



FORGED CONNECTIONS FOR PRESSURE VESSELS

LONG WELD NECK CONNECTIONS_____ LWN

HEAVY BARREL CONNECTIONS_____ HB

INTERMEDIATE BARREL CONNECTIONS_____ I₁, I₂ & I₃

EQUAL BARREL CONNECTIONS_____ E

SUPER BARREL CONNECTIONS_____ SB

INSERT LIP CONNECTIONS_____ Q

BUTT WELD STUB END CONNECTIONS

STUDDING OUTLETS

LARGE DIAMETER FLANGES ASME B16.47 SERIES A & B

CUSTOM PRODUCTS

ROUGH FORGINGS

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ADVANTAGES OF SEAMLESS INTEGRALLY REINFORCED FORGED CONNECTIONS

VS

MULTI-COMPONENT FABRICATION

Vessel Fabrication Advantages

The FCI forged connections simplify shop fabrication by "eliminating" the following:

- Reinforcing pad fabrication-layout, cutting, forming, drilling and tapping of weep hole
- Nozzle neck fabrication-layout, cut & bevel pipe/layout, cut & bevel, form, weld, inspect plate neck
- Component fabrication-fit and welding of flange to pipe/plate or forged cylinder neck
- Reinforcing pad installation-fit and welding of one/two piece pad to vessel shell and nozzle neck
- Inspection & testing-radiographic inspection, UT, PT, MT, air test and other non-destructive tests and inspection as required of components
- Handling of associated components to and from the various work stations
- Inspection and marking of component material-identification/traceability

Improved Quality Control

Material traceability, component and shop fabrication inspection is reduced allowing Quality Control Inspectors to direct their efforts to other more demanding/critical areas of concern.

In lighter duty applications, the use of Long Weld Ncks eliminates/reduces the possibility of barrel distortion that can occur in pipe neck due to heat input from welding.

Production Cost Reduction Advantages

The FCI integrally reinforced forged connections reduce fabrication production cost in the following areas:

- Material requisitioning, purchasing and expediting of one part verses three parts (pipe, flange and plate)
- Material handling of only one part into stock and then directly into the final assembly of the work
- Inventory control of fewer parts
- Quality control-traceability, inspection, testing, documentation
- Fabrication schedule reduced thereby improving Purchaser's deliveries and internal cash flow

Marketing Advantages

Marketing advantages of utilizing integrally reinforced forged connections:

- Improved and more consistent equipment deliveries to customers due to less variables affecting production
- More consistent pricing of equipment due to estimating of fewer variables
- More competitive pricing a result of being able to use smaller connections for manways and instrumentation connections as FCI forged connection bores are greater than corresponding nominal pipe sizes, e.g. associated connections may be of a size smaller to accomplish the same result
- Increased sales revenue a result of increased production
- Aesthetic appeal of completed work using seamless connections
- Predetermined cost and guaranteed quality level thus assuring on-target performance for the connection portion of the budget
- Special contour forged inser lips, contour forged with aligned grain flow- imparting maximum strength and toughness, can be specified for applications requiring superior resistance to thermal and mechanical stresses

In addition to the above advantages, quality conscious customer realize that integrally reinforced forged connection possess improved strength and toughness as the connection is forged close to the finished profile.

FCI CONNECTIONS

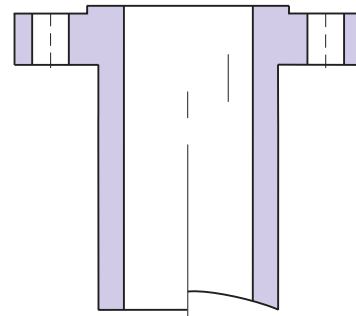
FCI connections are available in a wide variety of seamless configurations for use in pressure vessels and piping systems.

Standard connections are available in the complete range of sizes and pressure rating classes covered in ASME B16.5. Conditions of service, space factors, fabrication facility, correlation of piping, ladders and decks/ platforms, vessel internals, and other considerations determine connection configurations. The amount of reinforcement required from a pressure vessel connection can vary significantly in each application thereby determining the connection neck thickness.

Standard connections sold by FCI are manufactured in accordance with ASME Section VIII Div. 1 and ASME B16.5 latest edition. Upon request connections can be manufactured in accordance with ASME Section VIII Div. 2 latest edition and/or other Codes and Purchaser specifications. Materials of construction will be in compliance with the respective Code.

LONG WELD NECK "LWN" CONNECTIONS

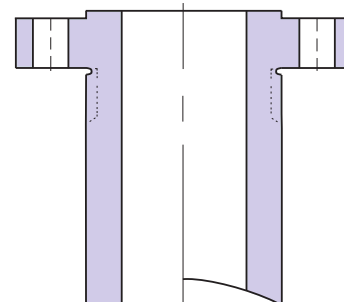
The Long Weld Neck "LWN" connection is the lightest and most economical of FCI standard connections offered for use where a minimum of reinforcing area is required. Long Weld Necks have a uniform barrel outside diameter that provides a nut relief clearance between the connection neck and the nut. Lengths can be increased to allow for any offset, "hillside" or tangential location attachment on pressure vessel shells or heads. Contoured bottoms are available upon request.



LONG WELD NECK "LWN" CONNECTIONS

HEAVY BARREL "HB" CONNECTIONS

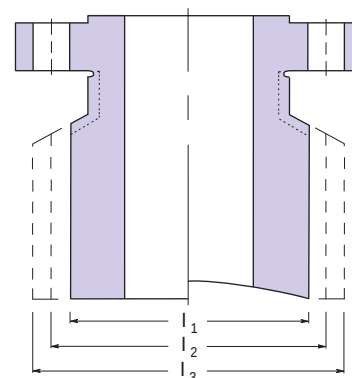
The FCI Heavy Barrel "HB" connection provides additional reinforcement than the Long Weld Neck by means of a thicker barrel/wall section. "HB" connections have a uniform barrel outside diameter in order to provide an automatic nut stop against the barrel, thereby eliminating the need for a holding wrench on the connection side. A nut relief in the barrel is optional upon request. Type "HB" connections 12" and less have Sch. 80 bores as standard; in sizes 14" and greater, bores are equal to nominal pipe sizes. Special bores are available upon request. Larger outside diameter/thicker barrels and contoured bottoms are available upon request.



HEAVY BARREL "HB" CONNECTIONS

INTERMEDIATE BARREL “I” CONNECTIONS

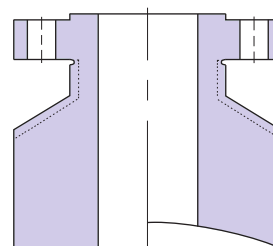
FCI Intermediate Barrel “I” connections, I_1 , I_2 and I_3 , provide three (3) standard intermediate barrel connections having progressively larger outside diameter barrels to provide added reinforcement greater than that of the “HB” connections and less than the Equal Barrel “E” connection. Within the flange hub area, the outside diameter of the barrel provides an automatic nut stop, but the remaining portion of the barrel is larger in outside diameter providing additional reinforcement. Intermediate Barrel “I” connections 12” and smaller have Sch. 80 bores as standard; in sizes 14” and greater, bores are equal to nominal pipe sizes. Barrel nut relief, special bores and contoured bottoms are available upon request.



INTERMEDIATE BARREL “I” CONNECTIONS

EQUAL BARREL “E” CONNECTIONS

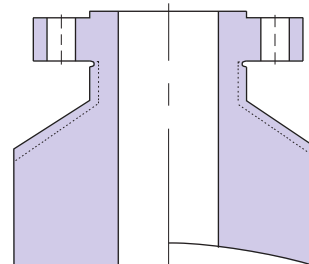
The FCI Equal Barrel “E” connection provides the most reinforcement of all standard connections produced by FCI. The barrel outside diameter equals the outside diameter of the bolting flange. Within the flange hub area, the outside diameter of the barrel provides an automatic nut stop. A nut relief in the barrel, special bores and contoured bottoms are available upon request.



EQUAL BARREL “E” CONNECTIONS

SUPER BARREL “SB” CONNECTIONS

The FCI Super Barrel “SB” connection is identical to the Equal Barrel “E” connection with the exception of the barrel outside diameter exceeding that of the bolting flange to provide additional reinforcement when required for an integrally reinforced connection. A nut relief in the barrel, special bores and contoured bottoms are available upon request. Purchaser to advise barrel outside diameter for required reinforcement.



SUPER BARREL “SB” CONNECTIONS

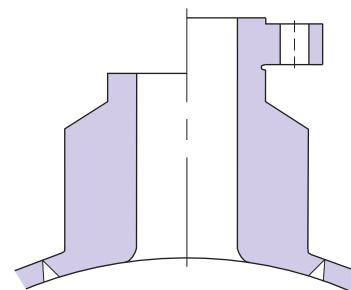
INSERT LIPS

Insert Lips are available on all connections. The letter “Q” appended to the above connection designations indicates an insert lip. For example, I_3Q designates an Intermediate Barrel type 3 connection with an insert lip. Purchaser to advise insert lip details.

Insert lips offer:

- ease and economy of installation,
- easier and less expensive weld inspections,
- superior toughness and ductility in high stress areas.

INSERT LIPS



BUTT WELD STUB END CONNECTIONS

The Butt Weld Stub End connection outside diameter can be identical to any of the above mentioned connections. Ends may be plain and square or:

- one end faced and tapped,
- one end tapered and with weld groove preparation to ASME B16.25, contoured as specified by Purchaser,
- one end prepared for a pipe butt weld connection, other end (reinforced barrel end) either flat or contoured to fit any shell or head mount,
- both ends prepared for butt welding – used as a seamless shell section.

Purchaser to advise all dimensional sizing.

Seamless forged rings and cylinders can be manufactured for custom high pressure components as per Purchaser's design.

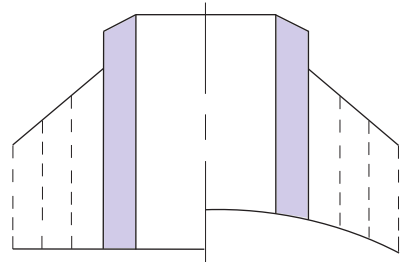
STUDDING OUTLETS

Studding Outlets provide a unique compact design with inherent reinforcement offering distinct advantages to designers and fabricators. The low profile of this connection provides for the lowest projection of a bolted connection where clearance may be a factor in connection selection. The outside diameter and/or body thickness may be increased where additional reinforcement is required. In addition, the Studding Outlet can be supplied with an optional contoured bottom and/or insert lip for simplified installation and reduction in cost of positional welding. Other common Studding Outlet options are air test holes, top or side connecting, special gasket surface faces, and custom machining of the mating surface to accommodate sight glass assemblies. The Studding Outlet is the most economical of bolted connections.

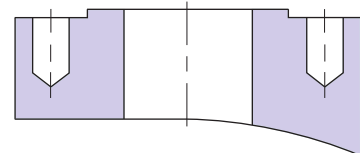
LARGE DIAMETER FLANGES

Large diameter flanges and blind flanges are produced in accordance with ASME B16.47 Series A and Series B for sizes NPS 26" to NPS 60" in pressure/temperature rating classes 75 through 900. Dimensional standards generally conform to both MSS SP44 (B16.47 Series A) and API 605 (B16.47 Series B). FCI can furnish flanges and blinds that meet other dimensional specifications upon request, when the Purchaser accepts responsibility for verifying that the flange geometry is suitable for the design conditions.

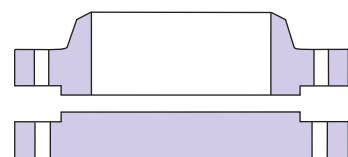
BUTT WELD STUB END CONNECTIONS

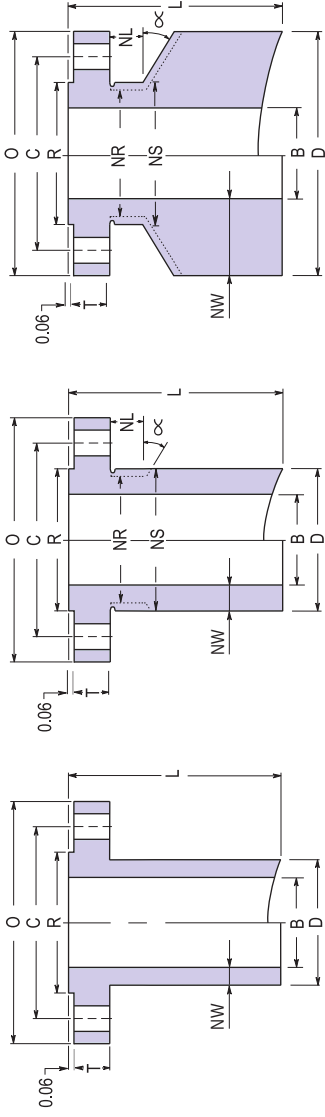


STUDDING OUTLETS



LARGE DIAMETER FLANGES





CROSS REFERENCE CHART

Connection Description	FCI	Other Designations
Long Weld Neck	LWN	LWN
Heavy Barrel	HB	H
Intermediate Barrel	- light - medium - heavy	I ₁ I ₂ I ₃
Equal Barrel	E	S
Super Barrel	SB*	Super S*
Insert Lip	Q*	M*
		Q*

*Denotes Custom Order

Size				Flange			Barrel OD			Wall Thickness			Bolting			Nut			Stud Bolt			Weights				Length
Nom	Bore LWN & E		Bore HB	OD	Thk	RF OD	LWN	HB	E	No Of Holes	Hole Size	Bolt Circle	Stop Dia	Relief Dia	Relief Length	Size	RF Length	RTJ Length	Base	Per 1"	Base	Per 1"	Base	Per 1"	E	Base
	B	B	O	T	R	D	D	D	D		D	C	NS	NR	NL		1/2	2 1/4								
1/2	0.50	0.55	3.50	0.38	1.38	1.19	1.50	3.50	1.50	4	0.62	2.38	1.50	1.19	0.75	1/2	2 1/4	2 3/4	3	0.3	5	0.4	21	2.7	9	
3/4	0.75	0.74	3.88	0.44	1.69	1.50	1.88	3.88	0.38	4	0.62	2.75	1.88	1.50	0.75	1/2	2 1/2	3	5	0.4	7	0.7	27	3.2	9	
1	1.00	0.96	4.25	0.50	2.00	1.94	2.25	4.25	0.47	4	0.62	3.12	2.25	1.94	0.75	1/2	2 1/2	3	7	0.6	10	0.9	30	3.8	9	
1 1/4	1.25	1.28	4.62	0.56	2.50	2.31	2.62	4.62	0.53	4	0.62	3.50	2.62	2.31	0.75	1/2	2 3/4	3 1/4	9	0.8	12	1.2	36	4.4	9	
1 1/2	1.50	1.50	5.00	0.63	2.88	2.56	3.00	5.00	0.53	4	0.62	3.88	3.00	2.56	0.75	1/2	2 3/4	3 1/4	11	1.0	16	1.5	41	5.1	9	
2	2.00	1.94	6.00	0.69	3.62	3.06	3.69	6.00	0.53	4	0.75	4.75	3.69	3.06	0.88	5/8	3 1/4	3 3/4	15	1.2	23	2.2	57	7.1	9	
2 1/2	2.50	2.32	7.00	0.82	4.12	3.56	4.44	7.00	0.53	4	0.75	5.50	4.44	3.56	0.88	5/8	3 1/2	4	19	1.4	34	3.2	79	10	9	
3	3.00	2.90	7.50	0.88	5.00	4.25	4.94	7.50	0.63	4	0.75	6.00	4.94	4.25	0.88	5/8	3 1/2	4 1/4	25	2.0	38	3.6	86	11	9	
3 1/2	3.50	3.36	8.50	0.88	5.50	4.81	5.94	8.50	0.66	8	0.75	7.00	5.94	4.81	0.88	5/8	3 1/2	4 1/4	31	2.4	55	5.3	110	13	9	
4	4.00	3.83	9.00	0.88	6.19	5.31	6.44	9.00	0.66	8	0.75	7.50	6.44	5.31	0.88	5/8	3 1/2	4 1/4	34	2.7	78	6.0	164	14	12	
5	5.00	4.81	10.00	0.88	7.31	6.44	7.25	10.00	0.72	8	0.88	8.50	7.25	6.44	1.00	3/4	3 3/4	4 1/2	54	3.7	87	6.5	189	17	12	
6	6.00	5.76	11.00	0.94	8.50	7.56	8.25	11.00	0.78	8	0.88	9.50	8.25	7.56	1.00	3/4	4	4 1/2	69	4.7	103	7.8	216	19	12	
8	8.00	7.62	13.50	1.06	10.62	9.69	10.50	13.50	0.85	8	0.88	11.75	10.50	9.69	1.00	3/4	4 1/4	4 3/4	99	6.6	157	11	292	26	12	
10	10.00	9.56	16.00	1.13	12.75	12.00	12.81	16.00	1.00	12	1.00	14.25	12.81	12.00	1.12	7/8	4 3/4	5 1/4	143	9.8	214	16	382	35	12	
12	12.00	11.38	19.00	1.19	15.00	14.38	15.56	19.00	1.19	12	1.00	17.00	15.56	14.38	1.12	7/8	4 3/4	5 1/2	205	14	329	25	535	48	12	
14	14.00	14.00	21.00	1.32	16.25	15.75	17.12	21.00	0.88	12	1.12	18.75	17.12	15.75	1.25	1	5 1/4	6	191	12	296	22	585	55	12	
16	16.00	16.00	23.50	1.38	18.50	18.00	19.62	23.50	1.00	16	1.12	21.25	19.62	18.00	1.25	1	5 1/2	6	245	15	388	29	714	66	12	
18	18.00	18.00	25.00	1.50	21.00	19.88	20.94	25.00	0.94	16	1.25	22.75	20.94	19.88	1.38	1 1/8	6	6 1/2	258	16	362	25	711	67	12	
20	20.00	20.00	27.50	1.63	23.00	22.00	23.19	27.50	1.00	20	1.25	25.00	23.19	22.00	1.38	1 1/8	6 1/4	7	311	19	434	31	840	79	12	
22	22.00	22.00	29.50	1.75	25.25	24.00	25.25	29.50	1.00	20	1.38	27.25	25.25	24.00	1.50	1 1/4	6 7/8	7 5/8	346	20	485	34	903	86	12	
24	24.00	24.00	32.00	1.82	27.25	26.12	27.50	32.00	1.06	20	1.38	29.50	27.50	26.12	1.50	1 1/4	7	7 3/4	407	24	574	40	1046	100	12	

NOTES:

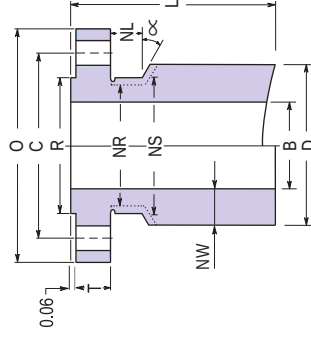
- MATERIAL:** SA 105 in accordance with ASME Section II. Other material grades and compositions available upon request. See Technical section.
- FACING:** Classes 150 and 300 flanges are regularly furnished with 1.5 mm (0.06 in.) raised face, which is in addition to the minimum flange thickness, if Classes 400, 600, 900, 1500, and 2500 flanges are regularly furnished with 6.4 mm (0.25 in.) raised face, which is in addition to the minimum flange thickness, but is included in length "L." Other standard and special facings available upon request with height or depth added to thickness "T".
- LENGTH:** Listed lengths are standards used for base weight calculations. Other lengths are available upon request.
- TOLERANCE:** Flanges are furnished to tolerances or ASME B16.5 unless otherwise specified.
- BORE:** Bore sizes listed are standard, smaller or larger bores are available upon request.
- NUT RELIEF:** All connections except LWNs will be supplied to the Nut Stop "NS" diameter listed. Unless the Nut Relier "NR" diameter is requested.
- CONTOURING:** All connections will be supplied square cut. Connection can be contoured to fit shell, head, cone, or other shape upon request.
- PRESSURE-TEMPERATURE RATING:** See Technical section.

class 150

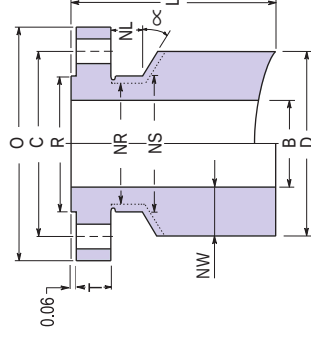
FCI INTERMEDIATE CONNECTIONS



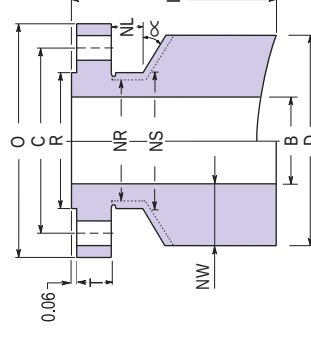
FCI Forged Components
A OneWest Company



INTERMEDIATE BARREL "1 1/4"



INTERMEDIATE BARREL "1 1/2"



INTERMEDIATE BARREL "1 3/4"



Custom barrel
connections and
other forged products
available upon request

Size		Flange			Barrel OD			Wall Thickness			Bolting		Nut			Stud Bolt			Weights				Length			
Nom	Bore	OD	Thk	RF OD	I 1	I 2	I 3	I 1	I 2	I 3	No Of Holes	Hole Size	Bolt Circle	Stop Dia	Relief Dia	Relief Length	Size	RF Length	RTJ Length	I 1	I 2	I 3				
																								O	T	R
1	0.96	4.25	0.50	2.00	2.75	3.25	4.00	0.90	1.15	1.52	4	0.62	3.12	2.25	1.94	0.75	1/2	2 1/2	3	19	1.5	26	2.2	38	3.4	12
1 1/2	1.50	5.00	0.63	2.88	3.25	4.00	4.62	0.88	1.25	1.56	4	0.62	3.88	3.00	2.56	0.75	1/2	2 3/4	3 1/4	25	1.9	37	3.1	49	4.3	12
2	1.94	6.00	0.69	3.62	4.00	4.62	5.50	1.03	1.34	1.78	4	0.75	4.75	3.69	3.06	0.88	5/8	3 1/4	3 3/4	35	2.7	48	3.9	67	5.9	12
2 1/2	2.32	7.00	0.82	4.12	4.62	5.75	6.00	1.15	1.72	1.84	4	0.75	5.50	4.44	3.56	0.88	5/8	3 1/2	4	48	3.5	73	6	81	7	12
3	2.90	7.50	0.88	5.00	5.75	6.00	6.38	1.43	1.55	1.74	4	0.75	6.00	4.94	4.25	0.88	5/8	3 1/2	4 1/4	69	5.5	75	6	85	7	12
3 1/2	3.36	8.50	0.88	5.50	6.38	7.00	7.75	1.51	1.82	2.20	8	0.75	7.00	5.94	4.81	0.88	5/8	3 1/2	4 1/4	83	7	102	8	126	11	12
4	3.83	9.00	0.88	6.19	7.00	7.75	8.25	1.59	1.96	2.21	8	0.75	7.50	6.44	5.31	0.88	5/8	3 1/2	4 1/4	95	8	119	10	137	12	12
5	4.81	10.00	0.88	7.31	7.75	8.25	8.88	1.47	1.72	2.04	8	0.88	8.50	7.25	6.44	1.00	3/4	3 3/4	4 1/2	104	8	121	10	144	12	12
6	5.76	11.00	0.94	8.50	8.88	9.88	10.38	1.56	2.06	2.31	8	0.88	9.50	8.25	7.56	1.00	3/4	4	4 1/2	126	10	167	14	188	17	12
8	7.62	13.50	1.06	10.62	11.00	11.50	12.12	1.69	1.94	2.25	8	0.88	11.75	10.50	9.69	1.00	3/4	4 1/4	4 3/4	180	14	205	17	236	20	12
10	9.56	16.00	1.13	12.75	13.50	14.25	15.12	1.97	2.35	2.78	12	1.00	14.25	12.81	12.00	1.12	7/8	4 3/4	5 1/4	337	20	399	25	474	31	16
12	11.38	19.00	1.19	15.00	16.25	17.38	18.25	2.44	3.00	3.44	12	1.00	17.00	15.56	14.38	1.12	7/8	4 3/4	5 1/2	494	30	606	38	696	45	16
14	14.00	21.00	1.32	16.25	18.25	19.38	20.12	2.13	2.69	3.06	12	1.12	18.75	17.12	15.75	1.25	1	5 1/4	6	501	31	622	40	705	47	16
16	16.00	23.50	1.38	18.50	20.12	21.00	22.25	2.06	2.50	3.13	16	1.12	21.25	19.62	18.00	1.25	1	5 1/2	6	562	33	666	41	820	53	16
18	18.00	25.00	1.50	21.00	22.25	23.25	24.12	2.13	2.63	3.06	16	1.25	22.75	20.94	19.88	1.38	1 1/8	6	6 1/2	624	38	751	48	864	57	16
20	20.00	27.50	1.63	23.00	24.12	25.00	26.25	2.06	2.50	3.13	20	1.25	25.00	23.19	22.00	1.38	1 1/8	6 1/4	7	684	41	804	50	978	64	16
22	22.00	29.50	1.75	25.25	26.50	27.75	28.38	2.25	2.88	3.19	20	1.38	27.25	25.25	24.00	1.50	1 1/4	6 7/8	6 5/8	802	48	985	63	1078	72	16
24	24.00	32.00	1.82	27.25	27.75	29.25	30.75	1.88	2.63	3.38	20	1.38	29.50	27.50	26.12	1.50	1 1/4	7	7 3/4	772	43	1007	62	1246	82	16

NOTES:

- MATERIAL:** SA 105 in accordance with ASME Section II. Other material grades and compositions available upon request. See Technical section.
- FACING:** Classes 150 and 300 flanges are regularly furnished with 1.5 mm (0.06 in.) raised face, which is in addition to the minimum flange thickness, if. Classes 400, 600, 900, 1500, and 2500 flanges are regularly furnished with 6.4 mm (0.25 in.) raised face, which is in addition to the minimum flange thickness, but is included in length "L". Other standard and special facings available upon request with height or depth added to thickness "T".
- LENGTH:** Listed lengths are standards used for base weight calculations. Other lengths are available upon request.
- TOLERANCE:** Flanges are furnished to tolerances of ASME B16.5 unless otherwise specified.

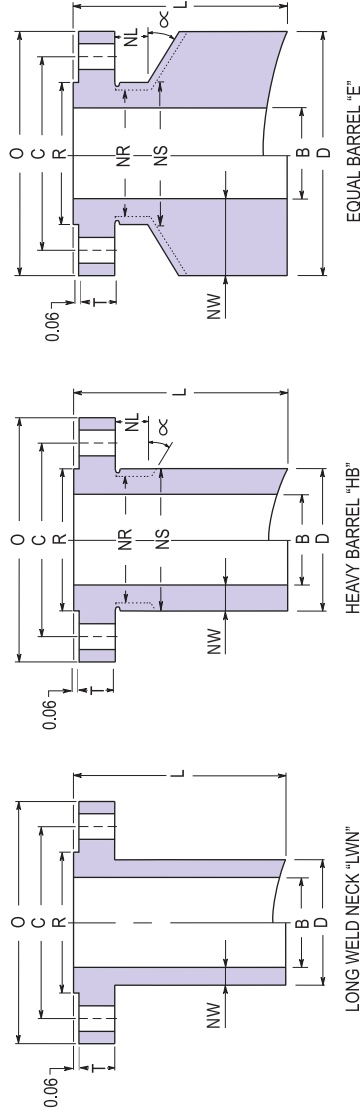
5. BORE: Bore sizes listed are standard, smaller or larger bores are available upon request.

6. NUT RELIEF: All connections except LWNs will be supplied to the Nut Stop "NS" diameter listed. Unless the Nut Relief "NR" diameter is requested.

7. CONTOURING: All connections will be supplied square cut. Connection can be contoured to fit shell, head, cone, or other shape upon request.

8. PRESSURE-TEMPERATURE RATING: See Technical section.





LONG WEIRD NECK "I WN"

HEAVY BARREL "HR"

EQUIVALENTS "E"

Size				Flange			Barrel OD			Wall Thickness				Bolting			Nut			Stud Bolt			Weights				Base	Length	
Nom	Bore LWN & HB		RF OD	Thk	OD	LWN	HB	E	LWN	HB	E	No Of Holes	Hole Size	Bolt Circle	Stop Dia	Relief Dia	Relief Length	Size	RF Length	RTJ Length	Base	LWN		HB		E			
	B	B																				Q	T	R	D	D			D
1/2	0.50	0.55	3.75	0.50	1.38	1.50	1.75	3.75	0.50	0.60	1.63	4	0.62	2.62	1.75	1.50	0.75	1/2	2 1/2	3	5	0.4	7	0.6	24	3.1	9		
3/4	0.75	0.74	4.62	0.56	1.69	1.88	2.19	4.62	0.57	0.73	1.94	4	0.75	3.25	2.19	1.88	0.88	5/8	3	3 1/2	3	9	0.7	11	0.9	37	4.6	9	
1	1.00	0.96	4.88	0.63	2.00	2.12	2.44	4.88	0.56	0.74	1.94	4	0.75	3.50	2.44	2.12	1.1	0.88	5/8	3 1/4	3 1/2	9	0.8	12	1.1	40	5.1	9	
1 1/4	1.25	1.28	5.25	0.69	2.50	2.50	2.81	5.25	0.63	0.77	2.00	4	0.75	3.88	2.81	2.50	0.88	5/8	3 1/4	3 3/4	13	1.0	15	1.4	45	5.8	9		
1 1/2	1.50	1.50	6.12	0.75	2.88	2.75	3.25	6.12	0.63	0.88	2.31	4	0.88	4.50	3.25	2.75	1.00	3/4	3 1/2	4	15	1.2	21	1.9	61	7.8	9		
2	2.00	1.94	6.50	0.82	3.62	3.31	3.94	6.50	0.66	1.00	2.25	8	0.75	5.00	3.94	3.31	0.88	5/8	3 1/2	4 1/4	20	1.5	28	2.6	68	8.5	9		
2 1/2	2.50	2.32	7.50	0.94	4.12	3.94	4.62	7.50	0.72	1.15	2.50	8	0.88	5.88	4.62	3.94	1.00	3/4	4	4 1/2	25	2.1	38	3.6	89	11	9		
3	3.00	2.90	8.25	1.06	5.00	4.62	5.38	8.25	0.81	1.24	2.63	8	0.88	6.62	5.38	4.62	1.00	3/4	4 1/4	5	35	2.7	49	4.6	106	13	9		
3 1/2	3.50	3.36	9.00	1.13	5.50	5.25	6.00	9.00	0.88	1.32	2.75	8	0.88	7.25	6.00	5.25	1.00	3/4	4 1/4	5	42	3.4	59	5.5	122	15	9		
4	4.00	3.83	10.00	1.19	6.19	5.75	6.62	10.00	0.88	1.40	3.00	8	0.88	7.88	6.62	5.75	1.00	3/4	4 3/4	5 1/4	62	3.8	91	6.5	207	19	12		
5	5.00	4.81	11.00	1.32	7.31	7.00	8.00	11.00	1.00	1.60	3.00	8	0.88	9.25	8.00	7.00	1.00	3/4	4 3/4	5 1/4	84	5.3	124	9.1	241	21	12		
6	6.00	5.76	12.50	1.38	8.50	8.12	9.38	12.50	1.06	1.81	3.25	12	0.88	10.62	9.38	8.12	1.00	3/4	4 3/4	5 3/4	105	6.7	165	12	303	27	12		
8	8.00	7.62	15.00	1.56	10.62	10.25	11.56	15.00	1.13	1.97	3.50	12	1.00	13.00	11.56	10.25	1.12	7/8	5 1/2	6 1/4	148	9.1	228	17	405	36	12		
10	10.00	9.96	17.50	1.82	12.75	12.62	13.62	17.50	1.31	2.03	3.75	16	1.12	15.25	13.62	12.62	1.25	1	6 1/4	7 1/4	210	13	291	21	499	46	12		
12	12.00	11.38	20.50	1.94	15.00	14.75	15.94	20.50	1.38	2.28	4.25	16	1.25	17.75	15.94	14.75	1.38	1 1/8	6 3/4	7 1/2	275	16	392	28	651	61	12		
14	14.00	14.00	23.00	2.06	16.25	16.75	18.44	23.00	1.38	2.22	4.50	20	1.25	20.25	18.44	16.75	1.38	1 1/8	7	7 3/4	324	19	456	32	785	74	12		
16	16.00	16.00	25.50	2.19	18.50	19.00	20.50	25.50	1.50	2.25	4.75	20	1.38	22.50	20.50	19.00	1.50	1 1/4	7 1/2	8 1/4	404	23	529	37	914	88	12		
18	18.00	18.00	28.00	2.32	21.00	21.00	22.75	28.00	1.50	2.38	5.00	24	1.38	24.75	22.75	21.00	1.50	1 1/4	7 3/4	8 1/4	465	26	630	43	1066	102	12		
20	20.00	20.00	30.50	2.44	23.00	23.12	25.00	30.50	1.56	2.50	5.25	24	1.38	27.00	25.00	23.12	1.50	1 1/4	8 1/4	9 1/4	549	30	741	50	1228	118	12		
22	22.00	22.00	33.00	2.56	25.25	25.25	26.88	33.00	1.63	2.44	5.50	24	1.62	29.25	26.88	25.25	1.75	1 1/2	9 1/4	10	631	34	808	53	1357	135	12		
24	24.00	24.00	36.00	2.69	27.25	27.62	29.62	36.00	1.81	2.81	6.00	24	1.62	32.00	29.62	27.62	1.75	1 1/2	9 1/4	10 1/4	778	43	1016	67	1627	160	12		

NOTES:

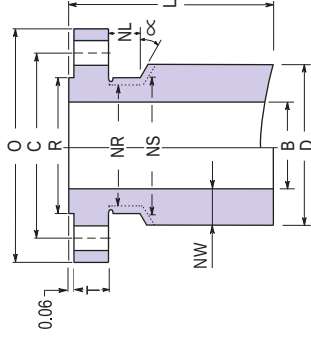
1. **MATERIAL:** SA 105 in accordance with ASME Section II. Other material grades and compositions available upon request.
2. **FACING:** Classes 150 and 300 flanges are regularly furnished with 1.5 mm (0.06 in.) raised face, which is in addition to the minimum flange thickness. If Classes 400, 600, 900, 1500, and 2500 flanges are regularly furnished with 6.4 mm (0.25 in.) raised face, which is in addition to the minimum flange thickness, but is included in length "L" Other standard and special facings available upon request with height or depth added to thickness "T".
3. **LENGTH** Listed lengths are standards used for base weight calculations. Other lengths are available upon request.
4. **TOLERANCE:** Flanges are furnished to tolerances of ASME B16.5 unless otherwise specified.
5. **BORE:** Bore sizes listed are standard, smaller or larger bores are available upon request.
6. **NUT RELIEF:** All connections except LVNMs will be supplied to the Nut Stop "NS" diameter listed.
7. **UNTOUCHING:** All connections will be supplied square cut. Connection can be contoured to fit shell, head, cone, or other shape upon request.
8. **PRESSURE-TEMPERATURE RATING:** See Technical section.

class 300

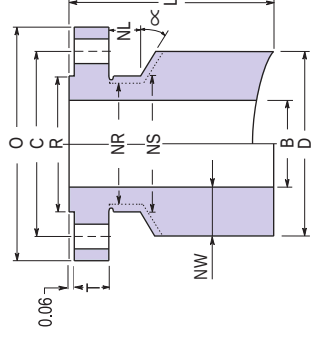
FCI INTERMEDIATE CONNECTIONS



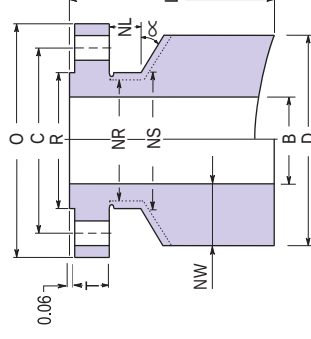
FCI Forged Components
A OneWest Company



INTERMEDIATE BARREL "1" 1



INTERMEDIATE BARREL "1" 2



INTERMEDIATE BARREL "1" 3



30° Min
Sect VIII DIV I
45° Min
Sect VIII DIV II

Size			Flange			Barrel OD			Wall Thickness			Bolting			Nut			Stud Bolt			Weights						Length				
Nom	Bore		OD	Thk	RF OD	I 1	I 2	I 3	I 1	I 2	I 3	No Of Holes	Hole Size	Bolt Circle	Stop Dia	Relief Dia	Relief Length	Size	RF Length	RTJ Length	Base	I 1	I 2	I 3	Base	Per 1"	Base	Per 1"	Base	Per 1"	Base
	B		O	T	R	D	D	D	NW	NW	NW			C	NS	NR	NL														L
1	0.96		4.88	0.63	2.00	2.75	3.75	4.00	0.90	1.40	1.52	4	0.75	3.50	2.44	2.12	0.88	5/8	3 1/4	3 1/2	20	1.5	34	2.9	39	3.4	12				12
1 1/2	1.50		6.12	0.75	2.88	4.00	4.62	5.50	1.25	1.56	2.00	4	0.88	4.50	3.25	2.75	1.00	3/4	3 1/2	4	39	3.1	51	4.3	70	6.2	12				12
2	1.94		6.50	0.82	3.62	4.62	5.50	6.00	1.34	1.78	2.03	8	0.75	5.00	3.94	3.31	0.88	5/8	3 1/2	4 1/4	49	3.9	69	5.9	81	7.2	12				12
2 1/2	2.32		7.50	0.94	4.12	5.75	6.00	6.38	1.72	1.84	2.03	8	0.88	5.88	4.62	3.94	1.00	3/4	4	4 1/2	72	6.2	80	6.8	90	7.8	12				12
3	2.90		8.25	1.06	5.00	6.00	6.38	7.00	1.55	1.74	2.05	8	0.88	6.62	5.38	4.62	1.00	3/4	4 1/4	5	78	6.1	88	7.2	106	9	12				12
3 1/2	3.36		9.00	1.13	5.50	7.00	7.75	8.25	1.82	2.20	2.45	8	0.88	7.25	6.00	5.25	1.00	3/4	4 1/4	5	104	8.4	127	11	144	13	12				12
4	3.83		10.00	1.19	6.19	7.00	7.75	8.88	1.59	1.96	2.53	8	0.88	7.88	6.62	5.75	1.00	3/4	4 1/2	5 1/4	102	7.6	125	10	164	14	12				12
5	4.81		11.00	1.32	7.31	8.25	8.88	9.88	1.72	2.04	2.54	8	0.88	9.25	8.00	7.00	1.00	3/4	4 3/4	5 1/4	133	10	155	12	194	17	12				12
6	5.76		12.50	1.38	8.50	9.88	10.38	11.00	2.06	2.31	2.62	12	0.88	10.62	9.38	8.12	1.00	3/4	4 3/4	5 3/4	185	14	206	17	233	20	12				12
8	7.62		15.00	1.56	10.62	12.12	13.50	14.25	2.25	2.94	3.32	12	1.00	13.00	11.56	10.25	1.12	7/8	5 1/2	6 1/4	255	20	324	28	364	32	12				12
10	9.56		17.50	1.82	12.75	14.25	15.12	16.25	2.35	2.78	3.35	16	1.12	15.25	13.62	12.62	1.25	1	6 1/4	7 1/4	425	25	498	31	591	38	16				16
12	11.38		20.50	1.94	15.00	16.25	17.38	18.25	2.44	3.00	3.44	16	1.25	17.75	15.94	14.75	1.38	1 1/8	6 3/4	7 1/2	532	30	636	38	720	45	16				16
14	14.00		23.00	2.06	16.25	19.38	20.12	22.25	2.69	3.06	4.13	20	1.25	20.25	18.44	16.75	1.38	1 1/8	7	7 3/4	681	40	761	47	996	67	16				16
16	16.00		25.50	2.19	18.50	22.25	23.25	24.12	3.13	3.63	4.06	20	1.38	22.50	20.50	19.00	1.50	1 1/4	7 1/2	8 1/2	877	53	988	63	1099	73	16				16
18	18.00		28.00	2.32	21.00	24.12	25.12	26.75	3.06	3.56	4.38	24	1.38	24.75	22.75	21.00	1.50	1 1/4	7 3/4	8 1/4	982	57	1102	68	1314	87	16				16
20	20.00		30.50	2.44	23.00	26.75	27.75	29.25	3.38	3.88	4.63	24	1.38	27.00	25.00	23.12	1.50	1 1/4	8 1/4	9 1/4	1176	70	1316	82	1525	101	16				16
22	22.00		33.00	2.56	25.25	29.25	30.25	31.50	3.63	4.13	4.75	24	1.62	29.25	26.88	25.25	1.75	1 1/2	9	10	1354	83	1497	96	1677	113	16				16
24	24.00		36.00	2.69	27.25	30.75	32.00	33.62	3.38	4.00	4.81	24	1.62	32.00	29.62	27.62	1.75	1 1/2	9 1/4	10 1/4	1455	82	1647	100	1899	123	16				16

NOTES:

- MATERIAL:** SA 105 in accordance with ASME Section II. Other material grades and compositions available upon request. See Technical section.
- FACING:** Classes 150 and 300 flanges are regularly furnished with 1.5 mm (0.06 in.) raised face, which is in addition to the minimum flange thickness, if Classes 400, 600, 900, 1500, and 2500 flanges are regularly furnished with 6.4 mm (0.25 in.) raised face, which is in addition to the minimum flange thickness, but is included in length "L". Other standard and special facings available upon request with height or depth added to thickness "T".
- LENGTH:** Listed lengths are standards used for base weight calculations. Other lengths are available upon request.
- TOLERANCE:** Flanges are furnished to tolerances of ASME B16.5 unless otherwise specified.

- BORE:** Bore sizes listed are standard, smaller or larger bores are available upon request.
- NUT RELIEF:** All connections except LWNs will be supplied to the Nut Stop "NS" diameter listed. Unless the Nut Relief "NR" diameter is requested.
- CONTOURING:** All connections will be supplied square cut. Connection can be contoured to fit shell, head, cone, or other shape upon request.
- PRESSURE-TEMPERATURE RATING:** See Technical section.

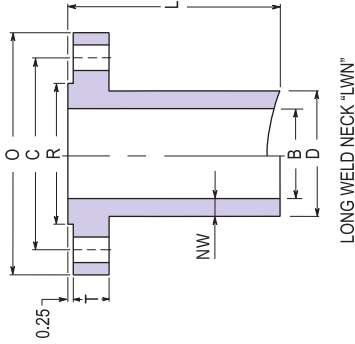


class 400

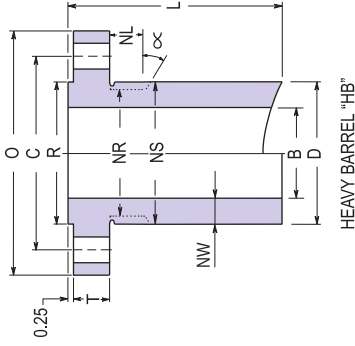
FCI STANDARD CONNECTIONS



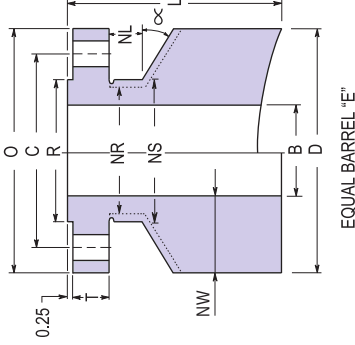
FCI Forged Components
A OneWest Company



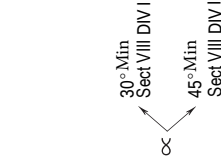
LONG WELD NECK "LWN"



HEAVY BARREL "HB"



EQUAL BARREL "E"



CROSS REFERENCE CHART

Connection Description	FCI	Other Designations
Long Weld Neck	LWN	LWN
Heavy Barrel	HB	H
Intermediate Barrel	- light - medium - heavy	I 1 I 2 I 3
Equal Barrel	E	S
Super Barrel	SB*	Super S*
Insert Lip	Q*	M*

*Denotes Custom Order

Size			Flange			Barrel OD			Wall Thickness			Bolting			Nut			Stud Bolt			Weights						Length						
Nom	Bore LWN & E		Bore HB	OD	Thk	RF OD	LWN	HB	E	D	D	D	LWN	HB	E	No Of Holes	Hole Size	Bolt Circle	Stop Dia	Relief Dia	Relief Length	Size	RF Length	RTJ Length	Base	Per 1"	Base	Per 1"	Base	Per 1"	Base	Per 1"	Length
1/2	0.50	0.55	3.75	0.56	1.38	1.50	1.75	3.75	0.60	0.60	0.62	2.62	1.75	1.50	0.75	1/2	3	3	5	0.4	7	0.6	24	3.1	5	0.4	7	0.6	24	3.1	9		
3/4	0.75	0.74	4.62	0.62	1.69	1.88	2.19	4.62	0.73	0.73	0.75	3.25	2.19	1.88	0.88	5/8	3 1/2	3 1/2	8	0.7	11	0.9	37	4.6	8	0.7	11	0.9	37	4.6	9		
1	1.00	0.96	4.88	0.69	2.00	2.12	2.44	4.88	0.74	1.94	0.75	3.25	2.44	2.12	0.88	5/8	3 1/2	3 1/2	9	0.8	12	1.1	40	5.1	9	0.8	12	1.1	40	5.1	9		
1 1/4	1.25	1.28	5.25	0.81	2.50	2.50	2.81	5.25	0.77	2.44	0.75	3.88	2.81	2.50	0.88	5/8	3 3/4	3 3/4	13	1.0	15	1.4	45	5.8	13	1.0	15	1.4	45	5.8	9		
1 1/2	1.50	1.50	6.12	0.88	2.88	2.75	3.25	6.12	0.88	2.31	0.88	4.50	3.25	2.75	1.00	3/4	4 1/4	4 1/4	16	1.2	21	1.9	61	7.8	16	1.2	21	1.9	61	7.8	9		
2	2.00	1.94	6.50	1.00	3.62	3.31	3.94	6.50	0.88	2.25	0.88	5.00	3.94	3.31	0.88	5/8	4 1/4	4 1/4	20	1.5	29	2.6	68	8.5	20	1.5	29	2.6	68	8.5	9		
2 1/2	2.50	2.32	7.50	1.12	4.12	3.94	4.62	7.50	0.72	2.50	0.88	5.88	4.62	3.94	1.00	3/4	4 3/4	4 3/4	27	2.1	39	3.6	88	11	27	2.1	39	3.6	88	11	9		
3	3.00	2.90	8.25	1.25	5.00	4.62	5.38	8.25	0.81	2.63	0.88	6.62	5.38	4.62	1.00	3/4	5	5	36	2.7	50	4.6	104	13	36	2.7	50	4.6	104	13	9		
3 1/2	3.50	3.36	9.00	1.38	5.50	5.25	5.81	9.00	0.88	1.23	1.00	7.25	5.81	5.25	1.12	7/8	5 1/2	5 1/2	45	3.4	61	5.5	116	15	45	3.4	61	5.5	116	15	9		
4	4.00	3.83	10.00	1.38	6.19	5.75	6.44	10.00	0.88	1.31	1.00	7.88	6.44	5.75	1.12	7/8	5 1/2	5 1/2	65	3.8	93	6.5	197	19	65	3.8	93	6.5	197	19	12		
5	5.00	4.81	11.00	1.50	7.31	7.00	7.81	11.00	1.00	1.50	1.00	9.25	7.81	7.00	1.12	7/8	5 3/4	5 3/4	88	5.3	127	9.1	229	22	88	5.3	127	9.1	229	22	12		
6	6.00	5.76	12.50	1.62	8.50	8.12	9.19	12.50	1.06	1.72	1.00	10.62	9.19	8.12	1.12	7/8	6	6	110	6.7	169	12	286	27	110	6.7	169	12	286	27	12		
8	8.00	7.62	15.00	1.88	10.62	10.25	11.38	15.00	1.13	1.88	1.12	13.00	11.38	10.25	1.25	1	6 3/4	6 3/4	154	9.1	233	17	379	36	154	9.1	233	17	379	36	12		
10	10.00	9.56	17.50	2.12	12.75	12.62	13.44	17.50	1.31	1.94	1.25	15.25	13.44	12.62	1.38	1 1/8	7 1/2	7 1/2	218	13	298	21	475	46	218	13	298	21	475	46	12		
12	12.00	11.38	20.50	2.25	15.00	14.75	15.75	20.50	1.38	2.19	1.38	17.75	15.75	14.75	1.50	1 1/4	8	8	285	16	401	28	627	62	285	16	401	28	627	62	12		
14	14.00	14.00	23.00	2.38	16.25	16.75	18.25	23.00	1.38	2.13	1.38	20.25	18.25	16.75	1.50	1 1/4	8 1/4	8 1/4	336	19	467	32	758	74	336	19	467	32	758	74	12		
16	16.00	16.00	25.50	2.50	18.50	19.00	20.31	25.50	1.50	2.16	1.50	22.50	20.31	19.00	1.62	1 3/8	8 3/4	8 3/4	418	23	542	37	884	88	418	23	542	37	884	88	12		
18	18.00	18.00	28.00	2.62	21.00	21.00	22.56	28.00	1.50	2.28	1.50	24.75	22.56	21.00	1.62	1 3/8	9	9	482	26	645	43	1033	102	482	26	645	43	1033	102	12		
20	20.00	20.00	30.50	2.75	23.00	23.12	24.63	30.50	1.56	2.32	1.56	27.00	24.63	23.12	1.75	1 1/2	9 1/2	9 1/2	568	30	759	50	1165	118	568	30	759	50	1165	118	12		
22	22.00	22.00	33.00	2.88	25.25	25.25	26.69	33.00	1.63	2.35	1.63	29.25	26.69	25.25	1.88	1 5/8	10 1/4	10 3/4	652	34	799	51	1308	135	652	34	799	51	1308	135	12		
24	24.00	24.00	36.00	3.00	27.25	27.62	29.25	36.00	1.81	2.63	1.88	32.00	29.25	27.62	2.00	1 3/4	10 1/2	11	804	42	1040	67	1540	160	804	42	1040	67	1540	160	12		

NOTES:

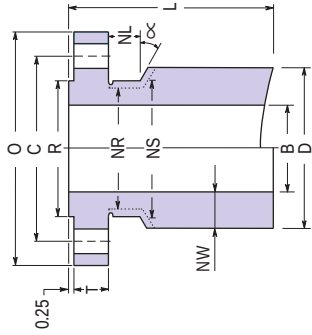
- MATERIAL:** SA 105 in accordance with ASME Section II. Other material grades and compositions available upon request.
- FACING:** Classes 150 and 300 flanges are regularly furnished with 1.5 mm (0.06 in.) raised face, which is in addition to the minimum flange thickness, if Classes 400, 600, 900, 1500, and 2500 flanges are regularly furnished with 6.4 mm (0.25 in.) raised face, which is in addition to the minimum flange thickness, but is included in length "L". Other standard and special facings available upon request with height or depth added to thickness "T".
- LENGTH:** Listed lengths are standards used for base weight calculations. Other lengths are available upon request.
- TOLERANCE:** Flanges are furnished to tolerances or ASME B16.5 unless otherwise specified.
- BORE:** Bore sizes listed are standard, smaller or larger bores are available upon request.
- NUT RELIEF:** All connections except LWNs will be supplied to the Nut Stop "NS" diameter listed. Unless the Nut Relier "NR" diameter is requested.
- CONTOURING:** All connections will be supplied square cut. Connection can be contoured to fit shell, head, cone, or other shape upon request.
- PRESSURE-TEMPERATURE RATING:** See Technical section.

class 400

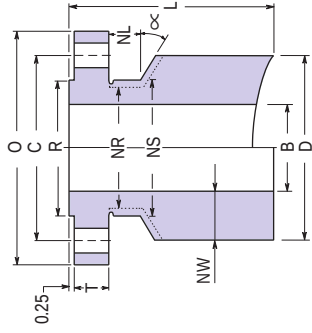
FCI INTERMEDIATE CONNECTIONS



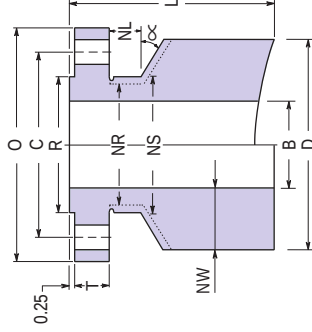
FCI Forged Components
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INTERMEDIATE BARREL "I" 1"



INTERMEDIATE BARREL "I" 2"



INTERMEDIATE BARREL "I" 3"



Size		Flange			Barrel OD			Wall Thickness			Bolting			Nut		Stud Bolt			Weights						Length						
Nom	Bore	OD	Thk	RF OD	I 1	I 2	I 3	I 1	I 2	I 3	No Of Holes	Hole Size	Bolt Circle	Stop Dia	Relief Dia	Relief Length	Size	RF Length	RTJ Length	I 1		I 2		I 3		Base	Per 1"	Base	Per 1"	Base	Per 1"
	B	O	T	R	D	D	D	NW	NW	NW			C	NS	NR	NL					Base	Per 1"	Base	Per 1"	Base	Per 1"					
1	0.96	4.88	0.89	2.00	2.75	3.25	4.00	0.90	1.15	1.52	4	0.75	3.50	2.44	2.12	0.88	5/8	3 1/2	3 1/2	20	1.5	27	39	3.4	20	1.5	27	39	3.4	12	
1 1/2	1.50	6.12	0.88	2.88	4.00	4.62	5.50	1.25	1.56	2.00	4	0.88	4.50	3.25	2.75	1.00	3/4	4 1/4	4 1/4	39	3.1	51	69	6.2	39	3.1	51	69	6.2	12	
2	1.94	6.50	1.00	3.62	4.62	5.50	6.60	1.34	1.78	2.03	8	0.75	5.00	3.94	3.31	0.88	5/8	4 1/4	4 1/4	49	3.9	69	95	8.9	49	3.9	69	95	8.9	12	
2 1/2	2.32	7.50	1.12	4.12	5.75	6.00	6.38	1.72	1.84	2.03	8	0.88	5.88	4.62	3.94	1.00	3/4	4 3/4	4 3/4	73	6.2	81	90	7.8	73	6.2	81	90	7.8	12	
3	2.90	8.25	1.25	5.00	6.00	6.38	7.00	1.55	1.74	2.05	8	0.88	6.62	5.38	4.62	1.00	3/4	5	5	79	6.1	89	106	9	79	6.1	89	106	9	12	
3 1/2	3.36	9.00	1.38	5.50	7.00	7.75	8.25	1.82	2.20	2.45	8	1.00	7.25	5.81	5.25	1.12	7/8	5 1/2	5 1/2	106	8.4	128	145	13	106	8.4	128	145	13	12	
4	3.83	10.00	1.38	6.19	7.00	7.75	8.88	1.59	1.96	2.53	8	1.00	7.88	6.44	5.75	1.12	7/8	5 1/2	5 1/2	104	7.6	126	140	14	104	7.6	126	140	14	12	
5	4.81	11.00	1.50	7.31	8.25	8.88	9.88	1.72	2.04	2.54	8	1.00	9.25	7.81	7.00	1.12	7/8	5 3/4	5 3/4	135	10	157	172	17	135	10	157	172	17	12	
6	5.76	12.50	1.62	8.50	9.88	10.38	11.00	2.06	2.31	2.62	12	1.00	10.62	9.19	8.12	1.12	7/8	6	6	188	14	208	235	20	188	14	208	235	20	12	
8	7.62	15.00	1.88	10.62	12.12	13.50	14.25	2.25	2.94	3.32	12	1.12	13.00	11.38	10.25	1.25	1	6 3/4	6 3/4	259	20	327	366	32	259	20	327	366	32	12	
10	9.56	17.50	2.12	12.75	14.25	15.12	16.25	2.35	2.78	3.35	16	1.25	15.25	13.44	12.62	1.38	1 1/8	7 1/2	7 1/2	431	25	502	594	38	431	25	502	594	38	16	
12	11.38	20.50	2.25	15.00	16.25	17.38	18.25	2.44	3.00	3.44	16	1.38	17.75	15.75	14.75	1.50	1 1/4	8	8	539	30	641	724	45	539	30	641	724	45	16	
14	14.00	23.00	2.38	16.25	19.38	20.12	22.25	2.69	3.06	4.13	20	1.38	20.25	18.25	16.75	1.50	1 1/4	8 1/4	8 1/4	690	40	768	874	67	690	40	768	874	67	16	
16	16.00	25.50	2.50	18.50	22.25	23.25	24.12	3.13	3.63	4.06	20	1.50	22.50	20.31	19.00	1.62	1 3/8	8 3/4	8 3/4	887	53	980	1078	73	887	53	980	1078	73	16	
18	18.00	28.00	2.62	21.00	24.12	25.12	26.75	3.06	3.56	4.38	24	1.50	24.75	22.56	21.00	1.62	1 3/8	9	9	982	57	1102	1284	87	982	57	1102	1284	87	16	
20	20.00	30.50	2.75	23.00	26.75	27.75	29.25	3.38	3.88	4.63	24	1.62	27.00	24.63	23.12	1.75	1 1/2	9 1/2	9 3/4	1176	70	1283	1476	101	1176	70	1283	1476	101	16	
22	22.00	33.00	2.88	25.25	29.25	30.25	31.50	3.63	4.13	4.81	24	1.75	29.25	26.69	25.25	1.88	1 5/8	10 1/4	10 3/4	1340	83	1474	1643	113	1340	83	1474	1643	113	16	
24	24.00	36.00	3.00	27.25	30.75	32.00	33.62	3.38	4.00	4.81	24	1.88	32.00	29.25	27.62	2.00	1 3/4	10 1/2	11	1437	82	1614	1844	123	1437	82	1614	1844	123	16	

NOTES:

1. **MATERIAL:** SA 105 in accordance with ASME Section II. Other material grades and compositions available upon request.

See Technical section.

2. **FACING:** Classes 150 and 300 flanges are regularly furnished with 1.5 mm (0.06 in.) raised face, which is in addition to the minimum flange thickness, t. Classes 400, 600, 900, 1500, and 2500 flanges are regularly furnished with 6.4 mm (0.25 in.) raised face, which is in addition to the minimum flange thickness, but is included in length "L." Other standard and special facings available upon request with height or depth added to thickness "T".

3. **LENGTH** Listed lengths are standards used for base weight calculations. Other lengths are available upon request.

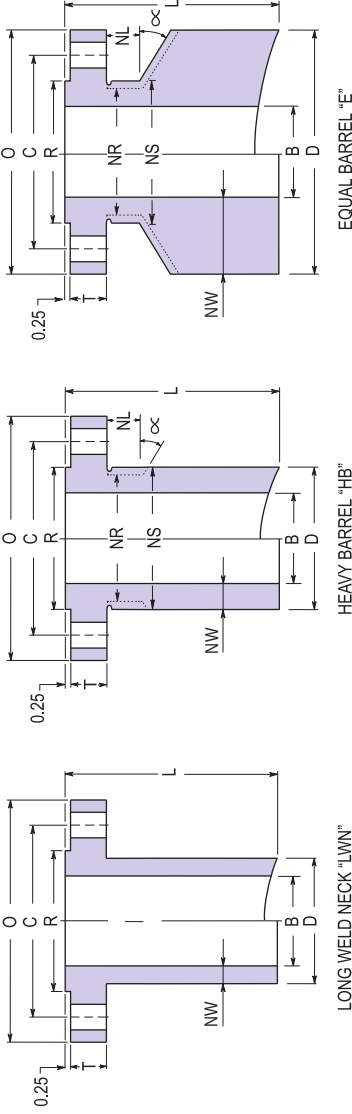
4. **TOLERANCE:** Flanges are furnished to tolerances of ASME B16.5 unless otherwise specified.

5. **BORE:** Bore sizes listed are standard, smaller or larger bores are available upon request.

6. **NUT RELIEF:** All connections except LWNs will be supplied to the Nut Stop "NS" diameter listed. Unless the Nut Relief "NR" diameter is requested.

7. **CONTOURING:** All connections will be supplied square cut. Connection can be contoured to fit shell, head, cone, or other shape upon request.

8. **PRESSURE-TEMPERATURE RATING:** See Technical section.



CROSS REFERENCE CHART

Connection Description	FCI	Other Designations
Long Weld Neck	LWN	LWN
Heavy Barrel	HB	H
Intermediate Barrel	- light - medium - heavy	I ₁ I ₂ I ₃
Equal Barrel	E	S
Super Barrel	SB*	Super S*
Insert Lip	Q*	M*
		Q*

*Denotes Custom Order

Size			Flange			Barrel OD			Wall Thickness			Bolting			Nut			Stud Bolt			Weights				Length			
Nom	Bore		OD	Thk	RF OD	LWN	HB	E	LWN	HB	E	No Of Holes	Hole Size	Bolt Circle	Stop Dia	Relief Dia	Relief Length	Size	RF Length	RTJ Length	Base	Per 1"	Base	Per 1"		Base	Per 1"	
	Bore LWN & E	HB																							B			B
1/2	0.50	0.55	3.75	0.56	1.38	1.50	1.75	3.75	0.50	0.60	1.63	4	0.62	2.62	1.75	1.50	0.75		1/2	3		5	0.4	7	0.6	24	3.1	9
3/4	0.75	0.74	4.62	0.62	1.69	1.88	2.19	4.62	0.57	0.73	1.94	4	0.75	3.25	2.19	1.88	0.88		5/8	3 1/2	3 1/2	8	0.7	11	0.9	36	4.6	9
1	1.00	0.96	4.88	0.69	2.00	2.12	2.44	4.88	0.56	0.74	1.94	4	0.75	3.25	2.44	2.12	0.88		5/8	3 1/2	3 1/2	9	0.8	12	1.1	39	5.1	9
1 1/4	1.25	1.28	5.25	0.81	2.50	2.50	2.81	5.25	0.63	0.77	2.00	4	0.75	3.88	2.81	2.50	0.88		5/8	3 3/4	3 3/4	13	1.0	15	1.4	44	5.8	9
1 1/2	1.50	1.50	6.12	0.88	2.88	2.75	3.25	6.12	0.63	0.88	2.31	4	0.88	4.50	3.25	2.75	1.00		3/4	4 1/4	4 1/4	16	1.2	21	1.9	59	7.8	9
2	2.00	1.94	6.50	1.00	3.62	3.31	3.94	6.50	0.66	1.00	2.25	8	0.75	5.00	3.94	3.31	0.88		5/8	4 1/4	4 1/4	20	1.5	29	2.6	67	8.5	9
2 1/2	2.50	2.32	7.50	1.12	4.12	3.94	4.62	7.50	0.72	1.15	2.50	8	0.88	5.88	4.62	3.94	1.00		3/4	5	4 3/4	27	2.1	39	3.6	85	11	9
3	3.00	2.90	8.25	1.25	5.00	4.62	5.38	8.25	0.81	1.24	2.63	8	0.88	6.62	5.38	4.62	1.00		3/4	5	5 1/4	36	2.7	50	4.6	104	13	9
3 1/2	3.50	3.36	9.00	1.38	5.50	5.25	5.81	9.00	0.88	1.23	2.75	8	1.00	7.25	5.81	5.25	1.12		7/8	5 1/2	5 1/2	45	3.4	57	5.0	116	15	9
4	4.00	3.83	10.75	1.50	6.19	6.00	7.06	10.75	1.00	1.62	3.38	8	1.00	8.50	7.06	6.00	1.12		7/8	5 3/4	6	77	4.5	113	7.8	238	22	12
5	5.00	4.81	13.00	1.75	7.31	7.44	8.88	13.00	1.22	2.04	4.00	8	1.12	10.50	8.88	7.44	1.25		1	6 1/2	6 1/2	123	7	180	12	336	32	12
6	6.00	5.76	14.00	1.88	8.50	8.75	9.88	14.00	1.38	2.06	4.00	12	1.12	11.50	9.88	8.75	1.25		1	6 3/4	7	152	9	207	14	373	36	12
8	8.00	7.62	16.50	2.19	10.62	10.75	11.94	16.50	1.38	2.16	4.25	12	1.25	13.75	11.94	10.75	1.38		1 1/8	7 3/4	8	207	11	277	19	478	46	12
10	10.00	9.56	20.00	2.50	12.75	13.50	15.00	20.00	1.75	2.72	5.00	16	1.38	17.00	15.00	13.50	1.50		1 1/4	8 1/2	8 3/4	324	18	433	30	683	67	12
12	12.00	11.38	22.00	2.62	15.00	15.75	17.25	22.00	1.88	2.94	5.00	20	1.38	19.25	17.25	15.75	1.50		1 1/4	8 3/4	9	393	23	533	37	779	76	12
14	14.00	14.00	23.75	2.75	16.25	17.00	18.56	23.75	1.50	2.28	4.88	20	1.50	20.75	18.56	17.00	1.62		1 3/8	9 1/4	9 1/2	471	21	631	33	1149	82	16
16	16.00	16.00	27.00	3.00	18.50	19.50	21.38	27.00	1.75	2.69	5.50	20	1.62	23.75	21.38	19.50	1.75		1 1/2	10	10 1/4	638	28	856	45	1471	105	16
18	18.00	18.00	29.25	3.25	21.00	21.50	23.19	29.25	1.75	2.60	5.63	20	1.75	25.75	23.19	21.50	1.88		1 5/8	10 3/4	11	731	31	941	48	1628	118	16
20	20.00	20.00	32.00	3.50	23.00	24.00	25.94	32.00	2.00	2.97	6.00	24	1.75	28.50	25.94	24.00	1.88		1 5/8	11 1/2	11 3/4	916	39	1180	61	1920	139	16
22	22.00	22.00	34.25	3.75	25.25	26.25	27.88	34.25	2.13	2.94	6.13	24	1.88	30.62	27.88	26.25	2.00		1 3/4	12 1/2	13	1059	46	1294	65	2093	153	16
24	24.00	24.00	37.00	4.00	27.25	28.25	30.06	37.00	2.13	3.03	6.50	24	1.88	33.00	30.06	28.25	2.12		1 7/8	13	13 1/2	1210	49	1486	73	2376	176	16

NOTES:

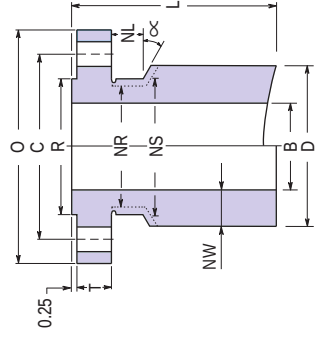
- MATERIAL:** SA 105 in accordance with ASME Section II. Other material grades and compositions available upon request. See Technical section.
- FACING:** Classes 150 and 300 flanges are regularly furnished with 1.5 mm (0.06 in.) raised face, which is in addition to the minimum flange thickness, if Classes 400, 600, 900, 1500, and 2500 flanges are regularly furnished with 6.4 mm (0.25 in.) raised face, which is in addition to the minimum flange thickness, but is included in length "L." Other standard and special facings available upon request with height or depth added to thickness "T".
- LENGTH:** Listed lengths are standards used for base weight calculations. Other lengths are available upon request.
- TOLERANCE:** Flanges are furnished to tolerances or ASME B16.5 unless otherwise specified.
- BORE:** Bore sizes listed are standard, smaller or larger bores are available upon request.
- NUT RELIEF:** All connections except LWNs will be supplied to the Nut Stop "NS" diameter listed. Unless the Nut Relier "NR" diameter is requested.
- CONTOURING:** All connections will be supplied square cut. Connection can be contoured to fit shell, head, cone, or other shape upon request.
- PRESSURE-TEMPERATURE RATING:** See Technical section.

class 600

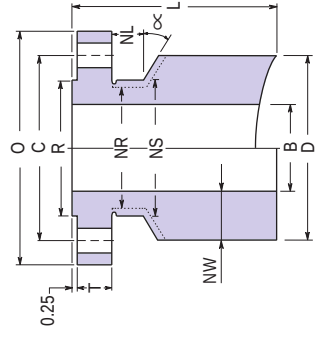
FCI INTERMEDIATE CONNECTIONS



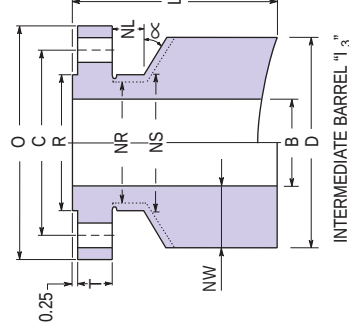
FCI Forged Components
A OneWest Company



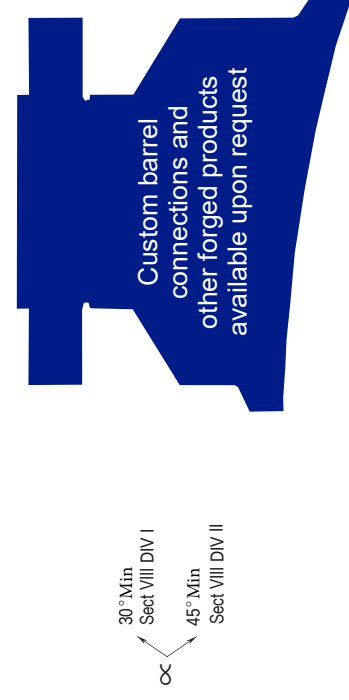
INTERMEDIATE BARREL "1 1/2"



INTERMEDIATE BARREL "1 2"



INTERMEDIATE BARREL "1 3"

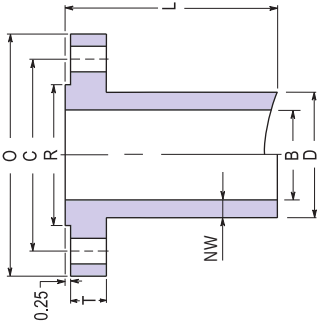


Size		Flange			Barrel OD			Wall Thickness			Bolting		Nut			Stud Bolt			Weights				Length						
Nom	Bore	OD	Thk	RF OD	I 1	I 2	I 3	I 1	I 2	I 3	No Of Holes	Hole Size	Bolt Circle	Stop Dia	Relief Dia	Relief Length	Size	RF Length	RTJ Length	I 1	I 2	I 3	Base	Per 1"	Base	Per 1"	Base	Per 1"	Base
	B	O	T	R	D	D	D	NW	NW	NW			C	NS	NR	NL				Base	Per 1"	Base	Per 1"	Base	Per 1"	Base	Per 1"	Base	Per 1"
1	0.96	4.88	0.69	2.00	3.25	4.00	4.62	1.15	1.52	1.84	4	0.75	3.50	2.44	2.12	0.88	5/8	3 1/2	3 1/2	26	2.2	38	3.4	50	4.6				
1 1/2	1.50	6.12	0.88	2.88	4.00	4.62	5.00	1.25	1.56	2.00	4	0.88	4.50	3.25	2.75	1.00	3/4	4 1/4	4 1/4	39	3.1	50	4.3	69	6.2	12			
2	1.94	6.50	1.00	3.62	4.62	5.50	6.00	1.34	1.78	2.03	8	0.75	5.00	3.94	3.31	0.88	5/8	4 1/4	4 1/2	50	3.9	69	5.9	81	7.2	12			
2 1/2	2.32	7.50	1.12	4.12	5.75	6.38	7.00	1.72	2.03	2.34	8	0.88	5.88	4.62	3.94	1.00	3/4	5	4 3/4	83	6.2	98	7.9	105	9.7	12			
3	2.90	8.25	1.28	5.00	6.38	7.00	7.75	1.74	2.05	2.43	8	0.88	6.62	5.38	4.62	1.00	3/4	5	5 1/4	88	7.2	105	9.0	127	11.5	12			
3 1/2	3.36	9.00	1.35	5.50	7.00	7.75	8.25	1.82	2.20	2.45	8	1.00	7.25	5.81	5.25	1.12	7/8	5 1/2	5 1/2	103	8.4	124	10.9	140	12.6	12			
4	3.83	10.75	1.50	6.19	7.75	8.88	9.88	1.96	2.53	3.03	8	1.00	8.50	7.06	6.00	1.12	7/8	5 3/4	6	132	10.1	169	14.2	205	18.4	12			
5	4.81	13.00	1.75	7.31	9.88	11.00	12.12	2.52	3.10	3.66	8	1.12	10.50	8.88	7.44	1.25	1	6 1/2	6 1/2	216	16.5	259	21.8	305	27.5	12			
6	5.76	14.00	1.88	8.50	11.00	12.12	13.25	2.62	3.18	3.75	12	1.12	11.50	9.88	8.75	1.25	1	6 3/4	7	235	20	300	25	350	32	12			
8	7.62	16.50	2.19	10.62	13.25	15.12	16.00	2.82	3.75	4.19	12	1.25	13.75	11.94	10.75	1.38	1 1/8	7 3/4	8	335	26	427	38	478	44	12			
10	9.56	20.00	2.50	12.75	16.25	17.38	18.25	3.35	3.91	4.35	16	1.38	15.00	15.00	13.50	1.50	1 1/4	8 1/2	8 3/4	650	38	747	47	824	54	16			
12	11.38	22.00	2.62	15.00	18.25	19.38	20.12	3.44	4.00	4.37	20	1.38	19.25	17.25	15.75	1.50	1 1/4	8 3/4	9	771	45	877	55	949	61	16			
14	14.00	23.75	2.75	16.25	19.38	20.12	22.25	2.69	3.06	4.13	20	1.50	20.75	18.56	17.00	1.62	1 3/8	9 1/4	9 1/2	708	40	781	47	994	67	16			
16	16.00	27.00	3.00	18.50	23.25	24.12	25.00	3.63	4.06	4.50	20	1.62	23.75	21.38	19.50	1.75	1 1/2	10	10 1/4	1055	63	1151	73	1248	82	16			
18	18.00	29.25	3.25	21.00	24.12	26.25	27.75	3.06	4.13	4.88	20	1.75	25.75	23.19	21.50	1.88	1 5/8	10 3/4	11	1044	57	1283	81	1456	99	16			
20	20.00	32.00	3.50	23.00	27.75	28.25	30.75	3.88	4.63	5.38	24	1.75	28.50	25.94	24.00	1.88	1 5/8	11 1/2	11 3/4	1398	82	1582	101	1767	121	16			
22	22.00	34.25	3.75	25.25	29.25	30.75	32.00	3.63	4.38	5.00	24	1.88	30.62	27.88	26.25	2.00	1 3/4	12 1/2	12	1465	83	1653	103	1810	120	16			
24	24.00	37.00	4.00	27.25	30.75	32.00	33.62	3.38	4.00	4.81	24	2.00	33.00	30.06	28.25	2.12	1 7/8	13	13 1/2	1574	82	1736	100	1946	123	16			

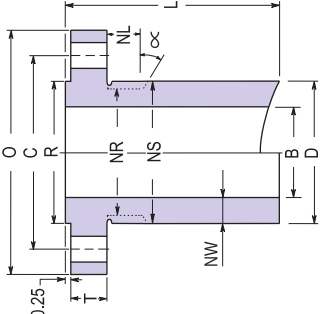
NOTES:

- MATERIAL:** SA 105 in accordance with ASME Section II. Other material grades and compositions available upon request. See Technical section.
- FACING:** Classes 150 and 300 flanges are regularly furnished with 1.5 mm (0.06 in.) raised face, which is in addition to the minimum flange thickness, tr. Classes 400, 600, 900, 1500, and 2500 flanges are regularly furnished with 6.4 mm (0.25 in.) raised face, which is in addition to the minimum flange thickness, but is included in length "L". Other standard and special facings available upon request with height or depth added to thickness "T".
- LENGTH:** Listed lengths are standards used for base weight calculations. Other lengths are available upon request.
- TOLERANCE:** Flanges are furnished to tolerances of ASME B16.5 unless otherwise specified.

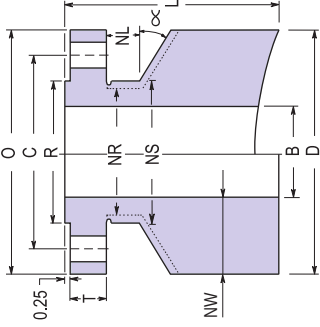
- BORE:** Bore sizes listed are standard, smaller or larger bores are available upon request.
- NUT RELIEF:** All connections except LWNs will be supplied to the Nut Stop "NS" diameter listed. Unless the Nut Relief "NR" diameter is requested.
- CONTOURING:** All connections will be supplied square cut. Connection can be contoured to fit shell, head, cone, or other shape upon request.
- PRESSURE-TEMPERATURE RATING:** See Technical section.



LONG WELD NECK "LWN"



HEAVY BARREL "HB"



EQUAL BARREL "E"



CROSS REFERENCE CHART

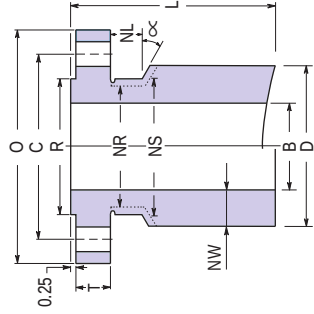
Connection Description	FCI	Other Designations
Long Weld Neck	LWN	LWN
Heavy Barrel	HB	H
Intermediate Barrel	- light - medium - heavy	I ₁ I ₂ I ₃
Equal Barrel	E	S
Super Barrel	SB*	Super S*
Insert Lip	Q*	M*
		Q*

*Denotes Custom Order

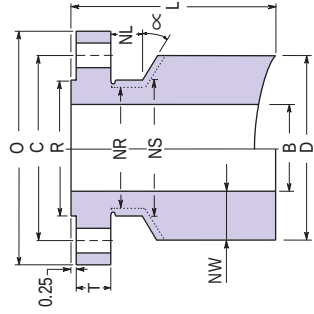
Size			Flange			Barrel OD			Wall Thickness			Bolting			Nut			Stud Bolt			Weights				Length																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
Nom	Bore LWN & HB		OD	Thk	RF OD	LWN	HB	E	No Of Holes	Hole Size	Bolt Circle	Stop Dia	Relief Dia	Relief Length	Size	RF Length	RTJ Length	LWN	HB	E		Base	Per 1"	Base	Per 1"	Base	Per 1"	Length																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
	B	B																		D	D								D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D

NOTES:

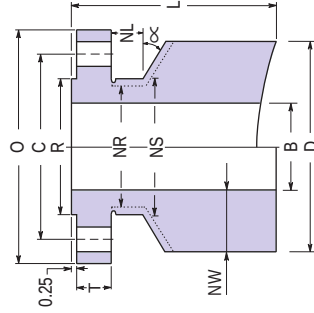
- MATERIAL:** SA 105 in accordance with ASME Section II. Other material grades and compositions available upon request. See Technical section.
- FACING:** Classes 150 and 300 flanges are regularly furnished with 1.5 mm (0.06 in.) raised face, which is in addition to the minimum flange thickness, if Classes 400, 600, 900, 1500, and 2500 flanges are regularly furnished with 6.4 mm (0.25 in.) raised face, which is in addition to the minimum flange thickness, but is included in length "L". Other standard and special facings available upon request with height or depth added to thickness "T".
- LENGTH:** Listed lengths are standards used for base weight calculations. Other lengths are available upon request.
- TOLERANCE:** Flanges are furnished to tolerances or ASME B16.5 unless otherwise specified.
- BORE:** Bore sizes listed are standard, smaller or larger bores are available upon request.
- NUT RELIEF:** All connections except LWNs will be supplied to the Nut Stop "NS" diameter listed. Unless the Nut Relier "NR" diameter is requested.
- CONTOURING:** All connections will be supplied square cut. Connection can be contoured to fit shell, head, cone, or other shape upon request.
- PRESSURE-TEMPERATURE RATING:** See Technical section.



INTERMEDIATE BARREL "I₁"



INTERMEDIATE BARREL "I" 2



INTERMEDIATE BARREL "I₃"

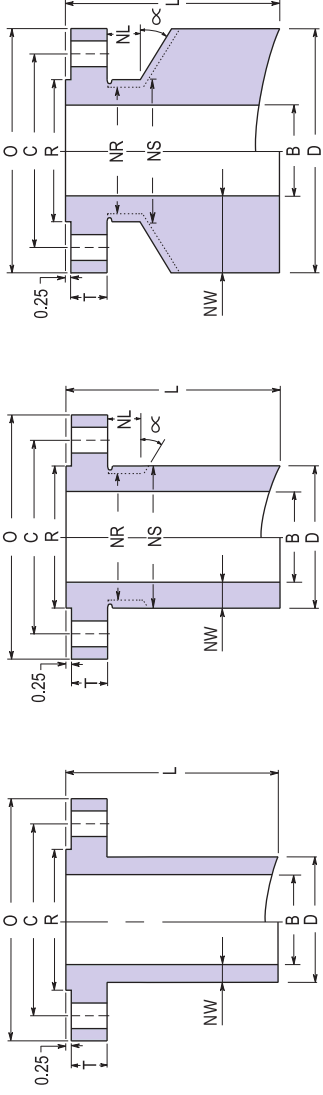


Size			Flange			Barrel OD			Wall Thickness			Bolting			Nut			Stud Bolt			Weights				Length		
Nom	Bore		OD	Thk	RF OD	I 1	I 2	I 3	I 1	I 2	I 3	No Of Holes	Hole Size	Bolt Circle	Stop Dia	Relief Dia	Relief Length	Size	RF Length	RTJ Length	I 1		I 2			I 3	
		B	O	T	R	D	D	D	NW	NW	NW			C	NS	NR	NL				Base	Per 1"	Base	Per 1"	Base	Per 1"	
1	0.96		5.88	1.12	2.00	3.25	4.00	4.62	1.15	1.52	1.83	4	1.00	4.00	2.56	2.06	1.12	7/8	5	5	29	2.2	41	3.4	51	4.6	12
1 1/2	1.50		7.00	1.25	2.88	4.00	5.50	6.00	1.25	2.00	2.25	4	1.12	4.88	3.25	2.75	1.25	1	5 1/2	5 1/2	43	3.1	71	6.2	82	7.5	12
2	1.94		8.50	1.50	3.62	5.50	7.00	7.00	1.78	2.03	2.53	8	1.00	6.50	5.06	4.12	1.12	7/8	5 3/4	5 3/4	80	5.9	92	7.2	117	10.1	12
2 1/2	2.32		9.62	1.62	4.12	6.38	7.00	8.25	2.03	2.34	2.97	8	1.12	7.50	5.88	4.88	1.25	1	6 1/4	6 1/4	107	8.0	123	10	188	14	12
3	2.90		9.50	1.50	5.00	7.00	7.75	8.25	2.05	2.43	2.68	8	1.00	7.50	6.06	5.00	1.12	7/8	5 3/4	5 3/4	114	9.0	136	12	151	13	12
4	3.83		11.50	1.75	6.19	8.88	9.88	10.38	2.53	3.03	3.28	8	1.25	9.25	7.44	6.25	1.38	1 1/8	6 3/4	6 3/4	177	14	211	18	228	21	12
5	4.81		13.75	2.00	7.31	10.38	11.00	12.12	2.79	3.10	3.66	8	1.38	11.00	9.00	7.50	1.50	1 1/4	7 1/2	7 1/2	242	19	285	22	309	28	12
6	5.76		15.00	2.19	8.50	11.00	12.12	13.50	2.62	3.18	3.87	12	1.25	12.50	10.69	9.25	1.38	1 1/8	7 1/2	7 3/4	271	20	317	25	377	33	12
8	7.62		18.50	2.50	10.62	15.12	16.25	17.38	3.75	4.32	4.88	12	1.50	15.50	13.31	11.75	1.62	1 3/8	8 3/4	8 3/4	474	38	528	46	584	54	12
10	9.56		21.50	2.75	12.75	17.38	18.25	20.12	3.91	4.35	5.28	16	1.50	18.50	16.31	14.50	1.62	1 3/8	9 1/4	9 1/4	804	47	880	54	1049	70	16
12	11.38		24.00	3.12	15.00	20.12	22.25	23.25	4.37	5.44	5.94	20	1.50	21.00	18.81	16.50	1.62	1 3/8	10	10	1038	61	1245	81	1345	92	16
14	14.00		25.25	3.38	16.25	22.25	23.25	24.12	4.13	4.63	5.06	20	1.62	22.00	19.62	17.75	1.75	1 1/2	10 3/4	11	1068	67	1166	77	1254	96	16
16	16.00		27.75	3.50	18.50	23.25	25.00	26.50	3.63	4.50	5.25	20	1.75	24.25	21.69	20.00	1.88	1 5/8	11 1/4	11 1/2	1100	63	1282	82	1451	89	16
18	18.00		31.00	4.00	21.00	26.00	27.75	29.25	4.00	4.88	5.63	20	2.00	27.50	24.06	22.25	2.12	1 7/8	12 3/4	13 1/4	1365	78	1555	99	1715	118	16
20	20.00		33.75	4.25	23.00	27.75	30.75	32.00	3.88	5.38	6.00	20	2.12	29.50	26.38	24.50	2.25	2	13 3/4	14 1/4	1525	82	1857	121	1994	139	16
24	24.00		41.00	4.50	27.25	33.62	35.00	36.00	4.81	5.50	6.00	20	2.62	35.50	31.62	29.50	2.75	2 1/2	17 1/4	18	2360	123	2515	144	2625	160	16

NOTES:

1. **MATERIAL:** SA 105 in accordance with ASME Section II. Other material grades and compositions available upon request.
2. **FACING:** Classes 150 and 300 flanges are regularly furnished with 1.5 mm (0.06 in.) raised face, which is in addition to the minimum flange thickness, if Classes 400, 600, 900, 1500, and 2500 flanges are regularly furnished with 6.4 mm (0.25 in.) raised face, which is in addition to the minimum flange thickness, but is included in length "L" Other standard and special facings available upon request with height or depth added to thickness "T".
3. **LENGTH** Listed lengths are standards used for base weight calculations. Other lengths are available upon request.
4. **TOLERANCE:** Flanges are furnished to tolerances of ASME B16.5 unless otherwise specified.

- 5. BORE:** Bore sizes listed are standard, smaller or larger bores are available upon request.
- 6. NUT RELIEF:** All connections except LWNs will be supplied to the Nut Stop "NS" diameter listed unless the Nut Relief "NR" diameter is requested.
- 7. CONTOURING:** All connections will be supplied square cut. Connection can be contoured to fit shell, head, cone, or other shape upon request.
- 8. PRESSURE-TEMPERATURE RATING:** See Technical section.



CROSS REFERENCE CHART

Connection Description	FCI	Other Designations
Long Weld Neck	LWN	LWN
Heavy Barrel	HB	H
Intermediate Barrel	- light - medium - heavy	I 1 I 2 I 3
Equal Barrel	E	S
Super Barrel	SB*	Super S*
Insert Lip	Q*	M*

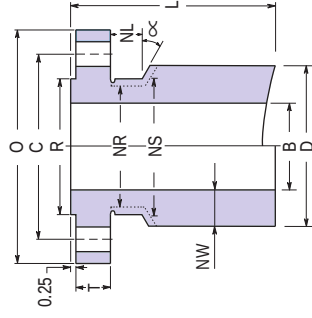
*Denotes Custom Order

Nom	Size	Flange			Barrel OD			Wall Thickness			Bolting			Nut			Stud Bolt			Weights			Length
		OD	Thk	RF OD	LWN	HB	E	LWN	HB	NW	No Of Holes	Hole Size	Bolt Circle	Stop Dia	Relief Dia	Relief Length	Size	RF Length	RTJ Length	LWN	HB	E	
	B	O	T	R	D	D	D	NW	NW	NW			C	NS	NR	NL				Base	Per 1"	Base	Per 1"
1/2	0.50	4.75	0.88	1.38	1.50	2.00	4.75	0.73	0.50	0.73	4	0.88	3.25	2.00	1.50	1.00	3/4	4 1/4	4 1/4	8	0.5	10	0.8
3/4	0.75	5.12	1.00	1.69	1.75	2.25	5.12	0.76	0.50	0.76	4	0.88	3.50	2.25	1.75	1.00	3/4	4 1/2	4 1/2	10	0.6	13	1.0
1	1.00	5.88	1.12	2.00	2.06	2.56	5.88	0.80	0.53	0.80	4	1.00	4.00	2.56	2.06	1.12	7/8	5	5	13	0.8	17	1.3
1 1/4	1.25	6.25	1.12	2.50	2.50	2.94	6.25	0.83	0.63	0.83	4	1.00	4.38	2.94	2.50	1.12	7/8	5	5	17	1.0	20	1.6
1 1/2	1.50	7.00	1.25	2.88	2.75	3.25	7.00	0.88	0.75	0.88	4	1.12	4.88	3.25	2.75	1.25	1	5 1/2	5 1/2	21	1.2	26	1.9
2	2.00	8.50	1.50	3.62	4.12	5.06	8.50	1.06	1.06	1.06	8	1.00	6.50	5.06	4.12	1.12	7/8	5 3/4	5 3/4	42	2.9	56	4.9
2 1/2	2.50	9.62	1.62	4.12	4.88	5.88	9.62	1.19	1.19	1.19	8	1.12	7.50	5.88	4.88	1.25	1	6 1/4	6 1/4	56	3.9	75	6.5
3	3.00	10.50	1.88	5.00	5.25	6.19	10.50	1.13	1.65	3.75	8	1.25	8.00	6.19	5.25	1.38	1 1/8	7	7	67	8.4	6.7	16.1
4	4.00	12.25	2.12	6.19	6.38	7.50	12.25	1.19	1.84	4.13	8	1.38	9.50	7.50	6.38	1.50	1 1/4	7 3/4	7 3/4	110	5.5	147	9.3
5	5.00	14.75	2.88	7.31	7.75	9.12	14.75	1.38	2.16	4.88	8	1.62	11.50	9.12	7.75	1.75	1 1/2	9 3/4	9 3/4	181	7.8	233	13
6	6.00	15.50	3.25	8.50	9.00	10.31	15.50	1.50	2.28	4.75	12	1.50	12.50	10.31	9.00	1.62	1 3/8	10 1/4	10 1/2	215	10	272	16
8	8.00	19.00	3.62	10.62	11.50	12.94	19.00	1.75	2.66	5.50	12	1.75	15.50	12.94	11.50	1.88	1 5/8	11 1/2	12 3/4	337	15	417	24
10	10.00	23.00	4.25	12.75	14.50	16.06	23.00	2.25	3.25	6.50	12	2.00	19.00	16.06	14.50	2.12	1 7/8	13 1/4	13 1/2	546	25	651	37
12	12.00	26.50	4.88	15.00	17.75	19.38	26.50	2.88	4.00	7.25	16	2.12	22.50	19.38	17.75	2.25	2	14 3/4	15 1/4	946	38	1148	55
14	14.00	29.50	5.25	16.25	19.50	21.50	29.50	2.75	3.75	7.75	16	2.38	25.00	21.50	19.50	2.50	2 1/4	16	16 3/4	1116	41	1308	59
16	16.00	32.50	5.75	18.50	21.75	23.88	32.50	2.88	3.94	8.25	16	2.62	27.75	23.88	21.75	2.75	2 1/2	17 1/2	18 1/2	1371	48	1588	70
18	18.00	36.00	6.38	21.00	23.50	26.25	36.00	2.75	4.13	9.00	16	2.88	30.50	26.25	23.50	3.00	2 3/4	19 1/2	20 3/4	1674	51	1959	81
20	20.00	38.75	7.00	23.00	25.25	28.12	38.75	2.63	4.06	9.38	16	3.12	32.75	28.12	25.25	3.25	3	21 1/4	22 1/4	1943	53	2241	87
24	24.00	46.00	8.00	27.25	30.00	33.62	46.00	3.00	4.81	11.00	16	3.62	39.00	33.62	30.00	3.75	3 1/2	24 1/4	25 1/2	2936	72	3334	123

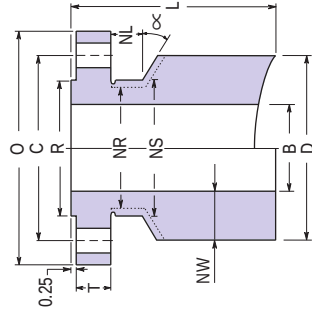
NOTES:

- MATERIAL:** SA 105 in accordance with ASME Section II. Other material grades and compositions available upon request. See Technical section.
- FACING:** Classes 150 and 300 flanges are regularly furnished with 1.5 mm (0.06 in.) raised face, which is in addition to the minimum flange thickness, if Classes 400, 600, 900, 1500, and 2500 flanges are regularly furnished with 6.4 mm (0.25 in.) raised face, which is in addition to the minimum flange thickness, but is included in length "L." Other standard and special facings available upon request with height or depth added to thickness "T".
- LENGTH:** Listed lengths are standards used for base weight calculations. Other lengths are available upon request.
- TOLERANCE:** Flanges are furnished to tolerances or ASME B16.5 unless otherwise specified.
- BORE:** Bore sizes listed are standard, smaller or larger bores are available upon request.
- NUT RELIEF:** All connections except LWNs will be supplied to the Nut Stop "NS" diameter listed. Unless the Nut Relier "NR" diameter is requested.
- CONTOURING:** All connections will be supplied square cut. Connection can be contoured to fit shell, head, cone, or other shape upon request.
- PRESSURE-TEMPERATURE RATING:** See Technical section.

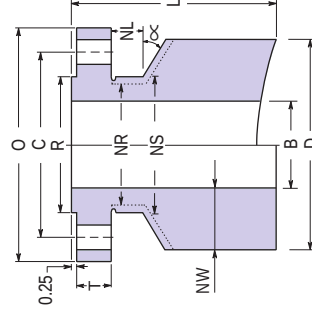
class 1500 FCI INTERMEDIATE CONNECTIONS



INTERMEDIATE BARREL "1" 1"



INTERMEDIATE BARREL "1" 2"



INTERMEDIATE BARREL "1" 3"



Size		Flange			Barrel OD			Wall Thickness			Bolting			Nut			Stud Bolt			Weights				Length		
Nom	Bore	OD	Thk	RF OD	I 1	I 2	I 3	I 1	I 2	I 3	No Of Holes	Hole Size	Bolt Circle	Stop Dia	Relief Dia	Relief Length	Size	RF Length	RTJ Length	I 1		I 2		I 3		Base
	B	O	T	R	D	D	D	NW	NW	NW			C	NS	NR	NL				Base	Per 1"	Base	Per 1"	Base	Per 1"	L
1	0.96	5.88	1.12	2.00	3.25	4.00	4.62	1.15	1.52	1.83	4	1.00	4.00	2.56	2.06	1.12	7/8	5	5	29	2.2	41	3.4	51	4.6	12
1 1/2	1.50	7.00	1.25	2.88	4.62	5.50	6.00	1.56	2.00	2.25	4	1.12	4.88	3.25	2.75	1.25	1	5 1/2	5 1/2	54	4.3	71	6.2	82	7.5	12
2	1.94	8.50	1.50	3.62	5.50	6.00	7.00	1.78	2.03	2.53	8	1.00	6.50	5.06	4.12	1.12	7/8	5 3/4	5 3/4	80	5.9	92	7.2	117	10.1	12
2 1/2	2.32	9.62	1.62	4.12	6.38	7.00	8.25	2.03	2.34	2.97	8	1.12	7.50	5.88	4.88	1.25	1	6 1/4	6 1/4	107	8	123	10	158	14	12
3	2.90	10.50	1.88	5.00	7.00	7.75	8.88	2.05	2.43	2.99	8	1.25	8.00	6.19	5.25	1.38	1 1/8	7	7	124	9	144	12	177	16	12
4	3.83	12.25	2.12	6.19	8.88	9.88	11.00	2.53	3.03	3.59	8	1.38	9.50	7.50	6.38	1.50	1 1/4	7 3/4	7 3/4	187	14	218	18	257	24	12
5	4.81	14.75	2.88	7.31	10.38	12.12	13.50	2.79	3.66	4.35	8	1.62	11.50	9.12	7.75	1.75	1 1/2	9 3/4	9 3/4	271	19	328	28	376	35	12
6	5.76	15.50	3.25	8.50	12.12	13.50	14.25	3.18	3.87	4.25	12	1.50	12.50	10.31	9.00	1.62	1 3/8	10 1/4	10 1/2	332	25	380	33	408	38	12
8	7.62	19.00	3.62	10.62	15.12	16.25	17.38	3.75	4.32	4.88	12	1.75	15.50	12.94	11.50	1.88	1 5/8	11 1/2	12 3/4	498	38	541	46	585	54	12
10	9.56	23.00	4.25	12.75	17.38	20.12	22.25	3.91	5.28	6.35	12	2.00	19.00	16.06	14.50	2.12	1 7/8	13 1/4	13 1/2	889	47	1088	70	1243	90	16
12	11.38	26.50	4.88	15.00	22.25	23.25	24.12	5.44	5.94	6.37	16	2.12	22.50	19.38	17.75	2.25	2	14 3/4	15 1/4	1348	81	1426	92	1495	101	16
14	14.00	29.50	5.25	16.25	23.25	25.00	27.75	4.63	5.50	6.88	16	2.38	25.00	21.50	19.50	2.50	2 1/4	16	16 3/4	1443	77	1579	95	1794	128	16
16	16.00	32.50	5.75	18.50	26.25	29.25	30.75	5.13	6.63	7.38	16	2.62	27.75	23.88	21.75	2.75	2 1/2	17 1/2	18 1/2	1771	96	1999	133	2111	153	16
18	18.00	36.00	6.38	21.00	27.75	30.75	33.62	4.88	6.38	7.81	16	2.88	30.50	26.25	23.50	3.00	2 3/4	19 1/2	20 3/4	2070	99	2285	138	2481	180	16
20	20.00	38.75	7.00	23.00	30.75	33.00	36.00	5.38	6.50	8.00	16	3.12	32.75	28.12	25.25	3.25	3	21 1/4	22 1/4	2417	121	2558	153	2727	200	16
24	24.00	46.00	8.00	27.25	36.00	37.50	40.50	6.00	6.75	8.25	16	3.62	39.00	33.62	30.00	3.75	3 1/2	24 1/4	25 1/2	3470	160	3545	185	3675	237	16

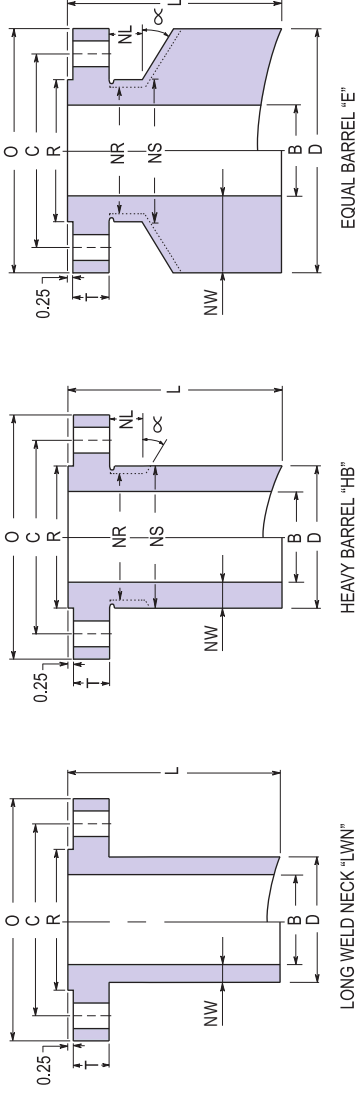
NOTES:

- MATERIAL:** SA 105 in accordance with ASME Section II. Other material grades and compositions available upon request. See Technical section.
- FACING:** Classes 150 and 300 flanges are regularly furnished with 1.5 mm (0.06 in.) raised face, which is in addition to the minimum flange thickness, if Classes 400, 600, 900, 1500, and 2500 flanges are regularly furnished with 6.4 mm (0.25 in.) raised face, which is in addition to the minimum flange thickness, but is included in length "L." Other standard and special facings available upon request with height or depth added to thickness "T".
- LENGTH:** Listed lengths are standards used for base weight calculations. Other lengths are available upon request.
- TOLERANCE:** Flanges are furnished to tolerances or ASME B16.5 unless otherwise specified.
- BORE:** Bore sizes listed are standard, smaller or larger bores are available upon request.
- NUT RELIEF:** All connections except LWNs will be supplied to the Nut Stop "NS" diameter listed. Unless the Nut Relier "NR" diameter is requested.
- CONTOURING:** All connections will be supplied square cut. Connection can be contoured to fit shell, head, cone, or other shape upon request.
- PRESSURE-TEMPERATURE RATING:** See Technical section.

class 2500 FCI STANDARD CONNECTIONS



FCI Forged Components
A OneWest Company



CROSS REFERENCE CHART

Connection Description	FCI	Other Designations
Long Weld Neck	LWN	LWN
Heavy Barrel	HB	H
Intermediate Barrel	- light - medium - heavy	I 1 I 2 I 3
Equal Barrel	E	S
Super Barrel	SB*	Super S*
Insert Lip	Q*	M*
		Q*

*Denotes Custom Order

Size			Flange			Barrel OD			Wall Thickness			Bolting			Nut			Stud Bolt			Weights				Length		
Nom	Bore LWN & HB E		OD	Thk	RF OD	LWN	HB	E	LWN	HB	E	No Of Holes	Hole Size	Bolt Circle	Stop Dia	Relief Dia	Relief Length	Size	RF Length	RTJ Length	LWN	HB	E	Base			
	B	B	O	T	R	D	D	D	NW	NW	NW	4	0.88	3.50	NS	NR	NL				Base	Per 1"	Base	Per 1"	Base	Per 1"	
1/2	0.50	0.55	5.25	1.19	1.38	1.69	2.25	5.25	0.60	0.85	2.38	4	0.88	3.50	2.25	1.69	1.00	3/4	4 3/4	4 3/4	11	0.7	14	1.1	45	6.1	9
3/4	0.75	0.74	5.50	1.25	1.69	2.00	2.50	5.50	0.63	0.88	2.38	4	0.88	3.75	2.50	2.00	1.00	3/4	5	5	13	0.8	17	1.3	49	6.6	9
1	1.00	0.96	6.25	1.38	2.00	2.25	2.81	6.25	0.63	0.93	2.63	4	1.00	4.25	2.81	2.25	1.12	7/8	5 1/2	5 1/2	18	0.9	22	1.6	62	8.5	9
1 1/4	1.25	1.28	7.25	1.50	2.50	2.88	3.50	7.25	0.82	1.11	3.00	4	1.12	5.12	3.50	2.88	1.25	1	6	6	27	1.5	32	2.4	84	11	9
1 1/2	1.50	1.50	8.00	1.75	2.88	3.12	3.94	8.00	0.81	1.22	3.25	4	1.25	5.75	3.94	3.12	1.38	1 1/8	6 3/4	6 3/4	33	1.7	42	3.0	94	14	9
2	2.00	1.94	9.25	2.00	3.62	3.75	5.12	9.25	0.88	1.59	3.63	8	1.12	6.75	5.12	3.75	1.25	1	7	7	48	2.2	66	5.0	131	18	9
2 1/2	2.50	2.32	10.50	2.25	4.12	4.50	5.94	10.50	1.00	1.81	4.40	8	1.25	7.75	5.94	4.50	1.38	1 1/8	7 3/4	8	66	3.1	90	6.7	165	23	9
3	3.00	2.90	12.00	2.62	5.00	5.25	7.00	12.00	1.13	2.05	4.50	8	1.38	9.00	7.00	5.25	1.50	1 1/4	8 3/4	9	97	4.1	127	9	210	30	9
4	4.00	3.83	14.00	3.00	6.19	6.50	8.38	14.00	1.25	2.28	5.00	8	1.62	10.75	8.38	6.50	1.75	1 1/2	10	10 1/4	159	5.8	218	12	391	40	12
5	5.00	4.81	16.50	3.62	7.31	8.00	10.00	16.50	1.50	2.60	5.75	8	1.88	12.75	10.00	8.00	2.00	1 3/4	11 3/4	12 1/4	248	8.7	319	17	518	55	12
6	6.00	5.76	19.00	4.25	8.50	9.25	11.38	19.00	1.63	2.81	6.50	8	2.12	14.50	11.38	9.25	2.25	2	13 1/2	14	358	11	441	21	641	73	12
8	8.00	7.62	21.75	5.00	10.62	12.00	14.12	21.75	2.00	3.25	6.88	12	2.12	17.25	14.12	12.00	2.25	2	15	15 1/2	589	18	743	31	1167	92	16
10	10.00	9.56	26.50	6.50	12.75	14.75	17.38	26.50	2.38	3.91	8.25	12	2.62	21.25	17.38	14.75	2.75	2 1/2	19 1/4	20	997	26	1202	47	1625	134	16
12	12.00	11.38	30.00	7.25	15.00	17.38	20.12	30.00	2.69	4.37	9.00	12	2.88	24.38	20.12	17.38	3.00	2 3/4	21 1/4	22	1363	35	1609	61	1995	168	16

NOTES:

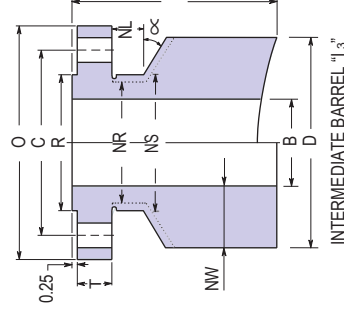
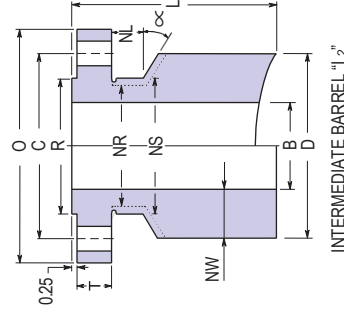
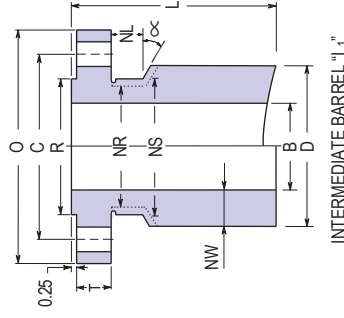
- MATERIAL:** SA 105 in accordance with ASME Section II. Other material grades and compositions available upon request. See Technical section.
- FACING:** Classes 150 and 300 flanges are regularly furnished with 1.5 mm (0.06 in.) raised face, which is in addition to the minimum flange thickness, if Classes 400, 600, 900, 1500, and 2500 flanges are regularly furnished with 6.4 mm (0.25 in.) raised face, which is in addition to the minimum flange thickness, but is included in length "L." Other standard and special facings available upon request with height or depth added to thickness "T".
- LENGTH:** Listed lengths are standards used for base weight calculations. Other lengths are available upon request.
- TOLERANCE:** Flanges are furnished to tolerances or ASME B16.5 unless otherwise specified.
- BORE:** Bore sizes listed are standard, smaller or larger bores are available upon request.
- NUT RELIEF:** All connections except LWNs will be supplied to the Nut Stop "NS" diameter listed. Unless the Nut Relier "NR" diameter is requested.
- CONTOURING:** All connections will be supplied square cut. Connection can be contoured to fit shell, head, cone, or other shape upon request.
- PRESSURE-TEMPERATURE RATING:** See Technical section.

class 2500

FCI INTERMEDIATE CONNECTIONS



FCI Forged Components
A OneWest Company



30° Min
Sect VIII DIV I
45° Min
Sect VIII DIV II

Size		Flange			Barrel OD			Wall Thickness				Bolting		Nut			Stud Bolt			Weights						Length
Norm	Bore	OD	Thk	RF OD	I 1	I 2	I 3	No Of Holes	Hole Size	Bolt Circle	Stop Dia	Relief Dia	Relief Length	Size	RF Length	RTJ Length	I 1	I 2	I 3	Base	Per 1"	Base	Per 1"	Base	Per 1"	
	B	O	T	R	D	D	D			C	NS	NR	NL													
1	0.96	6.25	1.38	2.00	4.00	4.62	5.50	4	1.00	4.25	2.81	2.25	1.12	7/8	5 1/2	5 1/2	43	3.4	54	4.6	71	6.5			12	
1 1/2	1.50	8.00	1.75	2.88	5.50	6.00	7.00	4	1.25	5.75	3.94	3.12	1.38	1 1/8	6 3/4	6 3/4	78	6.2	89	7.5	112	10.4			12	
2	1.94	9.25	2.00	3.62	6.00	7.00	8.00	8	1.12	6.75	5.12	3.75	1.25	1	7	7	99	7.2	123	10	149	13.4			12	
2 1/2	2.32	10.50	2.25	4.12	7.00	7.75	8.88	8	1.25	7.75	5.94	4.50	1.38	1 1/8	7 3/4	8	133	10	153	12	182	16			12	
3	2.90	12.00	2.62	5.00	8.25	9.88	11.00	8	1.38	9.00	7.00	5.25	1.50	1 1/4	8 3/4	9	184	13	229	20	263	25			12	
4	3.83	14.00	3.00	6.19	9.88	11.00	12.12	8	1.62	10.75	8.38	6.50	1.75	1 1/2	10	10 1/4	256	18	288	24	323	29			12	
5	4.81	16.50	3.62	7.31	11.00	13.50	15.25	8	1.88	12.75	10.00	8.00	2.00	1 3/4	11 3/4	12 1/4	344	22	417	35	470	47			12	
6	5.76	19.00	4.25	8.50	13.50	15.12	17.38	8	2.12	14.50	11.38	9.25	2.25	2	13 1/2	14	493	33	537	44	598	60			12	
8	7.62	21.75	5.00	10.62	15.12	18.25	20.12	12	2.12	17.25	14.12	12.00	2.25	2	15	15 1/2	794	38	970	61	1080	77			16	
10	9.56	26.50	6.50	12.75	20.12	22.25	24.12	12	2.62	21.25	17.38	14.75	2.75	2 1/2	19 1/4	20	1891	70	2157	90	2401	109			24	
12	11.38	30.00	7.25	15.00	22.25	25.00	27.75	12	2.88	24.38	20.12	17.38	3.00	2 3/4	21 1/4	22	2355	81	2711	110	3082	143			24	

NOTES:

- MATERIAL:** SA 105 in accordance with ASME Section II. Other material grades and compositions available upon request. See Technical section.
- FACING:** Classes 150 and 300 flanges are regularly furnished with 1.5 mm (0.06 in.) raised face, which is in addition to the minimum flange thickness. If Classes 400, 600, 900, 1500, and 2500 flanges are regularly furnished with 6.4 mm (0.25 in.) raised face, which is in addition to the minimum flange thickness, but is included in length "L". Other standard and special facings available upon request with height or depth added to thickness "T".
- LENGTH:** Listed lengths are standards used for base weight calculations. Other lengths are available upon request.
- TOLERANCE:** Flanges are furnished to tolerances of ASME B16.5 unless otherwise specified.
- BORE:** Bore sizes listed are standard, smaller or larger bores are available upon request.
- NUT RELIEF:** All connections except LWNs will be supplied to the Nut Stop "NS" diameter listed. Unless the Nut Relief "NR" diameter is requested.
- CONTOURING:** All connections will be supplied square cut. Connection can be contoured to fit shell, head, cone, or other shape upon request.
- PRESSURE-TEMPERATURE RATING:** See Technical section.



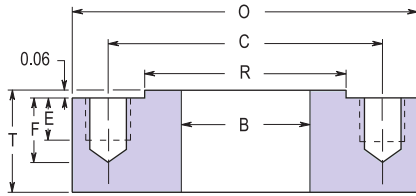
GENERAL NOTES FOR FCI STANDARD AND INTERMEDIATE BARREL CONNECTIONS

- CODES:** FCI connections are manufactured in compliance with ASME Section II, Section VIII, Div. 1, and ASME B16.5. Products may be ordered to special requirements or other standard codes such as ASME Section I, III and Section VIII, Div. 2, ASME B31.1 and B16.47 Series A&B, API and ASTM.
- MATERIALS:** All materials comply with the applicable ASME and ASTM specifications. Full traceability is mandated by our quality system. Standard forged material is carbon steel SA105. Connections can also be furnished in other carbon steels, alloy steels, stainless, high nickel and non-ferrous alloys upon request.
- BORES:** Heavy Barrel "HB" and Intermediate Barrel "I" connections 12" and smaller are provided with standard bores to match Sch. 80 pipe, thus eliminating turbulence and accelerated corrosion resulting from the orifice effect of a sharp constriction common to Long Weld Necks "LWN". In sizes 14" and greater, standard bores are equal to the nominal flange/pipe size. Special bores are available upon request for all products.
- FACING:** Standard facing is raised face to ASME B16.5. The 0.06" raised face is included in thickness "T" and length "L" dimensions for Class 150 and 300 flange connections. The 0.25" raised face is not included in thickness "T" but is included in length "L" dimensions for Class 400, 600, 900, 1500 and class 2500 flange connections. Other standard and special facings are available – see technical section.
- LENGTHS:** Listed lengths are standards used for base weight calculations. Other lengths are available upon request.
- FLANGES:** Flange dimensions and drilling are in accordance with ASME B16.5. Bolt holes will straddle natural centerlines, unless specified otherwise. Studs, bolts, nuts, and gaskets are not furnished, but can be supplied upon request.
- NUT RELIEF:** Standard on Long Weld Neck "LWN" connections only, optional on all other connections.
- NUT STOPS:** Standard on all Heavy Barrel "HB", Intermediate Barrel "I₁", "I₂", "I₃", Equal Barrel "E", and Super Barrel "SB" connections. Not available on Long Weld Neck "LWN" connections. The connection flange hub area outside diameter acts as the nut stop, preventing the nut from turning thereby only requiring one wrench to loosen or tighten the bolting on the mating side. Nut relief can be furnished on special order.
- CONTOURED BOTTOMS:** Connections will be furnished with flat bottoms unless specified otherwise. All connections are available with "contoured" bottoms for installation in shells, heads and cones. In these cases, the centerline length "CL" will be measured on the connection axis from the flange face or butt weld connection end to the bottom contour of the connection.
- INSERT LIPS:** All connections can be ordered with insert lips- "Q" type attachment.
- HEAT TREATMENT:** All standard connections over Class 300 rating are supplied in the normalized condition in accordance with the requirements of ASME Section II. Other heat treatment requirements can be provided upon request.
- TOLERANCE:** Manufacturing tolerances, as a minimum, will meet the requirements of ASME B16.5 where applicable.

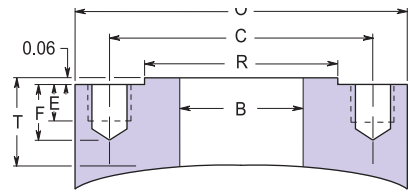
FCI STUDDING OUTLETS



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FLAT BOTTOM

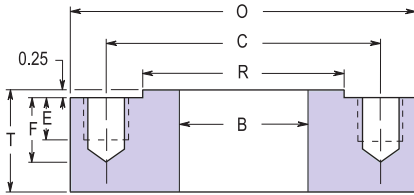


OPTIONAL CURVED BOTTOM

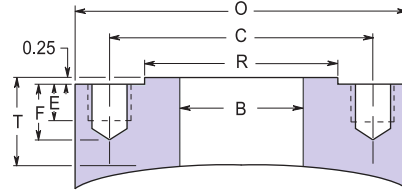
Size	Flange			Bolting				Stud Bolt			Weight	
Bore	OD	Thk	RF OD	No Of Holes	Hole Size	Hole Depth	Bolt Circle	Tap Size	T.P.I.	Tap Depth	Flat Bottom	
B	O	T	R			F	C			E	Base	Per 1"
class 150 STUDDING OUTLETS												
1/2	3.50	1.25	1.38	4	27/64	0.88	2.38	1/2	13	0.56	3	2.7
3/4	3.88	1.25	1.69	4	27/64	0.88	2.75	1/2	13	0.56	3.7	3.2
1	4.25	1.25	2.00	4	27/64	0.88	3.12	1/2	13	0.56	4.3	3.8
1 1/4	4.62	1.25	2.50	4	27/64	0.88	3.50	1/2	13	0.56	5.1	4.4
1 1/2	5.00	1.25	2.88	4	27/64	0.88	3.88	1/2	13	0.56	5.9	5.1
2	6.00	1.50	3.62	4	17/32	1.12	4.75	5/8	11	0.75	10.2	7.1
2 1/2	7.00	1.50	4.12	4	17/32	1.12	5.50	5/8	11	0.75	14	9.5
3	7.50	1.50	5.00	4	17/32	1.12	6.00	5/8	11	0.75	15	11
3 1/2	8.50	1.50	5.50	8	17/32	1.12	7.00	5/8	11	0.75	19	13
4	9.00	1.50	6.19	8	17/32	1.12	7.50	5/8	11	0.75	20	14
5	10.00	1.75	7.31	8	21/32	1.31	8.50	3/4	10	0.88	28	17
6	11.00	1.75	8.50	8	21/32	1.31	9.50	3/4	10	0.88	31	19
8	13.50	1.75	10.62	8	21/32	1.31	11.75	3/4	10	0.88	46	26
10	16.00	1.81	12.75	12	49/64	1.44	14.25	7/8	9	1.00	58	35
12	19.00	1.81	15.00	12	49/64	1.44	17.00	7/8	9	1.00	83	48
14	21.00	2.00	16.25	12	7/8	1.56	18.75	1	8	1.12	102	55
16	23.50	2.00	18.50	16	7/8	1.56	21.25	1	8	1.12	123	66
18	25.00	2.25	21.00	16	1	1.81	22.75	1 1/8	8	1.25	140	67
20	27.50	2.25	23.00	20	1	1.81	25.00	1 1/8	8	1.25	166	79
22	29.50	2.50	25.25	20	1 1/8	2.12	27.25	1 1/4	8	1.44	197	86
24	32.00	2.50	27.25	20	1 1/8	2.12	29.50	1 1/4	8	1.44	231	100
class 300 STUDDING OUTLETS												
1/2	3.75	1.25	1.38	4	27/64	0.88	2.62	1/2	13	0.56	3.5	3.1
3/4	4.62	1.50	1.69	4	17/32	1.12	3.25	5/8	11	0.75	6.4	4.6
1	4.88	1.50	2.00	4	17/32	1.12	3.50	5/8	11	0.75	7	5.1
1 1/4	5.25	1.50	2.50	4	17/32	1.12	3.88	5/8	11	0.75	8	5.8
1 1/2	6.12	1.75	2.88	4	21/32	1.31	4.50	3/4	10	0.88	13	7.8
2	6.50	1.50	3.62	8	17/32	1.12	5.00	5/8	11	0.75	12	8.5
2 1/2	7.50	1.75	4.12	8	21/32	1.31	5.88	3/4	10	0.88	18	11
3	8.25	1.75	5.00	8	21/32	1.31	6.62	3/4	10	0.88	22	14
3 1/2	9.00	1.75	5.50	8	21/32	1.31	7.25	3/4	10	0.88	25	15
4	10.00	1.75	6.19	8	21/32	1.31	7.88	3/4	10	0.88	30	19
5	11.00	1.75	7.31	8	21/32	1.31	9.25	3/4	10	0.88	36	21
6	12.50	1.75	8.50	12	21/32	1.31	10.62	3/4	10	0.88	44	27
8	15.00	1.88	10.62	12	49/64	1.44	13.00	7/8	9	1.00	63	36
10	17.50	2.12	12.75	16	7/8	1.56	15.25	1	8	1.12	90	46
12	20.50	2.25	15.00	16	1	1.81	17.75	1 1/8	8	1.25	127	61
14	23.00	2.25	16.25	20	1	1.81	20.25	1 1/8	8	1.25	153	74
16	25.50	2.50	18.50	20	1 1/8	2.12	22.50	1 1/4	8	1.44	201	88
18	28.00	2.50	21.00	24	1 1/8	2.12	24.75	1 1/4	8	1.44	235	102
20	30.50	2.50	23.00	24	1 1/8	2.12	27.00	1 1/4	8	1.44	273	118
22	33.00	2.88	25.25	24	1 3/8	2.38	29.25	1 1/2	8	1.69	353	135
24	36.00	2.88	27.25	24	1 3/8	2.38	32.00	1 1/2	8	1.69	425	160

See Notes on Pages 23-24

FCI STUDDING OUTLETS



FLAT BOTTOM

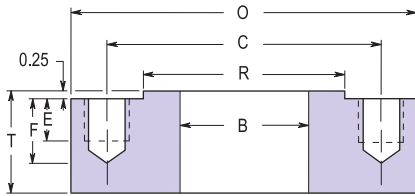


OPTIONAL CURVED BOTTOM

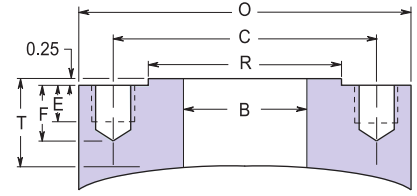
Size	Flange			Bolting				Stud Bolt			Weight	
Bore	OD	Thk	RF OD	No Of Holes	Hole Size	Hole Depth	Bolt Circle	Tap Size	T.P.I.	Tap Depth	Flat Bottom	
B	O	T	R		F	C				E	Base	Per 1"
class 600 STUDDING OUTLETS												
1/2	3.75	1.50	1.38	4	27/64	0.88	2.62	1/2	13	0.56	3.8	3.1
3/4	4.62	1.75	1.69	4	17/32	1.12	3.25	5/8	11	0.75	6.7	4.6
1	4.88	1.75	2.00	4	17/32	1.12	3.50	5/8	11	0.75	7.4	5.1
1 1/4	5.25	1.75	2.50	4	17/32	1.12	3.88	5/8	11	0.75	8.6	5.8
1 1/2	6.12	1.94	2.88	4	21/32	1.31	4.50	3/4	10	0.88	13	7.8
2	6.50	1.75	3.62	8	17/32	1.12	5.00	5/8	11	0.75	12	8.5
2 1/2	7.50	2.00	4.12	8	21/32	1.31	5.88	3/4	10	0.88	19	11
3	8.25	2.00	5.00	8	21/32	1.31	6.62	3/4	10	0.88	23	13
3 1/2	9.00	2.12	5.50	8	49/64	1.44	7.25	7/8	9	1.00	28	15
4	10.75	2.12	6.19	8	49/64	1.44	8.50	7/8	9	1.00	41	22
5	13.00	2.25	7.31	8	7/8	1.56	10.50	1	8	1.12	63	32
6	14.00	2.25	8.50	12	7/8	1.56	11.50	1	8	1.12	68	36
8	16.50	2.50	10.62	12	1	1.81	13.75	1 1/8	8	1.25	101	46
10	20.00	2.75	12.75	16	1 1/8	2.12	17.00	1 1/4	8	1.44	160	67
12	22.00	2.75	15.00	20	1 1/8	2.12	19.25	1 1/4	8	1.44	180	76
14	23.75	2.88	16.25	20	1 1/4	2.25	20.75	1 3/8	8	1.56	201	82
16	27.00	3.00	18.50	20	1 3/8	2.38	23.75	1 1/2	8	1.69	271	105
18	29.25	3.25	21.00	20	1 1/2	2.56	25.75	1 5/8	8	1.88	331	118
20	32.00	3.25	23.00	24	1 1/2	2.56	28.50	1 5/8	8	1.88	387	139
22	34.25	3.50	25.25	24	1 5/8	2.81	30.62	1 3/4	8	2.00	461	153
24	37.00	3.75	27.25	24	1 3/4	3.00	33.00	1 7/8	8	2.12	571	176
class 900 STUDDING OUTLETS												
1/2	4.75	2.00	1.38	4	21/32	1.31	3.25	3/4	10	0.88	8.2	5
3/4	5.12	2.00	1.69	4	21/32	1.31	3.50	3/4	10	0.88	10	5.7
1	5.88	2.12	2.00	4	49/64	1.44	4.00	7/8	9	1.00	14	7.5
1 1/4	6.25	2.12	2.50	4	49/64	1.44	4.38	7/8	9	1.00	15	8.3
1 1/2	7.00	2.25	2.88	4	7/8	1.56	4.88	1	8	1.12	20	10
2	8.50	2.12	3.62	8	49/64	1.44	6.50	7/8	9	1.00	27	15
2 1/2	9.62	2.25	4.12	8	7/8	1.56	7.50	1	8	1.12	37	19
3	9.50	2.12	5.00	8	49/64	1.44	7.50	7/8	9	1.00	33	18
4	11.50	2.50	6.19	8	1	1.81	9.25	1 1/8	8	1.25	56	26
5	13.75	2.75	7.31	8	1 1/8	2.12	11.00	1 1/4	8	1.44	87	37
6	15.00	2.50	8.50	12	1	1.81	12.50	1 1/8	8	1.25	91	42
8	18.50	3.00	10.62	12	1 1/4	2.25	15.50	1 3/8	8	1.56	162	62
10	21.50	3.00	12.75	16	1 1/4	2.25	18.50	1 3/8	8	1.56	210	81
12	24.00	3.00	15.00	20	1 1/4	2.25	21.00	1 3/8	8	1.56	251	96
14	25.25	3.25	16.25	20	1 3/8	2.38	22.00	1 1/2	8	1.69	275	98
16	27.25	3.50	18.50	20	1 1/2	2.56	24.25	1 5/8	8	1.88	348	114
18	31.00	3.88	21.00	20	1 3/4	3.00	27.00	1 7/8	8	2.12	473	142
20	33.75	4.25	23.00	20	1 7/8	3.31	29.50	2	8	2.25	608	164
24	41.00	5.12	27.25	20	2 3/8	4.00	35.50	2 1/2	8	2.81	1096	246

See Notes on Pages 23-24

FCI STUDDING OUTLETS



FLAT BOTTOM



OPTIONAL CURVED BOTTOM

Size	Flange			Bolting				Stud Bolt			Weight	
Bore	OD	Thk	RF OD	No Of Holes	Hole Size	Hole Depth	Bolt Circle	Tap Size	T.P.I.	Tap Depth	Flat Bottom	
B	O	T	R			F	C			E	Base	Per 1"
class 1500 STUDDING OUTLETS												
1/2	4.75	2.00	1.38	4	21/32	1.31	3.25	3/4	10	0.88	8.2	5
3/4	5.12	2.00	1.69	4	21/32	1.31	3.50	3/4	10	0.88	10	5.7
1	5.88	2.12	2.00	4	49/64	1.44	4.00	7/8	9	1.00	14	7.5
1 1/4	6.25	2.12	2.50	4	49/64	1.44	4.38	7/8	9	1.00	15	8.3
1 1/2	7.00	2.25	2.88	4	7/8	1.56	4.88	1	8	1.12	20	10
2	8.50	2.12	3.62	8	49/64	1.44	6.50	7/8	9	1.00	27	15
2 1/2	9.62	2.25	4.12	8	7/8	1.56	7.50	1	8	1.12	37	19
3	10.50	2.50	5.00	8	1	1.81	8.00	1 1/8	8	1.25	48	23
4	12.25	2.75	6.19	8	1 1/8	2.12	9.50	1 1/4	8	1.44	70	30
5	14.75	3.12	7.31	8	1 3/8	2.38	11.50	1 1/2	8	1.69	114	43
6	15.50	3.00	8.50	12	1 1/4	2.25	12.50	1 3/8	8	1.56	116	45
8	19.00	3.50	10.62	12	1 1/2	2.56	15.50	1 5/8	8	1.88	224	66
10	23.00	3.88	12.75	12	1 3/4	3.00	19.00	1 7/8	8	2.12	345	95
12	26.50	4.12	15.00	16	1 7/8	3.31	22.50	2	8	2.25	456	124
14	29.50	4.25	16.25	16	2 1/8	3.56	25.00	2 1/4	8	2.56	540	150
16	32.50	5.00	18.50	16	2 3/8	4.00	27.75	2 1/2	8	2.81	762	178
18	36.00	5.50	21.00	16	2 5/8	4.38	30.50	2 3/4	8	3.12	1024	216
20	38.75	5.88	23.00	16	2 7/8	4.62	32.75	3	8	3.44	1234	245
24	46.00	6.75	27.25	16	3 3/8	5.38	39.00	3 1/2	8	4.00	1992	343
class 2500 STUDDING OUTLETS												
1/2	5.25	2.00	1.38	4	21/32	1.31	3.50	3/4	10	0.88	10	6.1
3/4	5.50	2.00	1.69	4	21/32	1.31	3.75	3/4	10	0.88	11	6.6
1	6.25	2.12	2.00	4	49/64	1.44	4.25	7/8	9	1.00	15	8.5
1 1/4	7.25	2.25	2.50	4	7/8	1.56	5.12	1	8	1.12	22	11
1 1/2	8.00	2.50	2.88	4	1	1.81	5.75	1 1/8	8	1.25	29	14
2	9.25	2.25	3.62	8	7/8	1.56	6.75	1	8	1.12	34	18
2 1/2	10.50	2.50	4.12	8	1	1.81	7.75	1 1/8	8	1.25	49	23
3	12.00	2.75	5.00	8	1 1/8	2.12	9.00	1 1/4	8	1.44	71	30
4	14.00	3.25	6.19	8	1 3/8	2.38	10.75	1 1/2	8	1.69	112	40
5	16.50	3.75	7.31	8	1 5/8	2.81	12.75	1 3/4	8	2.00	179	55
6	19.00	4.12	8.50	8	1 7/8	3.31	14.50	2	8	2.25	259	72
8	21.75	4.38	10.62	12	1 7/8	3.31	17.25	2	8	2.25	345	91
10	26.50	5.12	12.75	12	2 3/8	4.00	21.25	2 1/2	8	2.81	590	134
12	30.00	5.50	15.00	12	2 5/8	4.38	24.38	2 3/4	8	3.12	799	168

See Notes on Pages 23-24

GENERAL NOTES FOR FCI STANDARD STUDDING OUTLETS

CODES: FCI Studding Outlets are manufactured in compliance with ASME Section II, Section VIII, Div. 1, and ASME B16.5. Products may be ordered to special requirements or other standard codes such as ASME Section I, III and Section VIII, Div. 2, ASME B31.1 or B31.7.

MATERIALS: All materials comply with the applicable ASME and ASTM specifications. Full traceability is mandated by our quality system. Standard forged material is carbon steel SA105. Connections can also be furnished in other carbon steels, alloy steels, stainless, high nickel and non-ferrous alloys upon request.

BORES: Standard studding outlet bores are equal to their nominal flange/pipe size. Special bores are available upon request.

FACING: Standard facing is raised face to ASME B16.5. The 0.06" raised face is included in thickness "T" for Class 150 and 300 studding outlet connections. The 0.25" raised face is included in thickness "T" for Class 600, 900, 1500 and Class 2500 studding outlet connections. Other standard and special facings are available.

THICKNESS: Listed thickness "T" dimensions in FCI charts are the minimums required per ASME Section VIII Div. 1 for thread engagement and thickness required for installing studding outlets to the inside diameter of vessel shells, heads, cones, pipes, etc. as shown in Figures A, B, C, and D of typical attachment styles for studding outlet connections.

For "through-type" installations as per Fig. B and per Fig. C, thickness "T" must generally be increased in accordance with the requirements of the ASME Code, Section VIII, Div. 1, paragraph UG-43(d), to provide additional material under the drilled and tapped holes of the studding outlet.

Surface mounted "set-on" studding outlets, as shown in Figures E, F and G, generally require a thickness less than that listed in accordance with ASME Code design.

Studding outlets will be priced and produced to other than the FCI listed thickness "T" at Purchaser's request. See following page of other studding outlet mounting configurations to determine thickness "T".

In all cases, Purchaser shall design and advise FCI of the required thickness "T" dimension.

BODY: Studding outlet body outside diameters are equal to the outside diameters of flanges, as specified in ASME B16.5 for the size and class of connection ordered. Upon request, studding outlet outside diameters may be increased to satisfy reinforcing requirements. Standard FCI studding outlet mating connection ends will be manufactured in accordance with ASME B16.5 flange and drilling dimensions. Drilled holes will be tapped in accordance with ASME Section VIII, Div. 1, paragraph UG-43(g). Bolt holes will straddle natural centerlines, unless specified otherwise. Studs, bolts, nuts, and gaskets are not furnished.

CONTOURED BOTTOMS: Studding outlet connections will be furnished with flat bottoms unless specified otherwise. All connections are available with optional "contoured" bottoms for installation in shells, heads and cones. In these cases, the minimum thickness "T" will be measured from the studding outlet face to the bottom contour of the connection. See preceding thickness note and typical attachment style as shown on following page.

Tolerance for bottom contouring will be in accordance with ASME Section VIII, Div. 1, paragraph UG-80 out-of-roundness tolerance. Purchaser to specify when connections are to be surface mounted for special contouring requirements, such as Fig. F and Fig. G.

Wrap around" connections exceeding the outside diameter of the shell to which they are mounted will have the transverse pendant points square cut.

Tangential/hillside, inclined, and other special contoured bottoms are available upon request.

GENERAL NOTES FOR FCI STANDARD STUDDING OUTLETS

INSERT LIPS: All studding outlet connections can be ordered with insert lips- "Q" type attachment.

TEST HOLES: Studding outlets may be ordered with test holes. Unless specified otherwise, test holes will be provided in accordance with Fig. E, 1/4" diameter drilling and tapped with a 1/8" N.P.T.

HEAT TREATMENT: All standard connections over Class 300 rating are supplied in the normalized condition in accordance with the requirements of ASME Section II. Other heat treatment requirements can be provided upon request.

TOLERANCE: Manufacturing tolerances, as a minimum, will meet the requirements of ASME B16.5 where applicable.

REINFORCEMENT:

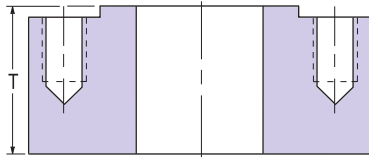
Reinforcement must be provided to satisfy area requirements for all planes through the center of the opening normal to the vessel surface especially the voids created by the drilled and tapped holes of studding outlets. The area requirements, planes of reinforcement and the "F" factor are to be addressed by Purchaser's designer in accordance with the ASME Code, Section VIII, Div. 1, paragraph UG-37. Increasing the thickness "T" and/or the outside diameter of the studding outlet connection may replace the area lost from the drilled and tapped holes. See following table for area loss of FCI standard studding outlet drilled and tapped holes:

<u>TAP SIZE</u> <u>(inches)</u>	<u>DEPTH OF HOLE</u> <u>(inches)</u>	<u>AREA</u> <u>(sq. inches)</u>
1/2	0.88	0.81
5/8	1.12	1.28
3/4	1.31	1.80
7/8	1.44	2.29
1	1.56	2.82
1 1/8	1.81	3.69
1 1/4	2.12	4.83
1 3/8	2.25	5.62
1 1/2	2.38	6.47
1 5/8	2.56	7.53
1 3/4	2.81	8.92
1 7/8	3.00	10.19
2	3.31	12.04
2 1/4	3.56	14.50
2 1/2	4.00	16.13
2 3/4	4.38	21.82
3	4.62	25.02
3 1/2	5.38	33.99

FCI STUDDING OUTLETS

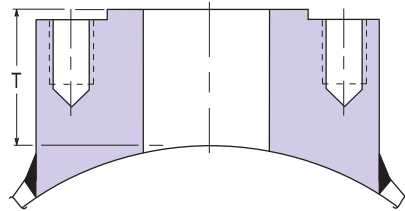
TYPICAL ATTACHMENT STYLES AND RELATED THICKNESS “T” DIMENSIONS

FIG. A



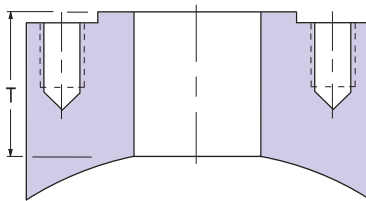
Standard Flat Bottom Attachment

FIG. B



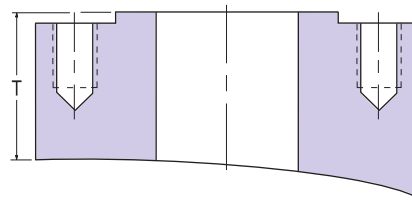
Optional Contoured “Through-Type” Shell Attachment

FIG. C



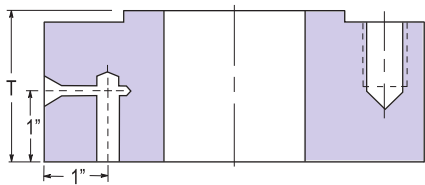
Optional Contoured For Spherical Head Attachment

FIG. D



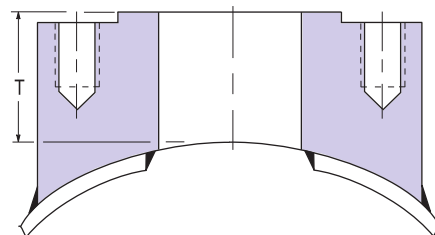
Optional Contoured Tangential Attachment

FIG. E



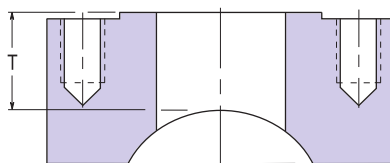
Optional “Pipe Tap Test Hole” Connection

FIG. F



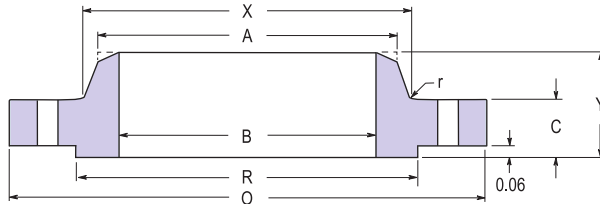
Optional Contoured Set-On Type Attachment

FIG. G

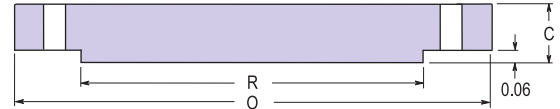


Optional “Wrap Around” Connection

LARGE DIAMETER FLANGES



WELDING NECK



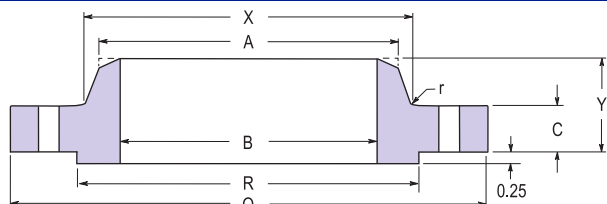
BLIND

Nominal Pipe Size	Flange								Bolting				Weights	
	OD	Thickness		Raised Face OD	Fillet Radius Min.	Hub			No. of Holes	Hole Size	Bolt Circle Dia.	Stud Bolt Diameter	Weld Neck Flange	Blind
		WN Flg	Blind			Length	Bottom OD	Top OD						
	O	C	C	R	r	Y	X	A						
class 150 LARGE DIAMETER FLANGES ASME B16.47 Series A or MSS SP- 44														
26	34.25	2.69	2.69	29.50	0.38	4.75	26.62	26.00	24	1.38	31.75	1 1/4	300	670
28	36.50	2.81	2.81	31.50	0.44	4.94	28.62	28.00	28	1.38	34.00	1 1/4	345	795
30	38.75	2.94	2.94	33.75	0.44	5.38	30.75	30.00	28	1.38	36.00	1 1/4	400	940
32	41.75	3.19	3.19	36.00	0.44	5.69	32.75	32.00	28	1.62	38.50	1 1/2	505	1175
34	43.75	3.25	3.25	38.00	0.50	5.88	34.75	34.00	32	1.62	40.50	1 1/2	540	1315
36	46.00	3.56	3.56	40.25	0.50	6.19	36.75	36.00	32	1.62	42.75	1 1/2	640	1590
38	48.75	3.44	3.44	42.25	0.50	6.19	39.00	38.00	32	1.62	45.25	1 1/2	720	1740
40	50.75	3.56	3.56	44.25	0.50	6.44	41.00	40.00	36	1.62	47.25	1 1/2	775	1955
42	53.00	3.81	3.81	47.00	0.50	6.75	43.00	42.00	36	1.62	49.50	1 1/2	890	2290
44	55.25	4.00	4.00	49.00	0.50	7.00	45.00	44.00	40	1.62	51.75	1 1/2	990	2790
46	57.25	4.06	4.06	51.00	0.50	7.31	47.12	46.00	40	1.62	53.75	1 1/2	1060	3050
48	59.50	4.25	4.25	53.50	0.50	7.56	49.12	48.00	44	1.62	56.00	1 1/2	1185	3220
50	61.75	4.38	4.38	55.50	0.50	8.00	51.25	50.00	44	1.88	58.25	1 3/4	1270	3545
52	64.00	4.56	4.56	57.50	0.50	8.25	53.25	52.00	44	1.88	60.50	1 3/4	1410	3990
54	66.25	4.75	4.75	59.50	0.50	8.50	55.25	54.00	44	1.88	62.75	1 3/4	1585	4455
56	68.75	4.88	4.88	62.00	0.50	9.00	57.38	56.00	48	1.88	65.00	1 3/4	1760	4920
58	71.00	5.06	5.06	64.00	0.50	9.25	59.38	58.00	48	1.88	67.25	1 3/4	1915	5465
60	73.00	5.19	5.19	66.00	0.50	9.44	61.38	60.00	52	1.88	69.25	1 3/4	2045	5800
class 300 LARGE DIAMETER FLANGES ASME B16.47 Series A or MSS SP- 44														
26	38.25	3.12	3.31	29.50	0.38	7.25	28.38	26.00	28	1.75	34.50	1 5/8	605	1010
28	40.75	3.38	3.56	31.50	0.44	7.75	30.50	28.00	28	1.75	37.00	1 5/8	745	1240
30	43.00	3.62	3.75	33.75	0.44	8.25	32.56	30.00	28	1.88	39.25	1 3/4	870	1450
32	45.25	3.88	3.94	36.00	0.44	8.75	34.69	32.00	28	2.00	41.50	1 7/8	1005	1685
34	47.50	4.00	4.12	38.00	0.50	9.12	36.88	34.00	28	2.00	43.50	1 7/8	1145	1915
36	50.00	4.12	4.38	40.25	0.50	9.50	39.00	36.00	32	2.12	46.00	2	1275	2280
38	46.00	4.25	4.25	40.50	0.50	7.12	39.12	38.00	32	1.62	43.00	1 1/2	695	1910
40	48.75	4.50	4.50	42.75	0.50	7.62	41.25	40.00	32	1.75	45.50	1 5/8	840	2270
42	50.75	4.69	4.69	44.75	0.50	7.88	43.25	42.00	32	1.75	47.50	1 5/8	950	2570
44	53.25	4.88	4.88	47.00	0.50	8.12	45.25	44.00	32	1.88	49.75	1 3/4	1055	2940
46	55.75	5.06	5.06	49.00	0.50	8.50	47.38	46.00	28	2.00	52.00	1 7/8	1235	3370
48	57.75	5.25	5.25	51.25	0.50	8.81	49.38	48.00	32	2.00	54.00	1 7/8	1380	3740
50	60.25	5.50	5.50	53.50	0.50	9.12	51.38	50.00	32	2.12	56.25	2	1530	4270
52	62.25	5.69	5.69	55.50	0.50	9.38	53.38	52.00	32	2.12	58.25	2	1660	4715
54	65.25	6.00	6.00	57.75	0.50	9.94	55.50	54.00	28	2.38	61.00	2 1/4	2050	5460
56	67.25	6.06	6.06	59.75	0.50	10.25	57.62	56.00	28	2.38	63.00	2 1/4	2155	5870
58	69.25	6.25	6.25	62.00	0.50	10.50	59.62	58.00	32	2.38	65.00	2 1/4	2270	6400
60	71.25	6.44	6.44	64.00	0.50	10.75	61.62	60.00	32	2.38	67.00	2 1/4	2470	7000

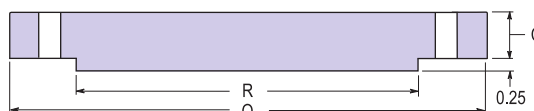
NOTE

Class 400 large diameter flanges and blinds are available upon request.

LARGE DIAMETER FLANGES



WELDING NECK



BLIND

Nominal Pipe Size	Flange								Bolting				Weights	
	OD	Thickness		Raised Face OD	Fillet Radius Min.	Hub			No. of Holes	Hole Size	Bolt Circle Dia.	Stud Bolt Diameter	Weld Neck Flange	Blind
		△ WN Flg	△ Blind			△ Length	Bottom OD	Top OD						
	O	C	C	R	r	Y	X	A						
class 600 LARGE DIAMETER FLANGES ASME B16.47 Series A or MSS SP-44														
26	40.00	4.25	4.94	29.50	0.50	8.75	29.44	26.00	28	2.00	36.00	1 7/8	940	1680
28	42.25	4.38	5.19	31.50	0.50	9.25	31.62	28.00	28	2.12	38.00	2	1060	1970
30	44.50	4.50	5.50	33.75	0.50	9.75	33.94	30.00	28	2.12	40.25	2	1210	1330
32	47.00	4.62	5.81	36.00	0.50	10.25	36.12	32.00	28	2.38	42.50	2 1/4	1375	2575
34	49.00	4.75	6.06	38.00	0.56	10.62	38.31	34.00	28	2.38	44.50	2 1/4	1540	3100
36	51.75	4.88	6.38	40.25	0.56	11.12	40.62	36.00	28	2.62	47.00	2 1/2	1705	3610
38	50.00	6.00	6.12	41.50	0.56	10.00	40.25	38.00	28	2.38	45.75	2 1/4	1470	3280
40	52.00	6.25	6.38	43.75	0.56	10.38	42.25	40.00	32	2.38	47.75	2 1/4	1630	3680
42	55.25	6.62	6.75	46.00	0.56	11.00	44.38	42.00	28	2.62	50.50	2 1/2	2030	4400
44	57.25	6.81	7.00	48.25	0.56	11.38	46.50	44.00	32	2.62	52.50	2 1/2	2160	4885
46	59.50	7.06	7.31	50.25	0.56	11.81	48.62	46.00	32	2.62	54.75	2 1/2	2410	5530
48	62.75	7.44	7.69	52.50	0.56	12.44	50.75	48.00	32	2.88	57.50	2 3/4	2855	6425
50	65.75	7.75	8.00	54.50	0.56	12.94	52.88	50.00	28	3.12	60.00	3	3330	7360
52	67.75	8.00	8.25	56.50	0.56	13.25	54.88	52.00	32	3.12	62.00	3	3560	8015
54	70.00	8.25	8.56	58.75	0.56	13.75	57.00	54.00	32	3.12	64.25	3	3920	8915
56	73.00	8.56	8.88	60.75	0.62	14.25	59.12	56.00	32	3.38	66.75	3 1/4	4280	10000
58	75.00	8.75	9.12	63.00	0.62	14.56	61.12	58.00	32	3.38	68.75	3 1/4	4640	10880
60	78.50	9.19	9.56	65.25	0.69	15.31	63.38	60.00	28	3.62	71.75	3 1/2	5000	12030
class 900 LARGE DIAMETER FLANGES ASME B16.47 Series A or MSS SP-44														
26	42.75	5.50	6.31	29.50	0.44	11.25	30.50	26.00	20	2.88	37.50	2 3/4	1525	2400
28	46.00	5.62	6.75	31.50	0.50	11.75	32.75	28.00	20	3.12	40.25	3	1810	2945
30	48.50	5.88	7.18	33.75	0.50	12.25	35.00	30.00	20	3.12	42.75	3	2120	3500
32	51.75	6.25	7.62	36.00	0.50	13.00	37.25	32.00	20	3.38	45.50	3 1/4	2545	4230
34	55.00	6.50	8.06	38.00	0.56	13.75	39.62	34.00	20	3.62	48.25	3 1/2	2970	5030
36	57.50	6.75	8.44	40.25	0.56	14.25	41.88	36.00	20	3.62	50.75	3 1/2	3395	5800
38	57.50	7.50	8.50	43.25	0.75	13.88	42.25	38.00	20	3.62	50.75	3 1/2	3385	5825
40	59.50	7.75	8.81	45.75	0.81	14.31	44.38	40.00	24	3.62	52.75	3 1/2	3620	6390
42	61.50	8.12	9.12	47.75	0.81	14.62	46.31	42.00	24	3.62	54.75	3 1/2	3960	7110
44	64.88	8.44	9.56	50.00	0.88	15.38	48.62	44.00	24	3.88	57.62	3 3/4	4300	8265
46	68.25	8.88	10.06	52.50	0.88	16.18	50.88	46.00	24	4.12	60.50	4	4640	10345
48	70.25	9.19	10.38	54.50	0.94	16.50	52.88	48.00	24	4.12	62.50	4	4980	10600
50	--	--	--	--	--	--	--	--	--	--	--	--	--	--
52	--	--	--	--	--	--	--	--	--	--	--	--	--	--
54	--	--	--	--	--	--	--	--	--	--	--	--	--	--
56	--	--	--	--	--	--	--	--	--	--	--	--	--	--
58	--	--	--	--	--	--	--	--	--	--	--	--	--	--
60	--	--	--	--	--	--	--	--	--	--	--	--	--	--

NOTE

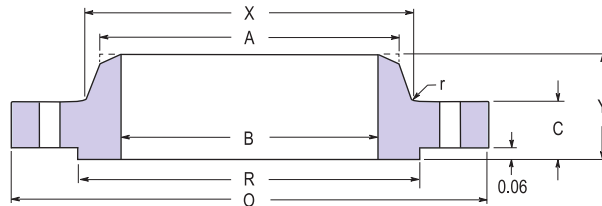
△ The 1/4" raised face is not included in Thickness C, Length Y.

See Notes on Page 30

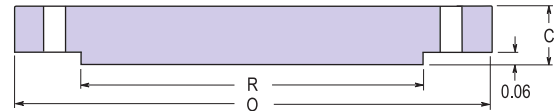
LARGE DIAMETER FLANGES



FCI Forged Components
A OneWest Company



WELDING NECK



BLIND

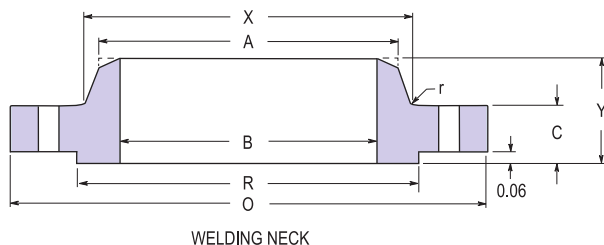
Nominal Pipe Size	Flange								Bolting				Weights	
	OD	Thickness		Raised Face OD	Fillet Radius Min.	Hub			No. of Holes	Hole Size	Bolt Circle Dia.	Stud Bolt Diameter	Weld Neck Flange	Blind
		WN Flg	Blind*			Length	Bottom OD	Top OD						
	O	C	C	R	r	Y	X	A						
class 75 LARGE DIAMETER FLANGES ASME B16.47 Series B or API 605*														
26	30.00	1.31	1.31	27.75	0.31	2.31	26.62	26.06	36	0.75	28.50	5/8	80	255
28	32.00	1.31	1.31	29.75	0.31	2.44	28.62	28.06	40	0.75	30.50	5/8	85	290
30	34.00	1.31	1.31	31.75	0.31	2.56	30.62	30.06	44	0.75	32.50	5/8	90	330
32	36.00	1.38	1.44	33.75	0.31	2.75	32.62	32.06	48	0.75	34.50	5/8	105	390
34	38.00	1.38	1.50	35.75	0.31	2.88	34.62	34.06	52	0.75	36.50	5/8	110	430
36	40.69	1.44	1.67	38.00	0.38	3.38	36.81	36.06	40	0.88	39.06	3/4	145	518
38	42.69	1.50	1.75	40.00	0.38	3.50	38.81	38.06	40	0.88	41.06	3/4	160	595
40	44.69	1.50	1.75	42.00	0.38	3.62	40.81	40.06	44	0.88	43.06	3/4	170	760
42	46.69	1.56	1.88	44.00	0.38	3.75	42.81	42.06	48	0.88	45.06	3/4	185	895
44	49.25	1.69	1.94	46.25	0.38	4.12	44.88	44.06	36	1.00	47.38	7/8	230	1065
46	51.25	1.75	2.00	48.25	0.38	4.25	46.88	46.06	40	1.00	49.38	7/8	245	1185
48	53.25	1.81	2.12	50.25	0.38	4.38	48.88	48.06	44	1.00	51.38	7/8	270	1315
50	55.25	1.88	2.18	52.25	0.38	4.56	50.94	50.06	44	1.00	53.38	7/8	290	1505
52	57.38	1.88	2.25	54.25	0.38	4.75	52.94	52.06	48	1.00	55.50	7/8	310	1665
54	59.38	1.94	2.38	56.25	0.38	4.94	55.00	54.06	48	1.00	57.50	7/8	340	1840
56	62.00	2.00	2.44	58.25	0.44	5.31	57.12	56.06	40	1.12	59.88	1	400	2110
58	64.00	2.06	2.50	60.50	0.44	5.44	59.12	58.06	44	1.12	61.88	1	430	2300
60	66.00	2.19	2.62	62.50	0.44	5.69	61.12	60.06	44	1.12	63.88	1	475	2500
class 150 LARGE DIAMETER FLANGES ASME B16.47 Series B or API 605*														
26	30.94	1.62	1.75	28.00	0.38	3.50	26.94	26.06	36	0.88	29.31	3/4	120	363
28	32.94	1.75	1.88	30.00	0.38	3.75	28.94	28.06	40	0.88	31.31	3/4	140	443
30	34.94	1.75	2.00	32.00	0.38	3.94	31.00	30.06	44	0.88	33.31	3/4	150	530
32	37.06	1.81	2.12	34.00	0.38	4.25	33.06	32.06	48	0.88	35.44	3/4	170	598
34	39.56	1.94	2.25	36.25	0.38	4.34	35.12	34.06	40	1.00	37.69	7/8	210	781
36	41.62	2.06	2.31	38.25	0.38	4.62	37.19	36.06	44	1.00	39.75	7/8	240	883
38	44.25	2.12	2.50	40.25	0.38	4.88	39.25	38.12	40	1.12	42.12	1	290	1050
40	46.25	2.19	2.62	42.50	0.38	5.06	41.31	40.12	44	1.12	44.12	1	310	1205
42	48.25	2.31	2.69	44.50	0.44	5.25	43.38	42.12	48	1.12	46.12	1	345	1350
44	50.25	2.38	2.81	46.50	0.44	5.38	45.38	44.12	52	1.12	48.12	1	370	1520
46	52.81	2.44	2.94	48.62	0.44	5.69	47.44	46.12	40	1.25	50.56	1 1/8	435	1796
48	54.81	2.56	3.06	50.75	0.44	5.88	49.50	48.12	44	1.25	52.56	1 1/8	480	2015
50	56.81	2.69	3.18	52.75	0.44	6.06	51.50	50.12	48	1.25	54.56	1 1/8	520	2245
52	58.81	2.75	3.31	54.75	0.44	6.19	53.56	52.12	52	1.25	56.56	1 1/8	550	2502
54	61.00	2.81	3.44	56.75	0.44	6.38	55.62	54.12	56	1.25	58.75	1 1/8	620	2780
56	63.00	2.88	3.56	58.75	0.56	6.56	57.69	56.12	60	1.25	60.75	1 1/8	650	3070
58	65.94	2.94	3.68	60.75	0.56	6.88	59.69	58.12	48	1.38	63.44	1 1/4	780	3492
60	67.94	3.00	3.81	63.00	0.56	7.06	61.81	60.12	52	1.38	65.44	1 1/4	850	3835

NOTE

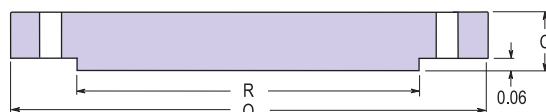
*Blinds are not included in API 605.

See Notes on Page 30

LARGE DIAMETER FLANGES



WELDING NECK



BLIND

Nominal Pipe Size	Flange								Bolting				Weights	
	OD	Thickness		Raised Face OD	Fillet Radius Min.	Hub			No. of Holes	Hole Size	Bolt Circle Dia.	Stud Bolt Diameter	Weld Neck Flange	Blind
		ΔWN Flg	Δ Blind*			Δ Length	Bottom OD	Top OD						
	O	C	C	R	r	Y	X	A						
class 300 LARGE DIAMETER FLANGES ASME B16.47 Series B or API 605*														
26	34.12	3.50	3.50	29.00	0.56	5.69	27.62	26.19	32	1.38	31.62	1 1/4	400	853
28	36.25	3.50	3.50	31.00	0.56	5.88	29.75	28.19	36	1.38	33.75	1 1/4	450	960
30	39.00	3.69	3.69	33.25	0.56	6.22	32.00	30.25	36	1.50	36.25	1 3/8	550	1182
32	41.50	4.06	4.06	35.50	0.62	6.62	34.00	32.25	32	1.62	38.50	1 1/2	685	1515
34	43.62	4.06	4.06	37.50	0.62	6.81	36.12	34.25	36	1.62	40.62	1 1/2	750	1660
36	46.12	4.06	4.06	39.75	0.62	7.12	38.00	36.25	32	1.75	42.88	1 5/8	840	1824
38	48.12	4.38	4.38	41.75	0.62	7.56	40.00	38.25	36	1.75	44.88	1 5/8	915	2140
40	50.12	4.56	4.56	43.88	0.62	7.81	42.00	40.25	40	1.75	46.88	1 5/8	990	2415
42	52.50	4.69	4.69	46.00	0.62	8.06	44.00	42.31	36	1.88	49.00	1 3/4	1135	2790
44	54.50	5.00	5.00	48.00	0.62	8.44	46.19	44.31	40	1.88	51.00	1 3/4	1235	3210
46	57.50	5.06	5.12	50.00	0.62	8.75	48.38	46.31	36	2.00	53.75	1 7/8	1470	3665
48	59.50	5.06	5.31	52.25	0.62	8.81	50.31	48.31	40	2.00	55.75	1 7/8	1575	4050
50	61.50	5.44	5.50	54.25	0.62	9.25	52.38	50.31	44	2.00	57.75	1 7/8	1710	4450
52	63.50	5.62	5.68	56.25	0.62	9.56	54.44	52.31	48	2.00	59.75	1 7/8	1840	4925
54	65.88	5.38	5.88	58.25	0.62	9.44	56.50	54.31	48	2.00	62.12	1 7/8	1980	5446
56	69.50	6.06	6.18	60.50	0.69	10.56	58.81	56.31	36	2.38	65.00	2 1/4	2595	6480
58	71.94	6.06	6.38	62.75	0.69	10.81	60.94	58.31	40	2.38	67.44	2 1/4	2770	7069
60	73.94	5.94	6.56	65.00	0.69	10.69	62.94	60.31	40	2.38	69.44	2 1/4	2870	7695
Δ class 600 LARGE DIAMETER FLANGES ASME B16.47 Series B or API 605*														
26	35.00	4.38	4.38	28.62	0.50	7.12	27.50	26.00	28	1.75	31.75	1 5/8	550	1109
28	37.50	4.56	4.56	30.88	0.50	7.50	29.62	28.00	28	1.88	34.00	1 3/4	650	1363
30	40.25	4.94	5.00	33.12	0.50	8.06	31.75	30.00	28	2.00	36.50	1 7/8	810	1655
32	42.75	5.12	5.31	35.25	0.50	8.50	33.88	32.00	28	2.12	38.75	2	950	2028
34	45.75	5.56	5.68	37.50	0.56	9.19	36.00	34.00	24	2.38	41.50	2 1/4	1205	2516
36	47.75	5.75	5.94	39.75	0.56	9.56	38.12	36.00	28	2.38	43.50	2 1/4	1340	2854
38	50.00	6.00	6.12	41.50	0.56	10.00	40.25	38.00	28	2.38	45.75	2 1/4	1470	3280
40	52.00	6.25	6.38	43.75	0.56	10.38	42.25	40.00	32	2.38	47.75	2 1/4	1630	3680
42	55.25	6.62	6.75	46.00	0.56	11.00	44.38	42.00	28	2.62	50.50	2 1/2	2030	4400
44	57.25	6.81	7.00	48.25	0.56	11.38	46.50	44.00	32	2.62	52.50	2 1/2	2160	4885
46	59.50	7.06	7.31	50.25	0.56	11.81	48.62	46.00	32	2.62	54.75	2 1/2	2410	5530
48	62.75	7.44	7.69	52.50	0.56	12.44	50.75	48.00	32	2.88	57.50	2 3/4	2855	6425
50	65.75	7.75	8.00	54.50	0.56	12.94	52.88	50.00	28	3.12	60.00	3	3330	7360
52	67.75	8.00	8.25	56.50	0.56	13.25	54.88	52.00	32	3.12	62.00	3	3560	8015
54	70.00	8.25	8.56	58.75	0.56	13.75	57.00	54.00	32	3.12	64.25	3	3920	8915
56	73.00	8.56	8.88	60.75	0.62	14.25	59.12	56.00	32	3.38	66.75	3 1/4	4280	10000
58	75.00	8.75	9.12	63.00	0.62	14.56	61.12	58.00	32	3.38	68.75	3 1/4	4640	10880
60	78.50	9.19	9.56	65.25	0.69	15.31	63.38	60.00	28	3.62	71.75	3 1/2	5000	12030

NOTE

Dimensions for Class 400 NPS 38 & Larger Series B Flanges are the same as for the Series A Flanges.

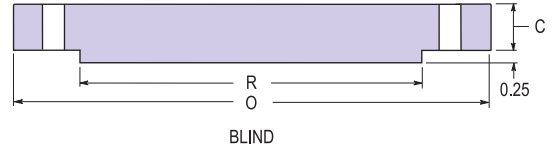
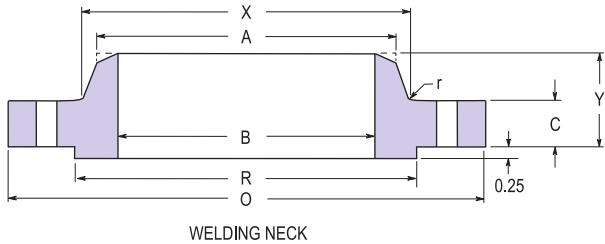
* Blinds are not included in API 605.

Δ The 1/4" raised face is not included in Thickness C, Length Y. See drawing on page 30 for details.

Class 400 large diameter flanges and blinds are available upon request.

See Notes on Page 30

LARGE DIAMETER FLANGES



Nominal Pipe Size	Flange								Bolting				Weights	
	OD	Thickness		Raised Face OD	Fillet Radius Min.	Hub			No. of Holes	Hole Size	Bolt Circle Dia.	Stud Bolt Diameter	Weld Neck Flange	Blind
		Δ WN Flg	Δ Blind*			Δ Length	Bottom OD	Top OD						
	O	C	C	R	r	Y	X	A						
class 900 LARGE DIAMETER FLANGES ASME B16.47 Series B or API 605*														
26	40.25	5.31	6.06	30.00	0.44	10.19	29.25	26.00	20	2.62	35.50	2 1/2	1050	1996
28	43.50	5.81	6.56	32.25	0.50	10.88	31.38	28.00	20	2.88	38.25	2 3/4	1520	2580
30	46.50	6.12	6.93	34.50	0.50	11.38	33.50	30.00	20	3.12	40.75	3	1820	3095
32	48.75	6.31	7.31	36.50	0.50	11.94	35.75	32.00	20	3.12	43.00	3	2065	3583
34	51.75	6.75	7.68	39.00	0.56	12.56	37.88	34.00	20	3.38	45.50	3 1/4	2450	4210
36	53.00	6.81	7.94	40.50	0.56	12.81	40.00	36.00	24	3.12	47.25	3	2520	4550
38	57.50	7.50	8.50	43.25	0.75	13.88	42.25	38.00	20	3.62	50.75	3 1/2	3385	5825
40	59.50	7.75	8.81	45.75	0.81	14.31	44.38	40.00	24	3.62	52.75	3 1/2	3620	6390
42	61.50	8.12	9.12	47.75	0.81	14.62	46.31	42.00	24	3.62	54.75	3 1/2	3960	7110
44	64.88	8.44	9.56	50.00	0.88	15.38	48.62	44.00	24	3.88	57.62	3 1/4	4300	8265
46	68.25	8.88	10.06	52.50	0.88	16.18	50.88	46.00	24	4.12	60.50	4	4640	10345
48	70.25	9.19	10.38	54.50	0.94	16.50	52.88	48.00	24	4.12	62.50	4	4980	10600
50	--	--	--	--	--	--	--	--	--	--	--	--	--	--
52	--	--	--	--	--	--	--	--	--	--	--	--	--	--
54	--	--	--	--	--	--	--	--	--	--	--	--	--	--
56	--	--	--	--	--	--	--	--	--	--	--	--	--	--
58	--	--	--	--	--	--	--	--	--	--	--	--	--	--
60	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Dimensions for Classes 600 & 900 NPS 38 & Larger Series B Flanges are the same as for the Series A Flanges.

* Blinds are not included in API 605.

Δ The 1/4" raised face is not included in Thickness C, Length Y.

GENERAL NOTES FOR FCI STANDARD LARGE DIAMETER FLANGES

CODES: FCI large diameter flanges are manufactured in compliance with ASME Section II, Section VIII, Div. 1, and ASME B16.47 Series A and B.

MATERIALS: All materials comply with the applicable ASME and ASTM specifications. Full traceability is mandated by our quality system. Standard forged material is carbon steel SA105. Large diameter flanges can also be furnished in other carbon steels, alloy steels, stainless, high nickel and non-ferrous alloys upon request.

BORES: Large diameter flange bores are to be specified by Purchaser.

FACING: Standard facing is raised face to ASME B16.47 Series A or B as applicable. The 0.06" raised face is included in thickness "C" and length "Y" dimensions for Class 75, 150 and 300 large diameter flange connections. The 0.25" raised face is not included in thickness "C" and "Y" dimensions for Class 400, 600, and Class 900 large diameter flange connections. Other standard and special facings are available upon request.

LENGTHS: Listed lengths are standard. Other lengths are available on special order.

FLANGES: Flange dimensions and drilling are in accordance with ASME B16.47 Series A or B as applicable. Studs, bolts, nuts, and gaskets are not furnished.

HEAT TREATMENT: All standard connections over Class 300 rating are supplied in the normalized condition in accordance with the requirements of ASME Section II. Other heat treatment requirements can be provided upon request.

TOLERANCE: Manufacturing tolerances as a minimum, will meet the requirements of ASME B16.47 unless otherwise specified.



2 1/2" to 34" Bar and Ingot Inventory



Carbon and Alloy Large Ingot and Billet Inventory



Carbon And Alloy Billet and Bar Inventory



Stainless Steel Billet and Bar Inventory



Forged Cylinders Being Air Cooled After Heat Treatment



Large Bore Long Weld Neck "LWN" Connection



California Style Ring Mill



Large Forged Cylinder

CUSTOM PRODUCTS



Pierced Block With ID



Large Diameter Forged Cylinder



2500 Ton Press Forging Large Cylinder



Large Diameter Flange



Large Diameter Flange



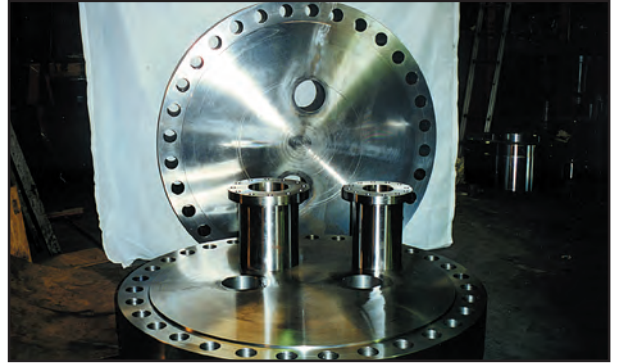
Integral Nozzle and Elliptical Head



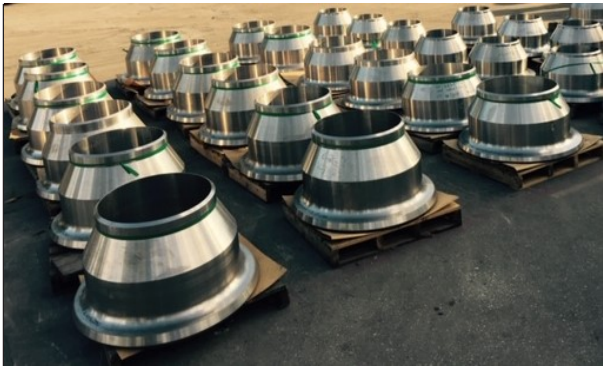
Dual Hub Q-lip Nozzle



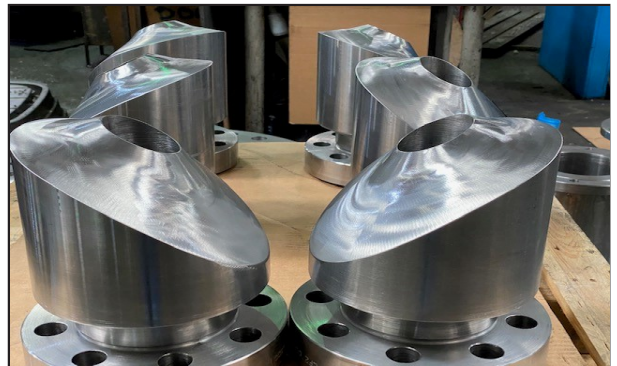
Vessel Insert Double Butt Weld Hubs



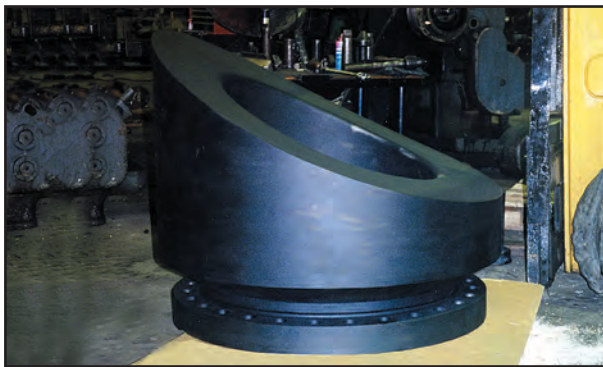
Blind Flanges and "LWN" Connections



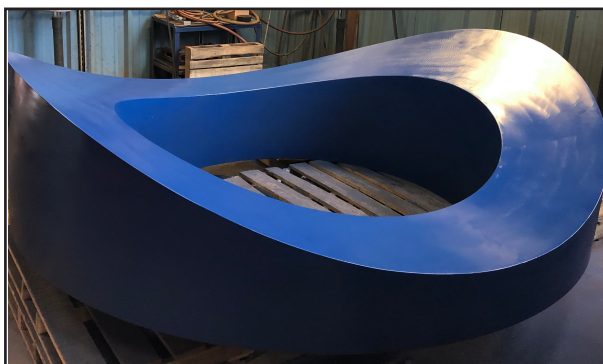
Q-lip Stub End Nozzles



Custom Nozzles



Tangential Super Barrel "SB" Connection



84" Contoured Butt Weld Stub



Forged Conical Reducer

CUSTOM PRODUCTS



HB Necks Q-Lip Style for Radial Attachments and Cylindrical Hillside Complete with Bevels



36" F11 Hillside Q-Lip Stubs for Coker Vessels



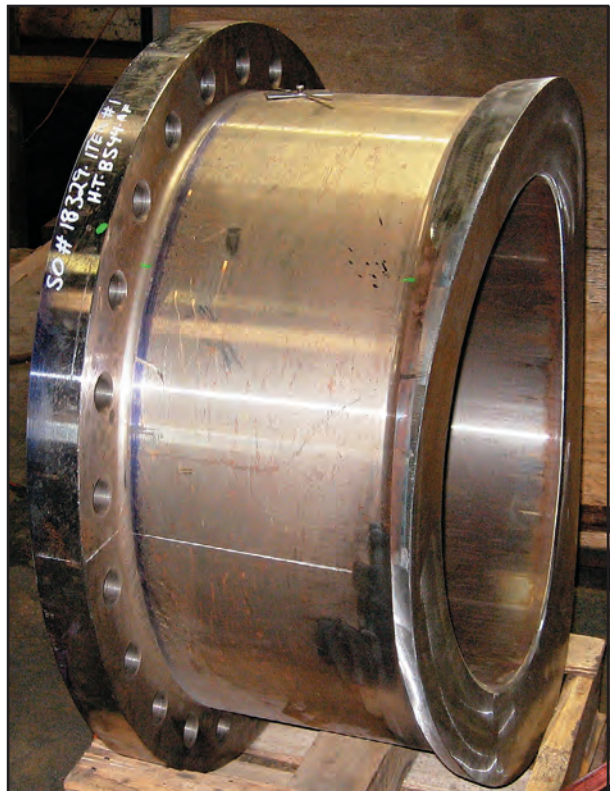
F11 Heavy Wall Q-Lip Stub



Hillside Q-Lip Stubs for Coker Vessels



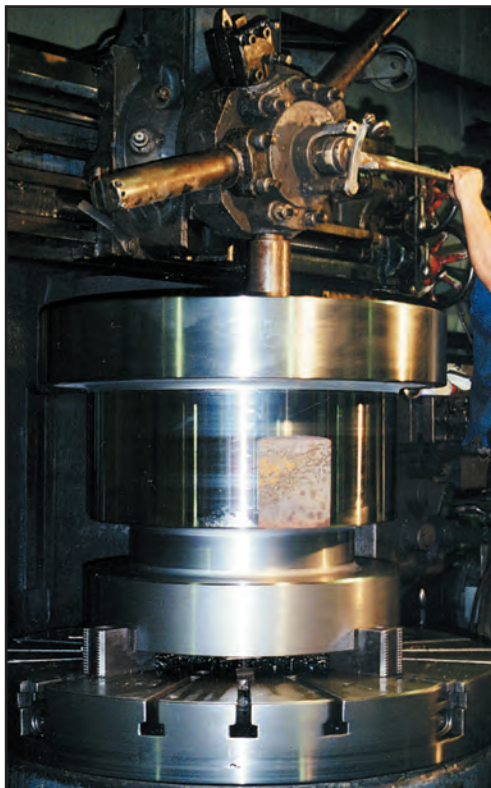
Elliptical Q-Lip Coker Nozzle



24" 300# Contoured Q-Lip Nozzle



19,000 Lb Pigable Y Block Forging



11" x 15M 7" x 20M Tubing Head



Hillside Contour with Pre-fabricated Outlet prep.



6" 600# H Neck 71" Long

CUSTOM PRODUCTS



**Tubing Head 13 5/8" 5M x 11" 10M
with 1 13/16" 10M Outlets**



**11" 10M Lower Slip Loc Housing
with FPO's**



Running Tool



15M and 10M Spool with Studed Outlets



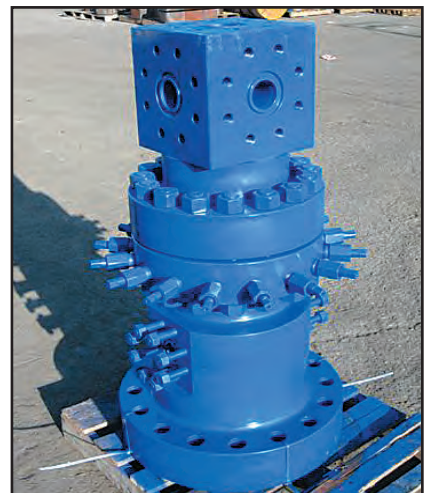
11" 10M Lower Connector



**Combination Test Plug, Running and
Retrieving Tool 11" x 4 1/2" IF**



11" 10M x 11" 10M Upper Mult-Bowl



**3 1/16" 15M Five Way Cross and
11" 10M x 7 1/16" 15M TCM Tubing Head**

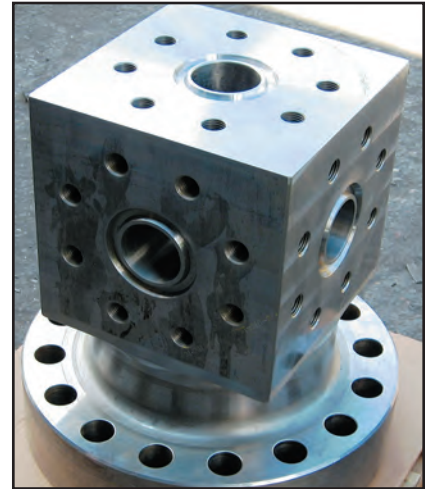
CUSTOM PRODUCTS



**Tubing Bonnet 11" 5M x 4" 5M with
2" 5M Outlet and Control Line**



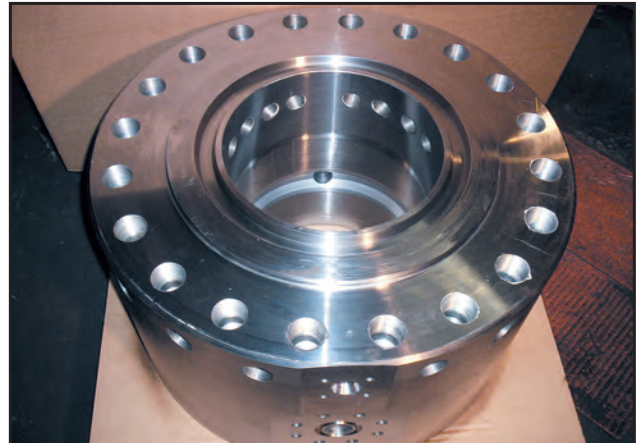
7 1/16" 5M Studded Tee



**7 1/16" 15M Studded Flange Bottom
x 3 1/16" 15M Five Way Cross Top**



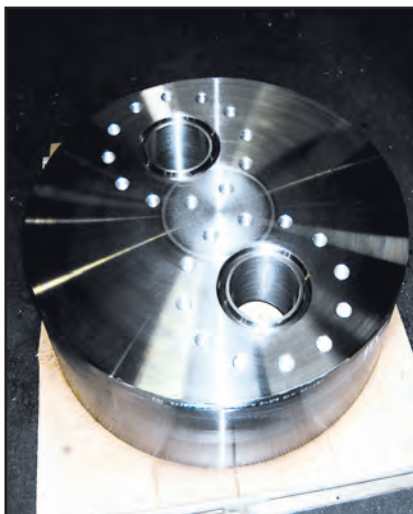
API Weld Neck Flange



Multi-Bowl 13 5/8" 5M x 13 5/8" 5M With Control Line



**7 1/16" 15M Spool with 4 1/16" 15M
Studded Outlets API PSL-3**



Dual Adapter 7 1/16" 10M x 7 1/16" 10M

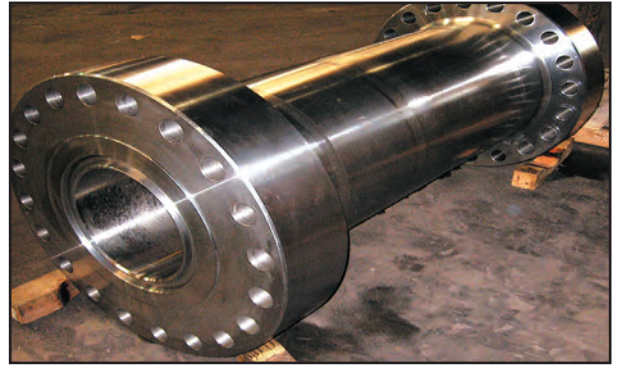


**12" 4130 High Pressure Water
Injection Tee**

CUSTOM PRODUCTS



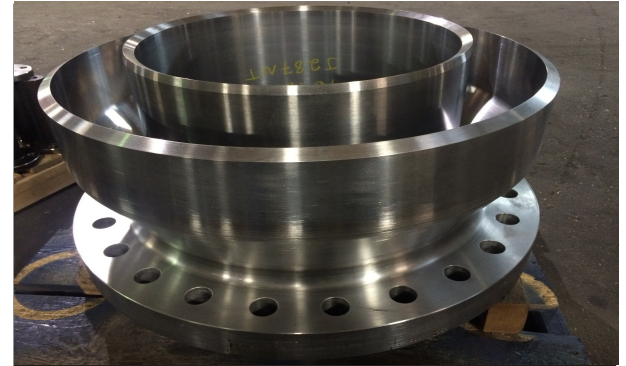
Forged Lateral



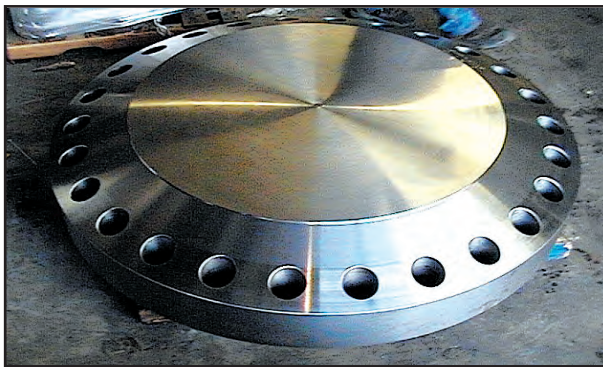
13 5/8" 15M x 13 5/8 15M Riser Spool 72" Long



4 1/16" 10M Tree Cap Components



Heat Exchanger Connection



High Pressure Tapered Plug Flange



Wellhead Remanufacture/Contract Machine Work



Double Hubbed Flanged Bonnet Forgings



Completed Double Hubbed Flanged Bonnet

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NOTE:

Technical data contained in this section governed by ASME or other Codes/Specifications are subject to change and are therefore provided for information purposes only and are not to be used for design purposes. Refer to latest edition of applicable Code / Specification and addendums thereto for required design data.

COMMON FORGING MATERIALS FOR FCI PRODUCTS *

SA 105	Carbon Steels	
SA 182	Low Alloy Steels	F1, F5, F5a, F9, F91, F11, F12, F22
	Martensitic Stainless Steels	F6a, F6NM
	Ferritic-Austenitic Stainless Steels	F51, F60
	Austenitic Stainless Steels	F304, F304HF304L, F310, F316, F316H, F316L, F317, F317L, F321, F321H, F347, F347H, F348, F348H
SA 266	Carbon Steels	Gr.1, Gr.2, Gr.3, Gr.4
SA 350	Carbon and Low Alloy Steels	LF1, LF2, LF3, LF6 Class1, LF6 Class2, LF9
SA 541	Q & T Carbon and Alloy Steels	Gr.2 Class 2, Gr.22 Class 3
SA 765	Carbon and Low Alloy, Low Temp. Steels	Gr.1, Gr.2, Gr.3, Gr.4
API	Carbon, Low Alloy and Stainless Steels	36K, 45K, 60K, 75K, 110K
AISI	Carbon Steels	1018M, 1020M, 1022M, 1030's, 1040's
	Carbon Alloy Steels	4130, 4140, 4340, 8630, 8630M
A 694	High Yield Steels	F42, F46, F48, F50, F52, F56, F60, F65, F70
A 705	Age Hardening Stainless Steels	17-4PH
A 707	Carbon and Alloy Steels	Gr.L3 Class 1, Gr.L3 Class 2, Gr.L3 Class 3
B 564	Nickel Alloy Steels	Series 400, 600 and 800

NOTE

Purchase to specify material class where applicable.

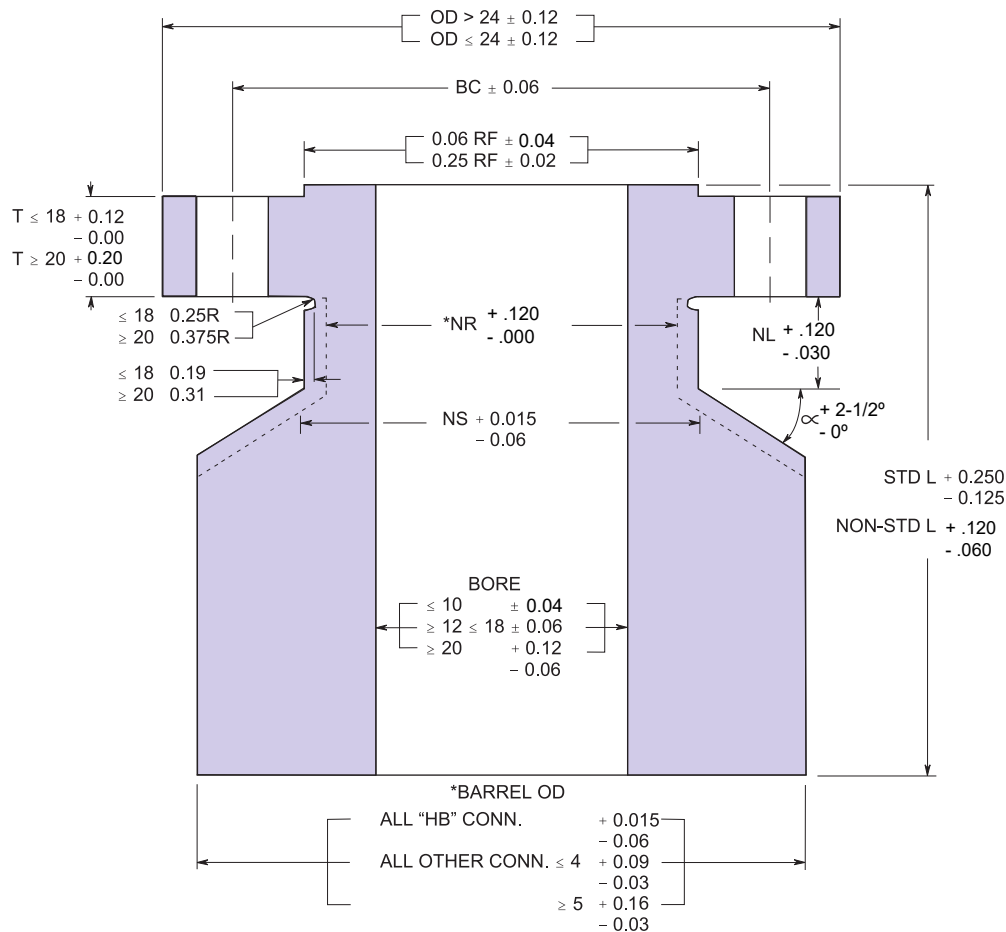
Materials listed are normally available in raw form from FCI inventories or stocks made available to FCI.

All materials comply with the applicable ASME, ASTM, API and AISI Codes and/or Specifications.

Materials can be selected to comply with "NACE" requirements upon request.

- * Products can also be furnished in other carbon steels, alloy steels, stainless, high nickel and non-ferrous alloys upon request.
- * Materials exhibiting other than standard Code chemical and/or physical properties or materials requiring specialized steel making practices can be furnished upon special order.

FCI CONNECTION TOLERANCES

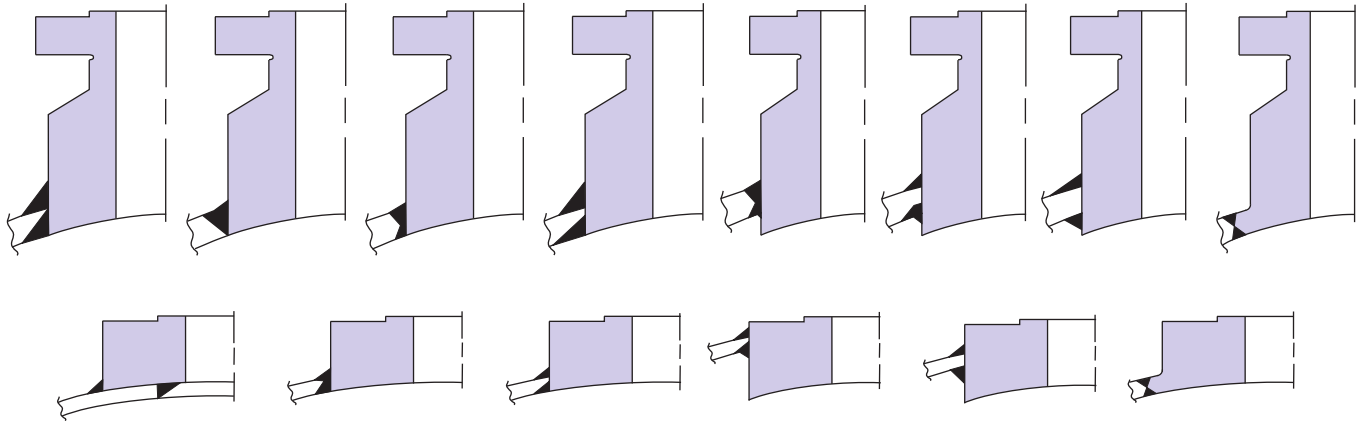


NOTE

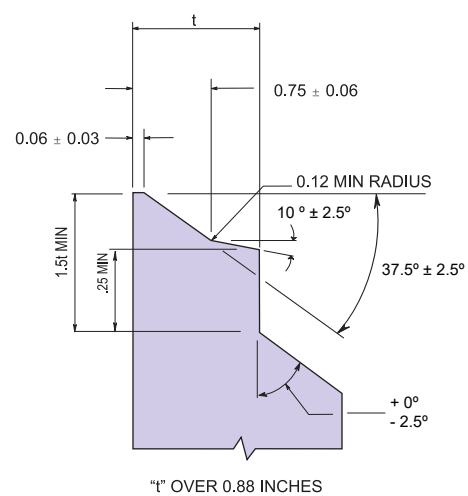
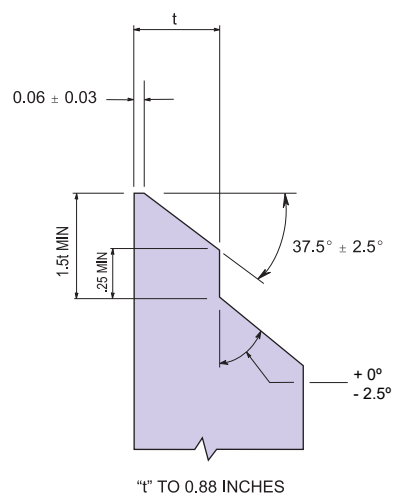
1. All dimensions are in inches.
2. Tolerances and undercut dimensions are in accordance with ASME B16.5 and ASME Section VIII, Div. 1, App. 2, Fig. 2-4.
3. Tolerances for FCI products will be modified as necessary to maintain compliance with latest Code updates.
4. Tolerances may be modified to meet other more stringent requirements upon Purchaser's request.

* Specific tolerance may deviate but minimum wall thickness will be maintained.

COMMON METHODS OF CONNECTION ATTACHMENTS



STANDARD WELD END PREPARATIONS



NOTE

1. All dimensions are in inches.
2. Bevel dimensions and tolerances are in accordance with ASME B16.5.
3. Butt weld end connections can be beveled to other special configurations upon Purchaser's request.

GENERAL NOTES FOR FCI FLANGE FACINGS

FCI connections are available with numerous standard and special facings. The more popular standard facings are described below. Special facing details if required are to be furnished by Purchaser.

RAISED FACE: Furnished as a standard facing on all FCI connections unless otherwise specified. The facing height and outside diameter are specified in the standard product tables. Gasket surface serrations are spiral and are in full compliance with the requirements of the latest issue of ASME B16.5, ASME B16.47 Series A & B, and ASME B46.1.

FLAT FACE: All connections may be ordered flat faced. Class 75, 150 and 300 connections and flanges ordered flat faced, will have the normally furnished raised face removed by machining. The resulting minimum flange thickness will be 0.06 inches less than that specified in the standard product tables. On connections and flanges rated Class 400 and greater, the raised face normally furnished will also be removed by machining, however, the resulting flange thickness will not be less than the flange thickness dimension specified in the product table.

Alternately, all connections and flanges may be ordered as "full-flat-face". When so ordered, Class 75, 150 and 300 connections and flanges will be furnished with a minimum flange thickness as specified in the product table. Class 400, 600, 900, 1500 and 2500 connections and flanges will be furnished with a minimum flange thickness as specified in the product table thickness plus 0.25 inches.

In all cases, the entire connection/flange mating surface will be finished to a surface roughness not exceeding 250 AARH unless otherwise specified by Purchaser.

Options mentioned above are in accordance with ASME B16.5 and ASME B16.47 Code requirements.

ROUGH FORGING: Except as otherwise specified, no finish machining or drilling of holes will be performed on rough forgings. A minimum of 0.12 inches will be provided on all surfaces for Purchaser machining. Facing heights exceeding those of a standard raised face must be indicated.

RING TYPE JOINT: The following table lists the dimensions and tolerances applicable to ring type joint facings for ASME B16.5 flanges. The side walls of the gasket groove are finished to a maximum surface roughness of 63 AARH. Ring joint facings can be furnished for large diameter flanges in accordance with ASME B16.47 upon request.

OTHER STANDARD FACINGS: The dimensional details of other standard facings for ASME B16.5 flanged connections are presented in the table following "Facing Dimensions For Ring Joint Connections". Other standard facings can be furnished for large diameter flanges in accordance with ASME B16.47 upon request.

"SWEEP LOSS" CHART

SHELL OR HEAD CROWN RADIUS	CONNECTION RADIUS																				
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	
5.375	0.39	0.92	1.78	3.40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
6.375	0.32	0.75	1.41	2.42	4.22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
7	0.29	0.68	1.26	2.10	3.39	7.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
8	0.25	0.58	1.07	1.76	2.71	4.13	8.00	-	-	-	-	-	-	-	-	-	-	-	-	-	
9	0.23	0.51	0.94	1.52	2.29	3.34	4.88	9.00	-	-	-	-	-	-	-	-	-	-	-	-	
10	0.20	0.46	0.83	1.34	2.00	2.86	4.00	5.64	10.00	-	-	-	-	-	-	-	-	-	-	-	
12	0.17	0.38	0.69	1.09	1.61	2.25	3.06	4.06	5.37	7.20	12.00	-	-	-	-	-	-	-	-	-	
15	0.13	0.30	0.54	0.86	1.25	1.73	2.31	3.00	3.82	4.80	6.00	7.52	9.61	15.00	-	-	-	-	-	-	
18	0.11	0.25	0.45	0.71	1.03	1.42	1.88	2.41	3.03	3.75	4.58	5.55	6.69	8.05	9.75	12.08	18.00	-	-	-	
21	0.10	0.22	0.38	0.60	0.88	1.20	1.58	2.03	2.53	3.11	3.77	4.51	5.35	6.30	7.40	8.67	10.18	12.06	14.60	21.00	
24	0.08	0.19	0.34	0.53	0.76	1.04	1.37	1.75	2.18	2.67	3.22	3.83	4.51	5.27	6.11	7.06	8.13	9.34	10.73	12.38	
27	0.07	0.17	0.30	0.47	0.68	0.92	1.21	1.54	1.92	2.34	2.81	3.34	3.91	4.55	5.25	6.02	6.88	7.82	8.86	10.03	
30	0.07	0.15	0.27	0.42	0.61	0.83	1.09	1.38	1.72	2.09	2.50	2.96	3.47	4.02	4.62	5.28	6.00	6.78	7.64	8.58	
33	0.06	0.14	0.24	0.38	0.55	0.75	0.98	1.25	1.55	1.89	2.26	2.67	3.12	3.61	4.14	4.72	5.34	6.02	6.75	7.54	
36	0.06	0.13	0.22	0.35	0.50	0.69	0.90	1.14	1.42	1.72	2.06	2.43	2.83	3.27	3.75	4.27	4.82	5.42	6.07	6.76	
39	0.05	0.12	0.21	0.32	0.46	0.63	0.83	1.05	1.30	1.58	1.89	2.23	2.60	3.00	3.43	3.90	4.40	4.94	5.52	6.14	
42	0.05	0.11	0.19	0.30	0.43	0.59	0.77	0.98	1.21	1.47	1.75	2.06	2.40	2.77	3.17	3.59	4.05	4.54	5.07	5.63	
45	0.04	0.10	0.18	0.28	0.40	0.55	0.72	0.91	1.13	1.37	1.63	1.92	2.23	2.57	2.94	3.33	3.76	4.21	4.69	5.20	
48	0.04	0.09	0.17	0.26	0.38	0.51	0.67	0.85	1.05	1.28	1.52	1.79	2.09	2.40	2.75	3.11	3.50	3.92	4.37	4.84	
54	0.04	0.08	0.15	0.23	0.33	0.46	0.60	0.76	0.93	1.13	1.35	1.59	1.85	2.13	2.42	2.75	3.09	3.45	3.84	4.25	
60	0.03	0.08	0.13	0.21	0.30	0.41	0.54	0.68	0.84	1.02	1.21	1.43	1.66	1.91	2.17	2.46	2.76	3.09	3.43	3.80	
66	0.03	0.07	0.12	0.19	0.27	0.37	0.49	0.62	0.76	0.92	1.10	1.29	1.50	1.73	1.97	2.23	2.50	2.79	3.10	3.43	
72	0.03	0.06	0.11	0.17	0.25	0.34	0.45	0.56	0.70	0.85	1.01	1.18	1.37	1.58	1.80	2.04	2.29	2.55	2.83	3.13	
78	0.03	0.06	0.10	0.16	0.23	0.31	0.41	0.52	0.64	0.78	0.93	1.09	1.27	1.46	1.66	1.88	2.11	2.35	2.61	2.88	
84	0.02	0.05	0.10	0.15	0.21	0.29	0.38	0.48	0.60	0.72	0.86	1.01	1.17	1.35	1.54	1.74	1.95	2.18	2.42	2.67	
90	0.02	0.05	0.09	0.14	0.20	0.27	0.36	0.45	0.56	0.67	0.80	0.94	1.10	1.26	1.43	1.62	1.82	2.03	2.25	2.48	
96	0.02	0.05	0.08	0.13	0.19	0.26	0.33	0.42	0.52	0.63	0.75	0.88	1.03	1.18	1.34	1.52	1.70	1.90	2.11	2.33	
102	0.02	0.04	0.08	0.12	0.18	0.24	0.31	0.40	0.49	0.59	0.71	0.83	0.97	1.11	1.26	1.43	1.60	1.79	1.98	2.19	
108	0.02	0.04	0.07	0.12	0.17	0.23	0.30	0.38	0.46	0.56	0.67	0.79	0.91	1.05	1.19	1.35	1.51	1.68	1.87	2.06	
114	0.02	0.04	0.07	0.11	0.16	0.22	0.28	0.36	0.44	0.53	0.63	0.74	0.86	0.99	1.13	1.27	1.43	1.59	1.77	1.95	
120	0.02	0.04	0.07	0.10	0.15	0.20	0.27	0.34	0.42	0.51	0.60	0.71	0.82	0.94	1.07	1.21	1.36	1.51	1.68	1.85	
126	0.02	0.04	0.06	0.10	0.14	0.19	0.25	0.32	0.40	0.48	0.57	0.67	0.78	0.90	1.02	1.15	1.29	1.44	1.60	1.76	
132	0.02	0.03	0.06	0.09	0.14	0.19	0.24	0.31	0.38	0.46	0.55	0.64	0.74	0.86	0.97	1.10	1.23	1.37	1.52	1.68	
138	0.01	0.03	0.06	0.09	0.13	0.18	0.23	0.29	0.36	0.44	0.52	0.61	0.71	0.82	0.93	1.05	1.18	1.31	1.46	1.61	
144	0.01	0.03	0.06	0.09	0.13	0.17	0.22	0.28	0.35	0.42	0.50	0.59	0.68	0.78	0.89	1.01	1.13	1.26	1.40	1.54	
150	0.01	0.03	0.05	0.08	0.12	0.16	0.21	0.27	0.33	0.40	0.48	0.56	0.65	0.75	0.86	0.97	1.08	1.21	1.34	1.48	
156	0.01	0.03	0.05	0.08	0.12	0.16	0.21	0.26	0.32	0.39	0.46	0.54	0.63	0.72	0.82	0.93	1.04	1.16	1.29	1.42	
162	0.01	0.03	0.05	0.08	0.11	0.15	0.20	0.25	0.31	0.37	0.45	0.52	0.61	0.70	0.79	0.89	1.00	1.12	1.24	1.37	

CALCULATION OF CONNECTION "SWEEP LOSS"

Formula for "Sweep Loss" Calculation of Integrally Reinforced Forged Connections:

$$\text{Sweep Loss} = R - \sqrt{R^2 - r^2}$$

NOTATION

- SL = Sweep loss, inches
- R = Inside radius of shell or head crown radius, inches
- r = Outside barrel radius of connection, inches
- L = Required overall connection length, inches
- P = Projection of connection from centerline of equipment, inches
- IP = Inside projection of connection, inches

Example:

See Fig.1

Determine the required overall connection length of a 16" - 300 #RFLWN set through a 60" ID Shell.

DESIGN DATA

- L = Required overall connection length, inches
- P = 40 inches projection of connection
- IP = 0.00 inches inside projection of connection
- R = 30 inches inside radius of shell
- r = 9.5 inches outside barrel radius of connection

From the "Sweep Loss" chart or by using the above formula determine the connection sweep loss.

$$SL = R - \sqrt{R^2 - r^2} = 30 - \sqrt{30^2 - 9.5^2} = 1.54 \text{ in.}$$

Determine the required overall connection length "L".

$$L = P - R + SL + IP = 40 - 30 + 1.54 + 0.0 = 11.54 \text{ in.}$$

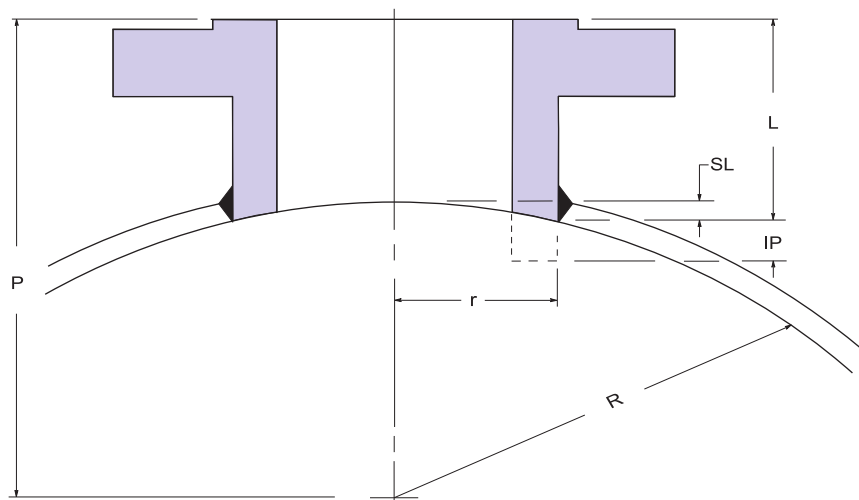


Fig. 1 Radially Installed Connection In Shell

CALCULATION OF CONNECTION “SWEEP LOSS”

Formula for “Sweep Loss” Calculation of Studding Outlet Connections:

$$\text{Sweep Loss \#1} = R - \sqrt{R^2 - r_i^2}$$

$$\text{Sweep Loss \#2} = R - \sqrt{R^2 - r_o^2}$$

NOTATION

SL1	= Sweep loss to inside radius of connection, inches
SL2	= Sweep loss to outside radius of connection, inches
R	= Inside radius of shell or head crown radius, inches
r_o	= Outside barrel radius of connection, inches
r_i	= Inside barrel radius of connection, inches
T	= Minimum required studding outlet thickness, inches
L	= Required overall studding outlet length, inches
P	= Projection of connection from centerline of equipment, inches
IP	= Inside projection of connection, inches
D	= Inside depth of head, inches

Example 1: Minimum Connection Length Per Fig. 2

Determine the required overall connection length of a 20” – 600# RF Studding Outlet set through a 48” OD ASME F&D head with a 42” inside dish radius.

DESIGN DATA

L = Required overall connection length, inches
 R = 42 inches inside head crown radius
 r_i = 10” inside barrel radius of connection
 r_o = 16” outside barrel radius of connection
 IP = 0.0” inside projection of connection
 T = 3.88” minimum required studding outlet thickness

From the “Sweep Loss” chart or by using the above formula determine connection sweep loss #1 and #2.

$$SL1 = R - \sqrt{R^2 - r_i^2} = 42 - \sqrt{42^2 - 10^2} = 1.21 \text{ in.}$$

$$SL2 = R - \sqrt{R^2 - r_o^2} = 42 - \sqrt{42^2 - 16^2} = 3.17 \text{ in.}$$

Determine the required overall connection length “L”.

$$L = T + SL2 - SL1 + IP = 3.88 + 3.17 - 1.21 + 0.0 = 5.84”$$

Example 2: Maintain Connection Projection Per Fig. 2

Determine the required overall connection length of a 20” – 600# RF Studding Outlet with internal projection set through a 48” OD ASME F&D head with a 42” inside dish radius.

DESIGN DATA

L = Required overall connection length, inches
 R = 42 inches inside head crown radius
 r_i = 10” inside barrel radius of connection
 r_o = 16” outside barrel radius of connection
 P = 12” inches projection of connection
 IP = 1.50” inside projection of connection
 T = 3.88” minimum required studding outlet thickness
 D = 8” inside depth of head

From the “Sweep Loss” chart or by using the above formula determine connection sweep loss #2.

$$SL2 = R - \sqrt{R^2 - r_o^2} = 42 - \sqrt{42^2 - 16^2} = 3.17 \text{ in.}$$

Determine the required overall connection length “L”.

$$L + P - D + SL2 + IP = 12 - 8 + 3.17 + 1.50 = 8.67”$$

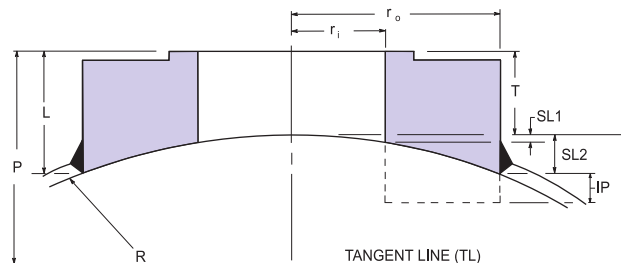
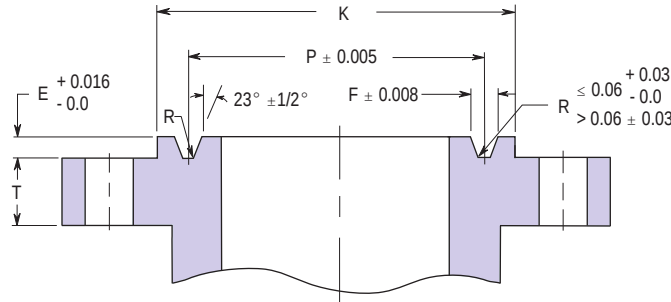


Fig. 2 Radially Installed Connection In Sphere

NOTE: In no case shall the required overall thickness “L” be less than the required minimum thickness “T”.



FACING DIMENSIONS FOR RING JOINT FLANGES



Nominal Pipe Size	Class	Ring & Groove Number	Pitch Diameter Ring & Groove	Groove Dimensions			Diameter Raised Face	Ring Gasket Dimensions			
				Depth	Width	Radius		Width	Height		Width of Flat
									Oval	Octagonal	
			P	E	F	R	K	A	B	H	C
1/2	300-600	R 11	1.344	0.219	0.281	0.03	2.00	0.250	0.4375	0.375	0.170
	900-1500	R 12	1.562	0.250	0.344	0.03	2.38	0.3125	0.5625	0.500	0.206
	2500	R 13	1.688	0.250	0.344	0.03	2.56	0.3125	0.5625	0.500	0.206
3/4	300-600	R 13	1.688	0.250	0.344	0.03	2.50	0.3125	0.5625	0.500	0.206
	900-1500	R 14	1.750	0.250	0.344	0.03	2.62	0.3125	0.5625	0.500	0.206
	2500	R 16	2.000	0.250	0.344	0.03	2.88	0.3125	0.5625	0.500	0.206
1	150	R 15	1.875	0.250	0.344	0.03	2.50	0.3125	0.5625	0.500	0.206
	300-600	R 16	2.000	0.250	0.344	0.03	2.75	0.3125	0.5625	0.500	0.206
	900-1500	R 16	2.000	0.250	0.344	0.03	2.81	0.3125	0.5625	0.500	0.206
	2500	R 18	2.375	0.250	0.344	0.03	3.25	0.3125	0.5625	0.500	0.206
1 1/4	150	R 17	2.250	0.250	0.344	0.03	2.88	0.3125	0.5625	0.500	0.206
	300-600	R 18	2.375	0.250	0.344	0.03	3.12	0.3125	0.5625	0.500	0.206
	900-1500	R 18	2.375	0.250	0.344	0.03	3.19	0.3125	0.5625	0.500	0.206
	2500	R 21	2.844	0.312	0.469	0.03	4.00	0.3125	0.5625	0.625	0.305
1 1/2	150	R 19	2.562	0.250	0.344	0.03	3.25	0.3125	0.5625	0.500	0.206
	300-600	R 20	2.688	0.250	0.344	0.03	3.56	0.3125	0.5625	0.500	0.206
	900-1500	R 20	2.688	0.250	0.344	0.03	3.62	0.3125	0.5625	0.500	0.206
	2500	R 23	3.250	0.312	0.469	0.03	4.50	0.3125	0.5625	0.625	0.305
2	150	R 22	3.250	0.250	0.344	0.03	4.00	0.3125	0.5625	0.500	0.206
	300-600	R 23	3.250	0.312	0.469	0.03	4.25	0.4375	0.6875	0.625	0.305
	900-1500	R 24	3.750	0.312	0.469	0.03	4.88	0.4375	0.6875	0.625	0.305
	2500	R 26	4.000	0.312	0.469	0.03	5.25	0.4375	0.6875	0.625	0.305
2 1/2	150	R 25	4.000	0.250	0.344	0.03	4.75	0.3125	0.5625	0.500	0.206
	300-600	R 26	4.000	0.312	0.469	0.03	5.00	0.4375	0.6875	0.625	0.305
	900-1500	R 27	4.250	0.312	0.469	0.03	5.38	0.4375	0.6875	0.625	0.305
	2500	R 28	4.375	0.375	0.531	0.06	5.88	0.5000	0.7500	0.688	0.341
3	150	R 29	4.500	0.250	0.344	0.03	5.25	0.3125	0.5625	0.500	0.206
	300-600	R 31	4.875	0.312	0.469	0.03	5.75	0.4375	0.6875	0.625	0.305
	900	R 31	4.875	0.312	0.469	0.03	6.12	0.4375	0.6875	0.625	0.305
	1500	R 35	5.375	0.312	0.469	0.03	6.62	0.4375	0.6875	0.625	0.305
	2500	R 32	5.000	0.375	0.531	0.06	6.62	0.500	0.750	0.6875	0.341
3 1/2	150	R 33	5.188	0.250	0.344	0.03	6.06	0.3125	0.5625	0.500	0.206
	300-600	R 34	5.188	0.312	0.469	0.03	6.25	0.4375	0.6875	0.625	0.305

NOTE:

1. All dimensions are in inches.
2. Dimension 'K' is minimum.
3. Height of raised portion is equal to the depth of groove dimension 'E', is not subjected to the tolerances for 'E'. Groove depth 'E' is not included in flange thickness 'T' but is included in the connection overall length 'L'.
4. Dimensions and tolerances are in accordance with ASME B16.5 and B16.20.
5. A plus tolerance of 3/64 in. for heights B and H is permitted providing the variation in the height of any ring does not exceed 1/64 in. throughout its entire circumference.

FACING DIMENSIONS FOR RING JOINT FLANGES

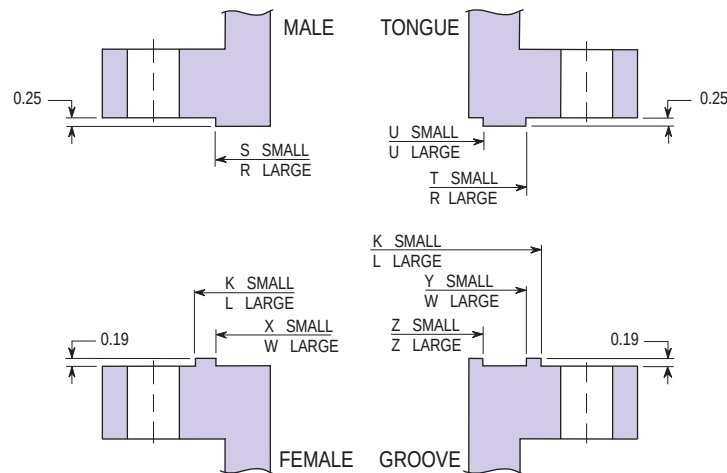
Nominal Pipe Size	Class	Ring & Groove Number	Pitch Diameter Ring & Groove	Groove Dimensions			Diameter Raised Face	Ring Gasket Dimensions			
				Depth	Width	Radius		Width	Height		Width of Flat
									Oval	Octagonal	
P	E	F	R	K	A	B	H	C			
4	150	R 36	5.875	0.250	0.344	0.03	6.75	0.3125	0.5625	0.500	0.206
	300-600	R 37	5.875	0.312	0.469	0.03	6.88	0.4375	0.6875	0.625	0.305
	900	R 37	5.875	0.312	0.469	0.03	7.12	0.4375	0.6875	0.625	0.305
	1500	R 39	6.375	0.312	0.469	0.03	7.62	0.4375	0.6875	0.625	0.305
	2500	R 38	6.188	0.438	0.656	0.06	8.00	0.6250	0.8750	0.813	0.413
5	150	R 40	6.750	0.250	0.344	0.03	7.62	0.3125	0.5625	0.500	0.206
	300-600	R 41	7.125	0.312	0.469	0.03	8.25	0.4375	0.6875	0.625	0.305
	900	R 41	7.125	0.312	0.469	0.03	8.50	0.4375	0.6875	0.625	0.305
	1500	R 44	7.625	0.312	0.469	0.03	9.00	0.4375	0.6875	0.625	0.305
	2500	R 42	7.500	0.500	0.781	0.06	9.50	0.7500	1.0000	0.938	0.485
6	150	R 43	7.625	0.250	0.344	0.03	8.62	0.3125	0.5625	0.500	0.206
	300-900	R 45	8.312	0.312	0.469	0.03	9.50	0.4375	0.6875	0.625	0.305
	1500	R 46	8.312	0.375	0.531	0.06	9.75	0.5000	0.7500	0.688	0.341
	2500	R 47	9.000	0.500	0.781	0.06	11.00	0.7500	1.0000	0.938	0.485
8	150	R 48	9.750	0.250	0.344	0.03	10.75	0.3125	0.5625	0.500	0.206
	300-600	R 49	10.625	0.312	0.469	0.03	11.88	0.4375	0.6875	0.625	0.305
	900	R 49	10.625	0.312	0.469	0.03	12.12	0.4375	0.6875	0.625	0.305
	1500	R 50	10.625	0.438	0.656	0.06	12.50	0.6250	0.8750	0.813	0.413
	2500	R 51	11.000	0.562	0.906	0.06	13.38	0.8750	1.1250	1.063	0.583
10	150	R 52	12.000	0.250	0.344	0.03	13.00	0.3125	0.5625	0.500	0.206
	300-600	R 53	12.750	0.312	0.469	0.03	14.00	0.4375	0.6875	0.625	0.305
	900	R 53	12.750	0.312	0.469	0.03	14.25	0.4375	0.6875	0.625	0.305
	1500	R 54	12.750	0.438	0.656	0.06	14.62	0.6250	0.8750	0.813	0.413
	2500	R 55	13.500	0.688	1.188	0.09	16.75	1.1250	1.4375	1.375	0.780
12	150	R 56	15.000	0.250	0.344	0.03	16.00	0.3125	0.5625	0.500	0.206
	300-600	R 57	15.000	0.312	0.469	0.03	16.25	0.4375	0.6875	0.625	0.305
	900	R 57	15.000	0.312	0.469	0.03	16.50	0.4375	0.6875	0.625	0.305
	1500	R 58	15.000	0.562	0.906	0.06	17.25	0.8750	1.1250	1.063	0.583
	2500	R 60	16.000	0.688	1.312	0.09	19.50	1.2500	1.5625	1.500	0.879
14	150	R 59	15.625	0.250	0.344	0.03	16.75	0.3125	0.5625	0.500	0.206
	300-600	R 61	16.500	0.312	0.469	0.03	18.00	0.4375	0.6875	0.625	0.305
	900	R 62	16.500	0.438	0.656	0.06	18.38	0.6250	0.8750	0.813	0.413
	1500	R 63	16.500	0.625	1.062	0.09	19.25	1.0000	1.3125	1.250	0.681
16	150	R 64	17.875	0.250	0.344	0.03	19.00	0.3125	0.5625	0.500	0.206
	300-600	R 65	18.500	0.312	0.469	0.03	20.00	0.4375	0.6875	0.625	0.305
	900	R 66	18.500	0.438	0.656	0.06	20.62	0.6250	0.8750	0.813	0.413
	1500	R 67	18.500	0.688	1.188	0.09	21.50	1.1250	1.4375	1.375	0.780
18	150	R 68	20.375	0.250	0.344	0.03	21.50	0.3125	0.5625	0.500	0.206
	300-600	R 69	21.000	0.312	0.469	0.03	22.62	0.4375	0.6875	0.625	0.305
	900	R 70	21.000	0.500	0.781	0.06	23.38	0.7500	1.0000	0.938	0.485
	1500	R 71	21.000	0.688	1.188	0.09	24.12	1.1250	1.4375	1.375	0.780
20	150	R 72	22.000	0.250	0.344	0.03	23.50	0.3125	0.5625	0.500	0.206
	300-600	R 73	23.000	0.375	0.531	0.06	25.00	0.5000	0.7500	0.688	0.341
	900	R 74	23.000	0.500	0.781	0.06	25.50	0.7500	1.0000	0.938	0.485
	1500	R 75	23.000	0.688	1.312	0.09	26.50	1.2500	1.5625	1.500	0.879
22	150	R 80	24.250	0.250	0.344	0.03	25.50	0.3125	-----	0.500	0.206
	300-600	R 81	25.000	0.438	0.594	0.06	27.00	0.5625	-----	0.750	0.377
24	150	R 76	26.500	0.250	0.344	0.03	28.00	0.3125	0.5625	0.500	0.206
	300-600	R 77	27.250	0.438	0.656	0.06	29.50	0.6250	0.8750	0.813	0.413
	900	R 78	27.250	0.625	1.062	0.09	30.38	1.0000	1.3125	1.250	0.681
	1500	R 79	27.250	0.812	1.438	0.09	31.25	1.3750	1.7500	1.625	0.977

- All dimensions are in inches.
- Dimension 'K' is minimum.
- Height of raised portion is equal to the depth of groove dimension 'E', is not subjected to the tolerances for 'E'. Groove depth 'E' is not included in flange thickness 'T' but is included in the connection overall length 'L'.

- Dimensions and tolerances are in accordance with ASME B16.5 and B16.20.
- A plus tolerance of 3/64 in. for heights B and H is permitted providing the variation in the height of any ring does not exceed 1/64 in. throughout its entire circumference.

OTHER STANDARD FACINGS

These standard male, female, tongue and groove facings are available on all FCI Connections



FLG SIZE	R	S	T	U	W	X	Y	Z	K	L
1/2	1.38	0.72	1.38	1.00	1.44	0.78	1.44	0.94	1.75	1.81
3/4	1.69	0.94	1.69	1.31	1.75	1.00	1.75	1.25	2.06	2.12
1	2.00	1.19	1.88	1.50	2.06	1.25	1.94	1.44	2.25	2.44
1 1/4	2.50	1.50	2.25	1.88	2.56	1.56	2.31	1.81	2.62	2.94
1 1/2	2.88	1.75	2.50	2.12	2.94	1.81	2.56	2.06	2.88	3.31
2	3.62	2.25	3.25	2.88	3.69	2.31	3.31	2.81	3.62	4.06
2 1/2	4.12	2.69	3.75	3.38	4.19	2.75	3.81	3.31	4.12	4.56
3	5.00	3.31	4.62	4.25	5.06	3.38	4.69	4.19	5.00	5.44
3 1/2	5.50	3.81	5.12	4.75	5.56	3.88	5.19	4.69	5.50	5.94
4	6.19	4.31	5.69	5.19	6.25	4.38	5.75	5.12	6.19	6.62
5	7.31	5.38	6.81	6.31	7.38	5.44	6.88	6.25	7.31	7.75
6	8.50	6.38	8.00	7.50	8.56	6.44	8.06	7.44	8.50	8.94
8	10.62	8.38	10.00	9.38	10.69	8.44	10.06	9.31	10.62	11.06
10	12.75	10.50	12.00	11.25	12.81	10.56	12.06	11.19	12.75	13.19
12	15.00	12.50	14.25	13.50	15.06	12.56	14.31	13.44	15.00	15.44
14	16.25	13.75	15.50	14.75	16.31	13.81	15.56	14.69	16.25	16.69
16	18.50	15.75	17.62	16.75	18.56	15.81	17.69	16.69	18.50	18.94
18	21.00	17.75	20.12	19.25	21.06	17.81	20.19	19.19	21.00	21.44
20	23.00	19.75	22.00	21.00	23.06	19.81	22.06	20.94	23.00	23.44
24	27.25	23.75	26.25	25.25	27.31	23.81	26.31	25.19	27.25	27.69

NOTE

1. All dimensions are in inches.
2. Dimensions and tolerances are in accordance with ASME B16.5.
3. The above dimensions are applicable to all ASME pressure Classes except that large male, female, tongue and groove facings are not available for Class 150 flanges because of potential dimension conflicts.
4. Face heights and groove depths are in addition to the basic flange thickness "T" dimensions and are to be included in overall length "L".

MATERIAL PRESSURE-TEMPERATURE RATINGS

Material Group	Material		See Notes
	Forgings	Plate	
1.1	A 105		1,2
		A 515-70	1
	A 350 LF2		1
	A 350 LF6 CL1		7
		A 516-70	1,7
		A 537 CL 1	10
	A 350 LF3		9
1.2	A 350 LF6 CL 2		7
		A 203 B	1
		A 203 E	1
1.4		A 515-60	1
	A 350 LF1 CL 1	A 516-60	1
1.5	A 182 F1	A 204 A	10
		A 204 B	10
1.7	A 182 F2		13
1.9	A 182 F11 CL 2		4,15
		A 387-11 CL 2	15
1.10	A 182 F22 CL 3	A 387-22 CL 2	15
1.13	A 182 F5a		
1.14	A 182 F9		
1.15	A 182 F91 TP 1	A 387-91 CL 2	
1.17	A 182 F12 CL 2		4,15
	A 182 F5		
2.1	A 182 F304	A 240-304	16
	A 182 F304H	A 240-304H	
2.2	A 182 F316	A 240-316	16
	A 182 F316H	A 240-316H	
	A 182 F317	A 240-317	16
2.3	A 182 F304L	A 240-304L	12
	A 182 F316L	A 240-316L	12
	A 182 F317L		12

Material Group	Material		See Notes
	Forgings	Plate	
2.4	A 182 F321	A 240-321	13
	A 182 F321H	A 240-321H	17
2.5	A 182 F347	A 240-347	13
	A 182F347H	A 240-347H	17
	A 182 F348	A 240-348	13
	A 182 F348H	A 240-348H	17
2.7	A 182 F310H	A 240-310H	
2.13	A 182 F51	A 240-S31803	8
	A 182 F60	A 240-S32205	8
		A 240-S32550	7
	A 182 F53	A 240-S32750	8
	A 182 F55	A 240-S32760	8
3.1	A 182 N08020	A 240-N08020	5
	B462 N08020	B463 N08020	5
3.2	B564 N02200	B162 N02200	5
3.4	B564 N04400	B127 N04400	5
3.5	B564 N06600	B168 N06600	5
3.6	A182 N08800	A240 N08800	5
	B564 N08800	B409 N08800	5
3.8	B462 N10276	B575 N10276	6,14
	B564 N010276		6,14
	B564 N06625	B443 N06625	5,18
		B333 N10001	5,11
		B434 N10003	5
		B575 N06455	6,11
3.15	B564 N08825	B424 N08825	5,13
	A182 N08810	A240-N08810	5
	B564 N08810	B409 N08810	5

GENERAL NOTES

Plate materials are listed for reference where they are to be used for blind flanges. For additional details see latest edition of ASME B16.5 2025.

NOTE

- Upon prolonged exposure to temperatures above 800°F, the carbide phase steel may be converted to graphite. Permissible, but not recommended for prolonged use above 800°F.
- Only killed steel shall be used above 850°F.
- Upon prolonged exposure to temperatures above 875°F, the carbide phase of carbon-molybdenum steel may be converted to graphite. Permissible, but not recommended for prolonged use above 875°F.
- Use normalized and tempered material only.
- Use annealed material only.
- Use solution annealed material only.
- Not to be used over 500°F.
- Not to be used over 600°F. Steel may become brittle after service at moderately elevated temperatures.
- Not to be used over 650°F.
- Not to be used over 700°F.
- Not to be used over 800°F.
- Not to be used over 850°F.
- Not to be used over 1000°F.
- Not to be used over 1250°F.
- Permissible, but not recommended for prolonged use above 1100°F.
- At temperatures over 1000°F, use only when the carbon content is 0.04% or higher.
- At temperatures over 1000°F, use only if the material is heat treated by heating to a minimum temperature of 2000°F.
- Not to be used over 1,200°F. Alloy N06625 in the annealed condition is subject to severe loss of impact strength at room temperatures after exposure in the range of 1,000°F to 1,400°F

Pressure-Temperature Ratings ASME B16.5 class 150 per material group

See Note 3	1.1	1.2	1.4	1.5	1.7	1.9	1.10	1.13	1.14	1.15	1.17	See Note 3
Min. to 100	285	290	235	265	290	290	290	290	290	290	290	Min. to 100
200	260	260	215	260	260	260	260	260	260	260	260	200
300	230	230	210	230	230	230	230	230	230	230	230	300
400	200	200	200	200	200	200	200	200	200	200	200	400
500	170	170	170	170	170	170	170	170	170	170	170	500
600	140	140	140	140	140	140	140	140	140	140	140	600
650	125	125	125	125	125	125	125	125	125	125	125	650
700	110	110	110	110	110	110	110	110	110	110	110	700
750	95	95	95	95	95	95	95	95	95	95	95	750
800	80	80	80	80	80	80	80	80	80	80	80	800
850	65	65	65	65	65	65	65	65	65	65	65	850
900	50	50	50	50	50	50	50	50	50	50	50	900
950	35	35	35	35	35	35	35	35	35	35	35	950
1000	20	20	20	20	20	20	20	20	20	20	20	1000
1050	-	-	-	-	20	-	-	-	-	-	-	1050
1100	-	-	-	-	20	-	-	-	-	-	-	1100
1150	-	-	-	-	-	-	-	-	-	-	-	1150
1200	-	-	-	-	-	-	-	-	-	-	-	1200

Pressure-Temperature Ratings ASME B16.5 class 150 per material group

See Note 3	2.1	2.2	2.3	2.4	2.5	2.7	2.13	3.1	3.2	3.4	3.5	3.6	3.8	3.15	See Note 3
Min. to 100	275	275	230	275	275	275	290	290	185	230	290	275	290	230	Min. to 100
200	230	235	195	250	255	245	260	260	185	200	260	255	260	210	200
300	205	215	175	230	230	225	230	230	185	190	230	230	230	200	300
400	190	195	160	200	200	200	200	200	185	180	200	200	200	190	400
500	170	170	150	170	170	170	170	170	170	170	170	170	170	170	500
600	140	140	140	140	140	140	140	140	140	140	140	140	140	140	600
650	125	125	125	125	125	125	-	125	-	125	125	125	125	125	650
700	110	110	110	110	110	110	-	110	-	110	110	110	110	110	700
750	95	95	95	95	95	95	-	95	-	95	95	95	95	95	750
800	80	80	80	80	80	80	-	80	-	80	80	80	80	80	800
850	65	65	65	65	65	65	-	-	-	65	65	65	65	65	850
900	50	50	-	50	50	50	-	-	-	50	50	50	50	50	900
950	35	35	-	35	35	35	-	-	-	-	35	35	35	35	950
1000	20	20	-	20	20	20	-	-	-	-	20	20	20	20	1000
1050	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1050
1100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1100
1150	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1150
1200	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1200
1250	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1250
1300	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1300
1350	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1350
1400	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1400
1450	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1450
1500	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1500

NOTE

1. See temperature notes for all materials (page # 50)
2. Pressures are in pounds per square inch, gage (psig)
3. See ASME B16.5 2025 para. 2.5.3 for guidance on how to determine minimum temperatures.

Pressure-Temperature Ratings ASME B16.5 class 300 per material group

See Note 3	1.1	1.2	1.4	1.5	1.7	1.9	1.10	1.13	1.14	1.15	1.17	See Note 3
Min. to 100	740	750	615	695	750	750	750	750	750	750	750	Min. to 100
200	680	750	565	695	750	750	750	750	750	750	735	200
300	655	730	545	685	730	720	730	730	730	730	700	300
400	635	705	525	660	705	695	705	705	705	705	670	400
500	605	565	500	640	665	665	665	665	665	665	645	500
600	570	615	475	620	630	630	630	630	630	630	625	600
650	550	590	455	610	615	615	615	615	615	615	615	650
700	530	555	440	600	600	600	600	600	600	600	600	700
750	505	505	430	555	555	555	555	555	555	555	555	750
800	410	410	370	535	535	535	535	535	535	535	535	800
850	320	320	300	510	510	510	510	490	510	510	490	850
900	230	225	170	470	475	470	475	375	475	475	375	900
950	135	135	135	280	315	320	390	275	375	425	275	950
1000	85	85	85	165	200	215	265	200	255	415	200	1000
1050	-	-	-	-	160	145	175	145	170	410	145	1050
1100	-	-	-	-	95	95	110	100	115	300	95	1100
1150	-	-	-	-	-	65	70	60	75	195	60	1150
1200	-	-	-	-	-	40	40	35	50	120	35	1200

Pressure-Temperature Ratings ASME B16.5 class 300 per material group

See Note 3	2.1	2.2	2.3	2.4	2.5	2.7	2.13	3.1	3.2	3.4	3.5	3.6	3.8	3.15	See Note 3
Min. to 100	720	720	600	720	720	720	750	750	480	600	750	720	750	600	Min. to 100
200	600	620	510	650	660	635	750	740	480	525	750	665	750	550	200
300	540	560	455	595	615	580	730	710	480	490	730	640	730	520	300
400	495	515	420	550	575	540	705	680	480	475	705	620	700	490	400
500	465	480	395	515	540	515	665	655	455	475	665	600	665	465	500
600	440	450	370	485	515	495	630	630	415	475	630	590	630	440	600
650	430	440	365	475	505	485	-	615	-	475	615	580	615	430	650
700	420	435	360	465	495	480	-	600	-	470	600	570	600	420	700
750	415	425	355	460	490	470	-	555	-	465	555	555	555	410	750
800	405	420	345	450	485	465	-	535	-	460	535	535	535	400	800
850	395	420	340	445	485	460	-	-	-	375	510	510	510	395	850
900	390	415	-	440	475	450	-	-	-	275	475	475	475	385	900
950	380	410	-	425	425	425	-	-	-	-	365	425	425	380	950
1000	355	385	-	410	415	415	-	-	-	-	240	415	415	370	1000
1050	325	385	-	410	410	355	-	-	-	-	155	410	410	350	1050
1100	255	305	-	310	375	260	-	-	-	-	105	375	375	345	1100
1150	205	235	-	235	320	190	-	-	-	-	75	320	320	320	1150
1200	165	185	-	185	240	135	-	-	-	-	70	225	205	240	1200
1250	135	145	-	140	200	105	-	-	-	-	-	145	165	200	1250
1300	115	115	-	110	150	75	-	-	-	-	-	70	120	160	1300
1350	95	95	-	85	110	60	-	-	-	-	-	55	120	125	1350
1400	80	80	-	65	85	45	-	-	-	-	-	40	90	90	1400
1450	60	60	-	50	60	35	-	-	-	-	-	35	75	75	1450
1500	50	45	-	40	45	25	-	-	-	-	-	25	50	50	1500

NOTE

1. See temperature notes for all materials (page # 50)
2. Pressures are in pounds per square inch, gage (psig)
3. See ASME B16.5 2025 para. 2.5.3 for guidance on how to determine minimum temperatures.

Pressure-Temperature Ratings ASME B16.5 class 400 per material group

See Note 3	1.1	1.2	1.4	1.5	1.7	1.9	1.10	1.13	1.14	1.15	1.17	See Note 3
Min. to 100	985	1000	825	930	1000	1000	1000	1000	1000	1000	1000	Min. to 100
200	905	1000	755	930	1000	1000	1000	1000	1000	1000	980	200
300	870	970	725	915	970	965	970	970	970	970	935	300
400	845	940	700	885	940	925	940	940	940	940	890	400
500	805	885	670	855	885	885	885	885	885	885	860	500
600	755	825	630	830	840	840	840	840	840	840	835	600
650	730	785	610	815	820	820	820	820	820	820	820	650
700	710	740	590	795	795	795	795	795	795	795	795	700
750	675	675	570	745	745	745	745	745	745	745	745	750
800	550	550	495	710	710	710	710	710	710	710	710	800
850	425	425	400	685	685	685	685	655	685	685	655	850
900	305	295	230	625	635	625	635	500	635	635	500	900
950	185	185	185	375	420	425	520	365	505	570	365	950
1000	115	115	115	220	270	290	355	265	340	550	265	1000
1050	-	-	-	-	210	190	235	190	230	545	190	1050
1100	-	-	-	-	130	130	145	135	150	400	130	1100
1150	-	-	-	-	-	85	90	80	100	260	80	1150
1200	-	-	-	-	-	55	55	45	70	160	45	1200

Pressure-Temperature Ratings ASME B16.5 class 400 per material group

See Note 3	2.1	2.2	2.3	2.4	2.5	2.7	2.13	3.1	3.2	3.4	3.5	3.6	3.8	3.15	See Note 3
Min. to 100	960	960	800	960	960	960	1000	1000	640	800	1000	960	1000	800	Min. to 100
200	800	825	680	865	885	850	1000	990	640	700	1000	885	1000	735	200
300	715	745	610	795	820	775	970	945	640	655	970	850	970	695	300
400	660	685	560	735	770	725	940	910	640	630	940	825	930	655	400
500	620	635	525	690	725	685	885	875	605	630	885	805	885	620	500
600	590	600	495	650	690	660	840	840	550	630	840	785	840	585	600
650	575	590	485	635	675	645	-	820	-	630	820	770	820	575	650
700	565	580	480	620	660	635	-	795	-	625	795	760	795	555	700
750	550	570	470	610	655	625	-	745	-	620	745	745	745	545	750
800	540	565	460	600	650	620	-	710	-	610	710	710	710	535	800
850	530	555	450	595	645	610	-	-	-	505	685	685	685	525	850
900	520	550	-	590	635	600	-	-	-	365	635	635	635	515	900
950	510	545	-	570	570	570	-	-	-	-	485	570	570	505	950
1000	475	515	-	550	550	550	-	-	-	-	320	550	550	495	1000
1050	435	510	-	545	545	470	-	-	-	-	205	545	545	465	1050
1100	345	405	-	415	500	345	-	-	-	-	135	500	500	455	1100
1150	275	315	-	315	425	250	-	-	-	-	100	425	425	425	1150
1200	220	245	-	245	320	185	-	-	-	-	90	300	275	320	1200
1250	180	195	-	185	270	135	-	-	-	-	-	190	220	270	1250
1300	150	155	-	145	200	100	-	-	-	-	-	90	160	215	1300
1350	125	130	-	115	145	80	-	-	-	-	-	75	160	165	1350
1400	105	105	-	85	115	60	-	-	-	-	-	50	120	120	1400
1450	80	80	-	70	80	45	-	-	-	-	-	45	100	100	1450
1500	65	60	-	50	60	35	-	-	-	-	-	35	70	70	1500

NOTE

1. See temperature notes for all materials (page # 50)
2. Pressures are in pounds per square inch, gage (psig)
3. See ASME B16.5 2025 para. 2.5.3 for guidance on how to determine minimum temperatures.

Pressure-Temperature Ratings ASME B16.5 class 600 per material group

See Note 3	1.1	1.2	1.4	1.5	1.7	1.9	1.10	1.13	1.14	1.15	1.17	See Note 3
Min. to 100	1480	1500	1235	1395	1500	1500	1500	1500	1500	1500	1500	Min. to 100
200	1360	1500	1130	1395	1500	1500	1500	1500	1500	1500	1470	200
300	1310	1455	1090	1375	1455	1445	1455	1455	1455	1455	1400	300
400	1265	1405	1055	1325	1410	1385	1410	1410	1410	1410	1335	400
500	1205	1330	1005	1285	1330	1330	1330	1330	1330	1330	1290	500
600	1135	1235	945	1245	1260	1260	1260	1260	1260	1260	1255	600
650	1100	1175	915	1220	1230	1230	1230	1230	1230	1230	1230	650
700	1060	1110	885	1190	1190	1190	1190	1190	1190	1190	1190	700
750	1015	1015	855	1120	1120	1120	1120	1120	1120	1120	1120	750
800	825	825	740	1065	1065	1065	1065	1065	1065	1065	1065	800
850	640	640	595	1030	1030	1030	1030	980	1030	1030	980	850
900	460	445	345	940	955	940	955	745	955	955	745	900
950	275	275	275	560	630	640	780	550	755	855	550	950
1000	170	170	170	330	405	430	535	400	505	825	400	1000
1050	-	-	-	-	315	290	350	290	345	820	290	1050
1100	-	-	-	-	190	190	220	200	225	595	190	1100
1150	-	-	-	-	-	130	135	125	150	390	125	1150
1200	-	-	-	-	-	80	80	70	105	240	70	1200

Pressure-Temperature Ratings ASME B16.5 class 600 per material group

See Note 3	2.1	2.2	2.3	2.4	2.5	2.7	2.13	3.1	3.2	3.4	3.5	3.6	3.8	3.15	See Note 3
Min. to 100	1440	1440	1200	1440	1440	1440	1500	1500	960	1200	1500	1440	1500	1200	Min. to 100
200	1200	1240	1020	1295	1325	1270	1500	1485	960	1050	1500	1330	1500	1105	200
300	1075	1120	910	1190	1235	1160	1455	1420	960	980	1455	1275	1455	1040	300
400	990	1025	840	1105	1150	1085	1410	1365	960	945	1410	1240	1395	980	400
500	925	955	785	1030	1085	1025	1330	1310	905	945	1330	1205	1330	925	500
600	885	900	745	975	1030	990	1260	1260	825	945	1260	1175	1260	880	600
650	860	885	730	950	1015	970	-	1230	-	945	1230	1155	1230	860	650
700	845	870	720	930	995	955	-	1190	-	940	1190	1140	1190	835	700
750	825	855	705	915	985	940	-	1120	-	930	1120	1120	1120	820	750
800	810	845	690	900	975	930	-	1065	-	915	1065	1065	1065	800	800
850	790	835	675	895	970	915	-	-	-	755	1030	1030	1030	785	850
900	780	825	-	885	955	900	-	-	-	550	955	955	955	775	900
950	765	815	-	855	855	855	-	-	-	-	725	855	855	760	950
1000	715	775	-	825	825	825	-	-	-	-	480	825	825	745	1000
1050	650	770	-	815	820	705	-	-	-	-	310	820	820	700	1050
1100	515	610	-	625	750	520	-	-	-	-	205	750	750	685	1100
1150	410	475	-	475	640	375	-	-	-	-	150	640	640	640	1150
1200	330	370	-	370	480	275	-	-	-	-	135	455	410	480	1200
1250	265	295	-	280	405	205	-	-	-	-	-	290	330	405	1250
1300	225	235	-	220	300	150	-	-	-	-	-	135	240	320	1300
1350	185	190	-	170	220	115	-	-	-	-	-	110	240	250	1350
1400	160	160	-	130	170	90	-	-	-	-	-	75	185	185	1400
1450	125	115	-	105	125	65	-	-	-	-	-	70	145	145	1450
1500	95	90	-	75	90	50	-	-	-	-	-	55	105	105	1500

NOTE

1. See temperature notes for all materials (page # 50)
2. Pressures are in pounds per square inch, gage (psig)
3. See ASME B16.5 2025 para. 2.5.3 for guidance on how to determine minimum temperatures.

Pressure-Temperature Ratings ASME B16.5 class 900 per material group

See Note 3	1.1	1.2	1.4	1.5	1.7	1.9	1.10	1.13	1.14	1.15	1.17	See Note 3
Min. to 100	2220	2250	1850	2090	2250	2250	2250	2250	2250	2250	2250	Min. to 100
200	2035	2250	1695	2090	2250	2250	2250	2250	2250	2250	2210	200
300	1965	2185	1635	2060	2185	2165	2185	2185	2185	2185	2100	300
400	1900	2110	1580	1985	2115	2080	2115	2115	2115	2115	2005	400
500	1810	1995	1505	1925	1955	1995	1995	1995	1995	1995	1940	500
600	1705	1850	1420	1865	1890	1890	1890	1890	1890	1890	1880	600
650	1650	1765	1370	1835	1845	1845	1845	1845	1845	1845	1845	650
700	1590	1665	1325	1790	1790	1790	1790	1790	1790	1790	1790	700
750	1520	1520	1285	1675	1675	1675	1675	1675	1675	1675	1675	750
800	1235	1235	1110	1600	1600	1600	1600	1600	1600	1600	1600	800
850	955	955	895	1540	1540	1540	1540	1470	1540	1540	1470	850
900	690	670	515	1410	1430	1410	1430	1120	1430	1430	1120	900
950	410	410	410	845	945	955	1175	825	1130	1275	825	950
1000	225	225	255	495	605	650	800	595	760	1245	595	1000
1050	-	-	-	-	475	430	525	430	515	1230	430	1050
1100	-	-	-	-	290	290	330	300	340	895	290	1100
1150	-	-	-	-	-	195	205	185	225	585	185	1150
1200	-	-	-	-	-	125	125	105	155	360	105	1200

Pressure-Temperature Ratings ASME B16.5 class 900 per material group

See Note 3	2.1	2.2	2.3	2.4	2.5	2.7	2.13	3.1	3.2	3.4	3.5	3.6	3.8	3.15	See Note 3
Min. to 100	2160	2160	1800	2160	2160	2160	2250	2250	1440	1800	2250	2160	2250	1800	Min. to 100
200	1800	1860	1535	1945	1985	1910	2250	2225	1440	1575	2250	1995	2250	1655	200
300	1615	1680	1370	1785	1850	1740	2185	2130	1440	1470	2185	1915	2185	1560	300
400	1485	1540	1260	1655	1730	1625	2115	2045	1440	1420	2115	1860	2095	1470	400
500	1390	1435	1180	1550	1625	1540	1995	1965	1360	1420	1995	1805	1995	1390	500
600	1325	1355	1115	1460	1550	1485	1890	1890	1240	1420	1890	1765	1890	1320	600
650	1290	1325	1095	1425	1520	1455	-	1845	-	1420	1845	1735	1845	1290	650
700	1265	1305	1080	1395	1490	1435	-	1790	-	1410	1790	1715	1790	1255	700
750	1240	1280	1060	1375	1475	1410	-	1675	-	1395	1675	1675	1675	1230	750
800	1215	1265	1035	1355	1460	1395	-	1600	-	1375	1600	1600	1600	1200	800
850	1190	1255	1015	1340	1455	1375	-	-	-	1130	1540	1540	1540	1180	850
900	1165	1240	-	1325	1430	1355	-	-	-	825	1430	1430	1430	1160	900
950	1145	1225	-	1275	1275	1275	-	-	-	-	1090	1275	1275	1140	950
1000	1070	1160	-	1235	1245	1245	-	-	-	-	720	1245	1245	1115	1000
1050	975	1150	-	1225	1230	1060	-	-	-	-	465	1230	1230	1050	1050
1100	770	915	-	935	1120	780	-	-	-	-	310	1120	1120	1030	1100
1150	615	710	-	710	960	565	-	-	-	-	225	960	955	955	1150
1200	495	555	-	555	725	410	-	-	-	-	205	680	615	725	1200
1250	400	440	-	420	605	310	-	-	-	-	-	430	495	605	1250
1300	340	350	-	330	455	225	-	-	-	-	-	205	360	485	1300
1350	280	290	-	255	330	175	-	-	-	-	-	165	360	375	1350
1400	235	235	-	195	255	135	-	-	-	-	-	115	275	275	1400
1450	185	175	-	155	185	100	-	-	-	-	-	105	220	220	1450
1500	145	135	-	115	135	75	-	-	-	-	-	80	160	160	1500

NOTE

1. See temperature notes for all materials (page # 50)
2. Pressures are in pounds per square inch, gage (psig)
3. See ASME B16.5 2025 para. 2.5.3 for guidance on how to determine minimum temperatures.

Pressure-Temperature Ratings ASME B16.5 class 1500 per material group

See Note 3	1.1	1.2	1.4	1.5	1.7	1.9	1.10	1.13	1.14	1.15	1.17	See Note 3
Min. to 100	3705	3750	3085	3480	3750	3750	3750	3750	3750	3750	3750	Min. to 100
200	3395	3750	2830	3480	3750	3750	3750	3750	3750	3750	3680	200
300	3270	3640	2725	3435	3640	3610	3640	3640	3640	3640	3495	300
400	3170	3520	2635	3310	3530	3465	3530	3530	3530	3530	3345	400
500	3015	3325	2510	3210	3325	3325	3325	3325	3325	3325	3230	500
600	2840	3085	2365	3105	3145	3145	3145	3145	3145	3145	3135	600
650	2745	2940	2285	3055	3070	3070	3070	3070	3070	3070	3070	650
700	2655	2775	2210	2980	2980	2980	2980	2980	2980	2980	2980	700
750	2535	2535	2140	2795	2795	2795	2795	2795	2795	2795	2795	750
800	2055	2055	1850	2665	2665	2665	2665	2665	2665	2665	2665	800
850	1595	1595	1490	2570	2570	2570	2570	2450	2570	2570	2450	850
900	1150	1115	855	2350	2380	2350	2380	1870	2380	2380	1870	900
950	685	685	685	1405	1575	1595	1955	1370	1885	2125	1370	950
1000	430	430	430	825	1010	1080	1335	995	1270	2075	995	1000
1050	-	-	-	-	790	720	875	720	855	2050	720	1050
1100	-	-	-	-	480	480	550	495	565	1490	480	1100
1150	-	-	-	-	-	325	345	310	375	975	310	1150
1200	-	-	-	-	-	205	205	170	255	600	170	1200

Pressure-Temperature Ratings ASME B16.5 class 1500 per material group

See Note 3	2.1	2.2	2.3	2.4	2.5	2.7	2.13	3.1	3.2	3.4	3.5	3.6	3.8	3.15	See Note 3
Min. to 100	3600	3600	3000	3600	3600	3600	3750	3750	2400	3000	3750	3600	3750	3000	Min. to 100
200	3000	3095	2555	3240	3310	3180	3750	3710	2400	2630	3750	3325	3750	2760	200
300	2690	2795	2280	2975	3085	2905	3640	3550	2400	2450	3640	3190	3640	2605	300
400	2470	2570	2100	2760	2880	2710	3530	3410	2400	2365	3530	3095	3490	2450	400
500	2315	2390	1970	2580	2710	2570	3325	3275	2270	2365	3325	3010	3325	2315	500
600	2210	2255	1860	2435	2580	2470	3145	3145	2065	2365	3145	2940	3145	2195	600
650	2150	2210	1825	2375	2530	2425	-	3070	-	2365	3070	2890	3070	2150	650
700	2110	2170	1800	2330	2485	2390	-	2980	-	2350	2980	2855	2980	2090	700
750	2065	2135	1765	2290	2460	2350	-	2795	-	2330	2795	2795	2795	2050	750
800	2030	2110	1730	2255	2435	2330	-	2665	-	2290	2665	2665	2665	2005	800
850	1980	2090	1690	2230	2425	2290	-	-	-	1885	2570	2570	2570	1970	850
900	1945	2065	-	2210	2380	2255	-	-	-	1370	2380	2380	2380	1930	900
950	1910	2040	-	2125	2125	2125	-	-	-	-	1815	2125	2125	1895	950
1000	1785	1935	-	2055	2075	2075	-	-	-	-	1200	2075	2075	1860	1000
1050	1630	1920	-	2040	2050	1765	-	-	-	-	770	2050	2050	1750	1050
1100	1285	1525	-	1560	1870	1305	-	-	-	-	515	1870	1870	1715	1100
1150	1030	1185	-	1185	1595	945	-	-	-	-	375	1595	1595	1595	1150
1200	825	925	-	925	1205	685	-	-	-	-	345	1130	1030	1205	1200
1250	670	735	-	705	1010	515	-	-	-	-	-	720	825	1010	1250
1300	565	585	-	550	755	375	-	-	-	-	-	345	600	805	1300
1350	465	480	-	430	550	290	-	-	-	-	-	275	600	625	1350
1400	395	395	-	325	430	225	-	-	-	-	-	190	465	465	1400
1450	310	290	-	255	310	165	-	-	-	-	-	170	360	360	1450
1500	245	225	-	190	225	130	-	-	-	-	-	135	260	260	1500

NOTE

1. See temperature notes for all materials (page # 50)
2. Pressures are in pounds per square inch, gage (psig)
3. See ASME B16.5 2025 para. 2.5.3 for guidance on how to determine minimum temperatures.

Pressure-Temperature Ratings ASME B16.5 class 2500 per material group

See Note 3	1.1	1.2	1.4	1.5	1.7	1.9	1.10	1.13	1.14	1.15	1.17	See Note 3
Min. to 100	6170	6250	5145	5805	6250	6250	6250	6250	6250	6250	6250	Min. to 100
200	5655	6250	4715	5805	6250	6250	6250	6250	6250	6250	6135	200
300	5450	6070	4545	5725	6070	6015	6070	6070	6070	6070	5830	300
400	5280	5865	4390	5520	5880	5775	5880	5880	5880	5880	5570	400
500	5025	5540	4185	5350	5540	5540	5540	5540	5540	5540	5385	500
600	4730	5145	3945	5175	5240	5240	5240	5240	5240	5240	5230	600
650	4575	4905	3805	5090	5125	5125	5125	5125	5125	5125	5125	650
700	4425	4630	3685	4965	4965	4965	4965	4965	4965	4965	4965	700
750	4230	4230	3565	4650	4650	4650	4650	4650	4650	4650	4650	750
800	3430	3430	3085	4440	4440	4400	4440	4440	4440	4440	4440	800
850	2655	2655	2485	4285	4285	4285	4285	4085	4285	4285	4085	850
900	1915	1855	1430	3915	3970	3915	3970	3115	3970	3970	3115	900
950	1145	1145	1145	2345	2630	2655	3225	2285	3145	3540	2285	950
1000	715	715	715	1370	1685	1800	2230	1655	2115	3455	1655	1000
1050	-	-	-	-	1315	1200	1455	1200	1430	3420	1200	1050
1100	-	-	-	-	800	800	915	830	945	2485	800	1100
1150	-	-	-	-	-	545	570	515	630	1630	515	1150
1200	-	-	-	-	-	345	345	285	430	1000	285	1200

Pressure-Temperature Ratings ASME B16.5 class 2500 per material group

See Note 3	2.1	2.2	2.3	2.4	2.5	2.7	2.13	3.1	3.2	3.4	3.5	3.6	3.8	3.15	See Note 3
Min. to 100	6000	6000	5000	6000	6000	6000	6250	6250	4000	5000	6250	6000	6250	5000	Min. to 100
200	5000	5160	4260	5400	5520	5300	6250	6180	4000	4380	6250	5540	6250	4600	200
300	4480	4660	3800	4960	5140	4840	6070	5920	4000	4080	6070	5320	6070	4340	300
400	4120	4280	3500	4600	4800	4520	5880	5680	4000	3940	5880	5160	5820	4080	400
500	3860	3980	3280	4300	4520	4280	5540	5460	3780	3940	5540	5020	5540	3860	500
600	3680	3760	3100	4060	4300	4120	5240	5240	3440	3940	5240	4900	5240	3660	600
650	3580	3680	3040	3960	4220	4040	-	5125	-	3940	5125	4820	5125	3580	650
700	3520	3620	3000	3880	4140	3980	-	4965	-	3920	4965	4760	4965	3480	700
750	3440	3560	2940	3820	4100	3920	-	4650	-	3880	4650	4650	4650	3420	750
800	3380	3520	2880	3760	4060	3880	-	4440	-	3820	4440	4440	4440	3340	800
850	3300	3480	2820	3720	4040	3820	-	-	-	3145	4285	4295	4285	3280	850
900	3240	3440	-	3680	3970	3760	-	-	-	2285	3970	3970	3970	3220	900
950	3180	3400	-	3540	3540	3540	-	-	-	-	3030	3540	3540	3160	950
1000	2970	3230	-	3430	3455	3455	-	-	-	-	2000	3455	3455	3100	1000
1050	2715	3200	-	3400	3420	2945	-	-	-	-	1285	3420	3420	2915	1050
1100	2145	2545	-	2600	3115	2170	-	-	-	-	855	3115	3115	2855	1100
1150	1715	1970	-	1970	2660	1570	-	-	-	-	630	2660	2655	2655	1150
1200	1370	1545	-	1545	2005	1145	-	-	-	-	570	1885	1715	2005	1200
1250	1115	1230	-	1170	1685	855	-	-	-	-	-	1200	1370	1685	1250
1300	945	970	-	915	1255	630	-	-	-	-	-	570	1000	1345	1300
1350	770	800	-	715	915	485	-	-	-	-	-	455	1000	1040	1350
1400	655	655	-	545	715	370	-	-	-	-	-	315	775	775	1400
1450	515	485	-	430	515	275	-	-	-	-	-	285	605	605	1450
1500	400	370	-	315	370	215	-	-	-	-	-	230	435	455	1500

NOTE

1. See temperature notes for all materials (page # 50)
2. Pressures are in pounds per square inch, gage (psig)
3. See ASME B16.5 2025 para. 2.5.3 for guidance on how to determine minimum temperatures.

CONNECTION BOLTING INFORMATION HEAT-TREATED ALLOY STUDS, BOLTS AND NUTS

ALLOY STEEL STUD BOLTING MATERIALS

The following grades of heat treated alloy steel studs are commonly used for high-pressure or extreme service in diameters of ¼ in. to 4 in., inclusive. Other grades and other diameters are available on special order.

ASTM 193, Grade B7

Heat treated chromium-molybdenum steel recommended for medium high temperature service. (Liquid quench -50° to 900° F, Air quench -40° to 900° F)

ASTM A193, Grade B7M

Similar to B7 studs except that the minimum yield and tensile strength requirements are reduced and the hardness controlled to 235 Brinell maximum. Recommended for use in corrosive environments. (-50° to 900° F)

ASTM A193, Grade B16

A heat treated chromium-molybdenum-vanadium steel recommended for high pressure, high temperature service. (-50° to 1100° F)

ASTM A320, Grade L7

This grade is intended for low temperature service down to minus 150° F and has a minimum Charpy impact value of 20 ft. lbs. at this temperature. (-50° to 1100° F)

ASTM A320, Grade L7M

Similar to L7 studs except that the minimum yield and tensile strength requirements are reduced and the hardness controlled to 235 Brinell maximum. This stud is recommended for use in low temperature corrosive environments. (-50° to 1100° F)

ASTM A320, Grade L43

This grade is intended for low temperature service down to minus 150° F and has a minimum Charpy impact value of 20 ft. lbs. at this temperature. Available in sizes up to a 4 inch diameter. (-150° to 1100° F)

ASTM A193, Grade B8

These Chromium-Nickel (AISI 304) austenitic steel studs are recommended for use in corrosive environments. (-325° to 1500° F)

ASTM A193, Grade B8M

These chromium-nickel molybdenum (AISI 316) austenitic steel studs are recommended for use in corrosive environments. (-325° to 1500° F)

NOTE

All data per ASME B16.5 – 2020 ED

CARBON AND ALLOY STEEL NUTS

ASTM A194, Latest Revision, Grade 2H

Suitable for use in high temperatures and high pressure conditions.

ASTM A194, Grade 2HM

Similar to 2H nuts except this grade is recommended for use in corrosive environments.

ASTM A194, Latest Revision, Grade 4

Heat treated molybdenum steel nuts suitable for severe temperature and pressure conditions.

ASTM A194, Latest Revision, Grade L7

New stamping as per ASTM is 7L. Heat treated chrome-molybdenum steel nuts suitable for extreme temperature and pressure conditions. Suitable for sub-zero service conditions and have minimum Charpy impact values in accordance with ASTM specifications. A320, Grade 7 down to -150° F.

ASTM A194, Grade L7M

New stamping as per ASTM is 7ML. Similar to grade L7 nuts except this grade is recommended for use in corrosive environments.

ASTM A194, Grade 8/8M

Stainless steel nuts recommended for use in corrosive environments.

Connection stud bolting can be furnished by FCI upon request.

BOLT AND NUT DIMENSIONS PER ASME B18.2

Stud Bolt Size	Thread Dimensions		Nut Dimensions		
	Threads Per Inch	Root Area	Across Flats Max	Across Corners Min	Nom. Thick.
1/2	13	0.126	0.875	0.969	0.484
5/8	11	0.202	1.063	1.175	0.609
3/4	10	0.302	1.250	1.383	0.734
7/8	9	0.419	1.438	1.589	0.859
1	8	0.551	1.625	1.796	0.984
1 1/8	8	0.728	1.813	2.002	1.109
1 1/4	8	0.929	2.000	2.209	1.219
1 3/8	8	1.155	2.188	2.416	1.344
1 1/2	8	1.405	2.375	2.622	1.469
1 5/8	8	1.680	2.563	2.828	1.594
1 3/4	8	1.980	2.750	3.035	1.719
1 7/8	8	2.300	2.938	3.242	1.844
2	8	2.650	3.125	3.449	1.969
2 1/4	8	3.420	3.500	3.862	2.203
2 1/2	8	4.290	3.875	4.275	2.453
2 3/4	8	5.260	4.250	4.688	2.703
3	8	6.320	4.625	5.102	2.953
3 1/4	8	7.490	5.000	5.515	3.188
3 1/2	8	8.750	5.375	5.928	3.438
3 3/4	8	10.110	5.750	6.341	3.688
4	8	11.570	6.125	6.755	3.938

Calculation of "Nut Stop Diameter"

Nut Stop Diameter = Bolt Circle Diameter - Nut Dimension Across Flats

Example: Determine nut stop diameter of a 16" - 300# RF Equal Barrel 'E' connection

DESIGN DATA

Bolt Circle Diameter = 22.50 inches (ref. 16" - 300# RF flange bolt circle)

Stud Bolt Size = 1.25 inches (ref. 16" - 300# RF flange)

Nut Dimension Across Flats = 2.00 inches (ref. above chart for nut dimension relating to stud bolt size)

Nut Stop Diameter = Bolt Circle Diameter - Nut Dimension Across Flats

Nut Stop Diameter = 22.50 - 2.00 = 20.50 in.

SUGGESTED ASSEMBLY TORQUE VALUES TO PRODUCE CORRESPONDING BOLT LOADS

Size	Tensile Stress Area A_s Sq. In.	SA193 & ASTM 193 B7 Studs with 2H Heavy Hex Nuts A194		
		Clamp Load P Lbs.	Tightening Torque	
			Dry = .223	Lubed = .167
			K	K
			Ft. Lbs.	Ft. Lbs.
1/2-13	0.138	10,350	96	72
9/16-12	0.177	13,275	139	104
5/8-11	0.220	16,500	192	143
3/4-10	0.327	24,525	342	256
7/8-9	0.452	33,900	551	413
1-8	0.594	44,550	828	620
1-1/8-8	0.776	58,200	1,217	911
1-1/4-8	0.984	73,800	1,714	1,284
1-3/8-8	1.215	91,125	2,328	1,744
1-1/2-8	1.471	110,325	3,076	2,303
1-5/8-8	1.769	132,675	4,006	3,000
1-3/4-8	2.06	154,500	5,024	3,763
1-7/8-8	2.41	180,750	6,298	4,716
2-8	2.74	205,500	7,638	5,720
2-1/4-8	3.52	264,000	11,038	8,266
2-1/2-8	4.40	330,000	15,331	11,481

Size	Tensile Stress Area A_s Sq. In.	SA193 & ASTM 193 B7M Studs with A194 2HM Heavy Hex Nuts		
		Clamp Load P Lbs.	Tightening Torque	
			Dry K = .223	Lubed K = .167
			Ft. Lbs.	Ft. Lbs.
1/2-13		7,866	73	55
9/16-12		10,089	105	79
5/8-11		12,540	146	109
3/4-10		18,639	260	194
7/8-9		25,764	419	314
1-8		33,858	629	471
1-1/8-8		44,232	925	692
1-1/4-8		56,088	1,303	976
1-3/8-8		69,255	1,770	1,325
1-1/2-8		83,847	2,337	1,750
1-5/8-8		100,833	3,045	2,280
1-3/4-8		117,420	3,818	2,860
1-7/8-8		137,370	4,786	3,584
2-8		156,180	5,805	4,347
2-1/4-8		200,640	8,389	6,282
2-1/2-8		250,800	11,652	8,726

Size	Tensile Stress Area A_s Sq. In.	SA320 & ASTM A320 L7 Studs with A194 Gr. 4 or Gr. L7 Heavy Hex Nuts		
		Clamp Load P Lbs.	Tightening Torque	
			Dry = .223	Lubed K = .167
			K	K
			Ft. Lbs.	Ft. Lbs.
1/2-13	0.138	10,350	96	72
9/16-12	0.177	13,275	139	104
5/8-11	0.220	16,500	192	143
3/4-10	0.327	24,525	342	256
7/8-9	0.452	33,900	551	413
1-8	0.594	44,550	828	620
1-1/8-8	0.776	58,200	1,217	911
1-1/4-8	0.984	73,800	1,714	1,284
1-3/8-8	1.215	91,125	2,328	1,744
1-1/2-8	1.471	110,325	3,076	2,303
1-5/8-8	1.769	132,675	4,006	3,000
1-3/4-8	2.06	154,500	5,024	3,763
1-7/8-8	2.41	180,750	6,298	4,716
2-8	2.74	205,500	7,638	5,720
2-1/4-8	3.52	264,000	11,038	8,266
2-1/2-8	4.40	330,000	15,331	11,481

Size	Tensile Stress Area A_s Sq. In.	SA320 & ASTM A320 L7M Studs with A194 Gr. 4 or Gr. L7M Heavy Hex Nuts		
		Clamp Load P Lbs.	Tightening Torque	
			Dry K = .223	Lubed K = .167
			Ft. Lbs.	Ft. Lbs.
1/2-13		7,866	73	55
9/16-12		10,089	105	79
5/8-11		12,540	146	109
3/4-10		18,639	260	194
7/8-9		25,764	419	314
1-8		33,858	629	471
1-1/8-8		44,232	925	692
1-1/4-8		56,088	1,303	976
1-3/8-8		69,255	1,770	1,325
1-1/2-8		83,847	2,337	1,750
1-5/8-8		100,833	3,045	2,280
1-3/4-8		117,420	3,818	2,860
1-7/8-8		137,370	4,786	3,584
2-8		156,180	5,805	4,347
2-1/4-8		200,640	8,389	6,282
2-1/2-8		250,800	11,652	8,726

NOTE

1. Tightening torque values from the formula $T = KDP$, where T = tightening torque, lb.ft. K = torque-friction coefficient, D = nominal bolt diameter, in.; and p = bolt clamping load developed by tightening, lb.
2. Clamp load is also known as preload or initial load in tension on bolt. Clamp load (lb.) is calculated by arbitrarily assuming useable bolt strength is 75% of bolt proof load (PSI) times the stress area (sq.in.) of threaded section of each bolt size.
Higher or lower values of clamp load can be used depending on the application requirements and the judgement of the designer.
3. No proof load has been established by ASTM. Values shown in table are assumed at 95% of yield strength.
* Grade 7M nuts at a hardness not exceeding 235HB (or equivalent) shall be used with Grade B7M studs.
4. Last update 1996. Refer to latest edition of applicable code/specification and addendums thereto for required design data.

PROPERTIES OF SEAMLESS AND WELDED STEEL PIPE

Nominal Pipe Size	O.D.	Pipe Sch.	Wall Thk.	I.D.	Weight per Foot	Nominal Pipe Size	O.D.	Pipe Sch.	Wall Thk.	I.D.	Weight per Foot
1/8	0.405	10S * 40 ** 80	0.049 0.068 0.095	0.307 0.269 0.215	0.186 0.244 0.314	2	2.375	5S 10S * 40 ** 80 160 XX-STG	0.065 0.109 0.154 0.218 0.344 0.436	2.245 2.157 2.067 1.939 1.687 1.503	1.604 2.638 3.652 5.022 7.450 9.029
1/4	0.540	10S * 40 ** 80	0.065 0.088 0.119	0.410 0.364 0.302	0.330 0.424 0.535	2 1/2	2.875	5S 10S * 40 ** 80 160 XX-STG	0.083 0.120 0.203 0.276 0.375 0.552	2.709 2.635 2.469 2.323 2.125 1.771	2.48 3.53 5.79 7.66 10.01 13.69
3/8	0.675	10S * 40 ** 80	0.065 0.091 0.126	0.545 0.493 0.423	0.423 0.567 0.738	3	3.500	5S 10S * 40 ** 80 160 XX-STG	0.083 0.120 0.216 0.300 0.438 0.600	3.334 3.260 3.068 2.900 2.624 2.300	3.03 4.33 7.57 10.25 14.32 18.58
1/2	0.840	5S 10S * 40 ** 80 160 XX-STG	0.065 0.083 0.109 0.147 0.188 0.294	0.710 0.674 0.622 0.546 0.464 0.252	0.538 0.671 0.850 1.087 1.310 1.714	3 1/2	4.000	5S 10S * 40 ** 80	0.083 0.120 0.226 0.318	3.834 3.760 3.548 3.364	3.47 4.97 9.11 12.51
3/4	1.050	5S 10S * 40 ** 80 160 XX-STG	0.065 0.083 0.113 0.154 0.219 0.308	0.920 0.884 0.824 0.742 0.612 0.434	0.684 0.857 1.130 1.473 1.940 2.440	4	4.500	5S 10S * 40 ** 80 120 160 XX-STG	0.083 0.120 0.237 0.337 0.438 0.531 0.674	4.334 4.260 4.026 3.826 3.624 3.438 3.152	3.92 5.61 10.79 14.98 19.00 22.60 27.54
1	1.315	5S 10S * 40 ** 80 160 XX-STG	0.065 0.109 0.133 0.179 0.250 0.358	1.185 1.097 1.049 0.957 0.815 0.599	0.868 1.404 1.678 2.171 2.850 3.659	5	5.563	5S 10S * 40 ** 80 120 160 XX-STG	0.109 0.134 0.258 0.375 0.500 0.625 0.750	5.345 5.295 5.047 4.813 4.563 4.313 4.063	6.35 7.77 14.62 20.78 27.10 32.96 38.55
1 1/4	1.660	5S 10S * 40 ** 80 160 XX-STG	0.065 0.109 0.140 0.191 0.250 0.382	1.530 1.442 1.380 1.278 1.160 0.896	1.107 1.806 2.272 2.996 3.764 5.214	6	6.625	5S 10S * 40 ** 80 120 160 XX-STG	0.109 0.134 0.280 0.432 0.562 0.719 0.864	6.407 6.357 6.065 5.761 5.501 5.187 4.897	7.59 9.29 18.97 28.57 36.40 45.30 53.16
1 1/2	1.900	5S 10S * 40 ** 80 160 XX-STG	0.065 0.109 0.145 0.200 0.281 0.400	1.770 1.682 1.610 1.500 1.338 1.100	1.274 2.085 2.717 3.631 4.862 6.408						

NOTE

- All dimensions are in inches.
- All weights are in pounds.
- Dimensions for STD WT, X-STG, XX-STG, SCH 10,20,30, 40, 60, 80, 100, 120, 140, and 160 are in accordance with ASME B36.10.
- Dimensions for SCH 5S, 10S, 40S, and 80S are in accordance with ASME B36.19.
- * Wall thickness for Schedule 40, 40S, and Standard Weight are identical though 10" nominal pipe size.
- ** Wall thickness for Schedules 80, 80S, and Extra Strong are identical through 8" nominal pipe size.
- ~ Includes Standard Weight.
- ^ Includes Extra Strong.
- The wall thickness shown is subject to a 12.5% Mill tolerance.

PROPERTIES OF SEAMLESS AND WELDED STEEL PIPE

Nominal Pipe Size	O.D.	Pipe Sch.	Wall Thk.	I.D.	Weight per Foot	Nominal Pipe Size	O.D.	Pipe Sch.	Wall Thk.	I.D.	Weight per Foot
8	8.625	5S	0.109	8.407	10	16	16.000	5S	0.165	15.670	28
		10S	0.148	8.329	13			10S	0.188	15.624	32
		20	0.250	8.125	22			10	0.250	15.500	42
		30	0.277	8.071	25			20	0.312	15.375	52
		* 40	0.322	7.981	29			30	0.375	15.250	63
		60	0.406	7.813	36			STD.WT.	0.375	15.250	63
		**80	0.500	7.625	43			40	0.500	15.000	83
		100	0.594	7.437	51			60	0.656	14.688	108
		120	0.719	7.187	61			X-STG	0.500	15.000	83
		140	0.812	7.001	68			80	0.844	14.312	137
10	10.750	160	0.906	6.813	75	18	18.000	100	1.031	13.938	165
		XX-STG	0.875	6.875	72			120	1.219	13.562	193
		5S	0.134	10.482	15			140	1.438	13.124	224
		10S	0.165	10.420	19			160	1.594	12.812	245
		20	0.250	10.250	28			5S	0.165	17.670	31
		30	0.307	10.136	34			10S	0.188	17.624	36
		* 40	0.365	10.020	40			10	0.250	17.500	47
		60	0.500	9.750	55			20	0.312	17.375	59
		^ 80S	0.500	9.750	55			30	0.438	17.124	82
		80	0.594	9.562	64			STD.WT.	0.375	17.250	71
12	12.750	100	0.719	9.312	77			40	0.562	16.876	105
		120	0.844	9.062	89			60	0.750	16.500	138
		140	1.000	8.750	104			X-STG	0.500	17.000	93
		160	1.125	8.500	116			80	0.938	16.124	171
		XX-STG	1.000	8.750	104			100	1.156	15.688	208
		5S	0.156	12.438	21			120	1.375	15.250	244
		10S	0.180	12.390	24			140	1.562	14.876	275
		20	0.250	12.250	33			160	1.781	14.438	309
		30	0.330	12.090	44	20	20.000	5S	0.188	19.624	40
		~ 40S	0.375	12.000	50			10S	0.218	19.564	46
14	14.000	40	0.406	11.938	54			10	0.250	19.500	53
		60	0.562	11.626	73			20	0.375	19.250	79
		^ 80S	0.500	11.750	65			30	0.500	19.000	105
		80	0.688	11.374	89			STD.WT.	0.375	19.250	79
		100	0.844	11.062	108			40	0.594	18.812	123
		120	1.000	10.750	126			60	0.812	18.376	167
		140	1.125	10.500	140			X-STG	0.500	19.000	105
		160	1.312	10.126	161			80	1.031	17.938	209
		XX-STG	1.000	10.750	126			100	1.281	17.438	256
		5S	0.156	13.688	23	24	24.000	120	1.500	17.000	297
16	16.000	10S	0.188	13.624	28			140	1.750	16.500	342
		10	0.250	13.500	37			160	1.969	16.062	379
		20	0.312	13.376	46			5S	0.218	23.564	55
		30	0.375	13.250	55			10S	0.250	23.500	63
		STD.WT.	0.375	13.250	55			10	0.250	23.500	63
		40	0.438	13.124	63			20	0.375	23.250	95
		60	0.594	12.812	85			30	0.562	22.876	141
		X-STG	0.500	13.000	72			STD.WT.	0.375	23.250	95
		80	0.750	12.500	107			40	0.688	22.624	171
		100	0.938	12.124	131			60	0.969	22.062	238
18	18.000	120	1.094	11.812	151			X-STG	0.500	23.000	125
		140	1.250	11.500	171			80	1.219	21.562	297
		160	1.406	11.188	190			100	1.531	20.938	367
		5S	0.156	15.750	31			120	1.812	20.376	429
		10S	0.188	15.624	36			140	2.062	19.876	484
		10	0.250	15.500	47			160	2.344	19.312	542
		20	0.312	15.375	59			5S	0.218	23.564	55
		30	0.438	15.124	82			10S	0.250	23.500	63
		STD.WT.	0.375	15.250	71			10	0.250	23.500	63
		40	0.562	14.876	105			20	0.375	23.250	95

NOTE

1. All dimensions are in inches.
2. All weights are in pounds.
3. Dimensions for STD WT, X-STG, XX-STG, SCH 10,20,30, 40, 60, 80, 100, 120, 140, and 160 are in accordance with ASME B36.10.
4. Dimensions for SCH 5S, 10S, 40S, and 80S are in accordance with ASME B36.19.
5. * Wall thickness for Schedule 40, 40S, and Standard Weight are identical though 10" nominal pipe size.
6. ** Wall thickness for Schedules 80, 80S, and Extra Strong are identical through 8" nominal pipe size.
7. ~ Includes Standard Weight.
8. ^ Includes Extra Strong.
9. The wall thickness shown is subject to a 12.5% Mill tolerance.

HARDNESS CONVERSION TABLE

Approximate Equivalent Hardness Numbers and Tensile Strengths for Vickers Hardness Numbers for Steel*

Vickers Hardness No.	Brinell Hardness No., 3000-kg load, 10-mm ball		Rockwell Hardness No.				Rockwell Superficial Hardness No., Superficial Brale Indenter			Tensile strength (approx) MPs	Tensile strength (approx) ksi
	Standard ball	Tungsten carbide ball	A scale, 60-kg load, Brale Indenter	B scale, 100-kg load, 1/16-in. diam. ball	C scale, 150-kg load, Brale Indenter	D scale, 100-kg load, Brale Indenter	15M scale 15-kg load	30M scale 30-kg load	45M scale, 45-kg load		
520	(480)	488	76.1	...	50.5	63.5	85.7	69.0	55.6	1793	260
510	(473)	479	75.7	...	49.8	62.9	85.4	68.3	54.7	1751	254
500	(465)	471	75.3	...	49.1	62.2	85.0	67.7	53.9	1703	247
490	(456)	460	74.9	...	48.4	61.6	84.7	67.1	53.1	1662	241
480	(448)	452	74.5	...	47.7	61.3	84.3	66.4	52.2	1620	235
470	441	442	74.1	...	46.9	60.7	83.9	65.7	51.3	1572	228
460	433	433	73.6	...	46.1	60.1	83.6	64.9	50.4	1538	223
450	425	425	73.3	...	45.3	59.4	83.2	64.3	49.4	1496	217
440	415	415	72.8	...	44.5	58.8	82.8	63.5	48.4	1462	212
430	405	405	72.3	...	43.6	58.2	82.3	62.7	47.4	1413	205
420	397	397	71.8	...	42.7	57.5	81.8	61.9	46.4	1372	199
410	388	388	71.4	...	41.8	56.6	81.4	61.1	45.3	1331	193
400	379	379	70.8	...	40.8	56.0	80.8	60.2	44.1	1289	187
390	369	369	70.3	...	39.8	55.2	80.3	59.3	42.9	1248	181
380	360	360	69.8	(110.0)	38.8	54.4	79.8	58.4	41.7	1207	175
370	350	350	69.2	...	37.7	53.6	79.2	57.4	40.4	1172	170
360	341	341	68.7	(109.0)	36.6	52.8	78.6	56.4	39.1	1131	164
350	331	331	68.1	...	35.5	51.9	78.0	55.4	37.8	1096	159
340	322	322	67.6	(108.0)	34.4	51.1	77.4	54.4	36.5	1069	155
330	313	313	67.0	...	33.3	50.2	76.8	53.6	35.2	1034	150
320	303	303	66.4	(107.0)	32.2	49.4	76.2	52.3	33.9	1007	146
310	294	294	65.8	...	31.0	48.4	75.6	51.3	32.5	979	142
300	284	284	65.2	(105.5)	29.8	47.5	74.9	50.2	31.1	951	138
295	280	280	64.8	...	29.2	47.1	74.6	49.7	30.4	938	136
290	275	275	64.5	(104.5)	28.5	46.5	74.2	49.0	29.5	917	133
285	270	270	64.2	...	27.8	46.0	73.8	48.4	28.7	903	131
280	265	265	63.8	(103.5)	27.1	45.3	73.4	47.8	27.9	899	130
275	261	261	63.5	...	26.4	44.9	73.0	47.2	27.1	876	127
270	256	256	63.1	(102.0)	25.6	44.3	72.6	46.4	26.2	855	124
265	252	252	62.7	...	24.8	43.7	72.1	45.7	25.2	841	122
260	247	247	62.4	(101.0)	24.0	43.1	71.6	45.0	24.3	827	120
255	243	243	62.0	...	23.1	42.2	71.1	44.2	23.2	807	117
250	238	238	61.6	99.5	22.2	41.7	70.6	43.4	22.2	793	115
245	233	233	61.2	...	21.3	41.1	70.1	42.5	21.1	779	113
240	228	228	60.7	98.1	20.3	40.3	69.6	41.7	19.9	765	111
230	219	219	...	96.7	(18.0)	...	...	...	...	731	106
220	209	209	...	95.0	(15.7)	...	...	...	...	696	101
210	200	200	...	93.4	(13.4)	...	...	...	...	669	97
200	190	190	...	91.5	(11.0)	...	...	...	...	634	92
190	181	181	...	89.5	(8.5)	...	...	...	...	607	88
180	171	171	...	87.1	(6.0)	...	...	...	...	579	84
170	162	162	...	85.0	(3.0)	...	...	...	...	545	79
160	152	152	...	81.7	(0.0)	...	...	...	...	517	75
150	143	143	...	78.7	...	...	...	...	...	490	71
140	133	133	...	75.0	...	...	...	...	...	455	66
130	124	124	...	71.2	...	...	...	...	...	427	62
120	114	114	...	66.7	...	...	...	...	...	393	57
110	105	105	...	62.3	...	...	...	...	...	...	...
100	95	95	...	56.2	...	...	...	...	...	...	...
95	90	90	...	52.0	...	...	...	...	...	...	...
90	86	86	...	48.0	...	...	...	...	...	...	...
85	81	81	...	41.0	...	...	...	...	...	...	...

* For carbon and alloy steels in the annealed, normalized, and quenched-and-tempered conditions; less accurate for cold work condition and for austenitic steels. The values in **boldface type** correspond to the values in the joint SAE-ASM-ASTM hardness conversions as printed in ASTM E140, Table 2, 1996. The values in parentheses are beyond normal range and are given for information only.

IMPACT ENERGY CONVERSION TABLE

The middle column of figures (**in bold-faced type**) contains the reading (in J or ft-lb) to be converted. If converting from ft-lb to J, read the J equivalent in the column headed "J". If converting from J to ft-lb, read the equivalent in the column headed "ft-lb". 1 ft-lb = 1.355818 J.

ft-lb		J	ft-lb		J	ft-lb		J	ft-lb		J
0.7376	1	1.3558	28.7649	39	52.8769	56.7923	77	104.3980	129.0734	175	237.2681
1.4751	2	2.7116	29.5025	40	54.2327	57.5298	78	105.7538	132.7612	180	244.0472
2.2127	3	4.0675	30.2400	41	55.5885	58.2674	79	107.1096	136.4490	185	250.8263
2.9502	4	5.4233	30.9776	42	56.9444	59.0050	80	108.4654	140.1368	190	257.6054
3.6878	5	6.7791	31.7152	43	58.3002	59.7424	81	109.8212	143.8246	195	264.3845
4.4254	6	8.1349	32.4527	44	59.6560	60.4801	82	111.1771	147.5124	200	271.1636
5.1629	7	9.4907	33.1903	45	61.0118	61.2177	83	112.5329	154.8880	210	284.7218
5.9005	8	10.8465	33.9279	46	62.3676	61.9552	84	113.8887	162.2637	220	298.2799
6.6381	9	12.2024	34.6654	47	63.7234	62.6928	85	115.2445	169.6393	230	311.8381
7.3756	10	13.5582	35.4030	48	65.0793	63.4303	86	116.6003	177.0149	240	325.3963
8.1132	11	14.9140	36.1405	49	66.4351	64.1679	87	117.9562	184.3905	250	338.9545
8.8507	12	16.2698	36.8781	50	67.7909	64.9055	88	119.3120	191.7661	260	352.5126
9.5883	13	17.6256	37.6157	51	69.1467	65.6430	89	120.6678	199.1418	270	366.0708
10.3259	14	18.9815	38.3532	52	70.5025	66.3806	90	122.0236	206.5174	280	379.6290
11.0634	15	20.3373	39.0908	53	71.8583	67.1182	91	123.3794	213.8930	290	393.1872
11.8010	16	21.6931	39.8284	54	73.2142	67.8557	92	124.7452	221.2686	300	406.7454
12.5386	17	23.0489	40.5659	55	74.5700	68.5933	93	126.0911	228.6442	310	420.3036
13.2761	18	24.4047	41.3035	56	75.9258	69.3308	94	127.4469	236.0199	320	433.8617
14.0137	19	25.7605	42.0410	57	77.2816	70.0684	95	128.8027	243.3955	330	447.4199
14.7512	20	27.1164	42.7786	58	78.6374	70.8060	96	130.1585	250.7711	340	460.9781
15.4888	21	28.4722	43.5162	59	79.9933	71.5435	97	131.5143	258.1467	350	474.5363
16.2264	22	29.8280	44.2537	60	81.3491	72.2811	98	132.8702	265.5224	360	488.0944
16.9639	23	31.1838	44.9913	61	82.7049	73.0186	99	134.2260	272.8980	370	501.6526
17.7015	24	32.5396	45.7288	62	84.0607	73.7562	100	135.5818	280.2736	380	515.2108
18.4390	25	33.8954	46.4664	63	85.4165	74.4938	105	142.3609	287.6492	390	528.7690
19.1766	26	35.2513	47.2040	64	86.7723	81.1308	110	149.1400	295.0248	400	542.3272
19.9142	27	36.6071	47.9415	65	88.1282	84.8196	115	155.9191	302.4005	410	555.8854
20.6517	28	37.9629	48.6791	66	89.4840	88.5075	120	162.6982	309.7761	420	569.4435
21.3893	29	39.3187	49.4167	67	90.8398	92.1953	125	169.4772	317.1517	430	583.0017
22.1269	30	40.6745	50.1542	68	92.1956	95.8831	130	176.2563	324.5273	440	596.5599
22.8644	31	42.0304	50.8918	69	93.5514	99.5709	135	183.0354	331.9029	450	610.1181
23.6020	32	43.3862	51.6293	70	94.9073	103.2587	140	189.8145	339.2786	460	623.6762
24.3395	33	44.7420	52.3669	71	96.2631	106.9465	145	196.5936	346.6542	470	637.2344
25.0771	34	46.0978	53.1045	72	97.6189	110.6343	150	203.3727	354.0298	480	650.7926
25.8147	35	47.4536	53.8420	73	98.9747	114.3221	155	210.1518	361.4054	490	664.3508
26.5522	36	48.8094	54.5796	74	100.3305	118.0099	160	216.9308	368.7811	500	677.9090
27.2898	37	50.1653	55.3172	75	101.6863	121.6977	165	223.7099			
28.0274	38	51.5211	56.0547	76	103.0422	125.3856	170	230.4890			



WEIGHT OF CIRCULAR STEEL PLATES PER 1" OF THICKNESS

Dia. Inches	Weight per Inch Thickness	Dia. Inches	Weight per Inch Thickness	Dia. Inches	Weight per Inch Thickness	Dia. Inches	Weight per Inch Thickness	Dia. Inches	Weight per Inch Thickness	Dia. Inches	Weight per Inch Thickness	Dia. Inches	Weight per Inch Thickness
1	0.22	9	18.02	17	64.30	25	139.07	33	242.31	41	374.04	49	534.29
1 1/8	0.28	9 1/8	18.53	17 1/8	65.25	25 1/8	140.46	33 1/8	244.15	41 1/8	376.31	49 1/8	537.02
1 1/4	0.35	9 1/4	19.04	17 1/4	66.21	25 1/4	141.86	33 1/4	245.99	41 1/4	378.60	49 1/4	539.76
1 3/8	0.42	9 3/8	19.56	17 3/8	67.17	25 3/8	143.27	33 3/8	247.85	41 3/8	380.90	49 3/8	542.50
1 1/2	0.50	9 1/2	20.08	17 1/2	68.14	25 1/2	144.68	33 1/2	249.71	41 1/2	383.22	49 1/2	545.25
1 5/8	0.59	9 5/8	20.61	17 5/8	69.12	25 5/8	146.11	33 5/8	251.57	41 5/8	385.51	49 5/8	548.01
1 3/4	0.68	9 3/4	21.15	17 3/4	70.10	25 3/4	147.54	33 3/4	253.45	41 3/4	387.84	49 3/4	550.78
1 7/8	0.78	9 7/8	21.70	17 7/8	71.09	25 7/8	148.97	33 7/8	255.33	41 7/8	390.16	49 7/8	553.55
2	0.89	10	22.25	18	72.09	26	150.41	34	257.22	42	392.48	50	556.33
2 1/8	1.01	10 1/8	22.81	18 1/8	73.10	26 1/8	151.86	34 1/8	259.11	42 1/8	394.84	50 1/8	559.11
2 1/4	1.13	10 1/4	23.38	18 1/4	74.11	26 1/4	153.32	34 1/4	261.01	42 1/4	397.19	50 1/4	561.90
2 3/8	1.26	10 3/8	23.95	18 3/8	75.13	26 3/8	154.78	34 3/8	262.92	42 3/8	399.54	50 3/8	564.70
2 1/2	1.39	10 1/2	24.53	18 1/2	76.15	26 1/2	156.25	34 1/2	264.84	42 1/2	401.89	50 1/2	567.51
2 5/8	1.54	10 5/8	25.12	18 5/8	77.19	26 5/8	157.73	34 5/8	266.76	42 5/8	404.27	50 5/8	570.32
2 3/4	1.69	10 3/4	25.71	18 3/4	78.22	26 3/4	159.22	34 3/4	268.69	42 3/4	406.65	50 3/4	573.14
2 7/8	1.84	10 7/8	26.32	18 7/8	79.27	26 7/8	160.71	34 7/8	270.63	42 7/8	409.03	50 7/8	575.97
3	2.01	11	26.92	19	80.32	27	162.21	35	272.57	43	411.41	51	578.80
3 1/8	2.18	11 1/8	27.54	19 1/8	81.39	27 1/8	163.71	35 1/8	274.52	43 1/8	413.82	51 1/8	581.64
3 1/4	2.36	11 1/4	28.16	19 1/4	82.45	27 1/4	165.22	35 1/4	276.48	43 1/4	416.20	51 1/4	584.49
3 3/8	2.54	11 3/8	28.79	19 3/8	83.53	27 3/8	166.74	35 3/8	278.44	43 3/8	418.60	51 3/8	587.34
3 1/2	2.73	11 1/2	29.43	19 1/2	84.61	27 1/2	168.27	35 1/2	280.41	43 1/2	421.04	51 1/2	590.21
3 5/8	2.93	11 5/8	30.07	19 5/8	85.70	27 5/8	169.80	35 5/8	282.39	43 5/8	423.45	51 5/8	593.07
3 3/4	3.14	11 3/4	30.72	19 3/4	86.79	27 3/4	171.34	35 3/4	284.38	43 3/4	425.88	51 3/4	595.95
3 7/8	3.35	11 7/8	31.38	19 7/8	87.89	27 7/8	172.89	35 7/8	286.37	43 7/8	428.32	51 7/8	598.83
4	3.57	12	32.04	20	89.00	28	174.44	36	288.37	44	430.76	52	601.72
4 1/8	3.80	12 1/8	32.71	20 1/8	90.12	28 1/8	176.01	36 1/8	290.38	44 1/8	433.22	52 1/8	604.62
4 1/4	4.03	12 1/4	33.39	20 1/4	91.24	28 1/4	177.57	36 1/4	292.39	44 1/4	435.69	52 1/4	607.52
4 3/8	4.27	12 3/8	34.08	20 3/8	92.37	28 3/8	179.15	36 3/8	294.41	44 3/8	438.15	52 3/8	610.43
4 1/2	4.52	12 1/2	34.77	20 1/2	93.51	28 1/2	180.73	36 1/2	296.42	44 1/2	440.62	52 1/2	613.35
4 5/8	4.77	12 5/8	35.47	20 5/8	94.65	28 5/8	182.32	36 5/8	298.46	44 5/8	443.08	52 5/8	616.27
4 3/4	5.03	12 3/4	36.17	20 3/4	95.80	28 3/4	183.91	36 3/4	300.50	44 3/4	445.57	52 3/4	619.20
4 7/8	5.30	12 7/8	36.88	20 7/8	96.96	28 7/8	185.52	36 7/8	302.56	44 7/8	448.07	52 7/8	622.14
5	5.58	13	37.60	21	98.13	29	187.13	37	304.60	45	450.56	53	625.09
5 1/8	5.86	13 1/8	38.33	21 1/8	99.30	29 1/8	188.74	37 1/8	306.67	45 1/8	453.08	53 1/8	628.04
5 1/4	6.15	13 1/4	39.06	21 1/4	100.48	29 1/4	190.37	37 1/4	308.74	45 1/4	455.60	53 1/4	631.00
5 3/8	6.45	13 3/8	39.80	21 3/8	101.66	29 3/8	192.00	37 3/8	310.81	45 3/8	458.10	53 3/8	633.96
5 1/2	6.75	13 1/2	40.55	21 1/2	102.85	29 1/2	193.64	37 1/2	312.90	45 1/2	460.65	53 1/2	636.94
5 5/8	7.06	13 5/8	41.31	21 5/8	104.05	29 5/8	195.28	37 5/8	314.97	45 5/8	463.17	53 5/8	639.92
5 3/4	7.38	13 3/4	42.07	21 3/4	105.26	29 3/4	196.93	37 3/4	317.07	45 3/4	465.72	53 3/4	642.90
5 7/8	7.70	13 7/8	42.84	21 7/8	106.47	29 7/8	198.59	37 7/8	319.19	45 7/8	468.27	53 7/8	645.90
6	8.01	14	43.62	22	107.69	30	200.25	38	321.29	46	470.82	54	648.90
6 1/8	8.35	14 1/8	44.39	22 1/8	108.92	30 1/8	201.93	38 1/8	323.42	46 1/8	473.37	54 1/8	651.91
6 1/4	8.69	14 1/4	45.18	22 1/4	110.15	30 1/4	203.61	38 1/4	325.54	46 1/4	475.94	54 1/4	654.92
6 3/8	9.04	14 3/8	45.98	22 3/8	111.40	30 3/8	205.29	38 3/8	327.66	46 3/8	478.52	54 3/8	657.94
6 1/2	9.40	14 1/2	46.78	22 1/2	112.64	30 1/2	206.99	38 1/2	329.82	46 1/2	481.10	54 1/2	660.97
6 5/8	9.77	14 5/8	47.59	22 5/8	113.90	30 5/8	208.69	38 5/8	331.94	46 5/8	483.71	54 5/8	664.01
6 3/4	10.14	14 3/4	48.41	22 3/4	115.16	30 3/4	210.39	38 3/4	334.10	46 3/4	486.28	54 3/4	667.94
6 7/8	10.52	14 7/8	49.23	22 7/8	116.43	30 7/8	212.11	38 7/8	336.25	46 7/8	488.89	54 7/8	670.10
7	10.90	15	50.06	23	117.71	31	213.83	39	338.43	47	491.50	55	673.15
7 1/8	11.30	15 1/8	50.90	23 1/8	118.99	31 1/8	215.56	39 1/8	340.61	47 1/8	494.13	55 1/8	676.22
7 1/4	11.70	15 1/4	51.75	23 1/4	120.28	31 1/4	217.29	39 1/4	342.79	47 1/4	496.76	55 1/4	679.29
7 3/4	12.10	15 3/8	52.60	23 3/8	121.58	31 3/8	219.03	39 3/8	344.97	47 3/8	499.37	55 3/8	682.36
7 1/2	12.52	15 1/2	53.46	23 1/2	122.88	31 1/2	220.78	39 1/2	347.16	47 1/2	502.04	55 1/2	685.45
7 5/8	12.94	15 5/8	54.32	23 5/8	124.19	31 5/8	222.54	39 5/8	349.37	47 5/8	504.67	55 5/8	688.54
7 3/4	13.36	15 3/4	55.20	23 3/4	125.51	31 3/4	224.30	39 3/4	351.58	47 3/4	507.33	55 3/4	691.64
7 7/8	13.80	15 7/8	56.08	23 7/8	126.83	31 7/8	226.07	39 7/8	353.79	47 7/8	509.97	55 7/8	694.74
8	14.24	16	56.96	24	128.16	32	227.85	40	355.99	48	512.66	56	697.85
8 1/8	14.69	16 1/8	57.86	24 1/8	129.50	32 1/8	229.63	40 1/8	358.23	48 1/8	515.32	56 1/8	700.97
8 1/4	15.14	16 1/4	58.76	24 1/4	130.85	32 1/4	231.42	40 1/4	360.47	48 1/4	518.01	56 1/4	704.10
8 3/8	15.61	16 3/8	59.66	24 3/8	132.20	32 3/8	233.22	40 3/8	362.71	48 3/8	520.68	56 3/8	707.23
8 1/2	16.08	16 1/2	60.58	24 1/2	133.57	32 1/2	235.02	40 1/2	364.95	48 1/2	523.40	56 1/2	710.37
8 5/8	16.55	16 5/8	61.50	24 5/8	134.93	32 5/8	236.83	40 5/8	367.21	48 5/8	526.09	56 5/8	713.52
8 3/4	17.04	16 3/4	62.43	24 3/4	136.30	32 3/4	238.65	40 3/4	369.48	48 3/4	528.78	56 3/4	716.67
8 7/8	17.53	16 7/8	63.36	24 7/8	137.68	32 7/8	240.48	40 7/8	371.75	48 7/8	531.50	56 7/8	719.83

CONVERSION FACTORS

Change	To	Multiply By	Change	To	Multiply By
A			G		
atmospheres	ft of water (at 4 °C)	33.90	gallons	cu cms	3,785.0
atmospheres	in of mercury (at 0 °C)	29.92	gallons	cu feet	0.1337
atmospheres	kgs/sq cm	1.0333	gallons	cu inches	231.0
atmospheres	pounds/sq in	14.70	gallons	cu meters	3.785 x 10 ⁻³
B			gallons	liters	3.785
bars	atmospheres	0.9869	gallons (liq Br. Imp.)	gallons (U.S. liq)	1.20095
BTU	foot-lbs	778.3	gallons (U.S.)	gallons (Imp.)	0.83267
BTU	joules	1,054.8	gallons of water	pounds of water	8.3453
BTU	kilowatt-hrs	2.298 x 10 ⁻⁴	grams	dynes	980.7
C			grams	kilograms	0.001
calories, gram (mean)	BTU (mean)	3.9685 x 10 ⁻³	grams	milligrams	1,000.0
Centigrade	Fahrenheit	(C° x 9/5) + 32	grams	ounces (avdp)	0.03527
centimeters	feet	3.281 x 10 ⁻²	grams	ounces (troy)	0.03215
centimeters	inches	0.3937	grams	poundals	0.07093
centimeters	kilometers	10 ⁻⁵	grams	pounds	2.205 x 10 ⁻³
centimeters	meters	0.01	grams/cu cm	pounds/cu ft	62.43
centimeters	millimeters	10.0	grams/cu cm	pounds/cu in	0.03613
cubic centimeters	cu feet	3.531 x 10 ⁻⁵	grams/sq cm	pounds/sq ft	2.0481
cubic centimeters	cu inches	0.06102	H		
cubic centimeters	cu meters	10 ⁻⁶	horsepower	BTU/min	42.44
cubic centimeters	gallons (U.S. liq)	2.642 x 10 ⁻⁴	horsepower	foot-lbs/min	33,000.0
cubic centimeters	liters	0.001	horsepower	foot-lbs/sec	550.0
cubic feet	cu inches	1,728.0	horsepower	kilowatts	0.7457
cubic feet	cu meters	0.02832	horsepower	watts	745.7
cubic feet	gallons (U.S. liq)	7.48052	I		
cubic feet	liters	28.32	inches	centimeters	2.540
cubic inches	cu cms	16.39	inches	meters	2.540 x 10 ⁻²
cubic inches	cu feet	5.787 x 10 ⁻⁴	inches	millimeters	25.40
cubic inches	cu meters	1.639 x 10 ⁻⁵	inches	mils	1,000.0
cubic inches	gallons	4.329 x 10 ⁻³	inches	feet	0.0833
cubic meters	cu cms	10 ⁶	inches of mercury	atmospheres	0.03342
cubic meters	cu feet	35.31	inches of mercury	inches of water	13.6
cubic meters	cu inches	61,023.0	inches of mercury	feet of water	1.1333
cubic meters	gallons (U.S. liq)	264.2	inches of mercury	kgs/sq cm	0.03453
cubic meters	liters	1,000.0	inches of mercury	kgs/sq meter	345.3
D			inches of mercury	pounds/sq ft	70.73
dynes	joules/cm	10 ⁻⁷	inches of mercury	pounds/sq in	0.4912
dynes	joules/meter (newtons)	10 ⁻⁵	inches of water (at 4°C)	atmospheres	2.458 x 10 ⁻³
dynes	kilograms	1.020 x 10 ⁻⁶	inches of water (at 4°C)	inches of mercury	0.07355
dynes	poundals	7.233 x 10 ⁻⁵	inches of water (at 4°C)	kgs/sq cm	2.540 x 10 ⁻³
dynes	pounds	2.248 x 10 ⁻⁵	inches of water (at 4°C)	ounces/sq in	0.5781
E			inches of water (at 4°C)	pounds/sq ft	5.204
ergs	BTU	9.480 x 10 ⁻¹¹	inches of water (at 4°C)	pounds/sq in	0.03613
ergs	foot-pounds	7.367 x 10 ⁻⁸	J		
ergs	joules	10 ⁻⁷	joules	BTU	9.480 x 10 ⁻⁴
ergs/sec	horsepower	1.341 x 10 ⁻¹⁰	joules	ergs	10 ⁷
F			joules	foot-pounds	0.7376
feet	centimeters	30.48	joules	watt-hrs	2.778 x 10 ⁻⁴
feet	meters	0.3048	joules/cm	grams	1.020 x 10 ⁻⁴
feet	millimeters	304.8	joules/cm	dynes	10 ⁷
feet	inches	12.0	joules/cm	joules/meter (newtons)	100.0
feet of water	atmospheres	0.02950	joules/cm	poundals	723.3
feet of water	in of mercury	0.8826	joules/cm	pounds	22.48
feet of water	pounds/sq ft	62.43	K		
feet of water	pounds/sq in	0.4335	kilograms	dynes	980,665.0
Fahrenheit	Centigrade	(° F - 32) x 5/9	kilograms	grams	1,000.0
foot-pounds	BTU	1.286 x 10 ⁻³	kilograms	joules/cm	0.09807
foot-pounds	ergs	1.356 x 10 ⁷	kilograms	joules/meter (newtons)	9.807
foot-pounds	joules	1.356	kilograms	poundals	70.93
foot-pounds	kilowatt-hrs	3.766 x 10 ⁻⁷	kilograms	pounds	2.205
kilograms	tons (short)	1.102 x 10 ⁻³	pounds	kilograms	0.4536
kilograms/cu meter	grams/cu cm	0.001	pounds	ounces	16.0
kilograms/cu meter	pounds/cu ft	0.06243	pounds	ounces (troy)	14.5833



CONVERSION FACTORS

Change	To	Multiply By	Change	To	Multiply By
K			P		
kilograms/cu meter	pounds/cu in	3.613×10^{-5}	pounds	poundals	32.17
kilograms/cu meter	pounds/mil-foot	3.405×10^{-10}	pounds	pounds (troy)	1.21528
kilograms/meter	pounds/ft	0.6720	pounds	tons (short)	0.0005
kilograms/sq cm	dynes	980,665.0	pounds of water	cu feet	0.01602
kilograms/sq cm	atmosphere	0.9678	pounds of water	cu inches	27.68
kilograms/sq cm	feet of water	32.81	pounds of water	gallons	0.1198
kilograms/sq cm	inches of mercury	28.96	pounds-feet	cm-dynes	1.356×10^7
kilograms/sq cm	pounds/sq ft	2,048.0	pounds-feet	cm-grams	13,825.0
kilograms/sq cm	pounds/sq in	14.22	pounds-feet	meter-kgs	0.1383
kilograms/sq meter	atmosphere	9.678×10^{-5}	pounds/ft	kgs/meter	1.488
kilograms/sq meter	bars	98.07×10^{-6}	pounds/in	gms/cm	178.6
kilograms/sq meter	feet of water	3.281×10^{-3}	pounds/sq ft	atmospheres	4.725×10^{-4}
kilograms/sq meter	inches of mercury	2.896×10^{-3}	pounds/sq ft	feet of water	0.01602
kilograms/sq meter	pounds/sq ft	0.2048	pounds/sq ft	inches of mercury	0.01414
kilograms/sq meter	pounds/sq in	1.422×10^{-3}	pounds/sq ft	kgs/sq meter	4.882
kilograms/sq mm	kgs/sq meter	10^6	pounds/sq ft	pounds/sq in	6.944×10^{-3}
kilowatts	BTU/min	56.92	pounds/sq in	atmospheres	0.06804
kilowatts	foot-lbs/min	4.426×10^4	pounds/sq in	inches of water	27.68
kilowatts	foot-lbs/sec	737.6	pounds/sq in	feet of water	2.307
kilowatts	horsepower	1.341	pounds/sq in	inches of mercury	2.036
kilowatts	watts	1000.0	pounds/sq in	kgs/sq meter	703.1
kilowatt-hrs	BTU	3413.0	pounds/sq in	pounds/sq in	144.0
kilowatt-hrs	ergs	3.600×10^{13}	S		
kilowatt-hrs	foot-pounds	2.655×10^6	short tons	pounds	2,000.0
kilowatt-hrs	joules	3.6×10^6	short tons	long tons	0.89285
L			slug	kilogram	14.59
liters	cu cm	1,000.0	slug	pounds	32.17
liters	cu feet	0.03531	square centimeters	sq feet	1.076×10^{-3}
liters	cu inches	61.02	square centimeters	sq inches	0.1550
liters	cu meters	0.001	square centimeters	sq meters	0.0001
liters	gallons (U.S. liq)	0.2642	square centimeters	sq millimeters	100.0
long tons	pounds	2,240.0	square feet	sq cms	929.0
M			square feet	sq inches	144.0
meters	centimeters	100.0	square feet	sq meters	0.09290
meters	feet	3.281	square feet	sq millimeters	9.290×10^4
meters	inches	39.37	square inches	sq cms	6.452
meters	millimeters	1,000.0	square inches	sq feet	6.944×10^{-3}
miles (statue)	feet	5,280.0	square inches	sq millimeters	645.2
miles (statue)	meters	1,609.0	square kilometers	sq cms	10^{10}
millimeters	centimeters	0.1	square kilometers	sq feet	10.76×10^6
millimeters	feet	3.281×10^{-3}	square kilometers	sq inches	1.550×10^9
millimeters	inches	0.03937	square kilometers	sq meters	10^6
mils	inches	0.001	square meters	sq cms	10^4
N			square meters	sq feet	10.76
newtons	dynes	10^5	square meters	sq inches	1,550.0
O			square meters	sq millimeters	10^6
ounces	grams	28.349527	square millimeters	sq cms	0.01
ounces	pounds	0.06250	square millimeters	sq feet	1.076×10^{-5}
ounces	ounces (troy)	0.9115	square millimeters	sq inches	1.550×10^{-3}
P			T		
Poise	gram/cm sec	1.0	tons (long)	kilograms	1,016.0
pounds (avoirdupois)	ounces (troy)	14.5833	tons (long)	pounds	2,240.0
poundals	dynes	13,826.0	tons (long)	tons (short)	1.120
poundals	joules/cm	1.383×10^{-3}	tons (metric)	kilograms	1,000.0
poundals	joules/meter (newtons)	0.1383	tons (metric)	pounds	2,205.0
poundals	kilograms	0.01410	W		
poundals	pounds	0.03108	watts	BTU/hr	3.4129
pounds	dynes	44.4823×10^4	watts	BTU/min	0.05688
pounds	grams	453.5924	watts	ergs/sec	10^7
pounds	joules/cm	0.04448	watts	horsepower	1.341×10^{-3}
pounds	joules/meter (newtons)	4.448	watts	kilowatts	0.001



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