISHES FOR CONTACT FACE OF FLANGES	59
19.	DIMENSIONAL TOLERANCES: FLANGES	60
20.	STRESS STRAIN CURVE	61
21.	USEFUL CONVERSION FACTORS	63
22.	WEIGHT CALCULATION CHART	63
23.	EFFECT OF CHEMICAL ELEMENTS ON MECHANICAL PROPERTIES OF STEEL	65
24.	SPECIFICATIONS OF STAINLESS STEEL, DUPLEX STAINLESS STEEL & NACE	68
25.	WHAT IS THE “DUPLEX SS FAMILY”	70
26.	NACE MR0175 PIPE, FITTINGS & FLANGES	71
27.	FITTINGS WEIGHT LIST	72
28.	SPECIFICATIONS OF ROLLED STEEL BEAMS	76
29.	SPECIFICATIONS OF EQUAL ANGELS	78
30.	GLOSSARY	79
31.	PROCESS FLOW	80

1. COMPANY INTRODUCTION:

Anggerik Laksana (India) Pvt Ltd, an ISO TUV NORD certified company started its journey from a small town of Tahliwal District Una (Himachal Pradesh) in the year 2012, with a team of young engineers and talented workers, under the guidance of a group of well experienced and educated managers and technocrats, having a wide knowledge of oil and gas industry. Since then Anggerik Laksana (India) Pvt Ltd has set very high standards of operational excellence with main focus on quality, safety, efficiency and delivery.

After the start off from the small town of Himachal Pradesh in 2012, Anggerik Laksana (India) Pvt Ltd has established to produce an extensive range of Pipe Fittings and Flanges for Oil and Gas industry for the Indian subcontinent.

Considering the rising demands for Fittings and Flanges with tight delivery schedule Anggerik Laksana (India) Pvt Ltd has set up its additional manufacturing facilities in Mumbai. Our Mumbai plant is equipped with Mandrel Machine and other state of the art equipments.

With dedicated effort, hard work and clear vision of our technical team and dynamic leadership of our management, Anggerik Laksana (India) Pvt Ltd is now well recognized in Oil and Gas industry both in upstream and downstream fields and is serving them to their entire satisfaction. We have extended our reach to Pharmaceutical industry also.

"VALUE CREATION FOR OUR ESTEEMED CUSTOMERS HAS BEEN OUR TOP PRIORITY SINCE INCEPTION"

2. GOALS, VISION & MISSION:

Goals:

· Operational excellence & Quality.
· Customer focus (Constant communication and engagement)
· Safe working and learning environment
· High performing team
· Receptive to change

Vision:

We aspire to master leading position in manufacturing and supplying of superior steel fittings, flanges and fasteners, that meet the highest level of quality and best delivery standard.

Mission:

Anggerik Laksana India Pvt Ltd is a customer focus company. Our mission includes followings:

· Strive to meet customer requirement to their satisfaction.
· Maintaining good corporate position by exercising globally acceptable standard and helping to improve the quality of life for community and society.
· Conducting fair business practices with all partners, customers and vendors while promoting confidence, affiliation and collaboration to expand business competence and increase long term efficiency.
· Deploy the right mix of people and product to deliver value added service to our client.
· Promoting capability, building resource and ensuring employees welfare.

To create a working culture that appreciate total quality consciousness and inculcation of ethical values in business.

3. ANGGERIK PRODUCT RANGE

Anggerik Laksana India has established to produce an extensive range of Pipe Fitings, Flanges, Fasteners Gaskets For Oil and Gas Industries conforming to The International Codes and Standards.

MANUFACTURING MATERIAL		
Steel Type	**Reference**	**Specification**
Carbon Steel	ASTM/ASME	A 234 WPB
Low temperature	ASTM/ASME	A420 WPL6/WPL3
Carbon-Moly Steel	ASTM/ASME	A234 WP1
Chrome-Moly Steel	ASTM/ASME	A234 WP5/9/11/12/22/91
Austenitic Stainless Steel	ASTM/ASME	A403 WP304 (L) (H) WP 321 (H) WP347 (H) WP316(L) (H) (T)
Duplex SS	ASTM/ASME	Lean / Duplex / Super Duplex
NACE Material	ASTM/ASME	NACE MR0175

Design & Stress Analysis (Reference specification)
ASME B 31.1/31.3/31.4/31.8
ASME I/ASME VIII
DIN 2413

Size Range : Seamless & Welded (Capability continuously upgraded)	
Elbows	1/4"to 36"
Returns	1/2" - 36"
Tees	1/2" - 36" (Equal & Unequal)
Caps	1/2" - 36"
Reducers	1/2" - 36" (CR & ER)
Stub ends	2" - 24"
Y-Pieces	2" - 36"
Nipples	As per specifications
Fastners	As per specific requirements
Flanges	1/2 " - 36" As per specifications

Other Products

FASTENERS

Stainless Steel: AISI 302, 304, 304L, 316, 316L, 310, 317, 317L, 321, 347, 410, 420, 904L etc.

Alloy Steel: 4.6, 5.6, 6.6, 8.8, 10.9 & 12.9/'R', 'S', 'T' Conditions.

Carbon Steel: Bare Condition, Galvanized, Phosphetised, Cadium Plated, Hot Deep Galvanized, Bloodied, Nickel Chrome Plated, etc.

Non Ferrous Metal: Copper, Brass, Aluminium, Titanium, Nichrome, Al. Bronze Phosphorous Bronze, etc.

Types: Bolts, Nuts, Washers, Anchor Fasteners, Stud Bolts, Eye Bolt, Stud, Threaded Rod, Cotter Pin, Socket Screw, Fine Fasteners & Spares, Foundation Fasteners, etc.

LONG RADIUS PIGGABLE BENDS

Seamless & Welded hot & cold radius piggable bends in 2D, 3D, 5D, 6D, 8D upto 10D, 45, 90, 180, 360 sizes upto 32” N.B with tangents length as per requirement.

4. CODES & STANDARDS

JIS : JAPANESE INDUSTRIAL STANDARDS	
JIS B 2311	Steel Butt Welding Pipe Fittings for Ordinary use.
JIS B 2312	Steel Butt Welding Pipe Fittings.
JIS B 2313	Steel Plate Butt Welding Pipe Fittings.
JIS B 2316	Steel Socket Welding Pipe Fittings.

ASTM : AMERICAN SOCIETY FOR TESTING AND MATERIALS	
ASTM A 105	Carbon Steel Forgings for Piping Applications
ASTM A 182	Forged or Rolled Alloy Steel Pipe Flanges, Forged Fittings, and Valves and Parts for high Temperature Service
ASTM A 234	Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service
ASTM A 350	Carbon and Low-Alloy Steel Forgings, Requiring Notch Toughness Testing for Piping Components
ASTM A 403	Wrought Austenitic Stainless Steel Piping Fittings
ASTM A 420	Piping Fittings of Wrought Carbon Steel and Alloy Steel for Low-Temperature Service
ASTM A 694	Carbon and Alloy Steel Forgings for Pipe Flanges, Fittings, Valves, and Parts for High-Pressure Transmission Service
ASTM A 815	Wrought Ferritic, Ferritic/Austenitic, and Martensitic Stainless Steel Piping Fittings
ASTM A 860	Wrought High-Stength Low-Alloy Steel Butt-Welding Fittings
ASTM B366	Factory-Made Wrought Nickel and Nickel Alloy Fittings

	BRITISH STANDARD
BS 3293	Standard Steel Flanges

API : AMERICAN PETROLEUM INSTITUTE	
API 5L	Line Pipe.
API 605	Flanges

MSS : MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY	
MSS SP-25	Standard Marketing System for Valves, Fittings, Flanges and Unions.
MSS SP-43	Wrought Stainless Steel Butt Welding Fittings.
MSS SP-44	Standard for Steel Pipe Line Flanges
MSS SP-75	Specification for High Test WroughtButt Welding Fittings.
MSS SP-79	Socket Welding Reducer Inserts.
MSS SP-83	Carbon Steel Pipe Union Socketwelding and Threaded.
MSS SP-87	Factory-Made Butt Welding Fittings for Class 1 Nuclear Piping Applications.
MSS SP-95	Swage[d} Nipples and Bull Plugs
MSS SP-97	Integrally Reinforced Forged Branch Outlet Fittings-socket Welding, Threaded and Butt Welding Ends.

ASME : AMERICAN SOCIETY OF MECHANICAL ENGINEERS ASME : ASME BOILER AND PRESSURE VESSEL CODE AN INTERNATIONAL CODE	
ASME B 16.5	Pipe Flanges and Flanged Fittings.
ASME B 16.9	Factory Made Wrought Steel Butt Welding Fittings.
ASME B 16.11	Forged Fittings, Socket welding and Threaded
ASME B 16.25	Butt Welding Ends.
ASME B 36.10	Welded and Seamless Wrought Steel Pipe.
ASME B 36.19	Stainless Steel Pipe.
ASME B31.1	Power piping.
ASME B31.3	Process piping.
ASME SECTION II	Materials.
ASME SECTION III	Rules for Construction of Nuclear Facirity Components.
ASME SECTION V	Nondestructive Examination.
ASME SECTION VIII	Rule for Construction of Pressure Vessels.
ASME SECTION IX	Welding and Brazing Qualifications.

Ferrous Material					
Material Classification				Comparison as nations	
Large	Middle	Small		ASTM(U.S.A)	
				Designation	Identification
Ferrous (Base Mat'l:Fe)	Carbon Steel	Ambient and Higher Temperature Service		A234	WPB
					WPC
		Low Temperature Service		A420	WPL3
					WPL6
					WPL9
	Alloy Steel (Cr _>1%)	Low Alloy (1% <_ Cr<_ 9%)		A234	WP1
					WP12
					WP11
					WP22
					WP5
					WP23
					WP9
					WP91
					WP92
		High Alloy (Cr >_ 12%) :Stainless Steel	Martensitic Stainless Steel	A815	WP410
			Ferritic Stainless Steel		WP430
			Austentic Stainless Steel	A403	WP304/L
					WP316/L
					WP317/L
					WP321/H
					WP347/H
			Super Austentic Stainless Steel	A403	S31254
					904L
			Ferrtic / Austenitic (Duplex / Super Suplex)	A815	S31803
					S32750
					S32760

○ Applicable Code/ Standard : ASTM Part A, Latest Edition,
■ Non Registered materials on ASTM Latest Edition.

Non - Ferrous Material Comparison		
Material Classification	Trade Mark	UNS NO.
Non - Ferrous (Base Mat'l : Ni)	Inconel 600	N06600
	Inconel 690	N06690
	Inconel 800H / 800HT	N08810 / N08811
	Inconel 625	N06625
	Incoloy 825	N08825
	Hastelloy B2	N10665
	Hastelloy C276	N10276
	Hastelloy C22	N06022
	Incoloy 020	N08020
	Monel 400	N04400
	Monel K500	N05500
Non - Ferrous (Base Mat'l : Cu)	Cu-Ni 70/30	C71500
	Cu-Ni 90/10	C70600

○ Applicable Code/ Standard : ASTM Part B, Latest Edition.

Anggerik Laksana (I) Pvt Ltd

5. MATERIAL SPECIFICATIONS

	Material	Chemical Composition (Percent) Max.orRange (Unless otherwise indicated)										Other Elements	Tensile Requirements					Maximum Serv. Temp. C
													Tensile Strength Min.orRange psi (Mpa)		Yield Strength Min. psi (Mpa)		Longitudinal Elongation in 2 in. (60 mm) Min., %	
		Form	C	Si	Mn	P	S	Ni	Cr	Mo	Ti							
WPS	A106 Gr.B	P	0.3	0.10 min.	0.29 - 1.06	0.048	0.058	...	...	...	...	...	60	**414**	35	**241**	30	
	A515 Gr.65	PL	0.28 - 0.33	0.13 - 0.33	**0.9**	0.035	**0.04**	...	...	...	...	...	65 - 85	(450-585)	35	**240**	23	565
	A515 Gr.70	PL	0.31 - 0.35	0.13 - 0.33	**0.9**	0.035	**0.04**	...	...	...	...	...	70 - 90	(485-620)	38	**260**	21	
WP9 CL - 1 CL - 3	A335 Gr. P5	P	0.15 max	0.50 max	0.30 - 0.60	**0.04**	**0.03**	...	4.0 - 6.0	0.44 - 0.65	...	...	60 - 85	(415 - 585)	30	**205**	30	
	A335 Gr. P5	P	0.15 max	0.50 max	0.30 - 0.60	**0.04**	**0.03**	...	4.0 - 6.0	0.44 - 0.65	...	...	75 - 100	(520 - 690)	45	**310**	30	650
	A387 Gr. 5	PL	0.15	**0.5**	0.27 - 0.63	**0.04**	**0.03**	...	4.00 - 6.00	0.40 - 0.70	...	...	60 - 85	(415 - 585)	30	**205**	18	
WP9 CL - 1 CL - 3	A335 Gr. P9	P	0.15 max	1.00 max	0.30 - 0.60	**0.03**	**0.03**	...	8.0 -10.0	0.90 - 1.10	...	...	60 - 85	(415 - 585)	30	**205**		
	A335 Gr. P9	P	0.15 max	1.00 max	0.30 - 0.60	**0.03**	**0.03**	...	8.0 -10.0	0.90 - 1.10	...	...	75 - 100	(520 - 690)	45	**310**		705
	A387 Gr.9	PL	0.15 max	0.25 - 1.00	0.30 - 0.60	**0.03**	**0.03**	...	8.00 - 10.00	0.90 - 1.10	...	...	60 - 85	(415 - 585)	30	**205**		
WP11 CL - 1 CL - 2 CL - 3	A335 Gr. P11	P	0.05 - 0.15	0.50 - 1.00	0.30 - 0.60	**0.03**	**0.03**	...	1.00 - 1.50	0.44 - 0.65	...	...	60 - 85	(415 - 585)	30	**205**	30	
	A335 Gr. P11	P	0.05 - 0.20	0.50 - 1.00	0.30 - 0.60	**0.04**	**0.04**	...	1.00 - 1.50	0.44 - 0.65	...	...	70 - 95	(485 - 655)	40	**275**	30	595
	A335 Gr. P11	P	0.05 - 0.20	0.50 - 1.00	0.30 - 0.60	**0.04**	**0.04**	...	1.00 - 1.50	0.44 - 0.65	...	...	75 - 100	(520 - 690)	45	**310**	30	
	A387 Gr. 11	PL	0.17	0.44 - 0.86	0.36 - 0.69	0.035	**0.04**	...	0.94 - 1.56	0.40 - 0.70	...	...	60 - 85	(415 - 585)	35	**240**	22	
WP22 CL - 1 CL - 3	A335 Gr. P22	P	0.05 - 0.15	0.50 max	0.30 - 0.60	**0.04**	**0.04**	...	1.90 - 2.60	0.87 - 1.13	...	...	60 - 85	(415 - 585)	30	**205**	30	
	A335 Gr. P22	P	0.05 - 0.15	0.50 max	0.30 - 0.60	**0.04**	**0.04**	...	1.90 - 2.60	0.87 - 1.13	...	...	75 - 100	(520 - 690)	45	**310**	30	620
	A387 Gr. 22	PL	0.15 - 0.17	**0.5**	0.27 - 0.63	0.035	0.035	...	1.88 - 2.62	0.85 - 1.15	...	...	60 - 85	(415 - 585)	30	**205**	18	
WP 304	A312 Gr. TP304	P	0.08	0.75	**2**	**0.04**	**0.03**	8.00 - 11.00	18.00 - 20.00	...	...	...	75	**517**	30	**207**	35	925
	A240 Type 304	PL	0.15	**1**	**2**	0.045	**0.03**	8.00 - 10.50	18.00 - 20.00	...	...	...	75	**515**	30	**205**	40	
WP 304 H	A312 Gr. TP304H	P	0.04 - 0.10	0.75	**2**	**0.04**	**0.03**	8.00 - 11.00	18.00 - 20.00	...	...	...	75	**517**	30	**207**	35	
	A240 Type 304	PL	0.04 - 0.10	**1**	**2**	0.045	**0.03**	8.00 - 10.50	18.00 - 20.00	...	...	...	75	**515**	30	**205**	40	
WP 304 L	A312 Gr. TP304L	P	0.035	0.75	**2**	**0.04**	**0.03**	8.00 - 13.00	18.00 - 20.00	...	...	...	65	**448**	25	**172**	35	
	A240 Type 304L	PL	**0.03**	**1**	**2**	0.045	**0.03**	8.00 - 12.00	18.00 - 20.00	...	...	...	65	**448**	25	**172**	40	
WP 316	A312 Gr. TP316	P	0.08	0.75	**2**	**0.04**	**0.03**	11.00 - 14.00	16.00 - 18.00	2.00 - 3.00	...	...	75	**517**	30	**207**	35	925
	A240 Type 316	PL	0.08	**1**	**2**	0.045	**0.03**	10.00 - 14.00	16.00 - 18.00	2.00 - 3.00	...	...	75	**515**	30	**205**	40	
WP 316 H	A312 Gr.TP316H	P	0.04 - 0.010	0.75	**2**	**0.04**	**0.03**	11.00 - 14.00	16.00 - 18.00	2.00 - 3.00	...	...	75	**517**	30	**207**	35	
	A240 Type 316	PL	0.04 - 0.010	**1**	**2**	0.045	**0.03**	10.00 - 14.00	16.00 - 18.00	2.00 - 3.00	...	...	75	**515**	30	**205**	40	
WP 316 L	A312 Gr. TP316L	P	0.035	0.75	**2**	**0.04**	**0.03**	10.00 - 15.00	16.00 - 18.00	2.00 - 3.00	...	...	70	**483**	25	**172**	35	
	A240 Type 316L	PL	**0.03**	**1**	**2**	0.045	0.035	10.00 - 14.00	16.00 - 18.00	2.00 - 3.00	...	...	65	**448**	25	**170**	40	
WP 321	A312 Gr. TP321	P	0.08	0.75	**2**	**0.04**	**0.03**	9.00 - 13.00	17.00 - 20.00	...	5xC - 0.60	...	75	**517**	30	**207**	35	925
	A240 Type 321	PL	0.08	**1**	**2**	0.045	**0.03**	9.00 - 12.00	17.00 - 19.00	...	5xC - 0.70	...	75	**515**	30	**205**	40	
WP 321 H	A312 Gr. TP321H	P	0.04 - 0.010	0.75	**2**	**0.04**	**0.03**	9.00 - 13.00	17.00 - 20.00	...	4xC - 0.60	...	75	**517**	30	**207**	35	
	A240 Type 321	PL	0.04 - 0.010	**1**	**2**	0.045	**0.03**	9.00 - 12.00	17.00 - 19.00	...	4xC - 0.70	...	75	**515**	30	**205**	40	
WP 347	A312 Gr. TP347	P	0.08	0.75	**2**	**0.04**	**0.03**	9.00 - 13.00	17.00 - 20.00	...	...	Cb + Ta 10xC - 1.00	75	**517**	30	**207**	35	925
	A240 Type 347	PL	0.08	**1**	**2**	0.045	0.035	9.00 - 13.00	17.00 - 19.00	...	...	Cb+ Ta 10xC - 1.10	75	**515**	30	**205**	40	
WP 347 H	A312 Gr. TP347H	P	0.04 - 0.10	0.75	**2**	**0.04**	**0.03**	9.00 - 13.00	17.00 - 20.00	...	...	Cb + Ta 8xC - 1.0	75	**517**	30	**207**	35	
	A240 Type 347	PL	0.08	**1**	**2**	0.045	**0.03**	9.00 - 13.00	17.00 - 19.00	...	...	Cb+ Ta 10xC - 1.10	75	**515**	30	**205**	40	
WPL3	A333 Gr, 3	P	0.19	0.18 - 0.37	0.31 - 0.64	**0.05**	**0.05**	3.18 - 3.82	...	...	...		65	448	35	**241**	30	
	A203 Gr. D	PL	0.17 - 0.20	0.13 - 0.32	0.70 - 0.80	0.035	**0.04**	3.18 - 3.82	...	...	...		65 - 85	(450 - 585)	37	**255**	23	
WPL6	A333 Gr. 6	P	**0.3**	0.10 min.	0.29 - 1.06	0.048	0.058	...	...	...	...		60	**414**	35	**241**	30	
	A516 Gr. 60	PL	0.21 - 0.27	0.13 - 0.33	0.60 - 1.25	0.035	**0.04**	...	...	...	...		60 - 80	(415 - 550)	32	**220**	25	

NOTES:
* Asterisks (*) denote that the carbon content shall be 0.04 to 0.10%
* Daggers ( ) denote that the minimum tensile strength shall be 85.000 psi (488 Mps) and that the minimum yield shrength shall be 25,000 psi (172 Mp.
* The yield shrength shall be determined by the offset method at 0.2% limiting permanent set in accordance with ASTM A370 Specification. An alternate method of determining yield strength may be based on a total extension under load of 0.5%.
* The basic minimum elongation for walts 3/16" (7.94mm) and over in thickness shall be determined according to strip tests; all small sizes are tested their full section.
* P denotes Pipe. PL Plate

STAINLESS STEEL & THEIR CHARACTERISTICS
Grade
304/304L/304H
316/316L/316H
321/321H

347/347H

Steel type	ASTM Grade	Chemical Composition									Mechanical Properties				
		C% max	Mn%	P% max	S% max	Si%	Cr%	Mo%	Ni%	Others	R. min. Tensile Strength MPa	S.min. Yield Strength MPa	A% min. (2" /4D) Elongation		Impact Test KCV (2) J
													Long	Transv.	
A234	WPB(1)	0.3	0.29-1.06	0.05	0.058	0.10 min	0.4	0.15	0.4	Cu=0.4 V=0.08 Cb=0.02	415-585	240	30	20	··
	WPC(1)	0.35	0.29-1.06	0.05	0.058	0.10 min	0.4	0.15	0.4	Cu=0.4 V=0.08 Cb=0.02	485-655	275	30	20	··
A420	WPL/6(1)	0.3	0.6-1.35	0.035	0.04	0.15-0.30	0.3	0.12	0.4	Cu=0.4 V=0.08 Cb=0.02	415-585	240	30	16.5	-45℃ 17.6/13.6
	WPL3	0.2	0.31-0.64	0.05	0.05	0.13-0.37	··	··	3.2-3.8	··	450-620	240	30	20	-101℃ 17.6/13.6
	WP1	0.28	0.30-0.9	0.045	0.045	0.10-0.50	··	0.44-0.65	··	··	380-550	205	30	20	··
	WP12CL1	0.05-0.2	0.3-0.8	0.045	0.045	0.6	0.8-1.25	0.44-0.65	··	··	415-585	220	30	20	··
	WP12CL2	..	..	..	..	..	..	..	..	..	485-655	275	30	20	..
A234	WP11CL1	0.5-0.15	0.3-0.6	0.3	0.3	0.5-10	1.0-1.5	0.44-0.65	··	··	415-585	205	30	20	··
	WP11CL2	0.5-0.2	0.3-0.8	0.4	0.4	0.5-10	1.0-1.5	0.44-0.65	··	··	485-655	275	30	20	··
	WP11CL3	..	..	..	..	..	..	..	..	..	520-690	310	30	20	..
	WP22CL1	0.05-0.15	0.3-0.6	0.04	0.04	0.5-10	1.9-2.6	0.87-113	··	··	415-585	205	30	20	··
	WP22CL3	..	..	..	..	..	..	..	..	..	520-690	310	30	20	..
	WP5	0.15	0.3-0.6	0.04	0.3	0.5	4.0-6.0	0.44-0.65	··	··	415-585	205	30	20	··
	WP9	0.15	0.3-0.6	0.03	0.03	0.25-10	8.0-10.0	0.9-1.10	··	··	415-585	205	30	20	··
	WP91	0.08-0.12	0.3-0.6	0.02	0.01	0.2-0.5	8.0-9.5	0.85-1.05	0.4	V=0.18-0.25 Cb=0.06-0.10 N=0.03-0.07 Al=0.04	585-760	415	20	··	··
A403	WP304	0.08	2	0.045	0.03	1	18-20	··	8.0-11.0	··	515	205	28	20	··
	WP304L	0.035	2	0.045	0.03	1	18-20	··	8.0-13.0	··	485	170	28	20	··
	WP304H	0.04-0.10	2	0.045	0.03	1	18-20	..	8.0-11.0	..	515	205	28	20	..
	WP316	0.08	2	0.045	0.03	1	18-20	2.0-3.0	11.0-14.0	..	515	205	28	20	..
	WP316L	0.035	2	0.045	0.03	1	18-20	2.0-3.0	10.0-16.0	..	485	170	28	20	..
	WP321	0.08	2	0.045	0.03	1	17.0-20.0	..	9.0-13.0	Ti=5xC max 0.70%	515	205	28	20	
	WP321H	0.04-0.10	2	0.045	0.03	1	17.0-20.0	··	9.0-13.0	Ti=4xC max 0.60%	515	205	28	20	··
	WP347	0.08	2	0.045	0.03	1	17.0-20.0	··	9.0-13.0	Cb+Ta>=10x%C max 0.10%	515	205	28	20	··
	WP347H	0.04-0.10	2	0.045	0.03	1	17.0-20.0	··	9.0-13.0	Cb+Ta>=8x%C max 0.10%	515	205	28	20	··
	WPS 31254	0.02	1	0.03	0.01	0.8	19.5-20.5	6.0-6.5	17.5-18.5	N=0.18-0.22 Cu=0.5-1.0	515	205	28	20	··
A815	S 31803	0.03	2	0.03	0.02	1	21.0-23.0	2.5-3.5	4.5-6.5	N=0.08-0.2	620	450	25	··	··
	WP410	0.15	1	0.04	0.03	1	11.5-13.5	..	0.5	..	485-655	205	20	..	..
B366	WPNIC10	0.06-0.10	1.5		0.015	1	19.0-23.0	··	30.0-35.0	Cu=0.75 Al=0.15-0.60 Ti=0.15-0.60	450	170	30		
	WPNIC11	0.06-0.10	1.5		0.015	1	19.0-23.0	··	30.0-35.0	Fe=39.5 min. Al+Ti=0.85-1.20	450	170	30		

Titanium alloys, Nickel alloys, Inconel alloys, Coupro nickel & Aluminium alloys are also available upon request.
For each reduction of 0.01% below the specified carbon max., an increase of 0.06% Mn above the specified max. will be permitted up to 1.35% max.
2) Relative to 10x10 specimen.

API 5L X52 X56 X60 X65 X 70 PROPERTIES

Chemical Properties

Grade	C	Si	Mn	P	S	V	Nb	Ti
API 5L X52	0.16	0.45	1.65	0.02	0.01	0.07	0.05	0.04
API 5L X56	0.16	0.45	1.65	0.02	0.01	0.07	0.05	0.04
API 5L X60	0.16	0.45	1.65	0.02	0.01	0.08	0.05	0.04
API 5L X65	0.16	0.45	1.65	0.02	0.01	0.09	0.05	0.06
API 5L X70	0.17	0.45	1.75	0.02	0.01	0.1	0.05	0.06

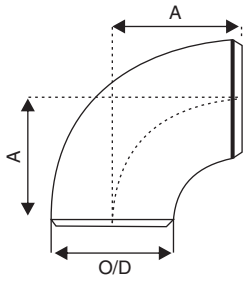
Mechanical Properties

Grade	Yield Strength Min. (MPA)	Tensile Strength Min. (MPA)	Elongation %
API 5L X52	355	450	21
API 5L X56	385	485	19
API 5L X60	410	515	19

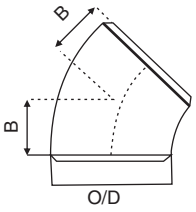
6. CARBON STEEL & STAINLESS STEEL, PIPE THICKNESS & WEIGHT CHART

Nominal Pipe Size	O.D mm	10	20	30	STD	40	60	XS	80	100	120	140	160	XXS	Nominal Pipe Size	FIGURES BASED ON AUSTENITIC STEEL 5S	10S	40S	80S	SHIPPING Vol/mm3
1/8	10,30				1,73 **0,37**	1,73 **0,37**		2,41 **0,47**	2,41 **0,47**						1/8		1,24 **0,28**	1,73 **0,36**	2.41 **0.48**	**0,0001**
1/4	13,70				2,24 **0,63**	2,24 **0,63**		3,02 **0,80**	3,02 **0,80**						1/4		1,65 **0,51**	2,24 **0,64**	3.02 **0.82**	**0,0002**
3/8	17,10				2,31 **0,84**	2,31 **0,84**		3,20 **1,10**	3,20 **1,10**						3/8		1,65 **0,64**	2,31 **0,86**	3.2 **1.12**	**0,0003**
½	21,30				2,77 **1,27**	2,77 **1,27**		3,73 **1,62**	3,73 **1,62**				4,78 **1,95**	7,47 **2,55**	½	1,65 **0,82**	2,11 **1,01**	2,77 **1,30**	3.73 **1.65**	**0,0004**
3/4	26,70				2,87 **1,69**	2,87 **1,69**		3,91 **2,20**	3,91 **2,20**				5,56 **2,90**	7,82 **3,64**	3/4	1,65 **1,04**	2,11 **1,31**	2,87 **1,71**	3.91 **2.24**	**0,0007**
1	33,40				3,38 **2,50**	3,38 **2,50**		4,55 **3,24**	4,55 **3,24**				6,35 **4,24**	9,09 **5,45**	1	1,65 **1,33**	2,77 **2,13**	3,38 **2,55**	4.55 **3.29**	**0,0011**
1 1/4	42,20				3,56 **3,39**	3,56 **3,39**		4,85 **4,47**	4,85 **4,47**				6,35 **5,61**	9,70 **7,77**	1 1/4	1,65 **1,68**	2,77 **2,76**	3,56 **3,46**	4.85 **4.56**	**0,0018**
1 1/2	48,30				3,68 **4,05**	3,68 **4,05**		5,08 **5,41**	5,08 **5,41**				7,14 **7,25**	10,15 **9,56**	1 1/2	1,65 **1,95**	2,77 **3,17**	3,68 **4,13**	5.08 **5.51**	**0,0023**
2	60,30				3,91 **5,44**	3,91 **5,44**		5,54 **7,48**	5,54 **7,48**				8,74 **11,11**	11,07 **13,44**	2	1,65 **2,24**	2,77 **4,01**	3,91 **5,54**	5.54 **7.63**	**0,0036**
2 1/2	73,00				5,16 **8,63**	5,16 **8,63**		7,01 **11,41**	7,01 **11,41**				9,53 **14,92**	14,02 **20,39**	2 1/2	2,11 **3,77**	3,05 **5,36**	5,16 **8,81**	7.01 **11.64**	**0,0053**
3	88,90				5,49 **11,29**	5,49 **11,29**		7,62 **15,27**	7,62 **15,27**				11,13 **21,35**	15,24 **27,68**	3	2,11 **4,60**	3,05 **6,59**	5,49 **11,52**	7.62 **15.59**	**0,0079**
3 ½	101,60				5,74 **13,57**	5,74 **13,57**		8,08 **18,63**	8,08 **18,63**				.. ..	.. ..	3 ½	2,11 **5,29**	3,05 **7,55**	5,74 **13,84**	8.08 **19.01**	**0,0103**
4	114,30				6,02 **16,07**	6,02 **16,07**		8,56 **22,32**	8,56 **22,32**		11,13 **28,32**		13,49 **33,54**	17,12 **41,03**	4	2,11 **5,96**	3,05 **8,52**	6,02 **16,40**	8.56 **22.77**	**0,0130**
5	141,30				6,55 **21,77**	6,55 **21,77**		9,53 **30,97**	9,53 **30,97**		12,70 **40,28**		15,88 **49,11**	19,05 **57,43**	5	2,77 **9,67**	3,40 **11,82**	6,55 **22,20**	9.53 **31.59**	**0,0199**
6	168,30				7,11 **28,26**	7,11 **28,26**		10,97 **42,56**	10,97 **42,56**		14,27 **54,20**		18,26 **67,56**	21,95 **79,22**	6	2,77 **11,55**	3,40 **14,13**	7,11 **28,83**	10.97 **43.42**	**0,028**
8	219,10		6,35 **33,31**	7,04 **36,81**	8,18 **42,55**	8,18 **42,55**	10.3 53.1	12,70 **64,64**	12,70 **64,64**	15,09 **75,92**	18,26 **90,44**	20,62 **100,92**	23,01 **111,27**	22,23 **107,92**	8	2,77 **15,09**	3,76 **20,37**	8,18 **43,39**	12.7 **65.95**	**0,048**
10	273,10		6,35 **41,77**	7,80 **51,03**	9,27 **60,31**	9,27 **60,31**	12.7 81.5	12,70 **81,55**	15,09 **96,01**	18,26 **114,75**	21,44 **133,06**	25,40 **155,15**	28,58 **172,33**	25,40 **155,15**	10	3,40 **23,08**	4,19 **28,34**	9,27 **61,52**	12.7 **83.19**	**0,074**
12	323,90		6,35 **49,73**	8,38 **65,20**	9,53 **73,88**	10,31 **79,73**	14.3 109	12,70 **97,46**	17,48 **132,08**	21,44 **159,91**	25,04 **186,97**	28,58 **208,14**	33,32 **238,76**	25,40 **186,97**	12	3,96 **31,89**	4,57 **36,73**	9,53 **75,32**	12.7 **99.43**	**0,104**
14	355,60	6,35 **54,69**	7,92 **67,90**	9,53 **81,33**	9,53 **81,33**	11,13 **94,55**	15.1 126.4	12,70 **107,39**	19,05 **158,10**	23,83 **194,96**	27,79 **224,65**	31,75 **253,56**	35,71 **281,70**		14	3,96 **35,06**	4,78 **42,14**			**0,126**
16	406,40	6,35 **62,64**	7,92 **77,83**	9,53 **93,27**	9,53 **93,27**	12,70 **123,30**	16.7 160	12,70 **123,30**	21,44 **203,53**	26,19 **245,56**	30,96 **286,64**	36.35 **333,19**	40,49 **365,35**		16	4,19 **42,41**	4,78 **48,26**			**0,165**
18	457,00	6,35 **70,57**	7,92 **87,71**	11,13 **122,38**	9,53 **105,16**	14,27 **155,80**	19 206	12,70 **139,15**	23,83 **254,55**	29,36 **309,62**	34,93 **363,56**	39,67 **408,26**	45,24 **459,37**		18	4,19 **47,77**	4,78 **54,36**			**0,208**
20	508,00	6,35 **78,55**	9,53 **117,15**	12,70 **155,12**	9,53 **117,15**	15,09 **183,42**	20.6 248.5	12,70 **155,12**	26,19 **311,17**	32,54 **381,53**	38,10 **441,49**	44,45 **508,11**	50,01 **564,81**		20	4,78 **60,46**	5,54 **70,00**			**0,258**
22	559,00	6,35 **86,54**	9,53 **129,13**	12,70 **171,09**	9,53 **129,13**	.. ..	22.2 294	12,70 **171,09**	28,58 **373,83**	34,93 **451,42**	41,28 **527,02**	47,63 **600,63**	53,98 **672,26**		22	4,78 **66,57**	5,54 **77,06**			**0,312**
24	610,00	6,35 **94,53**	9,53 **141,12**	14,27 **209,64**	9,53 **141,12**	17,48 **255,41**	24.6 355	12,70 **187,06**	30,96 **442,08**	38,89 **547,71**	46,02 **640,03**	52,37 **720,15**	59,54 **808,22**		24	5,54 **84,16**	6,35 **96,37**			**0,372**
26	660,00	7,92 **127,36**	12,70 **202,72**	.. ..	9,53 **152,87**	.. ..		12,70 **202,72**							26					**0,435**
28	711,00	7,92 **137,32**	12,70 **218,69**	15,88 **271,21**	9,53 **164,85**	.. ..		12,70 **218,69**							28					**0,505**
30	762,00	7,92 **147,28**	12,70 **234,67**	15,88 **292,18**	9,53 **176,84**	.. ..		12,70 **234,67**							30					**0,580**
32	813,00	7,92 **157,24**	12,70 **250,64**	15,88 **312,15**	9,53 **188,82**	17,48 **342,91**		12,70 **250,64**							32					**0,660**
34	864,00	7,92 **167,20**	12,70 **266,61**	15,88 **332,12**	9,53 **200,31**	17,48 **364,90**		12,70 **266,61**							34					**0,746**
36	914,00	7,92 **176,96**	12,70 **282,27**	15,88 **351,70**	9,53 **212,56**	19,05 **420,42**		12,70 **282,27**							36					**0,835**
38	965,00				9,53 **224,54**			12,70 **298,24**							38					**0,931**
40	1016,00				9,53 **236,53**			12,70 **314,22**							40					**1,032**
42	1067,00				9,53 **248,52**			12,70 **330,19**							42					**1,138**
44	1118,00				9,53 **260,50**			12,70 **346,16**							44					**1,249**
46	1168,00				9,53 **272,25**			12,70 **351,82**							46					**1,364**
48	1219,00				9,53 **284,24**			12,70 **377,79**							48					**1,485**

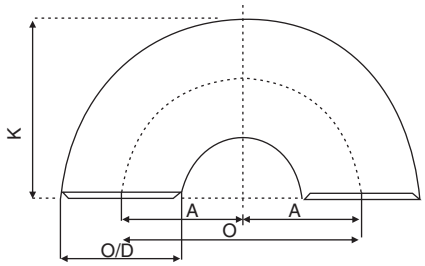
7. BUTT WELD PIPE FITTINGS



90 Deg LR ELBOW



45 Deg. LR ELBOW



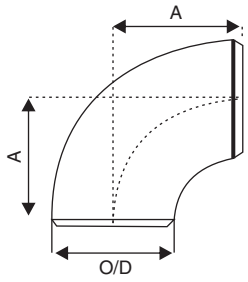
180 Deg. LR Return Bend

AS PER ASME B16.9

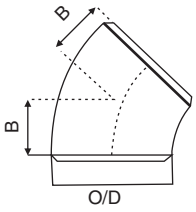
Nominal Pipe Size (NPS)	WALL THICKNESS				Outside Diameter Bevel (O/D)	Dimension A	Dimension B	Center to Center O	Back To Face K
	5S	10S	40S	80S					
½”	1.66	2.11	2.77	3.73	21.3	38.0	16	76	48
3/4”	1.65	2.11	2.87	3.91	26.7	38.0	19	76	51
1”	1.65	2.77	3.38	4.55	33.4	38.0	22	76	56
1.1/4”	1.65	2.77	3.56	4.85	42.2	48.0	25	95	70
1.1/2”	1.65	2.77	3.68	5.08	48.3	57.0	29	114	83
2”	1.65	2.77	3.91	5.54	60.3	76.0	35	152	106
2.1/2”	2.11	3.05	5.16	7.01	73.0	95.0	44	190	132
3”	2.11	3.05	5.49	7.62	88.9	114.0	51	229	159
3.1/2”	2.11	3.05	5.74	8.08	101.6	133.0	57	267	184
4”	2.11	3.05	6.02	8.56	114.3	152.0	64	305	210
5”	2.77	3.40	6.55	9.52	141.3	190.0	79	381	262
6”	2.77	3.40	7.11	10.97	168.3	229.0	95	457	313
8”	2.77	3.76	8.18	12.7	219.1	305.0	127	610	414
10”	3.40	4.19	9.27	15.7	273.0	381.0	159	762	518
12”	3.96	4.57	9.52	17.45	323.8	457.0	190	914	619
14”	3.96	4.78	11.13	15.0	355.6	533.0	222	1067	711
16”	4.19	4.78	12.7	21.45	406.4	610.0	254	1219	813
18”	4.19	4.78	14.27	23.80	457.0	686.0	286	1372	914
20”	4.78	5.54	15.09	26.19	508.0	762.0	318	1524	1016
22”	4.78	6.35	15.88	28.57	559.0	838.0	343	1676	1118
24”	5.54	6.35	17.48	30.94	610.0	914.0	381	1829	1219
26”					660.0	991.0	406	.....	.....
28”					711.0	1067.0	438	.....	.....
30”					762.0	1143.0	470	.....	.....
32”					813.0	1219.0	502	.....	.....
34”					864.0	1295.0	533	.....	.....
..... 36”					914.0	1372.0	565	.....	

NOTE - ALL DIMENSIONS ARE IN MM.

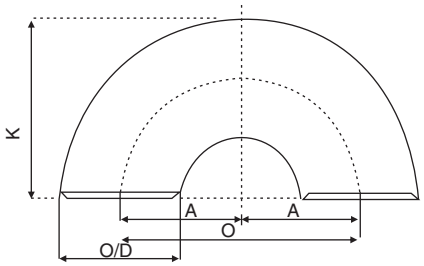
BUTT WELD PIPE FITTINGS



90 Deg SR ELBOW



45 Deg. SR ELBOW



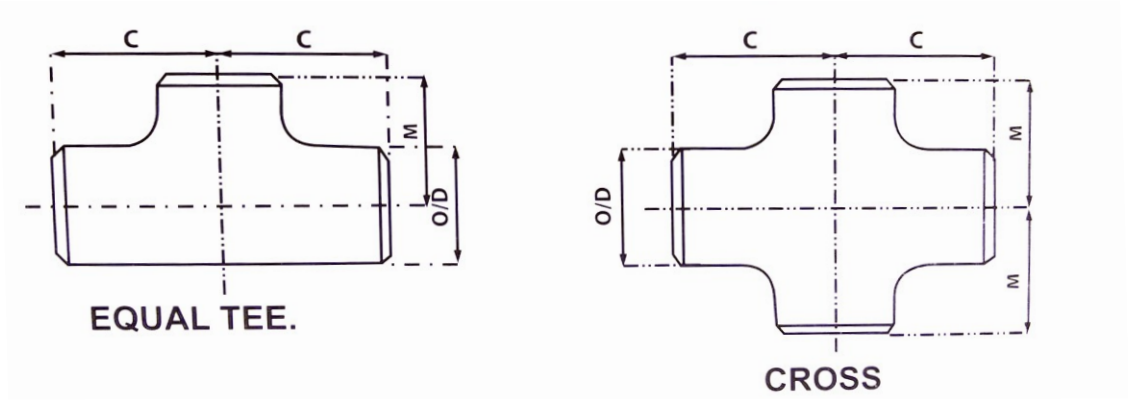
180 Deg. SR Return Bend

AS PER ASME B16.28

Nominal Pipe Size (NPS)	WALL THICKNESS				Outside Diameter Bevel (O/D)	Dimension A	Dimension B	Center to Center O	Back To Face K
	5S	10S	40S	80S					
½”	1.66	2.11	2.77	3.73	21.3				
3/4”	1.65	2.11	2.87	3.91	26.7				
1”	1.65	2.77	3.38	4.55	33.4	25		51	41
1.1/4”	1.65	2.77	3.56	4.85	42.2	32		64	52
1.1/2”	1.65	2.77	3.68	5.08	48.3	38		76	62
2”	1.65	2.77	3.91	5.54	60.3	51		102	81
2.1/2”	2.11	3.05	5.16	7.01	73.0	64		127	100
3”	2.11	3.05	5.49	7.62	88.9	76	31.6	152	121
3.1/2”	2.11	3.05	5.74	8.08	101.6	89	36.8	178	140
4”	2.11	3.05	6.02	8.56	114.3	102	42.1	203	159
5”	2.77	3.40	6.55	9.52	141.3	127	52.6	254	197
6”	2.77	3.40	7.11	10.97	168.3	152	63.4	305	237
8”	2.77	3.76	8.18	12.7	219.1	203	84.2	406	313
10”	3.40	4.19	9.27	12.7	273.0	254	105.2	508	391
12”	3.96	4.57	9.52	17.45	323.8	305	126.3	610	467
14”	3.96	4.78	11.13	15.0	355.6	356	147.3	711	533
16”	4.19	4.78	12.7	21.45	406.4	406	168.3	813	610
18”	4.19	4.78	14.27	23.80	457.0	457	189.4	914	686
20”	4.78	5.54	15.09	26.19	508.0	508	210.4	1016	762
22”	4.78	6.35	15.88	28.57	559.0	559	231.5	1118	838
24”	5.54	6.35	17.48	30.94	610.0	610	252.5	1219	914

NOTE - ALL DIMENSIONS ARE IN MM.

BUTT WELD PIPE FITTINGS

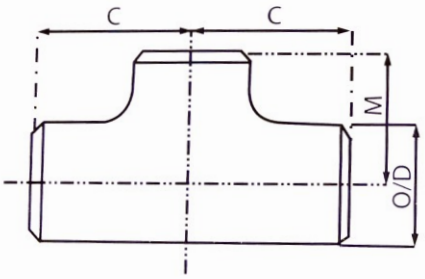


AS PER ASME B16.9

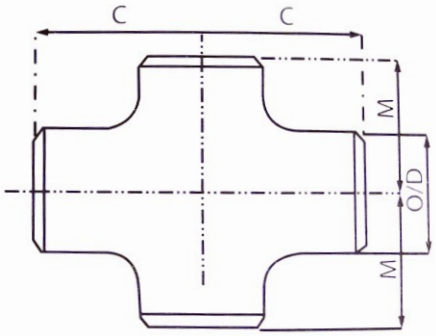
Nominal Pipe Size (NPS)	WALL THICKNESS				Outside Diameter Bevel (O/D)	Run 'C'	Outlet 'M'
	5S	10S	40S	80S			
½"	1.66	2.11	2.77	3.73	21.3	25	25
3/4"	1.65	2.11	2.87	3.91	26.7	29	29
1"	1.65	2.77	3.38	4.55	33.4	38	38
1.1/4"	1.65	2.77	3.56	4.85	42.2	48	48
1.1/2"	1.65	2.77	3.68	5.08	48.3	57	57
2"	1.65	2.77	3.91	5.54	60.3	64	64
2.1/2"	2.11	3.05	5.16	7.01	73.0	76	76
3"	2.11	3.05	5.49	7.62	88.9	86	86
3.1/2"	2.11	3.05	5.74	8.08	101.6	95	95
4"	2.11	3.05	6.02	8.56	114.3	105	105
5"	2.77	3.40	6.55	9.52	141.3	124	124
6"	2.77	3.40	7.11	10.97	168.3	143	143
8"	2.77	3.76	8.18	12.7	219.1	178	178
10"	3.40	4.19	9.27	15.7	273.0	216	216
12"	3.96	4.57	9.52	17.45	323.8	254	254
14"	3.96	4.78	11.13	15.0	355.6	279	279
16"	4.19	4.78	12.7	21.45	406.4	305	305
18"	4.19	4.78	14.27	23.80	457.0	343	343
20"	4.78	5.54	15.09	26.19	508.0	381	381
22"	4.78	6.35	15.88	28.57	559.0	419	419
24"	5.54	6.35	17.48	30.94	610.0	432	432
26"					660.0	495	495
28"					711.0	521	521
30"					762.0	559	559
32"					813.0	597	597
34"					864.0	635	635
36"					914.0	673	673

NOTE - ALL DIMENSIONS ARE IN MM.

BUTT WELD PIPE FITTINGS



UNEQUAL TEE.

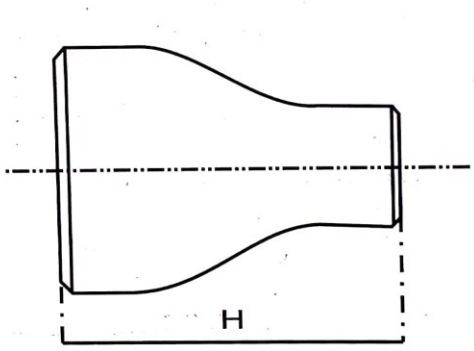


CROSS UNEQUAL

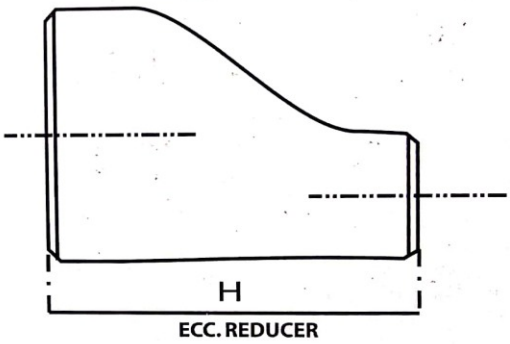
AS PER ASME B16.9

Nominal Pipe Size (NPS)	Outside Diameter at Bevel (O / D)		Center - to - Center		Nominal Pipe Size (NPS)	Outside Diameter at Bevel (O / D)		Center - to - Center	
	Run	Outlet	Run 'C'	Outlet 'M'		Run	Outlet	Run 'C'	Outlet 'M'
1/2" x 3/8"	21.3	17.3	25	25	10" x 8"	273.0	219.1	216	203
½" x 1/4"	21.3	13.7	25	25	10" x 6"	273.0	168.3	216	194
					10"x 5"	273.0	141.3	216	191
3/4" x 1/2"	26.7	21.3	29	29	10" x 4"	273.0	114.3	216	184
3/4" x 3/8"	26.7	17.3	29	29					
					12" x 10"	323.8	273.0	254	241
1" x 3/4"	33.4	26.7	38	38	12" x 8"	323.8	219.1	254	229
1" x ½"	33.4	21.3	38	38	12" x 6"	323.8	168.3	254	219
					12" x 5"	323.8	141.3	254	216
1.1/4" x 1"	42.2	33.4	48	48					
1.1/4" x 3/4"	42.2	26.7	48	48	14" x 12"	355.6	323.8	279	270
1.1/4" x 1/2"	42.2	21.3	48	48	14" x 10"	355.6	273.0	279	257
					14" x 8"	355.6	219.1	279	248
1.1/2" x 1.1/4"	48.3	42.2	57	57	14" x 6"	355.6	168.3	279	238
1.1/2" x 1"	48.3	33.4	57	57					
1.1/2" x 3/4"	48.3	26.7	57	57	16" x 14"	406.4	355.6	305	305
1.1/2" x 1/2"	48.3	21.3	57	57	16" x 12"	406.4	323.8	305	295
					16" x 10"	406.4	273.0	305	283
2" x 1.1/2"	60.3	48.3	64	60	16" x 8"	406.4	291.1	305	273
2" x 1.1/4"	60.3	42.2	64	57	16" x 6"	406.4	168.3	305	264
2" x 1"	60.3	33.4	64	51					
2" x 3/4"	60.3	26.7	64	44	18" x 16"	457.0	406.4	343	330
					18" x 14"	457.0	355.6	343	330
2.1/2" x 2"	73.0	60.3	76	70	18" x 12"	457.0	323.8	343	321
2.1/2" x 1.1/2"	73.0	48.3	76	67	18" x 10"	457.0	273.0	343	308
2.1/2" x 1.1/4"	73.0	42.2	76	64	18" x 8"	457.0	219.1	343	298
2.1/2" x 1"	73.0	33.4		57					
					20" x 18"	508.0	457.0	381	368
3" x 2.1/2"	88.9	73.0	86	83	20" x 16"	508.0	406.4	381	356
3"x 2"	88.9	60.3	86	76	20" x 14"	508.0	355.6	381	356
3" x 1.1/2"	88.9	48.3	86	73	20" x 12"	508.0	323.8	381	346
3" x 1.1/4"	88.9	42.2	86	70	20" x 10"	508.0	273.0	381	333
					20" x 8"	508.0	219.1	381	324
3.1/2" x 3"	101.6	88.9	95	92					
3.1/2" x 2.1/2"	101.6	73.0	95	89	22" x 20"	559.0	508.0	419	406
3.1/2" x 2"	101.6	60.3	95	83	22" x 18"	559.0	457.0	419	394
3.1/2" x 1.1/2"	101.6	48.3	95	79	22" x 16"	559.0	406.4	419	381
					22" x 14"	559.0	355.6	419	381
4"x 3.1/2"	114.3	101.6	105	102	22" x 12"	559.0	323.8	419	371
4" x 3"	114.3	88.9	105	98	22" x 10"	559.0	273.0	419	359
4" x 2.1/2"	114.3	73.0	105	95					
4" x 2"	114.3	60.3	105	89	24" x 22"	610.0	559.0	432	432
4" x 1.1/2"	114.3	48.3	105	86	24" x 20"	610.0	508.0	432	432
					24" x 18"	610.0	457.0	432	419
5" x 4"	141.3	114.3	124	117	24" x 16"	610.0	406.4	432	406
5" x 3.1/2"	141.3	101.6	124	114	24" x 14"	610.0	355.6	432	406
5" x 3"	141.3	88.9	124	111	24" x 12"	610.0	323.8	432	397
5" x 2.1/2"	141.3	73.0	124	108	24" x 10"	610.0	273.0	432	384
5" x 2"	141.3	60.3	124	105					
					26" x 24"	660.0	610.0	495	483
6" x 5"	168.3	141.3	143	137	26" x 22"	660.0	559.0	495	470
6" x 4"	168.3	114.3	143	130	26" x 20"	660.0	508.0	495	457
6" x 3.1/2"	168.3	101.6	143	127	26" x 18"	660.0	457.0	495	444
6" x 3"	168.3	88.9	143		26" x 16"	660.0	406.4	495	432
6" x 2.1/2"	168.3	73.0	143	121	26" x 14"	660.0	355.6	495	432
					26" x 12"	660.0	323.8	495	422
8" x 6"	219.1	168.3	178	168					
8" x 5"	219.1	141.3	178	162	28" x 26"	711.0	660.0	521	521
8" x 4"	219.1	114.3	178	156	28" x 24"	711.0	610.0	521	508
8" x 3.1/2"	219.1	101.6	178	152	28" x 22"	711.0	559.0	521	495
					28" x 20"	711.0	508.0	521	483

BUTT WELD PIPE FITTINGS



CONC. REDUCER



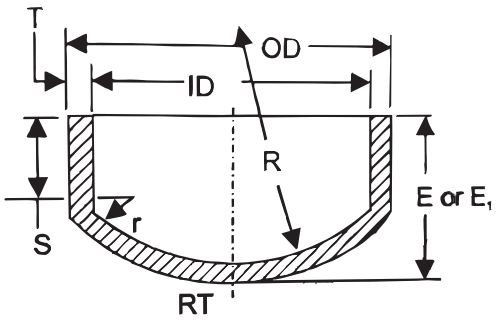
ECC. REDUCER

AS PER ASME B16.9

Nominal Pipe Size (NPS)	Outside Diameter at Bevel (O / D)		End-to-End	Nominal Pipe Size (NPS)	Outside Diameter at Bevel (O / D)		End-to-End
	Run	Outlet	H		Run	Outlet	H
3/4" X 1/2"	26.7	21.3	38	12" X 10"	323.8	273.0	203
3/4" X 3/8"	26.7	17.3	38	12" X 8"	323.8	219.1	203
1" X 3/4"	33.4	26.7	51	12" X 6"	323.8	168.3	203
1" X 1/2"	33.4	21.3	51	12" X 5"	323.8	141.3	203
1.1/4" X 1"	42.2	33.4	51	14" X 12"	355.6	323.8	330
1.1/4" X 3/4"	42.2	26.7	51	14" X 10"	355.6	273.0	330
1.1/4" X 1/2"	42.2	21.3	51	14" X 8"	355.6	219.1	330
1.1/2" X 1.1/4"	48.3	42.2	64	14" X 6"	355.6	168.3	330
1.1/2" X 1"	48.3	33.4	64	16" X 14"	406.4	355.6	356
1.1/2" X 3/4"	48.3	26.7	64	16" X 12"	406.4	323.8	356
1.1/2" X 1/2"	46.3	21.3	64	16" X 10"	406.4	273.0	356
2" X 1.1/2"	60.3	48.3	76	16" X 8"	406.4	219.1	356
2" X 1.1/4"	60.3	42.2	76	18" X 16"	457.0	406.4	381
2" X 1"	60.3	33.4	76	18" X 14"	457.0	356.6	381
2" X 3/4"	60.3	26.7	76	18" X 12"	457.0	323.8	381
2.1/2" X 2"	73	60.3	89	18" X 10"	457.0	273.0	381
2.1/2" X 1.1/2"	73	48.3	89	20" X 18"	508.0	457.0	508
2.1/2" X 1.1/4"	73	42.2	89	20" X 16"	508.0	406.4	508
2.1/2" X 1"	73	33.4	89	20" X 14"	508.0	355.6	508
3" X 2.1/2"	88.9	73.0	89	20" X 12"	508.0	323.8	508
3" X 2"	88.9	60.3	89	22" X 20"	559.0	508.0	508
3" X 1.1/2"	88.9	48.3	89	22" X 18"	559.0	457.0	508
3" X 1.1/4"	88.9	42.2	89	22" X 16"	559.0	406.4	508
3.1/2" X 3"	101.6	88.9	102	22" X 14"	559.0	355.6	508
3.1/2" X 2.1/2"	101.6	73.0	102	24" X 22"	610.0	559.0	508
3.1/2" X 2"	101.6	60.3	102	24" X 20"	610.0	508.0	508
3.1/2" X 1.1/2"	101.6	48.3	102	24" X 18"	610.0	457.0	508
4" X 3.1/2"	114.3	101.6	102	24" X 16"	610.0	406.4	508
4" X 3"	114.3	88.9	102	26" X 24"	660.0	610.0	610
4" X 2.1/2"	114.3	73.0	102	26" X 22"	660.0	559.0	610
4" X 2"	114.3	60.3	102	26" X 20"	660.0	508.0	610
4" X 1.1/2"	114.3	48.3	102	26" X 18"	660.0	457.0	610
5" X 4"	141.3	114.3	127	28" X 26"	711.0	660.0	610
5" X 3.1/2"	141.3	101.6	127	28" X 24"	711.0	610.0	610
5" X 3"	141.3	88.9	127	28" X 20"	711.0	508.0	610
5" X 2.1/2"	141.3	73.0	127	28" X 18"	711.0	457.0	610
5" X 2"	141.3	60.3	127	30" X 28"	762.0	711.0	610
6" X 5"	168.3	141.3	140	30" X 26"	762.0	660.0	610
6" X 4"	168.3	114.3	140	30" X 24"	762.0	610.0	610
6" X 3.1/2"	168.3	101.6	140	30" X 20"	762.0	508.0	610
6" X 3"	168.3	88.9	140	32" X 30"	813.0	762.0	610
6" X 2.1/2"	168.3	73.0	140	32" X 28"	813.0	711.0	610
8" X 6"	219.1	168.3	152	32" X 26"	813.0	660.0	610
8" X 5"	219.1	141.3	152	32" X 24"	813.0	610.0	610
8" X 4"	219.1	114.3	152	34" X 32"	864.0	813.0	610
8" X 3.1/2"	219.1	101.6	152	34" X 30"	864.0	762.0	610
10" X 8"	273	219.1	178	34" X 26"	864.0	660.0	610
10" X 6"	273	168.3	178	34" X 24"	864.0	610.0	610
10" X 5"	273	141.3	178				
10" X 4"	273	114.3	178				

BUTT WELD PIPE FITTINGS

CAPS



AS PER ASME B16.9

Nominal Pipe Size (NPS)	Outside Diameter at Bevel	Lenght E [Note (1)]	Limiting Wall Thickess for Lenght E	Lenght E [Note (2)]	Tangent S	Dish radius R	Knuckle radius r
½	21.3	25	4.57	25	18.8	13.72	2.54
3/4	26.7	25	3.81	25	23.62	18.29	3.56
1	33.4	38	4.57	38	27.94	23.37	4.32
1 1/4	42.2	38	4.83	38	25.91	34.29	5.84
1 1/2	48.3	38	5.08	38	24.13	35.81	6.86
2	60.3	38	5.59	44	21.08	45.97	8.64
2 1/2	73	38	7.11	51	17.27	54.61	10.41
3	88.9	51	7.62	64	25.91	68.33	12.95
3 1/2	101.6	64	8.13	76	35.31	78.99	14.99
4	114.3	64	8.64	76	32	89.41	17.02
5	141.3	76	9.65	89	37.59	112.27	21.34
6	168.3	89	10.92	102	43.18	134.87	25.65
8	219.1	102	12.7	127	42.67	177.29	33.78
10	273	127	12.7	152	54.1	222.76	42.42
12	323.8	152	12.7	178	66.55	266.7	50.8
14	355.6	165	12.7	191	71.37	294.64	56.13
16	406.4	178	12.7	203	71.37	338.84	64.52
18	457	203	12.7	229	84.07	383.03	73.15
20	508	229	12.7	254	96.77	427.74	81.53
22	559	254	12.7	254	109.47	472.44	89.92
24	610	267	12.7	305	109.47	516.89	98.55
26	660	267	.....	.....	96.77	561.34	106.93
28	711	267	.....	.....	84.07	605.79	115.32
30	762	267	.....	.....	71.37	650.24	123.95
32	813	267	.....	.....	58.67	694.69	132.33
34	864	267	.....	.....	45.67	739.14	140.72
36	914	267	.....	.....	33.27	783.59	149.35
42	1067	305	.....	.....	33.27	916.94	174.75
44	1118	343	.....	.....	.....	.....	.....
46	1168	343	.....	.....	.....	.....	.....
48	1219	343	.....	.....	.....	.....	.....

GENERAL NOTES :
(a) Dimensions are in millimeters.
(b) The shape of these caps shall be ellipsoidal and shall conform to the requirements as given in the ASME Boiler and Pressure Vessel Code.

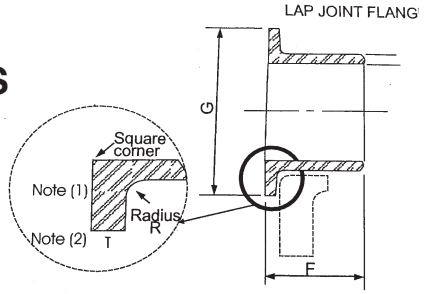
NOTES :
(1) Length E applies for thickness note exceeding that given in column "Limiting Wall Thickness for Length E".
(2) Length E, applies for thickness greater than that given in column "Limiting Wall Thickness" for NPS 24 and smaller.
For NPS 26 and larger, length E, shall be by agreement between the manufacturer and purchaser.

Tolerance Table (in mm)	
NPS	E
½" to 4"	3
5" to 24"	6
26" to 48"	10

* Applicable for ASME B16.9 & MSS SP - 43

BUTT WELD PIPE FITTINGS

LAP JOINT STUB ENDS



AS PER ASME B16.9

Nominal Pipe Size (NPS)	Outside Diameter at Bevel		Long Pattern Length F. [Notes (3), (4)]	Long Pattern Length F. [Notes (3), (4)]	Radius of Fillet, R [Note (5)]	Diameter of Lap, G [Note (6)]
	Max.	Min.				
½	22.8	20.5	76	51	3	35
3/4	28.1	25.9	76	51	3	43
1	35	32.6	102	51	3	51
1 1/4	43.6	41.4	102	51	5	64
1 1/2	49.9	47.5	102	51	6	73
2	62.4	59.5	152	64	8	92
2 1/2	75.3	72.2	152	64	8	105
3	91.3	88.1	152	64	10	127
3 1/2	104.0	100.8	152	76	10	140
4	116.7	113.5	152	76	11	157
5	144.3	140.5	203	76	11	186
6	171.3	167.5	203	89	13	216
8	222.1	218.3	203	102	13	270
10	277.2	272.3	254	127	13	324
12	328.0	323.1	254	152	13	381
14	359.9	354.8	305	152	13	413
16	411.0	405.6	305	152	13	470
18	462.0	456	305	152	13	533
20	514.0	507	305	152	13	584
22	565.0	558	305	152	13	641
24	616.0	609	305	152	13	692

GENERAL NOTES:
(a) All dimensions are in millimeters.
(b) Service conditions and joint construction often dictate stub end length requirements. Therefore, the purchaser must specify long or short pattern fitting when ordering.
NOTES:
1) Gasket face finish shall be in accordance with ASME B16.5 for raised face flanges.
(2) The lap thickness T shall not be less than nominal pipe wall thickness. (Modified spiral or concentric serration)
(3) When short pattern stub ends are used with larger flanges in Classes 300 and 600, and with most sizes in Classes 900 and higher, and when long pattern stub ends are used with larger flanges in Classes 1500 and 2500, it may be necessary to increase the length of the stub ends in order to avoid covering the weld with the flange. Such increases in length shall be a matter of agreement between the manufacturer and purchaser.
(4) When special facings such as tongue and groove, male and female, etc., are employed, additional lap thickness must be provided and such additional thickness shall be in addition to (not included in) the basic length F.
(5) These dimensions conform to the radius established for lap joint flanges in ASME B16.5.
(6) This dimension conforms to standard machined facings shown in ASME B16.5. The back face of the lap shall be machined to conform to the surface on which it seats. Where ring joint facings are to be applied, use dimension K as given in ASME B16.5.

Tolerance Table (in mm)				
NPS	F	G	T	R
½" to 3 ½"	2	+0,-1	+1.6,- 0	+0,-1
4" to 8"	2	+0,-1	+1.6,- 0	+0,-2
10" to 24"	2	+0,-2	+3.2,- 0	+0,-2
26" to 48"	5	-	-	

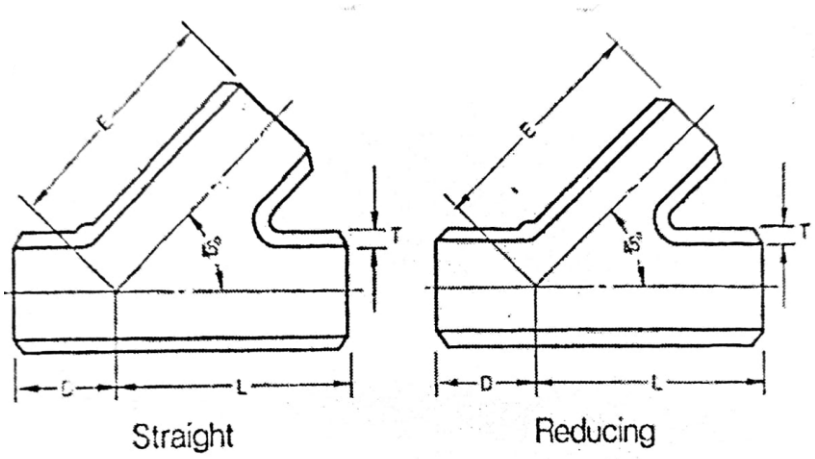
Legend :

T : Thickness of Lap

Applicable for ASME B16.9 & MSS SP - 43

BUTT WELD PIPE FITTINGS

LATERALS (STD, XS)



AS PER ASME B16.9

Nominal Pipe Size of Run	Center-to-End Dimension		STD		XS	
	L & E	D	ID	T	ID	T
1	3 1/2	1 3/4	1.049	0.133	0.957	0.179
1 1/4	4 1/4	2	1.380	0.140	1.278	0.191
1 1/2	5	2 1/2	1.610	0.145	1.500	0.200
2	6	3 1/4	2.067	0.154	1.939	0.218
2 1/2	7	3 1/2	2.469	0.203	2.323	0.276
3	7 1/4	3 3/4	3.068	0.216	2.900	0.300
3 1/2	8 1/8	4	3.548	0.226	3.364	0.318
4	8 1/2	4 1/2	4.026	0.237	3.826	0.337
5	11	4 3/4	5.047	0.258	4.813	0.375
6	12 1/2	5 1/4	6.065	0.280	5.761	0.432
8	15 1/4	6 1/4	7.981	0.322	7.625	0.500
10	18	7	10.020	0.365	9.750	0.500
12	21 1/2	8	12.000	0.375	11.750	0.500
14	25	10	13.250	0.375	13.000	0.500
16	28 1/2	12	15.250	0.375	15.000	0.500
18	32	13	17.250	0.375	17.000	0.500
20	35	14	19.250	0.375	19.000	0.500
24	41 1/4	16 1/4	23.250	0.375	23.000	0.500

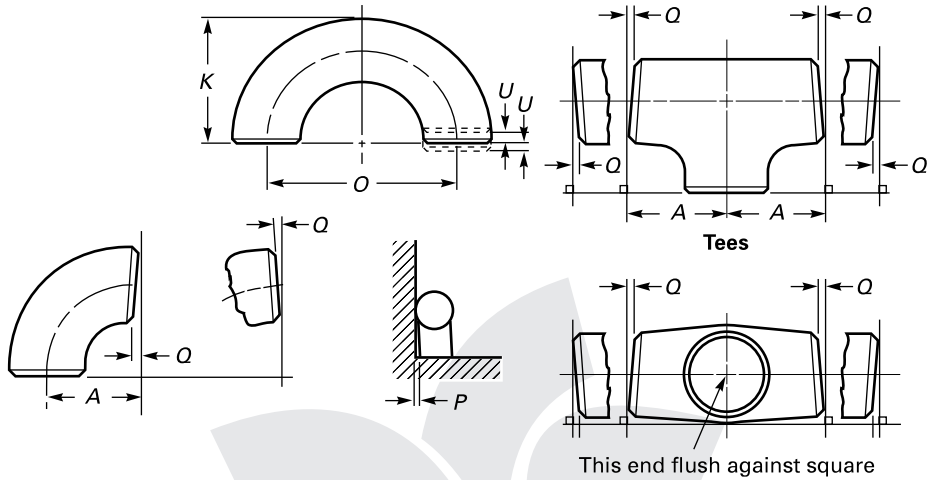
★ Pressure-temperature ratings:Laterals are rated for either 40% of the maximum allowable working pressure for the size and weight schedule of the mating pipe conforming to ASTM A 106/B,or 100% of the maximum allowable working pressure for the size and weight schedule of the mating pipe conforming to ASTM A 106/B. In the latter case, ANSI B31. 10, 1967 is used to calculate reinforcement requirements unless otherwise specified.

★ Wall Thickness Conform to ANSI B 36.10 Specifications

8. IS-1239 PART-II PIPE THICKNESS AND WEIGHT

Nominal Bore		Outside Diameter		Light (A-Class) Thickness Weight		Medium (B-Class) Thickness Weight		Heavy (C-Class) Thickness Weight	
Inch	mm	Inch	mm	mm	kg/mtr	mm	kg/mtr	mm	kg/mtr
1/8"	3 mm	0.406	10.32	1.8	0.361	2		2.65	0.493
1/4"	6 mm	0.532	13.49	1.8	0.517	2.35	0.407	2.9	0.769
3/8"	10 mm	0.872	17.1	1.8	0.674	2.35	0.852	2.9	1.02
1/2"	15 mm	0.844	21.43	2	0.952	2.65	1.122	3.25	1.45
3/4"	20 mm	1.094	27.2	2.35	1.41	2.65	1.58	3.25	1.9
1"	25 mm	1.312	33.8	2.65	2.01	3.25	2.44	4.05	2.97
1.1/4"	32 mm	1.656	42.9	2.65	2.58	3.25	3.14	4.05	3.84
1.1/2"	40 mm	1.906	48.4	2.9	3.25	3.25	3.61	4.05	4.43
2"	50 mm	2.375	60.3	2.9	4.11	3.65	5.1	4.47	6.17
2.1/2"	65 mm	3.004	76.2	3.25	5.84	3.65	6.61	4.47	7.9
3"	80 mm	3.5	88.9	3.25	6.81	4.05	8.47	4.85	10.1
4"	100 mm	4.5	114.3	3.65	9.89	4.5	12.1	5.4	14.4
5"	125 mm	5.5	139.7	..	..	4.85	16.2	5.4	17.8
6"	150 mm	6.5	165.1	..	..	4.85	19.2	5.4	21.2

Table 11-1 Tolerances



All Fittings [Notes (1) and (2)]				Center to End Dimensions, mm (in.)				180-deg Returns		
Nominal Pipe Size (NPS)	DN	Outside Diameter at Bevel, D, mm (in.) [Notes (3) and (4)]	Inside Diameter at End, mm (in.) [Notes (3) and (5)]	90-deg and 45-deg Long and Short Radius Elbows and Tees, A, B, C, M	3D Radius Elbows, *A, B*	Overall Length of Reducers and Lap Joint Stub Ends, *F, H,* mm (in.)	Overall Length of Caps, *E,* mm (in.)	Center-to-Center Dimension, *O,* mm (in.)	Back-to-Face Dimension, *K,* mm (in.)	Alignment of Ends, *U,* mm (in.)
1/2 to 21/2	15 to 65	+1.6, −0.8 (+0.06, −0.03)	0.8 (0.03)	2 (0.06)	3 (0.09)	2 (0.06)	3 (0.12)	6 (0.25	6 (0.25)	1 (0.03)
3 to 31/2	80 to 90	1.6 (0.06)	1.6 (0.06)	2 (0.06)	3 (0.09)	2 (0.06)	3 (0.12)	6 (0.25	6 (0.25)	1 (0.03)
4	100	1.6 (0.06)	1.6 (0.06)	2 (0.06)	3 (0.09)	2 (0.06)	3 (0.12)	6 (0.25	6 (0.25)	1 (0.03)
5 to 8	125 to 200	+2.4, −1.6 (+0.09, −0.06)	1.6 (0.06)	2 (0.06)	3 (0.09)	2 (0.06)	6 (0.25)	6 (0.25	6 (0.25)	1 (0.03)
10 to 18	250 to 450	+4.0, −3.2 (+0.16, −0.12)	3.2 (0.12)	2 (0.09)	3 (0.12)	2 (0.09)	6 (0.25)	10 (0.38)	6 (0.25)	2 (0.06)
20 to 24	500 to 600	+6.4, −4.8 (+0.25, −0.19)	4.8 0.19)	2 (0.09)	3 (0.12)	2 (0.09)	6 (0.25)	10 (0.38)	6 (0.25)	2 (0.06)
26 to 30	650 to 750	+6.4, −4.8 (+0.25, −0.19)	4.8 (0.19)	3 (0.12)	6 (0.25)	5 (0.19)	10 (0.38)	…	…	…
32 to 48	800 to 1200	+6.4, −4.8 (+0.25, −0.19)	4.8 (0.19)	5 (0.19)	6 (0.38)	5 (0.19)	10 (0.38)	…	…	…

Lap Joint Stub Ends [Note (6)]					Angularity Tolerances, mm (in.)			
Nominal Pipe Size (NPS)	DN	Outside Diameter of Lap, *G,* mm (in.)	Fillet Radius of Lap, *R,* mm (in.)	Lap Thickness, mm (in.)	Nominal Pipe Size (NPS)	DN	Off Angle, *Q*	Off Plane, *P*
1/2 to 21/2	15 to 65	+0, −1 (+0, −0.03)	+0, −1 (+0, −0.03)	+1.6, −0 (+0.06, −0)	1/2 to 4	15 to 100	1 (0.03)	2 (0.06)
3 to 31/2	80 to 90	+0, −1 (+0, −0.03)	+0, −1 (+0, −0.03)	+1.6, −0 (+0.06, −0)	5 to 8	125 to 200	2 (0.06)	4 (0.12)
4	100	+0, −1 (+0, −0.03)	+0, −2 (+0, −0.06)	+1.6, −0 (+0.06, −0)	10 to 12	250 to 300	3 (0.09)	5 (0.19)
5 to 8	125 to 200	+0, −1 (+0, −0.03)	+0, −2 (+0, −0.06)	+1.6, −0 (+0.06, −0)	14 to 16	350 to 400	3 (0.09)	6 (0.25)

Table 11-1 Tolerances (Cont'd)

Lap Joint Stub Ends [Note (6)]					Angularity Tolerances, mm (in.)			
Nominal Pipe Size (NPS)	DN	Outside Diameter of Lap, *G*, mm (in.)	Fillet Radius of Lap, *R*, mm (in.)	Lap Thickness, mm (in.)	Nominal Pipe Size (NPS)	DN	Off Angle, *Q*	Off Plane, *P*
10 to 18	250 to 450	+0, −2 (+0, −0.06)	+0, −2 (+0, −0.06)	+3.2, −0 (+0.12, −0)	18 to 24	450 to 600	4 (0.12)	10 (0.38)
20 to 24	500 to 600	+0, −2 (+0, −0.06)	+0, −2 (+0, −0.06)	+3.2, −0 (+0.12, −0)	26 to 30	650 to 750	5 (0.19)	10 (0.38)
26 to 30	650 to 750	…	…	…	32 to 42	800 to 1 050	5 (0.19)	13 (0.50)
32 to 48	800 to 1 200	…	…	…	44 to 48	1100 to 1200	5 (0.19)	19 (0.75)

GENERAL NOTE: Tolerances are equal plus and minus except as noted.

NOTES:
(1) The inside diameter and the nominal wall thicknesses at ends are to be specified by the purchaser.
(2) A minimum wall thickness of 87.5% applies unless the purchaser specifies a different wall thickness tolerance.
(3) Out-of-round is the sum of absolute values of plus and minus tolerances.
(4) This tolerance may not apply in localized areas of formed fittings where increased wall thickness is required to meet design requirements.
(5) Unless otherwise specified by the purchaser, these tolerances apply to the nominal inside diameter, which equals the difference between the nominal outside diameter and twice the nominal wall thickness.
(6) See Table on page 16 for limiting dimensions of outside diameter of barrel.

Bevelled ends for all fittings as per ASME B 16.9 & IBR

Wall Thickness	Weld Contour
<x	Ends cut square or manufacturers option
x to 22mm	Fig I
>22mm	Fig II

x> 5mm for carbon/ ferritic alloy steel & x=3 for austentic stainless steel

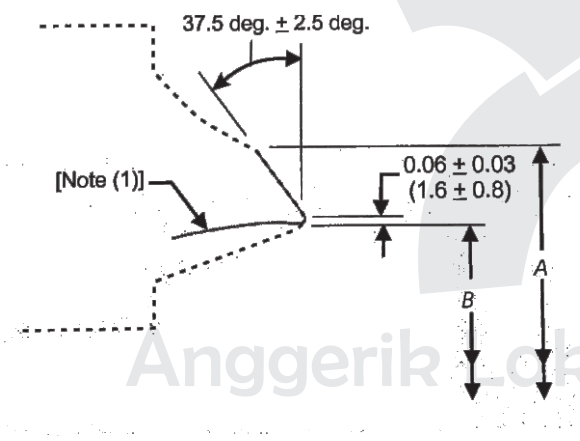
Bevelled ends for all fittings as per MSS SP – 43

Wall Thickness	Weld Contour
< 3mm	Ends cut square
>3mm	Fig I

Bevelled ends for all fittings as per EIL Specification. Contour of bevel shall be as follows:

Material	Wall Thickness	Weld Contour	B16.25
Carbon Steel (Except	Upto 22 mm	Figure I	Figure 2 Type A
Low Temp. Carbon Steel)	> 22 mm	Figure II	Figure 3 Type A
Alloy Steel,	Upto 10 mm	Figure III	Figure 4
Stainless Steel &	.10mm & Upto 25mm	Figure IV	Figure 5 Type A
Low Temp. Carbon Steel	> 25 mm	Figure V	Figure 6 Type A

FIG. I WELD BEVELS FOR WALL THICKNESS NOT OVER 0.88in.

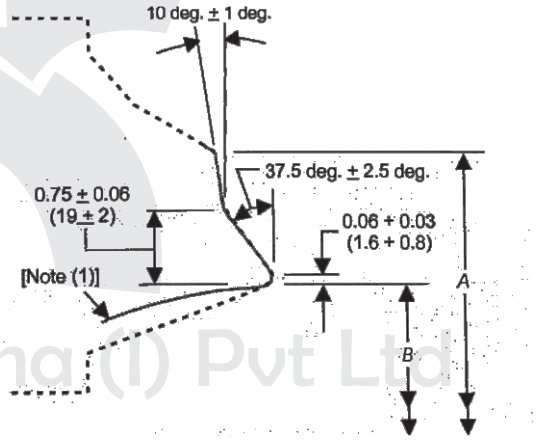


Welding End Detail for Joint Without Backing Ring

GENERAL NOTES:
1.Broken lines denote maximum envelope for transitions from welding bevel and root face into body of component.
2.Purchase order must specify contour of any backing ring to be used.
3.Linear dimensions are in inches with metric values (mm) in parentheses.

NOTES:
1.Internal surface may be as formed or machined for dimension B at root face.
2.Intersections should be slightly rounded.

FIG. II WELD BEVEL DETAILS FOR WALL THICKNESS OVER 0.88in.

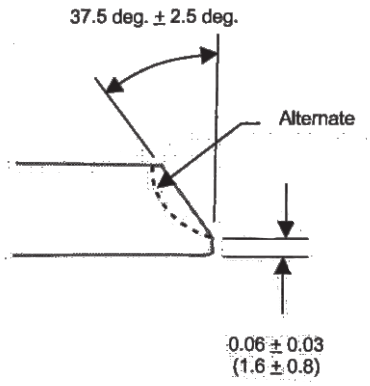


Welding End Detail for Joint Without Backing Ring

GENERAL NOTES:
1.Broken lines denote maximum envelope for transitions from welding groove and root face into body of component.
2.Purchase order must specify contour of any backing ring to be used.
3.Linear dimensions are in inches with metric values (mm) in parentheses.

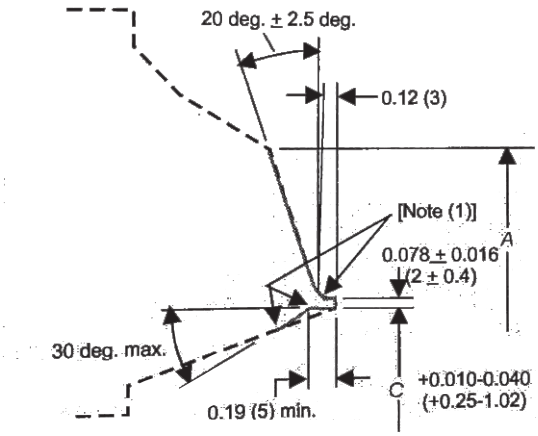
NOTES:
1.Internal surface may be as formed or machined for dimension B at root face.
2.Intersections should be slightly rounded.

FIG III WELD BEVEL DETAILS FOR GTAW ROOT PASS
(Wall Thickness Over 0.12 to 0.38., Inclusive)



GENERAL NOTES:
(a) This detail applies for gas tungsten arc welding (GTAW) of the root pass where nominal wall thickness is over 0.12 in. (3 mm) to 0.38 in. (10 mm), inclusive.
(b) Linear dimensions are in inches with metric values (mm) in parentheses.

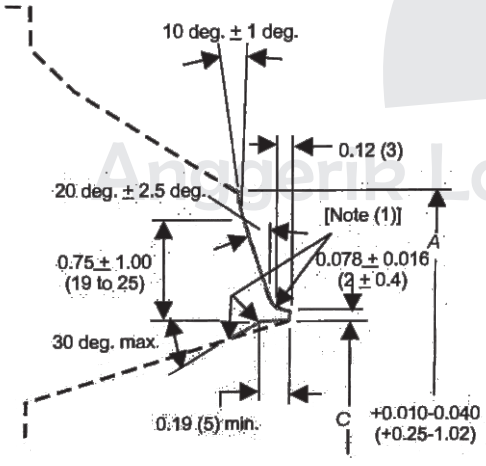
FIG IV WELD BEVEL DETAILS FOR GTAW ROOT PASS
(Wall Thickness Over 0.38 to 1 in., Inclusive)



GENERAL NOTES:
(a) This detail applies for gas tungsten arc welding (GTAW) of the root pass where nominal wall thickness is over 0.38 in. (10 mm) to 1 in. (25 mm), inclusive.
(b) Broken lines denote maximum envelope for transitions from welding groove and land into body of component.
(c) Linear dimensions are in inches with metric values (mm) in parentheses.

NOTE:
(1) Inside corners should be slightly rounded.

FIG V WELD BEVEL DETAILS FOR GTAW ROOT PASS
(Wall Thickness 1 in.)



GENERAL NOTES:
(a) This detail applies for gas tungsten arc welding (GTAW) of the root pass where nominal wall thickness is greater than 1 in. (25mm).
(b) Broken lines denote maximum envelope for transitions from Welding groove and land into body of component.
(c) Linear dimensions are in inches with metric values (mm) in parentheses.

NOTE:
(1) Inside corners should be slightly rounded.

BEVEL END TOLERANCES

Dimensions A, B, OD & ID at welding ends shall be as per the specification.

Larger diameter : Tolerances of +0.25mm to the average diameter.

Wall thickness : Max. thickness, t max, at the end of the component is:
a) Greater of t min + 4mm or 1.15 t min when ordered on a minimum wall basis
b) Greater of t min + 4mm or 1.10 t nom when ordered on a nominal wall basis

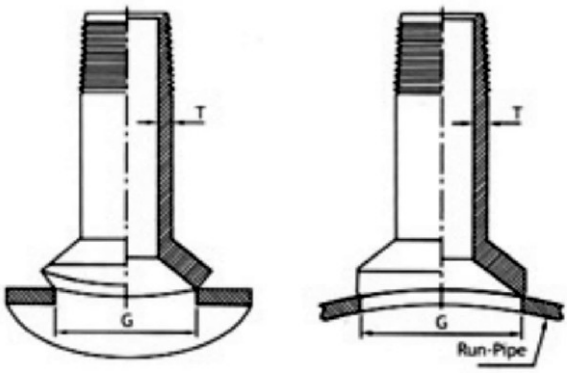
Min.thk. : As per Specification

9. FORGED STEEL OUTLET FITTINGS:
9.1 NIPPOLETS

3000#

(In millimeters)

Run-Pipe Size	Outlet Size	Wall-T	G	Unit Weight (Kg)
36 - 3/4	½	7.3	23.9	0.36
36 - 1	3/4	7.9	30.2	0.56
36 - 1 1/4	1	8.9	36.6	0.84
36 - 1 1/2	1 1/4	9.7	44.5	1.22
36 - 2	1 1/2	10.2	50.8	2.00
36 - 2 1/2	2	11.2	65.0	3.12

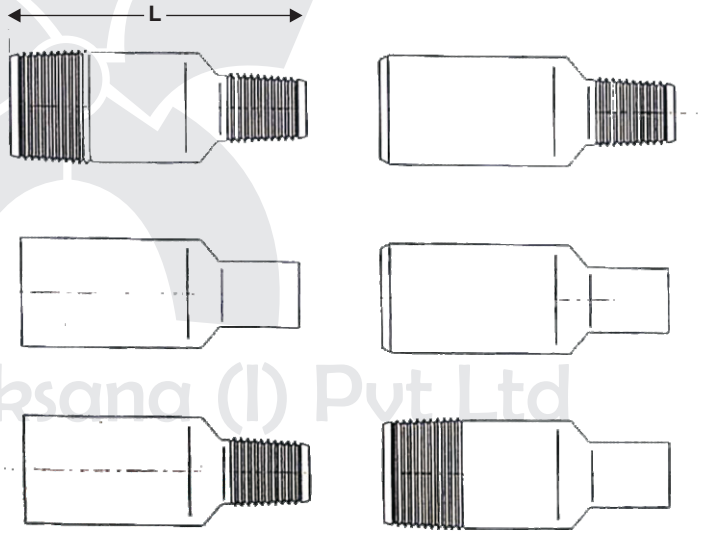


MSS SP- 97

SWAGED NIPPOLETS

(In millimeters)

Large end Size	Small and Size	Length-L
1/2	3/8-1/8	70
3/4	1/2-1/8	76
1	3/4-1/8	89
1 1/4	1-1/8	102
1 1/2	1 1/4-1/8	114
2	1 1/2-1/8	165
2 1/2	2-1/8	178
3	2 1/2-1/8	203
3 1/2	3-1/8	203
4	3 1/2-1/8	229

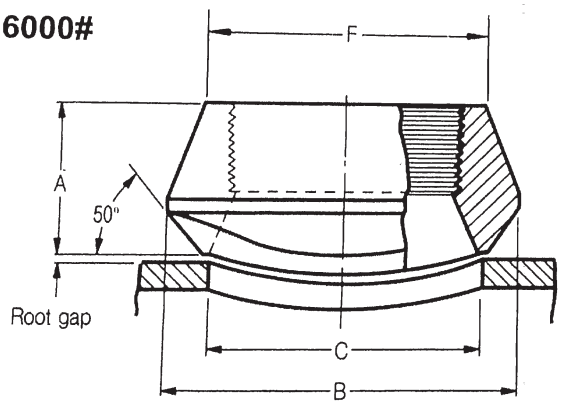


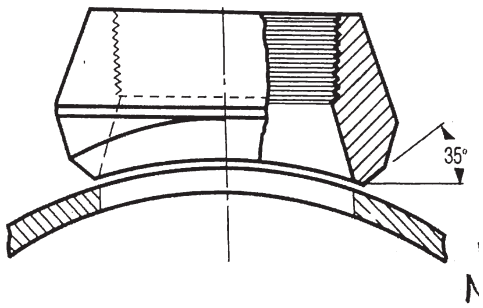
MSS SP - 95

TBE Threaded Both end
PBE Plain both end
PLE/TSE Plain large end - Threaded small end
BLE/TSE Beveled large end - Threaded small end
BLE/PSE Beveled Large end - Plain small end
TLE/PSE Threaded large end - Plain small end

9.2 SOCKOLETS

3000#, 6000#



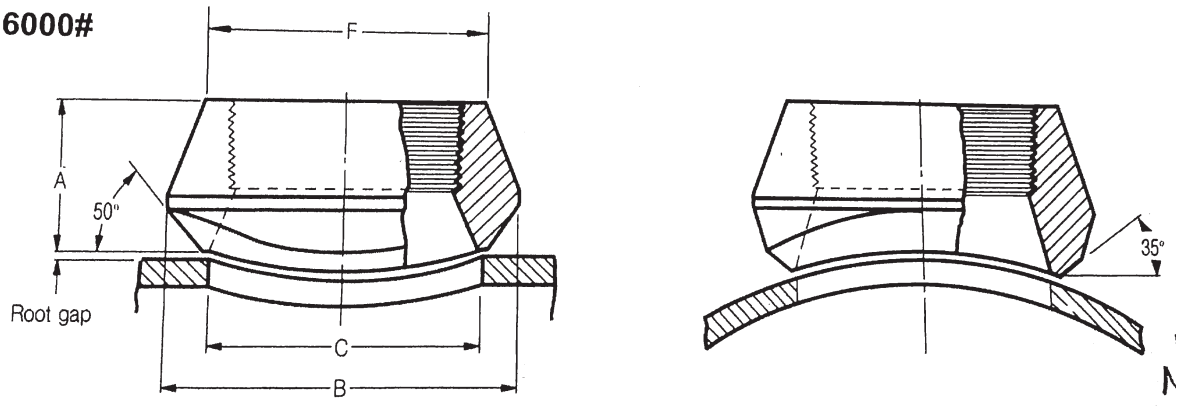


Outlet Size	A		B		C	
	3000#	6000#	3000#	6000#	3000#	6000#
1/2	25.4	31.8	34.9	44.5	23.8	19.1
3/4	27.0	36.5	44.5	50.8	30.2	25.4
1	33.3	39.7	54.0	61.9	36.5	33.3
1 1/4	33.3	41.3	65.1	69.9	44.5	38.1
1 1/2	34.9	42.9	73.0	82.6	50.8	49.2
2	38.1	52 .4	88.9	103.2	65.1	69.9
2 1/2	46.0	-	103.2	-	76.2	-
3	50.8	-	122.2	-	93.7	-
4	57.2	-	152.4	-	120.7	-

Applicable Run Sizes are From out-Let to 36
For the 3000# and 6000# Sockolets and Threadolets, Inside Bore, Thread, Socket Bore and Socket depth Dimensions are According to ANSI B16.11
Pipe Schedule Numbers and Weight Designation are in Accordance With ANSI B36.10
When Ordering Sockolets snd Threadolets, Include the Quantity, Run and Out-let Size, Item and Rating (or Schedule Number) and Material

9.3 THREADOLETS

3000#, 6000#

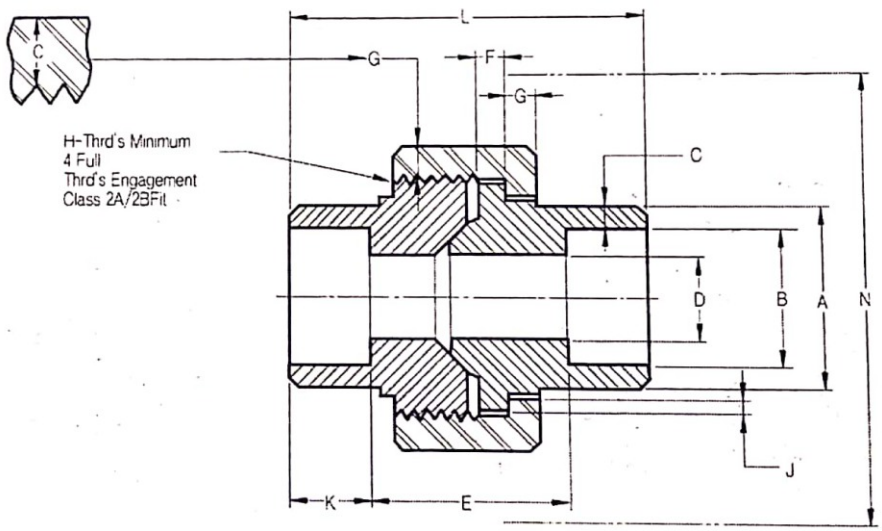


Outlet Size	A		B		C	
	3000#	6000#	3000#	6000#	3000#	6000#
1/2	25.4	31.8	34.9	44.5	23.8	19.1
3/4	27.0	36.5	44.5	50.8	30.2	25.4
1	33.3	39.7	54.0	61.9	36.5	33.3
1 1/4	33.3	41.3	65.1	69.9	44.5	38.1
1 1/2	34.9	42.9	73.0	82.6	50.8	49.2
2	38.1	52 .4	88.9	103.2	65.1	69.9
2 1/2	46.0	-	103.2	-	76.2	-
3	50.8	-	122.2	-	93.7	-
4	57.2	-	152.4	-	120.7	-

Applicable Run Sizes are From out-Let to 36
For the 3000# and 6000# Sockolets and Thredolets, Inside Bore, Thread, Socket Bore and Socket depth Dimensions are According to ANSI B16.11
Pipe Schedule Numbers and Weight Designation are in Accordance With ANSI B36.10
When Ordering Sockolets snd Thredolets, Include the Quantity, Run and Out-let Size, Item and Rating (or Schedule Number) and Material

9.4 UNION

3000#

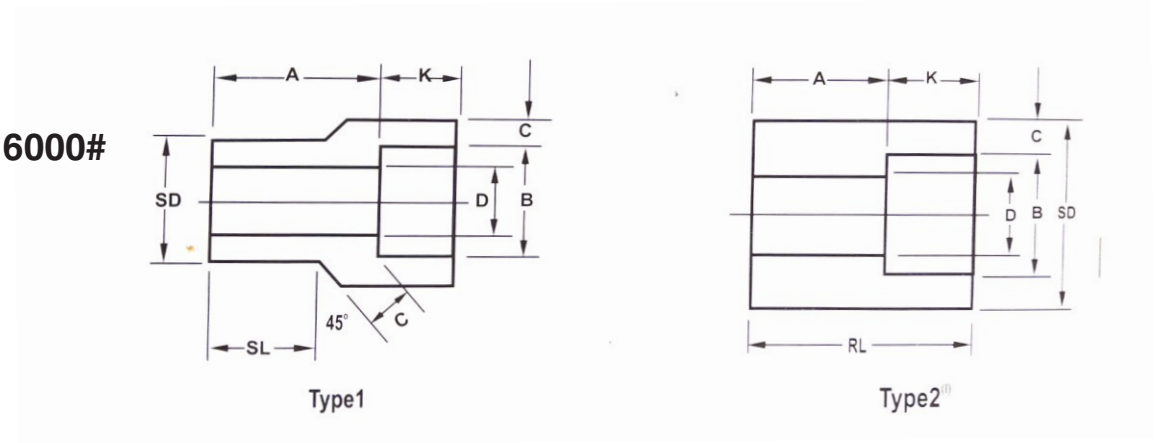


MSS SP-83

Nom. Pipe Size	Pipe End Min	Socket Bore Dia	Socket Wall Min.	Water Way Bore	Laying Length	Male Flange Min.	Nut Min.	Thrds Per 25.4 Max	Bearing Min.	Dept of Socket Min.	Length Assem Nominal	Class Assem Nut
	A	B	C	D	E	F	G	H	J	K	L	N
1/8	21.8	10.92 10.67	3.17	6.83 6.43	22.4 19.0	3.17	3.17	16	1.24	9.6	41.1	49.0
1/4	21.8	14.22 13.97	3.3	9.85 9.45	22.4 19.0	3.17	3.17	16	1.24	9.6	41.4	49.0
3/8	25.9	17.78 17.53	3.48	13.92 13.51	26.9 20.6	3.43	3.43	14	1.37	9.6	46	55.0
1/2	31.2	21.84 21.59	4.06	17.47 17.07	26.9 20.6	3.68	3.68	14	1.50	9.6	49	57.0
3/4	37.1	27.18 26.92	4.27	21.79 21.39	31.8 25.4	4.06	4.06	11	1.68	12.7	56.9	67.0
1	45.5	34.04 33.78	4.95	28.14 27.74	34.3 26.2	4.57	4.44	11	1.85	12.7	62	79.0
1 1/4	54.9	42.67 42.42	5.28	35.76 35.36	40.6 32.5	5.33	5.21	11	2.13	12.7	71.1	94.0
1 1/2	61.5	48.77 48.51	5.54	41.61 41.20	42.2 34.0	5.84	5.59	10	2.31	12.7	76.5	111.0
2	75.2	61.47 61.21	6.05	52.53 52.12	45.5 37.3	6.6	6.35	10	2.69	15.8	86.1	132.0
2 1/2	91.7	74.17 73.66	7.65	64.72 64.13	61.7 52.1	7.49	7.11	8	3.07	15.8	102.4	148.0
3	109.2	90.17 89.66	8.31	77.67 77.27	63.8 53.6	8.25	8.00	8	3.53	15.8	109	175.0

9.5 REDUCER INSERT

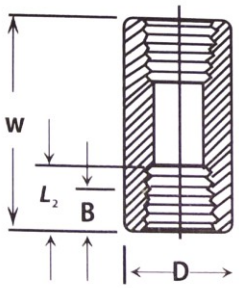
3000#, 6000#



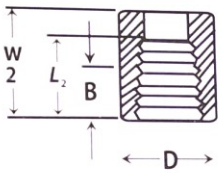
MSS SP-79

Nom. Pipe Size	Type		Socket		Shank Dia SD	Laying Length A		Bore D		Wall Min. C		Length Min			
			Dia B	Depth Min. K								SL		RL	
	3M	6M				3M	6M	3M	6M	3M	6M	3M	6M	3M	3M
3/8 x 1/4	1	1	14.22	9.52	17.14	19.0	20.6	9.14	6.35	3.78	4.6	14.22	15.75		
½ x 3/8	1	1	17.65	9.52	21.34	20.6	22.2	12.45	9.14	4.01	5.03	15.75	17.27		
x 1/4	2	1	14.22	9.52	21.34	15.8	20.6	9.14	6.35	3.78	4.6	17.27	17.27		
3/4 x 1/2	1	1	21.84	9.52	26.67	22.2	25.4	15.75	11.68	4.67	5.97	17.53	19.05		
x 3/8	2	1	17.65	9.52	26.67	15.8	22.2	12.45	9.14	4.01	5.03		19.05	26.92	
x 1/4	2	2	14.22	9.52	26.67	17.5	22.2	9.14	6.35	3.78	4.6			26.92	29.97
1 x 3/4	1	1	27.18	12.7	33.35	23.8	28.5	20.83	15.49	4.9	6.96	19.05	20.57		
x 1/2	2	2	21.84	9.52	33.35	15.8	20.6	15.75	11.68	4.67	5.97		20.57	28.45	
x 3/8	2	2	17.65	9.52	33.35	17.5	22.2	12.45	9.14	4.01	5.03			28.45	33.27
x 1/4	2	2	14.22	9.52	33.35	19.0	23.8	9.14	6.35	3.78	4.6			28.45	33.27
11/4 x 1	1	1	33.86	12.7	42.16	25.4	30.2	26.67	20.57	5.69	7.92	20.57	22.35		
x 3/4	2	2	27.18	12.7	42.16	17.5	20.6	20.88	15.49	4.9	6.96			31.75	34.8
x 1/2	2	2	21.84	9.52	42.16	19.0	22.2	15.75	11.68	4.67	5.97			31.75	34.8
x 3/8	2	2	17.65	9.52	42.16	20.6	23.8	12.45	9.14	4.01	5.03			31.75	34.8
x 1/4	2	2	14.22	9.52	42.16	22.2	25.4	9.14	6.35	3.78	4.6			31.75	34.8
1 1/2 x 1 1/4	1	1	42.67	12.7	48.26	28.5	35.1	35.05	29.46	6.07	7.92	22.22	25.4		
x 1	2	1	33.86	12.7	48.26	17.5	28.5	26.67	20.57	5.69	7.92		25.4	33.27	
x 3/4	2	2	27.18	12.7	48.26	19.0	25.4	20.83	15.49	4.9	6.96			33.27	39.62
x 1/2	2	2	21.84	9.52	48.26	20.6	26.9	15.75	11.68	4.67	5.97			33.27	39.62
x 3/8	2	2	17.65	9.52	48.26	22.2	28.5	12.45	9.14	4.01	5.03			33.27	39.62
x 11/2	1	1	48.77	12.7	60.32	31.7	46.0	40.89	34.04	6.35	8.91	25.4	39.62		
x 11/4	2	2	42.67	12.7	60.32	20.6	23.8	34.92	29.46	6.07	7.92			38.1	45.97
x 1	2	2	33.91	12.7	60.32	22.2	25.4	26.67	20.83	5.69	7.92			38.1	45.97
x 3/4	2	2	27.18	12.7	60.32	23.8	26.9	20.83	15.49	4.9	6.96			38.1	45.97
x ½	2	2	21.84	9.52	60.32	25.4	28.5	15.87	11.68	4.67	5.97			38.1	45.97

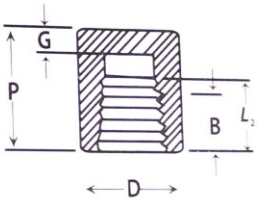
10. FORGED FITTINGS SOCKET-WELD & THREADED ASME B16.11-2011



Coupling



Half-Coupling



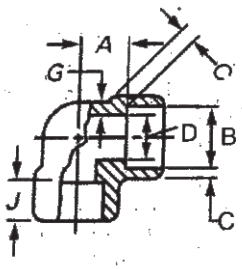
Cap

DN	Nominal Pipe Size	End-to-End Couplings, *W*		End-to-End Cops P		Outside Diameter , D		Min. End Wall Thickness, *G*		Min. Length of Thread [Note(1)]	
		2000 and 6000		3000	6000	3000	6000	3000	6000	*B*	L_2
6	1/8	32		19	…	16	22	4.8	…	6.4	6.7
8	1/4	35		25	27	19	25	4.8	6.4	8.1	10.2
10	3/8	34		25	27	22	32	4.8	6.4	9.1	10.4
15	½	48		32	33	28	38	6.4	7.9	10.9	13.6
20	3/4	51		37	38	35	44	6.4	7.9	12.7	13.9
25	1	60		41	43	44	57	9.7	11.2	14.7	17.3
32	1 1/4	67		44	46	57	64	9.7	11.2	17.0	18.0
40	1 ½	79		44	48	64	76	11.2	12.7	17.8	18.4
50	2	80		48	51	76	92	12.7	15.7	19.0	19.2
65	2 1/2	92		60	64	92	108	15.7	19.0	23.6	28.9
80	3	108		65	68	108	127	19.0	22.4	25.9	30.5
100	4	121		68	75	140	159	22.4	28.4	27.7	33.0

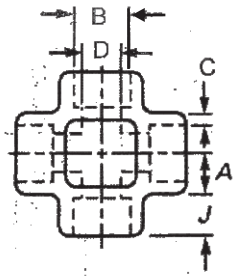
GENERAL NOTE:

a) Dimensions are in millimeters
b) Class 2000 and DN6 Class 6000 couplings, half couplings, and caps are not included in this Standard.

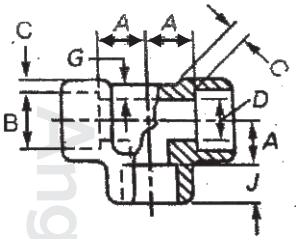
Note:
Dimensions B is minimum length of perfect thread. The length of useful thread (B plus threads with fully formed roots and flat crests) shall not be less than L (effective length of external thread) required by American National Standard for Pipe Threads (ASME B1.20.1). See Para. 6.3.



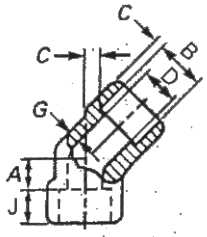
90 deg Elbow



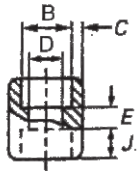
Cross



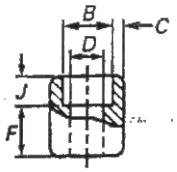
Tee



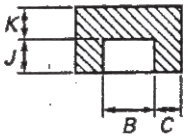
45 deg Elbow



Coupling



Half-Coupling

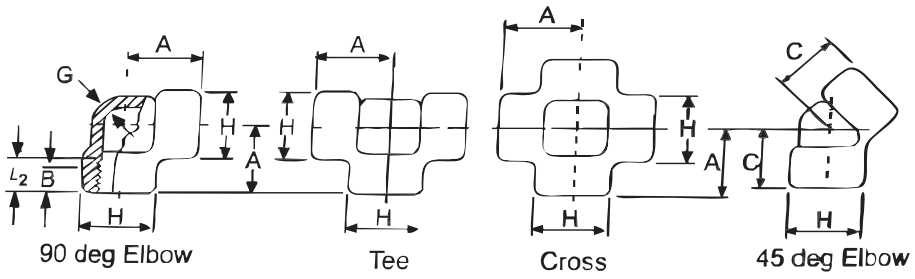


Cap

SOCKET WELDING FITTINGS AS PER B 16.11

DN	Nominal Pipe Size	Socket Bore Diameter B [Note (1)]	Bore Diameter of Fittings, D [Note (1)] Class Designation			Socket Wall Thickness, C [Note (1)] Class Designation						Body Wall, G Class Designation			Min. Dept of Socket J	Center to Bottom of Socket, A 90 deg Elbows, Tess, and Crosses Class Designation			Center to Bottom of Socket, A 45 deg Elbows Class Designation			Laying Lenghts		Tolerances,.±			End Wall Thickness, $K_{min.}$ Class Designation		
						3000		6000		9000												Couplings, E	Half Couplings, F	A	E	F			
			3000	6000	9000	Avg.	Min.	Avg.	Min.	Avg.	Min.	Min.	Min.	Min.		3000	6000	9000	3000	6000	9000						3000	6000	9000
6	1/4	11.2 10.8	7.6 6.1	4.8 3.2	... ...	3.18	3.18	3.96	3.43	...	...	2.41	3.15	...	9.5	11.0	11.0	...	8.0	8.0	...	6.5	16.0	1.0	1.5	1.0	4.8	6.4	...
8	1/4	14.6 14.2	10.0 8.5	7.1 5.6	... ...	3.78	3.30	4.60	4.01	...	...	3.02	3.68	...	9.5	11.0	13.5	...	8.0	8.0	...	6.5	16.0	1.0	1.5	1.0	4.8	6.4	...
10	3/8	18.0 17.6	13.3 11.8	9.9 8.4	... ...	4.01	3.50	5.03	4.37	...	...	3.20	4.01	...	9.5	13.5	15.5	...	8.0	11.0	...	6.5	17.5	1.5	3.0	1.5	4.8	6.4	...
15	½	22.2 21.8	16.6 15.0	12.5 11.0	7.2 5.6	4.67	4.09	5.97	5.18	9.35	8.18	3.73	4.78	7.47	9.5	15.5	19.0	25.5	11.0	12.5	15.5	9.5	22.5	1.5	3.0	1.5	6.4	7.9	11.2
20	3/4	27.6 27.2	21.7 20.2	16.3 14.8	11.8 10.3	4.90	4.27	6.96	6.04	9.78	8.56	3.91	5.56	7.82	12.5	19.0	22.5	28.5	13.0	14.0	19.0	9.5	24.0	1.5	3.0	1.5	6.4	7.9	12.7
25	1	34.3 33.9	27.4 25.9	21.5 19.9	16 14.4	5.69	4.98	7.92	6.93	11.38	9.96	4.55	6.35	9.09	12.5	22.5	27.0	32.0	14.0	17.5	20.5	12.5	28.5	2.0	4.0	2.0	9.6	11.2	14.2
32	1 1/4	43.1 42.7	35.8 34.3	30.2 28.7	23.5 22	6.07	5.28	7.92	6.93	12.14	10.62	4.85	6.35	9.70	12.5	27.0	32.0	35.0	17.5	20.5	22.5	12.5	30.0	2.0	4.0	2.0	9.6	11.2	14.2
40	1½	49.2 48.8	41.6 40.1	34.7 33.2	28.7 27.2	6.35	5.54	8.92	7.80	12.70	11.12	5.08	7.14	10.15	12.5	32.0	38.0	38.0	20.5	25.5	25.5	12.5	32.0	2.0	4.0	2.0	11.2	12.7	15.7
50	2	61.7 61.2	53.3 51.7	43.6 42.1	38.9 37.4	6.93	6.04	10.92	9.5	13.84	12.12	5.54	8.74	11.07	16.0	38.0	41.0	54.0	25.5	28.5	28.5	19.0	41.0	2.0	4.0	2.0	6.4	15.7	19.0
65	2 1/2	74.4 73.9	64.2 61.2	... ...	... ...	8.76	7.67	...	...	...	...	7.01	...	...	16.0	41.0	...	...	28.5	...	...	19.0	43.0	2.5	5.0	2.5	9.6	19.0	...
80	3	90.3 89.8	79.4 76.4	... ...	... ...	9.52	8.30	...	...	...	...	7.62	...	...	16.0	57.0	...	...	32.0	...	...	19.0	44.5	2.5	5.0	2.5	9.6	22.4	...
100	4	115.7 115.2	103.8 100.7	... ...	... ...	10.69	9.35	...	...	...	...	8.56	...	...	19.0	66.5	...	...	41.0	...	...	19.0	48.0	2.5	5.0	2.5	11.2	28.4	...

GENERAL NOTE: Dimensions are in millimeters.
NOTES:
(1) Upper and lower values for each size are the respective maximum and minimum dimensions.
(2) Average of socket wall thickness around periphery shall no less than listed values. The maximum values are permitted in localized area.



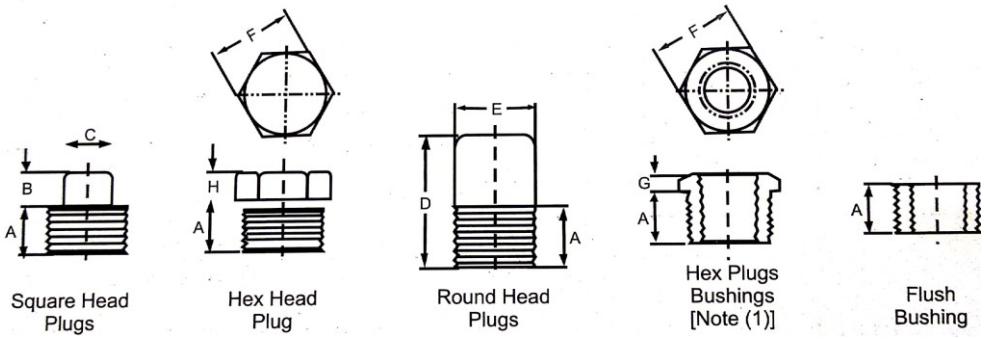
FORGED THREADED FITTINGS

AS PER ASME B16.11

DN	Nominal Pipe Size	Center-to-End Elbows, Tees, Crosses, *A*			Center-to-End 45 deg Elbow, *C*			Outside Diameter of Band, *H*			Min. Wall Thickness, *G*			Min. Length of Thread [Note(1)]	
		2000	3000	6000	2000	3000	6000	2000	3000	6000	2000	3000	6000	*B*	L_2
6	1/8	21	21	25	17	17	19	22	22	25	3.18	3.18	6.35	6.4	6.7
8	1/4	21	25	28	17	19	22	22	25	33	3.18	3.30	6.60	8.1	10.2
10	3/8	25	28	33	19	22	25	25	33	38	3.18	3.51	6.98	9.1	10.4
15	½	28	33	38	22	25	28	33	38	46	3.18	4.09	8.15	10.9	13.6
20	3/4	33	38	44	25	28	33	38	46	56	3.18	4.32	8.53	12.7	13.9
25	1	38	44	51	28	33	35	46	56	62	3.68	4.98	9.93	14.7	17.3
32	1 1/4	44	51	60	33	35	43	56	62	75	3.89	5.28	10.59	17.0	18.0
40	1 ½	51	60	64	35	43	44	62	75	84	4.01	5.56	11.07	17.8	18.4
50	2	60	64	83	43	44	52	75	84	102	4.27	7.14	12.09	19.0	19.2
65	2 1/2	76	83	95	52	52	64	92	102	121	5.61	7.65	15.29	23.6	28.9
80	3	86	95	106	64	64	79	109	121	146	5.99	8.84	16.64	25.9	30.5
100	4	106	114	114	79	79	79	146	152	152	6.55	11.18	18.67	27.7	33.0

GENERAL NOTE: Dimensions are in millimeters
NOTE:

(1) Dimensions B is minimum length of perfect thread. The length of useful thread (B plus threads with fully formed roots and flat crests) shall not be less than L (effective length of external thread) required by American National Standard for Pipe Threads (ASME B1.20.1). See Para. 6.3.

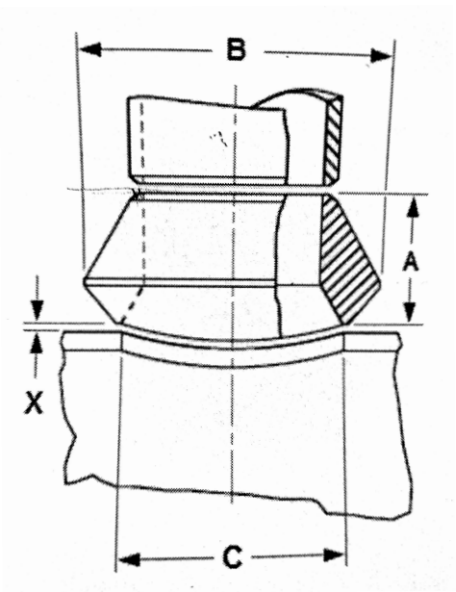


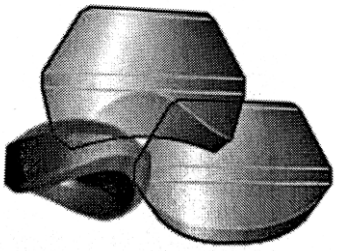
AS PER ASME B16.11

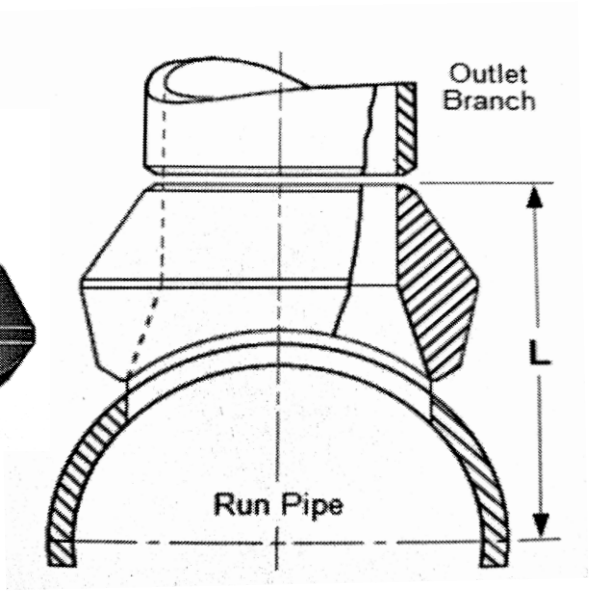
			Sqaure Head Plugs		Round Head Plugs		Hex Plugs and Bushing		
DN	Nominal Pipe Size	Min Length A	Min Square Height B	Min Width Flats C	Nominal Head Diameter, E	Min Length D	Nominal Width Flats, E	Min. Hex Height	
								Bushing G	Plug H
6	1/8	10	6	7	10	35	11	…	6
8	1/4	11	6	10	14	41	16	3	6
10	3/8	13	8	11	18	41	18	4	8
15	½	14	10	14	21	44	22	5	8
20	3/4	16	11	16	27	44	27	6	10
25	1	19	13	21	33	51	36	6	10
32	1 1/4	21	14	24	43	51	46	7	14
40	1 1/2	21	16	28	48	51	50	8	16
50	2	22	18	32	60	64	65	9	18
65	2 1/2	27	19	36	73	70	75	10	19
80	3	28	21	41	89	70	90	10	21
100	4	32	25	65	114	76	115	13	25

GENERAL NOTE: Dimensions are in millimeters
NOTE:
(1) Cautionary Note Regarding Hex Bushing: Hex head bushings of one-size reduction should not be used in services where they might be subject to harmful loads and forces other than internal pressures.

11. WELDOLET REDUCING STD MSS SP97







L = A+ Run Pipe OD + Root Gap

Schedule STD					
Size	Size in mm	Height A	OD - B	Hole Dia C	Weight in KG
1/4	8	14.3	25.4	15.9	0.04
3/8	10	19.05	31.75	19.05	0.07
½	15	19.05	34.93	23.81	0.08
3/4	20	22.23	44.45	30.16	0.11
1	25	26.99	53.98	36.51	0.23
1 1/4	32	31.75	65.09	44.45	0.36
1 1/2	40	33.34	73.03	50.8	0.45
2	50	38.1	88.9	65.09	0.79
2 1/2	65	41.28	103.19	76.2	1.13
3	80	44.45	122.24	93.66	1.81
3 1/2	90	47.63	142.88	112.71	2.5
4	100	50.8	152.4	120.65	2.86
5	130	57.15	179.3	141.29	4.65
6	150	60.33	215.9	169.86	6.44
8	200	69.85	263.53	220.66	10.66
10	250	77.79	322.26	274.64	17.69
12	300	85.73	377.83	325.44	26.76

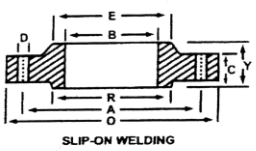
Schedule STD					
Size	Size in mm	Height A	OD - B	Hole Dia C	
14	350	88.9	409.58	357.19	29.94
16	400	93.6	463.55	407.99	34.02
18	450	96.84	520.7	458.79	44
20	500	101.6	571.5	508	53.52
24	600	144.5	717.5	609.6	101
26	650	155.6	778	660.4	120
30	750	174.6	893.6	762	190
36	900	206.4	1070	914.4	310
40	1000	225.4	1187.6	1016	435
42	1050	235	1244.6	1066.8	540
48	1200	241.3	1404	1219.2	750

Schedule XS					
Size	Size in mm	Height A	OD - B	Hole Dia C	Weight in KG
1/4	8	N/A	25.4	15.88	0.05
3/8	10	N/A	31.75	19.05	0.07
½	15	19.05	34.93	23.81	0.09
3/4	20	22.23	44.45	30.16	0.14
1	25	26.99	53.98	36.51	0.21
1 1/4	32	31.75	65.09	44.45	0.41
1 1/2	40	33.34	73.03	50.8	0.5
2	50	38.1	88.9	65.09	0.79
2 1/2	65	41.28	103.19	76.2	1.18
3	80	44.45	122.24	93.66	1.86
3 1/2	90	47.63	136.53	112.71	2.54
4	100	50.8	152.4	120.65	2.9
6	150	77.79	225.43	169.86	10.43
8	200	98.43	292.1	220.66	16.78
10	250	93.66	323.85	265.11	20.87
12	300	103.1	379.41	317.5	27.67
14	350	100.01	431.8	350.84	31.75
16	400	106.36	466.73	403.23	46.27
18	450	111.13	523.88	455.61	58.97
20	500	119.06	582.61	509.59	71.67
24	600	152.4	722.2	609.6	142
26	650	165.1	782.6	660.4	168
30	750	181	896.8	762	218
36	900	212.7	1074.4	914.4	404
40	1000	235	1194	1016	582
42	1050	244.5	1250.8	1066.8	590
42	1200	273	1425.6	1219.2	910

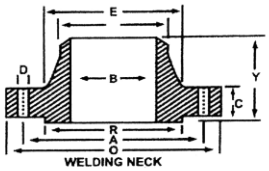
Schedule XXS					
Size	Size in mm	Height A	OD - B	Hole Dia C	Weight in KG
½	15	28.58	34.93	14.29	0.11
3/4	20	31.75	44.45	19.05	0.32
1	25	38.1	50.8	25.4	0.38
1 1/4	32	44.45	61.91	33.34	0.57
1 1/2	40	50.8	69.85	38.1	0.79
2	50	55.56	80.96	42.86	0.97
2 1/2	65	61.91	96.84	53.98	1.53
3	80	73.03	120.65	73.03	2.87
4	100	84.14	152.4	98.43	4.76
5	130	93.66	187.33	122.24	6.46
6	150	104.78	220.66	146.05	12.7
8	200	111.12	284.16	173.04	20.41
10	250	125.41	312.74	215.9	38.56

Schedule 160					
Size	Size in mm	Height A	OD - B	Hole Dia C	Weight in KG
½	15	28.58	34.93	14.29	0.11
3/4	20	31.75	44.45	19.05	0.32
1	25	38.1	50.8	25.4	0.38
1 1/4	32	44.45	61.91	33.34	0.57
1 1/2	40	50.8	69.85	38.1	0.79
2	50	55.56	80.96	42.86	0.97
2 1/2	65	61.91	96.84	53.98	1.53
3	80	73.03	120.65	73.03	2.87
4	100	84.14	152.4	98.43	4.76
5	130	93.66	187.33	122.24	6.46
6	150	104.78	220.66	146.05	12.7
8	200	111.12	284.16	173.04	20.41
10	250	125.41	312.74	215.9	38.56

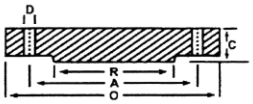
12. FLANGES ASME/ANSI B16.5 DIMENSION CHARTS



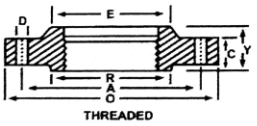
SLIP-ON WELDING



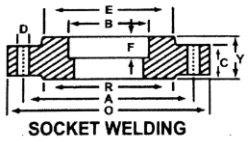
WELDING NECK



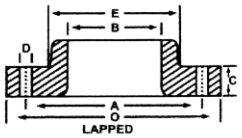
BLIND



THREADED



SOCKET WELDING



LAPPED

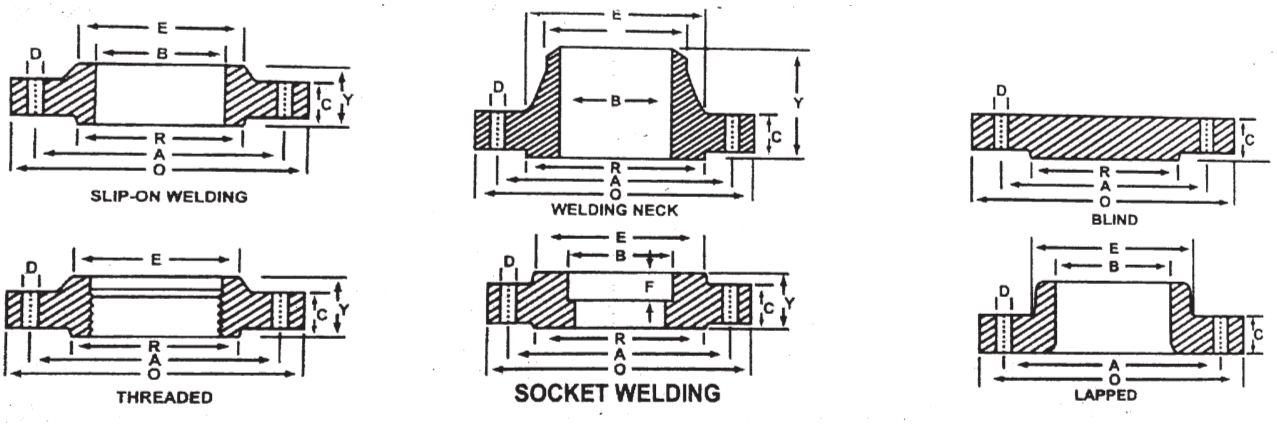
DIMENSIONS OF CLASS 150 FLANGES (ASME / ANSI B16.5)

Nominal Size Inch	W/N B	Flange Dia 0	Dia of Bolt Circle A	Dia of Bolt Holes D	No. of Holes	Thk of Flagne C	Dia of Hub E	Length through Hub			Dia of Bore		Dia of R/F R	Depth of Socket F
								S/O&S/W Y	W/N Y	L/J Y	S/O&S/W B	L/J B		
½	0.62 15.7	88.9	60.4	15.9	4	11.2	30.2	14.2	45.9	15.7	22.3	22.8	35	9.6
3/4	0.82 20.8	98.5	69.8	15.9	4	12.7	38.1	14.2	50.8	15.7	27.6	28.2	42.9	11.1
1	1.05 26.7	107.9	79.2	15.9	4	14.2	49.2	15.7	53.8	17.5	34.5	35	50.8	12.7
1 1/4	1.38 35.1	117.3	88.9	15.9	4	15.7	58.6	19.0	55.6	20.5	43.1	43.6	63.5	14.2
1 1/2	1.61 40.9	127	98.5	15.9	4	17.5	65.0	20.5	60.4	22.3	49.5	50	73.1	15.7
2	2.07 52.6	152.4	120.6	19.0	4	19	77.7	23.8	61.9	25.4	61.9	62.4	91.9	17.5
2 1/2	2.47 62.7	177.8	139.7	19.0	4	22.3	90.4	26.9	68.3	28.4	74.6	75.4	104.6	19
3	3.07 78.0	190.5	152.4	19.0	4	23.9	107.9	28.4	68.3	30.2	90.6	91.4	127	20.5
4	4.03 102.4	228.6	190.5	19.0	8	23.9	134.8	31.7	74.6	33.2	116	116.8	157.2	
5	5.05 128.3	254	215.9	22.2	8	23.9	163.5	35.0	87.3	36.5	143.7	144.5	185.6	
6	6.07 154.2	279.4	241.3	22.2	8	25.4	192.0	38.1	87.3	39.6	170.6	171.4	215.9	
8	7.98 202.7	342.9	298.4	22.2	8	28.4	246.1	42.9	100	44.4	221.4	222.2	269.7	
10	10.02 254.5	406.4	361.9	25.4	12	30.2	304.8	47.7	100	49.2	276.3	277.3	323.8	
12	12 304.8	482.6	431.8	25.4	12	31.8	365.2	53.8	112.7	55.6	327.1	328.1	381	
14	To be specified by purchaser	533.4	476.2	28.6	12	35	400.0	55.6	125.4	79.2	359.1	360.1	412.7	
16		596.9	539.7	28.6	16	36.6	457.2	61.9	125.4	87.3	410.4	411.2	469.9	
18		635.0	577.8	31.7	16	39.6	504.9	66.5	138.8	96.7	461.7	462.2	533.4	
20		698.5	635.0	31.7	20	42.9	558.8	71.3	142.7	103.1	513	514.3	584.2	
24		812.8	749.3	34.9	20	47.8	663.4	81.0	150.8	111.2	615.9	615.9	692.1	

DIMENSIONS OF CLASS 300 FLANGES (ASME / ANSI B16.5)

Nominal Size Inch	W/N B	Flange Dia 0	Dia of Bolt Circle A	Dia of Bolt Holes D	No. of Holes	Thk of Flagne C	Dia of Hub E	Length through Hub			Dia of Bore		Dia of R/F R	Depth of Socket F
								S/O&S/W Y	W/N Y	L/J Y	S/O&S/W B	L/J B		
½	0.62 15.7	95.2	66.5	15.9	4	14.2	38.1	20.5	50.8	22.3	22.3	22.8	35	9.6
3/4	0.82 20.8	117.3	82.5	19.0	4	15.7	47.7	23.8	55.6	25.4	27.6	28.2	42.9	11.1
1	1.05 26.7	123.9	88.9	19.0	4	17.5	53.8	25.4	60.4	26.9	34.5	35	50.8	12.7
1 1/4	1.38 35.1	133.3	98.5	19.0	4	19.0	63.5	25.4	63.5	26.9	43.1	43.6	63.5	14.2
1 1/2	1.61 40.9	155.4	114.3	22.2	4	20.6	69.8	28.4	66.5	30.2	49.5	50	73.1	15.7
2	2.07 52.6	165.1	127	19.0	8	22.4	84.0	33.2	69.8	33.2	61.9	62.4	91.9	17.5
2 1/2	2.47 62.7	190.5	149.3	22.2	8	25.4	100.0	38.1	76.2	38.1	74.6	75.4	104.6	19.0
3	3.07 78.0	209.5	168.1	22.2	8	28.4	117.3	42.9	79.2	42.9	90.6	91.4	127.0	20.5
4	4.03 102.4	254	200.1	22.2	8	31.8	146.0	47.7	85.8	47.7	116	116.8	157.2	
5	5.05 128.3	279.4	234.9	22.2	8	35.0	177.8	50.8	98.5	50.8	143.7	144.5	185.6	
6	6.07 154.2	317.5	269.7	22.2	12	36.6	206.2	52.3	98.5	52.3	170.6	171.4	215.9	
8	7.98 202.7	381	330.2	25.4	12	41.1	260.3	61.9	111.2	61.9	221.4	222.2	269.7	
10	10.02 254.5	444.5	387.3	28.6	16	47.8	320.5	66.5	117.3	95.2	276.3	277.3	323.8	
12	12 304.8	520.7	450.8	31.7	16	50.8	374.6	73.1	130.0	101.6	327.1	328.1	381	
14	To be specified by purchaser	584.2	514.3	31.7	20	53.8	425.4	76.2	142.2	111.2	359.1	360.1	412.7	
16		647.7	571.5	34.9	20	57.2	482.6	82.5	146.0	120.6	410.4	411.2	469.9	
18		711.2	628.6	34.9	24	60.5	533.4	88.9	158.7	130.0	461.7	462.2	533.4	
20		774.7	685.8	34.9	24	63.5	587.2	95.2	162.0	139.7	513.0	514.3	584.2	
24		914.4	812.8	41.3	24	69.9	701.5	106.4	168.1	152.4	615.9	615.9	692.1	

General Note : All Dimensions are in millimeters.
1) Thickness 'C' is inclusive Raised Face Thickness of 1.6 mm. For Class 150 and Class 300.

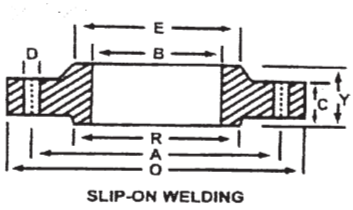


DIMENSIONS OF CLASS 600 FLANGES (ASME / ANSI B16.5)

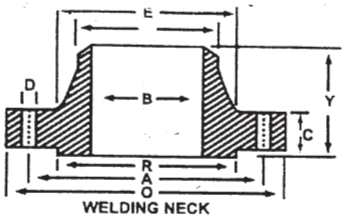
Nominal Size Inch	Flange Dia 0	Dia of Bolt Circle A	Dia of Bolt Holes D	No. of Holes	Thk of Flagne C	Dia of Hub E	Length through Hub			Dia of Bore		Dia of R/F R	Depth of Socket F
							S/O&S/W Y	W/N Y	L/J Y	S/O&S/W B	L/J B		
½	95.2	66.5	15.9	4	14.2	38.1	22.3	52.3	22.2	22.3	22.8	35.0	9.6
3/4	117.3	82.5	19.0	4	15.7	47.7	25.4	57.1	25.4	27.6	28.2	42.9	11.1
1	123.9	88.9	19.0	4	17.5	53.8	26.9	61.9	26.9	34.5	35.0	50.8	12.7
1 1/4	155.4	98.5	19.0	4	20.6	63.5	28.4	66.5	28.4	43.1	43.6	63.5	14.2
1 1/2	165.1	114.3	22.2	4	22.3	69.8	31.7	69.8	31.7	49.5	50.0	73.1	15.7
2	190.5	127.0	19.0	8	25.4	84.0	36.5	73.1	36.5	61.9	62.4	91.9	17.5
2 1/2	209.5	149.3	22.2	8	28.4	100.0	41.1	79.2	41.1	74.6	75.4	104.6	19.0
3	273.0	168.1	22.2	8	31.8	117.3	45.9	82.5	45.9	90.6	91.4	127.0	20.5
4	330.2	215.9	25.4	8	38.1	152.4	53.8	101.6	53.8	116.0	116.8	157.2	–
5	355.6	266.7	28.6	8	44.4	188.9	60.4	114.3	60.4	143.7	114.5	185.6	–
6	419.1	292.1	28.6	12	47.7	222.2	66.5	117.3	66.5	170.6	171.4	215.9	–
8	508.0	349.2	31.7	12	55.6	273.0	76.2	133.3	76.2	221.4	222.2	269.7	–
10	558.8	431.8	34.9	16	63.5	342.9	85.8	152.4	111.2	276.3	277.3	323.8	–
12	603.2	488.9	34.9	20	66.5	400.0	91.9	155.4	117.3	327.1	328.1	381.0	–
14	685.8	527.0	38.1	20	69.9	431.8	93.7	165.1	127.0	359.1	360.1	412.7	–
16	503.2	603.2	41.3	20	76.2	495.3	106.4	177.8	139.7	410.4	411.2	469.9	–
18	742.9	654.0	44.4	20	82.6	546.1	117.3	184.1	152.4	461.7	462.2	533.4	–
20	812.8	723.9	44.4	24	88.9	609.6	127.0	190.5	165.1	513.0	514.3	584.2	–
24	939.8	838.2	50.8	24	101.6	717.5	139.7	203.2	184.1	615.9	615.9	692.1	–

DIMENSIONS OF CLASS 900 FLANGES (ASME / ANSI B16.5)

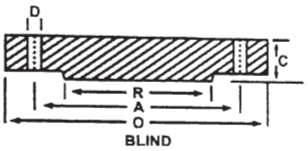
Nominal Size Inch	Flange Dia 0	Dia of Bolt Circle A	Dia of Bolt Holes D	No. of Holes	Thk of Flagne C	Dia of Hub E	Length through Hub			Dia of Bore		Dia of R/F R	Depth of Socket F
							S/O&S/W Y	W/N Y	L/J Y	S/O&S/W B	L/J B		
½	120.6	82.5	22.2	4	22.4	38.1	31.7	60.4	31.7	22.3	22.8	35.0	
3/4	130.0	88.9	22.2	4	25.4	44.4	35.0	69.8	35.0	27.6	28.2	42.9	
1	149.3	101.6	25.4	4	28.4	52.3	41.1	73.1	41.1	34.5	35.0	50.8	
1 1/4	158.7	111.2	25.4	4	28.4	63.5	41.1	73.1	41.1	43.1	43.6	63.5	
1 1/2	177.8	123.9	28.6	4	31.8	69.8	44.4	82.5	44.4	49.5	50.0	73.1	
2	215.9	165.1	25.4	8	38.1	104.6	57.1	101.6	57.1	61.9	62.4	91.9	
2 1/2	244.3	190.5	28.6	8	41.1	123.9	63.5	104.6	63.5	74.6	75.4	104.6	
3	241.3	190.5	25.4	8	38.1	127.0	53.8	101.6	53.8	90.6	91.4	127.0	
4	292.1	234.9	31.7	8	44.5	158.7	69.8	114.3	69.8	116.0	116.8	157.2	
5	349.2	279.4	34.9	8	50.8	190.5	79.2	127.0	79.2	143.7	144.5	185.6	
6	381.0	317.5	31.7	12	55.6	234.9	85.8	139.7	85.8	170.6	171.4	215.9	
8	469.9	393.7	38.1	12	63.5	298.4	101.6	162.0	114.3	221.4	222.2	269.7	
10	546.1	469.9	38.1	16	69.8	368.3	107.9	184.1	127.0	276.3	277.3	323.8	
12	609.6	533.4	38.1	20	79.2	419.1	117.3	200.1	142.7	327.1	328.1	381.0	



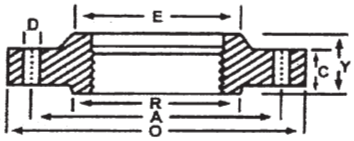
SLIP-ON WELDING



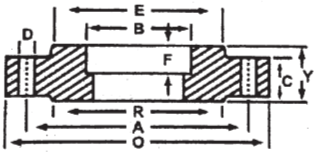
WELDING NECK



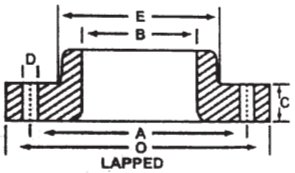
BLIND



THREADED



SOCKET WELDING



LAPPED

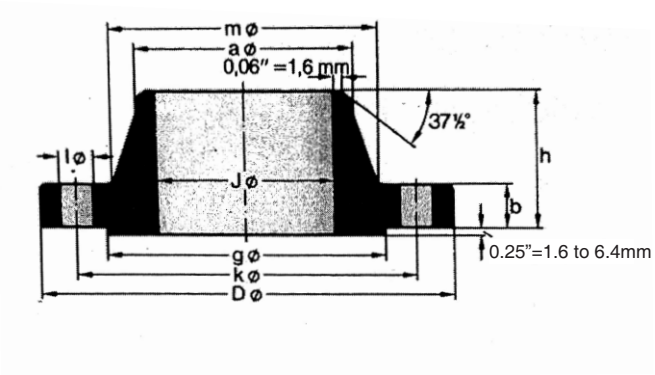
DIMENSIONS OF CLASS 1500 FLANGES (ASME / ANSI B16.5)

Nominal Size Inch	Flange Dia 0	Dia of Bolt Circle A	Dia of Bolt Holes D	No. of Holes	Thk of Flagne C	Dia of Hub E	Length through Hub			Dia of Bore		Dia of R/F R	Depth of Socket F
							S/O&S/W Y	W/N Y	L/J Y	S/O&S/W B	L/J B		
½	120.6	82.5	22.2	4	22.4	38.1	31.7	31.7	31.7	22.3	22.8	35.0	
3/4	130.0	88.9	22.2	4	25.4	44.4	35.0	35.0	35.0	27.6	28.2	42.9	
1	149.3	101.6	25.4	4	28.4	52.3	41.1	41.1	41.1	34.5	35.0	50.8	
1 1/4	158.7	111.2	25.4	4	28.4	63.5	41.1	41.1	41.1	43.1	43.6	63.5	
1 1/2	177.8	123.9	28.6	4	31.8	69.8	44.4	44.4	44.4	49.5	50.0	73.1	
2	215.9	165.1	25.4	8	38.1	104.6	57.1	57.1	57.1	61.9	62.4	91.9	
2 1/2	244.3	190.5	28.6	8	41.1	123.9	63.5	63.5	63.5	74.6	75.4	104.6	
3	266.7	203.2	31.7	8	47.8	133.3		117.3	73.1	90.6	91.4	127.0	
4	311.1	241.3	34.9	8	53.8	162.0		123.9	90.4	116.0	116.8	157.2	
5	374.6	292.1	41.2	8	73.2	196.8		155.4	104.6	143.7	144.5	185.6	
6	393.7	317.5	38.1	12	82.6	228.6		171.4	119.1	170.6	171.4	215.9	
8	482.6	393.7	44.4	12	91.9	292.1		212.8	142.7	221.4	222.2	269.7	
10	584.2	482.6	50.8	12	108.0	368.3		254.0	177.8	276.3	277.3	323.8	
12	673.1	571.5	54.0	16	124.0	450.8		282.4	218.9	327.1	328.1	381.0	

DIMENSIONS OF CLASS 2500 FLANGES (ASME / ANSI B16.5)

Nominal Size Inch	Flange Dia 0	Dia of Bolt Circle A	Dia of Bolt Holes D	No. of Holes	Thk of Flagne C	Dia of Hub E	Length through Hub			Dia of Bore		Dia of R/F R	Depth of Socket F
							S/O&S/W Y	W/N Y	L/J Y	S/O&S/W B	L/J B		
½	133.3	88.9	22.2	4	30.2	42.9	39.6	73.1	39.6	22.3	22.8	35.0	
3/4	139.7	95.2	22.2	4	31.7	50.8	42.9	79.2	42.9	27.6	28.2	42.9	
1	158.7	107.9	25.4	4	35.0	57.1	47.7	88.9	47.7	34.5	35.0	50.8	
1 1/4	184.1	130.0	28.6	4	38.1	73.2	52.3	95.2	52.3	43.1	43.6	63.5	
1 1/2	203.2	146.0	31.7	4	44.5	79.4	60.4	111.2	60.4	49.5	50.0	73.1	
2	234.9	171.4	28.6	8	50.8	95.2	69.3	127.0	69.3	61.9	62.4	91.9	
2 1/2	266.7	196.8	31.7	8	57.1	114.3	79.2	1427	79.2	74.6	75.4	104.6	
3	304.8	228.6	34.9	8	66.5	133.3	92.0	168.1	92.1	90.6	91.4	127.0	
4	355.6	273.0	41.3	8	76.2	165.1	107.9	190.5	107.9	116.0	116.8	157.2	
5	419.1	323.8	47.6	8	92.0	203.2	130.0	203.0	130.0	143.7	144.5	185.6	
6	482.6	368.3	54.0	8	107.9	234.9	152.4	273.0	152.4	170.6	171.4	215.9	
8	552.4	438.1	54.0	12	127.0	304.8	177.8	317.5	177.8	221.4	222.2	269.7	
10	673.1	539.7	66.7	12	165.1	374.6	228.6	419.1	228.6	276.3	277.3	323.8	
12	762.0	619.2	73.0	12	184.1	441.3	254.0	463.5	254.0	327.1	328.1	381.0	

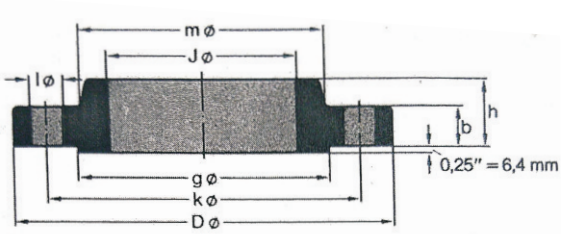
13. FLANGES ASME/ANSI 16.5 WEIGHT CHARTS
13.1 WELD NECK



ANSI B 16.5

Pipe		150 lb/sq.in. Approx Weight ≈	300 lb/sq.in. Approx Weight ≈	400 lb/sq.in. Approx Weight ≈	600 lb/sq.in. Approx Weight ≈	900 lb/sq.in. Approx Weight ≈	1500 lb/sq.in. Approx Weight ≈	2500 lb/sq.in. Approx Weight ≈
Nom. Size	O. D. in. mm.	Pound Kilo	Pound Kilo	Pound Kilo	Pound Kilo	Pound Kilo	Pound Kilo	Pound Kilo
½"	0,84 21,3	1,1 0,48	1,7 0,75	use 600 lb dimensions for these sizes	1,9 0,87	Use 1500 lb dimensions for these sizes	4,1 1,87	6,9 3,12
3/4"	1,05 26,7	1,6 0,71	2,8 1,26		3,2 1,45		5,6 2,56	8,1 3,70
1"	1,315 33,4	2,2 1,01	3,5 1,52		3,9 1,76		8,2 3,74	11,5 5,24
1 1/4"	1,66 42,2	2,9 1,33	4,5 2,03		5,5 2,49		9,5 4,33	17,0 7,74
1 1/2"	1,90 48,3	3,8 1,72	6,4 2,89		7,7 3,49		13,1 5,94	24,0 10,9
2"	2,375 60,3	5,7 2,58	7,5 3,40		9,6 4,36		23,8 10,8	35,7 16,2
2 1/2"	2,875 73,0	9,1 4,11	11,4 5,17		14,2 6,43		33,0 15,0	52,2 23,7
3"	3,50 88,9	10,8 4,92	15,3 6,93		18,8 8,53	30,2 13,7	43,8 19,9	79,7 36,2
3 1/2"	4,00 101,6	13,4 6,08	19,1 8,67		23,6 10,7			
4"	4,50 114,3	15,1 6,84	24,7 11,2	28,2 12,8	38,3 17,4	49,6 22,5	65,9 29,9	122 55,3
5"	5,563 141,3	18,9 8,56	33,3 15,1	37,2 16,9	64,3 29,2	82,4 37,4	122 55,4	204 92,5
6"	6,625 168,3	23,3 10,6	42,4 19,1	48,5 22,0	76,9 34,9	105 47,7	151 68,4	315 143
8"	8,625 219,1	38,8 17,6	65,9 29,9	76,4 34,7	119 53,9	179 81,3	258 117	474 215
10"	10,75 273	53,0 24,0	94,1 42,7	107 48,5	191 86,5	262 119	427 194	894 406
12"	12,75 323,8	80,4 36,5	136 61,8	153 69,6	227 103	346 157	634 288	1260 572
14"	14,0 355,6	107 48,4	189 85,8	210 95,5	269 122	379 180	837 380	
16"	16,0 406,4	134 60,6	234 106	260 118	374 170	478 217	1068 485	
18"	18,0 457,2	151 68,3	289 131	319 145	449 204	643 292	1419 644	
20"	20,0 508	186 84,5	348 158	381 173	560 254	797 362	1707 775	
24"	24,0 609,6	253 115	507 230	549 249	789 358	1465 665	2714 1232	

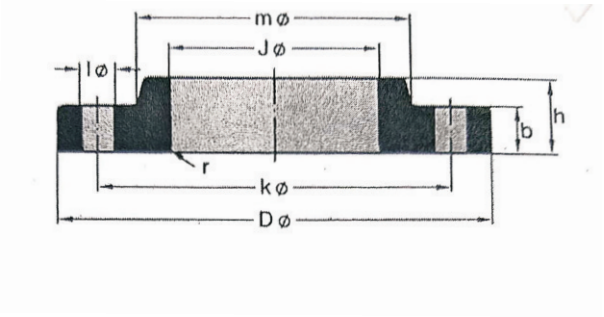
13.2 SLIP-ON FLANGES



ANSI B 16.5

Pipe		150 lb/sq.in. Approx Weight ≈	300 lb/sq.in. Approx Weight ≈	400 lb/sq.in. Approx Weight ≈	600 lb/sq.in. Approx Weight ≈	900 lb/sq.in. Approx Weight ≈	1500 lb/sq.in. Approx Weight ≈
Nom. Size	O. D. in. mm.	Pound Kilo	Pound Kilo	Pound Kilo	Pound Kilo	Pound Kilo	Pound Kilo
½"	0,84 21,3	0,9 0,39	1,4 0,64	use 600 lb dimensions for these sizes	1,6 0,74	Use 1500 lb dimensions for these sizes	3,8 1,74
3/4"	1,05 26,7	1,2 0,56	2,5 1,12		2,8 1,27		5,2 2,34
1"	1,315 33,4	1,7 0,78	3,0 1,36		3,3 1,52		7,6 3,44
1 1/4"	1,66 42,2	2,3 1,03	3,7 1,68		4,5 2,03		8,6 3,91
1 1/2"	1,90 48,3	2,9 1,32	5,5 2,49		6,5 2,96		11,8 5,36
2"	2,375 60,3	4,5 2,06	6,3 2,87		8,0 3,62		21,7 9,85
2 1/2"	2,875 73,0	7,2 3,28	9,5 4,32		11,6 5,28		30,2 13,7
3"	3,50 88,9	8,5 3,85	12,9 5,85		15,4 7,00	25,6 11,6	
3 1/2"	4,00 101,6	10,6 4,81	16,2 7,34		19,5 8,84		
4"	4,50 114,3	11,7 5,30	21,2 9,61	24,4 11,1	31,9 14,5	43,4 19,7	
5"	5,563 141,3	13,4 6,07	27,1 12,3	30,6 13,9	53,7 24,4	70,3 31,9	
6"	6,625 168,3	16,4 7,45	34,4 15,6	40,3 18,3	63,2 28,7	90,5 41,1	
8"	8,625 219,1	26,7 12,1	53,3 24,2	63,0 28,6	95,6 43,4	156 70,7	
10"	10,75 273	36,3 16,5	75,1 34,1	86,3 39,2	155 70,3	223 101	
12"	12,75 323,8	57,7 26,2	110 49,8	126 57,0	186 84,2	293 133	
14"	14,0 355,6	76,2 34,6	154 69,9	174 79,1	217 98,7	337 153	
16"	16,0 406,4	98,7 44,8	194 88,1	223 101	313 142	408 185	
18"	18,0 457,2	108 48,9	240 109	271 123	381 173	568 258	
20"	20,0 508	136 61,9	295 134	322 146	485 220	698 317	
24"	24,0 609,6	191 86,9	443 201	482 219	687 312	1335 606	

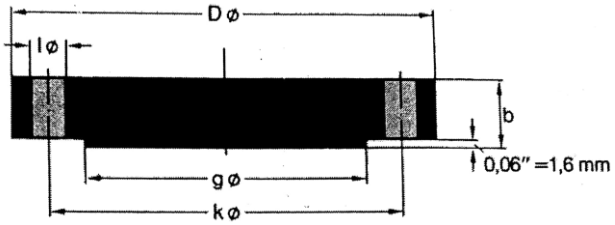
13.3 LAP JOINT FLANGES



ANSI B 16.5

Pipe		150 lb/sq.in. Approx Weight ≈	300 lb/sq.in. Approx Weight ≈	400 lb/sq.in. Approx Weight ≈	600 lb/sq.in. Approx Weight ≈	900 lb/sq.in. Approx Weight ≈	1500 lb/sq.in. Approx Weight ≈	2500 lb/sq.in. Approx Weight ≈
Nom. Size	O. D. in. mm.	Pound Kilo	Pound Kilo	Pound Kilo	Pound Kilo	Pound Kilo	Pound Kilo	Pound Kilo
½"	0,84 21,3	0,8 0,38	1,4 0,62	use 600 lb dimensions for these sizes	1,6 0,72	Use 1500 lb dimensions for these sizes	3,8 1,71	6,4 2,92
3/4"	1,05 26,7	1,2 0,55	2,4 1,10		2,8 1,25		5,1 2,30	7,5 3,40
1"	1,315 33,4	1,7 0,76	2,9 1,33		3,3 1,50		7,5 3,40	10,5 4,77
1 1/4"	1,66 42,2	2,2 1,01	3,6 1,65		4,4 2,00		8,5 3,85	15,6 7,08
1 1/2"	1,90 48,3	2,9 1,30	5,4 2,44		6,4 2,92		11,6 5,28	21,9 9,93
2"	2,375 60,3	4,5 2,03	6,2 2,83		7,8 3,55		21,5 9,78	32,4 14,7
2 1/2"	2,875 73,0	7,2 3,25	9,4 4,25		11,5 5,23		30,0 13,6	46,9 21,3
3"	3,50 88,9	8,4 3,81	12,7 5,78		15,3 6,95	24,9 11,3	39,2 17,8	71,1 32,3
3 1/2"	4,00 101,6	10,5 4,76	16,0 7,27		19,3 8,78			
4"	4,50 114,3	11,6 5,25	21,0 9,55	24,0 10,9	31,7 14,4	42,3 19,2	60,6 27,5	116 52,5
5"	5,563 141,3	13,3 6,02	26,9 12,2	30,2 13,7	53,5 24,3	68,7 31,2	113 51,5	182 82,6
6"	6,625 168,3	16,3 7,40	34,1 15,5	39,6 18,0	62,8 28,5	89,2 40,5	137 62,0	280 127
8"	8,625 219,1	26,7 12,1	53,1 24,1	62,3 28,3	94,9 43,1	158 71,5	231 105	410 186
10"	10,75 273	36,1 16,4	75,8 34,4	85,5 38,8	155 70,5	229 104	304 179	775 352
12"	12,75 323,8	57,5 26,1	111 50,4	125 56,6	190 86,1	306 139	593 269	1104 501
14"	14,0 355,6	76,0 34,5	156 70,9	173 78,6	220 100	355 161	804 365	
16"	16,0 406,4	98,2 44,6	197 89,5	220 100	319 145	427 194	1011 459	
18"	18,0 457,2	107 48,7	245 111	269 122	390 177	588 267	1317 598	
20"	20,0 508	136 61,6	302 137	319 145	496 225	736 334	1568 712	
24"	24,0 609,6	191 86,6	449 204	478 217	700 318	1361 618	2401 1090	

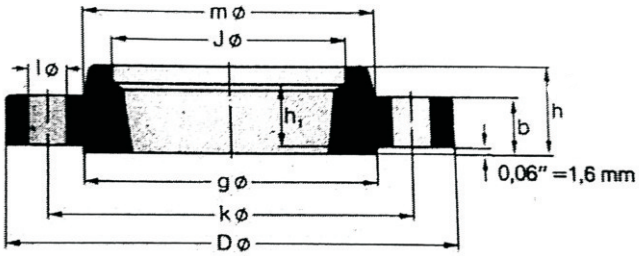
13.4 BLIND FLANGES



ANSI B 16.5

Pipe		150 lb/sq.in. Approx Weight ≈	300 lb/sq.in. Approx Weight ≈	400 lb/sq.in. Approx Weight ≈	600 lb/sq.in. Approx Weight ≈	900 lb/sq.in. Approx Weight ≈	1500 lb/sq.in. Approx Weight ≈	2500 lb/sq.in. Approx Weight ≈
Nom. Size	O. D. in. mm.	Pound Kilo	Pound Kilo	Pound Kilo	Pound Kilo	Pound Kilo	Pound Kilo	Pound Kilo
½"	0,84 21,3	0,9 0,42	1,4 0,64	use 600 lb dimensions for these sizes	1,7 0,76	Use 1500 lb dimensions for these sizes	3,9 1,77	6,6 2,99
3/4"	1,05 26,7	1,3 0,61	2,4 1,11		2,8 1,28		5,3 2,42	7,7 3,50
1"	1,315 33,4	1,9 0,86	3,1 1,39		3,5 1,60		7,9 3,57	10,9 4,96
1 1/4"	1,66 42,2	2,6 1,17	3,9 1,79		4,9 2,23		9,1 4,14	16,2 7,35
1 1/2"	1,90 48,3	3,4 1,53	5,9 2,66		7,2 3,25		12,7 5,75	22,9 10,4
2"	2,375 60,3	5,3 2,42	7,0 3,18		9,1 4,15		22,2 10,1	34,4 15,6
2 1/2"	2,875 73,0	8,7 3,92	10,7 4,85		13,5 6,13		30,8 14,0	49,8 22,6
3"	3,50 88,9	10,9 4,93	15,0 6,81		18,6 8,44	28,9 13,1	42,1 19,1	76,7 34,8
3 1/2"	4,00 101,6	13,6 6,17	19,2 8,71		24,2 11,0			
4"	4,50 114,3	15,4 7,00	25,3 11,5	30,2 13,7	38,1 17,3	59,3 26,9	65,9 29,9	119 53,9
5"	5,563 141,3	19,0 8,63	34,4 15,6	40,7 18,5	64,8 29,4	80,4 36,5	129 58,4	200 90,8
6"	6,625 168,3	24,9 11,3	46,0 20,9	56,2 25,5	79,5 36,1	104 47,4	158 71,8	311 141
8"	8,625 219,1	43,2 19,6	75,6 34,3	93,8 42,6	130 58,9	182 82,5	269 122	471 214
10"	10,75 273	63,4 28,8	117 53,3	142 64,5	215 97,5	269 122	463 210	905 411
12"	12,75 323,8	95,2 43,2	174 78,8	208 94,3	273 124	381 173	696 316	1304 592
14"	14,0 355,6	128 58,1	231 105	273 124	333 151	454 206	925 420	
16"	16,0 406,4	167 76,0	302 137	357 162	471 214	571 259	1229 558	
18"	18,0 457,2	206 93,7	386 175	452 205	599 272	808 367	1674 760	
20"	20,0 508	269 122	487 221	560 254	769 349	1020 463	2126 965	
24"	24,0 609,6	408 185	747 339	850 386	1174 533	1930 876	3432 1558	

13.5 THREADED FLANGES

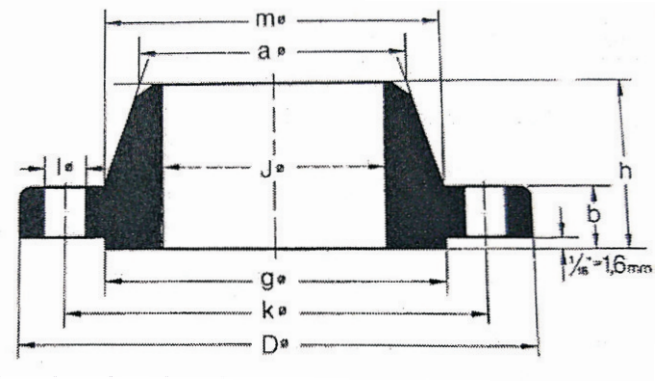


Thread type: Standard taper pipe thread to ANSI B 2.1

ANSI B 16.5

Pipe		150 lb/sq.in. Approx Weight ≈	300 lb/sq.in. Approx Weight ≈	400 lb/sq.in. Approx Weight ≈	600 lb/sq.in. Approx Weight ≈	900 lb/sq.in. Approx Weight ≈	1500 lb/sq.in. Approx Weight ≈	2500 lb/sq.in. Approx Weight ≈
Nom. Size	O. D. in. mm.	Pound Kilo	Pound Kilo	Pound Kilo	Pound Kilo	Pound Kilo	Pound Kilo	Pound Kilo
½"	0,84 21,3	0,9 0,39	1,4 0,64	use 600 lb dimensions for these sizes	1,6 0,74	Use 1500 lb dimensions for these sizes	3,8 1,74	6,5 2,95
3/4"	1,05 26,7	1,2 0,56	2,5 1,12		2,8 1,27		5,2 2,34	7,6 3,44
1"	1,315 33,4	1,7 0,78	3,0 1,36		3,3 1,52		7,6 3,44	10,6 4,82
1 1/4"	1,66 42,2	2,3 1,03	3,7 1,68		4,5 2,03		8,6 3,91	15,7 7,14
1 1/2"	1,90 48,3	2,9 1,32	5,5 2,49		6,5 2,96		11,8 5,36	22,0 10,0
2"	2,375 60,3	4,5 2,06	6,3 2,87		8,0 3,62		21,7 9,85	32,6 14,8
2 1/2"	2,875 73,0	7,2 3,28	9,5 4,32		11,6 5,28		30,2 13,7	47,4 21,5
3"	3,50 88,9	8,5 3,85	12,9 5,85		15,4 7,00	25,6 11,6	39,4 17,9	71,8 32,6
3 1/2"	4,00 101,6	10,6 4,81	16,2 7,34		19,5 8,84			
4"	4,50 114,3	11,7 5,30	21,2 9,61	24,4 11,1	31,9 14,5	43,4 19,7	61,2 27,8	117 52,9
5"	5,563 141,3	13,4 6,07	27,1 12,3	30,6 13,9	53,7 24,4	70,3 31,9	114 51,8	183 83,1
6"	6,625 168,3	16,4 7,45	34,4 15,6	40,3 18,3	63,2 28,7	90,5 41,1	134 61,0	282 128
8"	8,625 219,1	26,7 12,1	53,3 24,2	63,0 28,6	95,6 43,4	156 70,7	227 103	414 188
10"	10,75 273	36,3 16,5	75,1 34,1	86,3 39,2	155 70,3	223 101	386 175	782 355
12"	12,75 323,8	57,7 26,2	110 49,8	126 57,0	186 84,2	293 133	582 264	1110 504
14"	14,0 355,6	76,2 34,6	154 69,9	174 79,1	217 98,7	337 153		
16"	16,0 406,4	98,7 44,8	194 88,1	223 101	313 142	408 185		
18"	18,0 457,2	108 48,9	240 109	271 123	381 173	568 258		
20"	20,0 508	136 61,9	295 134	322 146	485 220	698 317		
24"	24,0 609,6	191 86,9	443 201	482 219	687 312	1335 606		

14. FLANGES B. S. 3293
14.1WELD NECK FLANGE B. S. 3293

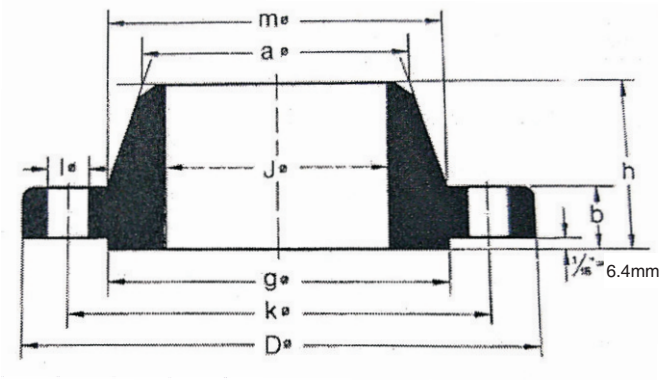


150 lb/sq. in. B. S. 3293

Pipe		Flange				Hub		Raised Face	Drilling Template			Approx Weight ≈ Pound Kilo
Nom. Size	O. D. in. mm.	D. in. mm.	J. in. mm.	b in. mm.	h in. mm.	a in. mm.	m in. mm.	g in. mm.	Num - ber	l in. mm.	k in. mm.	
26"	26,0 660,4	34 1/4 869,9	To be specified by purchaser	2 50,8	5 127,0	26 660,4	28 1/2 723,9	29 1/4 742,9	24	1 3/8 34,9	31 3/4 806,4	260 118
28"	28,0 711,2	36 1/2 927,1		2 1/16 52,4	5 1/16 128,6	28 711,2	30 3/4 781,0	31 1/4 793,7	28	1 3/8 34,9	34 863,6	295 134
30"	30,0 762	38 3/4 984,2		2 1/8 54,0	5 1/8 130,2	30 762,0	32 3/4 831,8	33 3/4 857,2	28	1 3/8 34,9	36 914,4	338 153
32"	32,0 812,8	41 3/4 1060,4		2 1/4 57,1	5 1/4 133,3	32 812,8	35 889,0	35 3/4 908,0	28	1 5/8 41,3	38 1/2 977,9	420 190
34"	34,0 863,6	43 3/4 1111,2		2 5/16 58,7	5 5/16 134,9	34 863,6	37 939,8	37 3/4 958,8	32	1 5/8 41,3	40 1/2 1028,7	468 212
36"	36,0 914,4	46 1168,4		2 3/8 60,3	5 3/8 136,5	36 914,4	39 1/4 996,9	40 1/4 1022,3	32	1 5/8 41,3	42 3/4 1085,8	534 242
38"	38,0 965,2	48 3/4 1238,2		2 3/8 60,3	5 3/8 136,5	38 965,2	41 3/4 1060,4	42 1/4 1073,1	32	1 5/8 41,3	45 1/4 1149,3	625 284
40"	40,0 1016,0	50 3/4 1289,0		2 1/2 63,5	5 1/2 139,7	40 1016,0	43 3/4 1111,2	44 1/4 1123,9	36	1 5/8 41,3	47 1/4 1200,1	685 311
42"	42,0 1066,8	53 1346,2		2 5/8 66,7	5 5/8 142,9	42 1066,8	46 1168,4	47 1193,8	36	1 5/8 41,3	49 1/2 1257,3	788 358
44"	44,0 1117,6	55 1/4 1403,3		2 5/8 66,7	5 5/8 142,9	44 1117,6	48 1219,2	49 1244,6	40	1 5/8 41,3	51 3/4 1314,4	830 376
46"	46,0 1168,4	57 1/4 1454,1		2 11/16 68,3	5 11/16 144,5	46 1168,4	50 1270,0	51 1295,4	40	1 5/8 41,3	53 3/4 1365,2	880 399
48"	48,0 1219,2	59 1/2 1511,1		2 3/4 69,8	5 3/4 146,0	48 1219,2	52 1/4 1327,1	53 1/2 1358,9	44	1 5/8 41,3	56 1422,4	970 440

300 lb/sq. in. B. S. 3293

Pipe		Flange				Hub		Raised Face	Drilling Template			Approx Weight ≈ Pound Kilo
Nom. Size	O. D. in. mm.	D. in. mm.	J. in. mm.	b in. mm.	h in. mm.	a in. mm.	m in. mm.	g in. mm.	Num - ber	l in. mm.	k in. mm.	
26"	26,0 660,4	38 1/4 971,5	To be specified by purchaser	3 1/8 79,4	7 1/4 184,1	26 1/4 666,7	28 3/8 720,7	29 1/2 749,3	28	1 3/4 44,4	34 1/2 876,3	615 279
28"	28,0 711,2	40 3/4 1035,0		3 3/8 85,7	7 3/4 196,8	28 1/4 717,5	30 1/2 774,7	31 1/2 800,1	28	1 3/4 44,4	37 939,8	750 340
30"	30,0 762	43 1092,2		3 5/8 92,1	8 1/4 209,5	30 1/4 768,3	32 9/16 827,1	33 3/4 857,2	28	1 7/8 47,6	39 1/4 996,9	858 390
32"	32,0 812,8	45 1/4 1149,3		3 7/8 98,4	8 3/4 222,2	32 1/4 819,1	34 11/16 881,1	36 914,4	28	2 50,8	41 1/2 1054,1	960 435
34"	34,0 863,6	47 1/2 1206,5		4 101,6	9 1/8 231,8	34 5/16 871,5	36 7/8 936,6	38 965,2	28	2 50,8	43 1/2 1104,9	1110 504
36"	36,0 914,4	50 1270,0		4 1/8 104,8	9 1/2 241,3	36 5/16 922,3	39 990,6	40 1/4 1022,3	32	2 1/8 54,0	46 1168,4	1233 560



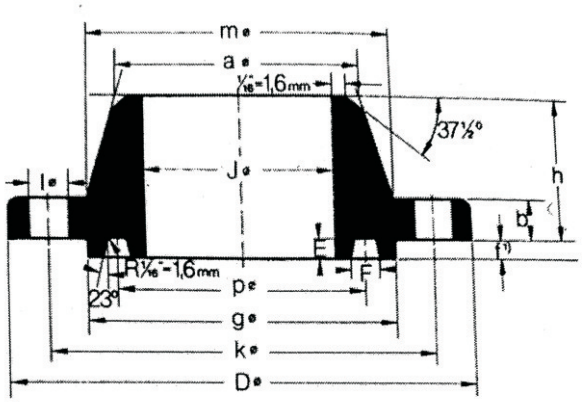
400 lb/sq. in. B. S. 3293

Pipe		Flange				Hub		Raised Face	Drilling Template			Approx Weight
Nom. Size	O. D. in. mm.	D. in. mm.	J. in. mm.	b in. mm.	h in. mm.	a in. mm.	m in. mm.	g in. mm.	Num - ber	l in. mm.	k in. mm.	≈ Pound Kilo
26"	26,0 660,4	38 1/4 971,5	To be specified by purchaser	3 1/2 88,9	7 5/8 193,7	26 5/16 668,3	28 5/8 727,1	29 1/2 749,3	28	1 7/8 47,6	34 1/2 876,3	750 340
28"	28,0 711,2	40 3/4 1035,0		3 3/4 95,2	8 1/8 206,4	26 5/16 719,1	30 13/16 782,6	31 1/2 800,1	28	2 50,8	37 939,8	880 399
30"	30,0 762	43 1092,2		4 101,6	8 5/8 219,1	30 5/16 769,9	32 15/16 836,6	33 3/4 857,2	28	2 1/8 54,0	39 1/4 996,9	1000 454
32"	32,0 812,8	45 1/4 1149,3		4 1/4 107,9	9 1/8 231,8	32 3/8 822,3	35 889,0	36 914,4	28	2 1/8 54,0	41 1/2 1054,1	1150 522
34"	34,0 863,6	47 1/2 1206,5		4 3/8 111,1	9 1/2 241,3	34 3/8 873,1	37 3/16 944,6	38 965,2	28	2 1/8 54,0	43 1/2 1104,9	1300 590
36"	36,0 914,4	50 1270,0		4 1/2 114,3	9 7/8 250,8	36 7/16 925,5	39 3/8 1000,1	40 1/4 1022,3	32	2 1/8 54,0	46 1168,4	1475 669

600 lb/sq. in. B. S. 3293

Pipe		Flange				Hub		Raised Face	Drilling Template			Approx Weight
Nom. Size	O. D. in. mm.	D. in. mm.	J. in. mm.	b in. mm.	h in. mm.	a in. mm.	m in. mm.	g in. mm.	Num - ber	l in. mm.	k in. mm.	≈ Pound Kilo
26"	26,0 660,4	40 1016,0	To be specified by purchaser	4 1/4 107,9	8 3/4 222,2	26 7/16 671,5	29 7/16 747,7	29 1/2 749,3	28	2 50,8	36 914,4	963 437
28"	28,0 711,2	42 1/4 1073,1		4 3/8 111,1	9 1/4 234,9	28 1/2 723,9	31 5/8 803,3	31 1/2 800,1	28	2 1/8 54,0	38 965,2	1120 508
30"	30,0 762	44 1/2 1130,3		4 1/2 114,3	9 3/4 247,6	30 1/2 774,7	33 15/16 862,0	33 3/4 857,2	28	2 1/8 54,0	40 1/4 1022,3	1232 559
32"	32,0 812,8	47 1193,8		4 5/8 117,5	10 1/4 260,3	32 1/2 825,5	36 1/8 917,6	36 914,4	28	2 3/8 60,3	42 1/2 1079,5	1500 680
34"	34,0 863,6	49 1244,6		4 3/4 120,6	10 5/8 269,9	34 9/16 877,9	38 5/16 973,1	38 965,2	28	2 3/8 60,3	44 1/2 1130,3	1580 717
36"	36,0 914,4	51 3/4 1314,4		4 7/8 123,8	11 1/8 282,6	36 9/16 928,7	40 5/8 1031,9	40 1/4 1022,3	28	2 5/8 66,7	47 1193,8	1719 780

14.2 WELD NECK FLANGES, RING JOINT TYPE B. S. 3293



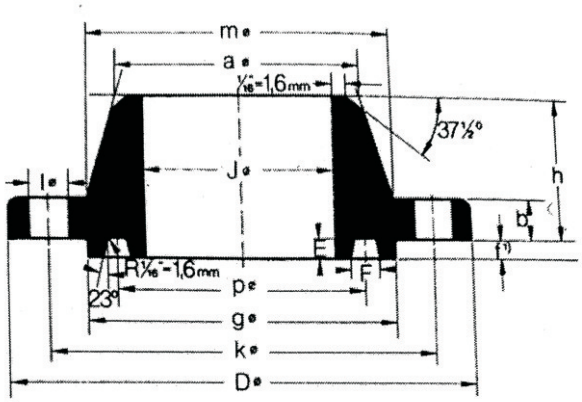
¹) f = Height of raised portion and depth of groove dimensions »E« but not covered by tolerances for »E«.

300 lb/sq. in. B. S. 3293

Pipe		Flange				Hub		Raised Face	Drilling Template			Ring Joint			Approx Weight
Nom. Size	O. D. in. mm.	D. in. mm.	J. in. mm.	b in. mm.	h in. mm.	a in. mm.	m in. mm.	g in. mm.	Num - ber	l in. mm.	k in. mm.	p in. mm.	E in. mm.	F in. mm.	≈ Pound Kilo
26"	26,0 660,4	38 1/4 971,5	To be specified by purchaser	3 1/8 79,4	7 1/4 184,1	26 1/4 666,7	28 3/8 720,7	31 7/8 809,6	28	1 3/4 44,4	34 1/2 876,3	29 1/2 749,3	1/2 12,7	25/ 32 19,8	657 298
28"	28,0 711,2	40 3/4 1035,0		3 3/8 85,7	7 3/4 196,8	28 1/4 717,5	30 1/2 774,7	33 7/8 860,4	28	1 3/4 44,4	37 939,8	31 1/2 800,1	1/2 12,7	25/ 32 19,8	794 360
30"	30,0 762	43 1092,2		3 5/8 92,1	8 1/4 209,5	30 1/4 768,3	32 9/16 827,1	36 1/8 917,6	28	1 7/8 47,6	39 1/4 996,9	33 3/4 857,2	1/2 12,7	25/ 32 19,8	908 412
32"	32,0 812,8	45 1/4 1149,3		3 7/8 98,4	8 3/4 222,2	32 1/4 819,1	34 11/16 881,1	38 3/4 984,2	28	2 50,8	41 1/2 1054,1	36 914,4	9/,16 14,3	29/ 32 23,0	1025 465
34"	34,0 863,6	47 1/2 1206,5		4 101,6	9 1/8 231,8	34 5/16 871,5	36 7/8 936,6	40 3/4 1035,0	28	2 50,8	43 1/2 1104,9	38 965,2	9/16 14,3	29/ 32 23,0	1182 536
36"	36,0 914,4	50 1270,0		4 1/8 104,8	9 1/2 241,3	36 5/16 922,3	39 990,6	43 1092,2	32	2 1/8 54,0	46 1168,4	40 1/4 1022,3	9/16 14,3	29/ 32 23,0	1312 595

400 lb/sq. in. B. S. 3293

Pipe		Flange				Hub		Raised Face	Drilling Template			Ring Joint			Approx Weight
Nom. Size	O. D. in. mm.	D. in. mm.	J. in. mm.	b in. mm.	h in. mm.	a in. mm.	m in. mm.	g in. mm.	Num - ber	l in. mm.	k in. mm.	p in. mm.	E in. mm.	F in. mm.	≈ Pound Kilo
26"	26,0 660,4	38 1/4 971,5	To be specified by purchaser	3 1/2 88,9	7 5/8 193,7	26 5/16 668,3	28 5/8 727,1	31 7/8 809,6	28	1 7/8 47,6	34 1/2 876,3	29 1/2 749,3	1/2 12,7	25/ 32 19,8	769 349
28"	28,0 711,2	40 3/4 1035,0		3 3/4 95,2	8 1/8 206,4	28 5/16 719,1	30 13/16 782,6	33 7/8 860,4	28	2 50,8	37 939,8	31 1/2 800,1	1/2 12,7	25/ 32 19,8	902 409
30"	30,0 762	43 1092,2		4 101,6	8 5/8 219,1	30 5/16 769,9	32 15/16 836,6	36 1/8 917,6	28	2 1/8 54,0	39 1/4 996,9	33 3/4 857,2	1/2 12,7	25/ 32 19,8	1025 465
32"	32,0 812,8	45 1/4 1149,3		4 1/4 107,9	9 1/8 231,8	32 3/8 822,3	35 889,0	38 3/4 984,2	28	2 1/8 54,0	41 1/2 1054,1	36 914,4	9/16 14,3	29/ 32 23,0	1188 539
34"	34,0 863,6	47 1/2 1206,5		4 3/8 111,1	9 1/2 241,3	34 3/8 873,1	37 3/16 944,6	40 3/4 1035,0	28	2 1/8 54,0	43 1/2 1104,9	38 965,2	9/16 14,3	29/ 32 23,0	1340 608
36"	36,0 914,4	50 1270,0		4 1/2 114,3	9 7/8 250,8	36 7/16 925,5	39 3/8 1000,1	43 1092,2	32	2 1/8 54,0	46 1168,4	40 1/4 1022,3	9/16 14,3	29/ 32 23,0	1520 689

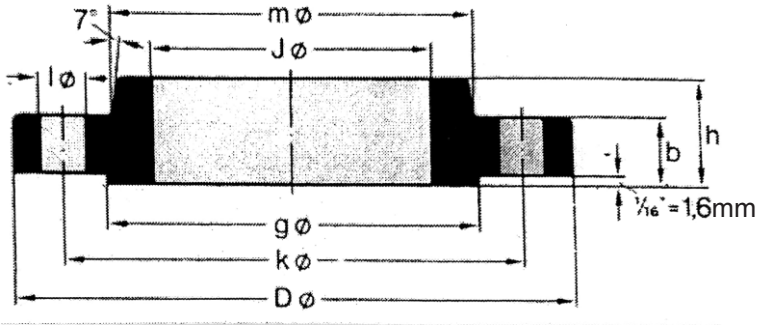


1) f = Height of raised portion and depth of groove dimensions »E« but not covered by tolerances for »E«.

600 lb/sq. in. B. S. 3293

Pipe		Flange				Hub		Raised Face	Drilling Template			Ring Joint			Approx Weight
Nom. Size	O. D. in. mm.	D. in. mm.	J. in. mm.	b in. mm.	h in. mm.	a in. mm.	m in. mm.	g in. mm.	Num - ber	l in. mm.	k in. mm.	p in. mm.	E in. mm.	F in. mm.	≈ Pound Kilo
26"	26,0 660,4	40 1016,0	To be specified by purchaser	4 1/4 107,9	8 3/4 222,2	26 7/16 671,5	29 7/16 747,7	31 7/8 809,6	28	2 50,8	36 914,4	29 1/2 749,3	1/2 12,7	25/ 32 19,8	983 446
28"	28,0 711,2	42 1/4 1073,1		4 3/8 111,1	9 1/4 234,9	28 1/2 723,9	31 5/8 803,3	33 7/8 860,4	28	2 1/8 54,0	38 965,2	31 1/2 800,1	1/2 12,7	25/ 32 19,8	1142 518
30"	30,0 762	44 1/2 1130,3		4 1/2 114,3	9 3/4 247,6	30 1/2 774,7	33 15/16 862,0	36 1/8 917,6	28	2 1/8 54,0	40 1/4 1022,3	33 3/4 857,2	1/2 12,7	25/ 32 19,8	1257 570
32"	32,0 812,8	47 1193,8		4 5/8 117,5	10 1/4 260,3	32 1/2 825,5	36 1/8 917,6	38 3/4 984,2	28	2 3/8 60,3	42 1/2 1079,5	36 914,4	9/16 14,3	29/ 32 23,0	1537 697
34"	34,0 863,6	49 1244,6		4 3/4 120,6	10 5/8 269,9	34 9/16 877,9	38 5/16 973,1	40 3/4 1035,0	28	2 3/8 60,3	44 1/2 1130,3	38 965,2	9/,16 14,3	29/ 32 23,0	1620 735
36"	36,0 914,4	51 3/4 1314,4		4 7/8 123,8	11 1/8 282,6	36 9/16 928,7	40 5/8 1031,9	43 1092,2	28	2 5/8 66,7	47 1193,8	40 1/4 1022,3	9/16 14,3	29/ 32 23,0	1764 800

14.3 SLIP-ON FLANGES, B.S. 3293

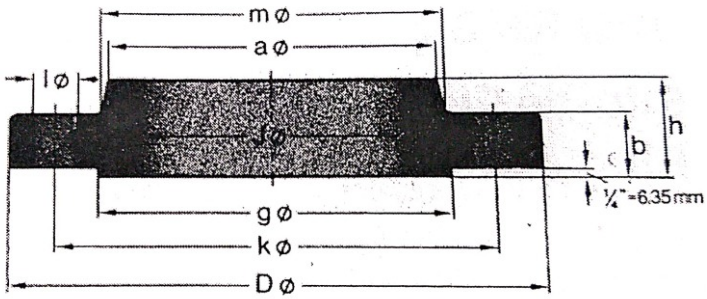


150 lb/sq. in. B. S. 3293

Pipe		Flange				Hub	Raised Face	Drilling Template			Approx Weight
Nom. Size	O. D. in. mm.	D. in. mm.	J. in. mm.	b in. mm.	h in. mm.	m in. mm.	g in. mm.	Num - ber	l in. mm.	k in. mm.	≈ Pound Kilo
26"	26,0 660,4	34 1/4 869,9	26 1/4 666,7	2 50,8	3 3/8 85,7	28 1/2 723,9	29 1/4 742,9	24	1 3/8 34,9	31 3/4 806,4	236 107
28"	28,0 711,2	36 1/2 927,1	28 1/4 717,6	2 1/16 52,4	3 7/16 87,3	30 3/4 781,0	31 1/4 793,7	28	1 3/8 34,9	34 863,6	270 122
30"	30,0 762	38 3/4 984,2	30 1/4 768,3	2 1/8 54,0	3 1/2 88,9	32 3/4 831,8	33 3/4 857,2	28	1 3/8 34,9	36 914,4	304 138
32"	32,0 812,8	41 3/4 1060,4	32 1/4 819,1	2 1/4 57,1	3 5/8 92,1	35 889,0	35 3/4 908,0	28	1 5/8 41,3	38 1/2 977,9	375 170
34"	34,0 863,6	43 3/4 1111,2	34 1/4 869,9	2 5/16 58,7	3 11/16 93,7	37 939,8	37 3/4 958,8	32	1 5/8 41,3	40 1/2 1028,7	405 184
36"	36,0 914,4	46 1168,4	36 1/4 920,7	2 3/8 60,3	3 3/4 95,2	39 1/4 996,9	40 1/4 1022,3	32	1 5/8 41,3	42 3/4 1085,8	464 211
38"	38,0 965,2	48 3/4 1238,2	38 1/4 971,5	2 3/8 60,3	3 3/4 95,2	41 3/4 1060,4	42 1/4 1073,1	32	1 5/8 41,3	45 1/4 1149,3	550 249
40"	40,0 1016,0	50 3/4 1289,0	40 1/4 1022,3	2 1/2 63,5	3 7/8 98,4	43 3/4 1111,2	44 1/4 1123,9	36	1 5/8 41,3	47 1/4 1200,1	600 272
42"	42,0 1066,8	53 1346,2	42 1/4 1073,1	2 5/8 66,7	4 101,6	46 1168,4	47 1193,8	36	1 5/8 41,3	49 1/2 1257,3	690 313
44"	44,0 1117,6	55 1/4 1403,3	44 1/4 1123,9	2 5/8 66,7	4 101,6	48 1219,2	49 1244,6	40	1 5/8 41,3	51 3/4 1314,4	730 331
46"	46,0 1168,4	57 1/4 1454,1	46 1/4 1174,7	2 11/16 68,3	4 1/16 103,2	50 1270,0	51 1295,4	40	1 5/8 41,3	53 3/4 1365,2	770 349
48"	48,0 1219,2	59 1/2 1511,1	48 1/4 1225,5	2 3/4 69,8	4 1/8 104,8	52 1/4 1327,1	53 1/2 1358,9	44	1 5/8 41,3	56 1422,4	840 381

300 lb/sq. in. B. S. 3293

Pipe		Flange				Hub		Raised Face	Drilling Template			Approx Weight
Nom. Size	O. D. in. mm.	D. in. mm.	J. in. mm.	b in. mm.	h in. mm.	a in. mm.	m in. mm.	g in. mm.	Num - ber	l in. mm.	k in. mm.	≈ Pound Kilo
26"	26,0 660,4	38 1/4 971,5	26 1/4 666,7	3 1/8 79,4	7 1/4 184,1	27 1/18 687,4	28 3/8 720,7	29 1/2 749,3	28	1 3/4 44,4	34 1/2 876,3	552 251
28"	28,0 711,2	40 3/4 1035,0	28 1/4 717,6	3 3/8 85,7	7 3/4 196,8	29 1/8 739,8	30 1/2 774,7	31 1/2 800,1	28	1 3/4 44,4	37 939,8	690 313
30"	30,0 762	43 1092,2	30 1/4 768,3	3 5/8 92,1	8 1/4 209,5	31 3/16 792,2	32 9/16 827,1	33 3/4 857,2	28	1 7/8 47,6	39 1/4 996,9	779 354
32"	32,0 812,8	45 1/4 1149,3	32 1/4 819,1	3 7/8 98,4	8 3/4 222,2	33 1/4 844,5	34 11/16 881,1	36 914,4	28	2 50,8	41 1/2 1054,1	870 395
34"	34,0 863,6	47 1/2 1206,5	34 1/4 869,9	4 101,6	9 1/8 231,8	35 5/16 896,9	36 7/8 936,6	38 965,2	28	2 50,8	43 1/2 1104,9	1014 460
36"	36,0 914,4	50 1270,0	36 1/4 920,7	4 1/8 104,8	9 1/2 241,3	37 3/8 949,3	39 990,6	40 1/4 1022,3	32	2 1/8 54,0	46 1168,4	1130 513



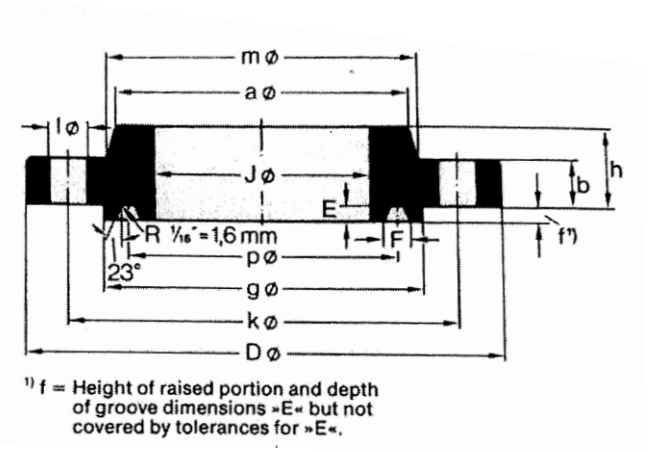
400 lb/sq. in. B. S. 3293

Pipe		Flange				Hub		Raised Face	Drilling Template			Approx Weight
Nom. Size	O. D. in. mm.	D. in. mm.	J. in. mm.	b in. mm.	h in. mm.	a in. mm.	m in. mm.	g in. mm.	Num - ber Anzahl	l in. mm.	k in. mm.	≈ Pound Kilo
26"	26,0 660,4	38 1/4 971,5	26 1/4 666,7	3 1/2 88,9	7 5/8 193,7	27 5/15 693,7	28 5/8 727,1	29 1/2 749,3	28	1 7/8 47,6	34 1/2 876,3	650 295
28"	28,0 711,2	40 3/4 1035,0	28 1/4 717,6	3 3/4 95,2	8 1/8 206,4	29 3/8 746,1	30 13/16 782,6	31 1/2 800,1	28	2 50,8	37 939,8	780 354
30"	30,0 762	43 1092,2	30 1/4 768,3	4 101,6	8 5/8 219,1	31 1/2 800,1	32 15/16 836,6	33 3/4 857,2	28	2 1/8 54,0	39 1/4 996,9	900 408
32"	32,0 812,8	45 1/4 1149,3	32 1/4 819,1	4 1/4 107,9	9 1/8 231,8	33 9/16 852,5	35 889,0	36 914,4	28	2 1/8 54,0	41 1/2 1054,1	1025 465
34"	34,0 863,6	47 1/2 1206,5	34 1/4 869,9	4 3/8 111,1	9 1/2 241,3	35 5/8 904,9	37 3/16 944,6	38 965,2	28	2 1/8 54,0	43 1/2 1104,9	1150 522
36"	36,0 914,4	50 1270,0	36 1/4 920,7	4 1/2 114,3	9 7/8 250,8	37 3/4 958,8	39 3/8 1000,1	40 1/4 1022,3	32	2 1/8 54,0	46 1168,4	1325 601

600 lb/sq. in. B. S. 3293

Pipe		Flange				Hub		Raised Face	Drilling Template			Approx Weight
Nom. Size	O. D. in. mm.	D. in. mm.	J. in. mm.	b in. mm.	h in. mm.	a in. mm.	m in. mm.	g in. mm.	Num - ber	l in. mm.	k in. mm.	≈ Pound Kilo
26"	26,0 660,4	40 1016,0	26 1/4 666,7	4 1/4 107,9	8 3/4 222,2	27 13/16 706,4	29 7/16 747,7	29 1/2 749,3	28	2 50,8	36 914,4	898 408
28"	28,0 711,2	42 1/4 1073,1	28 1/4 717,6	4 3/8 111,1	9 1/4 234,9	29 15/16 760,4	31 5/8 803,3	31 1/2 800,1	28	2 1/8 54,0	38 965,2	1040 472
30"	30,0 762	44 1/2 1130,3	30 1/4 768,3	4 1/2 114,3	9 3/4 247,6	32 1/16 814,4	33 15/16 862,0	33 3/4 857,2	28	2 1/8 54,0	40 1/4 1022,3	1158 526
32"	32,0 812,8	47 1193,8	32 1/4 819,1	4 5/8 117,5	10 1/4 260,3	34 3/16 868,4	36 1/8 917,6	36 914,4	28	2 3/8 60,3	42 1/2 1079,5	1335 605
34"	34,0 863,6	49 1244,6	34 1/4 869,9	4 3/4 120,6	10 5/8 269,9	36 5/16 922,3	38 5/16 973,1	38 965,2	28	2 3/8 60,3	44 1/2 1130,3	1436 652
36"	36,0 914,4	51 3/4 1314,4	36 1/4 920,7	4 7/8 123,8	11 1/8 282,6	38 7/16 976,3	40 5/8 1031,9	40 1/4 1022,3	28	2 5/8 66,7	47 1193,8	1638 744

14.4 SLIP-ON FLANGES RING JOINT TYPE B. S. 3293



¹) f = Height of raised portion and depth of groove dimensions »E« but not covered by tolerances for »E«.

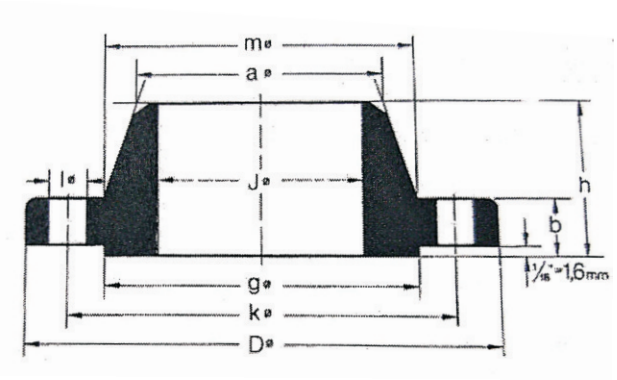
300 lb/sq. in. B. S. 3293

Pipe		Flange				Hub		Raised Face	Drilling Template			Ring Joint			Approx Weight
Nom. Size	O. D. in. mm.	D. in. mm.	J. in. mm.	b in. mm.	h in. mm.	a in. mm.	m in. mm.	g in. mm.	Num - ber	l in. mm.	k in. mm.	p in. mm.	E in. mm.	F in. mm.	≈ Pound Kilo
26"	26,0 660,4	38 1/4 971,5	26 1/4 666,7	3 1/8 79,4	7 1/4 184,1	27 1/16 687,4	28 3/8 720,7	31 7/8 809,6	28	1 3/4 44,4	34 1/2 876,3	29 1/2 749,3	1/2 12,7	25/ 32 19,8	595 270
28"	28,0 711,2	40 3/4 1035,0	28 1/4 717,6	3 3/8 85,7	7 3/4 196,8	29 1/8 739,8	30 1/2 774,7	33 7/8 860,4	28	1 3/4 44,4	37 939,8	31 1/2 800,1	1/2 12,7	25/ 32 19,8	734 333
30"	30,0 762	43 1092,2	30 1/4 768,3	3 5/8 92,1	8 1/4 209,5	31 3/16 792,2	32 9/16 827,1	36 1/8 917,6	28	1 7/8 47,6	39 1/4 996,9	33 3/4 857,2	1/2 12,7	25/ 32 19,8	829 376
32"	32,0 812,8	45 1/4 1149,3	32 1/4 819,1	3 7/8 98,4	8 3/4 222,2	33 1/4 844,5	34 11/16 881,1	38 3/4 984,2	28	2 50,8	41 1/2 1054,1	36 914,4	9/,16 14,3	29/ 32 23,0	937 425
34"	34,0 863,6	47 1/2 1206,5	34 1/4 869,9	4 101,6	9 1/8 231,8	35 5/16 896,9	36 7/8 936,6	40 3/4 1035,0	28	2 50,8	43 1/2 1104,9	38 965,2	9/16 14,3	29/ 32 23,0	1085 492
36"	36,0 914,4	50 1270,0	36 1/4 920,7	4 1/8 104,8	9 1/2 241,3	37 3/8 949,3	39 990,6	43 1092,2	32	2 1/8 54,0	46 1168,4	40 1/4 1022,3	9/16 14,3	29/ 32 23,0	1208 548

400 lb/sq. in. B. S. 3293

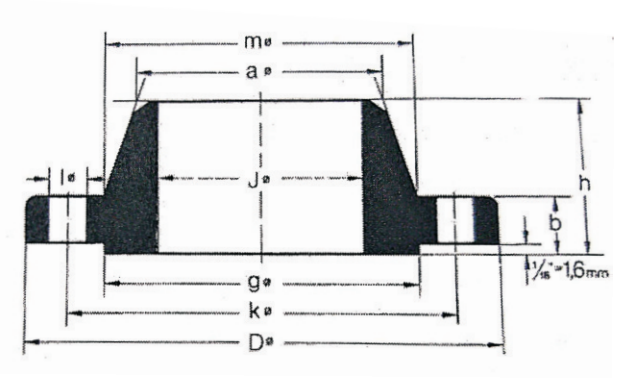
Pipe		Flange				Hub		Raised Face	Drilling Template			Ring Joint			Approx Weight
Nom. Size	O. D. in. mm.	D. in. mm.	J. in. mm.	b in. mm.	h in. mm.	a in. mm.	m in. mm.	g in. mm.	Num - ber	l in. mm.	k in. mm.	p in. mm.	E in. mm.	F in. mm.	≈ Pound Kilo
26"	26,0 660,4	38 1/4 971,5	26 1/4 666,7	3 1/2 88,9	7 5/8 193,7	27 5/16 693,7	28 5/8 727,1	31 7/8 809,6	28	1 7/8 47,6	34 1/2 876,3	29 1/2 749,3	1/2 12,7	25/ 32 19,8	670 304
28"	28,0 711,2	40 3/4 1035,0	28 1/4 717,6	3 3/4 95,2	8 1/8 206,4	29 3/8 746,1	30 13/16 782,6	33 7/8 860,4	28	2 50,8	37 939,8	31 1/2 800,1	1/2 12,7	25/ 32 19,8	802 364
30"	30,0 762	43 1092,2	30 1/4 768,3	4 101,6	8 5/8 219,1	31 1/2 800,1	32 15/16 836,6	36 1/8 917,6	28	2 1/8 54,0	39 1/4 996,9	33 3/4 857,2	1/2 12,7	25/ 32 19,8	924 419
32"	32,0 812,8	45 1/4 1149,3	32 1/4 819,1	4 1/4 107,9	9 1/8 231,8	33 9/16 852,5	35 889,0	38 3/4 984,2	28	2 1/8 54,0	41 1/2 1054,1	36 914,4	9/16 14,3	29/ 32 23,0	1063 482
34"	34,0 863,6	47 1/2 1206,5	34 1/4 869,9	4 3/8 111,1	9 1/2 241,3	35 5/8 904,9	37 3/16 944,6	40 3/4 1035,0	28	2 1/8 54,0	43 1/2 1104,9	38 965,2	9/16 14,3	29/ 32 23,0	1190 540
36"	36,0 914,4	50 1270,0	36 1/4 920,7	4 1/2 114,3	9 7/8 250,8	37 3/4 958,8	39 3/8 1000,1	43 1092,2	32	2 1/8 54,0	46 1168,4	40 1/4 1022,3	9/16 14,3	29/ 32 23,0	1369 621

15. FLANGES MSS SP-44
15.1 WELD NECK FLANGES MSS SP-44



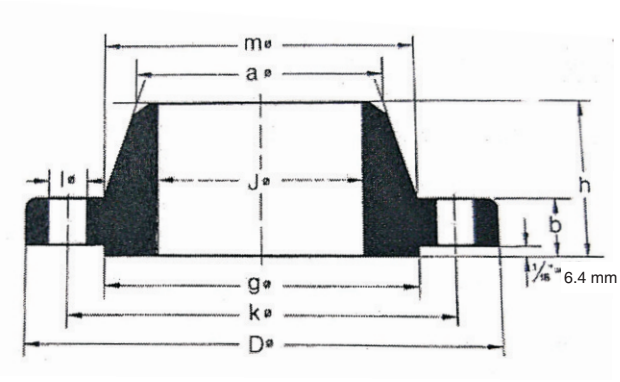
150 lb/sq. in. MSS SP-44

Pipe		Flange				Hub		Raised Face	Drilling Template			Approx Weight ≈ Pound Kilo
Nom. Size	O. D. in. mm.	D. in. mm.	J. in. mm.	b in. mm.	h in. mm.	a in. mm.	m in. mm.	g in. mm.	Num - ber	l in. mm.	k in. mm.	
26"	26,0 660,4	34 1/4 869,9	To be specified by purchaser	2 11/16 68,3	4 3/4 120,6	To be specified by purchaser	26 5/8 676,3	29 1/2 749,3	24	1 3/8 34,9	31 3/4 806,4	Wts. On Application
28"	28,0 711,2	36 1/2 927,1		2 11/16 71,4	4 15/16 125,4		28 5/8 727,1	31 1/2 800,1	28	1 3/8 34,9	34 863,6	
30"	30,0 762	38 1/4 984,2		2 15/16 74,6	5 3/8 136,5		30 3/4 781,0	33 3/4 857,2	28	1 3/8 34,9	36 914,4	
32"	32,0 812,8	41 3/4 1060,4		3 3/16 81,0	5 11/16 144,5		32 3/4 831,8	36 914,4	28	1 5/8 41,3	38 1/2 977,9	
34"	34,0 863,6	43 1/4 1111,2		3 1/4 82,5	5 7/8 149,2		34 3/4 882,6	38 965,2	32	1 5/8 41,3	40 1/2 1028,7	
36"	36,0 914,4	46 1168,4		3 9/16 90,5	6 3/16 157,2		36 3/4 933,4	40 1/4 1022,3	32	1 5/8 41,3	42 3/4 1085,8	
38"	38,0 965,2	48 3/4 1238,2		3 7/16 87,3	6 3/16 157,1		39 990,6	42 1/4 1073,1	32	1 5/8 41,3	45 1/4 1149,3	
40"	40,0 1016,0	50 3/4 1289,0		3 9/16 90,5	6 7/16 163,5		41 1041,4	44 1/4 1123,9	36	1 5/8 41,3	47 1/4 1200,1	
42"	42,0 1066,8	53 1346,2		3 13/16 96,8	6 3/4 171,4		43 1092,2	47 1193,8	36	1 5/8 41,3	49 1/2 1257,3	
44"	44,0 1117,6	55 1/4 1403,3		4 101,6	7 177,8		45 1143,0	49 1244,6	40	1 5/8 41,3	51 3/4 1314,4	
46"	46,0 1168,4	57 1/4 1454,1		4 1/16 103,1	7 5/16 185,7		47 1/8 1196,9	51 1295,4	40	1 5/8 41,3	53 3/4 1365,2	
48"	48,0 1219,2	59 1/2 1511,3		4 1/4 107,9	7 9/16 192,0		49 1/8 1247,6	53 1/2 1358,9	44	1 5/8 41,3	56 1422,4	
50"	50,0 1270,0	61 3/4 1568,4		4 3/8 111,1	8 203,2		51 1/4 1301,7	55 1/2 1409,7	44	1 7/8 47,7	58 1/4 1479,5	
52"	52,0 1320,8	64 1625,6		4 9/16 115,8	8 1/4 209,5		53 1/4 1352,5	57 1/2 1460,5	44	1 7/8 47,7	60 1/2 1536,7	
54"	54,0 1371,6	66 1/4 1682,7		4 3/4 120,6	8 1/2 215,9		55 1/4 1403,3	59 1/2 1511,3	44	1 7/8 47,7	62 3/4 1593,8	
56"	56,0 1422,4	68 3/4 1746,2		4 7/8 123,8	9 228,6		57 3/8 1457,4	62 1574,8	48	1 7/8 47,7	65 1651,0	
58"	58,0 1473,2	71 1803,4		5 1/16 128,5	9 1/4 234,9		59 3/8 1508,2	64 1625,6	48	1 7/8 47,7	67 1/4 1708,1	
60"	60,0 1524,0	73 1854,2		5 3/16 131,7	9 7/16 239,7		61 3/8 1559,0	66 1676,4	52	1 7/8 47,7	69 1/4 1758,9	



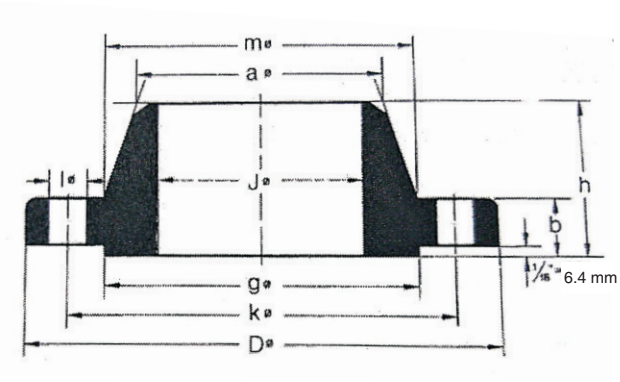
300 lb/sq. in. MSS SP-44

Pipe		Flange				Hub		Raised Face	Drilling Template			Approx Weight ≈ Pound Kilo
Nom. Size	O. D. in. mm.	D. in. mm.	J. in. mm.	b in. mm.	h in. mm.	a in. mm.	m in. mm.	g in. mm.	Num - ber	l in. mm.	k in. mm.	
26"	26,0 660,4	38 1/4 971,5	To be specified by purchaser	3 1/8 79,4	7 1/4 184,1	To be specified by purchaser	28 3/8 720,7	29 1/2 749,3	28	1 3/4 44,4	34 1/2 876,3	Wts. On Application
28"	28,0 711,2	40 3/4 1035,0		3 1/8 85,7	7 3/4 196,8		30 1/2 774,7	31 1/2 800,1	28	1 3/4 44,4	37 939,8	
30"	30,0 762	43 1092,2		3 5/8 92,1	8 1/4 209,5		32 9/16 827,1	33 3/4 857,2	28	1 7/8 47,6	39 1/4 996,9	
32"	32,0 812,8	45 1/4 1149,3		3 7/8 98,4	8 3/4 222,2		34 11/16 881,1	36 914,4	28	2 50,8	41 1/2 1054,1	
34"	34,0 863,6	47 1/2 1206,5		4 101,6	9 1/8 231,8		36 7/8 936,6	38 965,2	28	2 50,8	43 1/2 1104,9	
36"	36,0 914,4	50 1270,0		4 1/8 104,8	9 1/2 241,3		39 990,6	40 1/4 1022,3	32	2 1/8 54	46 1168,4	
38"	38,0 965,2	46 1168,4		4 1/4 107,9	7 1/8 180,9		39 1/8 993,7	40 1/2 1028,7	32	1 5/8 41,2	43 1092,2	
40"	40,0 1016,0	48 3/4 1238,2		4 1/2 114,3	7 5/8 193,6		41 1/4 1047,7	42 3/4 1085,8	32	1 3/4 44,4	45 1/2 1155,7	
42"	42,0 1066,8	50 3/4 1289,0		4 11/16 119,1	7 7/8 200,1		43 1/4 1098,5	44 3/4 1136,6	32	1 3/4 44,4	47 1/2 1206,5	
44"	44,0 1117,6	53 1/4 1352,5		4 7/8 123,9	8 1/6 206,3		45 1/4 1149,3	47 1193,8	32	1 7/8 47,6	49 3/4 1263,6	
46"	46,0 1168,4	55 3/4 1416,0		5 1/16 128,5	8 1/2 215,9		47 3/8 1203,4	49 1244,6	28	2 50,8	52 1320,8	
48"	48,0 1219,2	57 3/4 1466,8		5 1/4 133,4	8 13/16 223,8		49 3/8 1254,1	51 1/4 1301,7	32	2 50,8	54 1371,6	
50"	50,0 1270,0	60 1/4 1530,3		5 1/2 139,7	9 1/16 231,7		51 3/8 1304,9	53 1/2 1358,9	32	2 1/8 53,9	56 1/4 1428,7	
52"	52,0 1320,8	62 1/4 1581,1		5 11/16 144,5	9 3/8 238,1		53 3/8 1355,7	55 1/2 1409,7	32	2 1/8 53,9	58 1/4 1479,5	
54"	54,0 1371,6	65 1/4 1657,3		6 152,4	9 15/16 252,4		55 1/2 1409,7	57 3/4 1466,8	28	2 3/8 60,3	61 1549,4	
56"	56,0 1422,4	67 1/4 1708,1		6 1/16 153,9	10 1/4 260,3		57 5/8 1463,6	59 3/4 1517,6	28	2 3/8 60,3	63 1600,2	
58"	58,0 1473,2	69 1/4 1758,9		6 1/4 158,7	10 1/2 266,7		59 5/8 1514,4	62 1574,8	32	2 3/8 60,3	65 1651,0	
60"	60,0 1524,0	71 1/4 1809,7		6 7/16 163,5	10 3/4 273,0		61 5/8 1565,2	64 1625,6	32	2 3/8 60,3	67 1701,8	



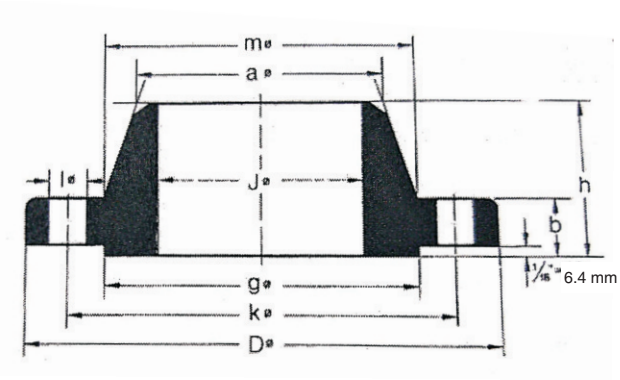
400 lb/sq. in. MSS SP-44

Pipe		Flange				Hub		Raised Face	Drilling Template			Approx Weight ≈ Pound Kilo
Nom. Size	O. D. in. mm.	D. in. mm.	J. in. mm.	b in. mm.	h in. mm.	a in. mm.	m in. mm.	g in. mm.	Num - ber	l in. mm.	k in. mm.	
26"	26,0 660,4	38 1/4 971,5	To be specified by purchaser	3 1/2 88,9	7 5/8 193,7	To be specified by purchaser	28 5/8 727,1	29 1/2 749,3	28	1 7/8 47,6	34 1/2 876,3	Wts. On Application
28"	28,0 711,2	40 1/4 1035,0		3 3/4 95,2	8 1/8 206,4		30 13/16 782,6	31 1/2 800,1	28	2 50,8	37 939,8	
30"	30,0 762	43 1092,2		4 101,6	8 5/8 219,1		32 15/16 836,6	33 1/4 857,2	28	2 1/8 54,0	39 1/4 996,9	
32"	32,0 812,8	45 1/4 1149,3		4 1/4 107,9	9 1/8 231,8		35 889,0	36 914,4	28	2 1/8 54,0	41 1/2 1054,1	
34"	34,0 863,6	47 1/2 1206,5		4 3/8 111,1	9 1/2 241,3		37 3/16 944,6	38 965,2	28	2 1/8 54,0	43 1/2 1104,9	
36"	36,0 914,4	50 1270,0		4 1/2 114,3	9 7/8 250,8		39 1/8 1000,1	40 1/4 1022,3	32	2 1/8 54,0	46 1168,4	
38"	38,0 965,2	47 1/2 1206,5		4 7/8 123,8	8 1/8 206,3		39 1/2 1003,3	40 3/4 1035,0	32	1 7/8 47,6	44 1117,6	
40"	40,0 1016,0	50 1270,0		5 1/8 130,1	8 1/2 215,9		41 1/2 1054,1	43 1092,2	32	2 50,8	46 1/4 1174,7	
42"	42,0 1066,8	52 1320,8		5 1/4 133,3	8 13/16 223,8		43 5/8 1108,0	45 1143,0	32	2 50,8	48 1/4 1225,5	
44"	44,0 1117,6	54 1/2 1384,3		5 1/2 139,7	9 3/16 233,3		45 5/8 1158,8	47 1/4 1200,1	32	2 1/8 53,9	50 1/2 1282,7	
46"	46,0 1168,4	56 3/4 1441,4		5 3/4 146,0	9 5/8 244,0		47 3/4 1212,8	49 1/2 1257,3	36	2 1/8 53,9	52 3/4 1339,8	
48"	48,0 1219,2	59 1/2 1511,3		6 152,4	10 1/8 257,1		49 7/8 1266,8	51 1/2 1308,1	28	2 3/8 60,3	55 1/4 1403,3	
50"	50,0 1270,0	61 3/4 1568,4		6 3/16 157,2	10 9/16 268,2		52 1320,8	53 5/8 1362,0	32	2 3/8 60,3	57 1/2 1460,5	
52"	52,0 1320,8	63 3/4 1619, 2		6 3/8 161,9	10 7/8 276,2		54 1371,6	55 5/8 1412,8	32	2 3/8 60,3	59 1/2 1511,3	
54"	54,0 1371,6	67 1701,8		6 11/18 169,9	11 3/8 288,9		56 1/8 1425,5	57 7/8 1470,0	28	2 5/8 66,6	62 1/4 1581,1	
56"	56,0 1422,4	69 1752,6		6 7/8 174,6	11 3/4 298,4		58 1/4 1479,5	60 1/8 1527,1	32	2 5/8 66,6	64 1/4 1631,9	
58"	58,0 1473,2	71 1803,4		7 177,8	12 1/16 306,3		60 1/4 1530,3	62 1/8 1577,9	32	2 5/8 66,6	66 1/4 1682,7	
60"	60,0 1524,0	74 1/4 1885,9		7 5/16 185,7	12 9/16 319,0		62 3/8 1584,3	64 3/8 1635,1	32	2 7/8 73,0	69 1752,6	



600 lb/sq. in. MSS SP-44

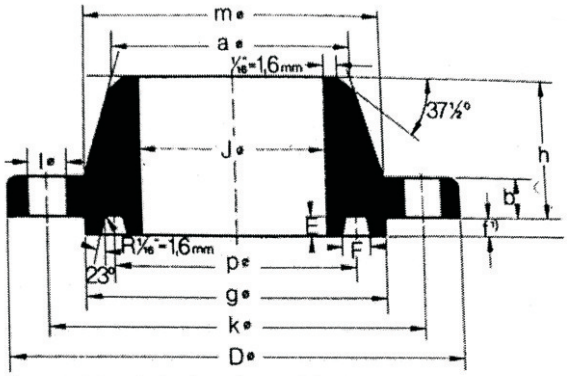
Pipe		Flange				Hub		Raised Face	Drilling Template			Approx Weight
Nom. Size	O. D. in. mm.	D. in. mm.	J. in. mm.	b in. mm.	h in. mm.	a in. mm.	m in. mm.	g in. mm.	Num - ber	l in. mm.	k in. mm.	≈ Pound Kilo
26"	26,0 660,4	40 1016,0	To be specified by purchaser	4 1/4 107,9	8 3/4 222,2	To be specified by purchaser	29 7/16 747,7	29 1/2 749,3	28	2 50,8	36 914,4	Wts. On Application
28"	28,0 711,2	42 1/4 1073,1		4 3/8 111,1	9 1/4 234,9		31 5/8 803,3	31 1/2 800,1	28	2 1/8 54,0	38 965,2	
30"	30,0 762	44 1/2 1130,3		4 1/2 114,3	9 3/4 247,6		33 15/16 862,0	33 3/4 857,2	28	2 1/8 54,0	40 1/4 1022,3	
32"	32,0 812,8	47 1193,8		4 5/8 117,5	10 1/4 260,3		36 1/8 917,6	36 914,4	28	2 3/8 60,3	42 1/2 1079,5	
34"	34,0 863,6	49 1244,6		4 3/4 120,6	10 5/8 269,9		38 5/16 973,1	38 965,2	28	2 3/8 60,3	44 1/2 1130,3	
36"	36,0 914,4	51 3/4 1314,4		4 7/8 123,8	11 1/8 282,6		40 5/8 1031,9	40 1/4 1022,3	28	2 5/8 66,7	47 1193,8	
38"	38,0 965,2	50 1270,0		6 152,4	10 254,0		40 1/4 1022,3	41 1/2 1054,1	28	2 3/8 60,3	45 3/4 1162,0	
40"	40,0 1016,0	52 1320,8		6 1/4 158,7	10 3/8 263,5		42 1/4 1073,1	43 3/4 1111,2	32	2 3/8 60,3	47 3/4 1212,8	
42"	42,0 1066,8	55 1/4 1403,3		6 5/8 168,2	11 279,4		44 3/8 1127,1	46 1168,4	28	2 5/8 66,7	50 1/2 1282,7	
44"	44,0 1117,6	57 1/4 1554,1		6 13/16 173,0	11 3/8 288,9		46 1/2 1181,1	48 1/4 1225,5	32	2 5/8 66,7	52 1/2 1333,5	
46"	46,0 1168,4	59 1/2 1511,3		7 1/16 179,3	11 13/16 300,0		48 5/8 1235,1	50 1/4 1276,3	32	2 5/8 66,7	54 3/4 1390,6	
48"	48,0 1219,2	62 3/4 1593,8		7 7/16 188,9	12 7/16 315,9		50 3/4 1289,0	52 1/2 1333,5	32	2 7/8 73,0	57 1/2 1460,5	
50"	50,0 1270,0	65 3/4 1670,0		7 3/4 196,8	12 15/16 328,6		50 7/8 1292,2	54 1/2 1384,3	28	3 1/8 79,3	60 1524,0	
52"	52,0 1320,8	67 3/4 1720,8		8 203,2	13 1/4 336,5		54 7/8 1393,8	56 1/2 1435,1	32	3 1/8 79,3	62 1574,8	
54"	54,0 1371,6	70 1778,0		8 1/4 209,5	13 3/4 349,2		57 1447,8	58 3/4 1492,2	32	3 1/8 79,3	64 1/4 1631,9	
56"	56,0 1422,4	73 1854,2		8 9/16 217,4	14 1/4 361,9		59 1/8 1501,7	60 3/4 1543,0	32	3 3/8 85,7	66 3/4 1695,4	
58"	58,0 1473,2	75 1905,0		8 3/4 222,2	14 9/16 369,8		61 1/8 1552,5	63 1600,2	32	3 3/8 85,7	68 3/4 1746,2	
60"	60,0 1524,0	78 1/2 1993,9		9 3/16 233,4	15 5/16 388,9		63 3/8 1609,7	65 1/4 1657,3	28	3 5/8 92,0	71 3/4 1822,4	



900 lb/sq. in. MSS SP-44

Pipe		Flange				Hub		Raised Face	Drilling Template			Approx Weight
Nom. Size	O. D. in. mm.	D. in. mm.	J. in. mm.	b in. mm.	h in. mm.	a in. mm.	m in. mm.	g in. mm.	Num - ber	l in. mm.	k in. mm.	≈ Pound Kilo
26"	26,0 660,4	42 3/4 1085,8	To be specified by purchaser	5 1/2 139,7	11 1/4 285,7	To be specified by purchaser	30 1/2 774,4	29 1/2 749,3	20	2 7/8 73,0	37 1/2 952,5	Wts. On Application
28"	28,0 711,2	46 1168,4		5 5/8 142,9	11 3/4 298,4		32 3/4 831,8	31 1/2 800,1	20	3 1/8 79,4	40 1/4 1022,3	
30"	30,0 762	48 1/2 1231,9		5 7/8 149,2	12 1/4 311,1		35 889,0	33 3/4 857,2	20	3 1/8 79,4	42 3/4 1085,8	
32"	32,0 812,8	51 3/4 1314,4		6 1/4 158,7	13 330,2		37 1/4 946,1	36 914,4	20	3 3/8 85,7	45 1/2 1155,7	
34"	34,0 863,6	55 1397,0		6 1/2 165,1	13 3/4 349,2		39 5/8 1006,5	38 965,2	20	3 5/8 92,1	48 1/4 1225,5	
36"	36,0 914,4	57 1/2 1460,5		6 3/4 171,4	14 1/4 361,9		41 7/8 1063,6	40 1/4 1022,3	20	3 5/8 92,1	50 3/4 1289,0	
38"	38,0 965,2	57 1/2 1460,5		7 1/2 190,5	13 7/8 352,4		42 1/4 1073,1	43 1/4 1098,5	20	3 5/8 92,1	50 3/4 1289,0	
40"	40,0 1016,0	59 1/2 1511,3		7 3/4 196,8	14 5/16 363,5		44 3/8 1127,1	45 3/4 1162,0	24	3 5/8 92,1	52 3/4 1339,8	
42"	42,0 1066,8	61 1/2 1562,1		8 1/8 206,3	14 5/8 371,4		46 5/16 1176,3	47 3/4 1212,8	24	3 5/8 92,1	54 3/4 1390,6	
44"	44,0 1117,6	64 7/8 1647,8		8 7/16 214,3	15 3/8 390,5		48 5/8 1235,0	50 1270,0	24	3 7/8 98,4	57 5/8 1463,6	
46"	46,0 1168,4	68 1/4 1733,5		8 7/8 225,4	16 3/16 411,1		50 7/8 1292,2	52 1/2 1333,5	24	4 1/8 104,7	60 1/2 1536,7	
48"	48,0 1219,2	70 1/4 1784,3		9 3/16 233,4	16 1/2 419,1		52 7/8 1343,0	54 1/2 1384,3	24	4 1/8 104,7	62 1/3 1587,5	

15.2 WELD NECK FLANGES, RING JOINT TYPE MSS SP-44



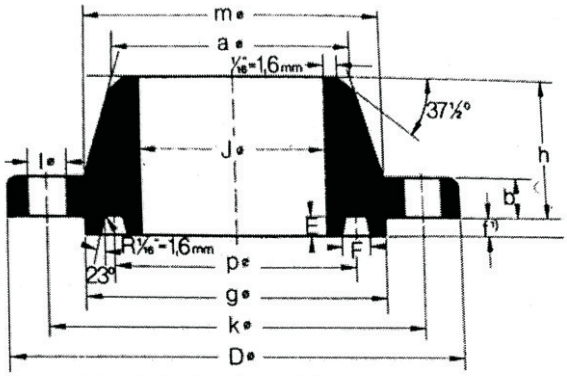
[1] f = Height of raised portion and depth of groove dimensions »E« but not covered by tolerances for »E«.

300 lb/sq. in. MSS SP-44

Pipe		Flange				Hub		Raised Face	Drilling Template			Ring Joint			Approx Weight
Nom. Size	O. D. in. mm.	D. in. mm.	J. in. mm.	b in. mm.	h in. mm.	a in. mm.	m in. mm.	g in. mm.	Num - ber	l in. mm.	k in. mm.	p in. mm.	E in. mm.	F in. mm.	≈ Pound Kilo
26"	26,0 660,4	38 1/4 971,5	To be specified by purchaser	3 1/8 79,4	7 1/4 184,1	To be specified by purchaser	28 3/8 720,7	31 7/8 809,6	28	1 3/4 44,4	34 1/2 876,3	29 1/2 749,3	1/2 12,7	25/ 32 19,8	To be specified by purchaser
28"	28,0 711,2	40 3/4 1035,0		3 3/8 85,7	7 3/4 196,8		30 1/2 774,7	33 7/8 860,4	28	1 3/4 44,4	37 939,8	31 1/2 800,1	1/2 12,7	25/ 32 19,8	
30"	30,0 762	43 1092,2		3 5/8 92,1	8 1/4 209,5		32 9/16 827,1	36 1/8 917,6	28	1 7/8 47,6	39 1/4 996,9	33 3/4 857,2	1/2 12,7	25/ 32 19,8	
32"	32,0 812,8	45 1/4 1149,3		3 7/8 98,4	8 3/4 222,2		34 11/16 881,1	38 3/4 984,2	28	2 50,8	41 1/2 1054,1	36 914,4	9/,16 14,3	29/ 32 23,0	
34"	34,0 863,6	47 1/2 1206,5		4 101,6	9 1/8 231,8		36 7/8 936,6	40 3/4 1035,0	28	2 50,8	43 1/2 1104,9	38 965,2	9/16 14,3	29/ 32 23,0	
36"	36,0 914,4	50 1270,0		4 1/8 104,8	9 1/2 241,3		39 990,6	43 1092,2	32	2 1/8 54,0	46 1168,4	40 1/4 1022,3	9/16 14,3	29/ 32 23,0	

400 lb/sq. in. MSS SP-44

Pipe		Flange				Hub		Raised Face	Drilling Template			Ring Joint			Approx Weight
Nom. Size	O. D. in. mm.	D. in. mm.	J. in. mm.	b in. mm.	h in. mm.	a in. mm.	m in. mm.	g in. mm.	Num - ber	l in. mm.	k in. mm.	p in. mm.	E in. mm.	F in. mm.	≈ Pound Kilo
26"	26,0 660,4	38 1/4 971,5	To be specified by purchaser	3 1/2 88,9	7 5/8 193,7	To be specified by purchaser	28 5/8 727,1	31 7/8 809,6	28	1 7/8 47,6	34 1/2 876,3	29 1/2 749,3	1/2 12,7	25/ 32 19,8	To be specified by purchaser
28"	28,0 711,2	40 3/4 1035,0		3 3/4 95,2	8 1/8 206,4		30 13/16 782,6	33 7/8 860,4	28	2 50,8	37 939,8	31 1/2 800,1	1/2 12,7	25/ 32 19,8	
30"	30,0 762	43 1092,2		4 101,6	8 5/8 219,1		32 15/16 836,6	36 1/8 917,6	28	2 1/8 54,0	39 1/4 996,9	33 3/4 857,2	1/2 12,7	25/ 32 19,8	
32"	32,0 812,8	45 1/4 1149,3		4 1/4 107,9	9 1/8 231,8		35 889,0	38 3/4 984,2	28	2 1/8 54,0	41 1/2 1054,1	36 914,4	9/16 14,3	29/ 32 23,0	
34"	34,0 863,6	47 1/2 1206,5		4 3/8 111,1	9 1/2 241,3		37 3/16 944,6	40 3/4 1035,0	28	2 1/8 54,0	43 1/2 1104,9	38 965,2	9/16 14,3	29/ 32 23,0	
36"	36,0 914,4	50 1270,0		4 1/2 114,3	9 7/8 250,8		39 3/8 1000,1	43 1092,2	32	2 1/8 54,0	46 1168,4	40 1/4 1022,3	9/16 14,3	29/ 32 23,0	



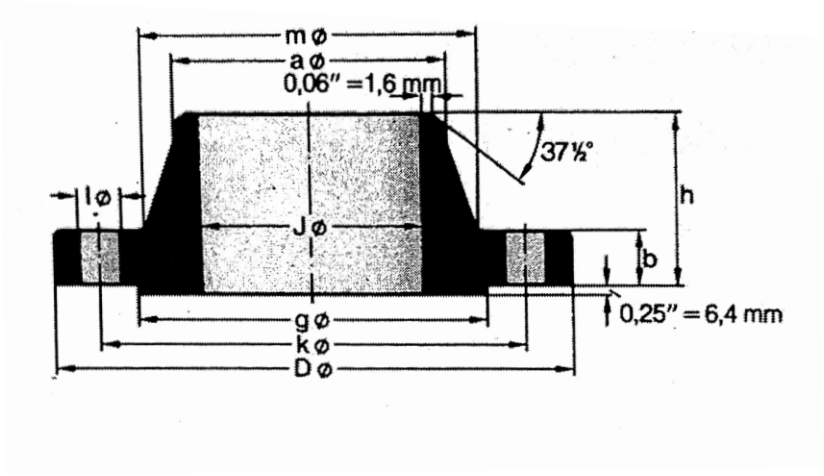
600 lb/sq. in.MSS SP-44

Pipe		Flange				Hub		Raised Face	Drilling Template			Ring Joint			Approx Weight
Nom. Size	O. D. in. mm.	D. in. mm.	J. in. mm.	b in. mm.	h in. mm.	a in. mm.	m in. mm.	g in. mm.	Num - ber	l in. mm.	k in. mm.	p in. mm.	E in. mm.	F in. mm.	≈ Pound Kilo
26"	26,0 660,4	40 1016,0	To be specified by purchaser	4 1/4 107,9	8 3/4 222,2	To be specified by purchaser	29 7/16 747,7	31 7/8 809,6	28	2 50,8	36 914,4	29 1/2 749,3	1/2 12,7	25/ 32 19,8	To be specified by purchaser
28"	28,0 711,2	42 1/4 1073,1		4 3/8 111,1	9 1/4 234,9		31 5/8 803,3	33 7/8 860,4	28	2 1/8 54,0	38 965,2	31 1/2 800,1	1/2 12,7	25/ 32 19,8	
30"	30,0 762	44 1/2 1130,3		4 1/2 114,3	9 3/4 247,6		33 15/16 862,0	36 1/8 917,6	28	2 1/8 54,0	40 1/4 1022,3	33 3/4 857,2	1/2 12,7	25/ 32 19,8	
32"	32,0 812,8	47 1193,8		4 5/8 117,5	10 1/4 260,3		36 1/8 917,6	38 3/4 984,2	28	2 3/8 60,3	42 1/2 1079,5	36 914,4	9/16 14,3	29/ 32 23,0	
34"	34,0 863,6	49 1244,6		4 3/4 120,6	10 5/8 269,9		38 5/16 973,1	40 3/4 1035,0	28	2 3/8 60,3	44 1/2 1130,3	38 965,2	9/,16 14,3	29/ 32 23,0	
36"	36,0 914,4	51 3/4 1314,4		4 7/8 123,8	11 1/8 282,6		40 5/8 1031,9	43 1092,2	28	2 5/8 66,7	47 1193,8	40 1/4 1022,3	9/16 14,3	29/ 32 23,0	

900 lb/sq. in. MSS SP-44

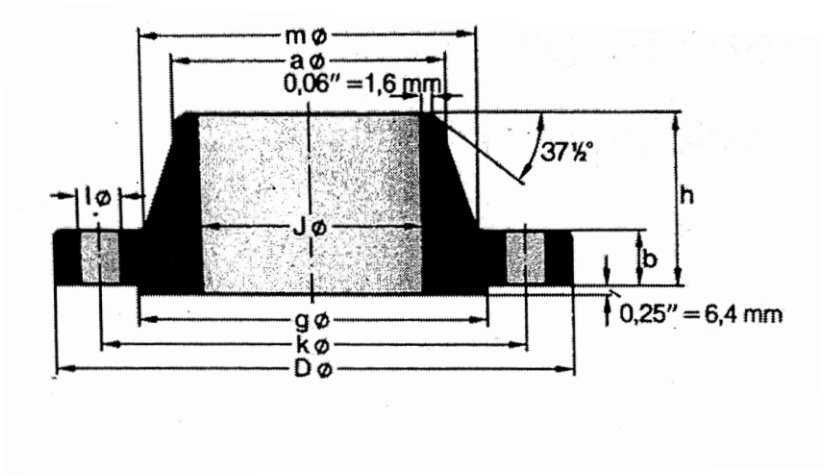
Pipe		Flange				Hub		Raised Face	Drilling Template			Ring Joint			Approx Weight
Nom. Size	O. D. in. mm.	D. in. mm.	J. in. mm.	b in. mm.	h in. mm.	a in. mm.	m in. mm.	g in. mm.	Num - ber	l in. mm.	k in. mm.	p in. mm.	E in. mm.	F in. mm.	≈ Pound Kilo
26"	26,0 660,4	42 3/4 1085,8	To be specified by purchaser	5 1/2 139,7	11 1/4 285,7	To be specified by purchaser	30 1/2 774,4	32 3/4 831,8	20	2 7/8 73,0	37 1/2 952,5	29 1/2 749,3	11/16 17,5	1 3/16 30,2	To be specified by purchaser
28"	28,0 711,2	46 1168,4		5 5/8 142,9	11 3/4 298,4		32 3/4 831,8	35 889,0	20	3 1/8 79,4	40 1/4 1022,3	31 1/2 800,1	11/16 17,5	1 5/16 33,3	
30"	30,0 762	48 1/2 1231,9		5 7/8 149,2	12 1/4 311,1		35 889,0	37 1/4 946,1	20	3 1/8 79,4	42 3/4 1085,8	33 3/4 857,2	11/16 17,5	1 5/16 33,3	
32"	32,0 812,8	51 3/4 1314,4		6 1/4 158,7	13 330,2		37 1/4 946,1	39 1/2 1003,3	20	3 3/8 85,7	45 1/2 1155,7	36 914,4	11/16 17,5	1 5/16 33,3	
34"	34,0 863,6	55 1397,0		6 1/2 165,1	13 3/4 349,2		39 5/8 1006,5	42 1066,8	20	3 5/8 92,1	48 1/4 1225,5	38 965,2	13/16 20,6	1 7/16 36,5	
36"	36,0 914,4	57 1/2 1460,5		6 3/4 171,4	14 1/4 361,9		41 7/8 1063,6	44 1/4 1123,9	20	3 5/8 92,1	50 3/4 1289,0	40 1/4 1022,3	13/16 20,6	1 7/16 36,5	

16. FLANGES, API 605



150 lb/sq. in. API Standard 605

Pipe		Flange				Hub		Raised Face	Drilling Template			Approx Weight
Nom. Size	O. D. in. mm.	D. in. mm.	J. in. mm.	b in. mm.	h in. mm.	a in. mm.	m in. mm.	g in. mm.	Num - ber	l in. mm.	k in. mm.	≈ Pound Kilo
26"	26,0 660,4	30 15/18 785,8	To be specified by purchaser	1 5/8 41,3	3 1/2 88,9	26 1/16 662,0	26 15/16 684,2	28 711,2	36	7/8 22,2	29 5/16 744,5	139 63
28"	28,0 711,2	32 15/16 836,6		1 3/4 44,4	3 3/4 95,2	28 1/16 712,8	28 15/16 735,0	30 762,0	40	7/8 22,2	31 5/16 795,3	163 74
30"	30,0 762	34 15/16 887,4		1 3/4 44,4	3 15/16 100,0	30 1/16 763,6	31 787,4	32 812,8	44	7/8 22,2	33 5/16 846,1	176 80
32"	32,0 812,8	37 1/16 941,4		1 13/16 46	4 1/4 107,9	32 1/16 814,4	33 1/16 839,8	34 863,6	48	7/8 22,2	35 7/16 900,1	203 92
34"	34,0 863,6	39 9/16 1004,9		1 15/16 49,2	4 11/32 110,3	34 1/16 865,2	35 1/8 892,2	36 1/4 920,7	40	1 25,4	37 11/16 957,3	249 113
36"	36,0 914,4	41 5/8 1057,3		2 1/16 52,4	4 5/8 117,5	36 1/16 916,0	37 3/16 944,6	38 1/4 971,5	44	1 25,4	39 3/4 1009,6	284 129
42"	42,0 1066,8	48 1/4 1225,5		2 5/16 58,7	5 1/4 133,3	42 1/8 1070,0	43 3/8 1101,7	44 1/2 1130,3	48	1 1/8 28,6	46 1/8 1171,6	406 184
48"	48,0 1219,2	54 13/16 1392,2		2 9/16 65,1	5 7/8 149,2	48 1/8 1222,4	49 1/2 1257,3	50 3/4 1289,0	44	1 1/4 31,7	52 9/16 1335,1	509 231
54"	54,0 1371,6	61 1549,4		2 13/16 71,4	6 3/8 161,9	54 1/8 1374,8	55 5/8 1412,9	56 3/4 1441,4	56	1 1/4 31,7	58 3/4 1492,2	632 287
60"	60,0 1524,0	67 15/16 1725,6		3 76,2	7 1/16 179,4	60 1/8 1527,2	61 13/16 1570,0	63 1600,2	52	1 3/8 34,9	65 7/16 1662,1	855 388

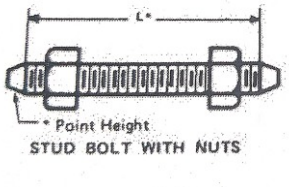


300 lb/sq. in. API Standard 605

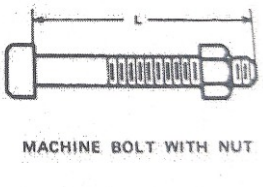
Pipe		Flange				Hub		Raised Face	Drilling Template			Approx Weight
Nom. Size	O. D. in. mm.	D. in. mm.	J. in. mm.	b in. mm.	h in. mm.	a in. mm.	m in. mm.	g in. mm.	Num - ber	l in. mm.	k in. mm.	≈ Pound Kilo
26"	26,0 660,4	34 1/8 866,8	To be specified by purchaser	3 1/2 88,9	5 11/16 144,5	26 3/16 665,2	27 5/8 701,7	29 736,6	32	1 3/8 34,9	31 5/8 803,3	399 181
28"	28,0 711,2	36 1/4 920,7		3 1/2 88,9	5 7/8 149,2	28 3/16 716,0	29 3/4 755,6	31 787,4	36	1 3/8 34,9	33 3/4 857,2	447 203
30"	30,0 762	39 990,6		3 11/16 93,7	6 7/32 158,0	30 1/4 768,4	32 812,8	33 1/4 844,5	36	1 1/2 38,1	36 1/4 920,7	590 268
32"	32,0 812,8	41 1/2 1054,1		4 1/16 103,2	6 5/8 168,3	32 1/4 819,2	34 863,6	35 1/2 901,7	32	1 5/8 41,3	38 1/2 977,9	727 330
34"	34,0 863,6	43 5/8 1108,1		4 1/16 103,2	6 13/16 173,0	34 1/4 869,9	36 1/8 917,6	37 1/2 952,5	36	1 5/8 41,3	40 5/8 1031,9	787 357
36"	36,0 914,4	46 1/8 1171,6		4 1/16 103,2	7 1/8 181,0	36 1/4 920,7	38 965,2	39 3/4 1009,6	32	1 3/4 44,4	42 7/8 1089,0	893 405
42"	42,0 1066,8	52 1/2 1333,5		4 11/16 119,1	8 1/16 204,8	42 5/16 1074,7	44 1117,6	46 1168,4	36	1 7/8 47,6	49 1244,6	1252 568
48"	48,0 1219,2	59 1/2 1511,3		5 1/16 128,6	8 13/16 223,8	48 5/16 1227,1	50 5/16 1277,9	52 1/4 1327,1	40	2 50,8	55 3/4 1416,0	1611 731
54"	54,0 1371,6	65 7/8 1673,2		5 3/8 136,5	9 7/16 239,7	54 5/16 1379,5	56 1/2 1435,1	58 1/4 1479,5	48	2 50,8	62 1/8 1578,0	1979 898
60"	60,0 1524,0	73 15/16 1878,0		5 15/16 150,8	10 11/16 271,5	60 5/16 1531,9	62 15/16 1598,6	65 1651,0	40	2 3/8 60,3	69 7/16 1763,7	2890 1311

17. FLANGES TO AMERICAN STANDARD

BOLTING
To suit R.F. Flange sizes DN 15 to 600 to ANSI - B16.5 (BS. 1560) and DN 750 & 900 to BS. 3293



STUD BOLT WITH NUTS



MACHINE BOLT WITH NUT

Diameter of Bolts is shown in inches. For nominal diameters 1 inch and smaller, threads are U.N.C,; nominal diameters 1-1/8 inch and larger threads are 8 U.N. (8 T.P.I.).
Length of Bolts (L) isshown in millimetres rounded to the nearest 5 mm. Stud Bolt lengths (L*) **do not** include the height of points.Machine Bolt lengths (L) include the height of point. **The length shown includes the height of the Raised Face in all cases.**

NOMINAL SIZES SHOWN ARE ⊕DN : SI METRIC TERM ☆ NPS : ANSI TERM

NOMINAL FLANGE SIZE		PN20 (CLASS 150)				Pn50 (CLASS 300)				PN 100 (CLASS 600)			PN 150 (CLASS 900)			PN 250 (CLASS 1500)				PN 420 (CLASS 2500)			NOMINAL FLANGE SIZE	
				L				L				L			L			L				L		
DN	NPS	No. Bolts	Dia. Bolts Ins.	Stud Bolts mm	Mach. Bolts mm	No. Bolts	Dia. Bolts Ins.	Stud Bolts mm	Mach. Bolts mm	No. Bolts	Dia. Bolts Ins.	Stud Bolts mm	No. Bolts	Dia. Bolts Ins.	Stud Bolts mm	No. Bolts	Dia. Bolts Ins.	Stud Bolts mm	No. Bolts	Dia. Bolts Ins.	Stud Bolts mm	DN	NPS
15	½	4	½	60	45	4	½	65	55	4	½	80				4	3/4	105	4	3/4	125	15	½
20	3/4	4	½	65	50	4	5/8	75	60	4	5/8	90				4	3/4	115	4	3/4	125	20	3/4
25	1	4	½	65	55	4	5/8	80	65	4	5/8	90	USE PN250 DIMENSIONS IN THESE SIZES			4	7/8	125	4	7/8	140	25	1
32	1 1/4	4	½	70	55	4	5/8	80	65	4	5/8	100				4	7/8	125	4	1	150	32	1 1/4
40	1 1/2	4	½	70	60	4	3/4	90	75	4	3/4	105				4	1	140	4	1-1/8	170	40	1 ½
50	2	4	5/8	80	65	8	5/8	90	75	8	5/8	105				8	7/8	145	8	1	175	50	2
65	2 1/2	4	5/8	90	75	8	3/4	100	85	8	3/4	120				8	1	160	8	1-1/8	195	65	2 ½
80	3	4	5/8	90	75	8	3/4	110	90	8	3/4	125	8	7/8	145	8	1-1/8	180	8	1-1/4	220	80	3
90	3 1/2	8	5/8	90	75	8	3/4	110	95	8	7/8	140	-	-	-	-	-	-	-	-	-	90	3 ½
100	4	8	5/8	90	75	8	3/4	110	95	8	7/8	145	8	1-1/8	170	8	1-1/4	195	8	1-1/2	255	100	4
125	5	8	3/4	90	80	8	3/4	120	100	8	1	165	8	1-1/4	190	8	1-1/2	250	8	1-3/4	300	125	5
150	6	8	3/4	100	85	12	3/4	125	105	12	1	170	12	1-1/8	195	12	1-3/8	260	8	2	345	150	6
200	8	8	3/4	110	90	12	7/8	140	110	12	1-1/8	195	12	1-3/8	220	12	1-5/8	290	12	2	380	200	8
250	10	12	7/8	115	95	16	1	155	130	16	1-1/4	215	16	1-3/8	235	12	1-7/8	335	12	2-1/2	485	250	10
300	12	12	7/8	120	100	16	1-1/8	170	145	20	1-1/4	220	20	1-3/8	255	16	2	375	12	2-3/4	540	300	12
350	14	12	1	130	110	20	1-1/8	175	150	20	1-3/8	235	20	1-1/2	275	16	2-1/4	405				350	14
400	16	16	1	135	115	20	1-1/4	190	160	20	1-1/2	255	20	1-5/8	285	16	2-1/2	445				400	16
450	18	16	1-1/8	150	125	24	1-1/4	195	170	20	1-5/8	275	20	1-7/8	325	16	2-3/4	495				450	18
500	20	20	1-1/8	160	135	24	1-1/4	205	180	24	1-5/8	290	20	2	345	16	3	540				500	20
600	24	20	1-1/4	175	145	24	1-1/2	230	195	24	1-7/8	330	20	2-1/2	435	16	3-1/2	615				600	24
750	30	28	1-1/4	190	160	28	1-3/4	290	250	28	2	355	PN150, 250 & 420 - Not listed in BS 3293									750	30
900	36	32	1-1/2	215	180	32	2	325	280	28	2-1/2	400										900	36

Raised Faceheight of 2 mm for PN 20 & 50 and 7 mm for PN100, 150, 250 & 420 is included in dimensions L (Bolt Length).

MATERIAL SPECIFICATIONS

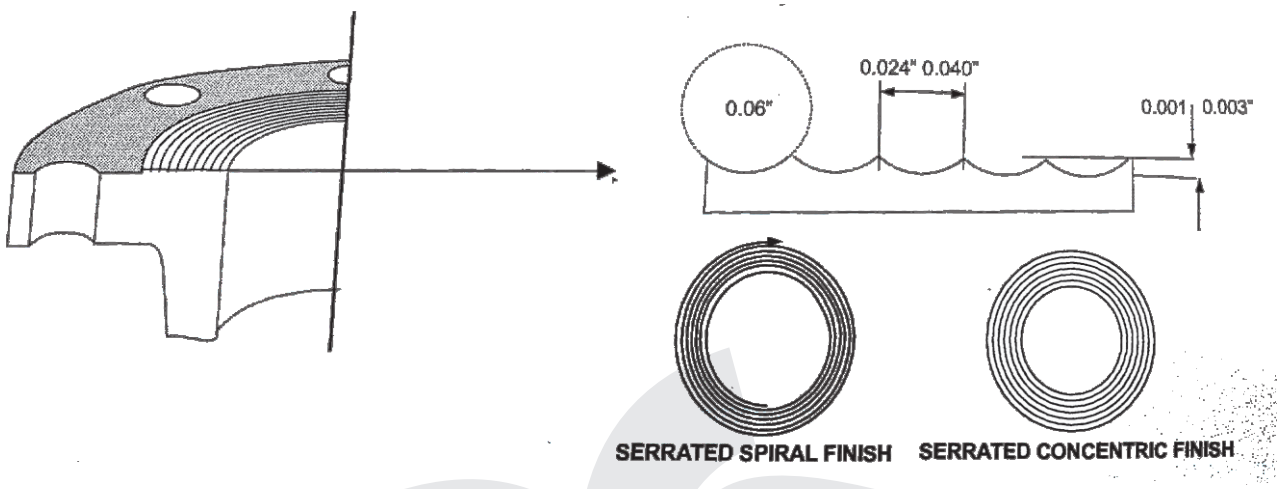
ASTM A193 GRADE B7
Standard specification for alloy steel and stainless steel bolting materials for high temperature service.

ASTM A194 GRADE 2H
Standard specification forcarbon and alloy steel nuts for bolts for high pressure and high temperature service.

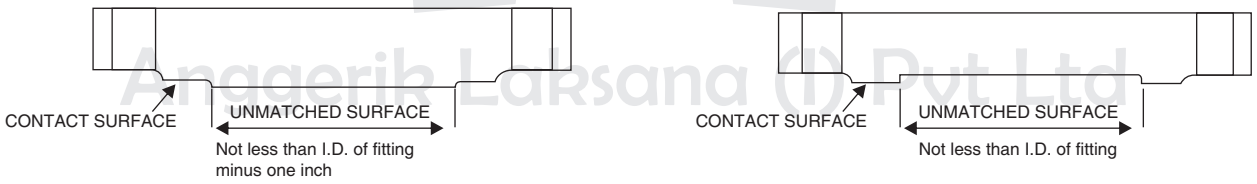
ASTM A320
Standard specification for alloy steel bolting materials for low temperature services.
Grade L7 covers alloy steel stud bolts.
Grade L4 covers alloy steel nuts to suit Grade l& stud bolts.

18. STANDARD FINISHES FOR CONTACT FACE OF FLANGES

1. **RAISED FACE, AND LARGE MALE AND FEMALE**
   Either a serrated-concentric or serrated-spiral finish having from 24 to 40 grooves per inch is used. The cutting tool employed has an approximately 0.06 in. or larger radius. The resultant surface finish has a 500 microinch approximate roughness.



2. **TONGUE AND GROOVE, AND SMALL MALE AND FEMALE**
   The gasket contact surface does not exceed 125 microinch roughness. *(AARH: Arithmetic Average Roughness Height)*
3. **RING JOINT**
   The side wall surface of gasket grove does not exceed 63 microinch roughness.
4. **BLIND**
   Blind flanges need not be faced in the centre if, when this centre part is raised, its diameter is at least 1 in. smaller than the inside diameter of fittings of the corresponding pressure class. When the centre part is depressed, its diameter is not greater than the inside diameter of the corresponding pressure class fittings. Machining of the depressed centre is not required



PERMISSIBLE IMPERFECTIONS IN FLANGE FACING FINISH FOR RAISED FACE AND LARGE MALE AND FEMALE FLANGES 1,2

NPS	Maximum Radial Projection of Imperfections which are no deeper than the bottom of the Serrations, in.	Maximum Depth and Radial Projection of Imperfections which are deeper than the Bottom of the Serrations, in.
½-2 ½	0.12	0.06
3	0.18	0.06
3 ½-6	0.25	0.06
8-14	0.31	0.12
16	0.38	0.18
18-24	0.50	0.25

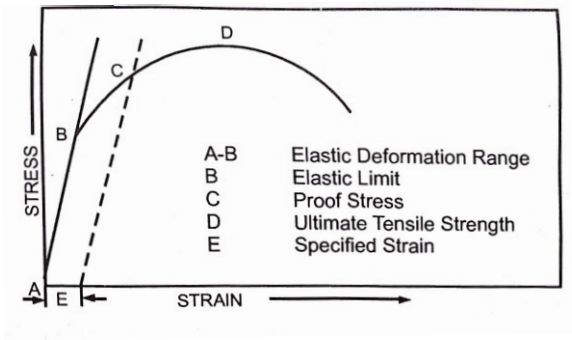
NOTES:
(1)Imperfections must be separated by at least four times the permissible radial projection.
(2)Protrusions above the serrations are not permitted.

19. DIMENSIONAL TOLERANCES : FLANGES

Threaded, Socket - Welding, Slip-on, Lap Joint and Blind		
Outside Diameter	When O.D. is 24" or less	±1/16" (1.6mm)
	When O.D IS Over 24"	±1/8" (3.2mm)
Inside Diameter	Threaded	Within limits on boring guage
	Socket - Welding, Slip-on and Lap joint	10" & Smaller +1/32" (0.8mm) - 0" 12" & Larger +1/16" (106mm) - 0"
Outside Diameter of Hub	12" and Smaller	+1/32" (0.8mm) -1/16" (1.6mm)
	14" and Larger	±1/8" (3.2mm)
Diameter of Contact Face	1/16" Raised Face	±1/32" (0.8mm)
	1/4" Raised Face Tongue & Groove Male , Female	±1./64" (0.4mm)
Diameter of Counterbore	**Same as for Inside Diameter**	
Drilling	Bolt Circle	±1/16" (106mm) - 0"
	Bolt Hole Spacing	±1/32" (0.8mm)
	Eccentricity of Both Circle with Respect to Facing	21/2" & Smaller 1/32" (0.8mm) max 3" & Larger 1/16" (1.6mm) max
	Eccentricity of Both Circle with Respect to Bore	1/32" (0.8mm) max
	Eccentricity of Facing with Respect to Bore	1/32" (0.8mm) max
Thickness Length	18" and Smaller	+1/8" (3.2mm) - 0"
	20" and Larger	+3/16" (4.8mm) - 0"
	10" and Smaller	±1/16" (1.6mm)
Thru. Hub	12" and Larger	±1/8" (3.2mm)

Welding Neck		
Outside Diameter	When O.D is 24" or Less	±1/16" (1.6mm)
	When O.D is over 24"	±1/8" (3.2mm)
Inside Diameter	10" and Smaller	+1/32" (0.8mm)
	12" thru 18"	+1/16" (1.6mm)
	20" and larger	+1/8" (3.2mm) -1/16" (106mm)
Diameter of Contact Face	1/16" Raised Face	+1/32" (0.8mm)
	1/4" Raised Face Tongue & Groove Male, Female	+1/64" (0.4mm)
Diameter of Hub at Base	When Hub Base is 24" or Smaller	=1/16" (1.6mm)
	When Hub Base is Over 24"	-1/8" (3.2mm)
Diameter of Hub at Point of Welding	5" and Smaller	+3/32" (2.4mm) -1/32" (0.8mm)
	6" and Larger	+5/32" (4.0mm) -1/32" (0.8mm)
	Bolt Circle	+1/16" (1.6mm)
Drilling	Bolt hole spacing	+1/32" (0.8mm)
	Eccentricity of Bolt Circle with Respect to Facing	21/2" & Smaller 1/32" (0.8mm) max 3" & Larger 1/16" (1.6mm) max
	Eccentricity of Bolt Circle with Respect to Bore	1/32" (0.8mm) max
	Eccentricity of Facing with Respect to Bore	1/32" (0.8mm) max
Thickness Length	18" and Smaller	+1/8" (3.2mm)-0"
	20" and Larger	+3/16" (4.8mm)-0"
	10" and Smaller	+1/16" (1.6mm)
Thru Hub	12" and Larger	+1/8" (3.2mm)

20. STRESS STRAIN CURVE



a) Ultimate Tensile Strength (D)

The maximum load applied during the test divided by the original cross sectional area of the test piece

b) Proof Stress (C)

This is the load at which the sample is permanently elongated by a specific percentage of the original length (e.g. 0.2%).

c) Yield Point

The lowest stress at which the elongation of the test piece proceeds without any increase in load.

d) Elongation

This is the extension of the test piece expressed as a percentage of its original length.

e) Reduction of area

This is the reduction in cross sectional area of the test piece after Tensile fracture expressed as a percentage of the original cross – sectional area.

1) Hardness Tests
These tests determine the resistance of material to indentation.

a) Brinell Hardness Test
A Standard size hardened Steel Ball is indented into the surface of material by an applied standard load for a duration of 15 seconds. The diameter of the impression is measured accurately by a microscope and the hardness value calculated from the formula :

$$\text{Brinell Hardness Number} = \frac{\text{Load (Kgs)}}{\text{Spherical Area of Impression (mm2)}}$$

b)Rockwell Hardness Test

This determines Hardness by measuring the depth to which a Diamond Cone or Hardened Steel Ball, under specific load, penetrates the material. The hardness number is indicated on a scale according to the load applied.

a) Vickers Diamond Hardness Test
This determines Hardness by measuring the impression left in material by a Diamond Pyramid under a standard load for a specified time. The square impression is measured accurately, diagonally and its area calculated. The hardness value is calculated from the formula:

$$\text{Vickers Hardness Number} = \frac{\text{Load (Kgs)}}{\text{Area of Impression (mm2)}}$$

APPROXIMATE EQUIVALENT HARDNESS NUMBERS AND TENSILE STRENGTHS FOR STEEL

Brinell Hardness No. 3000 kg load, 10-mm ball	Vickers hardness No.	Rockwell hardness No. B scale, 100-kg load, 1/16-in. Diam. Ball	Rockwell hardness No. C scale, 150 kg load, Brale, Indenter	Knoop hardness No., 500 g load and greater	Shore Sclero-scope hardness No.	Tensile strength (approx.) ksi	Tensile strength (approx.) MPa
223	234	97.3	-	247	-	107	738
217	228	96.4	-	242	33	105	724
212	222	95.5	-	237	32	102	703
207	218	94.6	-	232	31	100	690
201	212	93.7	-	227	-	98	676
197	207	92.8	-	222	30	95	655
192	202	91.9	-	217	29	93	641
187	196	90.9	-	212	-	90	621
183	192	90.0	-	207	28	89	614
179	188	89.0	-	202	27	87	600
174	182	88.0	-	198	-	85	586
170	178	87.0	-	194	26	83	572
167	175	86.0	-	190	-	81	559
163	171	85.0	-	186	25	79	545
159	167	83.9	-	182	-	78	538
156	163	82.9	-	178	24	76	524
152	159	81.9	-	174	-	75	517
149	156	80.8	-	170	23	73	503
146	153	79.7	-	166	-	72	496
143	150	78.6	-	163	22	71	490
137	143	76.4	-	157	21	67	462
131	137	74.2	-	151	-	65	448
126	132	72.0	-	145	20	63	434
121	127	69.8	-	140	19	60	414
116	122	67.6	-	135	18	58	400
111	117	65.4	-	131	17	56	386

2) Guided Bend Test

a) Bend Test

This is where ductility and structural soundness are to be proved and involves bending the sample through 180 and checking for cracking. This may be against or with the original curvature of the material, in this case of the former it is then called a reverse bend test.

21. USEFUL CONVERSION FACTORS

From	To	Multiply by
Inch	mm	25.4
mm	in	0.0393701
ft	m	0.3048
ft	mm	304.8
m	ft	3.28084
lbf	kgf	0.45359237 0.451
kgf	lbf	2.20462
lb/ft	kg/m	1.48816 1.4895**
kg/m	lb/ft bar kgf/cm^2	0.67197 0.6897 0.070307 0.0703*
Psi lbf/in	MPa MN/m^2 N/mm^2 N/cm^2	0.00689476 0.689476
kgf/cm	Psi lbf/in^2 MPa MN/m^2 N/mm^2 N/cm^2	14.2233 0.980665 9.80665
N/cm	Psi lbf/in^2 kgf/cm^2 MPa MN/m^2 N/mm^2	1045038 0.101972 0.001

From	To	Multiply by
HP	KW	0.7457
ksi	$tonf/in^2$ kgf/mm^2 MPa MN/m^2 N/mm^2	0.446429 0.70307 6.89476
kgf/mm^2	$tonf/in^2$ ksi MPa MN/m^2 N/mm^2 Psi lbf/in^2 kgf/cm^2	0.63497 1.42233 9.80665 145.038 10.1972
MPa MN/m^2 N/mm^2	N/cm^2 $tonf/in^2$ ksi kgf/mm^2	100 0.064749 0.145038 0.101972

* As per API
** As per API and ANSI/ASME

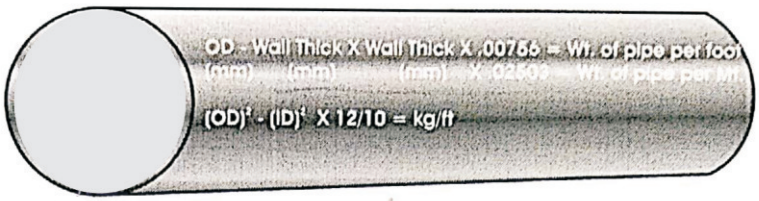
Abbreviations
in = inches
ft = foot
cm =centimeter
mm = millimeter
m = meter
lbf = pound - force
kgf = kilogram - force
Psi = pound - force per square inch

PETROLEUM
1 Barrel = 42 U.S. Gallons
1= 34.97 U.K. Gallons.
1 = 0.159 Cubic metre.

ksi = kilopound - force per square inch
ksi = kip/in = 1000lbf/in = 1000psi
tonf = ton-force
Mpa = megapascal = 106 N/m
Mpa = MN/m = N/mm
N = newton = kg.m/s
s = second

22. WEIGHT CALCULATION CHART

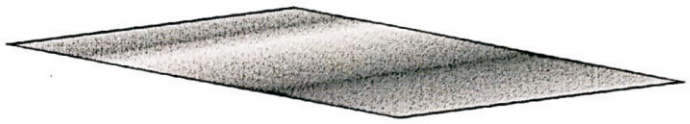
PIPE
{O.D. (mm) – Thickness (mm) }X Thickness (mm) X .00756 = Weight (kg/ft)
{O.D. (mm) – Thickness (mm) }X Thickness (mm) X .02503 = Weight (kg/m)
$W=\{(O.D.)^2 – (I.D.)^2\}X\ 12/10$
W = Weight per unit length (kg./ft)
O.D. = Outside diameter of pipe (in.)
ID = Inside diameter of pipe (in.)



API/ASTM
W = 0.02461615 (D-t)t
W = Weight per unit length (kg/m)
t = Wall thickness of pipe (mm)
D = Outside diameter of pipe (mm)

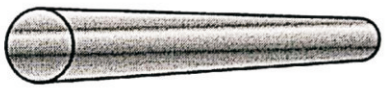
ASTM Conversation
2 lb/ft = 1.49 kg/m.

WEIGHT TOLERANCE(PIPES)
APIASTM
+10%+65%
-3.5%-3.5%

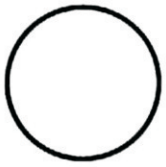


SHEET
Thickness (mm) X Length (mm) X 8 = Weight (kgs.)

BAR
Diameter (mm) X Diameter (mm) X 0.0019 = Weight (kg/ft)

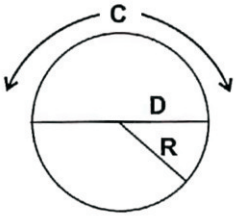


CIRCLE
Width (mm) X Thickness (mm) X 0.024 = Weight (kg/ft)

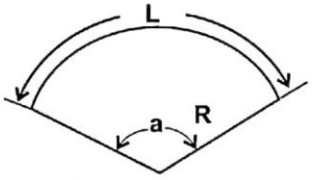


OTHER USEFUL FORMULAE

Where :
A = Area; A_1 = Surface areaof solids;
V = Volume; C = Circumference



Circle
A = 3.142 X R X R
C = 3.142 X D
D
R = 2
D = 2 X R



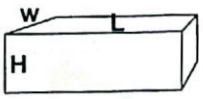
Sector of Circle

$$A = \frac{3.142 \times R \times R \times a}{360}$$

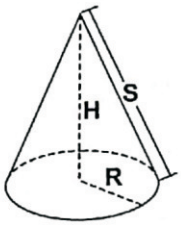
$$L = \frac{0.1745 \times R \times A}{I}$$

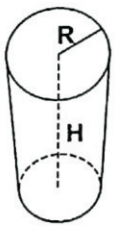
$$A = \frac{.01745 \times R \times L}{}$$

$$R = \frac{}{.01745 \times a}$$



Rectangular solid
$A_1 = 2[W \times L + L \times H + H \times W]$
$V = W \times L \times H$





Cone
$A_1 = 3.142 \times R \times S + 3.142 \times R \times R$
$V = 1.047 \times R \times R \times H$

Cylinder
$A_1 = 6.283 \times R \times H + 6.283 \times R \times R$
$V = 3.142 \times R \times R \times H$

Material	Colour
Carbon Steel	No Colour
WPL6	Water Green
WPL3	Aquamarine
AS-P1	Light Yellow
AS-P5	Sky Blue
AS-P9	Pink
AS-P11	Yellow
AS-P12	Violet
AS-P22	Off White
SS304	Navy Blue
SS304L	Red
SS316	Bus Green
SS316L	Black
SS321	Orange
SS347	White
SS310	Timber Brown

Temperature Scales

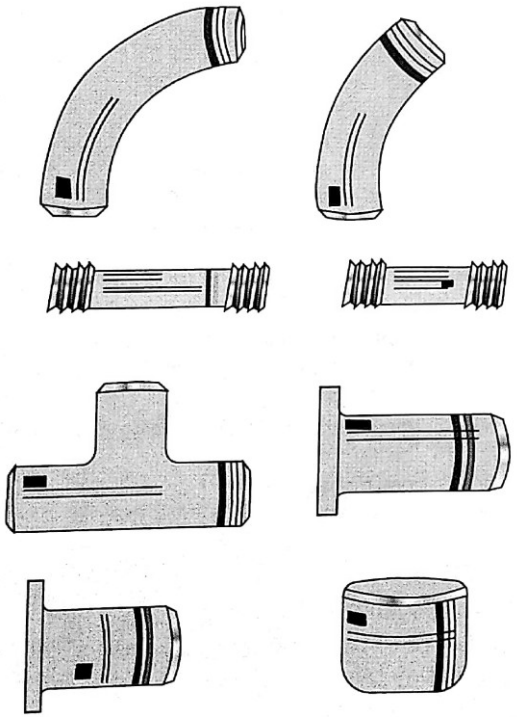
To compute Fahrenheit:
Multiply Centigrade
by 1.8 and add 32.

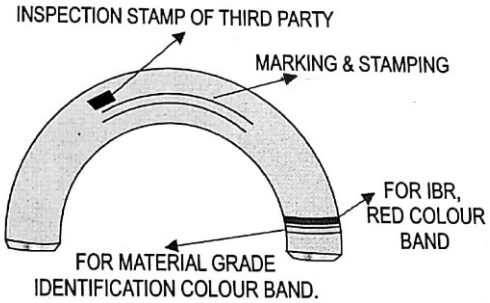
To Compute Centigrade:
Subtract 32 from
Fahrenhit and divide by 1.8

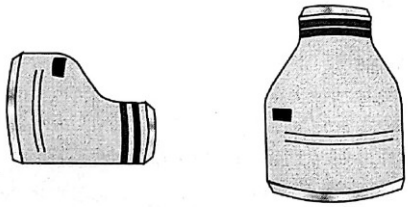
℃ = (˚F - 32) x 5/9

˚C	˚F
538	1000
500	932
450	842
427	800
400	752
371	700
350	662
316	600
300	572
260	500
250	482
200	392
150	307
100	212
90	194
80	176
70	158
60	140
50	122
40	104
35	95
30	86
25	77
20	68
15	59
10	50
5	41
0	32
-5	23
-10	14
-15	5
-17.8	0
-20	-4
-25	-13
-30	-22
-50	-58
-200	-328

THIRD PARTY & COLOUR CODING LOCATIONS ON FITTINGS







23. EFFECTS OF CHEMICAL ELEMENTS ON MECHANICAL PROPERTIES OF STEEL :

Steel in general is an alloy of carbon and iron, it does contain many other elements, some of which are retained from the steel making process, other elements are added to produce specific properties. We can see some most common chemical elements with important effects on steel properties.

1. Carbon (C)
Carbon is the most important element in steel, it is essential in steels which have to be hardened by quenching and the degree of carbon controls the hardness and strength of the material, as well as response to heat treatment (harnenability).

2. Manganese (Mn)
Manganese could be the second most important element after Carbon on steel. Mn has effects similar to those of carbon, and the steel producer uses these two elements in combination to obtain a material with the desired properties. Manganese is a necessity for the process of hot rolling of steel by its combination with oxygen and sulfur.
Its presence has below main effects:
It is a mild deoxidant acting as a cleanser taking the sulphur and oxygen out of the melt into the slag.
It increases the harden ability and tensile strength but decreases ductility.
It combines with sulphur to form globular manganese sulphides, essential in free cutting steels for good machinability.
Steels usually contain at least 0.30% manganese, however, amounts of up to 1.5% can be found in some carbon steels.
Manganese also tends to increase the rate of carbon penetration during carburizing and acts as a mild deoxidizing agent. However when too high carbon and too high manganese accompany each other, embrittlement sets in. Manganese is capable to form Manganese Sulphide (MnS) with sulphur, which is beneficial to machining. At the same time, it counters the brittleness from sulphur and is beneficial to the surface finish of carbon steel. For welding purposes, the ratio of manganese to sulphur should be at least 10 to 1. Manganese content of less than 0.30% may promote internal porosity and cracking in the weld bead, cracking can also result if the content is over 0.80%. Steel with low Manganese Sulphide ratio may contain sulphur in the form of iron Sulphide (FeS), which can cause cracking in the weld.

3. Phosphorus (P)
Although it increases the tensile strength of steel and improves machinability it is generally regarded as an undesirable impurity because of its embrittling effect.
Effect of phosphorus element will have various effects on steel depending on concentration. The maximum amount of phosphorus in higher grade steel is between 0.03 to 0.05% due to the fact that is detrimental. Up to 0.10% of phosphorus in low-alloy high-strength steels will increase the strength as well as improve the steel's resistance against corrosion. The possibility of brittlement increases when the content in hardened steel is too high. Even though the strength and hardness is improved, the ductility and toughness decreases. The machinability is improved in free-cutting steel, but weld brittle and/or weld cracks can occur during welding if the phosphorus content is more than 0.04%. Phosphorus also affects the thickness of the zinc layer when galvanising steel.

4. Sulfur (S)
Sulfur is normally regarded as an impurity and has an adverse effect on impact properties when a steel is high in sulphur and low in manganese. Sulphur improves machinability but lowers transverse ductility and notched impact toughness and has little effects on the longitudinal mechanical properties. Its content is limited to 0.05% in steels but is added to free cutting steels in amount up to 0.35% with the manganese content increased to counter or “freemachining”. Free cutting steels have sulphur added to improve machinability, usually up to a maximum of 0.35%.
Even though the effect of sulphur on steel is negative at certain stages, any sulphur content less than 0.05% has a positive effect on steel grades.

5. Silicon (Si)
Silicon is one of the principal deoxidizers for steel. Silicon helps to remove bubbles of oxygen from the molten steel. It is the element that is most commonly used to produce semi- and fully killed steels, and normally appears in amounts less than 0.40 percent, usually only small amount (0.20%) are present in rolled steel when it is used as a deoxidizer. However, in steel castings, 0.35 to 1.00% is commonly present.
Silicon dissolves in iron and tends to strengthen it. Some filler metals may contain up to 1% to provide enhanced cleaning and deoxidation for welding on contaminated surfaces. When these filler metals are used for welding on clean surfaces, the resulting weld metal strength will be markedly increased. Silicon increases strength and hardness but to a lesser extent than manganese. The resulting decrease in ductility could resent cracking problems.
For galvanizing purposes, steels containing more than 0.04% silicon can greatly affect the thickness and appearance of the galvanized coating. This will result in thick coatings consisting mainly zinc-iron alloys and the surface has a dark and dull finish. But it provides as much corrosion protection as a shiny galvanized coating where the outer layer is pure zinc.

6. Chromium (Cr)
Chromium is a powerful alloying element in steel. Cr presents in certain structural steels in small amounts. It is primarily used to increase hardenability of steel and increase the corrosion resistance as well as the yield strength of the steel material. For that reason often occurs in combination with nickel and copper. Stainless steels may contain in excess of 12% chromium. The well-known “18-8” stainless steel contains 8 percent of nickel and 18 percent of chromium.
When the percent of chromium in the steel exceeds 1.1% a surface layer is formed that helps protect the steel against oxidation.

7. Vanadium (V)
The effects of Vanadium chemical element are similar to those of Mn, Mo, and Cb. When used with other alloying elements it restricts grains growth, refines grain size, increases hardenability, fracture toughness, and resistance are improved. At greater than 0.05%, there may be a tendency for the steel to become embrittled during thermal stress relief treatments. Vanadium is used in nitriding, heat resisting, tool and spring steels together with other alloying elements.

8. Tungsten (W)
It is used with chromium, vanadium, molybdenum, or manganese to produce high speed steel used in cutting tools. Tungsten steel is said to be “red-hard” or hard enough to cut after it becomes red-hot.
Tungsten in the form of tungsten carbide
Gives steel high hardness even at red heats.
Promotes fine grains
Resists heat
Promote strength at elevated temperatures.

9. Molybdenum (Mo)
Molybdenum has effects similar to manganese and vanadium, and is often used in combination with one or the other. This element is a strong carbide former and is usually present in alloy steels in amounts less than 1%. It increases hardenability and elevated temperature strength and also improves corrosion resistance as well as increased creep strength. It is added to stainless steels to increase their resistance to corrosion and is also used in high speed tool steels.

10. Cobalt (Co)
Cobalt improves strength at high temperatures and magnetic permeability.
Increases hardness, also allows for higher quenching temperatures (during the heat treatment procedure). Intensifies the individual effects of other elements in more complex steels. Co is not a carbide former, however adding Cobalt to the alloy allows for higher attainable hardness and higher red hot hardness.

11. Nickel (Ni)
In addition to its favorable effect on the corrosion resistance of steel, Ni is added to steels to increase hardenability. Nickel enchances the low-temperature behavior of the material by improving the fracture toughness. The weldability of the steel is not decreased by the presence of this element. The nickel drastically increases the notch toughness of the steel. Nickel is often used in combination with other alloying elements, especially chromium and molybdenum. It is a key component in stainless steels but at the low concentrations found in carbon steels. Stainless steels contain between 8% and 14% nickel.
One more reason Ni is added to an alloy is that it creates brighter portions in damascus steels.

12. Copper (Cu)
Copper is another primary corrosion resistance elements. It also has a small impact on hardenability. It is typically found in amounts not less than 0.20 percent, and is the primary anti-corrosion component in steel grades like A242 and A441.
Most often found as a residual agent in steels, copper is also added to produce precipitation hardening properties and increase corrosion resistance.

13. Aluminum (Al)
Aluminum is one of the most important deoxidizers in very small amounts in the material, and also helps form a more fine-grained crystalline microstructure and increase the steel grade's toughness. It is usually used in combination with silicon to obtain a semi- or fully killed steel.

14. Titanium (Ti)
Toughness and ductility.
Ti is a very strong, very lightweight metal that can be used alone or alloyed with steels. It is added to steel to give them high strength at high temperatures. Modern jet engines used titanium steels.
It prevents localized depletion of chromium in stainless steels during long heating
Prevents formation of austenite in high chromium steels
Reduces martensitic hardness and hardenability in medium chromium steels.

15. Niobium (Nb, formerly known as Columbium – Columbium, Cb)
Niobium is a key grain refining element, as well a strength – enhancing elements in steel production. Niobium is a strong carbide former and forms very hard, very small, simple carbides. Improves ductility, hardness, wear and corrosion resistance. Also, refines grain structure. Formerly known as Columbium.

16. Boron (B)
The most important effect and the purpose of boron in steel is to drastically improve the hardenability.
The biggest advantage of boron is that a small amount can be added to get the same result as other elements required in large amount in terms of added hardenability. Typical range in steel alloys is 0.0005 to 0.003%.
During the heat treatment process boron, a replacement for other elements, is added to increase the hardenability of medium carbon steel. The cutting performance for high- speed steels is increased but at the expense of the forging quality. It is also possible that the content of boron can be too high which decreases hardenability, toughness as well as cause embrittlement. The percentage carbon present in the steel also plays a role in the hardenability effect of boron. As boron's effect on hardenability increases the amount of carbon should proportionally be decreased.
When boron is added to steel, precaution must be takes to ensure that it does not react with oxygen or nitrogen as the combination of boron with either one of the two will make the boron useless.

17. Lead (Pb)
The addition of lead in levels in very small amounts to improve machinability, up to 0.30%, improves machinability. Providing the distribution is homogenous it has little effect on the physical properties of the steel, and contrary to popular belief, it does not affect weld ability.

18. Zirconium (Zr)
Zirconium is added to steel to modify the shape of inclusions. Typically added to low alloy, low carbon steels. The result is that toughness and ductility are improved when transforms shape from elongated to globular, improving toughness and ductility.

19. Tantalum (Ta)
Chemically very similar to Niobium (Nb), as such, has similar effect on the alloy – forms very hard, very small, simple carbides. Improves ductility, hardness, wear and corrosion resistance. Also, refines grain.

20. Nitrogen (N)
Not Carbides. INFI had N, and there's few more, with Sandvik being the champion, having 3% N in the alloy, completely substituting C. Sadly, not available for knife makers. Because Nitrogen is less prone to form Chromium nitrides than Carbon is to form Chromium carbides, its presence improves corrosion resistance, leaving more free Chromium in the alloy. Since Nitrogen is less reactive in forming Nitrides, it can be used for added hardness without increasing carbide size and volume, e.g. Sandvik 14C28N steel.

21. Selenium (Se)
Typically not desirable in cutlery steel. Added to improve machinability. Similar with Sulfur, in the same chalcogen group.
All chemical elements and effects shown above is related in steel materials. So, if you are in the steel industry, you should same it.
There are some other small rare metal elements which we don't list in the above. You could leave a comment below, with details.

24. SPECIFICATIONS OF STAINLESS STEEL, DUPLEX STAINLESS STEEL & NACE

Stainless Steel:

Stainless steel may be by their crystalline structure into four main types;

(1) Austenitic (2) Ferritic
(2) Martensitic (4) Duplex

Austenitic Steel: These are non- magnetic that contain high level of chromium, nickel and low level of carbon. Known for their formability and resistance to corrosion. Austenitic steels are the most widely used grade of stainless steel.

Ferritic Steel: Ferritic steel have high chromium, and low carbon percentage known for their good ductility, corrosion resistance and stress corrosion cracking. It is commonly used in automatic application, kitchen ware and industrial equipment. It cannot be hardened or strengthened by heat treatment. It contains minimum 12% chromium. It do not retain strength at high temperature like austenitic stainless steel.

Difference between 304 & 316 stainless steel:

	304	**316**
Chrome	18%	16%
Nickel	8%	10%
Molyb.	---	2% (Added to restrict corrosion in chlorides)

Difference between 316 & 316L stainless steel:

- 316L has max 0.03% carbon and is good in welding.
- 316 has mid-range level of carbon.

These are austenitic alloys. In addition of Chromium and nickel these alloys contain Molybdenum, which also make them more corrosion resistance. 317L is more corrosion resistance, because its molybdenum content is 3-4% and molybdenum 2-3% is found in 316 & 316L.

Duplex Stainless Steel: SS 2205 is a duplex stainless steel with a microstructure of nearly equal proportion of austenite and ferrite, when properly heat treated. This microstructure ensures that 2205 is much more resistance to stress corrosion cracking than SS 304 or 316L. it's higher chromium, molybdenum, and nitrogen content gives the product significantly improved pitting and crevice-corrosion resistance in the presence of chlorides. SS 2205 also has better general corrosion resistance than 316L in most environments. In addition, 2205 has a 0.2% proof stress of approximately double that of conventional austenitic stainless steel. SS 2205 is highly suitable for service in environments containing chlorides and hydrogen sulphides, such as marine applications and the oil and gas extraction and processing industries.

Corrosion resistance is a critical component of material built to withstand natural disasters. Duplex stainless steel is less prone to damage by stress corrosion cracking. It also offers good corrosion fatigue strength and its microstructure and small carbon magnitude allow duplex steel to stand up against intergranular attack. Duplex grades have high surface toughness and can stand up to conditions of heavy water, sand or salt crystals.

Specifications

UNS: S32205, S31803
ASTM: A240
ASME: SA240
NACE: MR0175
W.Nr./EN: 1.4462

Chemical Composition, %

	Cr	Ni	Mn	Si	P	S	C	N	Mo	Fe
MIN	22.0	4.5	-	-	-	-	-	0.1	3.0	
MAX	23.0	6.5	2.0	1.0	0.03	0.02	0.03	0.2	3.5	bal

Features

- Microstructure ensures more resistance to stress-corrosion cracking
- Significantly improved pitting and crevice-corrosion resistance in the presence of chlorides
- 0.2% proof stress of approximately double that of conventional austenitic stainless steels
- Highly suitable material for service in environments containing chlorides and hydrogen sulfide

Applications

- Chemical industry (processing, transport and storage, pressure vessels, tanks, and piping)
- Pulp and paper industry (digesters and liquor tanks)
- Mining industry
- Heat exchangers (especially those where chloride-bearing water or brackish water is used as the cooling medium)
- Production tubing and flow lines for the extraction of oil and gas from sour wells

Duplex 2205

Physical Properties

Density: 0.278 lb/in ^{3}	**Melting Range: 2525 -2630 F**
Specific Heat Capacity at 212 F	0.119 Btu/lb/°F
Thermal Conductivity at 212 F	8.4 Btu/hr-ft-°F
Poisson"s Ratio	0.3
Elastic Modulus at 72 F	29 x 10 psi

Mechanical Properties

0.2% Yield Strength, ksi	65 min
Tensile Strength, ksi	90 min
Elongation, %	25 min
Hardness (HRC)	293 max

Tensile Properties at Elevated Temperatures

Temperature F	**212**	**302**	**392**	**572**
0.2% Yield Strength (ksi)	52	49	45	41
Ultimate Tensile Strength (ksi)	90	83	83	81

25. WHAT IS THE "DUPLEX SS FAMILY"

- **Lean Duplex SS –** lower nickel and no molybdenum – 2101,2102, 2202, 2304
- **Duplex SS –** higher nickel and molybdenum **– 2205,** 2003, 2404
- **Super Duplex –** 25 Chromium and higher nickel and molybdenum "plus" – 2507, 255 and Z100
- **Hyper Duplex –** More Cr, Ni, Mo and N - 2707

Chemistry of Lean Duplex SS

Name	UNS No.	C	Cr	Ni	Mo	N	Other
2101	**S32101**	**.04**	**21**	**1.5**	**0.5**	**.22**	**Mn=5**
2102	**S82011**	**.03**	**21.5**	**1.5**	**0.5**	**.21**	**Mn=2.5**
2202	**S32202**	**.03**	**22**	**2**	**0.5**	**.22**	
2304	**S32304**	**.03**	**23**	**4**	**0.5**	**.12**	
High Cr		**low Ni**		**0.2 N**		**and no Mo**	

Chemistry of Duplex SS

Name	UNS No.	C	Cr	Ni	Mo	N	Other
2003	**S32003**	**.03**	**20**	**3.5**	**1.7**	**.16**	
2404	**S82441**	**.03**	**24**	**3.5**	**1.5**	**.22**	**Cu**
2205	**S31803**	**.03**	**21.8**	**5**	**2.8**	**.12**	
2205	**S32205**	**.03**	**22.5**	**5**	**3.2**	**.16**	
High Cr	**ModerateNi and Mo**					**and 0.16N**	

Chemistry of Super Duplex SS And Hyper Duplex

Name	UNS No.	C	Cr	Ni	Mo	N	Other
2507	**S32750**	**.03**	**25**	**7**	**4.0**	**0.28**	**Cu=.5**
255	**S32550**	**.03**	**25.5**	**5.5**	**3.4**	**0.20**	**Cu=2.0**
Z100	**S32760**	**.03**	**25**	**7**	**3.5**	**0.25**	**Cu=.75 W=.75**
2707	**S32707**	**.03**	**27**	**6.5**	**4.8**	**0.40**	**.25+N**
High Cr				**More Ni and Mo and "others"**			

26. NACE MR 0175 PIPE, FITTINGS & FLANGES

What is NACE

NACE was established since 1943, full name is The National Association of Corrosion Engineers.

In NACE standards, MR0175 is the standard of material requirements for H2S containing oil and gas production and equipment.

As a result, Nace pipe is used in H2S containing gas and oil transportation.

Steel pipe and related fittings which are made from the NACE material (complied with NACE MR 0175) We call them NACE pipe, or NACE pipe fittings.

Therefore, these products are specially used in the oil and gas environments that contain the H2S etc corrosive chemicals.

Chemical Composition

For carbon and alloy steel pipes, **NACE MR0175 has limits for content Sulfur (S ≤ 0.002%), Phosphorus (P ≤ 0.020%) and Carbon (C ≤ 0.10%).**

Mechanical Strength

Mechanical properties of tensile strength, and yield strength is same with general pipes referred to corresponding standards.

NACE Test Methods

For sour service steel pipe, plate, fittings, commonly there are two test methods referred NACE. HIC and SSC.

HIC is Hydrogen Induced Cracking. HIC test is a mandatory test for NACE pipe and fittings. But if there is certificate to proof the material (Raw material for making pipes or fittings) comply to NACE MR0175, then there is no need to do this test again.

SSC is Sulfide Stress Cracking. SSC test is a long time lasting experiment. The test is specially to alloy steel, to put test material in corrosion environment plus with constant pulling force (Under situation of working force and metal inside force). In these two factors (Corrosion + Force) affects, material havs the brittle rupture. So this is SSC cracking.
(SSC cracking is one of the most harmful corrosion types, during corrosion, if there is any small cracks, the broken speed is far more soon than other type of corrosion. So SSC corrosion is an “Corrosion Disaster”. This happened in Bridge damage, Airplane accidents, boiler tank explosion. These are bring big loss for people's life and property. Other than this, power station, Ship, boiler tank, petroleum industries all happened SSC accidents.)

90° Long Radius Elbows

Unit:kg

	Carbon Steel & Alloy Steel										
	STD	XS	XXS	S40	S80	S120	S160	S10	S20	S30	S60
½	0.078	0.097	0.152	0.078	0.097	..	0.117	..	..	..	..
3/4	0.104	0.134	0.225	0.104	0.134	..	0.176	..	..	..	..
1	**0.15**	0.194	0.326	**0.15**	0.194	..	0.253	..	..	..	..
1- 1/4	0.254	0.335	0.583	0.254	0.335	..	0.421	..	..	..	..
1-1/2	0.364	0.486	0.858	0.364	0.486	..	0.651	..	..	..	..
2	0.651	0.895	**1.61**	0.651	0.895	**1.12**	**1.33**	..	..	..	..
2-1/2	**1.29**	**1.71**	**3.05**	**1.29**	**1.71**	**1.48**	**2.23**	..	..	..	..
3	**2.03**	**2.74**	**4.97**	**2.03**	**2.74**	**2.91**	**3.83**	..	..	..	..
3-1/2	**2.82**	**3.9**	**7.13**	**2.82**	**3.9**	..	**5.83**	..	..	..	..
4	**3.85**	**5.34**	**9.82**	**3.85**	**5.34**	**6.76**	**8.03**	..	..	..	..
5	**6.51**	**9.26**	**17.2**	**6.51**	**9.26**	**12**	**14.7**	..	..	..	..
6	**10.1**	**15.3**	**28.4**	**10.1**	**15.3**	**19.5**	**24.2**	..	..	..	..
8	**20.4**	**30.9**	**51.7**	**20.4**	**30.9**	**43.2**	**53.3**	..	**20.4**	**20.4**	..
10	**36.1**	**48.8**	**92.8**	**36.1**	**57.3**	**79.5**	**103**	..	**36.1**	**36.1**	..
12	**53**	**70**	**134**	**57.2**	**94.7**	**134**	**171**	..	**53**	**53**	**78.2**
14	**68.1**	**90**	..	**79.1**	**132**	**188**	**236**	**68.1**	**68.1**	**68.1**	**106**
16	**89.2**	**118**	..	**118**	**195**	**274**	**350**	**89.2**	**89.2**	**89.2**	**153**
18	**113**	**150**	..	**168**	**274**	**391**	**495**	**113**	**113**	**150**	**221**
20	**140**	**186**	..	**219**	**372**	**528**	**676**	**140**	**140**	**186**	**296**
22	**170**	**225**	..	**280**	**492**	**693**	**884**	**170**	**170**	**225**	..
24	**202**	**269**	..	**366**	**634**	**918**	**1160**	**202**	**202**	**366**	**610**

45° Long Radius Elbows

Unit:kg

	Carbon Steel & Alloy Steel										
	STD	XS	XXS	S40	S80	S120	S160	S10	S20	S30	S60
½	0.038	0.048	0.076	0.038	0.048	..	0.058	..	..	..	..
3/4	**0.06**	0.077	0.131	**0.06**	0.077	..	0.115	..	..	..	..
1	0.106	0.137	0.231	0.106	0.137	..	**0.18**	..	..	..	..
1- 1/4	0.163	0.215	0.374	0.163	0.215	..	**0.27**	..	..	..	..
1-1/2	0.218	0.292	0.515	0.218	0.292	..	**0.39**	..	..	..	..
2	0.361	0.497	0.893	0.361	0.497	**0.56**	0.736	..	..	..	..
2-1/2	0.728	0.961	**1.72**	0.728	0.961	**0.74**	**1.26**	..	..	..	..
3	**1.09**	**1.47**	**2.67**	**1.09**	**1.47**	1.455	**2.06**	..	..	..	..
3-1/2	**1.47**	**2.02**	**3.69**	**1.47**	**2.02**	..	**3.02**	..	..	..	..
4	**1.94**	**2.69**	**4.94**	**1.94**	**2.69**	**3.38**	**4.04**	..	..	..	..
5	**3.27**	**4.65**	**8.63**	**3.27**	**4.65**	**6**	**7.38**	..	..	..	..
6	**5.1**	**7.69**	**14.3**	**5.1**	**7.69**	**9.72**	**12.2**	..	..	..	..
8	**10.2**	**15.6**	**26**	**10.2**	**15.6**	**21.7**	**26.8**	..	**10.2**	**10.2**	..
10	**18.1**	**24.5**	**46.4**	**18.1**	**28.8**	**39.8**	**51.8**	..	**18.1**	**18.1**	..
12	**26.7**	**35.2**	**67**	**28.8**	**47.6**	**67**	**85.5**	..	**26.7**	**26.7**	**39.1**
14	**34.2**	**45.3**	..	**39.8**	**66.6**	**94.1**	**119**	**34.2**	**34.2**	**34.2**	**53**
16	**44.9**	**59.4**	..	**59.4**	**97.9**	**137**	**176**	**44.9**	**44.9**	**44.9**	**76.5**
18	**56.9**	**75.4**	..	**84.5**	**138**	**196**	**249**	**56.9**	**56.9**	**75.4**	**110**
20	**70.5**	**93.4**	..	**110**	**187**	**264**	**338**	**70.5**	**70.5**	**93.4**	**148**
22	**85**	112.5	..	**140**	**246**	**347**	**442**	**85**	**83.7**	112.5	..
24	**102**	**135**	..	**184**	**319**	**459**	**580**	**102**	**102**	**184**	**255**

90° Short Radius Elbows

Unit:kg

	Carbon Steel & Alloy Steel									
	STD	XS	XXS	S40	S80	S120	S160	S10	S20	S30
1	**0.1**	0.129	0.217	**0.1**	0.129	..	0.169	..	..	..
1- 1/4	0.169	0.223	0.388	0.169	0.223	..	**0.28**	..	..	..
1-1/2	0.242	0.324	0.572	0.242	0.324	..	0.434	..	..	..
2	0.434	0.597	**1.07**	0.434	0.597	..	0.884	..	..	..
2-1/2	0.861	**1.14**	**2.03**	0.861	**1.14**	..	**1.49**	..	..	..
3	**1.35**	**1.83**	**3.31**	**1.35**	**1.83**	..	**2.55**	..	..	..
3-1/2	**1.89**	**2.6**	**4.75**	**1.89**	**2.6**	..	**3.89**	..	..	..
4	**2.57**	**3.56**	**6.55**	**2.57**	**3.58**	**4.5**	**5.35**	..	..	..
5	**4.34**	**6.17**	**11.5**	**4.34**	**6.17**	**8.03**	**9.7**	..	..	..
6	**6.77**	**10.2**	**19**	**6.77**	**10.2**	**13**	**16.2**	..	..	..
8	**13.6**	**20.4**	**34.4**	**13.6**	**20.6**	**28.9**	**35.5**	..	**13.6**	**13.6**
10	**24.1**	**32.5**	**61.8**	**24.1**	**38.2**	**53**	**68.7**	..	**24.1**	**24.1**
12	**35.3**	**46.6**	**89.5**	**38.2**	**63.1**	**89.5**	**114**	..	**35.3**	**35.3**
14	**45.4**	**60**	..	**52.8**	**88.3**	**125**	**157**	**45.4**	**45.4**	**45.4**
16	**59.5**	**78.7**	..	**78.7**	**130**	**183**	**233**	**59.5**	**59.5**	**59.5**
18	**75.5**	**100**	..	**125**	**183**	**261**	**330**	**75.5**	**75.5**	**100**
20	**93.4**	**124**	..	**146**	**248**	**352**	**451**	**93.4**	**93.4**	**124**
22	**113**	150.2	..	**186**	**328**	**462**	**590**	**113**	**113**	150.2
24	**135**	**179**	..	**244**	**422**	**613**	**773**	**135**	**135**	**244**

Straight Tees

Unit:kg

	Carbon Steel & Alloy Steel									
	STD	XS	XXS	S40	S80	S120	S160	S10	S20	S30
½	0.102	0.118	0.17	0.102	0.118	··	0.139	··	··	··
3/4	0.136	0.18	0.25	0.136	0.18	··	0.211	··	··	··
1	0.3	0.388	0.544	0.3	0.388	··	0.424	··	··	··
1- 1/4	0.5	0.686	0.959	0.5	0.686	··	0.696	··	··	··
1-1/2	0.72	0.99	1.62	0.72	0.99	··	1.23	··	··	··
2	1.07	1.43	2.45	1.07	1.43	··	2.07	··	··	··
2-1/2	2.07	2.76	4.59	2.07	2.76	··	3.42	··	··	··
3	2.86	3.53	6.45	2.86	3.53	··	4.54	··	··	··
3-1/2	3.63	5.07	8.2	3.63	5.07	··	6.55	··	··	··
4	4.83	6.33	11.1	4.83	6.33	8.01	9.26	··	··	··
5	7.72	10	18.1	7.72	10	13.3	15.7	··	··	··
6	11.2	16.8	27.5	11.2	16.8	19.7	23.9	··	11.2	··
8	20.5	30	47	20.5	30	39.2	47	··	20.5	20.5
10	36.6	44.1	82.2	36.6	51	72.1	90.2	··	36.6	36.6
12	48.6	69.5	107	50.2	95.8	111	132	··	48.6	48.6
14	66.4	81.5	··	71.2	129	202	201	66.4	66.4	66.4
16	71.3	110	··	110	173	277	354	71.3	71.3	71.3
18	131	145	··	156	253	396	501	131	131	145
20	173	175	··	204	353	535	684	173	173	175
22	··	··	··	··	··	··	··	··	··	··
24	274	300	··	343	597	863	1090	274	274	348

Caps

Unit:kg

	Carbon Steel & Alloy Steel									
	STD	XS	XXS	S40	S80	S120	S160	S10	S20	S30
½	0.1	0.15	··	0.1	0.15	··	0.22	··	··	··
3/4	0.1	0.15	··	0.1	0.15	··	0.22	··	··	··
1	0.109	0.165	··	0.109	0.165	··	0.23	··	··	··
1- 1/4	0.145	0.197	··	0.145	0.197	··	0.26	··	··	··
1-1/2	0.171	0.236	··	0.171	0.236	··	0.34	··	··	··
2	0.234	0.33	··	0.234	0.33	··	0.52	··	··	··
2-1/2	0.42	0.565	··	0.42	0.565	··	0.77	··	··	··
3	0.664	0.917	··	0.664	0.917	··	1.35	··	··	··
3-1/2	0.958	1.36	··	0.958	1.36	··	··	··	··	··
4	1.17	1.68	··	1.17	1.68	2.68	2.52	··	··	··
5	1.9	2.73	··	1.9	2.73	4.35	4.1	··	··	··
6	2.83	4.38	··	2.83	4.38	6.28	6.58	··	··	··
8	5.11	7.91	··	5.11	7.91	13.2	16.7	··	5.19	5.19
10	8.92	12.2	··	8.92	16.4	23.3	33.4	··	6.33	9.15
12	13	17.4	··	14.1	26.4	38.6	50.6	··	9.43	13.3
14	15.9	21.2	··	18.6	34.9	51.1	65.6	16.6	13.2	15.9
16	20	26.7	··	26.7	49	70.8	92.8	21.2	16.6	20
18	25.5	34.1	··	41.5	69	101	131	31.9	21.2	25.6
20	31.8	42.5	··	54.1	93.8	136	179	31.9	31.9	50.4
22	··	··	··	··	··	··	··	··	··	··
24	45.1	60.1	··	89.7	160	237	306	45.1	45.1	82.7

Long Radius Returns

Unit:kg

	Carbon Steel & Alloy Steel									
	STD	XS	XXS	S40	S80	S120	S160	S10	S20	S30
½	0.152	0.194	0.304	0.152	0.194	··	0.234	··	··	··
3/4	0.208	0.268	0.45	0.208	0.268	··	0.352	··	··	··
1	0.3	0.388	0.652	0.3	0.388	··	0.506	··	··	··
1- 1/4	0.508	0.67	1.17	0.508	0.67	··	0.842	··	··	··
1-1/2	0.728	0.972	1.72	0.728	0.972	··	1.3	··	··	··
2	1.3	1.79	3.22	1.3	1.79	··	2.66	··	··	··
2-1/2	2.58	3.42	6.1	2.58	3.42	··	4.46	··	··	··
3	4.08	5.48	9.94	4.08	5.48	··	7.66	··	··	··
3-1/2	5.68	7.8	14.3	5.68	7.8	··	11.6	··	··	··
4	7.7	10.7	19.6	7.7	10.7	13.5	16	··	··	··
5	13	18.5	34.4	13	18.5	23.8	29.4	··	··	··
6	20.2	30.6	56.8	20.2	30.6	38.2	48.4	··	··	··
8	40.8	61.8	103.4	40.8	61.8	85.1	106	··	40.8	40.8
10	72.2	97.6	185.6	72.2	114	155	206	··	72.2	72.2
12	106	140	268	114	189	264	342	··	106	106
14	136	180	··	158	264	376	472	136	136	136
16	178	236	··	236	390	548	700	178	178	178
18	226	300	··	336	548	··	··	226	226	300
20	280	372	··	438	744	··	··	280	280	372

Short Radius Returns

Unit:kg

	Carbon Steel & Alloy Steel									
	STD	XS	XXS	S40	S80	S120	S160	S10	S20	S30
½	··	··	··	··	··	··	··	··	··	··
3/4	··	··	··	··	··	··	··	··	··	··
1	0.2	0.258	0.434	0.2	0.258	··	0.338	··	··	··
1- 1/4	0.338	0.446	0.676	0.338	0.446	··	0.56	··	··	··
1-1/2	0.484	0.648	1.14	0.484	0.648	··	0.868	··	··	··
2	0.868	1.19	2.14	0.868	1.19	··	1.77	··	··	··
2-1/2	1.72	2.28	4.06	1.72	2.28	··	2.98	··	··	··
3	2.7	3.66	6.62	2.7	3.66	··	5.1	··	··	··
3-1/2	3.78	5.2	9.5	3.78	5.2	··	7.78	··	··	··
4	5.14	7.12	13.1	5.14	7.12	10.7	10.7	··	··	··
5	8.68	12.3	23	8.68	12.3	19.4	19.6	··	··	··
6	13.5	20.4	38	13.5	20.4	32.4	32.4	··	··	··
8	27.2	41.2	68.8	27.2	41.2	71	71	··	27.2	27.2
10	48.2	65	136	48.2	76.4	106	137	··	48.2	48.2
12	70.6	93.2	179	76.4	126	179	228	··	70.6	70.6
14	90.8	120	··	106	177	250	314	··	90.8	90.8
16	119	157	··	157	260	366	466	90.8	119	119
18	151	200	··	224	366	··	660	119	··	··
20	186	248	··	292	496	··	902	··	··	··

Reducing Tees

Carbon Steel & Alloy Steel

Unit:kg

	STD	XS	XXS	S40	S80	S120	S160	S10	S20	S30
3/4 x 1/2	0.136	0.18	0.207	0.136	0.18	··	0.195	··	··	··
1 x 3/4	0.290	0.38	0.6	0.29	0.38	··	0.394	··	··	··
x 1/2	0.290	0.38	0.6	0.29	0.38	··	0.374	··	··	··
1-1/4 x 1	0.500	0.66	0.94	0.50	0.66	··	0.660	··	··	··
x 3/4	0.480	0.60	0.92	0.48	0.60	··	0.623	··	··	··
x 1/2	0.480	0.60	0.9	0.48	0.60	··	0.614	··	··	··
1-1/2 x 1-1/4	0.740	1.00	1.38	0.74	1.00	··	1.020	··	··	··
x 1	0.740	1.00	1.36	0.74	1.00	··	0.975	··	··	··
x 3/4	0.720	0.99	1.34	0.72	0.99	··	0.928	··	··	··
x 1/2	0.720	0.99	1.32	0.72	0.99	··	0.930	··	··	··
2 x 1-1/2	1.00	1.40	2.40	1.00	1.40	··	2.030	··	··	··
x 1-1/4	1.00	1.36	1.93	1.00	1.36	··	1.570	··	··	··
x 1	0.99	1.17	1.87	0.99	1.17	··	1.600	··	··	··
x 3/4	0.97	1.15	1.8	0.97	1.15	··	1.600	··	··	··
2-1/2 x 2	1.72	2.3	3.82	1.72	2.30	··	2.85	··	1.72	··
x 1-1/2	1.72	2.26	3.55	1.72	2.26	··	2.85	··	··	··
x 1-1/4	1.72	2.26	3.4	1.72	2.26	··	2.85	··	··	··
x 1	1.70	2.2	3.3	1.70	2.20	··	2.85	··	··	··
3 x 2-1/2	2.83	3.4	6.21	2.83	3.40	··	4.88	··	2.83	··
x 2	2.31	2.85	5.21	2.31	2.85	··	4.09	··	2.31	··
x 1-1/2	2.27	2.77	5.00	2.27	2.77	··	4.09	··	··	··
x 1-1/4	2.24	2.73	4.90	2.24	2.73	··	4.09	··	··	··
x 1	2.23	2.7	5.00	2.23	2.70	··	4.09	··	··	··
3-1/2 x 3	3.40	4.88	8.00	3.40	4.88	··	6.19	··	3.40	··
x 2-1/2	3.20	4.63	7.80	3.20	4.63	··	5.90	··	3.20	··
x 2	3.00	4.35	7.60	3.00	4.35	··	6.00	··	3.00	··
x 1-1/2	2.90	4.00	7.40	2.90	4.00	··	6.00	··	··	··
4 x 3-1/2	4.62	6.00	10.6	4.62	6.00	··	9.20	··	4.62	··
x 3	4.33	6.06	10.4	4.33	6.06	··	8.87	··	4.33	··
x 2-1/2	4.26	6.03	10.0	4.26	6.03	··	8.82	··	4.26	··
x 2	4.12	4.94	8.90	4.12	4.94	··	7.23	··	4.12	··
x 1-1/2	4.10	4.85	8.66	4.10	4.85	··	7.23	··	··	··
x 1-1/4	4.10	4.70	8.66	4.10	4.70	··	7.23	··	··	··
x 1	3.50	4.70	8.66	3.50	4.70	··	7.23	··	··	··
5 x 4	7.10	9.70	17.6	7.10	9.70	11.1	15.2	··	7.10	··
x 3-1/2	7.10	8.81	15.6	7.10	8.47	··	15.0	··	7.10	··
x 3	7.06	8.47	15.3	7.06	8.47	··	13.3	··	7.06	··
x 2-1/2	6.92	8.37	15.1	6.92	8.37	··	13.1	··	6.92	··
x 2	5.56	8.00	13.0	5.56	8.00	··	13.0	··	5.56	··
6 x 5	10.3	14.7	24.1	10.3	14.7	17.5	21.3	··	10.3	··
x 4	9.83	14.1	23.5	9.83	14.1	16.7	20.1	··	9.83	··
x 3-1/2	9.50	13.1	23.1	9.50	13.1	··	20.1	··	9.50	··
x 3	9.37	13.1	21.4	9.37	13.1	··	18.6	··	9.37	··
x 2-1/2	9.26	12.4	23.0	9.26	12.4	··	18.3	··	9.26	··
x 2	9.26	12.4	22.6	9.26	12.4	··	18.0	··	9.26	··
8 x 6	17.5	28.3	43.1	17.5	28.3	34.1	44.3	··	17.5	··
x 5	17.4	24.6	37.5	17.4	24.6	33.0	38.5	··	17.4	··
x 4	16.8	24.6	37.5	16.8	24.6	32	38.5	··	16.8	··
x 3-1/2	17.5	23.5	37.5	17.5	23.5	··	38.2	··	17.5	··
x 3	16.5	23.0	35.5	16.5	23.0	··	37	··	16.5	··
10 x 8	30.5	43.0	80.1	30.5	46.0	62.5	87.5	··	30.5	30.5
x 6	30.0	42.0	78.3	30.0	44.5	60	85.9	··	30	30
x 5	28.5	41.3	77.0	28.5	43.0	59	84.5	··	28.5	28.5
x 4	28.0	40	71.5	28.0	42.0	58	78	··	28	28.0
12 x 10	47.8	68.5	105	49.0	90.5	103	130	··	47.8	47.8
x 8	46.8	60	92.4	48.9	77.1	99.5	114	··	46.8	46.8
x 6	45.9	58	89.4	47.0	75.2	98	110	··	45.9	45.9
x 5	44.0	55	86.0	40.0	67.0	94	106	··	44	44.0
14 x 12	65.7	79.2	··	69.2	123	140	192	··	65.7	65.7
x 10	61.0	75	··	62.4	108	134	184	··	61	61
x 8	60.0	71.4	··	61.0	103	130	166	··	60	60
x 6	59.0	71.0	··	60.0	91.5	128	164	··	59	59
x 5	57.5	68.0	··	58.5	86.0	125	160	··	57.5	57.5
16 x 14	71.0	108	··	95.2	158	269	343	71	71	71
x 12	70.0	105	··	91.4	152	261	333	··	70	70
x 10	69.5	101	··	88.1	147	252	322	··	69.5	69.5
x 8	67.9	98.5	··	87.7	143	246	314	··	67.9	67.9
x 6	66.7	97.0	··	86.7	140	242	309	··	66.7	66.7
18 x 16	121	135	··	135	228	379	480	121	121	135
x 14	118	133	··	132	223	371	468	118	118	133
x 12	114	131	··	125	217	363	459	··	114	131
x 10	106	127	··	120	210	354	447	··	106	127
x 8	100	124	··	115	205	344	439	··	100	124
20 x 18	167	187	··	188	306	515	658	167	167	187
x 16	162	168	··	181	306	498	637	162	162	168
x 14	161	163	··	178	289	490	626	161	161	163
x 12	152	162	··	155	285	482	616	··	152	162
x 10	143	153	··	152	278	473	605	··	143	153
x 8	135	144	··	149	271	467	597	··	135	144
22 x 20	··	··	··	··	··	··	··	··	··	··
x 18	··	··	··	··	··	··	··	··	··	··
x 16	··	··	··	··	··	··	··	··	··	··
24 x 22	271	269	··	339	503	632	800	271	271	339
x 20	263	263	··	330	467	637	805	263	263	330
x 18	245	296	··	306	418	621	785	245	245	306

Reducers

Carbon Steel & Alloy Steel

Unit:kg

	STD	XS	XXS	S40	S80	S120	S160	S10	S20	S30
3/4 x ½	0.059	0.075	-	0.059	0.075	-	0.150	-	-	-
1 x 3/4	0.116	0.147	0.246	0.116	0.147	-	0.194	-	-	-
x ½	0.105	0.133	0.215	0.105	0.133	-	0.174	-	-	-
1-1/4 x 1	0.157	0.206	0.350	0.157	0.206	-	0.257	-	-	-
x 3/4	0.143	0.187	0.310	0.143	0.187	-	0.232	-	-	-
x ½	0.132	0.171	0.279	0.132	0.171	-	0.211	-	-	-
1-1/2 x 1-1/4	0.243	0.324	0.567	0.243	0.324	-	0.429	-	-	-
x 1	0.219	0.291	0.500	0.219	0.291	-	0.382	-	-	-
x 3/4	0.201	0.266	0.449	0.201	0.266	-	0.379	-	-	-
x ½	0.199	0.245	0.407	0.199	0.245	-	0.319	-	-	-
2 x 1-1/2	0.372	0.508	0.909	0.372	0.508	-	0.752	-	-	-
x 1-1/4	0.352	0.479	0.851	0.352	0.479	-	0.706	-	-	-
x 1	0.322	0.438	0.765	0.322	0.438	-	0.640	-	-	-
x 3/4	0.300	0.406	0.699	0.300	0.406	-	0.588	-	-	-
x ½	0.300	0.406	0.500	0.300	0.406	-	0.400	-	-	-
2-1/2 x 2	0.724	0.946	1.680	0.724	0.946	-	1.230	-	-	-
x 1-1/2	0.661	0.861	1.510	0.661	0.861	-	1.120	-	-	-
x 1-1/4	0.630	0.820	1.420	0.630	0.820	-	1.060	-	-	-
x 1	0.585	0.760	1.300	0.585	0.760	-	0.977	-	-	-
3 x 2-1/2	0.933	1.250	2.250	0.933	1.250	-	1.750	-	-	-
x 2	0.846	1.130	2.010	0.846	1.130	-	1.570	-	-	-
x 1-1/2	0.783	1.040	1.830	0.783	1.040	-	1.440	-	-	-
x 1-1/4	0.753	0.956	1.750	0.753	0.956	-	1.380	-	-	-
x 1	0.700	0.900	1.600	0.700	0.900	-	1.200	-	-	-
3-1/2 x 3	1.280	1.770	2.800	1.280	1.770	-	2.640	-	-	-
x 2-1/2	1.230	1.650	2.760	1.230	1.650	-	2.450	-	-	-
x 2	1.100	1.510	2.540	1.100	1.510	-	2.210	-	-	-
x 1-1/2	1.020	1.410	2.400	1.020	1.410	-	2.050	-	-	-
x 1-1/4	0.988	1.350	2.350	0.988	1.350	-	2.100	-	-	-
4 x 3-1/2	1.540	2.140	3.760	1.540	2.140	-	3.200	-	-	-
x 3	1.450	2.020	3.650	1.450	2.020	-	3.010	-	-	-
x 2-1/2	1.370	1.900	3.410	1.370	1.900	-	2.820	-	-	-
x 2	1.270	1.760	3.110	1.270	1.760	-	2.590	-	-	-
x 1-1/2	1.190	1.650	2.900	1.190	1.650	-	2.420	-	-	-
5 x 4	2.500	3.520	6.470	2.500	3.520	4.570	5.570	-	-	-
x 3-1/2	2.380	3.340	6.200	2.380	3.340	-	5.270	-	-	-
x 3	2.270	3.180	5.780	2.270	3.180	-	5.000	-	-	-
x 2-1/2	2.160	3.020	5.460	2.160	3.020	-	4.730	-	-	-
x 2	2.030	2.830	5.300	2.030	2.830	-	4.400	-	-	-
6 x 5	3.570	5.380	9.890	3.570	5.380	6.830	8.450	-	-	-
x 4	3.300	4.960	8.980	3.300	4.960	6.280	7.750	-	-	-
x 3-1/2	3.170	4.760	8.400	3.170	4.760	-	7.410	-	-	-
x 3	3.040	4.560	8.210	3.040	4.560	-	7.080	-	-	-
x 2-1/2	2.920	4.360	7.830	2.920	4.360	-	6.750	-	-	-
8 x 6	5.710	8.630	14.30	5.710	8.630	11.70	14.70	-	5.710	-
x 5	5.400	8.140	13.40	5.400	8.140	11.30	13.80	-	5.400	-
x 4	5.100	7.680	12.60	5.100	7.680	10.60	12.90	-	5.100	-
x 3-1/2	4.970	7.460	-	4.970	7.460	-	12.60	-	4.970	-
10 x 8	9.580	12.90	25.00	9.580	15.20	21.30	27.00	-	9.580	9.580
x 6	8.780	11.80	22.70	8.780	13.90	19.30	24.50	-	8.780	-
x 5	8.420	11.30	21.50	8.420	13.30	18.10	23.30	-	8.420	-
x 4	8.060	10.80	20.50	8.060	12.70	17.30	22.10	-	8.060	-
12 x 10	13.60	18.00	34.50	14.70	24.20	34.00	43.60	-	13.60	13.60
x 8	12.80	16.70	32.20	13.70	22.50	31.70	40.30	-	12.70	12.80
x 6	12.60	15.60	30.00	12.80	20.90	29.40	37.20	-	12.40	-
x 5	12.50	15.00	28.70	12.30	20.20	28.30	35.70	-	12.30	-
14 x 12	25.40	33.60	-	29.50	49.30	70.10	87.70	-	25.40	25.40
x 10	23.60	31.20	-	27.40	45.70	64.70	80.90	-	23.60	23.60
x 8	21.80	28.90	-	25.40	42.20	59.70	74.30	-	21.80	21.80
x 6	20.20	26.60	-	23.40	38.80	54.80	67.90	-	20.20	-
16 x 14	31.00	41.10	-	41.10	65.80	95.00	121.0	31.00	31.00	31.00
x 12	29.60	39.20	-	39.20	64.50	90.40	115.0	-	29.50	29.50
x 10	27.80	36.80	-	36.80	60.30	84.40	107.0	-	27.70	27.70
x 8	24.80	34.40	-	34.90	54.40	78.60	99.50	-	26.30	26.30
18 x 16	37.80	50.10	-	56.20	91.40	130.0	164.0	37.80	37.80	50.10
x 14	35.70	47.40	-	53.10	86.20	123.0	155.0	35.70	35.70	47.40
x 12	34.30	45.50	-	50.20	82.70	118.0	148.0	-	33.70	45.50
x 10	32.40	43.00	-	46.80	77.90	111.0	139.0	-	31.50	43.00
20 x 18	56.40	74.90	-	88.40	150.0	212.0	271.0	56.50	56.50	74.90
x 16	53.50	71.10	-	83.60	142.0	201.0	256.0	36.10	53.70	71.10
x 14	50.80	67.40	-	81.70	135.0	190.0	243.0	34.20	50.90	67.40
x 12	50.00	62.10	-	75.30	129.0	182.0	231.0	-	46.90	62.10
22 x 20	62.60	82.90	-	103.0	181.0	255.0	324.0	42.00	62.60	82.90
x 18	59.70	79.20	-	98.40	173.0	243.0	308.0	40.10	59.70	79.20
x 16	57.10	75.60	-	93.90	164.0	231.0	293.0	38.30	57.10	75.60
x 14	56.00	72.10	-	89.60	157.0	219.0	278.0	36.50	54.50	72.10
24 x 22	68.60	91.00	-	124.0	215.0	310.0	391.0	46.00	68.60	124.0
x 20	65.70	87.30	-	119.0	206.0	297.0	374.0	44.10	65.80	119.0
x 18	63.00	83.70	-	114.0	197.0	284.0	357.0	42.40	63.20	114.0
x 16	60.40	80.00	-	109.0	189.0	271.0	341.0	40.50	60.30	109.0

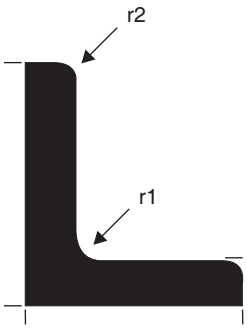
28. SPECIFICATIONS OF ROLLED STEEL BEAMS (Indian Standard)

Designation	Weight per meter (kg)	Sectional area (cm2)	Depth of Section (mm)	Width of Flange (mm)	Thickness of Flange (mm)	Thickness of Web (mm)
ISJB 150	7.1	9.01	150	50	4.6	3
ISJB 175	8.1	10.28	175	50	4.8	3.2
ISJB 200	9.9	12.64	200	60	5	3.4
ISJB 225	12.8	16.28	225	80	5	3.7
ISLB 75	6.1	7.7	75	50	5	3.7
ISLB 105	8	10.21	100	50	6.4	4
ISLB 125	11.9	15.12	125	75	6.5	4.4
ISLB 150	14.2	18.08	150	80	6.8	4.8
ISLB 175	16.7	21.3	175	90	6.9	5.1
ISLB 200	19.8	25.27	200	100	7.3	5.4
ISLB 225	23.5	29.92	225	100	8.6	5.8
ISLB 250	27.9	35.53	250	125	8.2	6.1
ISLB 275	33	42.02	275	140	8.8	6.4
ISLB 300	37.7	48.08	300	150	9.4	6.7
ISLB 325	43.1	54.9	325	165	9.8	7.3
ISLB 350	49.5	63.01	350	165	11.4	7.4
ISLB 400	56.9	72.43	400	165	12.5	8
ISLB 450	65.3	83.14	450	170	13.4	8.6
ISLB 500	75	95.5	500	180	14.1	9.2
ISLB 550	86.3	109.97	550	190	15	9.9
ISLB 600	99.5	126.69	600	210	15.5	10.5
ISMB 100	11.5	14.6	100	75	7.2	4
ISMB 125	13	16.6	125	75	7.6	4.4
ISMB 150	14.9	19	150	80	7.6	4.8
ISMB 175	19.3	24.62	175	90	8.6	5.5
ISMB 200	25.4	32.3	200	100	10.8	5.7
ISMB 225	31.2	39.72	225	110	11.8	6.5
ISMB 250	37.3	47.55	250	125	12.5	6.9
ISMB 300	44.2	56.26	300	140	12.4	7.5
ISMB 350	52.4	66.71	350	140	14.2	8.1
ISMB 400	61.6	78.46	400	140	16	8.9
ISMB 450	72.4	92.27	450	150	17.4	9.4
ISMB 500	86.9	110.74	500	180	17.2	10.2
ISMB 550	103.7	132.11	550	190	19.3	11.2
ISMB 600	122.6	156.21	600	210	20.8	12
ISMB 150	17	21.67	150	100	7	5.4

Designation	Weight per meter (kg)	Sectional area (cm2)	Depth of Section (mm)	Width of Flange (mm)	Thickness of Flange (mm)	Thickness of Web (mm)
ISJC 100	5.8	7.41	100	45	5.1	3
ISJC 125	7.9	10.07	125	50	6.6	3
ISJC 150	9.9	12.65	150	55	6.9	3.6
ISJC 175	11.2	14.24	175	60	6.9	3.6
ISJC 200	13.9	17.77	200	70	7.1	4.1
ISLC 75	5.7	7.26	75	40	6	3.7
ISLC 100	7.9	10.02	100	50	6.4	4
ISLC 125	10.7	13.67	125	65	6.6	4.4
ISLC 150	14.4	18.36	150	75	7.8	4.8
ISLC 175	17.6	22.4	175	75	9.5	5.1
ISLC 200	20.6	26.42	200	75	10.8	5.5
ISLC 225	24	30.53	225	90	10.2	5.8
ISLC 250	28	35.65	250	100	10.7	6.1
ISLC 300	33.1	42.11	300	100	11.6	6.7
ISLC 350	38.8	49.47	350	100	12.5	7.4
ISLC 400	45.7	58.25	400	100	14	8
ISMC 75	6.8	8.67	75	40	7.3	4.4
ISMC 100	9.2	11.7	100	50	7.5	4.7
ISMC 125	12.7	16.19	125	65	8.1	5
ISMC 150	16.4	20.88	150	75	9	5.4
ISMC 175	19.1	24.38	175	75	10.2	5.7
ISMC 200	22.1	28.21	200	75	11.4	6.1
ISMC 225	25.9	33.01	225	80	12.4	6.4
ISMC 250	30.4	38.67	250	80	14.1	7.1
ISMC 300	38.8	45.64	300	90	13.6	7.6
ISMC 350	42.1	53.66	350	100	13.5	8.1
ISMC 400	49.4	62.93	400	100	15.3	8.6

29. SPECIFICATIONS OF EQUAL ANGLES

Specifications Of Equal angles:- They are angles having both the sides of equal dimensions. For e.g. refer below given diagram,in which both the sides are of dimensions "a".



SIZES WITH SECTION WEIGHT OF EQUAL ANGLES

Size in mm	Weight in Kgs. Per Feet	Gauge Per Mtr.
20x20x3	0.274	0.899
25x25x3	0.335	1.099
25x25x5	0.548	1.798
31x31x3	0.39	1.28
35x35x5	0.792	2.599
37x37x3	0.518	1.7
40x40x3	0.548	1.798
40x40x5	0.915	3.002
40x40x6	1.066	3.498
50x50x5	1.158	3.799
50x50x6	1.372	4.502
60x60x6	1.645	5.397
65x65x6	1.767	5.798
65x65x8	2.346	7.697
65x65x10	2.864	9.397
75x75x6	2.072	6.798
75x75x8	2.712	8.898
75x75x10	3.352	10.998
80x80x6	2.224	7.297
80x80x8	2.925	9.597
90x90x6	2.499	8.199
90x90x8	3.292	10.801
90x90x10	4.084	13.4
100x100x6	2.804	9.2
100x100x8	3.687	12.097
100x100x10	4.545	14.912
100x100x12	5.395	17.701
110x110x12	5.028	16.497
130x130x10	6.004	19.699
150x150x10	6.95	22.803
150x150x12	8.29	27.199
150x150x16	10.911	35.799
150x150x20	13.441	44.1

30. GLOSSARY

Annealing – The heating and cooling of steel to remove stresses, alter physical, mechanical and metallurgical properties, increase corrosion resistance or to thermally treat steel prior to age hardening. Some scaling results from an oxide anneal.

Brinell Hardness – A hardness determined by applying a known load to the surface of a material to be tested through a hardened steel ball of known diameter. The diameter of the resulting permanent impression is measured. This method is not suitable for measuring the hardness of sheet and strip.

Carbon equivalent (for rating of weldability) – A value that takes into account the equivalent additive effects of carbon and other alloying elements on a particular characteristic of a steel. For rating of weldability, a formula commonly used is :
$CE = C + (Mn/6) + [(Cr + Mo + V)/5] + (Ni + Cu)/15]$.

Critical point (1) The temperature or pressure at which a change in crystal structure, phase or physical properties occurs; same as transformation temperature. (2) In an equilibrium diagram, that specific combination of composition, temperature and pressure at which the phases of an inhomogeneous system are in equilibrium.

Decarburization- Loss of carbon from the surface of a ferrous alloy as a result of heating in a medium that reacts with carbon.

Descaling (acid) - See pickling.

Killed steel – Steel deoxidized with a strong deoxidizing agent, such as silicon or aluminium, to reduce the oxygen content to such a level that no reaction occurs between carbon and oxygen during solidification.

Normalizing – Heating a ferrous alloy to a suitable temperature above the transformation range (approximately 100 C above the critical temperature range) and then cooling in still air to a temperature below that range to modify the grain size,to render the structure more uniform and usually to improve mechanical properties.

Pickling - As applied to stainless steels, is chemical removal of scale after annealing. The pickling agents used are generally a combination of HYDROFLUORIC and NITRIC ACID. Leaves a matt grey finish.

Soaking – Holding the material in a furnace after the outside has reached the desired temperature until uniformity of that temperature has been reached throughout its mass and desired metallurgical changes have been completed.

Stress relieving - A process of reducing internal residual stresses in the metal by heating to a suitable temperature and holding long enough at that temperature followed by cooling slowly enough to minimize the development of new residual stresses. This treatment may be applied to relieve stresses induced by casting,machining, cold working, welding, quenching and normalizing.

Tensile strength – A maximum load per unit of original cross- sectional area sustained by a material during a tension test.

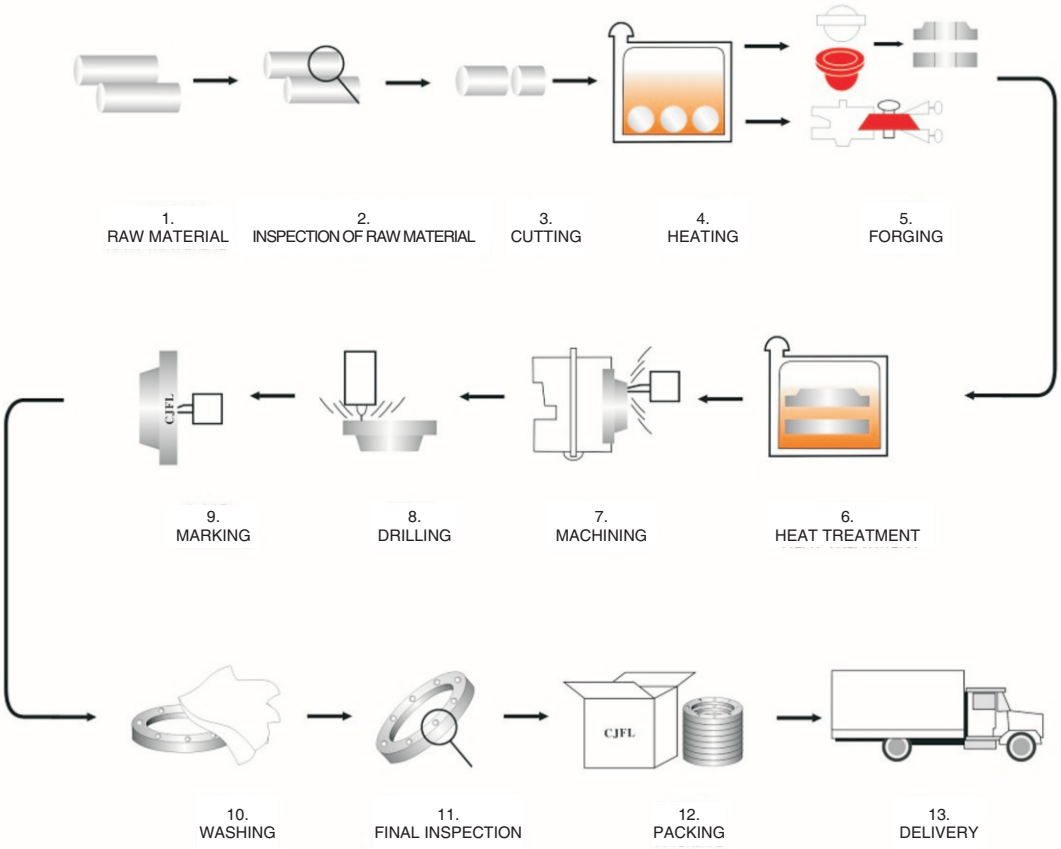
Tension test – A test in which a specimen is broken by applying an increasing load to the two ends. During the test the elastic properties and the ultimate tensile strength of the material are determined. After rupture the broken specimen may be measured for elongation and reduction area.

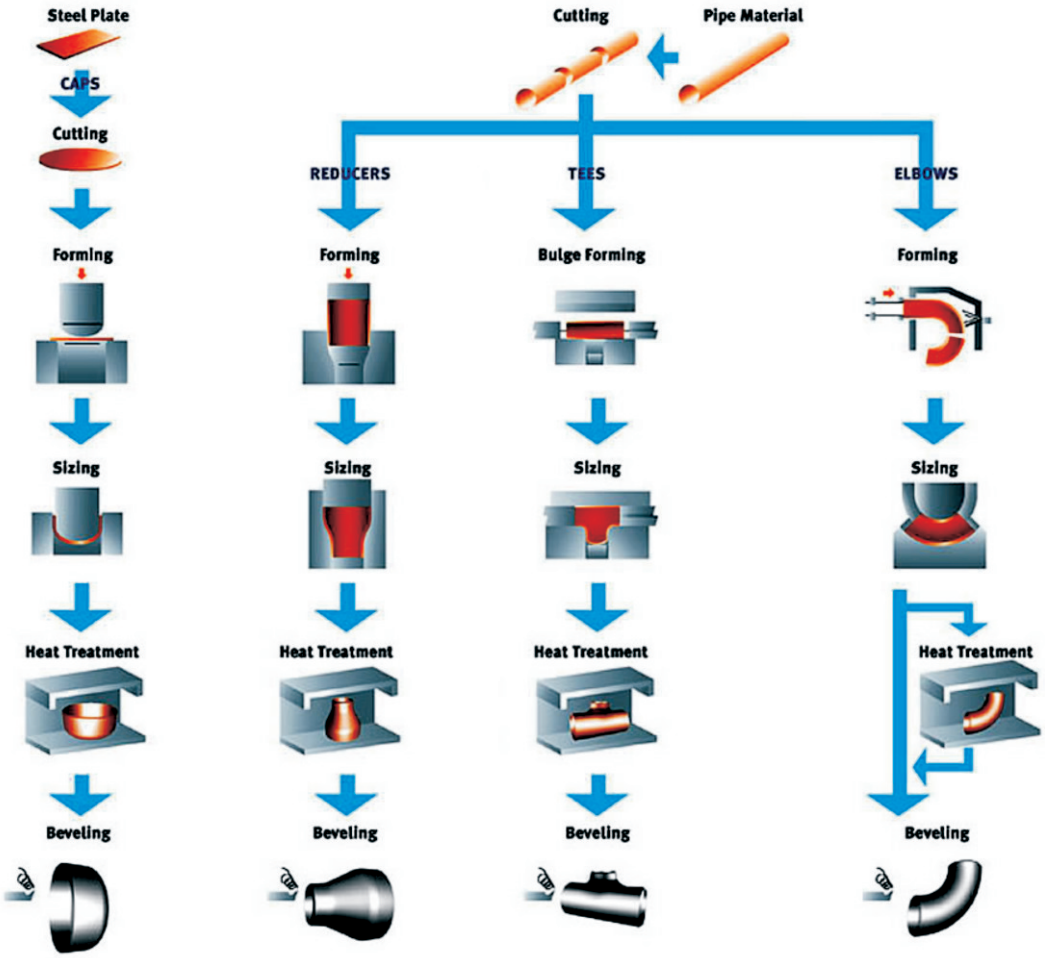
Tensile strength – A measure of the maximum pulling stress which a substance can endure before breaking. Tensile strength is rated as a given load across a unit area, in the U.K., as Newtons per square millimeter in the U.S.A as pounds per square inch; on the Continent as kilograms per square millimeter.

Yield point – The yield point is the load per unit area at which a marked increase in deformation of the specimen occurs without increase of load.

Yield Strength – Is defined as the stress at which a material deforms and will no longer return to its original state.

31. PROCESS FLOW





Address:
Marketing Office:
C-202, Radha Govind,
Radha Complex,
Siddharth Nagar,
Borivali (E)
Mumbai – 400066.

India Manufacturing Facility I:
Plot-2A, Phase 1,
Next Nestle India,
Industrial Area Tahliwal,
Dist. – Una,
Himachal Pradesh – 174301.

India Manufacturing Facility II:
Shed No. 1,
Ground Floor Rashid Compound,
Pelhar Village,
Survey No. 260,
Vasai East,
Dist Palghar – 401208, India

Contact Info:
Tel: +91-22-28461698
Fax: +91-22-28461698

E-mail: sales@anggerik.co.in
Web: www.anggerik.co.in

Anggerik Laksana (I) Pvt Ltd

We Speak Your Pipe Fitting's Language