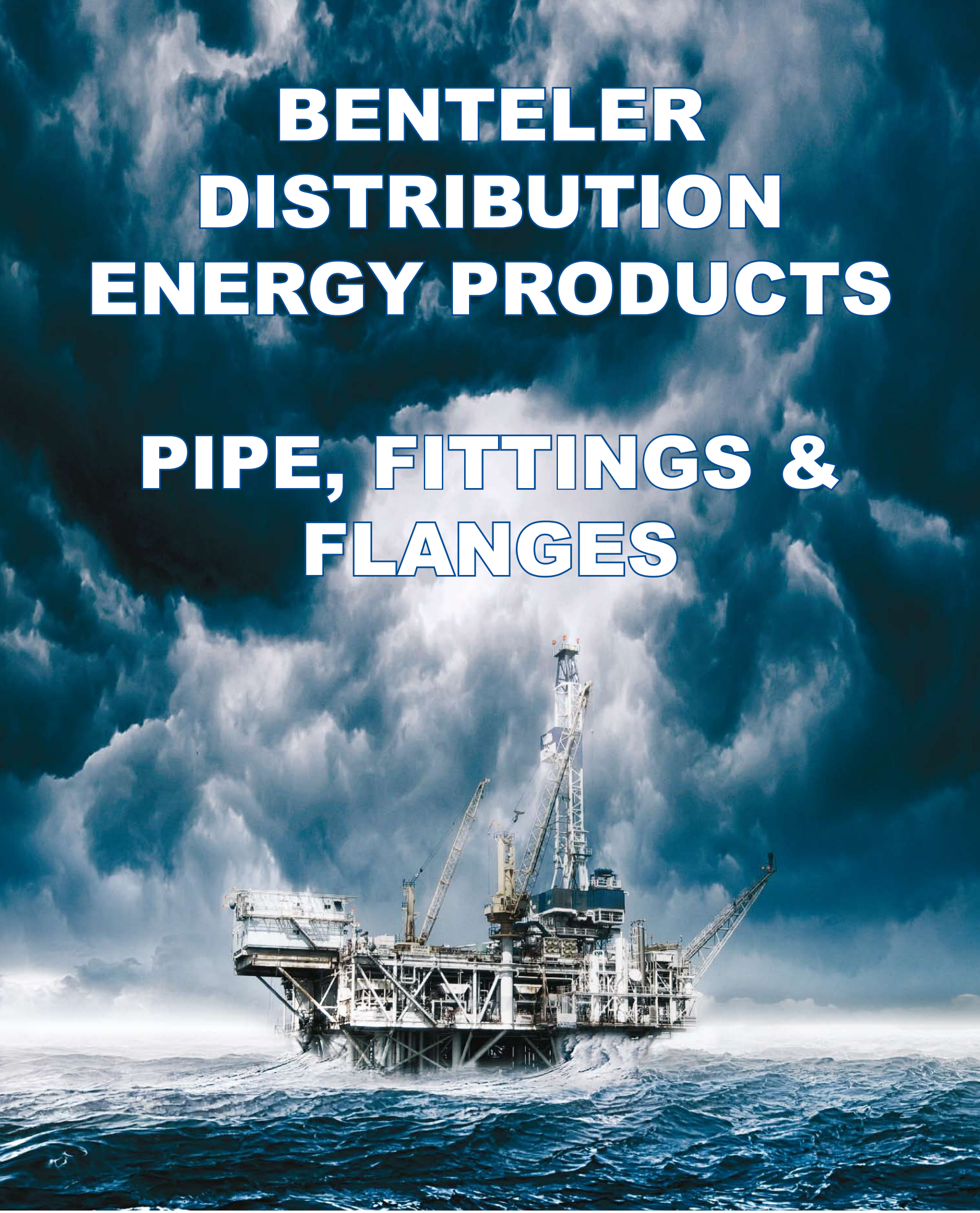
BENTELER DISTRIBUTION ENERGY PRODUCTS

PIPE, FITTINGS & FLANGES



CUSTOMISED SOLUTIONS WORLDWIDE

BENTELER Distribution

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CUSTOMISED SOLUTIONS WORLDWIDE

BENTELER Distribution

PROFILE

THE COMPLETE "ONE-STOP" SERVICE FOR PLANT OPERATORS, ENGINEERING CONTRACTORS AND FABRICATORS.

INTRODUCTION

Benteler Distribution is a worldwide stockholder and distributor, in Carbon, Alloy, Stainless, and specials including Duplex, Super Duplex, Hastelloy, Incoloy, and Titanium Alloys, servicing the Energy market.
We are a wholly owned subsidiary of Benteler AG, which has four divisions: Automotive Components, Automotive Machinery, Tube Manufacturing, and Distribution. We have over 24,000 employees worldwide, with a turnover of 6.3 Billion Euros.

EXPORT AND PROJECT MANAGEMENT

Benteler Distribution has extensive experience supplying the International Oil and Petrochemical Companies and Engineering Contractors and has developed a full Project Management Service to satisfy the needs of these customers and service their major projects.

QUALITY ASSURED SERVICE

Benteler Distribution worldwide provides a Quality assured service. In the UK we were amongst the first steel distribution companies to gain accreditation to the then BS5750 in 1986, and our current ISO 9001 and Achilles approvals, demonstrate our continual improvement and commitment to Quality.

FITTINGS & FLANGES

TESTING AND FINISHING FACILITIES

A comprehensive facility for Plant operators, Contractors and Fabricators is provided by Benteler Distribution extensive Finishing Facilities allowing the "customising" of material to specific Client requirements.
We offer Cutting, Bevelling, Threading and Machining facilities and a capability for Shotblasting and Coating. Mechanical, Chemical and Non-Destructive Testing is also available.

PRODUCT RANGE

- **Pipelines**
We supply a full range of carbon, alloy and stainless Pipe, Fittings, Flanges and ancillary products including valves, gaskets, bolts etc. in a wide range of international specifications.
- **Boilers**
We supply a full range of carbon, alloy and stainless tubes for the Boiler and Power Generation industries in full or cut lengths with a variety of end finishes, straight or manipulated.
- **Hydraulics**
We supply a full range of metric and imperial; carbon and stainless tubes with various protective coatings for Hydraulic and pneumatic applications.
- **Mechanical & Structural**
We supply a full range of Hot and Cold Finished, Seamless & Welded tubes in full or cut lengths for a variety of mechanical and structural applications.

Scotland - Energy

Unit 3, Abbots Road
Middlefield Industrial Estate
Falkirk
FK2 9HQ

North

New Progress Works
Crompton Way
Bolton
Lancashire
BL1 8TY

South - Midlands

Armstrong Road
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Basingstoke
Hampshire
RG24 8NU

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ENERGY

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GENERAL SALES

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PRODUCT RANGE

CARBON and ALLOY Type			Specification	Size Range
PIPE	Seamless		API 5L B API 5L X Grades ASTM A106 ASTM A333 ASTM A335 P Grades ASTM A53	1/4" to 24"
			EN 10216-2 EN 10210-2	1/4" to 26"
			BS3059	25.4 to 127.0mm
			AISI 4130/4140	2" to 20"
		Galvanised Threaded & Coupled	API 5L B ASTM A106 ASTM A53	1/4" to 4"
	Welded	Electric (ERW)	API 5L Grade B	1/4" to 24"
		Submerged Arc (SAW)	API 5L Grade B ASTM A671 ASTM A672 ASTM A691	1/4" to 60"
FITTINGS	Seamless	Buttweld	ASTM A234 WPB ASTM A234 WPL6 ASTM A234 P Grades High Yield Grades	1/4" to 24"
	Welded	Buttweld	ASTM A234 WPB ASTM A234 WPL6 ASTM A234 P Grades High Yield Grades	26"to 60"
	Forged	Threaded, Socket Weld and Olets	ASTM A105N ASTM A350 LF2 ASTM A182 Alloy Grades ASTM A182 High Yield Grades	1/8" to 4"
FLANGES	Plate		ANSI/ASME B16.5	1/2" to 24"
			ANSI/ASME B16.47	26" to 60"
			BS4504 BS10	3/8" to 48"
			EN 1092-1	10 to 3600mm
	Forged		BS4504 BS10	3/8" to 48"
			EN 1092-1	10 to 3600mm
		ANSI/ASME B16.5	ASTM A105N ASTM A350 LF2 ASTM A182 Alloy Grades ASTM A182 High Yield Grades	1/2" to 24"
		ANSI/ASME B16.47	ASTM A105N ASTM A350 LF2 ASTM A182 Alloy Grades ASTM A182 High Yield Grades	26" to 60"

NOTE: Other Specialised grades are also available, both from stock and manufactured to order.

STAINLESS Type			Specification	Size Range
PIPE	Seamless		ASTM A312 - All Grades	1/4"to 12"
			EN 10216-5 - All Grades	1/4"to 26"
		Annealed	ASTM A213 - All Grades ASTM A269 - All Grades	1/4" to 8"
	Welded		ASTM A312 - All Grades EN10217-7 - All Grades	1/2"to 40"
			ASTM A269 - All Grades	1/4" to 8"
FITTINGS	Seamless	Buttweld	ANSI/ASME B16.9 - ASTM A403 All Grades	1/2" to 12"
	Welded	Buttweld	ANSI/ASME B16.9 - ASTM A403 All Grades	1/2"to 40"
	Forged	Threaded, Socket Weld	ANSI B16.11 - ASTM A182 All Grades	1/8" to 4"
		Olets	MSS SP95/97 - ASTM A182 All Grades	1/8" to 24"
FLANGES	Plate		ANSI/ASME B16.5 - All Grades	1/2" to 24"
			ANSI/ASME B16.47 - All Grades	26" to 60"
			BS4504 - All Grades BS10 - All Grades	3/8" to 48"
			EN 1092-1 - All Grades	10 to 3600mm
	Forged		BS4504 - All Grades BS10 - All Grades	3/8" to 48"
			EN 1092-1 - All Grades	10 to 3600mm
			ANSI/ASME B16.5 - ASTM A182 All Grades	1/2" to 24"
			ANSI/ASME B16.47 - ASTM A182 All Grades	26" to 60"

NOTE: Other Specialised grades (Including Duplex, Super Duplex, Hastelloy and Incoloy) are also available, both from stock and manufactured to order.

LENGTHS

The normal lengths held in stock are;

Carbon & Alloy:	Single Randoms	5.0 to 8.0 metres
	Double Randoms	8.0 to 13.0 metres
Stainless:	Single Randoms	5.0 to 8.0 metres

Note: exact lengths and longer lengths can be manufactured and stocked to order.

END FINISH

The normal end finish of our stock is;

Carbon & Alloy:		
API/ASTM grades,	1 1/2"N.B. and below	Plain, Square Cut
Seamless & Welded:	2"N.B. and above	Bevelled
	above 22mm thick	Plain, Square Cut or Compound Bevelled
Stainless:		
ASTM grades,	Sch 10s and below	Plain, Square Cut
Seamless & Welded:	above Sch 10s	As per Carbon & Alloy above

Note: other end finishes can be manufactured and stocked to order.

Certificate of Registration

This is to certify that

Benteler Distribution Ltd

Supplier Number: 701623

are now fully registered as a supplier on the Utilities Vendor Database for the following product/service categories:

1.01.20	Fasteners & Fixings
1.11.03	Boiler Ancillary Equipment
1.13.02	Mechanical Seals & Gaskets
1.18.10	Pipes & Fittings - Steel
1.18.16	Pipes & Fittings - Stainless Steel

Ian Bartle
Steering Group Chairperson
CE Electric (UK) Limited
Registration Expiry Date: **30 May 2010**

This is not a legal document and cannot be used as such. To check the validity of this certificate please visit www.achilles.com

collaborative insightful neutral

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Certificate of Registration

QUALITY MANAGEMENT SYSTEM - ISO 9001:2008

This is to certify that:

Benteler Distribution Limited
Crompton Way
Bolton
BL1 8TY
United Kingdom

Holds Certificate No: **RS 00313**

and operates a Quality Management System which complies with the requirements of ISO 9001:2008 for the following scope:

Stockholding and supply of carbon, stainless and alloy tube, bar, sections and ancillary fittings to a variety of specifications including BS, EN and DIN standards from quality assured sources with or without lot traceability.
Additional processing in the form of cutting to length, deburring and tube washing is also available.

For and on behalf of BSI:

Managing Director, BSI EMEA

Originally registered: **01/11/1986** Latest Issue: **15/07/2009** Expiry Date: **11/08/2010**

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1. SPECIFICATIONS

1(A). SPECIFICATION REFERENCES

Specification			Description
GERMAN			
DIN	1626	PT 1	Seamless tubes in unalloyed steels for supply purposes, process plant and tanks, survey, technical conditions of delivery, general data
DIN	1626	PT 2	Seamless tubes in unalloyed steels for supply purposes, process plant and tanks, tubes of commercial quality, technical conditions of delivery
DIN	1626	PT 3	Seamless tubes in unalloyed steels for supply purposes, process plant and tanks, tubes with quality specifications, technical conditions of delivery
DIN	1626	PT 4	Seamless tubes in unalloyed steels for supply purposes, process plant and tanks, tubes with quality specifications, technical conditions of delivery
DIN	1629		Seamless circular tubes of non alloy steels with special quality requirements
DIN	17172		Steel pipes for pipelines for the transport of combustible fluids and gases
DIN	17173		Seamless circular tubes made from steels with low temperature service
DIN	17175		Seamless steel tubes for elevated temperatures
DIN	17177		Electric Pressure Welded steel tubes for elevated temperatures
EURONORM			
EN	10210	PT 1	Hot finished structural hollow sections of non alloy and fine grain structural steels technical delivery requirements
EN	10210	PT 2	Hot finished structural hollow sections of non alloy and fine grain structural steels tolerances, dimensions and sectional properties
EN	10216	PT 1	Seamless steel tubes for pressure purposes - non alloy steel tubes with specified room temperature properties
EN	10216	PT 2	Seamless steel tubes for pressure purposes - non alloy and alloy steel tubes with specified elevated temperature properties
EN	10216	PT 5	Seamless steel tubes for pressure purposes. Technical delivery conditions. Stainless steel tubes
EN	10217	PT 7	Welded steel tubes for pressure purposes. Stainless Steel.
EN	10025	PT 2	Hot rolled products of structural steel technical delivery conditions for non-alloy structural steels
EN	10305	PT 1	Steel tubes for precision applications technical delivery conditions seamless cold drawn tubes
EN	10305	PT 2	Steel tubes for precision applications technical delivery conditions welded cold drawn tubes
EN	10305	PT 3	Steel tubes for precision applications technical delivery conditions welded cold sized tubes
EN	10305	PT 4	Steel tubes for precision applications technical delivery conditions seamless cold drawn tubes for hydraulic and pneumatic power systems
EN	10305	PT 5	Steel tubes for precision applications technical delivery conditions welded and cold sized square and rectangular tubes
EN	10305	PT 6	Steel tubes for precision applications technical delivery conditions welded cold drawn tubes for hydraulic and pneumatic power systems
BRITISH			
BS	3059	PT 1	Low tensile carbon steel tubes without specified elevated temperature properties
BS	3059	PT 2	Carbon, alloy and austenitic stainless steel tubes with specified elevated temperature properties
BS	3601		Steel pipes and tubes for pressure purposes: carbon steel with specified room temperature properties
BS	3602		Steel pipes and tubes for pressure purposes: carbon and carbon manganese steel with specified elevated temperature properties
BS	3603		Steel pipes and tubes for pressure purposes: carbon and alloy steel with specified low temperature properties
BS	3604		Steel pipes and tubes for pressure purposes: ferritic alloy steel with specified elevated temperature properties
BS	3605		Seamless and welded austenitic stainless steel pipe and tubes for pressure purposes
BS	3606		Steel tubes for heat exchangers
AMERICAN			
ASTM	A53		Welded and seamless pipe, black and galvanised
ASTM	A106		Seamless Carbon Steel Pipe for High Temperature Service
ASTM	A120		Pipe, steel black and galvanised welded and seamless for ordinary uses
ASTM	A134		Electric fusion welded steel pipes 16" and over
ASTM	A135		Electric resistance welded steel pipe
ASTM	A139		Electric fusion welded steel pipes 4" and over
ASTM	A161		Seamless low carbon and carbon molybdenum steel tubes for refinery service
ASTM	A178		Electric resistance welded carbon steel boiler tubes
ASTM	A179		Seamless cold drawn low carbon steel heat exchanger and condenser tubes
ASTM	A192		Seamless carbon steel boiler tubes for high pressure service
ASTM	A200		Seamless intermediate alloy steel still tubes for refinery service
ASTM	A209		Seamless carbon molybdenum alloy steel boiler and super heater tubes
ASTM	A210		Seamless medium carbon steel boiler and super heater tubes
ASTM	A213		Seamless ferritic and austenitic alloy steel boiler, super heater, and heat exchanger tubes
ASTM	A214		Electric resistance welded carbon steel heat exchanger and condenser tubes
ASTM	A335		Seamless ferritic alloy steel pipe for high temperature service
ASTM	A450		General requirements for carbon, ferritic alloy and austenitic alloy steel tubes
ASTM	A520		Supplementary requirements for seamless and electric resistance welded carbon steel tubular products for high temperature service conforming to ISO recommendations for boiler construction
ASTM	A530		General requirements for specialised carbon and alloy steel pipes
ASTM	A587		Electric welded low carbon steel pipe for the chemical industry
ASTM	A671		Standard specification for electric fusion welded pipe for atmospheric and lower temperatures
ASTM	A672		Standard specification for electric fusion welded steel pipe for high pressure service at moderate temperatures
ASTM	A691		Standard specification for carbon and alloy steel pipe electric fusion welded for high pressure service at high temperatures

1(B). AMERICAN PIPE SPECIFICATIONS AND SIMILAR INTERNATIONAL COMPARISONS - CARBON AND ALLOY

American		British		German			French		Euronorm	
Standard	Grade	Standard	Grade	Standard	Grade	Werkstoff	Standard	Grade	Standard	Grade
		3059	320	17175	St35.8	1.0305	49213/15	TU 37 C	10216-2	P235GH
API 5L	A	3602	360	17175	St35.8	1.0305	49213/15	TU 37 C	10216-2	P235GH
	B	3602	430	17175	St45.8	1.0405	49213/15	TU 42 C	10216-2	P265GH
	C	3602	460	17175	17Mn4	1.0481	49213/15	TU 48 C		
ASTM A53	A	3601	360	17175	St35.8	1.0305	49213/15	TU 37 C	10216-2	P235GH
	B	3601	430	17175	St45.8	1.0405	49213/15	TU 42 C	10216-2	P265GH
ASTM A106	A	3602	360	17175	St35.8	1.0305	49213/15	TU 37 C	10216-2	P235GH
	B	3602	430	17175	St45.8	1.0405	49213/15	TU 42 C	10216-2	P265GH
	C	3602	460	17175	17Mn4	1.0481	49213/15	TU 48 C		
ASTM A333	1			17173	TTSt35N/V	1.1101			10216-4	P215NL/P255QL
	3	3603	503LT	17173	10Ni14	1.1101	49213/15	TU 10 N14	10222-3	12Ni14
	6	3603	430LT				49213/15	TU 42 BT		
ASTM A179		3059	360	17175	St35.8	1.0305	49213/15	TU 37 C	10216-2	P235GH
ASTM A192		3602	360	17175	St35.8	1.0305	49213/15	TU 37 C	10216-2	P235GH
ASTM A210	A 1	3602	430	17175	St45.8	1.0405	49213/15	TU 42 C	10216-2	P265GH
	C	3059	440	17175	17Mn4	1.0481	49213/15	TU 48 C		
API 5L	X42			17172	StE 290.7	1.0429/84			10208-2	L290MB
	X52			17172/17121	StE 360.7/ST52.3	1.0578/82			10208-2/10210	L360MB/S355 J2H
	X60			17172	StE 415.7	1.8972/73			10208-2	L415MB
	X65			17172	StE 445.7	1.8975			10208-2	L450MB
	X70			17172	StE 480.7	1.8977			10208-2	L485MB
	X80									
ASTM A335	P1	3606	245	17175	16Mo3	1.5423	49213/15	TU 15 D 3	10216-2	16Mo3
	P5	3059/3604	625	17176	12CrMo05	1.7362	49213/15	TU Z 10 CD 5-05	10216-2	X11CrMo5
	P9	3059/3604	629-590	17176	11CrMo9-10	1.7386	49213/15	TU Z 10 CD 09	10216-2	11CrMo9-10
	P11	3059/3604	621				49213/15	TU 10 CD 5.05		
	P12	3059/3604	620	17175	13CrMo44	1.7335	49213/15	TU 13 CD 4.04	10216-2	13CrMo4-5
	P22	3059/3604	622-440	17175	10CrMo9-10	1.7380	49213/15	TU 10 CD 9.10	10216-2	10CrMo9-10
	P91	3059/3604	91	17175	X10CrMoVNb9-1	1.4903	49213/15	TU Z 10 CD VNb09.01	10216-2	X10CrMoVNb9-1
ASTM A209	T1	3606	245	17175	15/16Mo3	1.5423	49213/15	TU 15 D 3	10216-2	16Mo3
ASTM A213	T5	3059/3604	625	17175	12CrMo5		49213/15	TU Z 10 CD 05.05	10216-2	X11CrMo5
	T9	3059/3604	629-470	17175	X12CrMo91		49213/15	TU Z 10 CD 09	10216-2	11CrMo9-10
	T11	3059/3604	621				49213/15	TU 10 CD 5.05		
	T12	3059/3604	620-460	17175	13CrMo44		49213/15	TU 13 CD 4.04	10216-2	13CrMo4-5
	T22	3059/3604	622-490	17175	10CrMo910		49213/15	TU 10 C 9.10	10216-2	10CrMo9-10
	T91	3059/3604	91	17175	X10CrMoVNb9-1	1.4903	49213/15	TU Z 10 CD VNb09.01	10216-2	X10CrMoVNb9-1
		3059/3604	762	17175	X20CrMoV12-1	1.4822			10216-2	X20CrMoV11-1

1(C). AMERICAN PIPE SPECIFICATIONS AND SIMILAR INTERNATIONAL COMPARISONS - STAINLESS STEEL

American		British		German			French		Euronorm	
Standard	Grade	Standard	Grade	Standard	Grade	Werkstoff	Standard	Grade	Standard	Grade
ASTM A312	304	3605	304S31	17456/58	X5CrNi1810	1.4301	49117	Z7 CN 18-09	10216-5	X5CrNi 18-10
	304L	3605	304S11	17456/58	X2CrNi1911	1.4306	49117	Z3 CN 18-10	10216-5	X2CrNi 19-11
	316	3605	316S31	17456/58	X5CrNiMo17122	1.4401	35572	Z7 CND 17-11-02	10216-5	X5CrNiMo 17-12-2
	316L	3605	316S11	17456/58	X5CrNiMo17133	1.4404	35572	Z3 CND 17-11-02	10216-5	X5CrNiMo 17-13-3
	316Ti	3605	320S31	17456/58	X6CrNiMoTi17122	1.4571	35572	Z6 CNDT 17-12	10216-5	X6CrNiMoTi 17-12-2
	321	3605	321S31	17456/58	X6CrNiTi1810	1.4541	35572	Z6 CNT 18-2	10216-5	X6CrNITi 18-10
	347	3605	347	17456/58	X6CrNiNb1810	1.4550			10216-5	X6CrNiNb 18-10
	309	3605	309	17456/58	X15CrNiSi2012	1.4828			10216-5	X15CrNiSi 20-12
	310	3605	310S	17456/58	X8CrNi2521	1.4845	35572	Z8 CN 25-20	10216-5	X8CrNi 25-21
	317L	3605	317S12	17456/58	X2CrNiMo18154	1.4438	35572	Z3 CND 19-15-04	10216-5	X2CrNiMo 18-15-4
	904L	3605	904S13	17456/58	X1NiCrMoCu25205	1.4539	35572	Z2 NCDU 25-20	10216-5	X1NiCrMoCu 25-20-5

2. CHEMICAL ANALYSES AND PHYSICAL PROPERTIES

2(A). CARBON AND ALLOY STEEL PIPE, FITTINGS AND FLANGES

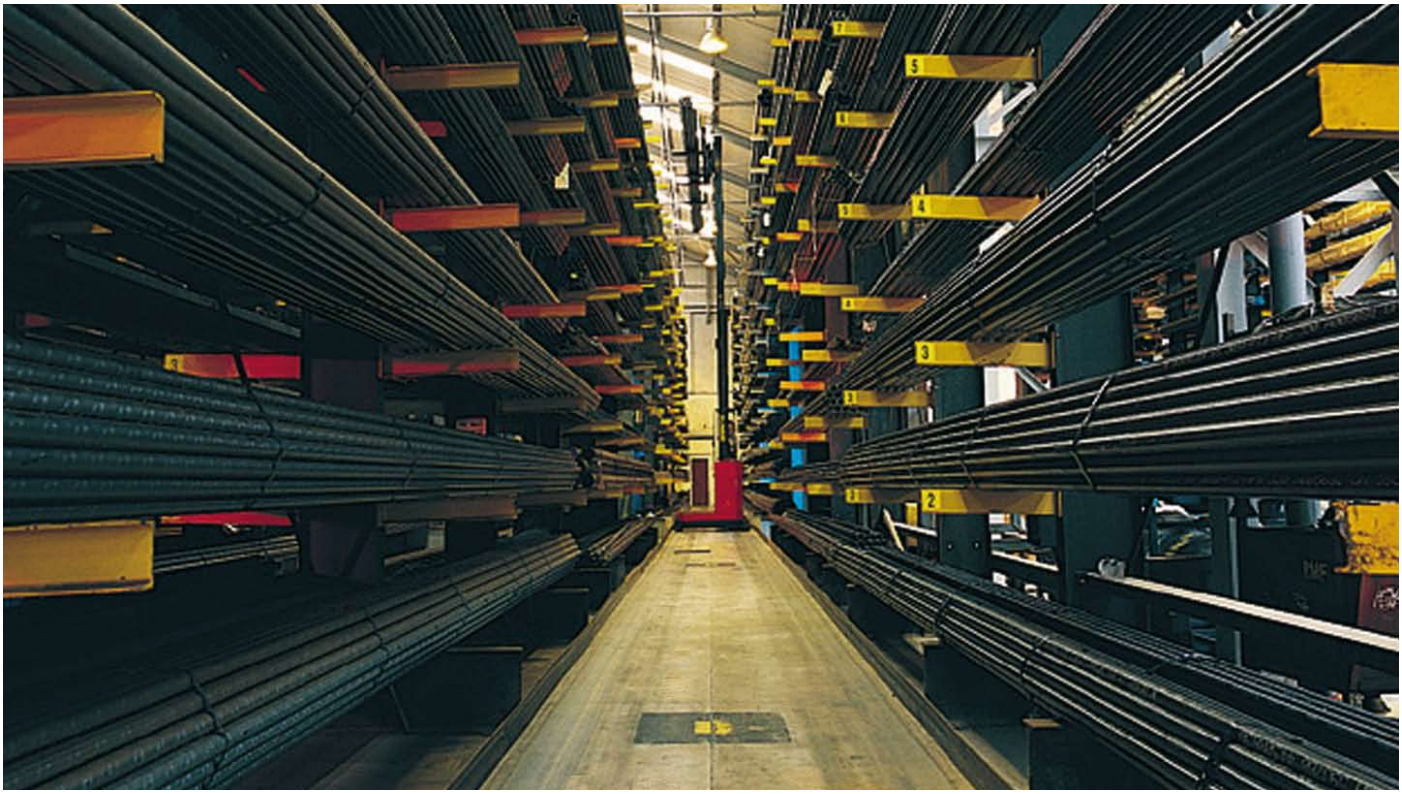
Material	Standard	Grade	Product	Chemical Composition %								Min tensile		Min Yield	
				Carbon	Manganese	Phos (max)	Sulpher (max)	Silicon	Chromium	Moly	Nickel	lb/in²	MPA	lb/in²	MPA
Carbon Steel[1]	API5L	B	Linepipe	0.27 max	1.15 max	0.040	0.050					60,000	413	35,000	241
		X42	Linepipe	0.29 max	1.25 max	0.040	0.050					60,000	413	42,000	289
		X46	Linepipe	0.31 max	1.35 max	0.040	0.050					63,000	434	46,000	317
		X52	Linepipe	0.31 max	1.35 max	0.040	0.050					66,000	455	52,000	358
		X60	Linepipe	0.26 max	1.35 max	0.040	0.050					75,000	517	60,000	413
Carbon Steel	ASTM A53	B	Pipe	0.30 max	1.20 max	0.050	0.060					60,000	415	35,000	240
Carbon Steel[1,2]	ASTM A106	B	Pipe	0.30 max	0.29-1.06	0.035	0.035	0.10 min				60,000	415	35,000	240
	ASTM A234	WPB	Fittings	0.30 max	0.29-1.06	0.050	0.058	0.10 min				60,000	415	35,000	240
Carbon Steel[3]	ASTM A106	C	Pipe	0.35 max	0.29-1.06	0.035	0.035	0.10 min				70,000	485	40,000	275
	ASTM A234	WPC	Fittings	0.35 max	0.29-1.06	0.050	0.058	0.10 min				70,000	485	40,000	275
Carbon Steel	ASTM A105[5]	N	Flanges Forged Fittings	0.35 max	0.60-1.05	0.040	0.050	0.10-0.35				70,000	485	36,000	250
Carbon Steel[1,2,3]	ASTM A333	6	Pipe	0.30 max	0.29-1.06	0.025	0.025	0.10 min				60,000	415	35,000	240
	ASTM A420	WPL6	Fittings	0.30 max	0.39-1.06	0.030	0.030	0.10 min				60,000	415	35,000	240
Carbon Steel	ASTM A350	LF 2	Flanges	0.30 max	1.35 max	0.035	0.040	0.15-0.30	0.30 max	0.12 max	0.40 max	70,000	485	36,000	250
Alloy Steel 3.5% Nickel[3]	ASTM A333	3	Pipe	0.19 max	0.31-0.64	0.025	0.025	0.18-0.37			3.18-3.82	65,000	450	35,000	240
	ASTM A420	WPL3	Fittings	0.20 max	0.31-0.64	0.050	0.050	0.13-0.37			3.18-3.82	65,000	450	35,000	240
	ASTM A350	LF 3	Flanges	0.20 max	0.90 max	0.035	0.040	0.20-0.35	0.30 max	0.12 max	3.25-3.75	70,000	485	36,000	250
Alloy Steel 1.25% Cr 0.5% Mo[4]	ASTM A335	P11	Pipe	0.05-0.15	0.30-0.60-	0.025	0.025	0.50-1.00	1.00-1.50	0.44-0.65		60,000	415	30,000	205
	ASTM A234	WP11 CL1	Fittings	0.05-0.15	0.30.-0.60	0.030	0.030	0.50-1.00	1.00-1.50	0.44-0.65		60,000	415	30,000	205
	ASTM A234	WP11 CL2	Fittings	0.05-0.20	0.30-0.80	0.040	0.040	0.50-1.00	1.00-1.50	0.44-0.65		70,000	485	40,000	275
	ASTM A234	WP11 CL3	Fittings	0.05-0.20	0.30-0.80	0.040	0.040	0.50-1.00	1.00-1.50	0.44-0.65		75,000	520	45,000	310
	ASTM A182	F11 CL1	Flanges	0.05-0.15	0.30-0.60	0.030	0.030	0.50-1.00	1.00-1.50	0.44-0.65		60,000	415	30,000	205
	ASTM A182	F11 CL2	Flanges	0.10-0.20	0.30-0.60	0.040	0.040	0.50-1.00	1.00-1.50	0.44-0.65		70,000	485	40,000	275
	ASTM A182	F11 CL3	Flanges	0.05-0.20	0.30-0.80	0.040	0.040	0.50-1.00	1.00-1.50	0.44-0.65		75,000	520	45,000	310
Alloy Steel 2.25% Cr 1% Mo[4]	ASTM A335	P22	Pipe	0.05-0.15	0.30-0.60	0.025	0.025	0.50 max	1.90-2.60	0.87-1.13		60,000	415	30,000	205
	ASTM A234	WP22 CL1	Fittings	0.05-0.15	0.30-0.60	0.040	0.040	0.50 max	1.90-2.60	0.87-1.13		60,000	415	30,000	205
	ASTM A234	WP22 CL3	Fittings	0.05-0.15	0.30-0.60	0.040	0.040	0.50 max	1.90-2.60	0.87-1.13		75,000	520	45,000	310
	ASTM A182	F22 CL1	Flanges	0.05-0.15	0.30-0.60	0.040	0.040	0.50 max	2.00-2.50	0.87-1.13		60,000	415	30,000	205
	ASTM A182	F22 CL3	Flanges	0.05-0.15	0.30-0.60	0.040	0.040	0.50 max	2.00-2.50	0.87-1.13		75,000	520	45,000	310
Alloy Steel 5% Cr 0.05% Mo[4]	ASTM A335	P5	Pipe	0.15 max	0.30-0.60	0.025	0.025	0.50 max	4.00-6.00	0.45-0.65		60,000	415	30,000	205
	ASTM A234	WP5	Fittings	0.15 max	0.30-0.60	0.040	0.030	0.50 max	4.00-6.00	0.45-0.65		60,000	415	30,000	205
	ASTM A182	F5	Flanges	0.15 max	0.30-0.60	0.030	0.030	0.50 max	4.00-6.00	0.45-0.65		70,000	485	40,000	275
Alloy Steel 9% Cr 1% Mo[4]	ASTM A335	P9	Pipe	0.15 max	0.30-0.60	0.025	0.025	0.25-1.00	8.00-10.00	0.90-1.10		60,000	415	30,000	205
	ASTM A234	WP9	Fittings	0.15 max	0.30-0.60	0.030	0.030	0.25-1.00	8.00-10.00	0.90-1.10		60,000	415	30,000	205
	ASTM A182	F9	Flanges	0.15 max	0.30-0.60	0.030	0.030	0.50-1.00	8.00-10.00	0.90-1.10		85,000	585	55,000	380

Notes:
1 A restriction on carbon of 0.20% maximum and on sulphur of 0.010% maximum is applied to Benteler Distribution stock pipe to API 5L S, ASTM A53 S, ASTM A 106 S, and ASTM A333 Grade 6 to meet current market needs.
2 In addition, ASTM A333 Grade 6 is Charpy impact tested at -45°C
3 Submerged arc/electric fusion welded pipe is also available in similar grades in ASTM A671 and ASTM A672 material.
4 Submerged arc/electric fusion welded pipe is also available in similar grades in ASTM A691 material.
5 stock flanges are normalised.

2(B). AMERICAN SPECIFICATIONS - STAINLESS STEELS - PIPE, FITTINGS AND FLANGES

Grade	Chemical Composition											Min Tensile		min Yield	
	Carbon (max[7])	Man-ganese (max[7])	Phos (max)	Sulphur (max)	Silicon (max[7])	Nickel	Chro-mium	Molyb-denum	Titanium	Co-lumbium plus Tanta-lum	Tan-talum (max)	Nitro-gen[6]	lb/in^2	MPA	lb/in^2	MPA
304	0.08	2.00	0.040	0.030	0.75	8.00-11.00	18.0-20.0	-	-	-	-	-	85,000	585	35,000	242
304H	0.04-0.10	2.00	0.040	0.030	0.75	8.00-11.00	18.0-20.0	-	-	-	-	-	85,000	585	35,000	242
304L	0.035[1]	2.00	0.040	0.030	0.75	8.00-13.0	18.0-20.0	-	-	-	-	-	80,000	553	30,000	207
310S	0.08	2.00	0.045	0.030	0.75	19.0-22.0	24.0-26.0	0.75	-	-	-	-	95,000	656	45,000	311
316	0.08	2.00	0.040	0.030	0.75	11.0-14-0	16.0-18.0	2.00-3.00	-	-	-	-	90,000	622	40,000	276
316H	0.04-0.10	2.00	0.040	0.030	0.75	11.0-14.0	16.0-18.0	2.00-3.00	-	-	-	-	90,000	622	40,000	276
316L	0.035[1]	2.00	0.040	0.030	0.75	10.0-15.0	16.0-18.0	2.00-3.00	-	-	-	-	80,000	553	35,000	242
317	0.08	2.00	0.040	0.030	0.75	11.0-14.0	18.0-20.0	3.00-4.00	-	-	-	-	90,000	622	40,000	276
317L	0.035	2.00	0.040	0.030	0.75	11.0-15.0	18.0-20.0	3.00-4.00	-	-	-	-	80,000	553	35,000	242
321	0.08	2.00	0.040	0.030	0.75	9.00-13.0	17.0-20.0	-	[2]	-	-	-	90,000	622	35,000	242
321H	0.04-0.10	2.00	0.040	0.030	0.75	9.00-13.0	17.0-20.0	-	[3]	-	-	-	90,000	622	35,000	242
347	0.08	2.00	0.040	0.030	0.75	9.00-13.0	17.0-20.0	-	-	[4]	-	-	95,000	656	40,000	276
347H	0.04-0.10	2.00	0.040	0.030	0.75	9.00-13.0	17.0-20.0	-	-	[5]	-	-	95,000	656	40,000	276

Notes:
1 For small diameter or thin walls or both, where many drawing passes are required, a carbon maximum of 0.040 per cent is necessary in grades TP304 and TP316L. Small outside diameter tubes are defined as those less than 0.500in. (12.7mm) in outside diameter and light wall tubes as those less than 0.049in. (1.24mm) in average wall thickness (0.044in. [1.12mm] in minimum wall thickness).
2 The titanium content shall not be less than five times the carbon content and not more than 0.6 per cent.
3 The titanium content shall not be less than four times the carbon content and not more than 0.6 per cent.
4 The columbium plus tantalum content shall be not less than ten times the carbon content and not more than 1.0 per cent.
5 The columbium plus tantalum content shall be not less than eight times the carbon content and not more than 1.0 per cent.
6 The method of analysis for nitrogen shall be a matter of agreement between the purchaser and manufacturer.
7 Maximum, unless otherwise indicated.
8 Vanadium content 0.10-0.30 per cent.



3. DIMENSIONAL TOLERANCES

3(A). DIMENSIONAL TOLERANCES - STEEL PIPE

ASTM A530 (INCHES AND MM)

Nominal Bore	Outside Diameter				Wall Thickness	Weight	Exacts	Randoms
	In		MM			(% of theoretical Weight)		
Uti 1 1/2"	+0.015	-0.031	+0.4	-0.8				
Over 11/2" Uti 4"	+0.031	-0.031	+0.8	-0.8	-12.5%	Uti 4"	+0.25" -0	
					see table below	+10% -3.5% Weighed in bundles		
Over 4" Uti 8"	+0.062	-0.031	+1.6	-0.8		Over 4" Uti 12"	+6mm -0	As agreed between manufacturer and purchaser
					+ Not Specified	+10% -3.5% Weighed singly		
Over 8" Uti 18"	+0.093	-0.031	+2.4	-0.8	See weight tolerance	Over 12"		
						+10% -5% Weighed singly		
Over 18" Uti 26"	+0.125	-0.031	+3.2	-0.8				

API 5L (INCHES AND MM)

Nominal Bore	Outside Diameter				Wall Thickness		Weight
	In		MM				(% of theoretical Weight)
Uti 1 1/2"	+0.016		+0.41	-0.79	+20%	-12.5%	
Over 11/2" Uti 21/2"	+0.75%	-0.75%			+20%	-12.5%	STD, XS, XXS
3"	+0.75%	-0.75%			+18%	-12.5%	+10% -3.5%
4" Uti 18"	+0.75%	-0.75%			+15%	-12.5%	
20" and larger	+1%	-1%			+15%	-12.5%	Special plain end pipe
Welded as above except							+10% -5%
20" and larger Non-Expanded	+1%	-1%			+17.5%	-10%	

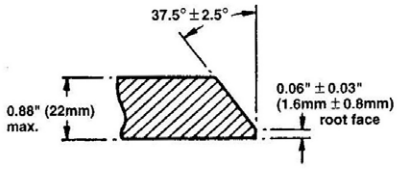
API 5L LENGTH TOLERANCES

Nominal Length		Minimum Length		Minimum Average Length for each order item*		Maximum Length	
ft	m	ft	m	ft	m	ft	m
Threaded and coupled pipe							
20	6	16.0	4.88	17.5	5.33	22.5	6.86
40	12	22.0	6.71	35.0	10.67	45.0	13.72
Plain end pipe							
20	6	9.0	2.74	17.5	5.33	22.5	6.86
40	12	14.0	4.27	35.0	10.67	45.0	13.72
50	15	17.5	5.33	43.8	13.35	55.0	16.76
60	18	21.0	6.40	52.5	16.00	65.0	19.81
80	24	28.0	8.53	70.0	21.34	85.0	25.91

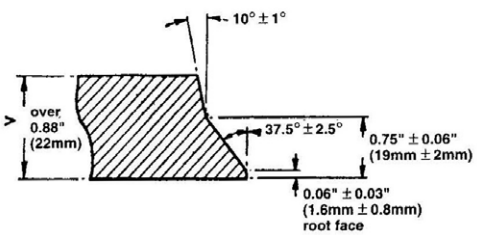
NOTES: Nominal lengths of 20ft (6m) were formerly designated "single random lengths", and those of 40ft (12m) "double random lengths
"By agreement between the purchaser and manufacturer, these tolerances shall apply to each carload.

DIMENSIONS AND TOLERANCES IN INS. FOR BEVELLED ENDS ON PIPE AND FITTINGS

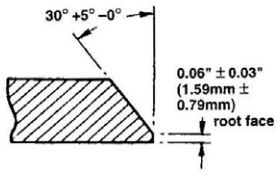
ANSI 816.25 Fig 2A
Bevel for wall thickness
up to and including 0.88" (22mm)



ANSI 816.25 Fig 3A
Bevel for wall thickness
over 0.88" (22mm)



API5L
Bevel for all wall thicknesses unless
otherwise specified



3(B).DIMENSIONAL TOLERANCE - BUTT WELD FITTINGS

ASME ANSI B16.9 - INCHES

All Fittings				90 deg. and 45 deg. Elbows and tees	Reducers and lap joint stub ends	Caps	180 deg. Returns			Lap Joint Stub Ends	
Nominal bore	Outside diameter at Bevel	Inside Diameter at End	Wall Thickness	Centre-to-end Dimension	Overall Length	Overall Length	Centre-to-Centre Dimension	Back-to-Face Dimension	Alignment of ends	Outside diameter of Lap	Fillet Radius of lap
1/2 to 21/2	+0.06 -0.03	0.03	Not less than 87.5% of nominal thickness	0.06	0.06	0.12	0.25	0.25	0.03	+0 -0.03	+0 -0.03
3 to 3/12	0.06	0.06		0.06	0.06	0.12	0.25	0.25	0.03	+0 -0.03	+0 -0.03
4	0.06	0.06		0.06	0.06	0.12	0.25	0.25	0.03	+0 -0.03	+0 -0.06
5 to 8	+0.09 -0.06	0.06		0.06	0.06	0.25	0.25	0.25	0.03	+0 -0.03	+0 -0.06
10 to 18	+0.16 -0.12	0.12		0.09	0.09	0.25	0.38	0.25	0.06	+0 -0.06	+0 -0.06
20 to 24	+0.25 -0.19	0.19		0.09	0.09	0.25	0.38	0.25	0.06	+0 .0.06	+0 -0.06
26 to 30	+0.25 -0.19	0.19		0.12	0.19	0.38	-	-	-	-	-
32 to 48	+0.25 -0.19	0.19		0.19	0.19	0.38	-	-	-	-	-

Tolerances are equal plus and minus except as noted.

ASME ANSI B16.9 - MM

All Fittings				90 deg. and 45 deg. Elbows and tees	Reducers and lap joint stub ends	Caps	180 deg. Returns			Lap Joint Stub Ends	
Nominal bore	Outside diameter at Bevel	Inside Diameter at End	Wall Thickness	Centre-to-end Dimension	Overall Length	Overall Length	Centre-to-Centre Dimension	Back-to-Face Dimension	Alignment of ends	Outside diameter of Lap	Fillet Radius of lap
1/2 to 21/2	1	0.8	Not less than 87.5% of nominal thickness	2	2	4	7	7	1	+0 -1	+0 -1
3 to 3/12	1	1.6		2	2	4	7	7	1	+0 -1	+0 -1
4	+2 -1	1.6		2	2	4	7	7	1	+0 -1	+0 -2
5 to 6	+3 -1	1.6		2	2	7	7	7	1	+0 -1	+0 -2
8	2	1.6		2	2	7	7	7	1	+0 -1	+0 -2
10	+4 -3	3.2		2	2	7	10	7	2	+0 -2	+0 -2
10 to 18	+4 -3	3.2		3	3	7	10	7	2	+0 -2	+0 -2
20 to 24	+6 -5	4.8		3	3	7	10	7	2	+0 -2	+0 -2
26 to 30	+7 -5	4.8		3	3	10	-	-	-	-	-
32 to 48	+7 -5	4.8		5	5	10	-	-	-	-	-

Tolerances are equal plus and minus except as noted.

3(C). DIMENSIONAL TOLERANCES - FLANGES

ASME/ANSI B16.5 . INCHES AND MM

Flange type	Nominal bore	Inside (bore) Diameter				Lenght through Hub		Flange thickness				Hub thickness
		In		mm		In	mm	In		mm		
Weldneck	Uti 10”	±0.03		±0.76		±0.06	±1.52	+0.12	-0	+3.05	-0	-12.5% + Not specified
	12” Uti 18”	±0.06		±1.52		±0.12	±3.05	+0.12	-0	+3.05	-0	
	20” and over	+0.12	-0.06	+3.05	-1.52	±0.12	±3.05	+0.19	-0	+4.83	-0	
Slip in, Lap Joint Socket Welded Counterbore Threaded	Uti 10”	+0.03	-0	+0.76	-0			+0.12	-0	+3.05	-0	-12.5% + Not specified
	12” Uti 18”	+0.06	-0	+1.52	-0			+0.12	-0	+3.05	-0	
	20” and over	+0.06	-0	+1.52	-0			+0.19	-0	+4.83	-0	

*Nominal outside diameter of weldneck flanges at bevel Uti 5” NB +0.09” -0.03”(+2.9mm -0.76mm)

Facing Type	Nominal Bore	Centre to contact surface		Contact to contact surface		OD in	OD mm
		In	mm	In	mm		
Raised	Uti 10”	±0.03	±0.76	±0.06	±1.52	±0.06	±1.52
	12” and over	±0.06	±01.52	±0.1	±3.05	±0.06	±1.52

4. DIMENSIONS and WEIGHTS - CARBON and ALLOY STEELS

4(A). INCHES and lB/FT - API 5L, ASME, ANSI, ASTM Specifications

Nominal Bore (in)	Outside Diameter	10	20	30	STD	40	60	XS	80	100	120	140	160	xxs
1/8	0.450				0.068	0.068		0.095	0.095					
					0.24	0.24		0.31	0.31					
1/4	0.540				0.088	0.088		0.119	0.119					
					0.42	0.42		0.54	0.54					
3/8	0.675				0.091	0.091		0.126	0.126					
					0.57	0.57		0.74	0.74					
1/2	0.840				0.109	0.109		0.147	0.147				0.188	0.294
					0.85	0.85		1.09	1.09				1.31	1.7
3/4	1.050				0.113	0.113		0.154	0.154				0.219	0.308
					1.13	1.13		1.47	1.47				1.94	2.44
1	1.315				0.133	0.133		0.179	0.179				0.250	0.358
					1.68	1.68		2.17	2.17				2.84	3.66
1 1/4	1.660				0.140	0.140		0.191	0.191				0.250	0.382
					2.27	2.27		3.00	3.00				3.76	5.21
1 1/2	1.900				0.145	0.145		0.200	0.200				0.281	0.400
					2.72	2.72		3.63	3.63				4.86	6.41
2	2.375				0.154	0.154		0.218	0.218				0.344	0.436
					3.65	3.65		5.02	5.02				7.46	9.03
2 1/2	2.875				0.203	0.203		0.276	0.76				0.375	0.552
					5.79	5.79		7.66	7.66				10.01	13.69
3	3.500				0.216	0.216		0.300	0.300				0.438	0.600
					7.58	7.58		10.25	10.25				14.32	18.58
3 1/2	4.000				0.226	0.226		0.318	0.318					
					9.11	9.11		12.50	12.50					
4	4.5				0.237	0.237		0.337	0.337		0.438		0.531	0.674
					10.79	10.79		14.98	14.98		19.00		22.51	27.54
5	5.563				0.258	0.258		0.375	0.375		0.500		0.625	0.750
					14.62	14.62		20.78	20.78		27.04		32.96	30.55
6	6.625				0.280	0.280		0.432	0.432		0.562		0.719	0.864
					18.97	18.97		28.57	28.57		36.39		45.35	53.16
8	8.625		0.250	0.277	0.322	0.322	0.406	0.500	0.500	0.594	0.719	0.812	0.906	0.875
			22.36	24.70	28.55	28.55	35.64	46.39	43.39	50.95	60.71	67.76	74.69	72.42
10	10.750		0.250	0.307	0.365	0.365	0.500	0.500	0.594	0.719	0.844	1.000	1.125	1.000
			28.04	34.24	40.48	40.48	54.74	54.74	64.43	77.03	89.29	104.13	115.64	104.13
12	12.750		0.250	0.330	0.375	0.406	0.562	0.500	0.688	0.844	1.000	1.125	1.312	1.000
			33.38	43.77	49.56	53.52	73.15	65.42	88.63	107.32	125.49	139.67	160.27	125.49
14	14.000	.250	0.312	0.375	0.375	0.438	0.594	0.500	0.750	0.938	1.094	1.250	1.406	
		36.71	45.61	54.57	54.57	63.44	85.05	72.09	106.13	130.85	150.79	170.21	189.11	
16	16.000	0.250	0.312	0.375	0.375	0.500	0.656	0.500	0.844	1.031	1.219	1.438	1.594	
		42.05	52.27	62.58	62.58	82.77	107.50	82.77	136.61	164.82	192.43	223.64	245.25	
18	18.000	0.250	0.312	0.438	0.375	0.562	0.750	0.500	0.938	1.156	1.375	1.562	1.781	
		47.39	58.94	82.15	70.59	104.67	138.17	93.45	170.92	207.96	244.14	274.22	308.50	
20	20.000	0.250	0.375	0.500	0.375	0.594	0.812	0.500	1.031	1.281	1.500	1.750	1.969	
		52.73	78.60	104.13	78.60	123.11	166.40	104.13	208.87	256.10	296.37	341.09	379.17	
24	24.000	0.250	0.375	0.562	0.375	0.688	0.969	0.500	1.219	1.531	1.812	2.062	2.344	
		63.41	94.62	140.68	94.62	171.29	238.35	125.49	296.58	367.39	429.39	483.12	542.13	
26	26.000	0.312	0.500		0.375			0.500						
		85.60	136.17		102.63			136.17						
30	30.000	0.312	0.500	0.625	0.375			0.500						
		98.93	157.53	196.08	118.64			157.53						
32	32.000	0.312	0.500	0.625	0.375	0.688		0.500						
		105.59	168.21	209.43	126.66	230.08		168.21						
34	34.000	0.312	0.500	0.625	0.375	0.688		0.500						
		112.25	178.89	222.78	134.67	244.77		178.89						
36	36.000	0.312	0.500	0.625	0.375	0.750		0.500						
		118.92	189.57	236.13	142.68	282.35		189.57						

Weight Formula:
lb/ft =10.68 (D-t)t where Key:
0= outside diameter rounded to nearest .001 in.
t = specified wall thickness rounded to nearest .001 in.

Wall Thickness, in - White Rows.
Weight, lb/ft - Blue Rows

4(B). MM and KG/M - API 5L, ASME, ANSI, ASTM Specifications

Nominal Bore (in)		Outside Diameter	10	20	30	STD	40	60	XS	90	100	120	140	160	xxs
in	mm	mm													
1/8	6	10.3				1.7	1.7		2.4	2.4					
						0.35	0.36		0.47	0.47					
1/4	8	13.7				2.2	2.2		3.0	3.0					
						0.62	0.62		0.79	0.79					
3/8	10	17.1				2.3	2.3		3.2	3.2					
						0.84	0.84		1.10	1.10					
1/2	15	21.3				2.8	2.8		3.7	3.7				4.8	7.5
						1.28	1.28		1.61	1.61				1.95	2.55
3/4	20	26.7				2.9	2.9		3.9	3.9				5.6	7.8
						1.70	1.70		2.19	2.19				2.91	3.64
1	25	33.4				3.4	3.4		4.5	4.5				6.4	9.1
						2.52	2.52		3.21	3.21				4.26	5.45
1 1/4	30	42.2				3.6	3.6		4.9	4.9				6.4	9.7
						3.43	3.43		4.51	4.51				5.65	7.77
1 1/2	40	48.3				3.7	3.7		5.1	5.1				7.1	10.2
						4.07	4.07		5.43	5.43				7.21	9.58
2	50	60.3				3.9	3.9		5.5	5.5				8.7	11.1
						5.42	5.42		7.43	7.43				11.076	13.47
2 1/2	65	73.0				5.2	5.2		7.0	7.0				9.5	14.0
						8.69	8.69		11.39	11.39				14.88	20.37
3	80	88.9				5.5	5.5		7.6	7.6				11.1	15.2
						11.31	11.31		15.24	15.24				21.30	27.63
3 1/2	90	101.6				5.7	5.7		8.1	8.1					
						13.48	13.48		18.68	18.68					
4	100	114.3				6.0	6.0		8.6	8.6		11.1		13.5	17.1
						16.02	16.02		22.42	22.42		28.25		33.56	40.99
5	125	141.3				6.6	6.6		9.5	9.5		12.7		15.9	19.1
						21.92	21.92		30.88	30.88		40.28		49.17	57.56
6	150	168.3				7.1	7.1		11.0	11.0		14.3		18.3	22.0
						28.22	28.22		42.67	42.67		54.31		67.69	79.37
8	200	219.1		6.4	7.0	8.2	8.2	10.3	12.7	12.7	15.1	18.3	20.6	23.0	22.2
				33.57	36.61	42.65	42.65	53.03	64.64	64.64	75.96	90.62	100.84	111.2	107.79
10	250	273.1		6.4	7.8	9.3	9.3	12.7	12.7	15.1	18.3	21.4	25.4	28.6	25.4
				42.09	51.03	60.50	60.50	81.55	81.55	96.07	114.99	132.83	155.15	172.44	155.15
12	300	323.9		6.4	8.4	9.5	10.3	14.3	12.7	17.5	21.4	25.4	28.6	33.3	25.4
				50.11	65.35	73.65	79.65	109.18	97.46	132.23	159.64	186.97	208.27	238.63	186.97
14	350	355.6	6.4	7.9	9.5	9.5	11.1	15.1	12.7	19.1	23.8	27.8	31.8	35.7	
			55.11	67.74	81.08	81.08	94.30	126.79	107.39	158.49	194.74	224.72	253.92	281.63	
16	400	406.4	6.4	7.9	9.5	9.5	12.7	16.7	12.7	21.4	26.2	31.0	36.5	40.5	
			63.13	77.63	92.98	92.98	123.30	160.49	123.30	203.17	245.64	286.98	332.94	365.44	
18	450	457.0	6.4	7.9	11.1	9.5	14.3	19.1	12.7	23.8	29.4	34.9	39.7	45.2	
			71.12	87.49	122.05	104.84	156.11	206.25	139.15	254.25	310.01	363.27	408.54	459.01	
20	500	508.0	6.4	9.5	12.7	9.5	15.1	20.6	12.7	26.2	32.5	38.1	44.4	50.0	
			79.16	116.78	155.12	116.78	183.54	247.60	155.12	311.29	381.09	441.49	507.6	564.71	
24	600	610.0	6.4	9.5	14.3	9.5	17.5	24.3	12.7	31.0	38.9	46.0	52.4	59.5	
			95.26	140.68	210.07	140.68	255.69	355.12	187.06	442.62	547.84	639.78	720.52	807.73	
26	650	666.0	7.9	12.7		9.5			12.7						
			127.04	202.72		152.39			202.72						
30	750	762.0	7.9	12.7	15.9	9.5			12.7						
			146.91	234.67	292.54	176.29			234.67						
32	800	813.0	7.9	12.7	15.9	9.5	17.5		12.7						
			156.84	250.64	312.54	188.24	343.30		250.64						
34	850	864.0	7.9	12.7	15.9	9.5	17.5		12.7						
			166.78	266.61	332.53	200.18	365.31		266.61						
36	900	914.0	7.9	12.7	15.9	9.5	19.1		12.7						
			176.52	282.27	352.14	211.90	421.50		282.27						

Weight Formula:
kg/mm =0.02466 (D-t)t,
where D =outside diameter rounded to the nearest 0.1 mm for sizes less than 457mm and to the nearest 1 mm for sizes 457mm and larger.
t = specified wall thickness rounded to the nearest o. rmm.

Key:
Wall Thickness, mm - White Rows.
Weight, kg/mm - Blue Rows

5. DIMENSIONS and WEIGHTS - STAINLESS STEELS

MM and KG/M - ASME, ANSI, ASTM Specifications

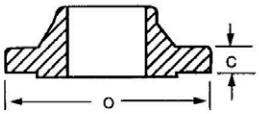
Pipe Size Inch	O.D. in mm	O.D. Inch	10 10S	20	30	STD 40S	40	60	XS 80S	90	100	120	140	160	xxs
1/8	10.3	0.405				1.73			2.41						
						0.063			0.095						
						0.37			0.47						
1/4	13.7	0.540				2.24			3.02						
						0.088			0.119						
						0.64			0.82						
3/8	17.1	0.675				2.31			3.20						
						0.091			0.126						
						0.87			1.12						
1/2	21.3	0.840	2.11			2.77			3.73					4.75	7.47
			0.083			0.109			0.147					0.187	0.294
			1.02			1.29			1.64					1.97	2.59
3/4	26.7	1.050	2.11			2.87			3.91					5.54	7.82
			0.083			0.113			0.154					0.218	0.308
			1.30			1.71			2.23					2.93	3.69
1	33.4	1.315	2.77			3.38			4.55					6.35	9.09
			0.109			0.133			0.179					0.250	0358
			2.13			2.54			3.29					4.30	5.53
1 1/4	42.2	1.660	2.77			3.56			4.85					6.35	9.70
			0.109			0.140			0.191					0.250	0.362
			2.73			3.44			4.53					5.69	7.88
1 1/2	48.3	1.900	2.77			3.68			5.08					7.14	10.16
			0.109			0.145			0.200					0.281	0.400
			3.16			4.11			5.49					7.35	9.69
2	60.3	2.375	2.77			3.91			5.54					8.71	11.07
			0.109			0.154			0.218					0.343	0.436
			3.99			5.52			7.60					11.26	13.65
2 1/2	73.0	2.875	3.05			5.16			7.01					9.53	14.02
			0.120			0.203			0.276					0.375	0.552
			5.34			8.77			11.59					15.15	20.72
3	88.9	3.500	3.05			5.449			7.62					11.13	15.24
			0.120			0.216			0.300					0.438	0.600
			6.56			11.47			15.51					21.67	28.11
3 1/2	101.6	4.000	3.05			5.74			8.08						16.15
			0.120			0.226			0.318						0.636
			7.53			13.78			18.92						34.56
4	114.3	4.500	3.05			6.02			8.56			11.13		13.49	17.12
			0.120			0.237			0.337			0.438		0.531	0.674
			8.50			16.32			22.66			28.75		34.05	41.66
5	141.3	5.563	3.40			6.55			9.53			12.70		15.88	19.05
			0.134			0.258			0.375			0.500		0.625	0.750
			11.74			22.10			31.44			40.90		49.87	58.31
6	168.3	6.625	3.40			7.11			10.97			14.27		18.24	21.95
			0.134			0.280			0.432			0.562		0.718	0.864
			14.04			28.69			43.21			55.05		68.53	80.43
8	219.1	8.625	3.76	6.35	7.04	8.18		10.81	12.70		15.06	18.24	20.62	23.01	22.23
			0.148	0.250	0.277	0.322		0.406	0.500		0.593	0.718	0.812	0.906	0.875
			20.27	33.82	37.38	4..20		53.90	65.63		76.93	91.73	102.47	112.97	109.57
10	273.0	10.75	4.19	6.35	7.80	9.27		12.70	12..70	15.06	18.24	21.41	25.40	28.58	25.40
			0.165	0.250	0.307	0.365		0.500	0.500	0.593	0.718	0.843	1.000	1.125	1.000
			28.20	42.41	51.81	61.22		82.80	82.80	97.27	116.38	134.90	157.51	174.95	157.51
12	323.8	12.75	4.57	6.35	8.38	9.53	10.31	14.27	12.70	17.45	21.41	25.40	28.58	33.32	25.40
			0.180	0.250	0.330	0.375	0.406	0.562	0.500	0.687	0.843	1.000	1.125	1.312	1.000
			36.54	50.48	66.20	75.01	80.94	110.62	98.95	133.88	162.14	189.82	211.31	242.40	189.82
14	355.6	14.00	6.35	7.92	9.53	9.53	11.13	15.06	12.70	19.05	23.80	27.76	31.75	35.71	
			0.250	0.312	0.375	0.375	0.438	0.593	0.500	0.750	0.937	1.093	1.250	1.406	
			55.53	68.95	82.58	82.58	96.0	128.42	109.04	160.54	197.74	227.88	257.47	286.04	
16	406.4	16.00	6.35	7.92	9.53	9.53	12.70	16.66	12.70	21.41	26.19	30.94	36.53	40.46	
			0.250	0.312	0.375	0.375	0.500	0.656	0.500	0.843	1.031	1.218	1.438	1.593	
			63.61	79.03	94.70	94.70	125.20	162.59	125.20	206.40	249.34	290.88	338.32	370.74	
18	457.0	18.00	6.35	7.92	11.13	9.53	14.27	19.05	12.70	23.80	29.36	34.93	39.67	45.24	
			0.250	0.312	0.438	0.375	0.562	0.750	0.500	0.937	1.156	1.365	1.562	1.781	
			71.69	89.10	124.32	106.83	158.27	209.00	141.35	258.29	314.54	369.34	414.75	466.67	
20	508.0	20.00	6.35	9.53	12.70	9.53	15.06	20.62	12.70	26.19	32.54	38.10	44.45	49.99	
			0.250	0.375	0.50	0.375	0.593	0.812	0.500	1.031	1.281	1.500	1.750	1.968	
			79.76	118.93	157.51	118.93	185.89	251.65	157.51	315.97	387.41	448.30	515.94	573.31	
22	559.0	22.00	6.35	9.53	12.7	9.53	15.88	22.23	12.70	28.57	34.92	41.27	47.62	53.97	
			0.250	0.375	0.500	0.375	0.625	0.875	0.500	1.125	1.375	1.525	1.875	2.125	
			87.84	131.07	173.66	131.07	316.04	298.55	173.66	379.70	457.83	535.17	609.30	682.57	
24	610.0	24.00	6.35	9.53	14.27	9.53	17.45	24.59	12.70	3.94	38.89	46.02	52.37	59.51	
			0.250	0.375	0.562	0.375	0.687	0.968	0.500	1.218	1.531	1.812	2.062	2.343	
			95.92	143.20	212.72	143.20	258.74	360.21	189.82	448.30	555.76	649.44	730.72	819.70	

Weight Formula:
W = 0.02504 (D-t)t
W = Weight (kg/m)
o Outside Diameter (mm)
t = Wall Thickness (mm)

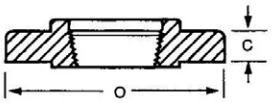
Key: Wall Thickness, mm - White rows
Wall Thickness, in - Light blue rows
Weight, kg/m - Blue Rows

6. DIMENSIONS OF FLANGES - ASME/ANSI B16.5

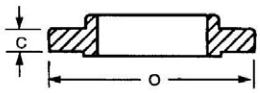
Welding-neck



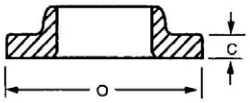
Screwed



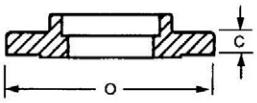
Slip-on-welding



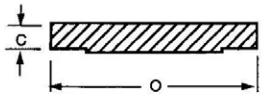
Lapped



Socket-welding (½" to 3" only)



Blind



6(A). DIMENSIONS OF FLANGES - INCHES AND MM

Nominal Bore	Outside diameter (O)		Thickness of Flange (C)		Lenght through Hub						Bolt Circle		Number and size of holes		
					Weld Neck		Thread Slip on		Lap joint						
in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	No	mm	in
Class 150															
1/2	88.9	3.50	11.2	0.44	47.8	1.88	15.7	0.62	15.7	0.62	60.5	2.38	4	15.7	0 .62
3/4	98.6	3.88	12.7	0.50	52.3	2.06	15.7	0.62	15.7	0.62	69.9	2.75	4	15.7	0.62
1	107.9	4.25	14.2	0.56	55.6	2.19	17.5	0.69	17.5	0.69	79.2	3.12	4	15.7	0.62
11/4	117.3	4.62	15.7	0.62	57.2	2.25	20.6	0.81	20.6	0.81	88.9	3.50	4	15.7	0.62
11/2	127.0	5.00	17.5	0.69	62.0	2.44	22.4	0.88	22.4	0.88	98.6	3.88	4	15.7	0.62
2	152.4	6.00	19.1	0.75	63.5	2.50	25.4	1.00	25.4	1.00	120.6	4.75	4	19.1	0.75
21/2	177.8	7.00	22.4	0.88	69.9	2.75	28.4	1.12	28.4	1.12	139.7	5.50	4	19.1	0.75
3	190.5	7.50	23.9	0.94	69.9	2.75	30.2	1.19	30.2	1.19	152.4	6.00	4	19.1	0.75
3/12	215.9	8.50	23.9	0.94	71.4	2.81	31.8	1.25	31.8	1.25	177.8	7.00	8	19.1	0.75
4	228.6	9.00	23.9	0.94	76.2	3.00	33.5	1.31	33.3	1.31	190.5	7.50	8	19.1	0.75
5	254.0	10.00	23.9	0.94	88.9	3.50	36.6	1.44	36.6	1.44	215.9	8.50	8	22.4	0.88
6	279.4	11.00	25.4	1.00	88.9	3.50	39.6	1.56	39.6	1.56	241.3	9.50	8	22.4	0.88
8	342.9	13.50	28.4	1.12	101.6	4.00	44.4	1.75	44.4	1.75	298.5	11.75	8	22.4	0.88
10	406.4	16.00	30.2	1.19	101.6	4.00	49.3	1.94	49.3	1.94	362.0	14.25	12	25.4	1.00
12	482.6	19.00	31.8	1.25	114.3	4.50	55.6	2.19	55.6	2.19	431.8	17.00	12	25.4	1.00
14	533.4	21.00	35.1	1.38	127.0	5.00	57.2	2.25	79.2	3.12	476.3	18.75	12	28.4	1.12
16	596.9	23.50	36.6	1.44	127.0	5.00	63.5	2.50	87.4	3.44	539.8	21.25	16	28.4	1.12
18	635.0	25.00	39.6	1.56	139.7	5.50	68.3	2.69	96.8	3.81	577.9	22.75	16	31.8	1.25
20	698.5	27.50	42.9	1.69	144.5	5.69	73.2	2.88	103.1	4.06	635.0	25.00	20	31.8	1.25
24	812.8	32.00	47.8	1.88	152.4	6.00	82.6	3.25	111.3	4.38	749.3	29.50	20	35.1	1.38
Class 300															
1/2	95.3	3.75	14.2	0.56	52.3	2.06	22.4	0.88	22.4	0.88	66.5	2.62	4	15.7	0.62
3/4	117.3	4.62	15.7	0.62	57.2	2.25	25.4	1.00	25.4	1.00	82.6	3.25	4	19.1	0.75
1	124.0	4.88	17.5	0.69	62.0	2.44	26.9	1.06	26.9	1.06	88.9	3.50	4	19.1	0.75
11/4	133.4	5.25	19.1	0.75	65.0	2.56	26.9	1.06	26.9	1.06	98.6	3.88	4	19.1	0.75
11/2	155.4	6.12	20.6	0.81	68.3	2.69	30.2	1.19	30.2	1.19	144.3	4.50	4	22.4	0.88
2	165.1	6.50	22.4	0.88	69.9	2.75	33.3	1.31	33.3	1.31	127.0	5.00	8	19.1	0.75
21/2	190.5	7.50	25.4	1.00	76.2	3.00	38.1	1.50	38.1	1.50	149.4	5.88	8	22.4	0.88
3	209.5	8.25	28.4	1.12	79.2	3.12	42.9	1.69	42.9	1.69	168.1	6.62	8	22.4	0.88
3/12	228.6	9.00	30.2	1.19	81.0	3.19	44.4	1.75	44.4	1.75	184.1	7.25	8	22.4	0.88
4	254.0	10.00	31.8	1.25	85.9	3.38	47.8	1.88	47.8	1.88	200.2	7.88	8	22.4	0.88
5	297.4	11.00	35.1	1.38	98.6	3.88	50.8	2.00	50.8	2.00	235.0	9.25	8	22.4	0.88
6	317.5	12.50	36.6	1.44	98.6	3.88	52.3	2.06	52.3	2.06	269.7	10.62	12	22.4	0.88
8	381.0	15.00	41.1	1.62	111.3	4.38	62.0	2.44	62.0	2.44	330.2	13.00	12	25.4	1.00
10	444.5	17.50	47.8	1.88	117.3	4.62	66.5	2.62	95.3	3.75	387.3	15.25	16	28.4	1.12
12	520.7	20.50	50.8	2.00	130.0	5.12	73.5	2.88	101.6	4.00	450.8	17.75	16	31.8	1.25
14	584.2	23.00	53.8	2.12	142.7	5.62	76.2	3.00	111.4	4.38	514.4	20.25	20	31.8	1.25
16	647.7	25.50	57.2	2.25	146.0	5.75	82.6	3.25	120.6	4.75	571.5	22.50	20	35.1	1.38
18	711.2	28.00	60.5	2.38	158.8	6.25	88.9	3.50	130.0	5.12	628.7	24.75	24	35.1	1.38
20	774.7	30.50	63.5	2.50	162.1	6.38	95.3	3.75	139.7	5.50	685.8	27.00	24	35.1	1.38
24	914.4	36.00	69.9	2.75	168.1	6.62	106.4	4.19	152.4	6.00	812.8	32.00	24	41.1	1.62

6(A). DIMENSIONS OF FLANGES - INCHES AND MM (CONTINUED)

Nominal Bore	Outside diameter (O)		Thickness of Flange (C)		Lenght through Hub						Bolt Circle		Number and size of holes		
					Weld Neck		Thread Slip on		Lap joint						
in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	No	mm	in
Class 400															
1/2	95.3	3.75	14.2	0.56	52.3	2.06	22.4	0.88	22.4	0.88	66.5	2.62	4	15.7	0.62
3/4	117.3	4.62	15.7	0.62	57.2	2.25	25.4	1.00	25.4	1.00	82.6	3.25	4	19.1	0.75
1	124.0	4.88	17.5	0.69	62.0	2.44	26.9	1.06	26.9	1.06	88.9	3.50	4	19.1	0.75
11/4	133.4	5.25	20.6	0.81	66.5	2.62	28.4	1.12	28.4	1.12	98.6	3.88	4	19.1	0.75
11/2	155.4	6.12	22.4	0.88	69.9	2.75	31.8	1.25	31.8	1.25	114.3	4.50	4	22.4	0.88
2	165.1	6.50	25.4	1.00	73.2	2.88	36.6	1.44	36.6	1.44	127.0	5.00	8	19.1	0.75
21/2	190.5	7.50	28.4	1.12	79.2	3.12	41.1	1.62	41.1	1.62	149.4	5.88	8	22.4	0.88
3	209.5	8.25	31.8	1.25	82.6	3.25	46.0	1.81	46.0	1.81	168.1	6.62	8	22.4	0.88
3/12	228.6	9.00	35.1	1.38	85.9	3.38	49.3	1.94	49.3	1.94	184.1	7.25	8	25.4	1.00
4	254.0	10.00	35.1	1.38	88.9	3.50	50.8	2.00	50.8	2.00	200.2	7.88	8	25.4	1.00
5	279.4	11.00	38.1	1.50	101.6	4.00	53.8	2.12	53.8	2.12	235.0	9.25	8	25.4	1.00
6	317.5	12.50	41.1	1.62	103.1	4.06	57.2	2.25	57.2	2.25	269.7	10.62	12	25.4	1.00
8	381.0	15.00	47.8	1.88	117.3	4.62	68.3	2.69	68.3	2.69	330.2	13.00	12	28.4	1.12
10	444.5	17.50	53.8	2.12	124.0	4.88	73.2	4.00	101.6	4.00	387.3	15.25	16	31.8	1.25
12	520.7	20.50	57.2	2.25	136.7	5.38	79.2	4.25	107.9	4.25	450.8	17.75	16	35.1	1.38
14	584.2	23.00	60.5	2.38	149.4	5.88	84.1	4.62	117.3	4.62	514.4	20.25	20	35.1	1.38
16	647.7	25.50	63.5	2.50	152.4	6.00	93.7	5.00	127.0	5.00	571.5	22.50	20	38.1	1.50
18	711.2	28.00	66.5	2.62	165.1	6.50	98.6	5.38	136.7	5.38	628.7	24.75	24	38.1	1.50
20	774.7	30.50	69.9	2.75	168.1	6.62	101.6	5.75	146.0	5.75	685.8	27.00	24	41.1	1.62
24	914..4	36.00	76.2	3.00	174.8	6.88	114.3	6.25	158.8	6.25	812.8	32.00	24	47.8	1.88
Class 600															
1/2	95.3	3.75	14.2	0.56	52.3	2.06	22.4	0.88	22.4	0.88	66.5	2.62	4	15.7	0.62
3/4	117.3	4.62	15.7	0.62	57.2	2.25	25.4	1.00	25.4	1.00	82.6	3.25	4	19.1	0.75
1	124.0	4.88	17.5	0.69	62.0	2.44	26.9	1.06	26.9	1.06	88.9	3.50	4	19.1	0.75
11/4	133.4	5.25	20.6	0.81	66.5	2.62	28.4	1.12	28.4	1.12	98.6	3.88	4	19.1	0.75
11/2	155.4	6.12	22.4	0.88	69.9	2.75	31.8	1.25	31.8	1.25	114.3	4.50	4	22.4	0.88
2	165.1	6.50	25.4	1.00	73.2	2.88	36.6	1.44	36.6	1.44	127.0	5.00	8	19.1	0.75
21/2	190.5	7.50	28.4	1.12	79.2	3012	41.1	1.62	41.1	1.62	149.4	5.88	8	22.4	0.88
3	209.5	8.25	31.8	1.25	82.9	3.25	46.0	1.81	46.0	1.81	168.1	6.62	8	22.4	0.88
3/12	228.6	9.00	35.1	1.38	85.9	3.38	49.3	1.94	49.3	1.94	184.1	7.25	8	22.4	0.88
4	273.1	10.75	38.1	1.50	101.6	4.00	53.8	2.12	53.8	2.12	215.9	8.50	8	25.4	1.12
5	330.2	13.00	44.4	1.75	114.3	4.50	60.5	2.38	60.5	2.38	266.7	10.50	8	25.4	1.12
6	355.6	14.00	47.8	1.88	117.3	4.62	66.5	2.62	66.5	2.62	292.1	11.50	12	25.4	1.12
8	419.1	16.50	55.6	2.19	133.4	5.25	76.2	3.00	76.2	3.00	349.3	13.75	12	31.8	1.25
10	508.0	20.00	63.5	2.50	152.4	6.00	85.9	3.38	111.3	4.38	431.8	17.00	16	35.1	1.38
12	558.8	22.00	66.5	2.62	155.4	6.12	91.9	3.62	117.3	4.62	489.0	19.25	16	35.1	1.38
14	603.3	23.75	69.9	2.75	165.1	6.50	93.7	3.69	127.0	5.00	527.1	20.75	20	38.1	1.50
16	685.8	27.00	76.2	3.00	177.8	7.00	106.4	4.19	139.7	5.50	603.3	23.75	20	41.1	1.62
18	742.9	29.25	82.6	3.25	184.1	7.25	117.5	4.62	152.4	6.00	654.1	25.75	20	44.5	1.75
20	812.8	32.00	88.9	3.50	190.5	7.50	127.0	5.00	165.1	6.50	723.9	28.50	24	44.5	1.75
24	939.8	37.00	101.6	4.00	203.2	8.00	139.7	5.50	184.1	7.25	838.2	33.00	24	50.8	2.00
Class 900															
1/2	120.6	4.75	22.4	0.88	60.5	2.38	31.8	1.25	31.8	1.25	82.6	3.25	4	22.8	0.88
3/4	130.0	5.12	25.4	1.00	69.9	2.75	35.1	1.38	35.1	1.38	88.9	3.50	4	22.8	0.88
1	149.4	5.88	28.4	1.12	73.2	2.88	41.1	1.62	41.1	1.62	101.6	4.00	4	25.4	1.00
11/4	158.8	6.25	28.4	1.12	73.2	2.88	41.1	1.62	41.1	1.62	111.3	4.38	4	25.4	1.00
11/2	177.8	7.00	31.8	1.25	82.6	3.25	44.4	1.75	44.4	1.75	124.0	4.88	4	28.4	1.12
2	215.9	8.50	38.1	1.50	101.6	4.00	57.2	2.25	57.2	2.25	165.1	6.50	8	25.4	1.00
21/2	244.3	9.62	41.1	1.62	104.6	4.12	63.5	2.50	63.5	2.50	190.5	7.50	8	28.4	1.12
3	241.3	9.50	38.1	1.50	101.6	4.00	53.8	2.12	53.8	2.12	190.5	7.50	8	25.4	1.00
4	292.1	11.50	44.4	1.75	114.3	4.50	69.9	2.75	69.9	2.75	235.0	9.25	8	31.8	1.25
5	349.3	13.75	50.8	2.00	127.0	5.00	79.2	3.12	79.2	3.12	279.4	11.00	8	35.1	1.38
6	381.0	15.00	55.6	2.19	139.7	5.50	85.9	3.38	85.9	3.38	317.5	12.50	12	31.8	1.25
8	469.0	18.50	63.5	2.50	162.1	6.38	101.6	4.00	114.3	4.50	393.7	15.50	12	38.1	1.50
10	546.1	21.50	69.9	2.75	184.1	7.25	107.6	4.25	127.0	5.00	469.9	18.50	16	38.1	1.50
12	609.6	24.00	79.2	3.12	200.2	7.88	117.3	4.62	142.7	5.62	533.4	21.00	20	38.1	1.50
14	641.3	25.25	85.9	3.38	212.9	8.38	130.0	5.12	155.4	6.12	558.8	22.00	20	41.1	1.62
16	704.8	27.75	88.9	3.50	215.9	8.50	133.4	5.25	165.1	6.50	615.9	24.25	20	44.5	1.75
18	787.4	31.00	101.6	4.00	228.6	9.00	152.4	6.00	190.5	7.50	685.8	27.00	20	50.8	2.00
20	857.3	33.75	107.9	4.25	247.6	9.75	158.8	6.25	209.5	8.25	749.3	29.50	20	53.8	2.12
24	1041.4	41.00	139.7	5.50	292.1	11.50	203.2	8.00	266.7	10.50	901.7	35.50	20	66.5	2.62

6(A). DIMENSIONS OF FLANGES - INCHES AND MM (CONTINUED)

Nominal Bore	Outside diameter (O)		Thickness of Flange (C)		Lenght through Hub						Bolt Circle		Number and size of holes		
					Weld Neck		Thread Slip on		Lap joint						
in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	No	mm	in
Class 1500															
1/2	120.6	4.75	22.4	0.88	60.5	2.38	31.8	1.25	31.8	1.25	82.6	32.5	4	22.4	0.88
3/4	130.0	5.12	25.4	1.00	69.9	2.75	35.1	1.38	35.1	1.38	88.9	3.50	4	22.4	0.88
1	149.4	5.88	28.4	1.12	73.2	2.88	41.1	1.62	41.1	1.62	101.6	4.00	4	25.4	1.00
11/4	158.8	6.25	28.4	1.12	73.2	2.88	41.1	1.62	41.1	1.62	111.3	4.38	4	25.4	1.00
11/2	177.8	7.00	31.8	1.25	82.6	3.25	44.4	1.75	44.4	1.75	124.0	4.88	4	28.4	1.12
2	215.9	8.50	38.1	1.50	101.6	4.00	57.2	2.25	57.2	2.25	165.1	6.50	8	25.4	1.00
21/2	244.3	9.62	41.1	1.62	104.6	4.12	63.5	2.50	63.5	2.50	190.5	7.50	8	28.4	1.12
3	266.7	10.50	47.8	1.88	117.3	4.62	73.2	2.88	73.2	2.88	203.2	8.00	8	31.8	1.25
4	311.2	12.25	53.8	2.12	124.0	4.88	90.4	3.56	90.4	3.56	241.3	9.50	8	35.1	1.38
5	374.7	14.75	73.2	2.88	155.4	6.12	104.6	4.12	104.6	4.12	292.1	11.50	8	41.1	1.62
6	393.7	15.50	82.6	3.25	171.5	6.754	119.1	4.69	119.1	4.69	317.5	12.50	12	38.1	1.50
8	482.6	19.00	91.9	3.62	212.9	8.38	142.7	5.62	142.7	5.62	393.7	15.50	12	44.5	1.75
10	584.2	23.00	107.9	4.25	254.0	10.00	158.8	6.25	177.8	7.00	482.6	19.00	12	50.8	2.00
12	673.1	26.50	124.0	4.88	282.4	11.12	180.8	7.12	218.9	8.62	571.5	22.50	16	53.8	2.12
14	749.3	29.50	133.4	5.25	298.5	11.75			241.3	9.50	635.0	25.00	16	60.5	2.38
16	825.5	32.50	146.0	5.75	311.2	12.25			260.3	10.25	704.8	27.75	16	66.5	2.62
18	914.4	36.00	162.1	6.38	327.2	12.88			276.4	10.88	774.7	30.50	16	73.2	2.88
20	984.3	38.75	177.8	7.00	355.6	14.00			292.1	11.50	831.8	32.75	16	79.2	3.12
24	1168.4	46.00	203.2	8.00	406.4	16.00			330.2	13.00	990.6	39.00	16	91.9	3.62
Class 2500															
1/2	133.4	5.25	30.2	1.19	73.2	2.88	39.6	1.56	39.6	1.56	88.9	3.50	4	22.4	0.88
3/4	139.7	5.50	31.8	1.25	79.2	3.12	42.9	1.69	42.9	1.69	95.3	3.75	4	22.4	0.88
1	158.8	6.25	35.1	1.38	88.9	3.50	47.8	1.88	47.8	1.88	107.9	4.25	4	25.4	1.00
11/4	184.1	7.25	38.1	1.50	95.3	3.75	52.3	2.06	52.3	2.06	130.0	5.12	4	28.4	1.12
11/2	203.2	8.00	44.4	1.75	111.3	4.38	60.5	2.38	60.5	2.38	146.0	5.75	4	31.8	1.25
2	235.0	9.25	50.8	2.00	127.0	5.00	69.9	2.75	69.9	2.75	171.5	6.75	8	28.5	1.12
21/2	266.7	10.50	57.2	2.25	142.7	5.62	79.2	3.12	79.2	3.12	196.9	7.75	8	31.8	1.25
3	304.8	12.00	66.5	2.62	168.1	6.62	91.9	3.62	91.9	3.62	228.6	9.00	8	35.1	1.38
4	355.6	14.00	76.2	3.00	190.5	7.50	107.9	4.25	107.9	4.25	273.1	10.75	8	44.1	1.62
5	419.1	16.50	91.9	3.62	228.6	9.00	130.0	5.12	130.0	5.12	323.8	12.75	8	47.8	1.88
6	482.6	19.00	107.9	4.25	273.1	10.75	152.4	6.00	152.4	6.00	368.3	14.50	8	53.8	2.12
8	552.4	21.75	127.0	5.00	317.5	12.50	177.8	7.00	177.8	7.00	438.2	17.25	12	53.8	2.12
10	673.1	26.50	165.1	6.50	419.1	16.50	228.6	9.00	228.6	9.00	539.8	21.25	12	66.5	2.62
12	762.0	30.00	184.1	7.25	463.5	18.25	254.0	10.00	254.0	10.00	619.3	24.38	12	73.2	2.88

6(B) DIMENSIONS of WELDING NECK FLANGE BORES - ASME/ANSI B16.5 - INCHES and MM

Nominal Bore (in)	Outside Diameter	10	20	30	40	STD	60	XS	90	100	120	140	160	xxs
½	0.840				15.8	15.8		13.9	13.9				11.8	6.4
					0.622	0.622		0.546	0.546				0.466	0.252
¾	1.050				20.9	20.9		18.8	18.8				15.6	11.0
					0.824	0.824		0.742	0.742				0.614	0.434
1	1.315				26.6	26.6		24.3	24.3				20.7	15.2
					1.049	1.049		0.957	0.957				0.815	0.599
1¼	1.660				35.1	35.1		32.5	32.5				29.5	22.8
					1.380	1.380		1.278	1.278				1.160	0.896
1½	1.900				40.9	40.9		38.1	38.1				34.0	27.9
					1.610	1.610		1.500	1.500				1.338	1.100
2	2.375				52.5	52.5		49.3	49.3				42.9	38.2
					2.067	2.067		1.939	1.939				1.689	1.503
2½	2.875				62.7	62.7		59.0	59.0				54.0	45.0
					2.469	2.469		2.323	2.323				2.125	1.771
3	3.500				77.9	77.9		73.7	73.7				66.6	58.4
					3.068	3.068		2.900	2.900				2.624	2.300
3½	4.000				90.1	90.1		85.4	85.4					
					3.548	3.548		3.364	3.364					
4	4.5				102.3	102.3		97.2	97.2		92.0		87.3	80.1
					4.026	4.026		3.826	3.826		3.624		3.438	3.152
5	5.563				128.2	128.2		122.3	122.3		115.9		109.6	103.2
					5.047	5.047		4.813	4.813		4.563		4.313	4.063
6	6.625				154.7	154.1		146.3	146.3		139.7		131.8	126.7
					6.065	6.065		5.761	5.761		5.501		5.189	4.987
8	8.625		206.4	205.00	202.7	202.7	198.5	193.7	193.7	189.0	182.6	177.8	173.1	174.6
			8.125	8.071	7.981	7.981	7.813	7.625	7.625	7.439	7.189	7.001	6.813	6.875
10	10.750		260.3	257.5	254.5	254.5	247.6	247.6	242.9	236.6	230.2	222.3	215.9	
			10.250	10.136	10.020	10.020	9.750	9.750	9.564	9.314	9.064	8.750	8.500	
12	12.750		311.2	307.1	303.2	304.8	295.3	298.5	289.0	281.0	273.1	266.7	257.2	
			12.250	12.090	11.938	12.000	11.626	11.750	11.376	11.064	10.750	10.500	10.126	
14	14.000	342.9	339.7	336.5	333.3	336.5	325.5	330.2	317..5	308.0	300.1	292.1	284.2	
		13.500	13.375	13.250	13.124	13.250	12.814	13.000	12.500	12.126	11.814	11.500	11.188	
16	16.000	393.7	390.5	387.3	381.0	387.3	373.1	381.0	363.6	354.0	344.5	333.3	325.5	
		15.500	15.375	15.250	15.000	15.250	14.688	15.000	14.314	13.938	13.564	13.124	12.814	
18	18.000	444.5	441.3	434.9	428.7	438.2	419.1	431.8	409.6	398.5	387.3	377.9	366.7	
		17.500	17.375	17.124	16.876	17.250	16.500	17.000	16.126	15.688	15.250	14.876	14.438	
20	20.000	495.3	489.0	482.6	477.9	489.0	466.8	482.6	455.6	442.9	431.8	419.1	408.0	
		19.500	19.250	19.000	18.814	19.250	18.376	19.000	17.938	17.438	17.000	16.500	16.064	
24	24.000	596.9	590.6	581.1	574.7	590.6	560.6	584.2	547.7	531.8	517.6	504.9	490.6	
		23.500	23.250	22.876	22.626	23.250	22.064	23.000	21.564	20.938	20.376	19.876	19.314	

7. FLANGE WEIGHTS - ASME/ANSI B16.5

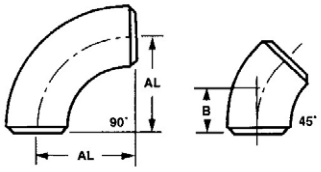
Class 150	kg per unit						
Nominal bore	Outside Diam-eter	Welding Neck	Slip on	Thread-ed Slip on	Lap Joint	Blind	Socket Type
½	3.50	0.50	0..40	0.40	0.40	0.40	0.40
¾	3.88	0.70	0.70	0.70	0.70	0.70	0.70
1	4.25	1.10	0.80	0.90	0.80	0.90	0.90
1¼	4.62	1.50	1.10	1.20	1.10	1.30	1.20
1½	5.00	1.80	1.40	1.50	1.40	1.60	1.50
2	6.00	2.70	2.20	2.30	2.20	2.60	2.30
2½	7.00	4.40	3.60	3.70	3.60	4.10	3.70
3	7.50	5.20	4.10	4.20	4.10	5.00	4.20
3½	8.50	6.40	5.20	5.30	5.20	6.40	
4	9.00	7.50	5.60	5.90	5.60	7.10	
5	10.00	9.2	6.30	7.00	6.30	9.00	
6	11.00	11.00	7.50	8.40	7.50	12.00	
8	13.50	19.30	12.60	13.00	12.60	21.00	
10	16.00	25.00	18.50	17.80	18.50	30.00	
12	19.00	39.00	28.00	29.50	28.00	45.00	
14	21.00	51.00	36.00	39.00	36.00	59.00	
16	23.50	60.00	46.00	47.00	46.00	79.00	
18	25.00	71.00	50.00	54.00	50.00	97.00	
20	27.50	88.00	64.00	68.00	64.00	124.00	
24	32.00	119.00	89.00	93.00	89.00	188.00	

Class 300	kg per unit						
Nominal bore	Outside Diam-eter	Welding Neck	Slip on	Thread-ed Slip on	Lap Joint	Blind	Socket Type
½	3.50	0.80	0.70	0.70	0.70	0.70	0.70
¾	3.88	1.30	1.10	1.20	1.10	1.20	1.20
1	4.25	1.70	1.40	1.40	1.40	1.50	1.40
1¼	4.62	2.20	1.80	1.90	1.80	2.00	1.90
1½	5.00	3.20	2.60	2.80	2.60	2.90	2.80
2	6.00	3.60	3.40	3.30	3.40	3.40	3.30
2½	7.00	5.40	4.40	4.60	4.40	5.10	4.60
3	7.50	7.40	6.10	6.30	6.30	7.00	6.30
3½	8.50	8.90	7.50	7.80	7.50	8.90	
4	9.00	11.90	10.10	10.20	10.10	11.80	
5	10.00	16.00	12.50	12.90	12.50	15.50	
6	11.00	20.00	14.10	15.00	14.10	21.30	
8	13.50	31.00	24.80	26.00	24.80	35.20	
10	16.00	44.00	37.10	38.00	37.10	57.00	
12	19.00	64.00	50.00	52.00	50.00	82.00	
14	21.00	88.00	70.00	72.00	70.00	106.00	
16	23.50	113.00	97.00	100.00	97.00	140.00	
18	25.00	134.00	123.00	126.00	123.00	178.00	
20	27.50	171.00	133.00	138.00	133.00	223.00	
24	32.00	238.00	208.00	213.00	208.00	345.00	

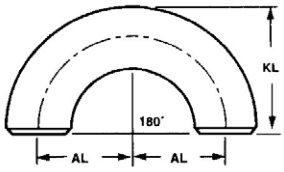
Class 600	kg per unit						
Nominal bore	Outside Diam-eter	Welding Neck	Slip on	Thread-ed Slip on	Lap Joint	Blind	Socket Type
½	3.50	0.90	0.80	1.00	0.80	0.70	0.80
¾	3.88	1.50	1.40	1.60	1.40	1.20	1.40
1	4.25	1.90	1.60	1.80	1.60	1.50	1.60
1¼	4.62	2.60	2.10	2.60	2.10	2.00	2.10
1½	5.00	3.30	3.10	3.30	3.10	3.20	3.10
2	6.00	4.70	3.70	3.90	3.70	4.30	3.70
2½	7.00	6.50	5.40	6.00	5.40	6.00	5.40
3	7.50	8.70	7.30	7.40	7.30	8.00	7.30
3½	8.50	11.20	8.90	9.50	89.0	10.50	
4	9.00	18.10	15.80	17.00	15.80	18.00	
5	10.00	30.00	24.50	27.00	24.50	29.00	
6	11.00	36.00	29.50	32.00	29.50	36.00	
8	13.50	50.00	43.00	46.00	43.00	58.00	
10	16.00	90.00	70.00	74.00	70.00	98.00	
12	19.00	110.00	86.00	90.00	86.00	125.00	
14	21.00	150.00	100.00	108.00	100.00	151.00	
16	23.50	190.00	142.00	150.00	142.00	215.00	
18	25.00	240.00	175.00	188.00	175.00	275.00	
20	27.50	295.00	221.00	230.00	221.00	350.00	
24	32.00	365.00	315.00	325.00	315.00	532.00	

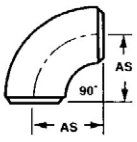
8. WELDING FITTING DIMENSIONS - ASME/ANSI B16.9 and B16.28

Elbows and Return Bends – long radius

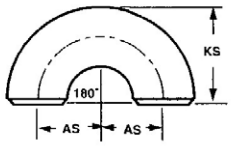


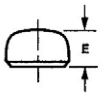
short radius



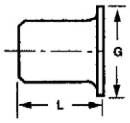


Caps





Lap Joint stub ends



8(A) ELBOWS, RETURN BENDS, CAPS AND LAP JOINT STUB ENDS

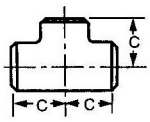
(INCHES)

Nominal Bore	Outside Diameter	AL	B	KL	AS	KS	E	E1	L (Short)	L (Long)	G
½	0.840	1.50	0.62	1.88			1.00			3.00	1.38
¾	1.050	1.50	0.75	2.00			1.00		2.00	3.00	1.69
1	1.315	1.50	0.88	2.19	1.00	1.63	1.50		2.00	4.00	2.00
1¼	1.660	1.88	1.00	2.75	1.25	2.06	1.50		2.00	4.00	2.50
1½	1.900	2.25	1.12	3.25	1.50	2.44	1.50		2.00	4.00	2.88
2	2.375	3.00	1.38	4.19	2.00	3.19	1.50	1.75	2.50	6.00	3.62
2½	2.875	3.75	1.75	5.19	2.50	3.94	1.50	2.00	2.50	6.00	4.12
3	3.500	4.50	2.00	6.25	3.00	4.75	2.00	2.50	2.50	6.00	5.00
3½	4.000	5.25	2.25	7.25	3.50	5.50	2.50	3.00	3.00	6.00	5.50
4	4.500	6.00	2.50	8.25	4.00	6.25	2.50	3.00	3.00	6.00	6.19
5	5.563	7.50	3.12	10.31	5.00	7.75	3.00	3.50	3.00	8.00	7.31
6	6.625	9.00	3.75	12.31	6.00	9.31	3.50	4.00	3.50	8.00	8.50
8	8.625	12.00	5.00	16.31	8.00	12.31	4.00	5.00	4.00	8.00	10.62
10	10.750	15.00	6.25	20.38	10.00	15.38	5.00	6.00	5.00	10.00	12.75
12	12.750	18.00	7.50	24.38	12.00	18.38	6.00	7.00	6.00	10.00	15.00
14	14.000	21.00	8.75	28.00	14.00	21.00	6.50	7.50	6.00	12.00	16.25
16	16.000	24.00	10.00	32.00	16.00	24.00	7.00	8.00	6.00	12.00	18.50
18	18.000	27.00	11.25	36.00	18.00	27.00	8.00	9.00	6.00	12.00	21.00
20	20.000	30.00	12.50	40.00	20.00	30.00	9.00	10.00	6.00	12.00	23.00
24	24.000	36.00	15.00	48.00	24.00	36.00	10.50	12.00	6.00	12.00	27.25
26	26.000	39.00	16.00	52.00	26.00		10.50				
30	30.000	45.00	18.50	60.00	30.00		10.50				
36	36.000	54.00	22.25		36.00		10.50				

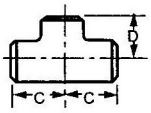
(MM)

Nominal Bore	Outside Diameter	AL	B	KL	AS	KS	E	E1	L (Short)	L (Long)	G
½	21	38	16	48			25			76	35
¾	27	38	19	51			25		51	76	43
1	33	38	22	56	25	41	38		51	102	51
1¼	42	48	25	70	32	52	38		51	102	64
1½	48	57	29	83	38	62	38		51	102	73
2	60	76	35	106	51	81	38	44	64	152	92
2½	73	95	44	132	64	100	38	51	64	152	105
3	89	114	51	159	76	121	51	64	64	152	127
3½	102	133	57	184	89	140	64	76	76	152	140
4	114	152	64	210	102	159	64	76	76	203	157
5	141	190	79	262	127	197	76	89	76	203	186
6	168	229	95	313	152	237	89	102	89	203	216
8	219	305	127	414	203	313	102	127	102	254	270
10	273	381	159	518	254	391	127	152	127	254	324
12	324	457	190	619	305	467	152	178	152	305	381
14	356	533	222	711	356	533	165	191		305	413
16	406	610	254	813	406	610	178	203		305	470
18	457	686	286	914	457	686	203	229		305	533
20	508	762	318	1016	508	762	229	254			584
24	610	914	381	1219	610	914	267	305			692
26	660	991	406	1321			267				
30	762	1143	470	1524			267				
36	914	1372	565				267				

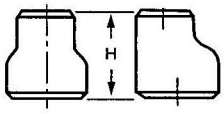
Tees



Reducing Tees



Con. and Ecc. Reducers



8(B). TEES and REDUCERS - INCHES

NOMINAL BORE	OUTLET	C	D	H	NOMINAL BORE	OUTLET	C	D	H	NOMINAL BORE	OUTLET	C	D	H
1	1	1.50			5	5	4.88			18	18	13.50		
1	¾	1.50	1.50	2.00	5	4	4.88	4.62	5.00	18	16	13.50	13.00	15.00
1	½	1.50	1.50	2.00	5	3½	4.88	4.50	5.00	18	14	13.50	13.00	15.00
					5	3	4.88	4.38	5.00	18	12	13.50	12.62	15.00
1¼	1¼	1.88			5	2½	4.88	4.35	5.00	18	10	13.50	12.12	15.00
1¼	1	1.88	1.88	2.00	5	2	4.88	4.12	5.00	18	8	13.50	11.75	15.00
1¼	¾	1.88	1.88	2.00										
1¼	½	1.88	1.88	2.00	6	6	5.62			20	20	15.00		
					6	5	5.62	5.38	5.50	20	18	15.00	14.50	20.00
1½	1½	2.25			6	4	5.62	5.12	5.50	20	16	15.00	14.00	20.00
1½	1¼	2.25	2.25	2.50	6	3½	5.62	5.00	5.50	20	14	15.00	14.00	20.00
1½	1	2.25	2.25	2.50	6	3	5.62	4.88	5.50	20	12	15.00	13.62	20.00
1½	¾	2.25	2.25	2.50	6	2½	5.62	4.75	5.50	20	10	15.00	13.12	20.00
1½	½	2.25	2.25	2.50						20	8	15.00	12.75	20.00
					8	8	7.00							
2	2	2.50			8	6	7.00	6.62	6.00	24	24	17.00		
2	1½	2.50	2.38	3.00	8	5	7.00	6.38	6.00	24	20	17.00	17.00	20.00
2	1¼	2.50	2.25	3.00	8	4	7.00	6.12	6.00	24	18	17.00	16.50	20.00
2	1	2.50	2.00	3.00	8	3½	7.00	6.00	6.00	24	16	17.00	16.00	20.00
2	¾	2.50	1.75	3.00						24	14	17.00	16.00	20.00
					10	10	8.50			24	12	17.00	15.62	20.00
2½	2½	3.00			10	8	8.50	8.00	7.00	24	10	17.00	15.12	20.00
2½	2	3.00	2.75	3.50	10	6	8.50	7.62	7.00					
2½	1½	3.00	2.62	3.50	10	5	8.50	7.50	7.00	26	26	19.50	19.00	24.00
2½	1¼	3.00	2.50	3.50	10	4	8.50	7.25	7.00	26	24	19.50	18.50	24.00
2½	1	3.00	2.25	3.50						26	20	19.50	18.00	24.00
					12	12	10.00			26	18	19.50	17.50	24.00
3	3	3.38			12	10	10.00	9.50	8.00	26	16	19.50	17.00	24.00
3	2½	3.38	3.25	3.50	12	8	10.00	9.00	8.00	26	14	19.50	17.00	24.00
3	2	3.38	3.00	3.50	12	6	10.00	8.62	8.00	26	12	19.50	16.62	24.00
3	1½	3.38	2.88	3.50	12	5	10.00	8.50	8.00					
3	1¼	3.38	2.75	3.50						30	30	22.00	21.50	24.00
					14	14	11.00			30	26	22.00	21.50	24.00
3½	3½	3.75			14	12	11.00	10.62	13.00	30	24	22.00	21.00	24.00
3½	3	3.75	3.62	4.00	14	10	11.00	10.12	13.00	30	22	22.00	20.50	24.00
3½	2½	3.75	3.50	4.00	14	8	11.00	9.75	13.00	30	20	22.00	20.00	24.00
3½	2	3.75	3.25	4.00	14	6	11.00	9.38	13.00	30	18	22.00	19.50	24.00
3½	1½	3.75	3.12	4.00						30	16	22.00	19.00	24.00
					16	16	12.00							
4	4	4.12			16	14	12.00	12.00	14.00	36	36	26.50	26.00	24.00
4	3½	4.12	4.00	4.00	16	12	12.00	11.62	14.00	36	30	26.50	25.00	24.00
4	3	4.12	3.88	4.00	16	10	12.00	11.12	14.00	36	24	26.50	24.00	24.00
4	2½	4.12	3.75	4.00	16	8	12.00	10.75	14.00	36	20	26.50	23.00	24.00
4	2	4.12	3.50	4.00	16	6	12.00	10.38	14.00					
4	1½	4.12	3.38	4.00										

8(B). TEES and REDUCERS - MM

NOMINAL BORE (IN)	OUTLET (IN)	C	D	H	NOMINAL BORE (IN)	OUTLET (IN)	C	D	H	NOMINAL BORE (IN)	OUTLET (IN)	C	D	H
1	1	38			5	5	124			18	18	343		
1	¾	38	38	51	5	4	124	117	127	18	16	343	330	381
1	½	38	38	51	5	3½	124	114	127	18	14	343	330	381
					5	3	124	111	127	18	12	343	321	381
1¼	1¼	48			5	2½	124	108	127	18	10	343	308	381
1¼	1	48	48	51	5	2	124	105	127	18	8	343	298	381
1¼	¾	48	48	51										
1¼	½	48	48	51	6	6	143			20	20	381		
					6	5	143	137	140	20	18	381	368	508
1½	1½	57			6	4	143	130	140	20	16	381	356	508
1½	1¼	57	57	64	6	3½	143	127	140	20	14	381	356	508
1½	1	57	57	64	6	3	143	124	140	20	12	381	346	508
1½	¾	57	57	64	6	2½	143	121	140	20	10	381	333	508
1½	½	57	57	64						20	8	381	324	508
					8	8	178							
2	2	64			8	6	178	168	152	24	24	432		
2	1½	64	60	76	8	5	178	162	152	24	20	432	432	508
2	1¼	64	57	76	8	4	178	156	152	24	18	432	419	508
2	1	64	51	76	8	3½	178	152	152	24	16	432	406	508
2	¾	64	44	76						24	14	432	406	508
					10	10	216			24	12	432	397	508
2½	2½	76			10	8	216	203	178	24	10	432	385	508
2½	2	76	70	89	10	6	216	194	178					
2½	1½	76	67	89	10	5	216	191	178	26	26	495	483	610
2½	1¼	76	64	89	10	4	216	184	178	26	24	495	470	610
2½	1	76	57	89						26	20	495	457	610
					12	12	254			26	18	495	444	610
3	3	86			12	10	254	241	203	26	16	495	432	610
3	2½	86	83	89	12	8	254	229	203	26	14	495	432	610
3	2	86	76	89	12	6	254	219	203	26	12	495	422	610
3	1½	86	73	89	12	5	254	216	203					
3	1¼	86	70	89						30	30	559	546	610
					14	14	279			30	26	559	546	610
3½	3½	95			14	12	279	270	330	30	24	559	533	610
3½	3	95	92	102	14	10	279	257	330	30	22	559	521	610
3½	2½	95	89	102	14	8	279	248	330	30	20	559	508	610
3½	2	95	83	102	14	6	279	238	330	30	18	559	495	610
3½	1½	95	79	102						30	16	559	483	610
					16	16	305							
4	4	105			16	14	305	305	356	36	36	673	660	610
4	3½	105	102	102	16	12	305	295	356	36	30	673	635	610
4	3	105	98	102	16	10	305	283	356	36	24	673	610	610
4	2½	105	95	102	16	8	305	273	356	36	20	673	584	610
4	2	105	89	102	16	6	305	264	356					
4	1½	105	86	102										

9. WELDING FITTINGS WEIGHTS

9(A). 90° ELBOWS - LONG AND SHORT RADIUS - KG PER UNIT

NOMINAL BORE (in)	10	20	30	40	STD	60	XS	80	100	120	140	160	XXS
½				0.08				0.18				0.22	
¾				0.08				0.18				0.25	
1				0.15				0.20				0.30	0.40
				0.10									
1¼				0.25				0.35				0.44	0.61
				0.16									
1½				0.36				0.60				0.80	0.90
				0.24				0.30					
2				0.65				0.94				1.50	1.80
				0.43				0.60					
2½				1.28				1.70				2.35	3.21
				0.82				1.15					
3				2.03				2.75				4.00	5.20
				1.35				1.85					
3½				2.87				3.95					7.49
				1.90				2.60					
4				3.90				5.40		6.95		9.00	10.30
				2.60				3.55		4.72			
5				6.50				8.85		12.62		15.44	18.11
				4.35				6.20		8.44			
6				10.20				15.35		23.00		27.00	30.00
				6.45				10.20		13.62			
8		16.57	17.50	20.30		26.30		29.90	38.00	40.50	52.00	58.00	54.50
		11.10	12.26	16.50		17.75		22.50	26.40	30.00	32.00		
10		25.79	31.30	37.00		48.60		57.11	75.00	85.00	97.00	123.00	
		17.35	21.25	31.15		31.15	31.15	40.00	50.00	53.00	62.00		
12		37.23	46.06	58.15	54.00	82.62	70.00	94.82	123.00	140.00	157.00	180.00	
		25.00	32.78	40.00	45.00	54.93	49.03	66.28	81.00	92.00	99.00		
14	57.47	59.93	68.00	79.96	68.00	111.26	94.35	132.16	188.00	190.00	224.00	247.50	
	30.50	39.50	52.50	55.39	52.50	74.00	63.11	93.07	120.00	124.00	139.00		
16	63.20	78.09	89.20	124.75	89.20	161.17	124.75	204.30	260.00	274.00	323.00	367.00	
	39.00	52.20	71.25	82.63	71.25	107.14	82.63	136.20	166.00	171.50	198.00		
18	82.00	99.43	139.63	117.06	112.90	231.54	157.50	287.84	390.00	405.00	422.00	545.00	
	48.50	65.35	93.07	117.59	90.00	154.36	104.87	191.60	257.00	283.00	387.00		
20	100.00	142.40	194.30	230.00	142.40	311.44	194.30	390.90	476.00	508.00	607.00	770.00	
	67.50	110.00	129.84	153.45	110.00	207.48	129.54	260.14	332.00	376.00	430.00		
22	120.00	178.00	250.20		178.00	412.70	236.00	523.40	638.00	700.00	850.00	1020.00	
	84.5	132.00	171.50		132.00	281.50	157.00	350.50	430.00	497.00	555.00		
24	146.00	202.00	318.70	384.00	202.00	533.90	268.50	667.40	820.00	954.00	1100.00	1270.00	
	96.50	165.00	213.38	256.00	165.00	355.48	188.41	443.55	530.00	621.00	680.00		
26					270.00		348.00						
28					300.00		404.00						
30					333.00		441.00						
36					482.00		625.00						
40					580.00		745.00						
42					655.00		840.00						
48					885.00		1067.00						

Key: Long Radius - White Short Radius - Blue

9(B) 45° LONG RADIUS - KG PER UNIT

NOMINAL BORE (in)	10	20	30	40	STD	60	XS	80	100	120	140	160	XXS
½				0.04				0.08				0.12	
¾				0.04				0.08				0.12	
1				0.08				0.10				0.14	
1¼				0.12				0.18				0.22	0.30
1½				0.18				0.25				0.33	0.45
2				0.32				0.47				0.70	0.84
2½				0.64				0.85				1.20	1.60
3				1.02				1.37				2.00	2.60
3½				1.43				1.97					3.75
4				1.95				2.70		3.47		4.00	5.20
5				3.25				4.42		6.31		7.50	9.08
6				5.10				7.79		9.81		14.00	15.00
8		9.00	10.35	11.15		13.34		14.95	19.07	21.59	26.00	29.00	27.00
10		18.50	19.65	20.50		24.30	2430	30.00	37.55	41.77	48.50	61.00	
12		24.75	26.09	29.57	27.00	41.31	35.00	49.94	61.50	70.82	79.00	90.34	
14	25.00	32.00	34.00	39.98	34.00	55.84	47.17	69.92	94.00	95.00	112.00	123.94	
16	32.00	46.50	48.00	62.37	48.00	80.81	62.37	102.15	130.00	137.00	161.50	183.00	
18	41.00	56.00	69.91	88.53	60.00	115.77	79.00	143.92	195.00	202.50	211.00	272.00	
20	50.00	71.20	97.16	114.00	71.20	155.72	97.16	195.67	238.00	254.00	303.50	385.00	
22	60.00	89.00	128.10		89.00	205.35	118.00	256.70	329.00	365.00	425.00	510.00	
24	73.00	102.95	159.35	192.04	102.95	266.95	141.20	333.70	410.00	477.00	545.00	635.00	
26					124.90		165.71						
28					150.00		202.00						
30					167.00		220.00						
36					241.00		312.00						
40					290.00		373.00						
42					327.00		443.00						
48					443.00		533.00						

9(C). EQUAL TEES - KG PER UNIT

NOMINAL BORE (in)	10	20	30	40	STD	60	XS	80	100	120	140	160	XXS
½				0.16				0.25				0.28	
¾				0.20				0.27				0.29	0.38
1				0.29				0.35				0.45	0.58
1¼				0.53				0.65				0.77	1.05
1½				0.77				0.96				1.21	1.56
2				1.88				1.90				2.25	2.69
2½				2.69				3.07				3.42	4.54
3				3.82				4.50				6.21	7.63
3½				5.18				6.17				9.00	9.62
4				6.00				8.44				15.53	17.00
5				9.94				12.94		18.00		23.93	25.00
6				16.48				19.30		24.00		38.59	39.00
8		29.00	31.00	33.00	33.00	34.50	34.56	34.50	43.65	50.00	84.00	71.00	69.00
10		34.70	36.77	49.35	49.35	58.57	58.57	68.00	74.00	93.00	99.00	120.00	
12		59.00	61.74	70.50	65.00	102.60	84.90	115.00	136.00	150.00	177.00	184.00	
14	87.16	90.00	93.00	114.41	93.00	141.20	127.12	165.00	206.00	240.00	275.00	300.00	
16	90.80	100.00	115.00	167.52	115.00	207.99	167.52	249.00	305.00	330.00	385.00	425.00	
18	94.50	127.12	181.14	238.35	135.00	277.85	190.00	322.00	380.00	450.00	500.00	590.00	
20	120.00	168.00	265.00	320.52	168.00	378.64	245.00	459.05	540.00	590.00	720.00	790.00	
22	143.00	200.00	355.00		200.00	510.00	280.00	600.00	725.00	840.00	950.00	1110.00	
24	170.00	240.00	443.55	570.68	240.00	656.48	350.00	748.00	910.00	1100.00	1180.00	1310.00	
26					288.00		360.50						
30					388.50		483.50						
36					587.50		731.00						
40					690.00		894.50						
42					831.00		1112.50						
48					1112.50		1498.50						

9(D). CONCENTRIC and ECCENTRIC REDUCERS - KG PER UNIT

NOMINAL BORE (in)	OUTLET (in)	10	20	30	40	STD	60	XS	80	100	120	140	160	XXS
¾	⅜				0.07				0.10					
	½				0.07				0.10				0.14	0.19
1	½				0.13				0.16				0.21	0.28
	¾				0.13				0.16				0.21	0.28
1¼	½				0.17				0.23				0.29	0.39
	¾				0.17				0.23				0.29	0.39
	1				0.17				0.23				0.29	0.39
1½	½				0.26				0.35				0.46	0.61
	¾				0.26				0.35				0.46	0.61
	1				0.26				0.35				0.46	0.61
	1¼				0.26				0.35				0.46	0.61
2	½				0.41				0.57				0.84	1.03
	¾				0.41				0.57				0.84	1.03
	1				0.41				0.57				0.84	1.03
	1¼				0.41				0.57				0.84	1.03
	1½				0.41				0.57				0.84	1.03
2½	1				0.77				1.01				1.33	1.81
	1¼				0.77				1.01				1.33	1.81
	1½				0.77				1.01				1.33	1.81
	2				0.77				1.01				1.33	1.81
3	1				1.00				1.36				1.89	2.47
	1¼				1.00				1.36				1.89	2.47
	1½				1.00				1.36				1.89	2.47
	2				1.00				1.36				1.89	2.47
	2½				1.00				1.36				1.89	2.47
3½	1¼				1.40				1.89					3.45
	1½				1.40				1.89					3.45
	2				1.40				1.89					3.45
	2½				1.40				1.89					3.45
	3				1.40				1.89					3.45
4	1				1.60				2.27				3.41	4.18
	1½				1.60				2.27				3.41	4.18
	2				1.60				2.27				3.41	4.18
	2½				1.60				2.27				3.41	4.18
	3				1.60				2.27				3.41	4.18
	3½				1.60				2.27					4.18
5	2				2.80				3.93				6.26	7.31
	2½				2.80				3.93				6.26	7.31
	3				2.80				3.93				6.26	7.31
	3½				2.80				3.93					7.31
	4				2.80				3.93		5.68		6.26	7.31
6	2				3.90				5.95				9.40	11.08
	2½				3.90				5.95				9.40	11.08
	3				3.90				5.95				9.40	11.08
	3½				3.90				5.95				9.40	11.08
	4				3.90				5.95		7.58			11.08
	5				3.90				5.95		7.58		9.40	11.08
8	3				3.90				5.95				9.40	11.08
	3½				6.50				9.86				16.90	16.43
	4				6.50				9.86		13.70		16.90	16.43
	5				6.50				9.86		13.70		16.90	16.43
	6				6.50				9.86		13.70		16.90	16.43
10	4				10.70			14.50	17.00		23.60		30.60	
	5				10.70			14.50	17.00		23.60		30.60	
	6				10.70			14.50	17.00		23.60		30.60	
	8		7.50	9.00	10.70		14.50	14.50	17.00		23.60	27.50	30.60	
12	5				16.30	15.00		19.80	26.80		38.00		48.60	
	6				16.30	15.00		19.80	26.80		38.00		48.60	
	8		10.16	13.20	16.30	15.00	22.20	19.80	26.80	32.40	38.00	42.30	48.60	
	10		10.16	13.20	16.30	15.00	22.20	19.80	26.80	32.40	38.00	42.30	48.60	
14	6				31.10	26.90		35.50	52.20		73.00		86.00	
	8		22.60	26.80	31.10	26.90	42.00	35.50	52.20	64.00	73.00	78.00	86.00	
	10		22.60	26.80	31.10	26.90	42.00	35.50	52.20	64.00	73.00	78.00	86.00	
	12		22.60	26.80	31.10	26.90	42.00	35.50	52.20	64.00	73.00	78.00	86.00	
16	8		27.90	33.10	43.80	33.00	57.00	44.00	72.00	83.00	97.00	112.00	121.00	
	10		27.90	33.10	43.80	33.00	57.00	44.00	72.00	83.00	97.00	112.00	121.00	
	12		27.90	33.10	43.80	33.00	57.00	44.00	72.00	83.00	97.00	112.00	121.00	
	14	28.00	27.90	33.10	43.80	33.00	57.00	44.00	72.00	83.00	97.00	112.00	121.00	

9(D). CONCENTRIC and ECCENTRIC REDUCERS - KG PER UNIT - CONTINUED

NOMINAL BORE (in)	OUTLET (in)	10	20	30	40	STD	60	XS	80	100	120	140	160	XXS
18	8		33.30	48.00	59.00	40.00	79.00	53.00	96.70	116.00	136.00	145.00	159.00	
	10		33.30	48.00	59.00	40.00	79.00	53.00	96.70	116.00	136.00	145.00	159.00	
	12		33.30	48.00	59.00	40.00	79.00	53.00	96.70	116.00	136.00	145.00	159.00	
	14	34.00	33.30	48.00	59.00	40.00	79.00	53.00	96.70	116.00	136.00	145.00	159.00	
	16	34.00	33.30	48.00	59.00	40.00	79.00	53.00	96.70	116.00	136.00	145.00	159.00	
20	12		58.00	79.00	93.00	59.00	126.00	79.00	158.00	163.00	178.00	305.00	340.00	
	14	50.00	58.00	79.00	93.00	59.00	126.00	79.00	158.00	163.00	178.00	305.00	340.00	
	16	50.00	58.00	79.00	93.00	59.00	126.00	79.00	158.00	163.00	178.00	305.00	340.00	
	18	50.00	58.00	79.00	93.00	59.00	126.00	79.00	158.00	163.00	178.00	305.00	340.00	
22	14	57.00	61.00	92.00		65.00	150.00	87.00	188.00	201.00	233.00	415.00	460.00	
	16	57.00	61.00	92.00		65.00	150.00	87.00	188.00	201.00	233.00	415.00	460.00	
	18	57.00	61.00	92.00		65.00	150.00	87.00	188.00	201.00	233.00	415.00	460.00	
	20	57.00	61.00	92.00		65.00	150.00	87.00	188.00	201.00	233.00	415.00	460.00	
24	16	63.00	72.00	107.00	129.00	72.00	180.00	95.00	228.00	241.00	295.00	540.00	610.00	
	18	63.00	72.00	107.00	129.00	72.00	180.00	95.00	228.00	241.00	295.00	540.00	610.00	
	20	63.00	72.00	107.00	129.00	72.00	180.00	95.00	228.00	241.00	295.00	540.00	610.00	
	22	63.00	72.00	107.00		72.00	180.00	95.00	228.00	241.00	295.00	540.00	610.00	
26	18					91.00		115.00						
	20					91.00		115.00						
	22					91.00		115.00						
	24					91.00		115.00						
30	20					100.00		143.00						
	24					100.00		143.00						
	26					100.00		143.00						
	28					100.00		143.00						
36	24					145.00		160.00						
	26					150.00		160.00						
	30					154.00		165.00						
	32					154.00		165.00						
	34					154.00		165.00						
						154.00		165.00						

9(E). END CAPS - KG PER UNIT

NOMINAL BORE (in)		10	20	30	40	STD	60	XS	80	100	120	140	160	XXS
½					0.03				0.05					
¾					0.06				0.10					
1					0.10				0.13				0.15	0.20
1¼					0.14				0.20				0.23	0.28
1½					0.20				0.23				0.30	0.36
2					0.30				0.30				0.55	0.59
2½					0.50				0.50				0.90	1.00
3					0.70				0.90				1.40	1.78
3½					1.40				1.70					2.63
4					1.60				2.00		2.31		2.75	3.17
5					2.30				3.00		3.89		5.00	5.50
6					3.60				4.00		6.02		7.50	8.10
8			4.50	5.00	5.50		7.00		8.40	11.00	15.50	18.50	20.00	19.50
10			7.00	7.63	10.00		13.60	13.60	16.20	21.00	24.00	27.00	30.00	
12			9.00	13.00	19.00	15.00	22.00	22.00	26.90	32.50	41.00	42.00	44.50	
14			15.50	17.00	23.00	17.00	32.00	27.00	34.70	42.00	47.00	52.00	60.00	
16		18.00	20.00	23.00	30.00	23.00	37.00	30.00	43.50	54.00	64.00	73.00	79.00	
18		22.00	25.00	30.30	39.00	29.00	66.00	32.00	72.50	75.00	88.00	93.00	104.00	
20		31.00	36.00	49.00	66.70	36.00	94.50	49.00	98.50	100.00	105.00	153.00	170.00	
22		35.50	42.00	59.00		42.00	107.00	51.00	120.00	135.00	150.00	198.00	220.00	
24		44.00	52.00	74.50	93.00	52.00	120.00	69.00	150.00	180.00	200.00	250.00	285.00	
26						46.50		66.00						
30		51.00				57.00		79.50						
36		62.00				79.50		107.00						
40						91.00		122.50						
42						104.50		136.50						
48						116.00		154.50						

9(F). REDUCING TEES - KG PER UNIT

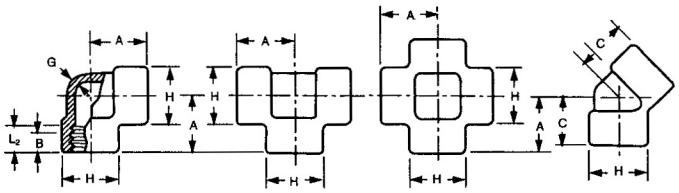
NOMINAL BORE (in)	OUTLET (in)	10	20	30	40	STD	60	XS	80	100	120	140	160	XXS
½	¼				0.16				0.25					
	⅜				0.16				0.25					
¾	⅜				0.25				0.34					
	½				0.25				0.34				0.27	0.48
1	½				0.34				0.40				0.44	0.55
	¾				0.35				0.40				0.46	0.57
1¼	½				0.53				0.58				0.76	1.00
	¾				0.54				0.59				0.78	1.02
	1				0.55				0.60				0.80	1.09
1½	½				0.73				0.94				1.19	
	¾				0.73				0.94				1.19	1.50
	1				0.73				0.96				1.25	1.55
	1¼				0.80				0.99				1.25	1.62
2	¾				1.29				2.05				2.16	2.52
	1				1.31				2.05				2.19	2.65
	1¼				1.46				2.05				2.23	2.71
	1½				1.50				2.05				2.27	2.73
2½	1				1.96				3.37				3.57	4.27
	1¼				1.99				3.37				3.60	4.46
	1½				2.04				3.37				3.65	4.49
	2				2.08				3.37				3.45	4.58
3	1				2.88				4.25				5.40	7.40
	1¼				2.88				4.25				5.40	7.40
	1½				2.88				4.25				5.50	7.50
	2				2.90				4.25				5.50	7.50
	2½				3.00				4.25				5.60	7.70
4	1½				4.95				7.50				15.50	17.00
	2				4.99				7.50				15.50	17.00
	2½				5.13				7.50				15.50	17.00
	3				5.18				7.50				15.50	17.00
	3½				5.27				7.50		11.09			17.00
5	2				7.81				12.10				23.00	22.20
	2½				7.90				12.10				23.00	22.20
	3				7.99				12.10				23.00	26.20
	3½				8.08				12.10					26.20
	4				8.22				12.10		18.10		23.00	26.20
6	2				16.00				18.00				29.00	29.00
	2½				16.00				18.00				29.00	29.00
	3				16.00				18.00				30.00	29.00
	3½				16.00				18.00					29.00
	4				16.00				18.00		29.00		30.00	29.00
	5				16.00				18.00		29.00		30.00	38.00
8	3				28.00				34.00					
	3½				28.00				34.00					
	4				28.00				34.00		44.00		49.00	51.00
	5				28.00				34.00		44.00		52.00	51.00
	6				28.00				34.00		52.00		52.00	51.00
10	4				41.00			52.00	53.00		71.00		85.00	
	5				41.00			52.00	53.00		71.00		89.00	
	6				41.00			52.00	53.00		82.00		101.00	
	8		29.00	35.00	41.00		53.00	58.00	71.00	73.00	89.00	99.00	109.00	
12	5				64.00	63.00		82.00	82.00		103.00		144.00	
	6				64.00	63.00		82.00	82.00					
	8		41.00	60.00	64.00	63.00	82.00	82.00	82.00	122.00	133.00	144.00	155.00	
	10		43.00	62.00	67.00	63.00	103.00	85.00	103.00	126.00	149.00	160.00	171.00	
14	6				109.00	107.00		122.00	122.00		205.00			270.00
	8		90.00	99.00	109.00	107.00	136.00	122.00	122.00	195.00	220.00	250.00		270.00
	10		90.00	99.00	109.00	107.00	136.00	127.00	141.00	195.00	230.00	265.00		285.00
	12		95.00	103.00	114.00	111.00	141.00	127.00	143.00	206.00	235.00	275.00		300.00
16	6				160.00	116.00		160.00	163.00		250.00		295.00	
	8		98.00	107.00	160.00	116.00	161.00	160.00	163.00	210.00	280.00	295.00	295.00	
	10		98.00	107.00	160.00	116.00	163.00	160.00	163.00	210.00	295.00	310.00	360.00	
	12		100.00	110.00	161.00	119.00	181.00	167.00	181.00	250.00	310.00	340.00	385.00	
	14	84.00	100.00	119.00	167.00	119.00	208.00	167.00	200.00	260.00	320.00	360.00	410.00	
18	8		123.00	140.00	150.00	129.00	188.00	154.00	205.00	310.00	360.00	360.00	455.00	
	10		123.00	140.00	150.00	129.00	212.00	164.00	225.00	325.00	385.00	385.00	475.00	
	12		127.00	154.00	194.00	135.00	212.00	164.00	234.00	325.00	410.00	410.00	500.00	
	14	105.00	127.00	164.00	194.00	135.00	212.00	190.00	258.00	370.00	420.00	455.00	520.00	
	16	105.00	127.00	164.00	238.00	135.00	257.00	190.00	279.00	380.00	440.00	475.00	550.00	

9(F). REDUCING TEES - KG PER UNIT - CONTINUED

NOMINAL BORE (in)	OUTLET (in)	10	20	30	40	STD	60	XS	80	100	120	140	160	XXS
20	8		164.00	214.00	220.00	163.00	224.00	214.00	228.00	390.00	420.00	450.00	660.00	
	10		164.00	214.00	220.00	163.00	286.00	214.00	293.00	420.00	475.00	500.00	680.00	
	12		164.00	214.00	224.00	163.00	293.00	214.00	324.00	450.00	500.00	540.00	700.00	
	14	110.00	164.00	214.00	224.00	163.00	293.00	214.00	324.0	470.00	530.00	590.00		
	16	112.00	168.00	218.00	230.00	168.00	324.00	218.00	355.00	470.00	550.00	630.00	750.00	
	18	112.00	168.00	218.00	265.00	168.00	351.00	218.00	410.00	540.00	570.00	680.00	770.00	
22	10		173.00	245.00		172.00	337.00	245.00	374.00	525.00	695.00	725.00	860.00	
	12		173.00	245.00		172.00	337.00	245.00	374.00	525.00	695.00	725.00	860.00	
	14	160.00	173.00	245.00		172.00	337.00	245.00	374.00	525.00	695.00	725.00	860.00	
	16	190.00	209.00	260.00		209.00	390.00	260.00	415.00	642.00	780.00	840.00	965.00	
	18	190.00	209.00	260.00		209.00	390.00	260.00	415.00	642.00	780.00	840.00	965.00	
	20	210.00	220.00	280.00		220.00	445.00	280.00	513.00	725.00	820.00	910.00	1020.00	
24	10		204.00	320.00	308.00	204.00	389.00	300.00	452.00	635.00	920.00	950.00	1040.00	
	12		218.00	320.00	308.00	218.00	389.00	300.00	452.00	770.00	950.00	980.00	1090.00	
	14	150.00	222.00	320.00	309.00	222.00	427.00	300.00	490.00	770.00	1000.00	1050.00	1140.00	
	16	150.00	222.00	340.00	309.00	222.00	427.00	320.00	490.00	815..00	1010.00	1060.00	1180.00	
	18	151.00	227.00	340.00	390.00	227.00	472.00	320.00	533.00	815.00	1040.00	1090.00	1210.00	
	20	151.00	227.00	373.00	390.00	227.00	545.00	350.00	606.00	910.00	1090.00	1140.00	1270.00	
	22	151.00	227.00	373.00		227.00	595.00	350.00	675.00	910.00	1140.00	1160.00	1290.00	
26	12					231.00		293.00						
	14					239.00		309.00						
	16					247.00		309.00						
	18					255.00		323.00						
	20					264.00		330.00						
	22					272.00		340.00						
	24					280.00		350.00						
30	10					296.00		377.00						
	12					304.00		385.00						
	14					312.00		395.00						
	16					321.00		405.00						
	18					330.00		417.00						
	20					340.00		429.00						
	22					351.00		441.00						
	24					361.00		452.00						
	26					372.00		463.00						
	28					380.00		475.00						
36	16					472.00		602.00						
	18					483.00		611.00						
	20					493.00		621.00						
	22					502.00		622.00						
	24					513.00		643.00						
	26					526.00		654.00						
	38					537.00		670.00						
	30					548.00		685.00						
	32					561.00		700.00						
	34					574.00		715.00						

10. FORGED STEEL FITTINGS - DIMENSIONS and TOLERANCES ASME/ANSI B16.11

10(A). THREADED - ELBOWS, TEES AND CROSSES



90° Elbow Tee Cross 45° Elbow

(INCHES)

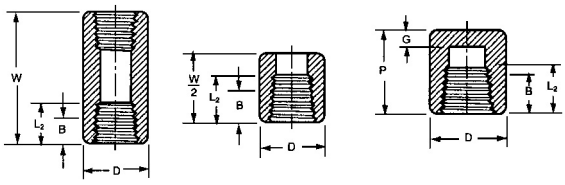
NOMINAL PIPE SIZE	CENTRE TO END ELBOWS, TEES, CROSSES A		CENTRE TO END 45° ELBOW C		OUTSIDE DIAMETER OF BAND H		MINIMUM WALL THICKNESS G		LENGHT OF THREAD MIN. (1)	
	3000	6000	3000	6000	3000	6000	3000	6000	B	L_2
1/8	0.81	0.97	0.69	0.75	0.88	1.00	0.125	0.250	0.25	0.2639
¼	0.97	1.12	0.75	0.88	1.00	1.31	0.130	0.260	0.32	0.4018
3/8	1.12	1.31	0.88	1.00	1.31	1.50	0.138	0.275	0.36	0.4078
½	1.31	1.50	1.00	1.12	1.50	1.81	0.161	0.321	0.43	0.5337
¾	1.50	1.75	1.12	1.31	1.81	2.19	0.170	0.336	0.50	0.5457
1	1.75	2.00	1.31	1.38	2.19	2.44	0.196	0.391	0.58	0.6828
1 ¼	2.00	2.38	1.38	1.69	2.44	2.97	0.208	0.417	0.67	0.7068
1 ½	2.38	2.50	1.69	1.72	2.97	3.31	0.219	0.436	0.70	0.7235
2	2.50	3.25	1.72	2.06	3.31	4.00	0.281	0.476	0.75	0.7565
2 ½	.325	3.75	2.06	2.50	4.00	4.75	0.301	0.602	0.93	1.138
3	3.75	4.19	2.50	3.12	4.75	5.75	0.348	0.655	1.02	1.200
4	4.50	4.50	3.12	3.12	6.00	6.00	0.440	0.735	1.09	1.300

(MM)

1/8	21	25	17	19	22	25	3.0	6.5	6.5	6.5
¼	25	29	19	22	25	33	3.5	6.5	8.0	10.0
3/8	29	33	22	25	33	38	3.5	7.0	9.0	10.5
½	33	38	25	29	38	46	4.0	8.0	11.0	13.5
¾	38	44	29	33	46	56	4.5	8.5	12.5	14.0
1	44	51	33	35	46	62	5.0	10.0	14.5	17.5
1 ¼	51	60	35	43	62	75	5.5	10.5	17.0	18.0
1 ½	60	64	43	44	75	84	5.5	11.0	18.0	18.5
2	64	83	45	52	84	102	7.0	12.0	19.0	19.0
2 ½	83	95	52	64	102	121	7.5	15.5	23.5	29.0
3	95	106	64	79	121	146	9.0	16.5	26.0	30.5
4	114	114	79	79	152	152	11.0	18.5	27.5	33.0

NOTE: (1) Dimension 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 (ANSI/ASME 81.20.1).

10(B). THREADED - COUPLINGS AND CAPS



Coupling Half-Coupling Cap

(INCHES)

NOMINAL PIPE SIZE	END TO END COUPLINGS W	END TO END CAPS P		OUTSIDE DIAMETER D		END WALL THICKNESS G MIN		LENGHT OF THREAD MIN. (2)	
	3000 & 6000	3000	6000	3000	6000	3000	6000	B	L_2
1/8	1.25	0.75		0.62	0.88	0.19		0.25	0.2639
¼	1.38	1.00	1.06	0.75	1.00	0.19	0.25	0.32	0.4018
3/8	1.50	1.00	1.06	0.88	1.25	0.19	0.25	0.36	0.4078
½	1.88	1.25	1.31	1.12	1.50	0.25	0.31	0.43	0.5337
¾	2.00	1.44	1.50	1.38	1.75	0.25	0.31	0.50	0.5457
1	2.38	1.62	1.69	1.75	2.25	0.38	0.44	0.58	0.6828
1 ¼	2.62	1.75	1.81	2.25	2.50	0.38	0.44	0.67	0.7068
1 ½	3.12	1.75	1.88	2.50	3.00	0.44	0.50	0.70	0.7235
2	3.38	1.88	2.00	3.00	3.62	0.50	0.62	0.75	0.7565
2 ½	3.62	2.38	2.50	3.62	4.25	0.62	0.75	0.93	1.138
3	4.25	2.56	2.69	4.25	5.00	0.75	0.88	1.02	1.200
4	4.75	2.69	2.94	5.50	6.25	0.88	1.12	1.09	1.300

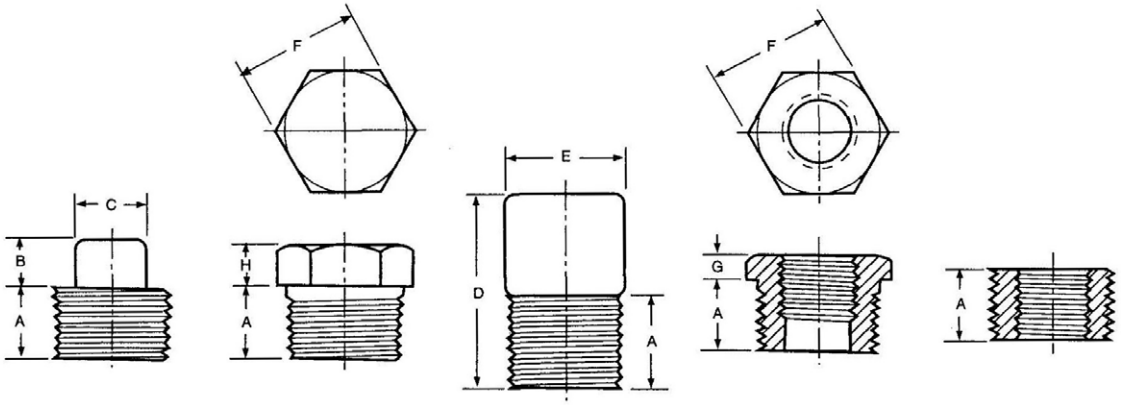
10(B). THREADED - COUPLINGS AND CAPS - CONTINUED

(MM)

NOMINAL PIPE SIZE	END TO END COUPLINGS W	END TO END CAPS P		OUTSIDE DIAMETER D		END WALL THICKNESS G MIN		LENGHT OF THREAD MIN. (2)	
	3000 & 6000	3000	6000	3000	6000	3000	6000	B	L_2
1/8	32	19		16	22	5.0		6.5	6.5
¼	35	25	27	19	25	5.0	6.5	8.0	10.0
3/8	38	25	27	22	32	5.0	6.5	9.0	10.5
½	48	32	33	29	38	6.5	8.0	11.0	13.5
¾	51	37	38	35	44	6.5	8.0	12.5	14.0
1	60	41	43	44	57	9.5	11.0	14.5	17.5
1 ¼	67	44	46	57	64	9.5	11.0	17.0	18.0
1 ½	79	44	48	64	76	11.0	12.5	18.0	18.5
2	86	48	51	76	92	12.5	16.0	19.0	19.0
2 ½	92	60	64	92	108	16.0	19.0	23.5	29.0
3	108	65	68	108	127	19.0	22.0	26.0	30.5
4	121	68	75	140	159	22.0	28.5	27.5	33.0

NOTE: (1) Class 2000 and NPS V. class 6000 couplings, half couplings, and caps are not Included In this Standard.
(2) Dimension 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 (ANSI/ASME B1.20.1).

10(C). PLUGS AND BUSHES



Square Head Plug | Hex Head Plug | Round Head Plug | Hex Head Bushing [See Note (1)] | Flush Bushing

(INCHES)

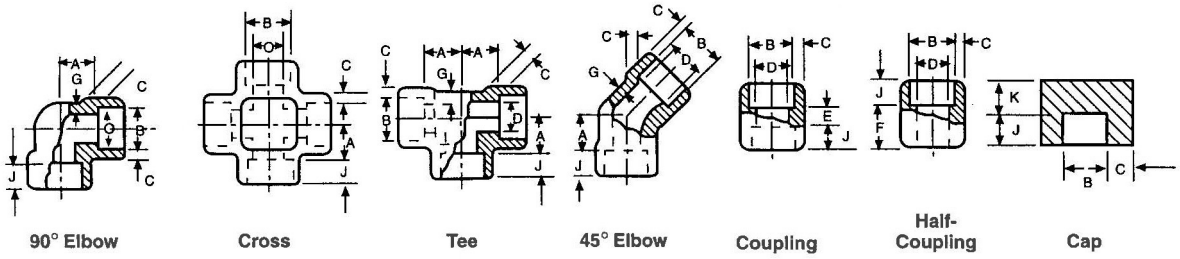
NOMINAL PIPE SIZE	Plugs Square Head			Plugs Round Head		Hex Plugs & Bushings		
	Length (minimum) A	Height of Square (Minimum) B	Width of Flats (Minimum) C	Nominal Diameter of Head E	Length (Minimum) D	Wodth Flats (Nominal) F	Hex Height (mm) Bushing G	Hex Height (mm) Plug H
1/8	0.38	0.25	0.28	0.41	1.38	0.44		0.25
¼	0.44	0.25	0.38	0.53	1.62	0.62	0.12	0.25
3/8	0.50	0.31	0.44	0.69	1.62	0.69	0.16	0.31
½	0.56	0.38	0.56	0.84	1.75	0.88	0.19	0.31
¾	0.62	0.44	0.62	1.06	1.75	1.06	0.22	0.38
1	0.75	0.50	0.81	1.31	2.00	1.38	0.25	0.38
1 ¼	0.81	0.56	0.94	1.69	2.00	1.75	0.28	0.56
1 ½	0.81	0.62	1.12	1.91	2.00	2.00	0.31	0.62
2	0.88	0.69	1.31	2.38	2.50	2.50	0.34	0.69
2 ½	1.06	0.75	1.50	2.88	2.75	3.00	0.38	0.75
3	1.12	0.81	1.69	3.50	2.75	3.50	0.41	0.81
4	1.25	1.00	2.50	4.50	3.00	4.62	0.50	1.00

(MM)

1/8	9.5	6	7.0	10	35	11.0		6
¼	11.0	6	9.5	13	41	16.0	3	6
3/8	12.5	8	11.0	17	41	17.5	4	8
½	14.5	10	14.5	21	44	22.0.	5	8
¾	16.0	11	16.0	27	44	27.0	6	10
1	19.0	13	20.5	33	51	35.0	6	10
1 ¼	20.5	14	24.0	43	51	44.5	7	14
1 ½	20.5	16	28.5	48	51	51.0	8	16
2	22.0	17	33.5	60	64	63.5	9	17
2 ½	27.0	19	38.0	73	70	76.0	10	19
3	28.5	21	43.0	89	70	89.0	10	21
4	32.0	25	63.5	114	76	117.5	13	25

NOTE: (1) Cautionary Note Regarding Hex Head Bushings. Hex Head Bushings of one size reduction should not be used in services wherein they might be subject to harmful loads and forces other than internal pressures.

10(D). SOCKET WELD - ELBOWS, TEES, CROSSES, COUPLINGS and CAPS



(INCHES)

Nom Pipe Size	Socket Bore Dia (2) B	Bore Diameter of Fittings (2) D			Socket Wall Thickness (1) C						Body Wall G			Dpth of Socket J	Centre to bottom of socket - A						Laying Lengths		Tolerances ±			End Wall Thickness K min		
		Class Designation			Class Designation						Designation				90° Elbows Tees and Crosses			45° Elbows			Cou-plings E	Half Cou-plings F				Class Designation		
		3000	6000	9000	3000		6000		9000		3000	6000	9000	Min.	Class Designation								A	E	F			
					Ave.	Min.	Ave.	Min.	Ave.	Min.	Min.	Min.	Min.		3000	6000	9000	3000	6000	9000						3000	6000	9000
1/8	0.440	0.299	0.189		0.125	0.125	0.156	0.135			0.095	0.124		0.38	0.44	0.44		0.31	0.31		0.25	0.62	0.03	0.06	0.03	0.19	0.25	
	0.420	0.239	0.126																									
¼	0.575	0.394	0.280		0.149	0.130	0.181	0.158			0.119	0.145		0.38	0.44	0.53		0.31	0.31		0.25	0.62	0.03	0.06	0.03	0.19	0.25	
	0.555	0.334	0.220																									
3/8	0.710	0.523	0.389		0.158	0.138	0.198	0.172			0.126	0.158		0.38	0.53	0.62		031	0.44		0.25	0.69	0.06	0.12	0.06	0.19	0.25	
	0.690	0.463	0.329																									
½	0.875	0.652	0.494	0.282	0.184	0.161	0.235	0.204	0.368	0.322	0.147	0.188	0.294	0.38	0.62	0.75	1.00	0.44	0.50	0.62	0.38	0.88	0.06	0.12	0.06	0.25	0.31	0.44
	0.855	0.592	0.434	0.222																								
¾	1.085	0.854	0.642	0.464	0.193	0.168	0.274	0.238	0.385	0.337	0.154	0.219	0.308	0.50	0.75	0.88	1.12	0.50	0.56	0.75	0.38	0.94	0.06	0.12	0.06	0.25	0.31	0.50
	1.065	0.794	0.582	0.404																								
1	1.350	1.079	0.845	0.629	0.224	0.198	0.312	0.273	0.448	0.392	0.179	0.250	0.358	0.50	0.88	1.06	1.25	0.56	0.69	0.81	0.50	1.12	0.08	0.16	0.08	0.38	0.44	0.56
	1.350	1.019	0.785	0.569																								
1 ¼	1.695	1.410	1.190	0.926	0.239	0.208	0.312	0.273	0.478	0.418	0.191	0.250	0.382	0.50	1.06	1.25	1.38	0.69	0.81	0.88	0.50	1.19	0.08	0.16	0.08	0.38	0.44	0.56
	1.675	1.350	1.130	0.866																								
1 ½	1.935	1.640	1.368	1.130	0.250	0.218	0.351	0.307	0.500	0.438	0.200	0.281	0.400	0.50	1.25	1.50	1.50	0.81	1.00	1.00	0.50	1.25	0.08	0.16	0.08	0.44	0.50	0.62
	1.915	1.580	1.308	1.070																								
2	2.426	2.097	1.717	1.533	0.273	0.238	0.430	0.374	0.545	0.477	0.218	0.344	0.436	0.62	1.50	1.62	2.12	1.00	1.12	1.12	0.75	1.62	0.08	0.16	0.08	0.50	0.62	0.75
	2.406	2.037	1.657	1.473																								
2 ½	2.931	2.529			0.345	0.302					0.276			0.62	1.62			1.12			0.75	1.69	0.10	0.20	0.10	0.62	0.75	
	2.906	2.409																										
3	3.560	3.128			0.375	0.327					0.300			0.62	2.25			1.25			0.75	1.75	0.10	0.20	0.10	0.75	0.88	
	3.535	3.008																										
4	4.570	4.086			0.421	0.368					0.337			0.75	2.62			1.62			0.75	1.88	0.10	0.20	0.10	0.88	1.12	
	4.545	3.966																										

(MM)

1/8	11.15	7.6	4.8		3.20	3.20	3.95	3.45			2.40	3.15		10	12	12		9	9		8	17				5.0	6.5	
	10.65	6.1	3.2												10	10		7	7		5	15						
¼	14.60	10.0	7.1		3.80	3.30	4.60	4.00			3.00	3.70		10	12	17		9	9		8	17				5.0	6.5	
	14.10	8.5	5.6												10	13		7	7		5	15						
3/8	18.05	13.3	9.9		4.00	3.50	5.05	4.35			3.20	4.00		10	15	17		9	13		9	19				5.0	6.5	
	17.55	11.8	8.4												12	14		6	10		3	16						
½	20.20	16.6	12.5	7.2	4.65	4.10	5.95	5.20	9.35	8.20	3.75	4.80	7.45	10	17	21	27	13	14	17	13	24				6.5	8.0	11.0
	21.70	15.0	11.0	5.6											14	18	24	10	11	14	6	21						
¾	27.55	21.7	16.3	11.8	4.90	4.25	6.95	6.05	9.80	8.55	3.90	5.55	7.80	13	21	24	30	14	16	21	13	25				6.5	8.0	12.5
	27.05	20.2	14..8	10.3											18	21	27	11	13	17	6	22						
1	34.30	27.4	21.5	16.0	5.70	5.00	7.90	6.95	11.40	9.95	4.55	6.35	9.10	13	24	29	34	16	19	23	17	31				9.5	11.0	14.0
	33.80	25.9	19.9	14.5											20	25	30	12	15	19	9	27						
1 ¼	43.05	35.8	30.2	23.5	6.05	5.30	7.90	6.95	12.15	10.60	4.85	6.35	9.70	13	29	34	37	19	23	24	17	32				9.5	11.0	14.0
	42.55	34.3	28.7	22.0											25	30	33	15	19	20	9	28						
1 ½	49.15	41.7	34.7	28.7	6.35	5.55	8.90	7.80	12.70	11.15	5.10	7.15	10.15	13	34	40	40	23	27	28	17	34				11.0	12.5	16.0
	48.65	40.1	33.2	27.2											30	36	36	19	23	23	9	30						
2	61.60	43.5	43.6	38.9	6.95	6.05	10.90	9.50	13.85	12.15	5.55	8.75	11.05	16	40	43	56	27	31	31	23	43				12.5	16.0	19.0
	61.10	51.7	42.1	37.4											36	39	52	23	27	26	15	39						
2 ½	74.45	64.2			8.75	7.65					7.00			16	44			31			24	45				16.0	19.0	
	73.80	61.2													39			27			14	40						
3	90.40	79.5			9.50	8.30					7.60			16	60			34			24	47				19.0	22.0	
	89.30	46.4													55			29			14	42						
4	116.05	103.8			10.70	9.35					8.55			19	69			44			24	50				22.0	28.5	
	115.45	100.7													64			39			14	45						

NOTES: (1) Average of Socket Wall Thickness around periphery shall be no less than listed values. The minimum values are permitted in localised areas.
(2) Upper and lower values for each size are the respective maximum and minimum dimensions.

11. APPROXIMATE WEIGHTS OF FORGED FITTINGS

11(A). THREADED FITTINGS - KG PER UNIT

Nominal bore (in)	90° Elbow		45° Elbow		Tee		Cross		Coupling		Half Coupling		Cap		Square Head Plug		Hexagon Head Plug		Round Head Plug		Hexagon Head Bush		Union	
	3000	6000	3000	6000	3000	6000	3000	6000	3000	6000	3000	6000	3000	6000	3000	6000	3000	6000	3000	6000	3000	6000	3000	6000
1/8	0.14	0.30	0.12	0.41	0.20	0.42	0.21	0.51	0.04	0.06	0.02	0.03	0.04	0.06	0.01	0.01	0.02	0.02	0.03	0.03	-	-	0.14	0.20
¼	0.14	0.30	0.12	0.41	0.20	0.42	0.21	0.51	0.04	0.06	0.02	0.03	0.04	0.06	0.01	0.01	0.02	0.02	0.04	0.04	0.02	0.02	0.14	0.20
3/8	0.27	0.46	0.27	0.59	0.38	0.63	0.43	0.70	0.06	0.18	0.03	0.09	0.05	0.09	0.03	0.03	0.05	0.05	0.07	0.07	0.03	0.03	0.20	0.40
½	0.42	0.72	0.34	0.61	0.56	0.98	0.66	1.17	0.13	0.31	0.06	1.16	0.10	0.14	0.05	0.05	0.07	0.07	0.12	0.12	0.04	0.04	0.35	0.60
¾	0.65	1.16	0.54	1.02	0.84	1.65	1.05	1.91	0.19	0.41	0.09	0.21	0.18	0.20	0.08	0.08	0.18	0.18	0.19	0.19	0.07	0.07	0.43	0.80
1	1.04	1.62	0.72	1.38	1.36	2.19	1.69	2.56	0.39	0.85	0.20	0.43	0.33	0.34	0.16	0.16	0.25	0.25	0.34	0.34	0.10	0.10	0.65	0.90
1 ¼	1.30	2.67	0.97	2.07	1.65	3.32	1.99	4.35	0.68	1.05	0.34	0.53	0.60	0.60	0.27	0.27	0.45	0.45	0.55	0.55	0.20	0.20	0.98	1.35
1 ½	2.22	3.21	1.84	2.61	3.10	4.42	3.69	5.17	0.99	1.81	0.50	0.91	0.70	0.77	0.38	0.38	0.60	0.60	0.72	0.72	0.30	0.30	1.26	2.50
2	2.47	7.94	1.93	4.37	5.18	8.50	3.77	12.00	1.37	3.40	0.69	1.70	1.06	1.47	0.63	0.63	1.16	1.16	1.41	1.41	0.45	0.45	2.00	5.30
2 ½	7.34	9.85	3.46	7.00	8.80	13.10	9.50	16.50	2.07	4.19	1.04	2.10	1.84	2.10	0.95	0.95	1.75	1.75	2.20	2.20	0.54	0.54	4.50	7.00
3	7.78	18.00	5.45	14.16	9.50	24.00	13.00	28.00	3.08	6.10	1.54	3.05	1.65	2.50	1.54	1.54	2.50	2.50	3.26	3.26	1.17	1.17	7.00	12.00
4	13.28	-	9.50	14.16	17.20	24.00	19.00	-	5.44	10.03	2.73	5.03	4.57	6.30	3.85	3.85	6.00	6.00	6.00	6.00	3.15	3.15	12.00	-

12(B). SOCKET WELD FITTINGS - KG PER UNIT

Nominal bore (in)	90° Elbow		45° Elbow		Tee		Cross		Coupling		Half Coupling		Cap	
	3000LB	6000LB	3000LB	6000LB	3000LB	6000LB	3000LB	6000LB	3000LB	6000LB	3000LB	6000LB	3000LB	6000LB
1/8	0.12	-	0.09	-	0.12	-	0.18	-	0.05	-	0.02	0.05	0.01	-
¼	0.12	0.30	0.09	0.25	0.12	0.12	0.18	0.62	0.05	0.10	0.02	0.09	0.04	-
3/8	0.11	0.30	0.09	0.25	0.10	0.18	0.15	0.62	0.06	0.18	0.03	0.11	0.05	-
½	0.22	0.40	0.26	0.31	0.21	0.40	0.36	0.63	0.13	0.23	0.06	0.16	0.10	0.19
¾	0.31	0.62	0.35	0.52	0.31	0.62	0.45	1.04	0.18	0.32	0.09	0.32	0.16	0.27
1	0.47	1.02	0.38	0.92	0.47	1.02	0.76	1.71	0.26	0.64	0.13	0.36	0.22	0.53
1 ¼	0.67	1.32	0.61	1.02	0.67	1.32	1.09	2.11	0.48	0.72	0.24	0.58	0.41	0.64
1 ½	0.90	2.37	0.71	1.92	0.90	2.37	1.45	3.95	0.57	1.17	0.28	1.04	0.51	0.97
2	1.36	2.72	1.14	2.28	1.36	2.72	2.35	4.22	0.92	2.08	0.46	1.40	0.85	1.64
2 ½	2.80	5.80	3.36	4.04	2.80	5.80	4.50	11.80	1.40	2.80	0.70	1.61	1.25	2.23
3	4.40	8.40	4.70	5.80	4.40	8.40	7.80	13.20	1.80	3.23	0.90	3.11	1.95	3.45
4	13.30	15.80	9.00	10.65	13.30	16.50	21.50	26.00	3.23	6.22	-	-	3.36	6.04

12(C). OLETS - MSS SP95/97 - KG PER UNIT

NOMINAL BORE (IN)	ELBOLETS (THREADED AND SOCKET WELD)						THREADOLETS		SOCKOLETS		WELDOLETS			
	3000LB	6000LB	SCH 40	SCH 80	SCH 160	SCH XXS	3000LB	6000LB	3000LB	6000LB	STD	SCH XS	SCH 160	SCH XXS
1/8							0.05		0.05					
¼	0.23	0.34	0.23	0.23	0.34	0.34	0.05	0.14	0.05					
3/8	0.23	0.34	0.23	0.23	0.34	0.34	0.09	0.14	0.09					
½	0.30	0.39	0.30	0.30	0.39	0.39	0.11	0.20	0.14	0.23	0.07	0.07	0.11	0.11
¾	0.34	0.57	0.34	0.34	0.57	0.57	0.16	0.34	0.15	0.36	0.11	0.33	1.32	1.32
1	0.52	1.00	0.52	0.52	1.00	1.00	0.28	0.56	0.27	0.60	0.18	0.18	1.32	1.32
1¼	0.86	1.80	0.86	0.86	1.80	1.80	0.41	0.71	0.39	0.75	0.32	0.32	1.57	1.57
1½	1.20	2.80	1.20	1.20	2.80	2.86	0.45	0.89	0.47	0.90	0.36	0.41	1.79	1.79
2	2.40		2.40	2.40			0.79	2.30	0.73	2.30	0.68	0.73	1.97	1.97
2 ½							1.36		1.25		1.02	1.13	1.53	1.53
3							1.97		1.72		1.70	1.81	2.87	2.87
3 ½							2.61		1.95		2.30	2.30		
4							3.22		3.30		3.00	3.00	4.76	4.76
5							5.44		5.40		3.90	3.90	6.46	6.46
6							6.94		6.60		6.40	6.40	13.72	13.72
8											12.70	14.50		
10											17.70	20.90		
12											29.50	37.70		

12. PRESSURE TEMPERATURE RATINGS - SEAMLESS PIPE AND FITTINGS

12(A) FORMULA

1. SEAMLESS CARBON AND ALLOY STEEL PIPE AND FITTINGS

The maximum working pressures in the following tables have been calculated from the following formula, based on paragraph 304.1.2. Formula 3B of ASME B31.3--1993, Code for Pressure Piping:

$$P = \frac{2sE \times t}{D}$$

where:
P = the maximum working pressure;
S = the basic allowable stresses in tension for metals as shown in Table A-1 of ASME B31-3 1993 Edition;
E = a quality factor (which is 1 for seamless);
t = the thickness less the minus tolerance (taken as -12.5% for Seamless);
D = the outside diameter.

The calculations are based on the Imperial Dimensions and are rounded to the nearest whole number.
The resultant pounds per square inch (psi) are converted to Megapascals (MPa) by the formula:
1 PSI = .006895 MPa.
The results are rounded to 1 decimal place.

The following formula is used to convert degrees Fahrenheit (F) to degrees Celsius (C):
Degrees C = 5/9 (Degrees F -32).
The results are rounded to the nearest Degree C.

2. WELDING FITTINGS TO ASME/ANSI B16.9-

The allowable pressure ratings for fittings may be calculated as for straight seamless pipe of equivalent material (as shown by comparison of composition and mechanical properties in the respective material specifications) in accordance with the rules in ASME B31.3, Code for Pressure Piping (see following tables).

3. FORGED FITTINGS TO ASME/ANSI B16.11-

The schedule of pipe corresponding to each Class of fitting for rating purposes is shown in the table below.
Within the limits of the design temperatures and other service conditions provided by the material of construction of the fitting, the maximum allowable pressure of a fitting may be calculated as for straight seamless pipe of equivalent material (as shown by comparison of composition and mechanical properties in the respective material specifications).
The wall thickness used in the calculation shall be as shown in ANSI B36.10M for the size and applicable schedule of pipe reduced by applicable manufacturing tolerances and other allowances (e.g. threading allowances).

CORRELATION OF FITTINGS CLASS WITH SCHEDULE NO. OR WALL DESIGNATION OF PIPE FOR CALCULATION OF RATINGS

Class Designation of Fitting	Type of Fitting	Pipe Used for Rating	
		Schedule No.	Wall Designation
2000	Threaded/Socket-welding	80	XS
3000	Threaded/Socket-welding	100	-
6000	Threaded/Socket-welding	-	XXS

12(B). CARBON STEEL PIPE - API 5L, ASTM A53, ASTM A 106 Gr. B and ASTM A333 Gr. 6

			Temperature, Degrees - C	-29 to 204*		371		399		427		485		538		593	
			- F	-20 to 400*		700		750		800		900		1000		1100	
			Allowable Stress - MPa	137.9		113.8		89.6		74.5		44.8		17.2		6.9	
			- PSI	20000		16500		13000		10800		6500		2500		1000	
Nominal bore and OD (in)	Shedule Number	Wall Designation	Wall Thickness	Maximum Working Pressure - MPa and PSI													
				MPa	PSI	MPa	PSI	MPa	PSI	MPa	PSI	MPa	PSI	MPa	PSI	MPa	PSI
½	40	STD	0.109	31.3	4542	25.8	3747	20.4	2952	16.9	2453	10.2	1476	3.91	548	1.6	227
0.840	80	XS	0.147	42.2	6125	34.8	5053	27.5	3981	22.8	3308	13.7	1991	5.28	766	2.1	306
	160		0.188	54.0	7833	44.6	6463	35.1	5092	29.2	4230	7.6	2546	6.75	979	2.7	392
		XXS	0.294	84.5	12250	69.7	10106	54.9	7963	45.6	6615	27.5	3981	1056	1531	4.2	613
¾	40	STD	0.113	26.0	3767	21.4	3108	16.9	2448	14.0	2034	8.4	1224	3.25	471	1.3	188
1.050	80	XS	0.154	35.4	5133	29.2	4235	23.0	3337	19.1	2772	11.5	1668	4.42	642	1.8	257
	160		0.219	50.3	7300	41.5	6023	32.7	4745	27.2	3942	16.4	2373	6.29	913	2.5	365
		XXS	0.308	70.8	10267	58.4	8470	46.0	6673	38.2	5544	23.0	3337	8.85	1283	3.5	513
1	40	STD	0.133	24.4	3540	20.1	2920	15.9	2301	13.2	1912	7.9	1150	3.05	442	1.2	177
1.315	80	XS	0.179	32.8	4764	27.1	3931	21.4	3097	17.7	2573	10.7	1548	4.11	596	1.6	238
	160		0.250	45.9	6654	37.9	5490	29.8	4325	24.8	3593	14.9	2163	5.73	832	2.3	333
		XXS	0.358	65.7	9529	54.2	7861	42.7	6194	35.5	5145	21.4	3097	8.21	1191	3.3	476
1¼	40	STD	0.140	20.4	2952	16.8	2435	13.2	1919	11.0	1594	6.6	959	2.54	369	1.0	148
1.660	80	XS	0.191	27.8	4027	22.9	3322	18.0	2618	15.0	2175	9.0	1309	3.47	503	1.4	201
	160		0.250	36.3	5271	30.0	4349	23.6	3426	19.6	2846	11.8	1713	4.54	659	1.8	264
		XXS	0.382	55.5	8054	45.8	6645	36.1	5235	30.0	4349	18.0	2618	6.94	1007	2.8	403
1½	40	STD	0.145	18.4	2671	15.2	2204	12.0	1736	9.9	1442	6.0	868	2.30	334	0.9	134
1.900	80	XS	0.200	25.4	3684	21.0	3039	16.5	2395	13.7	1989	8.3	1197	3.18	461	1.3	184
	160		0.281	35.7	5176	29.4	4270	23.2	3365	19.3	2795	11.6	1682	4.46	647	1.8	259
		XXS	0.400	50.8	7368	41.9	6079	33.0	4789	27.4	3979	16.5	2395	6.35	921	2.5	368
2	40	STD	0.154	15.6	2269	12.9	1872	10.2	1475	8.4	1226	5.1	738	1.96	284	0.8	113
2.375	80	XS	0.218	22.2	3213	18.3	2650	14.4	2088	12.0	1735	7.2	1044	2.77	402	1.1	161
	160		0.344	35.0	5069	28.8	4182	22.7	3295	18.9	2738	11.4	1648	4.37	634	1.7	253
		XXS	0.436	44.3	6429	36.5	5301	28.8	4176	23.9	3470	14.4	2088	5.54	803	2.2	321
2½	40	STD	0.203	17.0	2471	14.1	2039	11.1	1606	9.2	1335	5.5	803	2.13	309	0.9	124
2.875	80	XS	0.276	23.3	3360	19.1	2772	15.1	2184	12.5	1814	7.5	1092	2.90	420	1.2	168
	160		0.375	31.5	4565	26.0	3766	20.5	2967	17.0	2465	10.2	1484	3.93	571	1.6	228
		XXS	0.552	46.3	6720	38.2	5544	30.1	4368	25.0	3629	15.1	2184	5.79	840	2.3	336
3	40	STD	0.216	14.9	2160	12.3	1782	9.7	1404	8.0	1166	4.8	702	1.86	270	0.7	108
3.50	80	XS	0.300	20.7	3000	17.1	2475	13.4	1950	11.2	1620	6.7	975	2.59	375	1.0	150
	160		0.438	30.2	4380	24.9	3614	19.6	2847	16.3	2365	9.8	1424	3.78	548	1.5	219
		XXS	0.600	41.4	6000	34.1	4950	26.9	3900	22.3	3240	13.4	1950	5.17	750	2.1	300
3½	40	STD	0.226	13.6	1978	11.2	1631	8.9	1285	7.4	1068	4.4	643	1.70	247	0.7	99
4.000	80	XS	0.318	19.2	2783	15.8	2296	12.5	1809	10.4	1503	6.2	904	2.40	348	1.0	139
4	40	STD	0.237	12.7	1843	10.5	1521	8.3	1198	6.9	995	4.1	599	1.59	230	0.6	92
4.500	80	XS	0.337	18.1	2621	14.9	2162	11.7	1704	9.8	1415	5.9	852	2.26	328	0.9	131
	120		0.438	23.5	3407	19.4	2811	15.3	2214	12.7	1840	7.6	1107	2.94	426	1.2	170
	160		0.531	28.5	4130	23.5	3407	18.5	2685	15.4	2230	9.3	1342	3.56	516	1.4	207
		XXS	0.674	36.1	5242	29.8	4325	23.5	3407	19.5	2831	11.7	1704	4.52	655	1.8	262
5	40	STD	0.258	11.2	1623	9.2	1339	7.3	1055	6.0	877	3.6	528	1.40	203	0.6	81
5.563	80	XS	0.375	16.3	2359	13.4	1946	10.6	1534	8.8	1274	5.3	767	2.03	295	0.8	118
	120		0.500	21.7	3146	19.9	2595	14.1	2045	11.7	1699	7.0	1022	2.71	393	1.1	157
	160		0.625	21.1	3932	22.4	3244	17.6	2556	14.6	2123	8.8	1278	3.39	492	1.4	197
		XXS	0.750	32.5	4719	26.8	3893	21.1	3067	17.6	2548	10.6	1534	4.07	590	1.6	236
6	40	STD	0.280	10.2	1479	8.4	1220	6.6	962	5.5	799	3.3	481	1.27	185	0.5	74
6.625	80	XS	0.432	15.7	2282	13.0	1883	10.2	1483	8.5	1232	5.1	742	1.97	285	0.8	114
	120		0.562	20.5	2969	16.9	2449	13.3	1980	11.1	1603	6.7	965	2.56	371	1.0	148
	160		0.719	26.2	3798	21.6	3134	17.0	2469	14.1	2051	8.5	1235	3.27	475	1.3	190
		XXS	0.864	31.5	4565	26.0	3766	20.5	2967	17.0	2465	10.2	1483	3.93	571	1.6	228
8	20		0.250	7.0	1014	5.8	837	4.5	659	3.8	548	2.3	330	0.87	127	0.3	51
8.625	30		0.277	7.8	1124	6.4	927	5.0	731	4.2	607	2.5	365	0.97	141	0.4	56
	40	STD	0.322	9.0	1307	7.4	1078	5.9	849	4.9	706	2.9	425	1.13	163	0.5	65
	60		0.406	11.4	1648	9.4	1359	7.4	1071	6.1	890	3.7	535	1.42	206	0.6	82
	80	XS	0.500	14.0	2029	11.5	1674	9.1	1319	7.6	1096	4.5	659	1.75	254	0.7	101
	100		0.594	16.6	2410	13.7	1989	10.8	1567	9.0	1302	5.4	783	2.08	301	0.8	121
	120		0.719	20.1	2918	16.6	2407	13.1	1896	10.9	1576	6.5	948	2.51	365	1.0	146
	140		0.812	22.7	3295	18.7	2718	14.8	2142	12.3	1779	7.4	1071	2.84	412	1.1	165
		XXS	0.875	24.5	3551	20.2	2929	15.9	2308	13.2	1917	8.0	1154	3.06	444	1.2	178
	160		0.906	25.3	3677	20.9	3033	16.5	2390	13.7	1985	8.2	1195	3.17	460	1.3	184
10	20		0.250	5.6	814	4.6	672	3.6	529	3.0	110	1.8	265	0.70	102	0.3	41
10.750	30		0.307	6.9	1000	5.7	825	4.5	650	3.7	540	2.2	325	0.86	125	0.3	50
	40	STD	0.365	8.2	1188	6.8	980	5.3	772	4.4	642	2.7	386	1.02	149	0.4	59
	60	XS	0.500	11.2	1628	9.3	1314	7.3	1058	6.1	879	3.6	529	1.40	203	0.6	81
	80		0.594	13.3	1934	11.0	1596	8.7	1257	7.2	1044	4.3	629	1.67	242	0.7	97
	100		0.719	16.1	2341	13.3	1931	10.5	1522	8.7	1264	5.2	761	2.02	293	0.8	117
	120		0.844	18.9	2748	15.6	2267	12.3	1786	10.2	1484	6.2	893	2.37	343	0.9	137
	140	XXS	1.000	22.4	3256	18.5	2686	14.6	2116	12.1	1758	7.3	1058	2.81	407	1.1	163
	160		1.125	25.3	3663	20.8	3022	16.4	2381	13.6	1978	8.2	1190	3.16	458	1.3	183

*Minimum temperature for ASTM A333 Grade 6 is -50°F (-46°C)

12(B). CARBON STEEL PIPE - API 5L, ASTM A53, ASTM A 106 Gr. B and ASTM A333 Gr. 6 - CONTINUED

			Temperature, Degrees - C	-29 to 204*	371	399	427	485	538	593
			- F	-20 to 400*	700	750	800	900	1000	1100
			Allowable Stress - MPa	137.9	113.8	89.6	74.5	44.8	17.2	6.9
			- PSI	20000	16500	13000	10800	6500	2500	1000

Nominal bore and OD (in)	Shedule Number	Wall Designation	Wall Thickness	Maximum Working Pressure - MPa and PSI													
				MPa	PSI	MPa	PSI	MPa	PSI	MPa	PSI	MPa	PSI	MPa	PSI	MPa	PSI
12	20		0.250	4.7	686	3.9	566	3.1	446	2.6	371	1.5	223	0.59	86	0.2	34
12.750	30		0.330	6.2	906	5.2	747	4.1	589	3.4	489	2.0	294	0.78	113	0.3	45
		STD	0.375	7.1	1029	5.9	849	4.6	669	3.8	556	2.3	335	0.89	129	0.4	51
	40		0.406	7.7	1115	6.3	919	5.0	724	4.1	602	2.5	362	0.96	139	0.4	56
		XS	0.500	9.5	1373	7.8	1132	6.2	892	5.1	741	3.1	446	1.18	172	0.5	69
	60		0.562	10.6	1543	8.8	1273	6.9	1003	5.7	833	3.5	501	1.33	193	0.5	77
	80		0.688	13.0	1889	10.7	1558	8.5	1228	7.0	1020	4.2	614	1.63	236	0.7	94
	100		0.844	16.0	2317	13.2	1911	10.4	1506	8.6	1251	5.2	753	2.00	290	0.8	116
	120	XXS	1.000	18.9	2745	15.6	2265	12.3	1784	10.2	1482	6.2	892	2.37	343	0.9	137
	140		1.125	21.3	3088	17.6	2548	13.8	2007	11.5	1668	6.9	1004	2.66	386	1.1	154
	160		1.312	24.8	3602	20.5	2971	16.1	2341	13.4	1945	8.1	1171	3.10	450	1.2	180
14	10		0.250	4.3	625	3.6	516	2.8	406	2.3	338	1.4	203	0.54	78	0.2	31
14.00	20		0.312	5.4	780	4.4	644	3.5	507	2.9	421	1.7	254	0.67	98	0.3	39
	30	STD	0.375	6.5	938	5.3	773	4.2	509	3.5	506	2.1	305	0.81	117	0.3	47
	40		0.438	7.6	1095	6.2	903	4.9	712	4.1	591	2.5	356	0.94	137	0.4	55
		XS	0.500	8.6	1250	7.1	1031	5.6	813	4.7	675	2.8	406	1.08	156	0.4	63
	60		0.594	10.2	1485	8.4	1225	6.7	965	5.5	802	3.3	483	1.28	186	0.5	74
	80		0.750	12.9	1875	10.7	1547	8.4	1219	7.0	1013	4.2	609	1.62	234	0.6	94
	100		0.938	16.2	2345	13.3	1935	10.5	1524	8.7	1266	5.3	762	2.02	293	0.8	117
	120		1.094	18.9	2735	15.6	2256	12.3	1778	10.2	1477	6.1	889	2.36	342	0.9	137
	140		1.250	21.5	3125	17.8	2578	14.0	2031	11.6	1688	7.0	1016	2.69	391	1.1	156
	160		1.406	24.2	3515	20.0	2900	15.8	2285	13.1	1898	7.9	1142	3.03	439	1.2	176
16	10		0.250	3.8	547	3.1	451	2.5	355	2.0	295	1.2	178	0.47	68	0.2	27
16.000	20		0.312	4.7	683	3.9	563	3.1	444	2.5	369	1.5	222	0.59	85	0.2	34
	30	STD	0.375	5.7	820	4.7	677	3.7	533	3.1	443	1.8	267	0.71	103	0.3	41
	40	XS	0.500	7.5	1094	6.2	902	4.9	711	4.1	591	2.5	355	0.94	137	0.4	55
	60		0.656	9.9	1435	8.2	1184	6.4	933	5.3	775	3.2	466	1.24	179	0.5	72
	80		0.844	12.7	1846	10.5	1523	8.3	1200	6.9	997	4.1	600	1.59	231	0.6	92
	100		1.031	15.6	2255	12.8	1861	10.1	1466	8.4	1218	5.1	733	1.94	282	0.8	113
	120		1.219	18.4	2667	15.2	2200	12.0	1733	9.9	1440	6.0	867	2.30	333	0.9	133
	140		1.438	21.7	3146	17.9	2595	14.1	2045	11.7	1699	7.0	1022	2.71	393	1.1	157
	160		1.594	24.0	3487	19.8	2877	15.6	2266	13.0	1883	7.8	1133	3.01	436	1.2	174
18	10		0.250	3.4	486	2.8	401	2.2	316	1.8	263	1.1	158	0.42	61	0.2	24
18.000	20		0.312	4.2	607	3.5	501	2.7	394	2.3	328	1.4	197	0.52	76	0.2	30
		STD	0.375	5.0	729	4.1	602	3.3	474	2.7	394	1.6	237	0.63	91	0.3	36
	30		0.438	5.9	852	4.8	703	3.8	554	3.2	460	1.9	277	0.73	106	0.3	43
		XS	0.500	6.7	972	5.5	802	4.4	632	3.6	525	2.2	316	0.84	122	0.3	49
	40		0.562	7.5	1093	6.2	902	4.9	710	4.1	590	2.4	355	0.94	137	0.4	55
	60		0.750	10.1	1458	8.3	1203	6.5	948	5.4	788	3.3	474	1.26	182	0.5	73
	80		0.938	12.6	1824	10.4	1505	8.2	1186	6.8	985	4.1	593	1.57	228	0.6	91
	100		1.156	15.5	2248	12.8	1854	10.1	1461	8.4	1214	5.0	731	1.94	281	0.8	112
	120		1.375	18.4	2674	15.2	2206	12.0	1738	10.0	1444	6.0	869	2.30	334	0.9	134
	140		1.562	20.9	3037	17.3	2506	13.6	1974	11.3	1640	6.8	987	2.62	380	1.0	152
	160		1.781	2.9	3463	19.7	2857	15.5	2251	12.9	1870	7.8	1125	2.98	433	1.2	173
20	10		0.250	3.0	438	2.5	361	2.0	284	1.6	236	1.0	142	0.38	55	0.2	22
20.00	20	STD	0.375	4.5	656	3.7	541	2.9	427	2.4	354	1.5	213	0.57	82	0.2	33
	30	XS	0.500	6.0	875	5.0	722	3.9	569	3.3	473	2.0	284	0.75	106	0.3	44
	40		0.594	7.2	1040	5.9	858	4.7	676	3.9	561	2.3	338	0.90	130	0.4	52
	60		0.812	9.8	1421	8.1	1172	6.4	924	5.3	767	3.2	462	1.22	178	0.5	71
	80		1.031	12.4	1084	10.3	1489	8.1	1173	6.7	974	4.0	586	1.56	226	0.6	90
	100		1.281	15.5	2242	12.8	1849	10.0	1457	8.3	1211	5.0	729	1.93	280	0.8	112
	120		1.500	18.1	2625	14.9	2166	11.8	1706	9.8	1418	5.9	853	2.26	328	0.9	131
	140		1.750	21.1	3063	17.4	2527	13.7	1991	11.4	1654	6.9	995	2.64	383	1.1	153
	160		1.969	23.8	3446	19.6	2843	15.4	2240	12.8	1861	7.7	1120	2.97	431	1.2	172
24	10		0.250	2.5	365	2.1	301	1.6	237	1.4	197	0.8	118	0.37	46	0.1	18
24.000	20	STD	0.375	3.8	547	3.1	451	2.5	355	2.0	295	1.2	178	0.47	68	0.2	27
		XS	0.500	5.0	729	4.1	602	3.3	474	2.7	394	1.6	237	0.63	91	0.3	36
	30		0.562	5.7	820	4.7	676	3.7	533	3.1	443	1.8	266	0.71	102	0.3	41
	40		0.688	6.9	1003	5.7	828	4.5	652	3.7	542	2.2	326	0.86	125	0.3	50
	60		0.969	9.7	1413	8.0	1166	6.3	919	5.3	763	3.2	459	1.22	177	0.5	71
	80		1.219	12.3	1778	10.1	1467	8.0	1156	6.6	960	4.0	578	1.53	222	0.6	89
	100		1.531	15.4	2233	12.7	1842	10.0	1451	8.3	1206	5.0	726	1.92	279	0.8	112
	120		1.812	18.2	2643	15.0	2180	11.8	1718	9.8	1427	5.9	859	2.28	330	0.9	132
	140		2.062	20.7	3007	17.1	2481	13.5	1955	11.2	1624	6.7	977	2.59	376	1.0	150
	160		2.344	23.6	3418	19.4	2820	15.3	2222	12.7	1846	7.7	1111	2.95	427	1.2	171

*Minimum temperature for ASTM A333 Grade 6 is -50°F (-46°C)

12(C). ALLOY PIPE - ASTM A335 P5

			Temperature, Degrees - C	-29 to 38		204		427		482		510		538		593	
			- F	-20 to 100		400		800		900		950		1000		1000	
			Allowable Stress - MPa	137.9		118.6		88.3		75.2		55.2		40.0		20.0	
			- PSI	20000		17200		12800		10900		8000		5800		2900	
Nominal bore and OD (in)	Shedule Number	Wall Designation	Wall Thickness	Maximum Working Pressure - MPa and PSI													
				MPa	PSI	MPa	PSI	MPa	PSI	MPa	PSI	MPa	PSI	MPa	PSI	MPa	PSI
½	40	STD	0.109	31.3	2542	26.9	3906	20.0	2907	17.1	2475	12.5	1817	9.1	1317	4.5	659
0.840	80	XS	0.147	42..2	6125	36.3	5268	27.0	3920	23.0	3338	16.9	2450	12.2	1776	6.1	888
	160		0.188	54.0	7833	46.4	6737	34.6	5013	29.4	4269	21.6	3133	15.7	2272	7.8	1136
		XXS	0.294	84.5	12250	72.6	10535	54.1	7840	46.0	6676	33.8	4900	24.5	3553	12.2	1776
¾	40	STD	0.113	26.0	3767	22.3	3239	16.6	2411	14.2	2053	10.4	1507	7.5	1092	3.8	546
1.050	80	XS	0.154	34.4	5133	30.4	4415	22.7	3285	19.3	2798	14.2	2053	10.3	1489	5.1	744
	160		0.219	50.3	7300	43.3	6278	32.2	4672	27.4	3979	20.1	2920	14.6	2117	7.3	1059
		XXS	0.308	70.8	10267	60.9	8829	45.3	6571	38.6	5595	28.3	4107	20.5	2977	10.3	1489
1	40	STD	0.133	24.4	3540	21.0	3044	15.6	2266	13.3	1929	9.8	1416	7.1	1027	3.5	513
1.315	80	XS	0.179	32.8	4764	28.3	4097	21.0	3049	17.9	2597	13.1	1906	9.5	1382	4.8	691
	160		0.250	45.9	6654	39.5	5722	29.4	4259	25.0	3626	18.4	2662	13.3	1930	6.7	965
		XXS	0.358	65.7	9529	56.5	8195	42.0	6098	35.8	5193	26.3	3811	19.1	2763	9.5	1382
1¼	40	STD	0.140	20.4	2952	17.5	2539	13.0	1889	11.1	1609	8.1	1181	5.9	856	3.0	428
1.660	80	XS	0.191	27.8	4027	23.9	3463	17.8	2577	15.1	2195	11.1	1611	8.1	1168	4.0	584
	160		0.250	36.3	5271	31.3	3466	23.3	3373	19.8	2873	14.5	2108	10.5	1529	5.3	764
		XXS	0.382	55.5	8054	47.8	6927	35.5	5155	30.3	4390	22.2	3222	16.1	2336	8.1	1168
1½	40	STD	0.145	18.4	2671	15.8	2297	11.8	1709	10.0	1456	7.4	1068	5.3	775	2.7	387
1.900	80	XS	0.200	25.4	3684	21.8	3168	16.3	2358	13.8	2008	10.2	1474	7.4	1068	3.7	534
	160		0.281	35.7	5176	30.7	4452	22.8	3313	19.5	2821	14.3	2071	10.4	1501	5.2	751
		XXS	0.400	50.8	7368	43.7	6337	32.5	4716	27.7	4016	20.3	2947	14.7	2137	7.4	1068
2	40	STD	0.154	15.6	2269	13.5	1952	10.0	1452	8.5	1237	6.3	908	4.5	658	2.3	329
2.375	80	XS	0.218	22.2	3213	19.0	2763	14.2	2056	12.1	1751	8.9	1285	6.4	932	3.2	466
	160		0.344	35.0	5069	30.1	4360	22.4	3244	19.0	2763	14.0	2028	10.1	1470	5.1	735
		XXS	0.436	44.3	6425	38.1	5526	28.4	4112	24.1	3502	17.7	2570	12.8	1863	6.4	932
2½	40	STD	0.203	17.0	2471	14.7	2125	10.9	1582	9.3	1347	6.8	989	4.9	717	2.5	358
2.875	80	XS	0.276	23.2	3360	19.9	2890	14.8	2150	12.6	1831	9.3	1344	6.7	974	3.4	487
	160		0.375	31.5	4565	27.1	3926	20.1	2922	17.2	2488	12.6	1826	9.1	1324	4.6	662
		XXS	0.552	46.3	6720	39.8	5779	29.7	4301	25.3	3662	18.5	2688	13.4	1949	6.7	974
3	40	STD	0.216	14.9	2160	12.8	1858	9.5	1382	8.1	1177	6.0	864	4.3	626	2.2	313
3.50	80	XS	0.300	20.7	3000	17.8	2580	13.2	1920	11.3	1635	8.3	1200	6.0	870	3.0	435
	160		0.438	30.2	4380	26.0	3767	19.3	2803	16.5	2387	12.1	1752	8.8	1270	4.4	635
		XXS	0.600	41.4	6000	35.6	5160	26.5	3840	22.5	3270	16.5	2400	12.0	1740	6.0	870
3½	40	STD	0.226	13.6	1978	11.7	1701	8.7	1266	7.4	1078	5.5	791	4.0	573	2.0	287
4.000	80	XS	0.318	19.2	2783	16.5	2393	12.3	1781	10.5	1516	7.7	1113	5.96	807	2.8	403
4	40	STD	0.237	12.7	1843	10.9	1585	8.1	1180	6.9	1005	5.1	737	3.7	535	1.8	267
4.500	80	XS	0.337	18.1	2621	15.5	2254	11.6	1678	9.8	1429	7.2	1048	5.2	760	2.6	380
	120		0.438	23.5	3407	20.2	2930	15.0	2180	12.8	1857	9.4	1363	6.8	988	3.4	494
	160		0.531	28.5	4130	24.5	3552	18.2	2643	15.5	2251	11.4	1652	8.3	1198	4.1	599
		XXS	0.674	36.1	5242	31.1	4508	23.1	3355	19.7	2857	14.5	2097	10.5	1520	5.2	760
5	40	STD	0.258	11.2	1623	9.6	1396	7.2	1039	6.1	885	4.5	649	3.2	471	1.6	235
5.563	80	XS	0.375	16.3	2359	14.0	2029	10.4	1510	8.9	1286	6.5	944	4.7	684	2.4	342
	120		0.500	21.7	3146	18.7	2705	13.9	2013	11.8	1714	8.7	1258	6.3	912	3.1	456
	160		0.625	271	3932	23.3	3382	17.4	2517	14.8	2143	10.8	1573	7.9	1140	3.9	570
		XXS	0.750	32.5	4719	28.0	4058	20.8	3020	17.7	2572	13.0	1887	9.4	1368	4.7	684
6	40	STD	0.280	10.2	1479	8.8	1272	6.5	947	5.6	806	4.1	592	3.0	429	1.5	214
6.625	80	XS	0.432	15.7	2282	13.5	1963	10.1	1461	8.6	1244	6.3	913	5.6	662	2.3	331
	120		0.562	20.5	2969	17.6	2553	13.1	1900	11.2	1618	8.2	118	5.9	861	3.0	431
	160		0.719	26.2	3798	22.5	3267	16.8	2431	14.3	2070	10.5	1519	7.6	1102	3.8	551
		XXS	0.864	31.5	4565	27.1	3925	20.1	2921	17.2	2488	12.6	1826	9.1	1324	4.6	662
8	20		0.250	7.0	1014	6.0	872	4.5	649	3.8	553	2.8	406	2.0	294	1.0	147
8.625	30		0.277	7.8	1124	6.7	967	5.0	719	4.2	613	3.1	450	2.2	326	1.1	163
	40	STD	0.322	9.0	1307	7.7	1224	5.8	836	4.9	712	3.6	523	2.6	379	1.3	189
	60		0.406	11.4	1648	9.8	1417	7.3	1054	6.2	898	4.5	659	3.3	478	1.6	239
	80	XS	0.500	14.0	2029	12.0	1745	9.0	1299	7.6	1106	5.6	812	4.1	588	2.0	294
	100		0.594	16.6	2410	14.3	2073	10.6	1543	9.1	1314	6.6	964	4.8	699	2.4	350
	120		0.719	20.1	2918	17.3	2509	12.9	1867	11.0	1590	8.0	1167	5.8	846	2.9	423
	140		0.812	22.7	3295	19.5	2834	14.5	2109	12.4	1796	9.1	1318	6.6	956	3.3	478
		XXS	0.875	24.5	3551	21.1	3054	15.7	2272	13.3	1935	9.8	1420	7.1	1030	3.5	515
	160		0.906	25.3	3677	21.8	3162	16.2	2353	13.8	2004	10.1	1471	7.4	1066	3.7	533
10	20		0.250	5.6	814	4.8	700	3.6	521	3.1	444	2.2	326	1.6	236	0.8	118
10.750	30		0.307	6.9	1000	5.9	860	4.4	640	3.8	545	2.8	400	2.0	290	1.0	145
	40	STD	0.365	8.2	1188	7.0	1022	5.2	761	4.5	648	3.3	475	2.4	345	1.2	172
	60	XS	0.500	11.2	1628	9.7	1400	7.2	1042	6.1	887	4.5	651	3.3	472	1.6	236
	80		0.594	13.3	1934	11.5	1663	8.5	1238	7.3	1054	5.3	774	3.9	561	1.9	280
	100		0.719	16.1	2341	13.9	2013	10.3	1498	8.8	1276	6.5	936	4.7	679	2.3	339
	120		0.844	18.9	2748	16.3	2363	12.1	1759	10.3	1498	7.6	1099	5.5	797	2.7	398
	140	XXS	1.000	22.4	3256	19.3	2800	14.4	2084	12.2	1774	9.0	1302	6.5	944	3.3	472
	160		1.125	25.3	3663	21.7	3150	16.2	2344	13.8	1996	10.1	1465	7.3	1062	3.7	531

12(C). ALLOY PIPE - ASTM A335 P5 - CONTINUED

			Temperature, Degrees - C	-29 to 38	204	427	482	510	538	593
			- F	-20 to 100	400	800	900	950	1000	1000
			Allowable Stress - MPa	137.9	118.6	88.3	75.2	55.2	40.0	20.0
			- PSI	20000	17200	12800	10900	8000	5800	2900

Nominal bore and OD (in)	Shedule Number	Wall Designation	Wall Thickness	Maximum Working Pressure - MPa and PSI											
				MPa	PSI	MPa	PSI	MPa	PSI	MPa	PSI	MPa	PSI	MPa	PSI	MPa	PSI
12	20		0.250	4.7	686	4.1	590	3.0	439	2.6	374	1.9	275	1.4	199	0.7	100
12.750	30		0.330	6.2	906	5.4	779	4.0	580	3.4	494	2.5	362	1.8	263	0.9	131
		STD	0.375	7.1	1029	6.1	885	4.5	659	3.9	561	2.8	412	2.1	299	1.0	149
	40		0.406	7.7	1115	6.6	958	4.9	713	4.2	607	3.1	446	2.2	323	1.1	162
		XS	0.500	9.5	1373	8.1	1180	6.1	873	5.2	748	3.8	549	2.7	398	1.4	199
	60		0.562	10.6	1543	9.1	1327	6.8	987	5.8	841	4.3	617	3.1	447	1.5	224
	80		0.688	13.0	1889	11.2	1624	8.3	1209	7.1	1029	5.2	755	3.8	548	1.9	274
	100		0.844	16.0	2317	13.7	1993	10.2	1483	8.7	1263	6.4	927	4.6	672	2.3	336
	120	XXS	1.000	18.9	2745	16.3	2361	12.1	1757	10.3	1496	7.6	1098	5.5	769	2.7	398
	140		1.125	21.3	3088	18.3	2656	13.6	1976	11.6	1683	8.5	1235	6.2	896	3.1	448
	160		1.312	24.8	3602	21.4	3097	15.9	2305	13.5	1963	9.9	1441	7.2	1044	3.6	522
14	10		0.250	4.3	625	3.7	538	2.8	400	2.3	341	1.7	250	1.2	181	0.6	91
14.00	20		0.312	5.4	780	4.6	671	3.4	499	2.9	425	2.2	312	1.6	226	0.8	113
	30	STD	0.375	6.5	938	5.6	806	4.1	600	3.5	411	2.6	375	1.9	272	0.9	136
	40		0.438	7.6	1095	6.5	942	4.8	701	4.1	597	3.0	438	2.2	318	1.1	159
		XS	0.500	8.6	1250	7.4	1075	5.5	800	4.7	681	3.4	500	2.5	363	1.2	181
	60		0.594	10.2	1485	8.8	1277	6.6	950	5.6	809	4.1	594	3.0	431	1.5	215
	80		0.750	12.9	1875	11.1	1613	8.3	1200	7.0	1022	5.2	750	3.7	544	1.9	272
	100		0.938	16.2	2345	13.9	2017	10.3	1501	8.8	1278	6.5	938	4.7	680	2.3	340
	120		1.094	18.9	2735	16.2	2352	12.1	1750	10.3	1491	7.5	1094	5.5	793	2.7	397
	140		1.250	21.5	3125	18.5	2688	13.8	2000	11.7	1703	8.6	1250	6.2	906	3.1	453
	160		1.406	24.2	3515	20.8	3023	15.5	2250	13.2	1916	9.7	1406	7.0	1019	3.5	510
16	10		0.250	3.8	547	3.2	407	2.4	350	2.1	298	1.5	219	1.1	159	0.5	79
16.000	20		0.312	4.7	683	4.0	587	3.0	437	2.6	372	1.9	273	1.4	198	0.7	99
	30	STD	0.375	5.7	820	4.9	705	3.6	525	3.1	447	2.3	328	1.6	238	0.8	119
	40	XS	0.500	7.5	1094	6.5	941	4.8	700	4.1	596	3.0	438	2.2	317	1.1	159
	60		0.656	9.9	1435	8.5	1234	6.3	918	5.4	782	4.0	574	2.9	416	1.4	208
	80		0.844	12.7	1846	10.9	1588	8.1	1182	6.9	1006	5.1	739	3.7	535	1.8	268
	100		1.031	15.6	2255	13.4	1940	10.0	1443	8.5	1229	6.2	902	4.5	654	2.3	327
	120		1.219	18.4	2667	15.8	2293	11.8	1707	10.0	1453	7.4	1067	5.3	773	2.7	387
	140		1.438	21.7	3146	18.7	2705	13.9	2013	11.8	1714	8.7	1258	6.3	912	3.1	456
	160		1.594	24.0	3487	20.7	2999	15.4	2232	13.1	1900	9.6	1395	7.0	1011	3.5	506
18	10		0.250	3.4	486	2.9	418	2.1	311	1.8	265	1.3	194	1.0	141	0.5	70
18.000	20		0.312	4.2	607	3.6	522	2.7	388	2.3	331	1.7	243	1.2	176	0.6	88
		STD	0.375	5.0	729	4.3	627	3.2	467	2.7	397	2.0	292	1.5	211	0.7	106
	30		0.438	5.9	852	5.1	732	3.8	545	3.2	464	2.3	341	1.7	247	0.9	123
		XS	0.500	6.7	972	5.8	836	4.3	622	3.7	530	2.7	389	1.9	282	1.0	141
	40		0.562	7.5	1093	6.5	940	4.8	699	4.1	596	3.0	437	2.2	317	1.1	158
	60		0.750	10.1	1458	8.6	1254	6.4	933	5.5	795	4.0	583	2.9	423	1.5	211
	80		0.938	12.6	1824	10.8	1569	8.0	1167	6.9	994	5.0	730	3.6	529	1.8	264
	100		1.156	15.5	2248	13.3	1933	9.9	1439	8.4	1225	6.2	899	4.5	652	2.2	326
	120		1.375	18.4	2674	15.9	2299	11.8	1711	10.0	1457	7.4	1069	5.3	775	2.7	388
	140		1.562	20.9	3037	18.0	2612	13.4	1944	11.4	1655	8.4	1215	6.1	881	3.0	440
	160		1.781	23.9	3463	20.5	2978	15.3	2216	13.0	1887	9.6	1385	6.9	1004	3.5	502
20	10		0.250	3.0	438	2.6	376	1.9	280	1.6	238	1.2	175	0.9	127	0.4	63
20.00	20	STD	0.375	4.5	656	3.9	564	2.9	420	2.5	358	1.8	263	1.3	190	0.7	95
	30	XS	0.500	6.0	875	5.2	753	3.9	560	3.3	477	2.4	350	1.7	254	0.9	127
	40		0.594	7.2	1040	6.2	894	4.6	665	3.9	567	2.9	416	2.1	301	1.0	151
	60		0.812	9.8	1421	8.4	1222	6.3	909	5.3	774	3.9	568	2.8	412	1.4	206
	80		1.031	12.4	1804	10.8	1552	8.0	1155	6.8	983	5.0	722	3.6	523	1.8	262
	100		1.281	15.5	2242	13.3	1928	9.9	1435	8.4	1222	6.2	897	4.5	650	2.2	325
	120		1.500	18.1	2625	15.6	2258	11.6	1680	9.9	1431	7.2	1050	5.2	761	2.6	381
	140		1.750	21.1	3063	18.2	2634	13.5	1960	11.5	1669	8.4	1225	6.1	888	3.1	444
	160		1.969	23.6	3446	20.4	2963	15.2	2205	12.9	1878	9.5	1378	6.9	999	3.4	500
24	10		0.250	2.5	365	2.2	314	1.6	233	1.4	199	1..0	146	0.7	106	0.4	53
24.000	20	STD	0.375	3.8	547	3.2	470	2.4	350	2.1	198	1.5	219	1.1	159	0.5	79
		XS	0.500	5.0	729	4.3	627	3.2	467	2.7	397	2.0	292	1.5	211	0.7	106
	30		0.562	5.7	820	4.9	705	3.6	525	3.1	447	2.3	328	1.6	238	0.8	119
	40		0.688	6.9	1003	5.9	863	4.4	642	3.8	547	2.8	401	2.0	291	1.0	145
	60		0.969	9.7	1413	8.4	1215	6.2	904	5.3	770	3.9	565	2.8	410	1.4	205
	80		1.219	12.3	1778	10.5	1529	7.8	1138	6.7	969	4.9	711	3.6	516	1.8	258
	100		1.531	15.4	2233	13.2	1920	9.9	1429	8.4	1217	6.2	893	4.5	647	2.2	324
	120		1.812	18.2	2643	15.7	2273	11.7	1691	9.9	1440	7.3	1057	5.3	766	2.6	383
	140		2.062	20.7	3007	17.8	2586	13.3	1925	11.3	1639	8.3	1203	6.0	872	3.0	436
	160		2.344	23.6	3418	20.3	2940	15.1	2188	12.8	1863	9.4	1367	6.8	991	3.4	496

12(D). ALLOY PIPE - ASTM A335 P11

			Temperature, Degrees - C	-29 to 38		204		427		482		510		538		593	
			- F	-20 to 100		400		800		900		950		1000		1000	
			Allowable Stress - MPa	137.9		120.7		103.4		88.3		64.1		43.4		19.3	
			- PSI	20000		17500		15000		12800		9300		6300		2800	
Nominal bore and OD (in)	Shedule Number	Wall Designation	Wall Thickness	Maximum Working Pressure - MPa and PSI													
				MPa	PSI	MPa	PSI	MPa	PSI	MPa	PSI	MPa	PSI	MPa	PSI	MPa	PSI
½	40	STD	0.109	31.3	4542	27.4	3974	23.5	3406	20.0	2907	14.6	2112	9.9	1431	4.4	636
0.840	80	XS	0.147	42.2	6125	37.0	5359	31.7	4594	27.0	3920	19.6	2848	13.3	1929	5.9	858
	160		0.188	54.0	7833	47.3	6854	40.5	5875	34.6	5013	25.1	3643	17.0	2468	7.6	1097
		XXS	0.294	84.5	12250	73.9	10729	63.3	9188	54.1	7840	39.3	5696	26.6	3859	11.8	1715
¾	40	STD	0.113	26.0	3767	22.7	3296	19.5	2825	16.6	2411	12.1	1752	8.2	1187	3.6	527
1.050	80	XS	0.154	35.4	5133	31.0	4492	26.5	3850	22.7	3285	16.5	2387	11.1	1617	5.0	719
	160		0.219	50.3	7300	44.0	6388	37.8	5475	32.2	4672	23.4	3395	15.9	2300	7.0	1022
		XXS	0.308	70.8	10267	61.9	8983	53.1	7700	45.3	6571	32.9	4774	22.3	3234	9.9	1437
1	40	STD	0.133	24.4	3540	21.4	3097	18.3	2655	15.6	2266	11.3	1646	7.7	1115	3.4	496
1.315	80	XS	0.179	32.8	4764	28.7	4169	24.6	3573	21.0	3049	15.3	2215	10.3	1501	4.6	667
	160		0.250	45.9	6654	40.1	5822	34.4	4990	29.4	4259	21.3	3094	14.5	2096	6.4	932
		XXS	0.358	65.7	9529	57.5	8337	49.3	7146	42.0	6098	30.6	4431	20.7	3001	9.2	1334
1¼	40	STD	0.140	20.4	2952	17.8	2583	15.3	2214	13.0	1889	9.5	1373	6.4	930	2.8	413
1.660	80	XS	0.191	27.8	4027	24.3	3524	20.8	3020	17.8	2577	12.9	1873	8.7	1269	3.9	564
	160		0.250	36.3	5271	31.8	4612	27.3	3953	23.3	3373	16.9	2451	11.4	1660	5.1	738
		XXS	0.382	55.5	8054	48.6	7047	41.7	6041	35.5	5155	25.8	3745	17.5	2537	7.8	1128
1½	40	STD	0.145	18.4	2671	16.1	2337	13.8	2003	11.8	1709	8.6	1242	5.8	841	2.6	374
1.900	80	XS	0.200	25.4	3684	22.2	3224	19.1	2763	16.3	2358	11.8	1713	8.0	1161	3.6	516
	160		0.281	35.7	5176	31.2	4529	26.8	3882	22.8	3313	16.6	2407	11.2	1631	5.0	725
		XXS	0.400	50.8	7368	44.5	6447	38.1	5526	32.5	4716	23.6	3426	16.0	2321	7.1	1032
2	40	STD	0.154	15.6	2269	13.7	1986	11.7	1702	10.0	1452	7.3	1055	4.9	715	2.2	318
2.375	80	XS	0.218	22.2	3213	19.4	2811	16.6	2409	14.2	2056	10.3	1949	7.0	1012	3.1	450
	160		0.344	35.0	5069	30.6	4436	26.2	3802	22.4	3244	16.3	2357	11.0	1597	4.9	710
		XXS	0.436	44.3	6425	38.8	5622	33.2	4819	28.4	4112	20.6	2988	14.0	2024	6.2	900
2½	40	STD	0.203	17.0	2471	14.9	2162	12.8	1853	10.9	1582	7.9	1149	5.4	778	2.4	346
2.875	80	XS	0.276	23.2	3360	20.3	2940	17.4	2520	14.8	2150	10.8	1562	7.3	1058	3.2	470
	160		0.375	31.5	4565	27.5	3995	23.6	3424	20.1	2922	14.6	2123	9.9	1438	4.4	639
		XXS	0.552	46.3	6720	40.5	5880	34.8	5040	29.7	4301	21.5	3125	14.6	2117	6.5	941
3	40	STD	0.216	14.9	2160	13.0	1890	11.2	1620	9.5	1382	6.9	1004	4.7	680	2.1	302
3.50	80	XS	0.300	20.7	3000	18.1	2625	15.5	2250	13.2	1920	9.6	1395	6.5	945	2.9	420
	160		0.438	30.2	4380	26.4	3833	22.7	3285	19.3	2803	14.0	2037	9.5	1380	4.2	613
		XXS	0.600	41.4	6000	36.2	5250	31.0	4500	26.5	3840	19.2	2790	13.0	1890	5.8	840
3½	40	STD	0.226	13.6	1978	11.9	1730	10.2	1483	8.7	1266	6.3	920	4.3	623	1.9	277
4.000	80	XS	0.318	19.2	2783	16.8	2435	14.4	2087	12.3	1781	8.9	1294	6.0	876	2.7	390
4	40	STD	0.237	12.7	1843	11.1	1613	9.5	1383	8.1	1180	5.9	857	4.0	581	1.8	258
4.500	80	XS	0.337	18.1	2621	15.8	2293	13.6	1966	11.6	1678	8.4	1219	5.7	826	2.5	367
	120		0.438	23.5	3407	20.6	2981	17.6	2555	15.0	2180	10.9	1584	7.4	1073	3.3	477
	160		0.531	28.5	4130	24.9	3614	21.4	3098	18.2	2643	13.2	1920	9.0	1301	4.0	578
		XXS	0.674	36.1	5242	31.6	4587	27.1	3932	23.1	3355	16.8	2438	11.4	1651	5.1	734
5	40	STD	0.258	11.2	1623	9.8	1420	8.4	1217	7.2	1039	5.2	755	3.5	511	1.6	227
5.563	80	XS	0.375	16.3	2359	14.2	2064	12.2	1770	10.4	1510	7.6	1097	5.1	743	2.3	330
	120		0.500	21.7	3146	19.0	2753	16.3	2359	13.9	2013	10.1	1463	6.8	991	3.0	440
	160		0.625	27.1	3932	23.7	3441	20.3	2949	17.4	2517	12.6	1838	8.5	1239	3.8	551
		XXS	0.750	32.5	4719	28.5	4129	24.4	3539	20.8	3020	15.1	2194	10.2	1486	4.6	661
6	40	STD	0.280	10.2	1479	8.9	1294	7.6	1109	6.5	947	4.7	688	3.2	466	1.4	207
6.625	80	XS	0.432	15.7	2282	13.8	1997	11.8	1712	10.1	1461	7.3	1061	5.0	719	2.2	320
	120		0.562	20.5	2969	17.9	2598	15.4	2227	13.1	1900	9.5	1381	6.4	935	2.9	416
	160		0.719	26.2	3798	22.9	3324	19.6	2849	16.8	2431	12.2	1766	8.3	1197	3.7	532
		XXS	0.864	31.5	4565	27.5	3994	23.6	3423	20.1	2921	14.6	2123	9.9	1438	4.4	639
8	20		0.250	7.0	1014	6.1	888	5.2	761	4.5	649	3.3	472	2.2	320	1.0	142
8.625	30		0.277	7.8	1124	6.8	984	5.8	843	5.0	719	3.6	523	2.4	354	1.1	157
	40	STD	0.322	9.0	1307	7.9	1143	6.8	980	5.8	836	4.2	608	2.8	412	1.3	183
	60		0.406	11.4	1648	9.9	1442	8.5	1236	7.3	1054	5.3	766	3.6	519	1.6	231
	80	XS	0.500	14.0	2029	12.2	1775	10.5	1522	9.0	1299	6.5	943	4.4	639	2.0	284
	100		0.594	16.6	2410	14.5	2109	12.5	1808	10.3	1543	7.7	1121	5.2	759	2.3	337
	120		0.719	20.1	2918	17.6	2553	15.1	2188	12.9	1867	9.4	1357	6.3	919	2.8	408
	140		0.812	22.7	3295	19.9	2883	17.0	2471	14.5	2109	10.6	1532	7.2	1038	3.2	461
		XXS	0.875	24.5	3551	21.4	3107	18.4	2663	15.7	2272	11.4	1651	7.7	1118	3.4	497
	160		0.906	25.3	3677	22.2	3217	19.0	2757	16.2	2353	11.8	1710	8.0	1158	3.5	515
10	20		0.250	5.6	814	4.9	712	4.2	610	3.6	521	2.6	378	1.8	256	0.8	114
10.750	30		0.307	6.9	1000	6.0	875	5.2	750	4.4	640	3.2	465	2.2	315	1.0	140
	40	STD	0.365	8.2	1188	7.2	1040	6.1	891	5.2	761	3.8	553	2.6	374	1.1	166
	60	XS	0.500	11.2	1628	9.8	1424	8.4	1221	7.2	1042	5.2	757	3.5	513	1.6	228
	80		0.594	13.3	1934	11.7	1692	10.0	1450	8.5	1238	6.2	899	4.2	609	1.9	271
	100		0.719	16.1	2341	14.1	2048	12.1	1756	10.3	1498	7.5	1089	5.1	737	2.3	328
	120		0.844	18.9	2748	16.6	2404	14.2	2061	12.1	1759	8.8	1278	6.0	866	2.7	385
	140	XXS	1.000	22.4	3256	19.6	2849	16.8	2442	14.4	2084	10.4	1514	7.1	1026	3.1	456
	160		1.125	25.3	3663	22.1	3205	18.9	2747	16.2	2344	11.7	1703	8.0	1154	3.5	513

12(D). ALLOY PIPE - ASTM A335 P11 - CONTINUED

			Temperature, Degrees - C	-29 to 38	204	427	482	510	538	593
			- F	-20 to 100	400	800	900	950	1000	1000
			Allowable Stress - MPa	137.9	120.7	103.4	88.3	64.1	43.4	19.3
			- PSI	20000	17500	15000	12800	9300	6300	2800

Nominal bore and OD (in)	Shedule Number	Wall Designation	Wall Thickness	Maximum Working Pressure - MPa and PSI											
				MPa	PSI	MPa	PSI	MPa	PSI	MPa	PSI	MPa	PSI	MPa	PSI
12	20		0.250	4.7	686	4.1	600	3.5	515	3.0	439	2.2	319	1.5	216	0.7	96
12.750	30		0.330	6.2	906	5.5	793	4.7	679	4.0	580	2.9	421	2.0	285	0.9	127
		STD	0.375	7.1	1029	6.2	901	5.3	772	4.5	659	3.3	479	2.2	324	1.0	144
	40		0.406	7.7	1115	6.7	975	5.8	836	4.9	713	3.6	518	2.4	351	1.1	156
		XS	0.500	9.5	1373	8.3	1201	7.1	1029	6.1	878	4.4	638	3.0	432	1.3	192
	60		0.562	10.6	1543	9.3	1350	8.0	1157	6.8	987	4.9	717	3.4	486	1.5	216
	80		0.688	13.0	1889	11.4	1653	9.8	1416	8.3	1209	6.1	878	4.1	595	1.8	264
	100		0.844	16.0	2317	14.0	2027	12.0	1738	10.2	1483	7.4	1077	5.0	730	2.2	324
	120	XXS	1.000	18.9	2745	16.6	2402	14.2	2059	12.1	1757	8.8	1276	6.0	865	2.6	384
	140		1.125	21.3	3088	18.6	2702	16.0	2316	13.6	1976	9.9	1436	6.7	973	3.0	432
	160		1.312	24.8	3602	21.7	3151	18.6	2701	15.9	2305	11.5	1675	7.8	1134	3.5	504
14	10		0.250	4.3	625	3.8	547	3.2	469	2.8	400	2.0	291	1.4	197	0.6	88
14.00	20		0.312	5.4	780	4.7	683	4.0	585	3.4	499	2.5	363	1.7	246	0.8	109
	30	STD	0.375	6.5	938	5.7	820	4.8	703	4.1	600	3.0	436	2.0	295	0.9	131
	40		0.438	7.6	1095	6.6	958	5.7	821	4.8	701	3.5	509	2.4	345	1.1	153
		XS	0.500	8.6	1250	7.5	1094	6.5	938	5.5	800	4.0	581	2.7	394	1.2	175
	60		0.594	10.2	1485	9.0	1299	7.7	1114	6.6	950	4.8	691	3.2	468	1.4	208
	80		0.750	12.9	1875	11.3	1641	9.7	1406	8.3	1200	6.0	872	4.1	591	1.8	263
	100		0.938	16.2	2345	14.1	2052	12.1	1759	10.3	1501	7.5	1090	5.1	739	2.3	328
	120		1.094	18.9	2735	16.5	2393	14.1	2051	12.1	1750	8.8	1272	5.9	862	2.6	383
	140		1.250	21.5	3125	18.9	2734	16.2	2344	13.8	2000	10.0	1453	6.8	984	3.0	438
	160		1.406	24.2	3515	21.2	3076	18.2	2636	15.5	2250	11.3	1534	7.6	1107	3.4	492
16	10		0.250	3.8	547	3.3	479	2.8	410	2.4	350	1.8	254	1.2	172	0.5	77
16.000	20		0.312	4.7	683	4.1	597	3.5	512	3.0	437	2.2	317	1.5	215	0.7	96
	30	STD	0.375	5.7	820	4.9	718	4.2	615	3.6	525	2.6	381	1.8	258	0.8	115
	40	XS	0.500	7.5	1094	6.6	957	5.7	820	4.8	700	3.5	509	2.4	345	1.1	153
	60		0.656	9.9	1435	8.7	1256	7.4	1076	6.3	918	4.6	667	3.1	452	1.4	201
	80		0.844	12.7	1846	11.1	1615	9.5	1385	8.1	1182	5.9	859	4.0	582	1.8	258
	100		1.031	15.6	2255	13.6	1973	11.7	1691	10.0	1443	7.2	1049	4.9	710	2.2	316
	120		1.219	18.4	2667	16.1	2333	13.8	2000	11.8	1707	8.5	1240	5.8	840	2.6	373
	140		1.438	21.7	3146	19.0	2752	16.3	2359	13.9	2013	10.1	1463	6.8	991	3.0	4 40
	160		1.594	24.0	3487	21.0	3051	18.0	2615	15.4	2232	11.2	1621	7.6	1098	3.4	488
18	10		0.250	3.4	486	2.9	425	2.5	365	2.1	311	1.6	226	1.1	153	0.5	68
18.000	20		0.312	4.2	607	3.7	531	3.1	455	2.7	388	1.9	282	1.3	191	0.6	85
		STD	0.375	5.0	729	4.4	638	3.8	547	3.2	467	2.3	339	1.6	230	0.7	102
	30		0.438	5.9	852	5.1	745	4.4	639	3.8	545	2.7	396	1.8	268	0.8	119
		XS	0.500	6.7	972	5.9	851	5.0	729	4.3	622	3.1	452	2.1	306	0.9	136
	40		0.562	7.5	1093	6.6	956	5.7	820	4.8	699	3.5	508	2.4	344	1.1	153
	60		0.750	10.1	1458	8.8	1276	7.5	1094	6.4	933	4.7	678	3.2	459	1.4	204
	80		0.938	12.6	1824	11.0	1596	9.4	1368	8.0	1167	5.8	848	4.0	575	1.8	255
	100		1.156	15.5	2248	13.6	1967	11.6	1686	9.9	1439	7.2	1045	4.9	708	2.2	315
	120		1.375	18.4	2674	16.1	2339	13.8	2005	11.8	1711	8.6	1243	5.8	842	2.6	374
	140		1.562	20.9	3037	18.3	2658	15.7	2278	13.4	1944	9.7	1412	6.6	957	2.9	4 25
	160		1.781	23.9	3463	20.9	3030	17.9	2597	15.3	2216	11.1	1610	7.5	1091	3.3	485
20	10		0.250	3.0	438	2.6	383	2.3	328	1.9	280	1.4	203	1.0	138	0.4	61
20.00	20	STD	0.375	4.5	656	4.0	574	3.4	492	2.9	420	2.1	305	1.4	207	0.6	92
	30	XS	0.500	6.0	875	5.3	766	4.5	656	3.9	560	2.8	407	1.9	276	0.8	132
	40		0.594	7.2	1040	6.3	910	5.4	780	4.6	665	3.3	483	2.3	327	1.0	146
	60		0.812	9.8	1421	8.6	1243	7.3	1066	6.3	909	4.6	661	3.1	448	1.4	199
	80		1.031	12.4	1804	10.9	1579	9.3	1353	8.0	1155	5.8	839	3.9	568	1.7	253
	100		1.281	15.5	2242	13.5	1962	11.6	1681	9.9	1435	7.2	1042	4.9	706	2.2	314
	120		1.500	18.1	2625	15.8	2297	13.6	1969	11.6	1680	8.4	1221	5.7	827	2.5	368
	140		1.750	21.1	3063	18.5	2680	15.8	2297	13.5	1960	9.8	1424	6.7	965	3.0	429
	160		1.969	23.8	3446	20.8	3015	17.8	2584	15.2	2205	11.0	1602	7.5	105	3.3	482
24	10		0.250	2.5	365	2.2	319	1.9	273	1.6	233	1.2	170	0.8	115	0.4	51
24.000	20	STD	0.375	3.8	547	3.3	479	2.8	410	2.4	350	1.8	254	1.2	172	0.5	77
		XS	0.500	5.0	729	4.4	638	3.8	547	3.2	467	2.3	339	1.6	230	0.7	102
	30		0.562	5.7	820	4.9	717	4.2	615	3.6	525	2.6	381	1.8	258	0.8	115
	40		0.688	6.9	1003	6.1	876	5.2	752	4.4	642	3.2	467	2.2	316	1.0	140
	60		0.969	9.7	1413	8.5	1236	7.3	1060	6.2	904	4.5	657	3.1	445	1.4	198
	80		1.219	12.3	1778	10.7	1555	9.2	1333	7.8	1138	5.7	827	3.9	560	1.7	249
	100		1.531	15.4	223	13.5	1954	11.5	1675	9.9	1429	7.2	1038	4.8	703	2.2	313
	120		1.812	18.2	2643	15.9	2312	13.7	1982	11.7	1691	8.5	1229	5.7	832	2.6	370
	140		2.062	20.7	3007	18.1	2631	15.6	2255	13.3	1925	9.6	1398	6.5	947	2.9	421
	160		2.344	23.6	3418	20.6	2991	17.7	2564	15.1	2188	11.0	1590	7.4	1077	3.3	479

12(E). ALLOY PIPE - ASTM A335 P22

			Temperature, Degrees - C	-29 to 38		204 to 399		427		482		510		538		593	
			- F	-20 to 100		400 to 750		800		900		950		1000		1000	
			Allowable Stress - MPa	137.9		123.4		104.8		93.8		74.5		53.8		22.1	
			- PSI	20000		17900		15200		13600		10800		7800		3200	
Nominal bore and OD (in)	Shedule Number	Wall Designation	Wall Thickness	Maximum Working Pressure - MPa and PSI													
				MPa	PSI	MPa	PSI	MPa	PSI	MPa	PSI	MPa	PSI	MPa	PSI	MPa	PSI
½	40	STD	0.109	31.3	4542	28.0	4065	23.8	3452	21.3	3088	16.9	2453	12.2	1771	5.0	727
0.840	80	XS	0.147	42.2	6125	37.8	5482	32.1	4655	28.7	4165	22.8	3308	16.5	2389	6.8	980
	160		0.188	54.0	7833	48.3	7011	41.0	5953	36.7	5327	29.2	4230	21.1	3055	9.6	1253
		XXS	0.294	84.5	12250	75.6	10964	64.2	9310	57.4	8330	45.6	6615	32.9	4778	13.5	1960
¾	40	STD	0.113	26.0	3767	23.2	3371	19.7	2863	17.7	2561	14.0	2034	10.1	1469	4.2	603
1.050	80	XS	0.154	35.4	5133	31.7	4594	26.9	3901	24.1	3491	19.1	2772	13.8	2002	5.7	821
	160		0.219	50.3	7300	45.0	6534	38.3	5548	34.2	4964	27.2	3942	19.6	2847	8.1	1168
		XXS	0.308	70.8	10267	63.4	9189	53.8	7803	48.1	6981	38.2	5544	25.6	4004	11.3	1643
1	40	STD	0.133	24.4	3540	21.8	3168	18.5	2690	16.6	2407	13.2	1912	9.5	1381	3.9	566
1.315	80	XS	0.179	32.8	4764	29.4	4264	25.0	3621	22.3	3240	17.7	2573	12.8	1858	5.3	762
	160		0.250	45.9	6654	41.1	5955	34.9	5057	31.2	4525	24.8	3593	17.9	2595	7.3	1065
		XXS	0.358	65.7	9529	58.8	8528	49.9	7242	44.7	6479	35.5	5145	25.6	3716	10.5	1525
1¼	40	STD	0.140	20.4	2952	18.2	2642	15.5	2243	13.8	2007	11.0	1594	7.9	1151	3.3	472
1.660	80	XS	0.191	27.8	4027	24.9	3904	21.1	3061	18.9	2738	15.0	2175	10.8	1571	4.4	644
	160		0.250	36.3	5271	32.5	4718	27.6	4006	24.7	3584	19.6	2846	14.2	2056	5.8	843
		XXS	0.382	55.5	8054	49.7	7209	42.2	6121	37.5	5477	30.0	4349	21.7	3141	8.9	1289
1½	40	STD	0.145	18.4	2871	16.5	2391	14.0	2030	12.5	1816	9.9	1442	7.2	1042	2.9	427
1.900	80	XS	0.200	25.4	3684	22.7	3297	19.3	2800	17.3	2505	13.7	1989	9.9	1437	4.1	589
	160		0.281	35.7	5176	31.9	4633	27.1	3934	24.3	3520	19.3	2795	13.9	2019	5.7	828
		XXS	0.400	50.8	7368	45.5	6595	38.6	5600	34.5	5011	27.4	3979	19.8	2874	8.1	1179
2	40	STD	0.154	15.6	2269	14.0	2031	11.9	1725	10.6	1543	8.4	1226	6.1	885	2.5	363
2.375	80	XS	0.218	22.2	3213	19.8	2875	16.8	2442	15.1	2185	12.0	1735	8.6	1253	3.5	514
	160		0.344	35.0	5069	31.3	4537	26.6	3853	23.6	3447	18.9	2738	13.6	1977	5.6	811
		XXS	0.436	44.3	6425	39.7	5751	33.7	4883	30.1	4369	23.9	3470	17.3	2506	7.1	1028
2½	40	STD	0.203	17.0	2471	15.3	2212	13.0	1878	11.6	1680	9.2	1335	6.6	964	2.7	395
2.875	80	XS	0.276	23.2	3360	20.7	3007	17.6	2554	15.8	2285	12.5	1814	9.0	1310	3.7	538
	160		0.375	31.5	4565	28.2	4086	23.9	3470	21.4	3104	17.0	2465	12.3	1780	5.0	730
		XXS	0.552	46.3	6720	41.5	6014	35.2	5107	31.5	4570	25.0	3629	18.1	2621	7.4	1075
3	40	STD	0.216	14.9	2160	13.3	1933	11.3	1642	10.1	1469	8.0	1166	5.8	842	2.4	346
3.50	80	XS	0.300	20.7	3000	18.5	2685	15.7	2280	14.1	2040	11.2	1620	8.1	1170	3.3	480
	160		0.438	30.2	4380	27.0	3920	23.0	3329	20.5	2978	16.3	2365	11.8	1708	4.8	701
		XXS	0.600	41.4	6000	37.0	5370	31.4	4560	28.1	4080	22.3	3240	16.1	2340	6.6	960
3½	40	STD	0.226	13.6	1978	12.2	1770	10.4	1503	9.3	1345	7.4	1068	5.3	771	2.2	316
4.000	80	XS	0.318	19.2	2783	17.2	2490	14.6	2115	13.0	1892	10.4	1503	7.5	1085	3.1	445
4	40	STD	0.237	12.7	1843	11.4	1650	9.7	1401	8.6	1253	6.9	995	5.0	719	2.0	295
4.500	80	XS	0.337	18.1	2621	16.2	2346	13.7	1992	12.3	1782	9.8	1415	7.0	1022	2.9	419
	120		0.438	23.5	3407	21.0	3049	17.9	2589	16.0	2317	12.7	1840	9.2	1329	3.8	545
	160		0.531	28.5	4130	25.5	3696	21.6	3139	19.4	2808	15.4	2230	11.1	1611	4.6	661
		XXS	0.674	36.1	5242	32.3	4692	27.5	3984	24.6	3565	19.5	2831	14.1	2044	5.8	839
5	40	STD	0.258	11.2	1623	10.0	1453	8.5	1234	7.6	1104	6.0	887	4.4	633	1.8	260
5.563	80	XS	0.375	16.3	2359	14.6	2112	12.4	1793	11.1	1604	8.8	1274	6.3	920	2.6	377
	120		0.500	21.7	3146	19.4	2815	16.5	2391	14.7	2139	11.7	1699	8.5	1227	3.5	503
	160		0.625	27.1	3932	24.3	3519	20.6	2988	18.4	2674	14.6	2123	10.6	1534	4.3	629
		XXS	0.750	32.5	4719	29.1	4223	24.7	3586	22.1	3209	17.6	2548	12.7	1840	5.2	755
6	40	STD	0.280	10.2	1479	9.1	1324	7.8	1124	6.9	1006	5.5	799	4.0	577	1.6	237
6.625	80	XS	0.432	15.7	2282	14.1	2043	12.0	1735	10.7	1552	8.5	1232	6.1	890	2.5	365
	120		0.562	20.5	2969	18.3	2657	15.6	2256	13.9	2019	11.1	1603	8.0	1158	3.3	475
	160		0.719	36.2	3798	23.4	3400	19.9	2887	17.8	2583	14.1	2051	10.2	1481	4.2	608
		XXS	0.864	31.5	4565	28.2	4085	23.9	3469	21.4	3104	17.0	2465	12.3	1780	5.0	730
8	20		0.250	7.0	1014	6.3	908	5.3	771	4.8	690	3.8	548	2.7	396	1.1	162
8.625	30		0.277	7.8	1124	6.9	1006	5.9	854	5.3	764	4.2	607	3.0	438	1.2	180
	40	STD	0.322	9.0	1307	8.1	1169	6.8	993	6.1	889	4.9	706	3.5	510	1.4	209
	60		0.406	11.4	1648	10.2	1475	8.6	1252	7.7	1120	6.1	890	4.4	643	1.8	264
	80	XS	0.500	14.0	2029	12.5	1816	10.6	1542	9.5	1380	7.6	1096	5.5	791	2.2	325
	100		0.594	16.6	2410	14.9	2157	12.6	1832	11.3	1639	9.0	1302	6.5	940	2.7	386
	120		0.719	20.1	2918	18.0	2611	15.3	2217	13.7	1984	10.9	1576	7.8	1138	3.2	467
	140		0.812	22.7	3295	20.3	2949	17.3	2504	15.4	2241	12.3	1779	8.9	1285	3.6	527
		XXS	0.875	24.5	3551	21.9	3178	18..6	2699	16.6	2414	13.2	1917	9.5	1385	3.9	568
	160		0.906	25.3	3677	22.7	3290	19.3	2794	17.2	2500	13.7	1985	9.9	1434	4.1	588
10	20		0.250	5.6	814	5.0	728	4.3	619	3.8	553	3.0	440	2.2	317	0.9	130
10.750	30		0.307	6.9	1000	6.2	895	5.2	760	4.7	680	3.7	540	2.7	390	1.1	160
	40	STD	0.365	8.2	1188	7.3	1064	6.2	903	5.6	808	4.4	642	3.2	463	1.3	190
	60	XS	0.500	11.2	1628	10.0	1457	8.5	1237	7.6	1107	6.1	879	4.4	635	1.8	260
	80		0.594	13.3	1934	11.9	1731	10.1	1470	9.1	1315	7.2	1044	5.2	754	2.1	309
	100		0.719	16.1	2341	14.4	2095	12.3	1779	11.0	1592	8.7	1264	6.3	913	2.6	375
	120		0.844	18.9	2748	17.0	2459	14.4	2088	12.9	1869	10.2	1484	7.4	1072	3.0	440
	140	XXS	1.000	22.4	3256	20.1	2914	17.1	2474	15.3	2214	12.1	1758	8.8	1270	3.6	521
	160		1.125	25.3	3663	22.6	3278	19.2	2784	17.2	2491	13.6	1978	9.8	1428	4.0	586

12(E). ALLOY PIPE - ASTM A335 P22 - CONTINUED

			Temperature, Degrees - C	-29 to 38		204 to 399		427		482		510		538		593	
			- F	-20 to 100		400 to 750		800		900		950		1000		1000	
			Allowable Stress - MPa	137.9		123.4		104.8		93.8		74.5		53.8		22.1	
			- PSI	20000		17900		15200		13600		10800		7800		3200	
Nominal bore and OD (in)	Shedule Number	Wall Designation	Wall Thickness	Maximum Working Pressure - MPa and PSI													
				MPa	PSI	MPa	PSI	MPa	PSI	MPa	PSI	MPa	PSI	MPa	PSI	MPa	PSI
12	20		0.250	4.7	686	4.2	614	3.6	522	3.2	467	2.6	371	1.8	268	0.8	110
12.750	30		0.330	6.2	906	5.6	811	4.7	688	4.2	616	3.4	489	2.4	353	1.0	145
		STD	0.375	7.1	1029	6.4	921	5.4	782	4.8	700	3.8	556	2.8	401	1.1	165
	40		0.406	7.7	1115	6.9	997	5.8	847	5.2	758	4.1	602	3.0	435	1.2	178
		XS	0.500	9.5	1373	8.5	1228	7.2	1043	6.4	933	5.1	741	3.7	535	1.5	220
	60		0.562	10.6	1543	9.5	1381	8.1	1172	7.2	1049	5.7	833	4.1	602	1.7	247
	80		0.688	13.0	1889	11.7	1690	9.9	1435	8.9	1284	7.0	1020	5.1	737	2.1	302
	100		0.844	16.0	2317	14.3	2074	12.1	1761	10.9	1575	8.6	1251	6.2	904	2.6	371
	120	XXS	1.000	18.9	2745	16.9	2457	14.4	2086	12.9	1867	10.2	1482	7.4	1071	3.0	439
	140		1.125	21.3	3088	19.1	2764	16.2	2347	14.5	2100	11.5	1668	8.3	1204	3.4	494
	160		1.312	24.8	3602	22.2	3223	18.9	2737	16.9	2449	13.4	1945	9.7	1405	4.0	576
14	10		0.250	4.3	625	3.9	559	3.3	475	2.9	425	2.3	338	1.7	244	0.7	100
14.00	20		0.312	5.4	780	4.8	698	4.1	593	3.7	530	2.9	421	2.1	304	0.9	125
	30	STD	0.375	6.5	938	5.8	839	4.9	713	4.4	638	3.5	506	2.5	366	1.0	150
	40		0.438	7.6	1095	6.8	980	5.7	832	5.1	745	4.1	591	2.9	427	1.2	175
		XS	0.500	8.6	1250	7.7	1119	6.6	950	5.9	850	4.7	675	3.4	488	1.4	200
	60		0.594	10.2	1485	9.2	1329	7.8	1129	7.0	1010	5.5	802	4.0	579	1.6	238
	80		0.750	12.9	1875	11.6	1678	9.8	1425	8.8	1275	7.0	1013	5.0	731	2.1	300
	100		0.938	16.2	2345	14.5	2099	12.3	1782	11.0	1595	8.7	1266	6.3	915	2.6	375
	120		1.094	18.9	2735	16.9	2448	14.3	2079	12.8	1860	10.2	1477	7.4	1067	3.0	438
	140		1.250	21.5	3125	19.3	2797	16.4	2375	14.7	2125	11.6	1688	8.4	1219	3.4	500
	160		1.406	24.2	3515	21.7	3146	18.4	2671	16.5	2390	13.1	1898	9.5	1371	3.9	562
16	10		0.250	3.8	547	3.4	489	2.9	416	2.6	372	2.0	295	1.5	213	0.6	88
16.000	20		0.312	4.7	683	4.2	611	3.6	519	3.2	464	2.5	369	1.8	266	0.8	109
	30	STD	0.375	5.7	820	5.1	734	4.3	623	3.8	558	3.1	443	2.2	320	0.9	131
	40	XS	0.500	7.5	1094	6.7	979	5.7	831	5.1	744	4.1	591	2.9	427	1.2	175
	60		0.656	9.9	1435	8.9	1284	7.5	1091	6.7	976	5.3	775	3.9	560	1.6	230
	80		0.844	12.7	1846	11.4	1652	9.7	1403	8.7	1255	6.9	997	5.0	720	2.0	295
	100		1.031	15.6	2255	13.9	2019	11.8	1714	10.6	1534	8.4	1218	6.1	880	2.5	361
	120		1.219	18.4	2667	16.5	2387	14.0	2027	12.5	1813	9.9	1440	7.2	1040	2.9	427
	140		1.438	21.7	3146	19.4	2815	16.5	2391	14.7	2139	11.7	1699	8.5	1227	3.5	503
	160		1.594	24.0	3487	21.5	3121	18.3	2650	16.3	2371	13.0	1883	9.4	1360	3.8	558
18	10		0.250	3.4	486	3.0	435	2.5	369	2.3	331	1.8	263	1.3	190	0.5	78
18.000	20		0.312	4.2	607	3.7	543	3.2	461	2.8	413	2.3	328	1.6	237	0.7	97
		STD	0.375	5.0	729	4.5	653	3.8	554	3.4	496	2.7	394	2.0	284	0.8	117
	30		0.438	5.9	852	5.3	762	4.5	647	4.0	579	3.2	460	2.3	332	0.9	136
		XS	0.500	6.7	972	6.0	870	5.1	739	4.6	661	3.6	525	2.6	379	1.1	156
	40		0.562	7.5	1093	6.7	978	5.7	831	5.1	743	4.1	590	2.9	426	1.2	175
	60		0.750	10.1	1458	9.0	1305	7.6	1108	6.8	992	5.4	788	3.9	569	1.6	233
	80		0.938	12.6	1824	11.3	1632	9.6	1386	8.6	1240	6.8	985	4.9	711	2.0	292
	100		1.156	15.5	2248	13.9	2012	11.8	1708	10.5	1538	8.4	1214	6.0	877	2.5	360
	120		1.375	18.4	2674	16.5	2393	14.0	2032	12.5	1818	10.0	1444	7.2	1043	2.9	428
	140		1.562	20.9	3037	18.7	2718	15.9	2308	14.2	2065	11.3	1640	8.2	1185	3.4	486
	160		1.781	23.9	3463	21.4	3099	18.1	2632	16.2	2355	12.9	1870	9.3	1351	3.8	554
20	10		0.250	3.0	438	2.7	392	2.3	333	2.1	298	1.6	236	1.2	171	0.5	70
20.00	20	STD	0.375	4.5	656	4.0	587	3.4	499	3.1	446	2.4	354	1.8	256	0.7	105
	30	XS	0.500	6.0	875	5.4	783	4.6	655	4.1	595	3.3	473	2.4	341	1.0	140
	40		0.594	7.2	1040	6.4	930	5.4	790	4.9	707	3.9	561	2.8	405	1.1	166
	60		0.812	9.8	1421	8.8	1272	7.4	1080	6.7	966	5.3	767	3.8	554	1.6	227
	80		1.031	12.4	1804	11.1	1615	9.5	1371	8.5	1227	6.7	974	4.9	704	2.0	289
	100		1.281	15.5	2242	13.8	2006	11.7	1704	10.5	1524	8.3	1211	6.0	874	2.5	359
	120		1.500	18.1	2625	16.2	2349	13.8	1995	12.3	1785	9.8	1418	7.1	1024	2.9	420
	140		1.750	21.1	3063	18.9	2741	16.0	2328	14.4	2083	11.4	1654	8.2	1194	3.4	490
	160		1.969	23.8	3446	21.3	3084	18.1	2619	16.2	2343	12.8	1861	9.3	1344	3.8	551
24	10		0.250	2.5	365	2.2	326	1.9	277	1.7	248	1.4	197	1.0	142	0.4	58
24.000	20	STD	0.375	3.8	547	3.4	489	2.8	416	2.6	272	2.0	295	1.5	213	0.6	88
		XS	0.500	5.0	729	4.5	653	3.8	554	3.4	496	2.7	394	2.0	284	0.8	117
	30		0.562	5.7	820	5.1	734	4.3	623	3.8	557	3.1	443	2.2	320	0.9	131
	40		0.688	6.9	1003	6.2	898	5.3	763	4.7	682	3.7	542	2.7	391	1.1	161
	60		0.969	9.7	1413	8.7	1265	7.4	1074	6.6	981	5.3	763	3.8	551	1.6	226
	80		1.219	12.3	1778	11.0	1591	9.3	1351	8.3	1209	6.6	960	4.8	693	2.0	284
	100		1.531	15.4	2233	13.8	1998	11.7	1697	10.5	1518	8.3	1206	6.0	871	2.5	257
	120		1.812	18.2	2643	16.3	2365	13.8	2008	12.4	1797	9.8	1427	7.1	1031	2.9	423
	140		2.062	20.7	3007	18.6	2691	15.9	2285	14.1	2045	11.2	1624	8.1	1173	3.3	481
	160		2.344	23.6	3418	21.1	3059	17.9	2598	16.0	2324	12.7	1846	9.2	1333	3.8	547

13. PRESSURE TEMPERATURE RATINGS - FLANGES

13(A). FORMULA

The maximum non-shock service pressure ratings in the following tables are from ANSI B16.5-1988 Table 2.
The ratings are calculated from the following formula:

$$Pt = \frac{PrS}{8750}$$

where:
Pt = the rated working pressure, psi, for the specified material at temperature T.
Pr = the pressure rating class index, psi (e.g. Pr = 300 psi for Class 300).
S = the selected stress, psi, for the specified material at temperature T.
The resultant pounds per square inch (psi) are convered to Megapascals (MPa) by the formula:
1 PSI = .006895 MPa.
The results are rounded to 1 decimal place.
The following formula is used to convert degrees Fahrenheit (°F) to degrees Celsius (°C):
°C = 5/9(°F -32).
The results are rounded to the nearest °C.

13(B). FLANGE RATINGS

		Maximum Non-shock Service Pressure Ratings								Maximum Non-shock Service Pressure Ratings							
Grade		A105		A182 F11		A182 F22		A182F5		A105		A182 F11		A182 F22		ASTM A182F5	
Service Temperature																	
°F	°C	MPa	PSI	MPa	PSI	MPa	PSI	MPa	PSI	MPa	PSI	MPa	PSI	MPa	PSI	MPa	PSI
		CLASS 150								**CLASS 300**							
-20 to 100	-30 to 40	2.0	2.85	2.0	290	2.0	290	2.0	290	5.1	740	5.2	750	5.2	750	5.2	750
200	95	1.8	2.60	1.8	260	1.8	260	1.8	260	4.7	674	4.9	710	4.9	715	5.2	750
300	150	1.6	230	1.6	230	1.6	230	1.6	230	4.5	644	4.7	674	4.7	675	5.0	730
400	205	1.4	200	1.4	200	1.4	200	1.4	200	4.4	635	4.6	660	4.5	650	4.9	705
500	260	1.2	170	1.2	170	1.2	170	1.2	170	4.1	600	4.4	640	4.4	640	4.6	665
600	315	1.0	140	1.0	140	1.0	140	1.0	140	3.8	550	4.2	605	4.2	605	4.2	605
650	345	0.9	125	0.9	125	0.9	125	0.9	125	3.7	535	4.1	590	4.1	590	4.1	590
700	370	0.8	110	0.8	110	0.8	110	0.8	110	3.7	535	3.9	570	3.9	570	3.9	570
750	400	0.7	95	0.7	95	0.7	95	0.7	95	3.5	505	3.7	530	3.7	530	3.7	530
800	425	0.6	80	0.6	80	0.6	80	0.6	80	2.8	410	3.5	510	3.5	510	3.4	500
850	455	0.4	65	0.4	65	0.4	65	0.4	65	1.9	270	3.3	485	3.3	485	3.0	440
900	480	0.3	50	0.3	50	0.3	50	0.3	50	0.2	170	3.1	450	3.1	450	2.4	355
950	510	0.2	35	0.2	35	0.2	35	0.2	35	0.7	105	2.6	380	2.6	380	1.8	260
1000	540	0.1	20	0.1	20	0.1	20	0.1	20	0.3	50	1.6	225	1.9	270	1.3	190
1050	565											1.0	140	1.4	200	1.0	140
1100	595											0.7	95	0.8	115	0.7	105
1150	620											0.3	50	0.7	105	0.5	70
1200	650											0.2	35	0.4	55	0.3	45
		CLASS 400								**CLASS 600**							
-20 to 100	-30 to 40	6.8	990	6.9	1000	6.9	1000	6.9	1000	10.2	1480	10.3	1500	10.3	1500	10.3	1500
200	95	6.2	900	6.6	950	6.6	955	6.9	1000	9.3	1350	9.8	1425	9.9	1430	10.3	1500
300	150	6.0	875	6.2	895	6.2	905	6.7	970	9.1	1315	9.3	1345	9.3	1355	10.0	1455
400	205	5.8	845	6.1	880	6.0	865	6.5	940	8.8	1270	9.1	1315	8.9	1295	9.7	1410
500	260	5.5	800	5.9	855	5.9	855	6.1	885	8.3	1200	8.9	1285	8.8	1280	9.2	1330
600	315	5.0	730	5.6	805	5.6	805	5.6	805	7.6	1095	8.3	1210	8.3	1210	8.3	1210
650	345	4.9	715	5.4	785	5.4	785	5.4	785	7.4	1075	8.1	1175	8.1	1175	8.1	1175
700	370	4.9	710	5.2	755	5.2	755	5.2	755	7.3	1065	7.8	1135	7.8	1135	7.8	1135
750	400	4.6	670	4.9	710	4.9	710	4.9	710	7.0	1010	7.3	1065	7.3	1065	7.3	1065
800	425	3.8	550	4.7	675	4.7	675	4.6	665	5.7	825	7.0	1015	7.0	1015	6.9	995
850	455	2.4	355	4.5	650	4.5	650	4.0	585	3.7	535	6.7	975	6.7	975	6.1	880
900	480	1.6	230	4.1	600	4.1	600	3.2	470	2.4	345	6.2	900	6.2	900	4.9	70
950	510	1.0	140	3.5	505	3.5	505	2.4	350	1.4	205	5.2	755	5.2	755	3.6	525
1000	540	0.5	70	2.1	300	2.4	355	1.8	255	0.7	105	3.1	445	3.7	535	2.7	385
1050	565			1.3	185	1.8	265	1.3	190			1.9	275	2.8	400	1.9	280
1100	595			0.9	130	1.0	150	1.0	140			1.3	190	1.6	225	1.4	205
1150	620			0.5	70	1.0	140	0.6	90			0.7	105	1.4	205	1.0	140
1200	650			0.3	45	0.5	75	0.4	60			0.5	70	0.8	110	0.6	90

13(B). FLANGE RATINGS - CONTINUED

Grade		Maximum Non-shock Service Pressure Ratings							
		A105		A182 F11		A182 F22		A182F5	
Service Temperature									
°F	°C	MPa	PSI	MPa	PSI	MPa	PSI	MPa	PSI
		CLASS 900							
-20 to 100	-30 to 40	15.3	2220	15.5	2250	15.5	2250	15.5	2250
200	95	14.0	2025	14.7	2135	14.8	2150	15.5	2250
300	150	13.6	1970	13.9	2020	14.0	2030	15.1	2185
400	205	13.1	1900	13.6	1975	13.4	1945	14.6	2115
500	260	12.4	1795	13.3	1925	13.2	1920	13.8	1995
600	315	11.3	1640	12.5	1815	12.5	1815	12.5	1815
650	345	11.1	1610	12.2	1765	12.2	1765	12.2	1765
700	370	11.0	1600	11.8	1705	11.8	1705	11.8	1705
750	400	10.4	1510	11.0	1595	11.0	1595	11.0	1595
800	425	8.5	1235	10.5	1525	10.5	1525	10.3	1490
850	455	5.6	805	10.1	1460	10.1	1460	9.1	1315
900	480	3.6	515	9.3	1350	9.3	1350	7.3	1060
950	510	2.1	310	7.8	1130	7.8	1130	5.4	780
1000	540	1.1	155	4.6	670	5.6	805	4.0	575
1050	565			2.8	410	4.1	595	2.9	420
1100	595			2.0	290	2.3	340	2.1	310
1150	620			1.1	155	2.1	310	1.4	205
1200	650			0.7	105	1.1	165	0.9	135
		CLASS 2500							
-20 to 100	-30 to 40	42.5	6170	43.1	6250	43.1	6250	43.1	6250
200	95	38.8	5625	40.9	5930	41.1	5965	43.1	6250
300	150	37.7	5470	38.6	5606	38.9	5640	41.9	6070
400	205	36.4	5280	37.8	5485	37.2	5400	40.5	5880
500	260	34.4	4990	36.9	5350	36.8	5330	38.2	5540
600	315	31.4	4560	34.8	5040	34.8	5040	34.8	5040
650	345	30.9	4475	33.8	4905	33.8	4905	33.8	4905
700	370	30.6	4440	32.6	4730	32.6	4730	32.6	4730
750	400	29.0	4200	30.5	4430	30.5	4430	30.5	4430
800	425	23.6	3430	29.5	4230	29.2	4230	28.6	4145
850	455	15.4	2230	28.0	4060	28.0	4060	25.2	3660
900	480	9.9	1430	25.8	3745	25.8	3745	20.3	2945
950	510	5.9	860	21.7	3145	21.7	3145	15.0	2170
1000	540	3.0	430	12.8	1860	15.4	2230	11.0	1600
1050	565			7.9	1145	11.4	1660	8.1	1170
1100	595			5.5	800	6.5	945	5.9	860
1150	620			3.0	430	5.9	860	3.9	570
1200	650			2.0	285	3.2	460	2.6	370

Grade		Maximum Non-shock Service Pressure Ratings							
		A105		A182 F11		A182 F22		ASTM A182F5	
Service Temperature									
°F	°C	MPa	PSI	MPa	PSI	MPa	PSI	MPa	PSI
		CLASS 1500							
-20 to 100	-30 to 40	25.5	3705	25.9	3750	25.9	3750	25.9	3750
200	95	23.3	3375	24.5	3560	24.7	3580	25.9	3750
300	150	22.6	3280	23.2	3365	23.3	3385	25.1	3640
400	205	21.9	3170	22.7	3290	22.3	3240	24.3	3530
500	260	20.7	2995	22.1	3210	22.1	3200	22.9	3325
600	315	18.9	2735	20.9	3025	20.9	3025	20.9	3025
650	345	18.5	2685	20.3	2940	20.3	2940	20.3	2940
700	370	18.4	2665	19.6	2840	19.6	2840	19.6	2840
750	400	17.4	2520	18.3	2660	18.3	2660	18.3	2660
800	425	14.2	2060	17.5	2540	17.5	2540	17.1	2485
850	455	9.2	1340	16.8	2435	16.8	2435	15.1	2195
900	480	5.9	860	15.5	2245	15.5	2245	12.2	1765
950	510	3.6	515	13.0	1885	13.0	1885	9.0	1305
1000	540	1.8	260	7.7	1115	9.2	1340	6.6	960
1050	565			4.7	685	6.9	995	4.9	705
1100	595			3.3	480	3.9	565	3.6	515
1150	620			1.8	260	3.6	515	2.4	345
1200	650			1.2	170	1.9	275	1.6	225

14. CONVERSION FACTORS

LINEAR, SQUARE AND CUBIC MEASUREMENTS						
FROM	TO	MULTIPLY BY		FROM	TO	MULTIPLY BY
in	mm	25.4		mm	in	0.03937
ft	m	0.03048		m	ft	3.28084
miles	km	1.609344		km	miles	0.62137
in^2	mm^2	645.16		mm^2	in^2	0.00155
ft^2	m^2	0.092903		m^2	ft^2	10.7639
in^2	cm^3	16.3871		cm^3	in^2	0.06102
ft^3	m^3	0.02832		m^3	ft^3	35.3147
ft^3	litres	28.375		litres	ft^3	0.0352
ft^3	Imp. gallons	6.23		Imp. gallons	ft^3	0.16
ft^3	U.S. gallons	7.4805		U.S. gallons	ft^3	0.1337
Imp. gallons	litres	4.5461		litres	Imp. gallons	0.22
MASS, MASS/UNIT LENGTH AND DENSITY (MASS/VOLUME)						
FROM	TO	MULTIPLY BY		FROM	TO	MULTIPLY BY
lb	kg	0.45359		kg	lb	2.2046
tons	tonnes	1.01605		tonnes	tons	0.9842
in^3 of water	lb (15°C)	0.0361		lb (15°C)	in^3 of water	27.70083
ft^3 of water	lb (15°C)	62.4		lb (15°C)	ft^3 of water	0.01603
Imp. gallons of water	lb (15°C)	10		lb (15°C)	Imp. gallons of water	0.1
U.S. gallons of water	lb (15°C)	8.33		lb (15°C)	U.S. gallons of water	0.12
litre of water	lb (15°C)	2.2		lb (15°C)	litre of water	0.45
in^3 of water	in^3 of mercury	0.735		in^3 of mercury	in^3 of water	13.6
in^3 of mercury	lb	0.491		lb	in^3 of mercury	2.037
lb/ft	kg/m	1.4882		kg/m	lb/ft	0.672
lb/ft	tons/miles	2.3571		tons/miles	lb/ft	0.4242
lb^3/ft	kg/m^3	16.0185		kg/m^3	lb^3/ft	0.06243
PRESSURE						
FROM	TO	MULTIPLY BY		FROM	TO	MULTIPLY BY
in of water	lb/in^2 (psi)	0.0361		lb/in^2 (psi)	in of water	27.7
in of water	in of mercury	0.0735		in of mercury	in of water	13.6
ft of water	lb/in^2 (psi)	0.4332		lb/in^2 (psi)	ft of water	2.308
ft of water	in of mercury	0.8824		in of mercury	ft of water	1.133
in of mercury	lb/in^2 (psi)	0.4912		lb/in^2 (psi)	in of mercury	2.04
cm of mercury	lb/in^2 (psi)	0.1934		lb/in^2 (psi)	cm of mercury	5.1706
atmosphere	lb/in^2 (psi)	14.696		lb/in^2 (psi)	atmosphere	0.06805
atmosphere	ft of water	34		ft of water	atmosphere	0.0294
atmosphere	mm of mercury	760		mm of mercury	atmosphere	0.00132
kg/cm^2	lb/in^2 (psi)	14.225		lb/in^2 (psi)	kg/cm^2	0.0703
kg/m^2	lb/in^2 (psi)	0.00142		lb/in^2 (psi)	kg/m^2	703.08
FORCE						
FROM	TO	MULTIPLY BY		FROM	TO	MULTIPLY BY
lbf	N	4.4482		N	lbf	0.2248
kgf	N	9.80665		N	kgf	0.102
lb/in^2 (psi)	kPa	6.895		kPa	lb/in^2 (psi)	0.14503
lb/in^2 (psi)	MPa	0.006895		MPa	lb/in^2 (psi)	145.03263
ft-lb	joules(J)	1.3558		joules(J)	ft-lb	0.73757
PRESSURE (stress)						
FROM	TO	MULTIPLY BY		FROM	TO	MULTIPLY BY
lbf/in^2	kgf/cm^2	0.07031		kgf/cm^2	lbf/in^2	14.2233
lbf/in^2	bar	0.06895		bar	lbf/in^2	14.5038
lbf/in^2	N/m^2	6894.76		N/m^2	lbf/in^2	0.000145
kgf/cm^2	bar	0.980665		bar	kgf/cm^2	1.0197
$tonf/in^2$	kgf/mm^2	1.5749		kgf/mm^2	$tonf/in^2$	0.635
$tonf/in^2$	N/mm^2	15.4443		N/mm^2	$tonf/in^2$	0.06475
kgf/mm^2	N/mm^2	9.80665		N/mm^2	kgf/mm^2	0.102
TEMPERATURE						
FROM	TO	MULTIPLY BY		FROM	TO	MULTIPLY BY
Fahrenheit °F	Celsius °C	°C= (°F-32)0.555		Celsius °C	Fahrenheit °F	°F=(°C x 1.8)+32

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