FCI Forged Components

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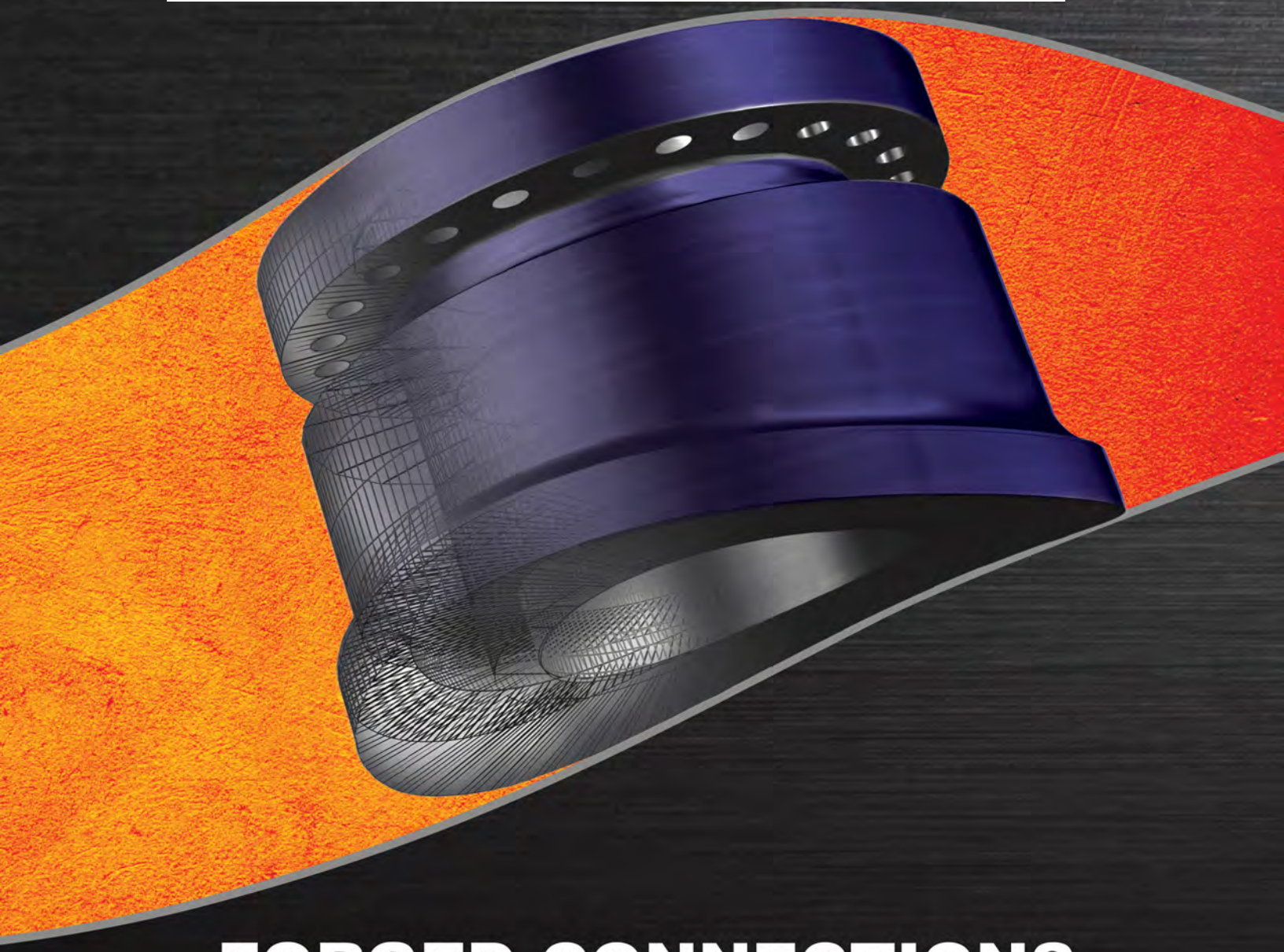

FORGED CONNECTIONS

FOR ASME AND API PRESSURE-CONTAINING COMPONENTS

LWN HB *I-1 *I-2 *I-3 *E

*Denotes I-1, I-2, I-3, & E are trademarks of FCI

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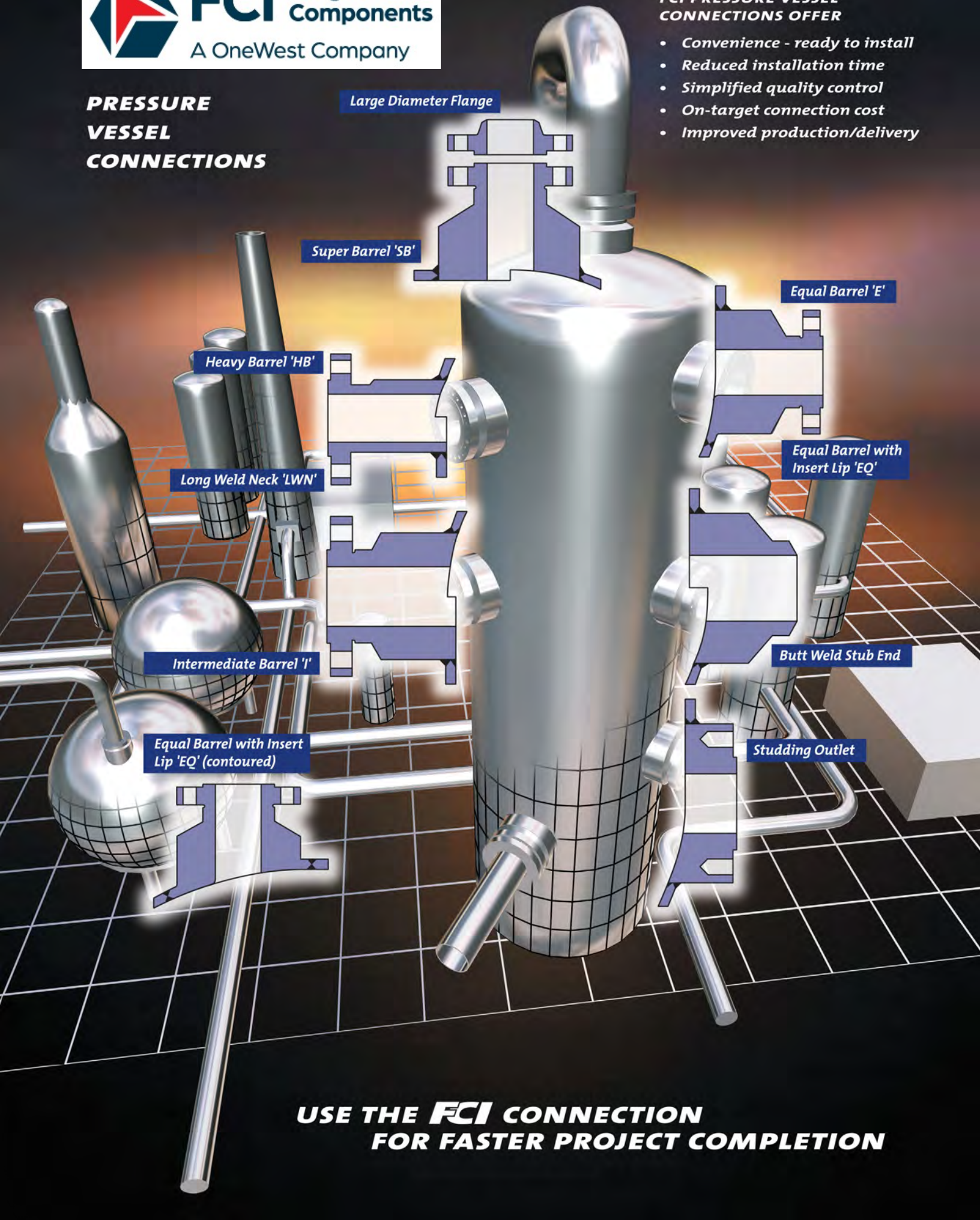
PRESSURE VESSEL CONNECTIONS

FCI PRESSURE VESSEL CONNECTIONS OFFER

- Convenience - ready to install
- Reduced installation time
- Simplified quality control
- On-target connection cost
- Improved production/delivery



USE THE FCI CONNECTION FOR FASTER PROJECT COMPLETION

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FORGED CONNECTIONS FOR PRESSURE VESSELS

LONG WELD NECK CONNECTIONS_____ LWN

HEAVY BARREL CONNECTIONS_____ HB

INTERMEDIATE BARREL CONNECTIONS_____ I_1, I_2 & I_3

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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Tel: (281) 441-4088 Fax: (281) 441-8899

E-mail: sales@onewestmfg.com
www.forgedcomponents.com

10/06/2025

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OneWest Manufacturing Partners

Federal Flange | FCI Forged Components | Westbrook Manufacturing

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.

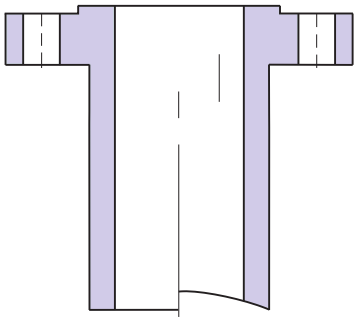
Standard connections are available in the complete range of sizes and pressure rating classes covered in ASME B16.5. Conditions of service, space factors, fabrication facility, correlation of piping, ladders and decks/ platforms, vessel internals, and other considerations determine connection configurations. 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 wth 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.

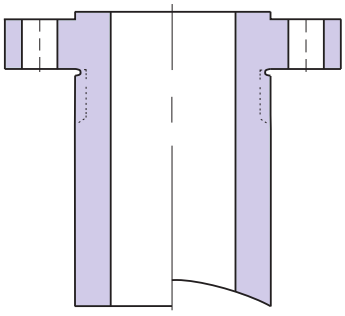
LONG WELD NECK "LWN" CONNECTIONS



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



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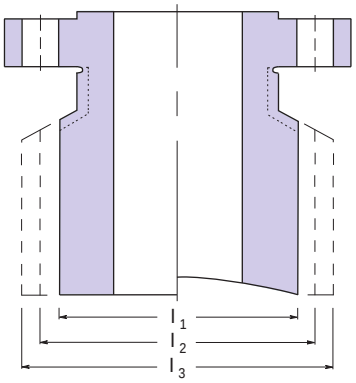
INTERMEDIATE BARREL "I" CONNECTIONS

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.

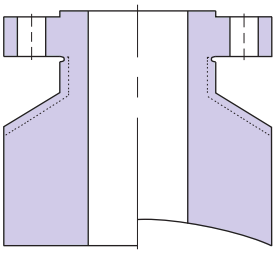
INTERMEDIATE BARREL "I" CONNECTIONS



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.

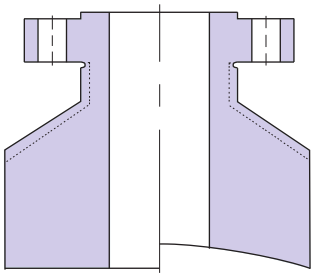
EQUAL BARREL "E" CONNECTIONS



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



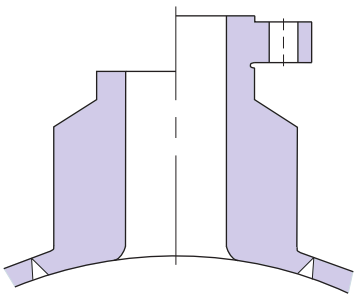
INSERT LIPS

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



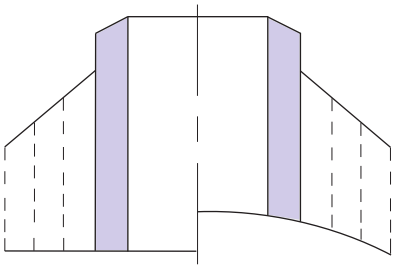
BUTT WELD STUB END CONNECTIONS

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.

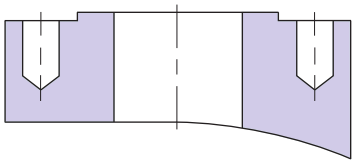
BUTT WELD STUB END CONNECTIONS



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.

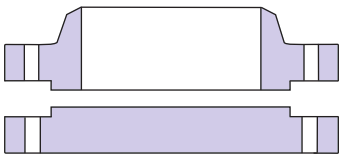
STUDDING OUTLETS



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.

LARGE DIAMETER FLANGES



class 150 FCI STANDARD CONNECTIONS

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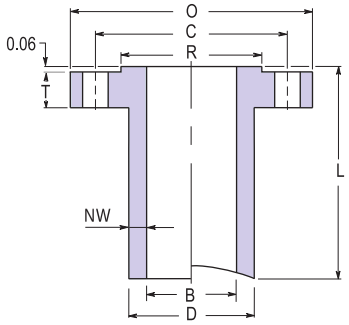
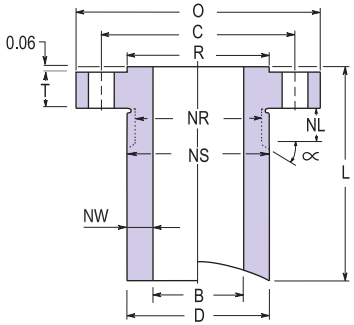
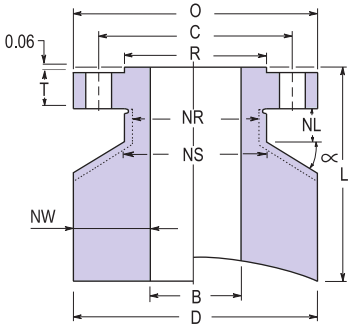


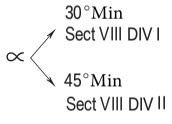
LONG WELD NECK "LWN"



HEAVY BARREL "HB"



EQUAL BARREL "E"



CROSS REFERENCE CHART

Connection Description		FCI	Other Designations	
Long Weld Neck		LWN	LWN	LWN
Heavy Barrel		HB	H	HB
Intermediate Barrel	- light	I_1	*	V_1
	- medium	I_2	*	V_2
	- heavy	I_3	*	V_3
Equal Barrel		E	S	F
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	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			C	NS	NR	NL				Base	Per 1"	Base	Per 1"	Base	Per 1"	L
1/2	0.50	0.55	3.50	0.38	1.38	1.19	1.50	3.50	0.35	0.48	1.50	4	5/8	2.38	1.50	1.19	0.75	1/2	2.25	---	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	0.57	1.57	4	5/8	2.75	1.88	1.50	0.75	1/2	2.50	---	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	0.65	1.63	4	5/8	3.12	2.25	1.94	0.75	1/2	2.50	3.00	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	0.67	1.69	4	5/8	3.50	2.62	2.31	0.75	1/2	2.75	3.25	9	0.8	12	1.2	36	4.4	9
1 1/2	1.50	1.50	5.00	0.62	2.88	2.56	3.00	5.00	0.53	0.75	1.75	4	5/8	3.88	3.00	2.56	0.75	1/2	2.75	3.25	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	0.88	2.00	4	3/4	4.75	3.69	3.06	0.88	5/8	3.25	3.75	15	1.2	23	2.2	57	7.1	9
2 1/2	2.50	2.32	7.00	0.81	4.12	3.56	4.44	7.00	0.53	1.06	2.25	4	3/4	5.50	4.44	3.56	0.88	5/8	3.50	4.00	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	1.02	2.25	4	3/4	6.00	4.94	4.25	0.88	5/8	3.50	4.00	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	1.29	2.50	8	3/4	7.00	5.94	4.81	0.88	5/8	3.50	4.00	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	1.31	2.50	8	3/4	7.50	6.44	5.31	0.88	5/8	3.50	4.00	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	1.22	2.50	8	7/8	8.50	7.25	6.44	1.00	3/4	3.75	4.25	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	1.25	2.50	8	7/8	9.50	8.25	7.56	1.00	3/4	4.00	4.50	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	1.44	2.75	8	7/8	11.75	10.50	9.69	1.00	3/4	4.25	4.75	99	6.6	157	11	292	26	12
10	10.00	9.56	16.00	1.12	12.75	12.00	12.81	16.00	1.00	1.63	3.00	12	1	14.25	12.81	12.00	1.12	7/8	4.50	5.00	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	2.09	3.50	12	1	17.00	15.56	14.38	1.12	7/8	4.75	5.25	205	14	329	25	535	48	12
14	14.00	14.00	21.00	1.31	16.25	15.75	17.12	21.00	0.88	1.56	3.50	12	1 1/8	18.75	17.12	15.75	1.25	1	5.25	5.75	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	1.81	3.75	16	1 1/8	21.25	19.62	18.00	1.25	1	5.25	5.75	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	1.47	3.50	16	1 1/4	22.75	20.94	19.88	1.38	1 1/8	5.75	6.25	258	16	362	25	711	67	12
20	20.00	20.00	27.50	1.62	23.00	22.00	23.19	27.50	1.00	1.60	3.75	20	1 1/4	25.00	23.19	22.00	1.38	1 1/8	6.25	6.75	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	1.63	3.75	20	1 3/8	27.25	25.25	24.00	1.50	1 1/4	6.75	7.25	346	20	485	34	903	86	12
24	24.00	24.00	32.00	1.81	27.25	26.12	27.50	32.00	1.06	1.75	4.00	20	1 3/8	29.50	27.50	26.12	1.50	1 1/4	6.75	7.25	407	24	574	40	1046	100	12

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, tf. 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.

class 150 FCI INTERMEDIATE CONNECTIONS

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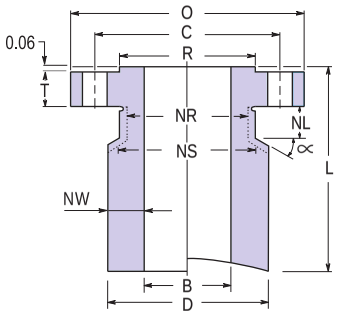
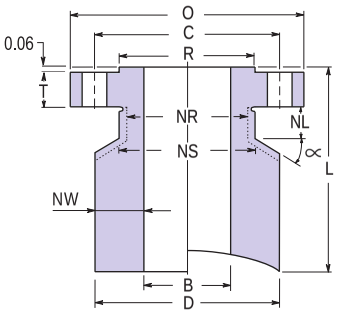
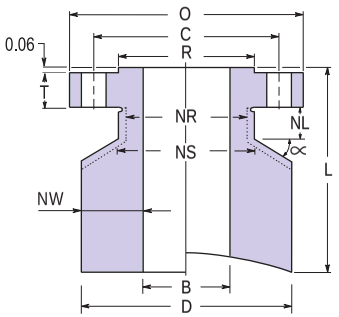


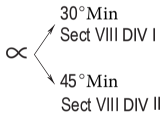
INTERMEDIATE BARREL "l 1"



INTERMEDIATE BARREL "l 2"



INTERMEDIATE BARREL "l 3"



Custom barrel connections and other forged products available upon request

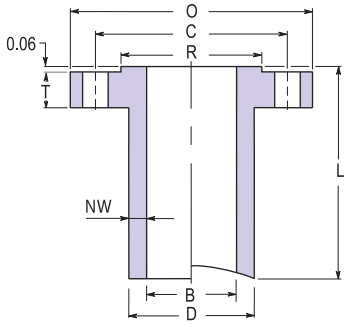
Size		Flange			Barrel OD			Wall Thickness			Bolting			Nut			Stud Bolt			Weights						Length
Nom	Bore	OD	Thk	RF OD	l 1	l 2	l 3	l 1	l 2	l 3	No Of Holes	Hole Size	Bolt Circle	Stop Dia	Relief Dia	Relief Length	Size	RF Length	RTJ Length	l 1		l 2		l 3		Base
	B	O	T	R	D	D	D	NW	NW	NW			C	NS	NR	NL				Base	Per 1"	Base	Per 1"	Base	Per 1"	L
1	0.96	4.25	0.50	2.00	2.75	3.25	4.00	0.90	1.15	1.52	4	5/8	3.12	2.25	1.94	0.75	1/2	2.50	3.00	19	1.5	26	2.2	38	3.4	12
1 1/2	1.50	5.00	0.62	2.88	3.25	4.00	4.62	0.88	1.25	1.56	4	5/8	3.88	3.00	2.56	0.75	1/2	2.75	3.25	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	3/4	4.75	3.69	3.06	0.88	5/8	3.25	3.75	35	2.7	48	3.9	67	5.9	12
2 1/2	2.32	7.00	0.81	4.12	4.62	5.75	6.00	1.15	1.72	1.84	4	3/4	5.50	4.44	3.56	0.88	5/8	3.50	4.00	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	3/4	6.00	4.94	4.25	0.88	5/8	3.50	4.00	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	3/4	7.00	5.94	4.81	0.88	5/8	3.50	4.00	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	3/4	7.50	6.44	5.31	0.88	5/8	3.50	4.00	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	2.03	8	7/8	8.50	7.25	6.44	1.00	3/4	3.75	4.25	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	7/8	9.50	8.25	7.56	1.00	3/4	4.00	4.50	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	7/8	11.75	10.50	9.69	1.00	3/4	4.25	4.75	180	14	205	17	236	20	12
10	9.56	16.00	1.12	12.75	13.50	14.25	15.12	1.97	2.35	2.78	12	1	14.25	12.81	12.00	1.12	7/8	4.50	5.00	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	17.00	15.56	14.38	1.12	7/8	4.75	5.25	494	30	606	38	696	45	16
14	14.00	21.00	1.31	16.25	18.25	19.38	20.12	2.13	2.69	3.06	12	1 1/8	18.75	17.12	15.75	1.25	1	5.25	5.75	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 1/8	21.25	19.62	18.00	1.25	1	5.25	5.75	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 1/4	22.75	20.94	19.88	1.38	1 1/8	5.75	6.25	624	38	751	48	864	57	16
20	20.00	27.50	1.62	23.00	24.12	25.00	26.25	2.06	2.50	3.13	20	1 1/4	25.00	23.19	22.00	1.38	1 1/8	6.25	6.75	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 3/8	27.25	25.25	24.00	1.50	1 1/4	6.75	7.25	802	48	985	63	1078	72	16
24	24.00	32.00	1.81	27.25	27.75	29.25	30.75	1.88	2.63	3.38	20	1 3/8	29.50	27.50	26.12	1.50	1 1/4	6.75	7.25	772	43	1007	62	1246	82	16

NOTES:

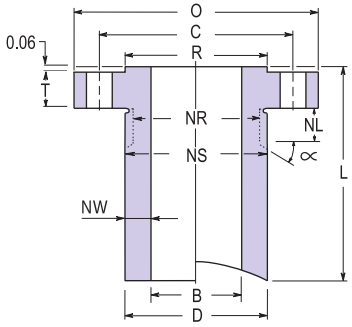
1. **MATERIAL:** SA 105 in accordance with ASME Section II. Other material grades and compositions available upon request. See Technical section.
2. **FACING:** Classes 150 and 300 flanges are regularly furnished with 1.5 mm (0.06 in.) raised face, which is in addition to the minimum flange thickness, tf. 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.

class 300 FCI STANDARD CONNECTIONS

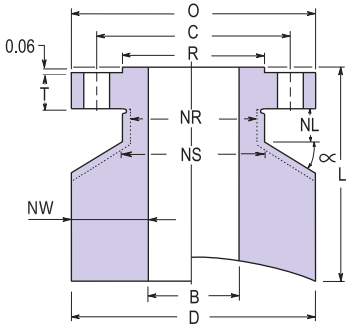
FCI Forged Components
A OneWest Company



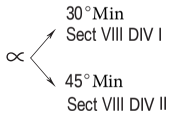
LONG WELD NECK "LWN"



HEAVY BARREL "HB"



EQUAL BARREL "E"



CROSS REFERENCE CHART

Connection Description		FCI	Other Designations	
Long Weld Neck		LWN	LWN	LWN
Heavy Barrel		HB	H	HB
Intermediate Barrel	- light	I_1	*	V_1
	- medium	I_2	*	V_2
	- heavy	I_3	*	V_3
Equal Barrel		E	S	F
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	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			C	NS	NR	NL				Base	Per 1"	Base	Per 1"	Base	Per 1"	L
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	5/8	2.62	1.75	1.50	0.75	1/2	2.50	3.00	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	0.72	1.94	4	3/4	3.25	2.19	1.88	0.88	5/8	3.00	3.50	9	0.7	11	0.9	37	4.6	9
1	1.00	0.96	4.88	0.62	2.00	2.12	2.44	4.88	0.56	0.74	1.94	4	3/4	3.50	2.44	2.12	0.88	5/8	3.00	3.50	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	3/4	3.88	2.81	2.50	0.88	5/8	3.25	3.75	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	7/8	4.50	3.25	2.75	1.00	3/4	3.50	4.00	15	1.2	21	1.9	61	7.8	9
2	2.00	1.94	6.50	0.81	3.62	3.31	3.94	6.50	0.66	1.00	2.25	8	3/4	5.00	3.94	3.31	0.88	5/8	3.50	4.00	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	7/8	5.88	4.62	3.94	1.00	3/4	4.00	4.50	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	7/8	6.62	5.38	4.62	1.00	3/4	4.25	4.75	35	2.7	49	4.6	106	13	9
3 1/2	3.50	3.36	9.00	1.12	5.50	5.25	6.00	9.00	0.88	1.32	2.75	8	7/8	7.25	6.00	5.25	1.00	3/4	4.25	5.00	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	7/8	7.88	6.62	5.75	1.00	3/4	4.50	5.00	62	3.8	91	6.5	207	19	12
5	5.00	4.81	11.00	1.31	7.31	7.00	8.00	11.00	1.00	1.60	3.00	8	7/8	9.25	8.00	7.00	1.00	3/4	4.75	5.25	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	7/8	10.62	9.38	8.12	1.00	3/4	4.75	5.50	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	13.00	11.56	10.25	1.12	7/8	5.50	6.00	148	9.1	228	17	405	36	12
10	10.00	9.56	17.50	1.81	12.75	12.62	13.62	17.50	1.31	2.03	3.75	16	1 1/8	15.25	13.62	12.62	1.25	1	6.25	6.75	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 1/4	17.75	15.94	14.75	1.38	1 1/8	6.75	7.25	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 1/4	20.25	18.44	16.75	1.38	1 1/8	7.00	7.50	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 3/8	22.50	20.50	19.00	1.50	1 1/4	7.50	8.00	404	23	529	37	914	88	12
18	18.00	18.00	28.00	2.31	21.00	21.00	22.75	28.00	1.50	2.38	5.00	24	1 3/8	24.75	22.75	21.00	1.50	1 1/4	7.75	8.25	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 3/8	27.00	25.00	23.12	1.50	1 1/4	8.00	8.75	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 5/8	29.25	26.88	25.25	1.75	1 1/2	9.00	10.00	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 5/8	32.00	29.62	27.62	1.75	1 1/2	9.00	10.00	778	42	1016	67	1627	160	12

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, tf. 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.

class 300 FCI INTERMEDIATE CONNECTIONS

FCI Forged Components
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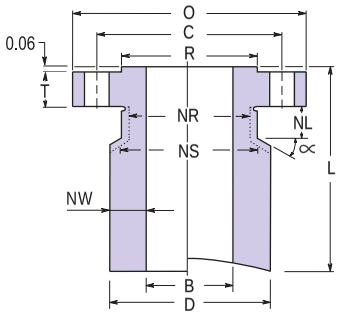
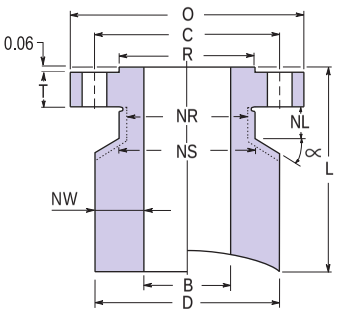
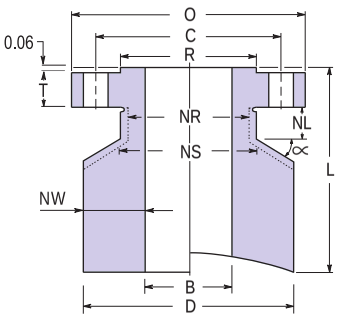


INTERMEDIATE BARREL "l_1"



INTERMEDIATE BARREL "l_2"



INTERMEDIATE BARREL "l_3"

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

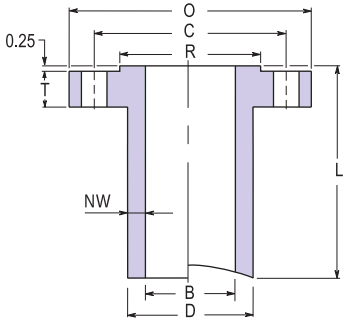
Size		Flange			Barrel OD			Wall Thickness			Bolting			Nut			Stud Bolt			Weights						Length
Nom	Bore	OD	Thk	RF OD	l_1	l_2	l_3	l_1	l_2	l_3	No Of Holes	Hole Size	Bolt Circle	Stop Dia	Relief Dia	Relief Length	Size	RF Length	RTJ Length	l_1		l_2		l_3		Base
	B	O	T	R	D	D	D	NW	NW	NW			C	NS	NR	NL				Base	Per 1"	Base	Per 1"	Base	Per 1"	L
1	0.96	4.88	0.62	2.00	2.75	3.75	4.00	0.90	1.40	1.52	4	3/4	3.50	2.44	2.12	0.88	5/8	3.00	3.50	20	1.5	34	2.9	39	3.4	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	7/8	4.50	3.25	2.75	1.00	3/4	3.50	4.00	39	3.1	51	4.3	70	6.2	12
2	1.94	6.50	0.81	3.62	4.62	5.50	6.00	1.34	1.78	2.03	8	3/4	5.00	3.94	3.31	0.88	5/8	3.50	4.00	49	3.9	69	5.9	81	7.2	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	7/8	5.88	4.62	3.94	1.00	3/4	4.00	4.50	72	6.2	80	6.8	90	7.8	12
3	2.90	8.25	1.06	5.00	6.00	6.38	7.00	1.55	1.74	2.05	8	7/8	6.62	5.38	4.62	1.00	3/4	4.25	4.75	78	6.1	88	7.2	106	9	12
3 1/2	3.36	9.00	1.12	5.50	7.00	7.75	8.25	1.82	2.20	2.45	8	7/8	7.25	6.00	5.25	1.00	3/4	4.25	5.00	104	8.4	127	11	144	13	12
4	3.83	10.00	1.19	6.19	7.00	7.75	8.88	1.59	1.96	2.53	8	7/8	7.88	6.62	5.75	1.00	3/4	4.50	5.00	102	7.6	125	10	164	14	12
5	4.81	11.00	1.31	7.31	8.25	8.88	9.88	1.72	2.03	2.54	8	7/8	9.25	8.00	7.00	1.00	3/4	4.75	5.25	133	10	155	12	194	17	12
6	5.76	12.50	1.38	8.50	9.88	10.38	11.00	2.06	2.31	2.62	12	7/8	10.62	9.38	8.12	1.00	3/4	4.75	5.50	185	14	206	17	233	20	12
8	7.62	15.00	1.56	10.62	12.12	13.50	14.25	2.25	2.94	3.32	12	1	13.00	11.56	10.25	1.12	7/8	5.50	6.00	255	20	324	28	364	32	12
10	9.56	17.50	1.81	12.75	14.25	15.12	16.25	2.35	2.78	3.35	16	1 1/8	15.25	13.62	12.62	1.25	1	6.25	6.75	425	25	498	31	591	38	16
12	11.38	20.50	1.94	15.00	16.25	17.38	18.25	2.44	3.00	3.44	16	1 1/4	17.75	15.94	14.75	1.38	1 1/8	6.75	7.25	532	30	636	38	720	45	16
14	14.00	23.00	2.06	16.25	19.38	20.12	22.25	2.69	3.06	4.13	20	1 1/4	20.25	18.44	16.75	1.38	1 1/8	7.00	7.50	681	40	761	47	996	67	16
16	16.00	25.50	2.19	18.50	22.25	23.25	24.12	3.13	3.63	4.06	20	1 3/8	22.50	20.50	19.00	1.50	1 1/4	7.50	8.00	877	53	988	63	1099	73	16
18	18.00	28.00	2.31	21.00	24.12	25.12	26.75	3.06	3.56	4.38	24	1 3/8	24.75	22.75	21.00	1.50	1 1/4	7.75	8.25	982	57	1102	68	1314	87	16
20	20.00	30.50	2.44	23.00	26.75	27.75	29.25	3.38	3.88	4.63	24	1 3/8	27.00	25.00	23.12	1.50	1 1/4	8.00	8.75	1176	70	1316	82	1525	101	16
22	22.00	33.00	2.56	25.25	29.25	30.25	31.50	3.63	4.13	4.75	24	1 5/8	29.25	26.88	25.25	1.75	1 1/2	9.00	10.00	1354	83	1497	96	1677	113	16
24	24.00	36.00	2.69	27.25	30.75	32.00	33.62	3.38	4.00	4.81	24	1 5/8	32.00	29.62	27.62	1.75	1 1/2	9.00	10.00	1455	82	1647	100	1899	123	16

NOTES:

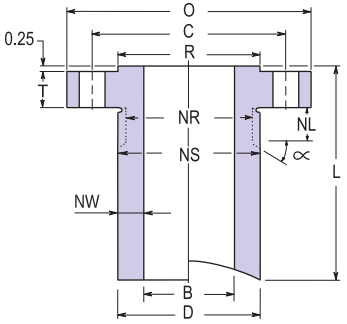
1. **MATERIAL:** SA 105 in accordance with ASME Section II. Other material grades and compositions available upon request. See Technical section.
2. **FACING:** Classes 150 and 300 flanges are regularly furnished with 1.5 mm (0.06 in.) raised face, which is in addition to the minimum flange thickness, tf. 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.

class 400 FCI STANDARD CONNECTIONS

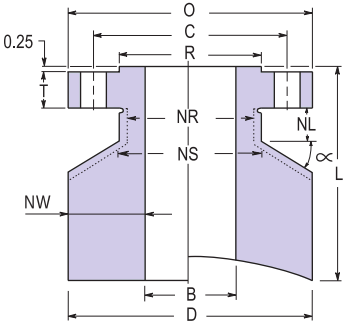
FCI Forged Components
A OneWest Company



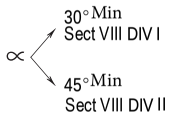
LONG WELD NECK "LWN"



HEAVY BARREL "HB"



EQUAL BARREL "E"



CROSS REFERENCE CHART

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

**Denotes Custom Order*

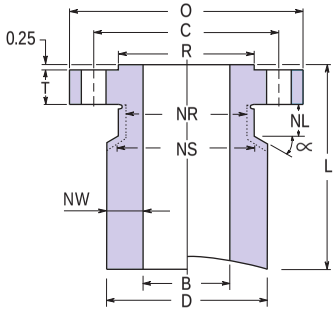
Size			Flange			Barrel OD			Wall Thickness			Bolting			Nut			Stud Bolt			Weights						Length
Nom	Bore LWN & E	Bore HB	OD	Thk	RF OD	LWN	HB	E	LWN	HB	E	No Of Holes	Hole Size	Bolt Circle	Stop Dia	Relief Dia	Relief Length	Size	RF Length	RTJ Length	LWN		HB		E		Base
	B	B	O	T	R	D	D	D	NW	NW	NW			C	NS	NR	NL				Base	Per 1"	Base	Per 1"	Base	Per 1"	L
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	5/8	2.62	1.75	1.50	0.75	1/2	3.00	3.00	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	3/4	3.25	2.19	1.88	0.88	5/8	3.50	3.50	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	0.56	0.74	1.94	4	3/4	3.50	2.44	2.12	0.88	5/8	3.50	3.50	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	0.63	0.77	2.00	4	3/4	3.88	2.81	2.50	0.88	5/8	3.75	3.75	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	0.63	0.88	2.31	4	7/8	4.50	3.25	2.75	1.00	3/4	4.25	4.25	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	0.66	1.00	2.25	8	3/4	5.00	3.94	3.31	0.88	5/8	4.25	4.25	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	1.15	2.50	8	7/8	5.88	4.62	3.94	1.00	3/4	4.75	4.75	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	1.24	2.63	8	7/8	6.62	5.38	4.62	1.00	3/4	5.00	5.00	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	7.25	5.81	5.25	1.12	7/8	5.50	5.50	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	3.00	8	1	7.88	6.44	5.75	1.12	7/8	5.50	5.50	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	3.00	8	1	9.25	7.81	7.00	1.12	7/8	5.75	5.75	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	3.25	12	1	10.62	9.19	8.12	1.12	7/8	6.00	6.00	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	3.50	12	1 1/8	13.00	11.38	10.25	1.25	1	6.75	6.75	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	3.75	16	1 1/4	15.25	13.44	12.62	1.38	1 1/8	7.50	7.50	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	4.25	16	1 3/8	17.75	15.75	14.75	1.50	1 1/4	8.00	8.00	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	4.50	20	1 3/8	20.25	18.25	16.75	1.50	1 1/4	8.25	8.25	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	4.75	20	1 1/2	22.50	20.31	19.00	1.62	1 3/8	8.75	8.75	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	5.00	24	1 1/2	24.75	22.56	21.00	1.62	1 3/8	9.00	9.00	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	5.25	24	1 5/8	27.00	24.63	23.12	1.75	1 1/2	9.50	9.75	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	5.50	24	1 3/4	29.25	26.69	25.25	1.88	1 5/8	10.00	10.25	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	6.00	24	1 7/8	32.00	29.25	27.62	2.00	1 3/4	10.50	11.00	804	42	1040	67	1540	160	12

NOTES:

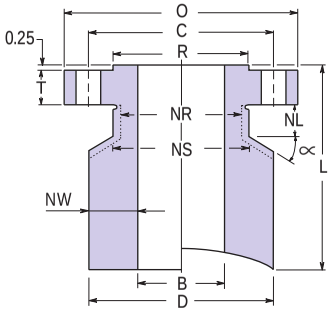
1. **MATERIAL:** SA 105 in accordance with ASME Section II. Other material grades and compositions available upon request. See Technical section.
2. **FACING:** Classes 150 and 300 flanges are regularly furnished with 1.5 mm (0.06 in.) raised face, which is in addition to the minimum flange thickness, tf. 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.

class 400 FCI INTERMEDIATE CONNECTIONS

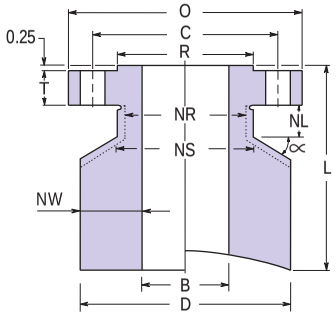
FCI Forged Components
A OneWest Company



INTERMEDIATE BARREL "I 1"



INTERMEDIATE BARREL "I 2"



INTERMEDIATE BARREL "I 3"

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

Custom barrel connections and other forged products available upon request

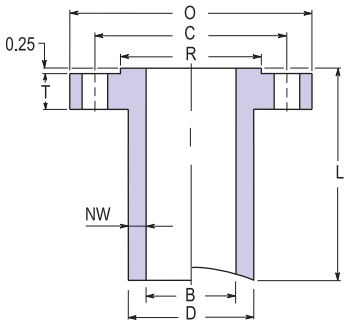
Size		Flange			Barrel OD			Wall Thickness			Bolting			Nut			Stud Bolt			Weights						Length
Nom	Bore	OD	Thk	RF OD	I 1	I 2	I 3	I 1	I 2	I 3	No Of Holes	Hole Size	Bolt Circle	Stop Dia	Relief Dia	Relief Length	Size	RF Length	RTJ Length	I 1		I 2		I 3		Base
	B	O	T	R	D	D		NW	NW	NW			C	NS	NR	NL				Base	Per 1"	Base	Per 1"	Base	Per 1"	
1	0.96	4.88	0.69	2.00	2.75	3.25	4.00	0.90	1.15	1.52	4	3/4	3.50	2.44	2.12	0.88	5/8	3.50	3.50	20	1.5	27	2.2	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	7/8	4.50	3.25	2.75	1.00	3/4	4.25	4.25	39	3.1	51	4.3	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	3/4	5.00	3.94	3.31	0.88	5/8	4.25	4.25	49	3.9	69	5.9	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	7/8	5.88	4.62	3.94	1.00	3/4	4.75	4.75	73	6.2	81	6.8	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	7/8	6.62	5.38	4.62	1.00	3/4	5.00	5.00	79	6.1	89	7.2	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	7.25	5.81	5.25	1.12	7/8	5.50	5.50	106	8.4	128	11	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	7.88	6.44	5.75	1.12	7/8	5.50	5.50	104	7.6	126	10	165	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	9.25	7.81	7.00	1.12	7/8	5.75	5.75	135	10	157	12	195	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	10.62	9.19	8.12	1.12	7/8	6.00	6.00	188	14	208	17	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 1/8	13.00	11.38	10.25	1.25	1	6.75	6.75	259	20	327	28	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 1/4	15.25	13.44	12.62	1.38	1 1/8	7.50	7.50	431	25	502	31	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 3/8	17.75	15.75	14.75	1.50	1 1/4	8.00	8.00	539	30	641	38	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 3/8	20.25	18.25	16.75	1.50	1 1/4	8.25	8.25	690	40	768	47	974	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 1/2	22.50	20.31	19.00	1.62	1 3/8	8.75	8.75	887	53	980	63	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 1/2	24.75	22.56	21.00	1.62	1 3/8	9.00	9.00	982	57	1102	68	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 5/8	27.00	24.63	23.12	1.75	1 1/2	9.50	9.75	1176	70	1283	82	1476	101	16
22	22.00	33.00	2.88	25.25	29.25	30.25	31.50	3.63	4.13	4.75	24	1 3/4	29.25	26.69	25.25	1.88	1 5/8	10.00	10.25	1340	83	1474	96	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 7/8	32.00	29.25	27.62	2.00	1 3/4	10.50	11.00	1437	82	1614	100	1844	123	16

NOTES:

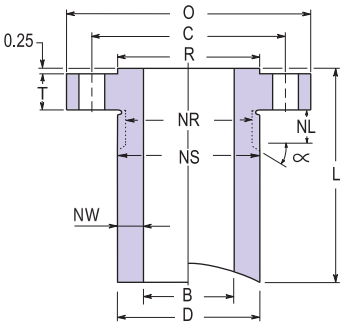
1. **MATERIAL:** SA 105 in accordance with ASME Section II. Other material grades and compositions available upon request. See Technical section.
2. **FACING:** Classes 150 and 300 flanges are regularly furnished with 1.5 mm (0.06 in.) raised face, which is in addition to the minimum flange thickness, tf. 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.

class 600 FCI STANDARD CONNECTIONS

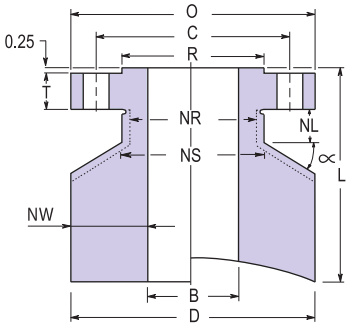
FCI Forged Components
A OneWest Company



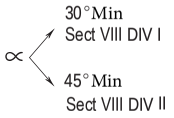
LONG WELD NECK "LWN"



HEAVY BARREL "HB"



EQUAL BARREL "E"



CROSS REFERENCE CHART

Connection Description		FCI	Other Designations	
Long Weld Neck		LWN	LWN	LWN
Heavy Barrel		HB	H	HB
Intermediate Barrel	- light	I_1	*	V_1
	- medium	I_2	*	V_2
	- heavy	I_3	*	V_3
Equal Barrel		E	S	F
Super Barrel		SB*	Super S*	*
Insert Lip		Q*	M*	Q*

*Denotes Custom Order

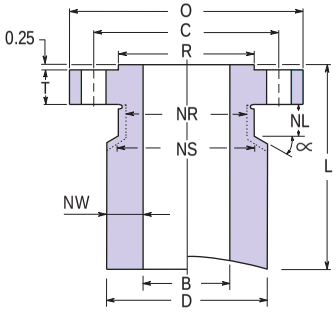
Size			Flange			Barrel OD			Wall Thickness			Bolting			Nut			Stud Bolt			Weights						Length
Nom	Bore LWN & E	Bore HB	OD	Thk	RF OD	LWN	HB	E	LWN	HB	E	No Of Holes	Hole Size	Bolt Circle	Stop Dia	Relief Dia	Relief Length	Size	RF Length	RTJ Length	LWN		HB		E		Base
	B	B	O	T	R	D	D	D	NW	NW	NW			C	NS	NR	NL				Base	Per 1"	Base	Per 1"	Base	Per 1"	L
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	5/8	2.62	1.75	1.50	0.75	1/2	3.00	3.00	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	3/4	3.25	2.19	1.88	0.88	5/8	3.50	3.50	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	3/4	3.50	2.44	2.12	0.88	5/8	3.50	3.50	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	3/4	3.88	2.81	2.50	0.88	5/8	3.75	3.75	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	7/8	4.50	3.25	2.75	1.00	3/4	4.25	4.25	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	3/4	5.00	3.94	3.31	0.88	5/8	4.25	4.25	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	7/8	5.88	4.63	3.94	1.00	3/4	4.75	4.75	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	7/8	6.62	5.38	4.62	1.00	3/4	5.00	5.00	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	7.25	5.81	5.25	1.12	7/8	5.50	5.50	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	8.50	7.06	6.00	1.12	7/8	5.75	5.75	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 1/8	10.50	8.88	7.44	1.25	1	6.50	6.50	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 1/8	11.50	9.88	8.75	1.25	1	6.75	6.75	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 1/4	13.75	11.94	10.75	1.38	1 1/8	7.50	7.75	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 3/8	17.00	15.00	13.50	1.50	1 1/4	8.50	8.50	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 3/8	19.25	17.25	15.75	1.50	1 1/4	8.75	8.75	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 1/2	20.75	18.56	17.00	1.62	1 3/8	9.25	9.25	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 5/8	23.75	21.38	19.50	1.75	1 1/2	10.00	10.00	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 3/4	25.75	23.19	21.50	1.88	1 5/8	10.75	10.75	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 3/4	28.50	25.94	24.00	1.88	1 5/8	11.25	11.50	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 7/8	30.62	27.88	26.25	2.00	1 3/4	12.00	12.25	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	2	33.00	30.06	28.25	2.12	1 7/8	13.00	13.25	1210	49	1486	73	2376	176	16

NOTES:

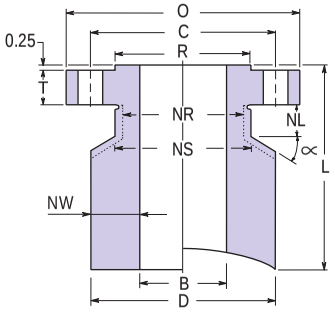
1. **MATERIAL:** SA 105 in accordance with ASME Section II. Other material grades and compositions available upon request. See Technical section.
2. **FACING:** Classes 150 and 300 flanges are regularly furnished with 1.5 mm (0.06 in.) raised face, which is in addition to the minimum flange thickness, tf. 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.

class 600 FCI INTERMEDIATE CONNECTIONS

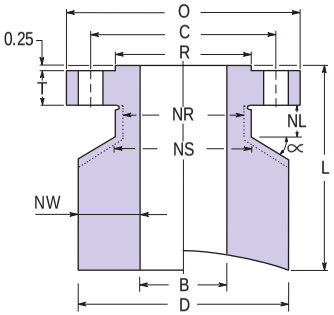
FCI Forged Components
A OneWest Company



INTERMEDIATE BARREL "I 1"



INTERMEDIATE BARREL "I 2"



INTERMEDIATE BARREL "I 3"

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

Custom barrel connections and other forged products available upon request

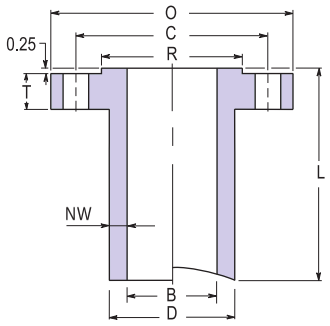
Size		Flange			Barrel OD			Wall Thickness			Bolting			Nut			Stud Bolt			Weights						Length
Nom	Bore	OD	Thk	RF OD	I 1	I 2	I 3	I 1	I 2	I 3	No Of Holes	Hole Size	Bolt Circle	Stop Dia	Relief Dia	Relief Length	Size	RF Length	RTJ Length	I 1		I 2		I 3		Base
	B	O	T	R	D	D	D	NW	NW	NW			C	NS	NR	NL				Base	Per 1"	Base	Per 1"	Base	Per 1"	L
1	0.96	4.88	0.69	2.00	3.25	4.00	4.62	1.15	1.52	1.84	4	3/4	3.50	2.44	2.12	0.88	5/8	3.50	3.50	26	2.2	38	3.4	50	4.6	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	7/8	4.50	3.25	2.75	1.00	3/4	4.25	4.25	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	3/4	5.00	3.94	3.31	0.88	5/8	4.25	4.25	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	7/8	5.88	4.63	3.94	1.00	3/4	4.75	4.75	83	6.2	98	7.9	105	9.7	12
3	2.90	8.25	1.25	5.00	6.38	7.00	7.75	1.74	2.05	2.43	8	7/8	6.62	5.38	4.62	1.00	3/4	5.00	5.00	88	7.2	105	9.0	127	11.5	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	7.25	5.81	5.25	1.12	7/8	5.50	5.50	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	2.52	3.02	8	1	8.50	7.06	6.00	1.12	7/8	5.75	5.75	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	2.53	3.10	3.66	8	1 1/8	10.50	8.88	7.44	1.25	1	6.50	6.50	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 1/8	11.50	9.88	8.75	1.25	1	6.75	6.75	235	20	300	25	350	32	12
8	7.62	16.50	2.19	10.62	13.25	15.13	16.00	2.82	3.75	4.19	12	1 1/4	13.75	11.94	10.75	1.38	1 1/8	7.50	7.75	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 3/8	17.00	15.00	13.50	1.50	1 1/4	8.50	8.50	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 3/8	19.25	17.25	15.75	1.50	1 1/4	8.75	8.75	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 1/2	20.75	18.56	17.00	1.62	1 3/8	9.25	9.25	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 5/8	23.75	21.38	19.50	1.75	1 1/2	10.00	10.00	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 3/4	25.75	23.19	21.50	1.88	1 5/8	10.75	10.75	1044	57	1283	81	1456	99	16
20	20.00	32.00	3.50	23.00	27.75	29.25	30.75	3.88	4.63	5.38	24	1 3/4	28.50	25.94	24.00	1.88	1 5/8	11.25	11.50	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 7/8	30.62	27.88	26.25	2.00	1 3/4	12.00	12.25	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	33.00	30.06	28.25	2.12	1 7/8	13.00	13.25	1574	82	1736	100	1946	123	16

NOTES:

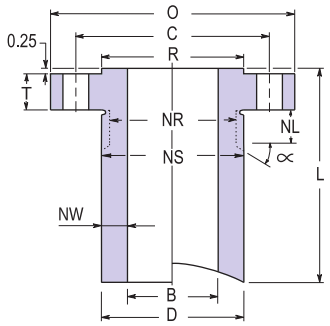
1. **MATERIAL:** SA 105 in accordance with ASME Section II. Other material grades and compositions available upon request. See Technical section.
2. **FACING:** Classes 150 and 300 flanges are regularly furnished with 1.5 mm (0.06 in.) raised face, which is in addition to the minimum flange thickness, tf. 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.

class 900 FCI STANDARD CONNECTIONS

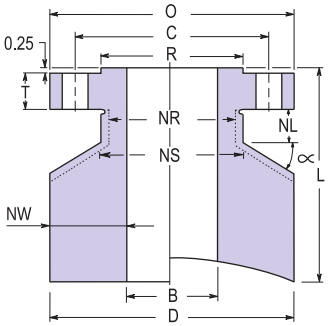
FCI Forged Components
A OneWest Company



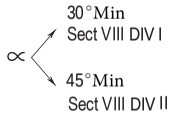
LONG WELD NECK "LWN"



HEAVY BARREL "HB"



EQUAL BARREL "E"



CROSS REFERENCE CHART

Connection Description		FCI	Other Designations	
Long Weld Neck		LWN	LWN	LWN
Heavy Barrel		HB	H	HB
Intermediate Barrel	- light	I_1	*	V_1
	- medium	I_2	*	V_2
	- heavy	I_3	*	V_3
Equal Barrel		E	S	F
Super Barrel		SB*	Super S*	*
Insert Lip		Q*	M*	Q*

*Denotes Custom Order

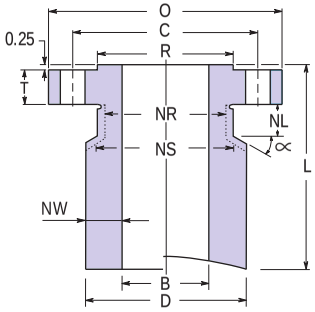
Size			Flange			Barrel OD			Wall Thickness			Bolting			Nut			Stud Bolt			Weights						Length
Nom	Bore LWN & E	Bore HB	OD	Thk	RF OD	LWN	HB	E	LWN	HB	E	No Of Holes	Hole Size	Bolt Circle	Stop Dia	Relief Dia	Relief Length	Size	RF Length	RTJ Length	LWN		HB		E		Base
	B	B	O	T	R	D	D	D	NW	NW	NW			C	NS	NR	NL				Base	Per 1"	Base	Per 1"	Base	Per 1"	L
1/2	0.50	0.55	4.75	0.88	1.38	1.50	2.00	4.75	0.50	0.73	2.13	4	7/8	3.25	2.00	1.50	1.00	3/4	4.25	4.25	8	0.5	10	0.8	37	5.0	9
3/4	0.75	0.74	5.12	1.00	1.69	1.75	2.25	5.12	0.50	0.76	2.19	4	7/8	3.50	2.25	1.75	1.00	3/4	4.50	4.50	10	0.6	13	1.0	42	5.7	9
1	1.00	0.96	5.88	1.12	2.00	2.06	2.56	5.88	0.53	0.80	2.44	4	1	4.00	2.56	2.06	1.12	7/8	5.00	5.00	13	0.8	17	1.3	54	7.5	9
1 1/4	1.25	1.28	6.25	1.12	2.50	2.50	2.94	6.25	0.63	0.83	2.50	4	1	4.38	2.94	2.50	1.12	7/8	5.00	5.00	17	1.0	20	1.6	61	8.3	9
1 1/2	1.50	1.50	7.00	1.25	2.88	2.75	3.25	7.00	0.63	0.88	2.75	4	1 1/8	4.88	3.25	2.75	1.25	1	5.50	5.50	21	1.2	26	1.9	77	10	9
2	2.00	1.94	8.50	1.50	3.62	4.12	5.06	8.50	1.06	1.56	3.25	8	1	6.50	5.06	4.12	1.12	7/8	5.75	5.75	42	2.9	56	4.9	115	15	9
2 1/2	2.50	2.32	9.62	1.62	4.12	4.88	5.88	9.62	1.19	1.78	3.56	8	1 1/8	7.50	5.88	4.88	1.25	1	6.25	6.25	56	3.9	75	6.5	144	19	9
3	3.00	2.90	9.50	1.50	5.00	5.00	6.06	9.50	1.00	1.58	3.25	8	1	7.50	6.06	5.00	1.12	7/8	5.75	5.75	51	3.6	71	6.3	139	18	9
4	4.00	3.83	11.50	1.75	6.19	6.25	7.44	11.50	1.13	1.80	3.75	8	1 1/4	9.25	7.44	6.25	1.38	1 1/8	6.75	6.75	93	5.1	133	9.1	270	26	12
5	5.00	4.81	13.75	2.00	7.31	7.50	9.00	13.75	1.25	2.10	4.38	8	1 3/8	11.00	9.00	7.50	1.50	1 1/4	7.50	7.50	135	7	194	13	376	37	12
6	6.00	5.76	15.00	2.19	8.50	9.25	10.69	15.00	1.63	2.46	4.50	12	1 1/4	12.50	10.69	9.25	1.38	1 1/8	7.50	7.75	191	11	259	18	436	42	12
8	8.00	7.62	18.50	2.50	10.62	11.75	13.31	18.50	1.88	2.85	5.25	12	1 1/2	15.50	13.31	11.75	1.62	1 3/8	8.75	8.75	297	16	389	27	626	62	12
10	10.00	9.56	21.50	2.75	12.75	14.50	16.31	21.50	2.25	3.38	5.75	16	1 1/2	18.50	16.31	14.50	1.62	1 3/8	9.25	9.25	422	25	558	39	824	81	12
12	12.00	11.38	24.00	3.12	15.00	16.50	18.81	24.00	2.25	3.72	6.00	20	1 1/2	21.00	18.81	16.50	1.62	1 3/8	10.00	10.00	518	29	715	50	984	96	12
14	14.00	14.00	25.25	3.38	16.25	17.75	19.62	25.25	1.88	2.81	5.63	20	1 5/8	22.00	19.62	17.75	1.75	1 1/2	10.75	11.00	624	26	817	42	1368	98	16
16	16.00	16.00	27.75	3.50	18.50	20.00	21.69	27.75	2.00	2.84	5.88	20	1 3/4	24.25	21.69	20.00	1.88	1 5/8	11.25	11.50	750	32	942	48	1573	114	16
18	18.00	18.00	31.00	4.00	21.00	22.25	24.06	31.00	2.13	3.03	6.50	20	2	27.00	24.06	22.25	2.12	1 7/8	12.75	13.25	950	38	1169	57	1898	142	16
20	20.00	20.00	33.75	4.25	23.00	24.50	26.38	33.75	2.25	3.19	6.88	20	2 1/8	29.50	26.38	24.50	2.25	2	13.75	14.25	1121	43	1378	66	2182	164	16
24	24.00	24.00	41.00	5.50	27.25	29.50	31.62	41.00	2.75	3.81	8.50	20	2 5/8	35.50	31.62	29.50	2.75	2 1/2	17.25	18.00	1865	65	2160	94	3084	246	16

NOTES:

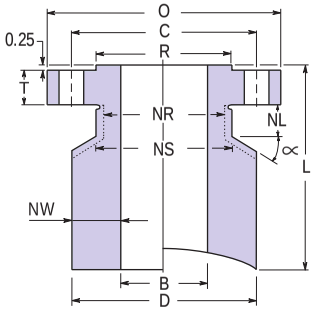
1. **MATERIAL:** SA 105 in accordance with ASME Section II. Other material grades and compositions available upon request. See Technical section.
2. **FACING:** Classes 150 and 300 flanges are regularly furnished with 1.5 mm (0.06 in.) raised face, which is in addition to the minimum flange thickness, tf. 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.

class 900 FCI INTERMEDIATE CONNECTIONS

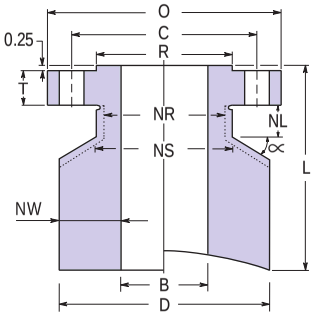
FCI Forged Components
A OneWest Company



INTERMEDIATE BARREL "I 1"



INTERMEDIATE BARREL "I 2"



INTERMEDIATE BARREL "I 3"

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

Custom barrel connections and other forged products available upon request

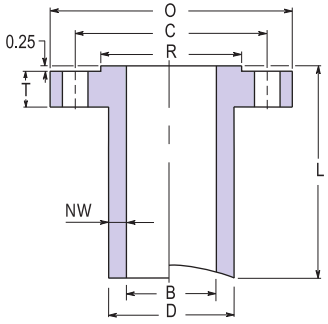
Size		Flange			Barrel OD			Wall Thickness			Bolting			Nut			Stud Bolt			Weights						Length
Nom	Bore	OD	Thk	RF OD	I 1	I 2	I 3	I 1	I 2	I 3	No Of Holes	Hole Size	Bolt Circle	Stop Dia	Relief Dia	Relief Length	Size	RF Length	RTJ Length	I 1		I 2		I 3		Base
	B	O	T	R	D	D	D	NW	NW	NW			C	NS	NR	NL				Base	Per 1"	Base	Per 1"	Base	Per 1"	L
1	0.96	5.88	1.12	2.00	3.25	4.00	4.63	1.15	1.52	1.83	4	1	4.00	2.56	2.06	1.12	7/8	5.00	5.00	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 1/8	4.88	3.25	2.75	1.25	1	5.50	5.50	43	3.1	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	6.50	5.06	4.12	1.12	7/8	5.75	5.75	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 1/8	7.50	5.88	4.88	1.25	1	6.25	6.25	107	8.0	123	10	158	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	7.50	6.06	5.00	1.12	7/8	5.75	5.75	114	9.0	136	12	151	13	12
4	3.83	11.50	1.75	6.19	8.88	9.88	10.38	2.52	3.02	3.27	8	1 1/4	9.25	7.44	6.25	1.38	1 1/8	6.75	6.75	177	14	211	18	228	21	12
5	4.81	13.75	2.00	7.31	10.38	11.00	12.12	2.78	3.10	3.66	8	1 3/8	11.00	9.00	7.50	1.50	1 1/4	7.50	7.50	242	19	265	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 1/4	12.50	10.69	9.25	1.38	1 1/8	7.50	7.75	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 1/2	15.50	13.31	11.75	1.62	1 3/8	8.75	8.75	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 1/2	18.50	16.31	14.50	1.62	1 3/8	9.25	9.25	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 1/2	21.00	18.81	16.50	1.62	1 3/8	10.00	10.00	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 5/8	22.00	19.62	17.75	1.75	1 1/2	10.75	11.00	1068	67	1166	77	1254	86	16
16	16.00	27.75	3.50	18.50	23.25	25.00	26.50	3.63	4.50	5.25	20	1 3/4	24.25	21.69	20.00	1.88	1 5/8	11.25	11.50	1100	63	1282	82	1451	99	16
18	18.00	31.00	4.00	21.00	26.00	27.75	29.25	4.00	4.88	5.63	20	2	27.00	24.06	22.25	2.12	1 7/8	12.75	13.25	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 1/8	29.50	26.38	24.50	2.25	2	13.75	14.25	1525	82	1857	121	1994	139	16
24	24.00	41.00	5.50	27.25	33.62	35.00	36.00	4.81	5.50	6.00	20	2 5/8	35.50	31.62	29.50	2.75	2 1/2	17.25	18.00	2360	123	2515	144	2625	160	16

NOTES:

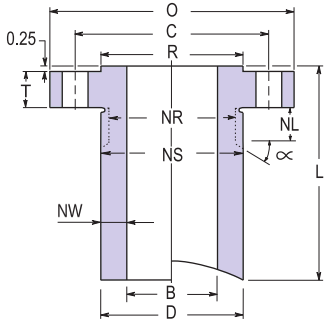
1. **MATERIAL:** SA 105 in accordance with ASME Section II. Other material grades and compositions available upon request. See Technical section.
2. **FACING:** Classes 150 and 300 flanges are regularly furnished with 1.5 mm (0.06 in.) raised face, which is in addition to the minimum flange thickness, tf. 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.

class 1500 FCI STANDARD CONNECTIONS

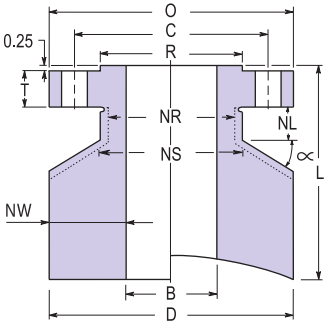
FCI Forged Components
A OneWest Company



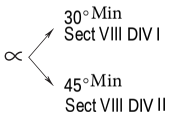
LONG WELD NECK "LWN"



HEAVY BARREL "HB"



EQUAL BARREL "E"



CROSS REFERENCE CHART

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

**Denotes Custom Order*

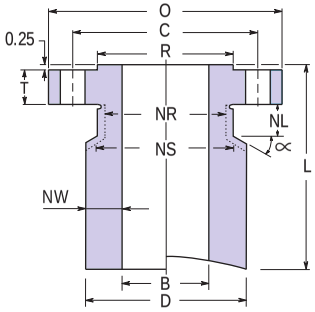
Size			Flange			Barrel OD			Wall Thickness			Bolting			Nut			Stud Bolt			Weights						Length
Nom	Bore LWN & E	Bore HB	OD	Thk	RF OD	LWN	HB	E	LWN	HB	E	No Of Holes	Hole Size	Bolt Circle	Stop Dia	Relief Dia	Relief Length	Size	RF Length	RTJ Length	LWN		HB		E		Base
	B	B	O	T	R	D	D	D	NW	NW	NW			C	NS	NR	NL				Base	Per 1"	Base	Per 1"	Base	Per 1"	L
1/2	0.50	0.55	4.75	0.88	1.38	1.50	2.00	4.75	0.50	0.73	2.13	4	7/8	3.25	2.00	1.50	1.00	3/4	4.25	4.25	8	0.5	10	0.8	37	5.0	9
3/4	0.75	0.74	5.12	1.00	1.69	1.75	2.25	5.12	0.50	0.76	2.19	4	7/8	3.50	2.25	1.75	1.00	3/4	4.50	4.50	10	0.6	13	1.0	42	5.7	9
1	1.00	0.96	5.88	1.12	2.00	2.06	2.56	5.88	0.53	0.80	2.44	4	1	4.00	2.56	2.06	1.12	7/8	5.00	5.00	13	0.8	17	1.3	54	7.5	9
1 1/4	1.25	1.28	6.25	1.12	2.50	2.50	2.94	6.25	0.63	0.83	2.50	4	1	4.38	2.94	2.50	1.12	7/8	5.00	5.00	17	1.0	20	1.6	61	8.3	9
1 1/2	1.50	1.50	7.00	1.25	2.88	2.75	3.25	7.00	0.63	0.88	2.75	4	1 1/8	4.88	3.25	2.75	1.25	1	5.50	5.50	21	1.2	26	1.9	77	10	9
2	2.00	1.94	8.50	1.50	3.62	4.12	5.06	8.50	1.06	1.56	3.25	8	1	6.50	5.06	4.12	1.12	7/8	5.75	5.75	42	2.9	56	4.9	115	15	9
2 1/2	2.50	2.32	9.62	1.62	4.12	4.88	5.88	9.62	1.19	1.78	3.56	8	1 1/8	7.50	5.88	4.88	1.25	1	6.25	6.25	56	3.9	75	6.5	144	19	9
3	3.00	2.90	10.50	1.88	5.00	5.25	6.19	10.50	1.13	1.65	3.75	8	1 1/4	8.00	6.19	5.25	1.38	1 1/8	7.00	7.00	67	4.1	84	6.7	161	23	9
4	4.00	3.83	12.25	2.12	6.19	6.38	7.50	12.25	1.19	1.84	4.13	8	1 3/8	9.50	7.50	6.38	1.50	1 1/4	7.75	7.75	110	5.5	147	9.3	302	30	12
5	5.00	4.81	14.75	2.88	7.31	7.75	9.12	14.75	1.38	2.16	4.88	8	1 5/8	11.50	9.12	7.75	1.75	1 1/2	9.75	9.75	181	7.8	233	13	414	43	12
6	6.00	5.76	15.50	3.25	8.50	9.00	10.31	15.50	1.50	2.28	4.75	12	1 1/2	12.50	10.31	9.00	1.62	1 3/8	10.25	10.50	215	10	272	16	445	46	12
8	8.00	7.62	19.00	3.62	10.62	11.50	12.94	19.00	1.75	2.66	5.50	12	1 3/4	15.50	12.94	11.50	1.88	1 5/8	11.50	11.75	337	15	417	24	629	67	12
10	10.00	9.56	23.00	4.25	12.75	14.50	16.06	23.00	2.25	3.25	6.50	12	2	19.00	16.06	14.50	2.12	1 7/8	13.25	13.50	546	25	651	37	888	97	12
12	12.00	11.38	26.50	4.88	15.00	17.75	19.38	26.50	2.88	4.00	7.25	16	2 1/8	22.50	19.38	17.75	2.25	2	14.75	15.25	946	38	1148	55	1683	127	16
14	14.00	14.00	29.50	5.25	16.25	19.50	21.50	29.50	2.75	3.75	7.75	16	2 3/8	25.00	21.50	19.50	2.50	2 1/4	16.00	16.75	1116	41	1308	59	1929	150	16
16	16.00	16.00	32.50	5.75	18.50	21.75	23.88	32.50	2.88	3.94	8.25	16	2 5/8	27.75	23.88	21.75	2.75	2 1/2	17.50	18.50	1371	48	1588	70	2238	178	16
18	18.00	18.00	36.00	6.38	21.00	23.50	26.25	36.00	2.75	4.13	9.00	16	2 7/8	30.50	26.25	23.50	3.00	2 3/4	19.50	20.75	1674	51	1959	81	2629	216	16
20	20.00	20.00	38.75	7.00	23.00	25.25	28.12	38.75	2.63	4.06	9.38	16	3 1/8	32.75	28.12	25.25	3.25	3	21.25	22.25	1943	53	2241	87	2868	245	16
24	24.00	24.00	46.00	8.00	27.25	30.00	33.62	46.00	3.00	4.81	11.00	16	3 5/8	39.00	33.62	30.00	3.75	3 1/2	24.25	25.50	2936	72	3334	123	3819	343	16

NOTES:

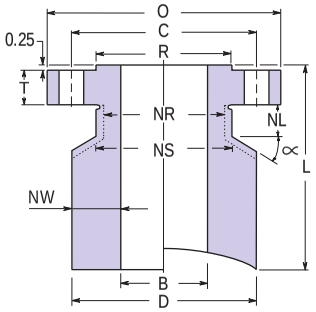
1. **MATERIAL:** SA 105 in accordance with ASME Section II. Other material grades and compositions available upon request. See Technical section.
2. **FACING:** Classes 150 and 300 flanges are regularly furnished with 1.5 mm (0.06 in.) raised face, which is in addition to the minimum flange thickness, tf. 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.

class 1500 FCI INTERMEDIATE CONNECTIONS

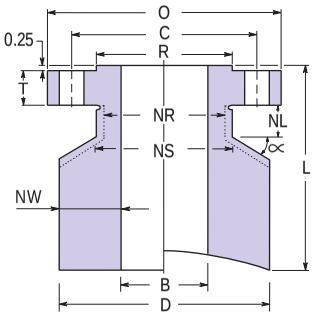
FCI Forged Components
A OneWest Company



INTERMEDIATE BARREL "I 1"



INTERMEDIATE BARREL "I 2"



INTERMEDIATE BARREL "I 3"

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

Custom barrel connections and other forged products available upon request

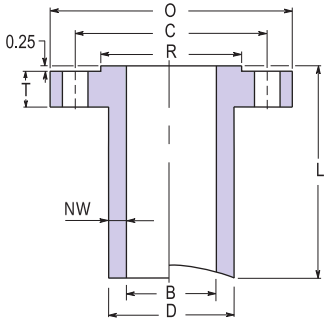
Size		Flange			Barrel OD			Wall Thickness			Bolting			Nut			Stud Bolt			Weights						Length
Nom	Bore	OD	Thk	RF OD	I 1	I 2	I 3	I 1	I 2	I 3	No Of Holes	Hole Size	Bolt Circle	Stop Dia	Relief Dia	Relief Length	Size	RF Length	RTJ Length	I 1		I 2		I 3		Base
	B	O	T	R	D	D	D	NW	NW	NW			C	NS	NR	NL				Base	Per 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	4.00	2.56	2.06	1.12	7/8	5.00	5.00	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 1/8	4.88	3.25	2.75	1.25	1	5.50	5.50	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	6.50	5.06	4.12	1.12	7/8	5.75	5.75	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 1/8	7.50	5.88	4.88	1.25	1	6.25	6.25	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 1/4	8.00	6.19	5.25	1.38	1 1/8	7.00	7.00	124	9	144	12	177	16	12
4	3.83	12.25	2.12	6.19	8.88	9.88	11.00	2.52	3.02	3.59	8	1 3/8	9.50	7.50	6.38	1.50	1 1/4	7.75	7.75	187	14	218	18	257	24	12
5	4.81	14.75	2.88	7.31	10.38	12.12	13.50	2.78	3.66	4.35	8	1 5/8	11.50	9.12	7.75	1.75	1 1/2	9.75	9.75	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 1/2	12.50	10.31	9.00	1.62	1 3/8	10.25	10.50	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 3/4	15.50	12.94	11.50	1.88	1 5/8	11.50	11.75	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	19.00	16.06	14.50	2.12	1 7/8	13.25	13.50	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 1/8	22.50	19.38	17.75	2.25	2	14.75	15.25	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 3/8	25.00	21.50	19.50	2.50	2 1/4	16.00	16.75	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 5/8	27.75	23.88	21.75	2.75	2 1/2	17.50	18.50	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 7/8	30.50	26.25	23.50	3.00	2 3/4	19.50	20.75	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 1/8	32.75	28.12	25.25	3.25	3	21.25	22.25	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 5/8	39.00	33.62	30.00	3.75	3 1/2	24.25	25.50	3470	160	3545	185	3675	237	16

NOTES:

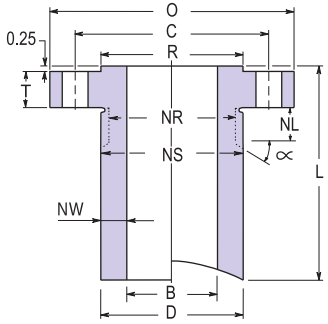
1. **MATERIAL:** SA 105 in accordance with ASME Section II. Other material grades and compositions available upon request. See Technical section.
2. **FACING:** Classes 150 and 300 flanges are regularly furnished with 1.5 mm (0.06 in.) raised face, which is in addition to the minimum flange thickness, tf. 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.

class 2500 FCI STANDARD CONNECTIONS

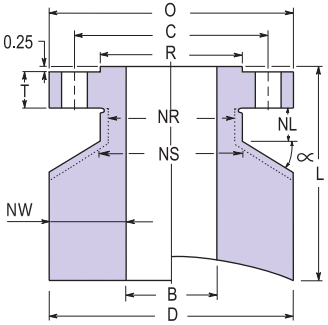
FCI Forged Components
A OneWest Company



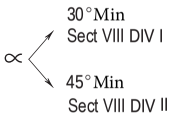
LONG WELD NECK "LWN"



HEAVY BARREL "HB"



EQUAL BARREL "E"



CROSS REFERENCE CHART

Connection Description		FCI	Other Designations	
Long Weld Neck		LWN	LWN	LWN
Heavy Barrel		HB	H	HB
Intermediate Barrel	- light	I 1	*	V 1
	- medium	I 2	*	V 2
	- heavy	I 3	*	V 3
Equal Barrel		E	S	F
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	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			C	NS	NR	NL				Base	Per 1"	Base	Per 1"	Base	Per 1"	L
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	7/8	3.50	2.25	1.69	1.00	3/4	4.75	4.75	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	7/8	3.75	2.50	2.00	1.00	3/4	5.00	5.00	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	4.25	2.81	2.25	1.12	7/8	5.50	5.50	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 1/8	5.12	3.50	2.88	1.25	1	6.00	6.00	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 1/4	5.75	3.94	3.12	1.38	1 1/8	6.75	6.75	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 1/8	6.75	5.12	3.75	1.25	1	7.00	7.00	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	4.00	8	1 1/4	7.75	5.94	4.50	1.38	1 1/8	7.75	8.00	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 3/8	9.00	7.00	5.25	1.50	1 1/4	8.75	9.00	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	2.27	5.00	8	1 5/8	10.75	8.38	6.50	1.75	1 1/2	10.00	10.25	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 7/8	12.75	10.00	8.00	2.00	1 3/4	11.75	12.25	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 1/8	14.50	11.38	9.25	2.25	2	13.50	14.00	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 1/8	17.25	14.12	12.00	2.25	2	15.00	15.50	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 5/8	21.25	17.38	14.75	2.75	2 1/2	19.25	20.00	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 7/8	24.38	20.12	17.38	3.00	2 3/4	21.25	22.00	1363	35	1609	61	1995	168	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, tf. 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.

class 2500 FCI INTERMEDIATE CONNECTIONS

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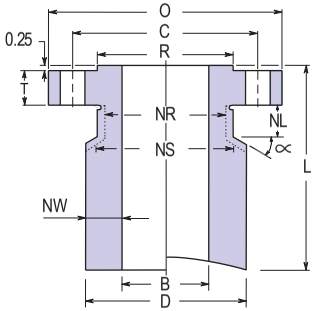
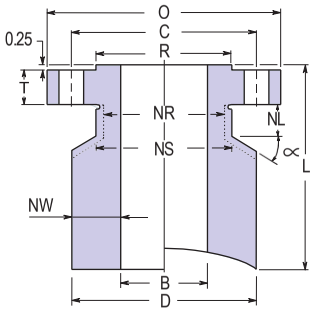


INTERMEDIATE BARREL "I 1"



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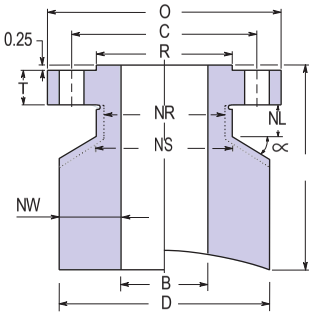
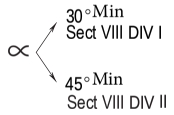


INTERMEDIATE BARREL "I 3"



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		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	6.25	1.38	2.00	4.00	4.62	5.50	1.52	1.83	2.27	4	1	4.25	2.81	2.25	1.12	7/8	5.50	5.50	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	2.00	2.25	2.75	4	1 1/4	5.75	3.94	3.12	1.38	1 1/8	6.75	6.75	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	2.03	2.53	3.03	8	1 1/8	6.75	5.12	3.75	1.25	1	7.00	7.00	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	2.34	2.72	3.28	8	1 1/4	7.75	5.94	4.50	1.38	1 1/8	7.75	8.00	133	10	153	12	182	16	12
3	2.90	12.00	2.62	5.00	8.25	9.88	11.00	2.68	3.49	4.05	8	1 3/8	9.00	7.00	5.25	1.50	1 1/4	8.75	9.00	184	13	229	20	263	25	12
4	3.83	14.00	3.00	6.19	9.88	11.00	12.12	3.03	3.59	4.15	8	1 5/8	10.75	8.38	6.50	1.75	1 1/2	10.00	10.25	256	18	288	24	323	29	12
5	4.81	16.50	3.62	7.31	11.00	13.50	15.25	3.10	4.35	5.22	8	1 7/8	12.75	10.00	8.00	2.00	1 3/4	11.75	12.25	344	22	417	35	470	47	12
6	5.76	19.00	4.25	8.50	13.50	15.12	17.38	3.87	4.68	5.81	8	2 1/8	14.50	11.38	9.25	2.25	2	13.50	14.00	493	33	537	44	598	60	12
8	7.62	21.75	5.00	10.62	15.12	18.25	20.12	3.75	5.32	6.25	12	2 1/8	17.25	14.12	12.00	2.25	2	15.00	15.50	794	38	970	61	1080	77	16
10	9.56	26.50	6.50	12.75	20.12	22.25	24.12	5.28	6.35	7.28	12	2 5/8	21.25	17.38	14.75	2.75	2 1/2	19.25	20.00	1891	70	2157	90	2401	109	24
12	11.38	30.00	7.25	15.00	22.25	25.00	27.75	5.44	6.81	8.19	12	2 7/8	24.38	20.12	17.38	3.00	2 3/4	21.25	22.00	2355	81	2711	110	3082	143	24

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, tf. 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.

FCI Forged Components
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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 "I_1", "I_2", "I_3", 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

FCI Forged Components
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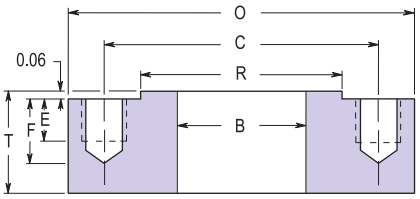
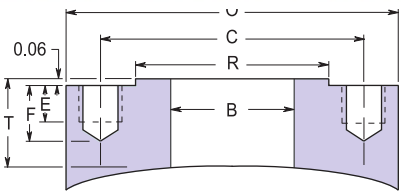


FLAT BOTTOM



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

FCI Forged Components
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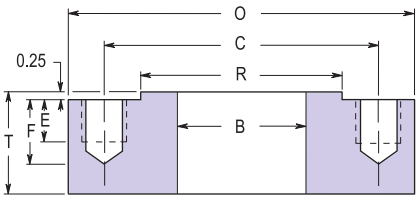
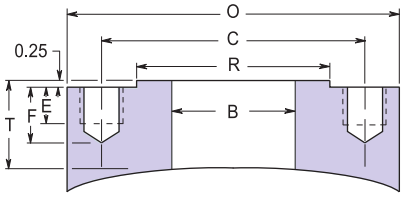


FLAT BOTTOM



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 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

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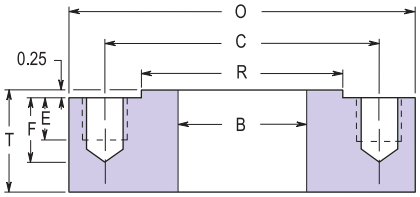
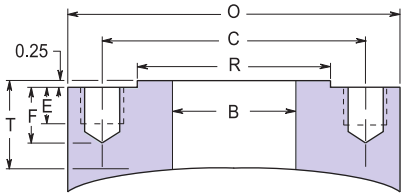


FLAT BOTTOM



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 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

FCI Forged Components
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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.

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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, ¼” 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:

TAP SIZE (inches)	DEPTH OF HOLE (inches)	AREA (sq. inches)
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**

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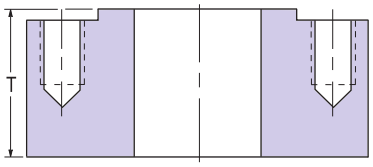
FCI STUDDING OUTLETS

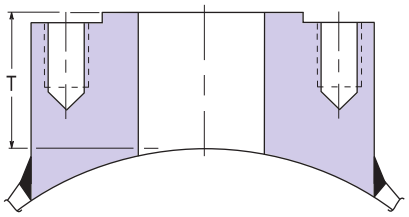
TYPICAL ATTACHMENT STYLES AND RELATED THICKNESS "T" DIMENSIONS

FIG. A



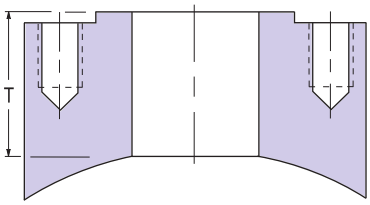
Standard Flat Bottom Attachment

FIG. B



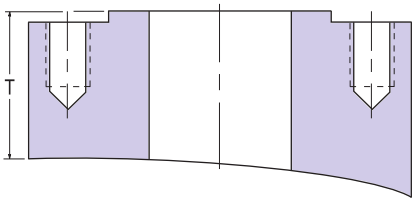
Optional Contoured "Through-Type" Shell Attachment

FIG. C



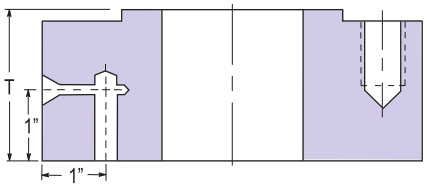
Optional Contoured For Spherical Head Attachment

FIG. D



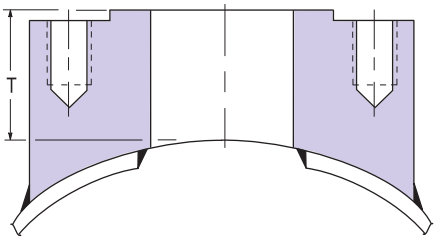
Optional Contoured Tangential Attachment

FIG. E



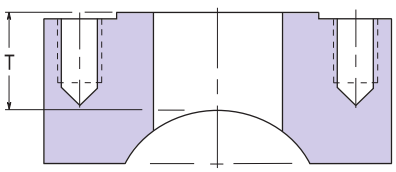
Optional "Pipe Tap Test Hole" Connection

FIG. F



Optional Contoured Set-On Type Attachment

FIG. G



Optional "Wrap Around" Connection

LARGE DIAMETER FLANGES

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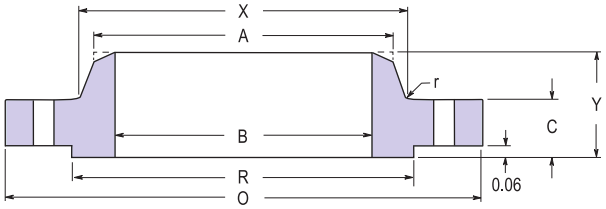
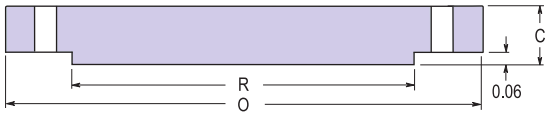


WELDING NECK



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.

See Notes on Page 30

LARGE DIAMETER FLANGES

FCI Forged Components
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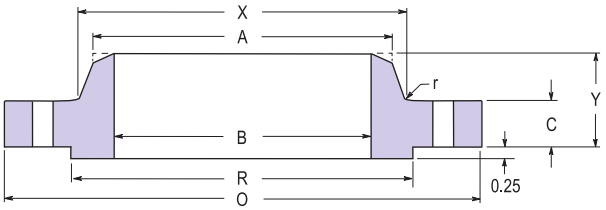
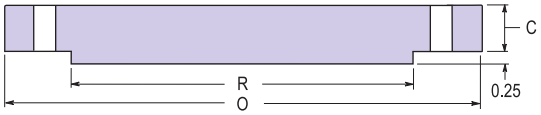


WELDING NECK



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
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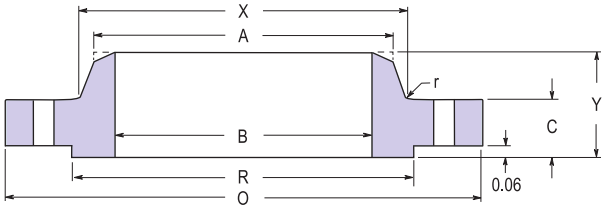
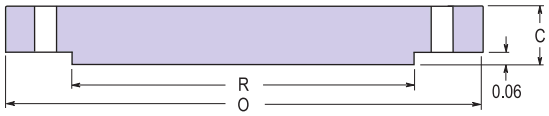


WELDING NECK



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

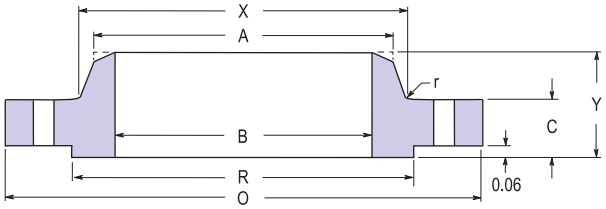
NOTE

*Blinds are not included in API 605.

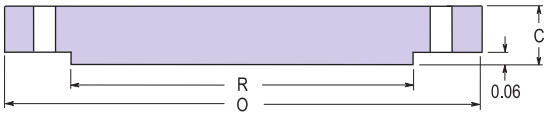
See Notes on Page 30

LARGE DIAMETER FLANGES

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 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
△ 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.

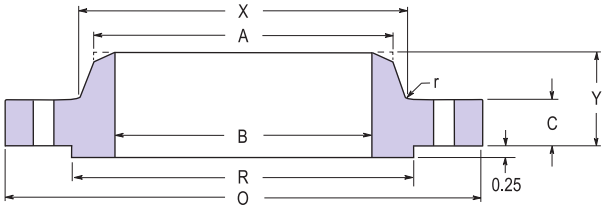
△ The 1/4" raised face is not included in Thickness C, Length Y. See drawing on page 30 for details.

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

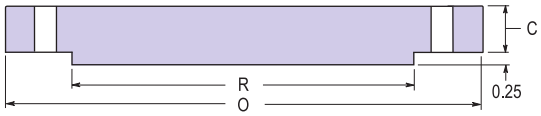
See Notes on Page 30

LARGE DIAMETER FLANGES

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 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.

△ 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

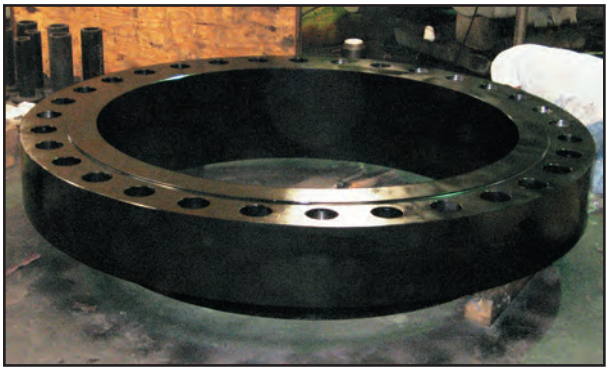
CUSTOM PRODUCTS

Pierced Block With ID

Large Diameter Forged Cylinder

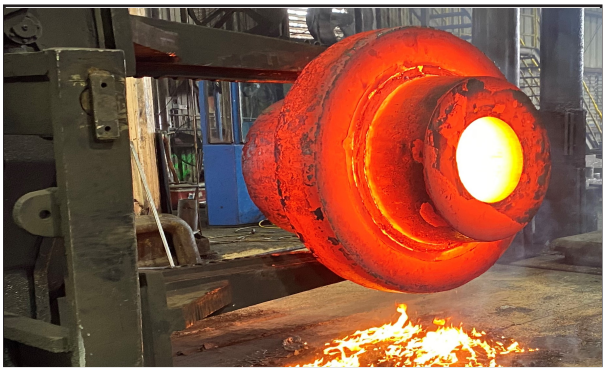
2500 Ton Press Forging Large Cyclinder

Large Diameter Flange

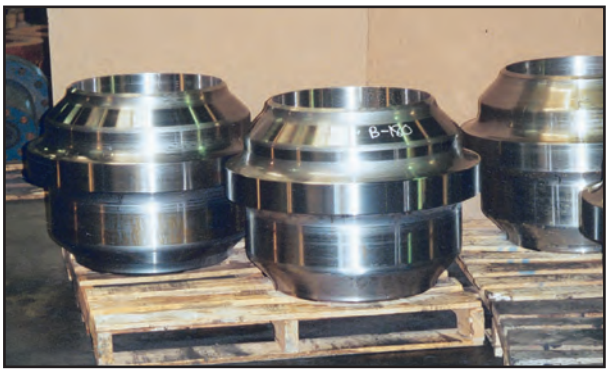


Large Diameter Flange

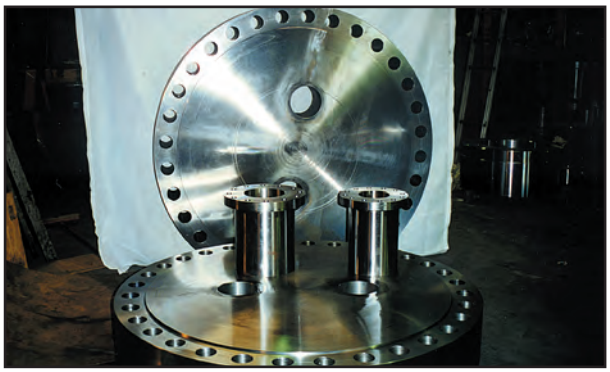
Intergral Nozzle and Elliptical Head



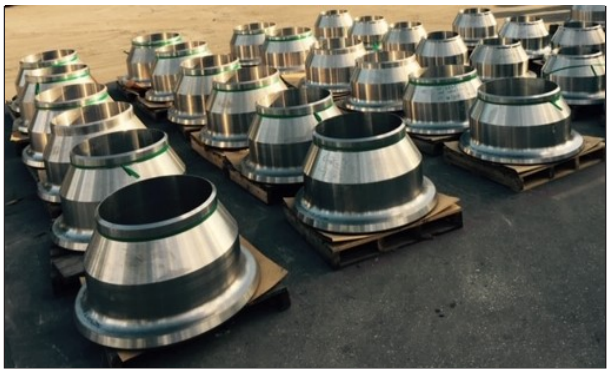
Dual Hub Q-lip Nozzle



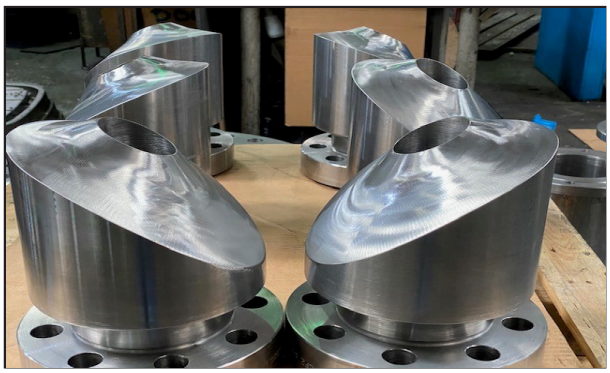
Vessel Insert Double Butt Weld Hubs



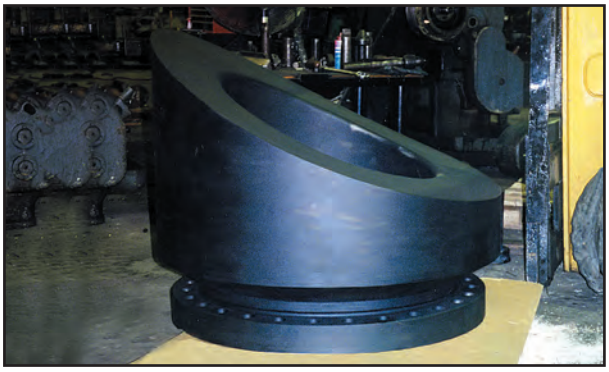
Blind Flanges and “LWN” Connections



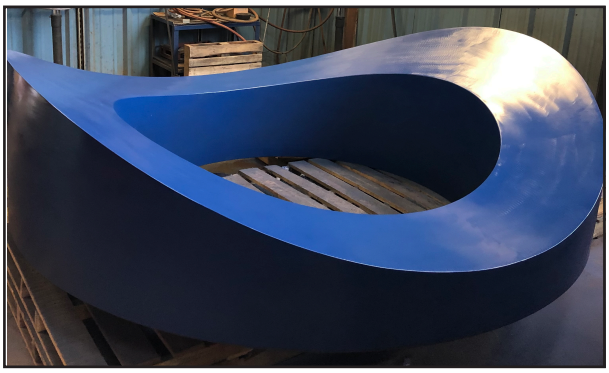
Q-lip Stub End Nozzles



Custom Nozzles



Tangential Super Barrel “SB” Connection



84” Contoured Butt Weld Stub

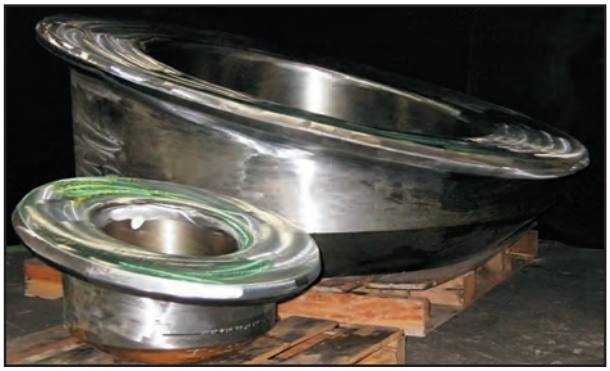
Forged Concical Reducer

CUSTOM PRODUCTS

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

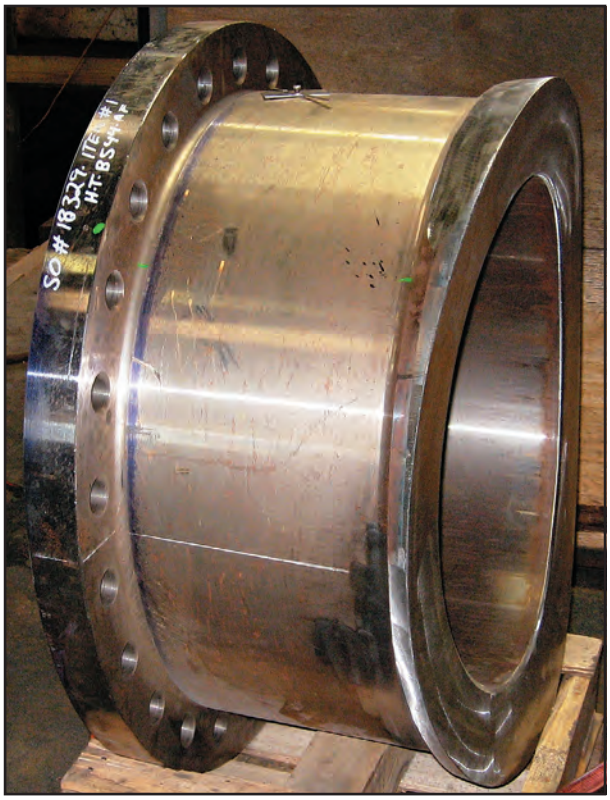
36” F11 Hillside Q-Lip Stubs for Coker Vessels

F11 Heavy Wall Q-Lip Stub



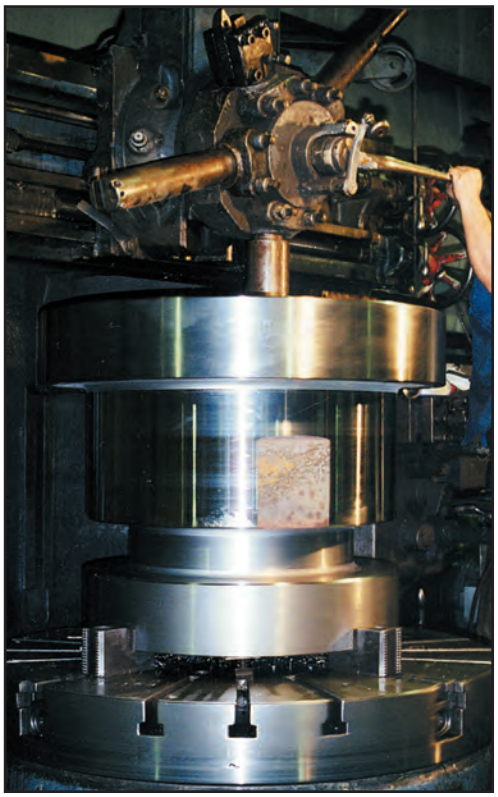
Hillside Q-Lip Stubs for Coker Vessels

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

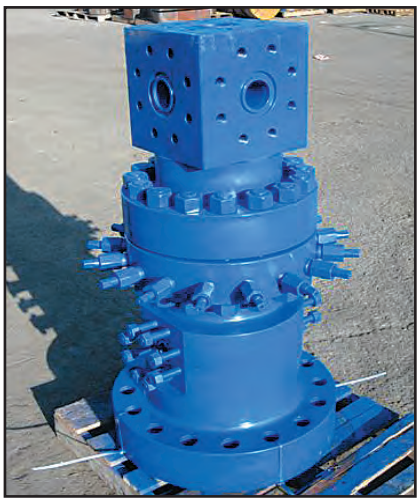
Running Tool

15M and 10M Spool with Studded Outlets

11” 10M Lower Connector

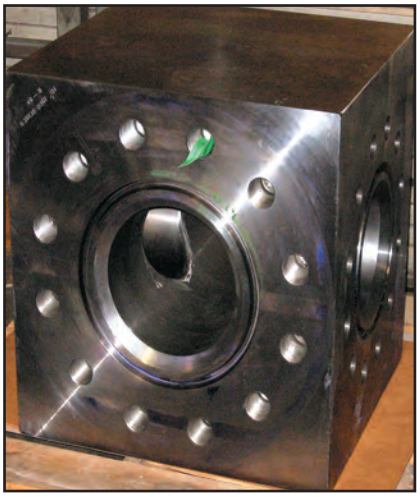
Combination Test Plug, Running and Retrieving Tool 11” x 4 1/2” IF

11” 10M x 11” 10M Upper Mulit-Bowl

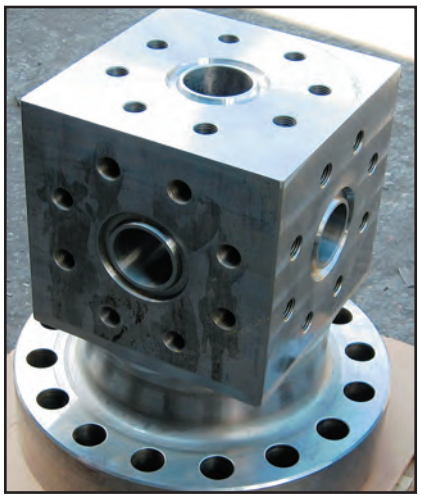


3 1/16” 15M Five Way Cross and 11” 10M x 7 1/16” 15M TCM Tubing Head

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



7 1/16” 5M Studded Tee

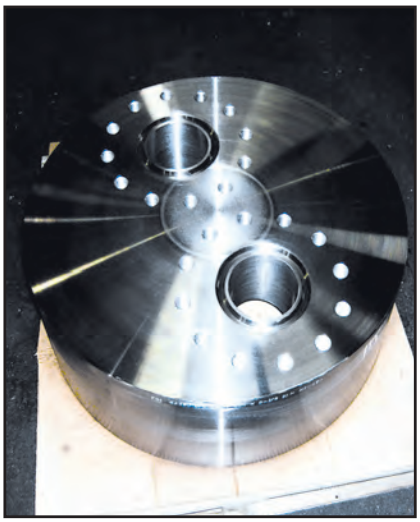


7 1/16” 15M Studded Flange Bottom x 3 1/16” 15M Five Way Cross Top

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

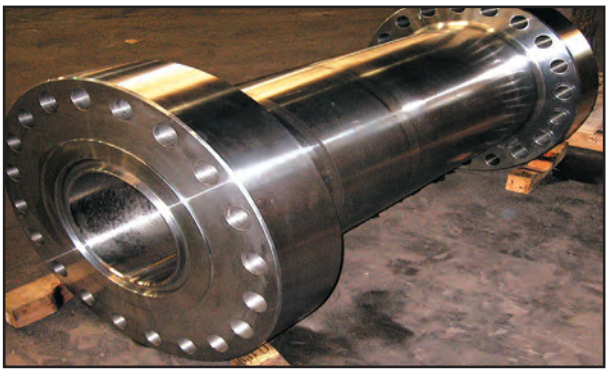


Dual Adapter 7 1/16” 10M x 7 1/16” 10M

12” 4130 High Pressure Water Injection Tee

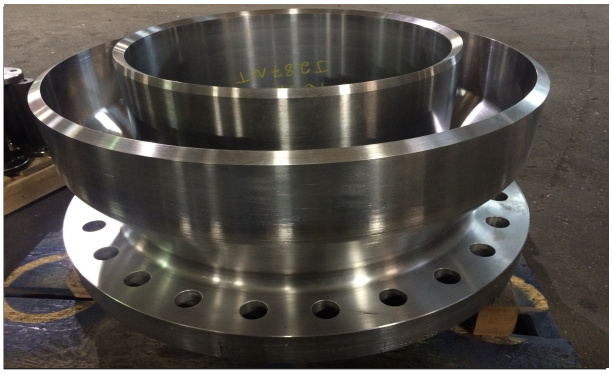
CUSTOM PRODUCTS

Forged Lateral

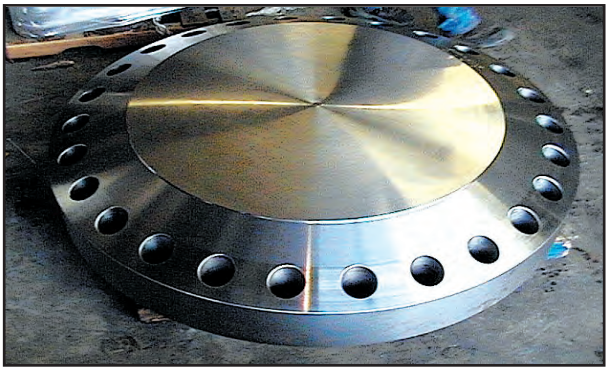


13 5/8” 15M x 13 5/8 15M Riser Spool 72” Long

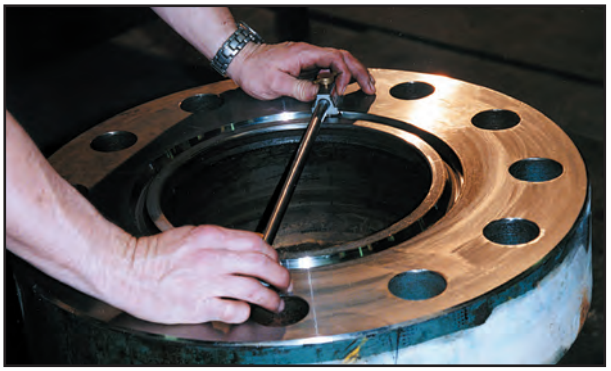
4 1/16” 10M Tree Cap Components



Heat Exchanger Connection

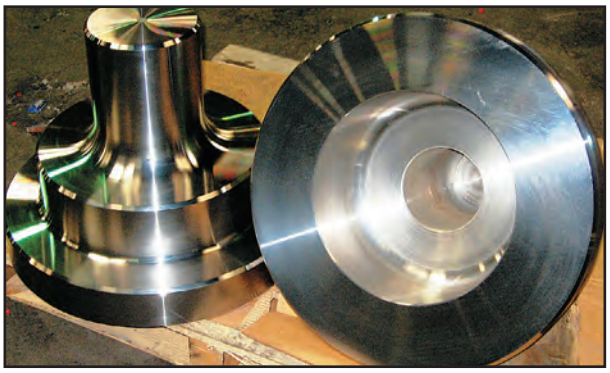


High Pressure Tapered Plug Flange



Wellhead Remanufacture/Contract Machine Work

Double Hubbed Flanged Bonnet Forgings



Completed Double Hubbed Flanged Bonnet

FCI Forged Components
A OneWest Company

TECHNICAL SECTION

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, F304H, F304L, 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 Class 1, LF6 Class 2, 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

Purchaser to specify material class where applicable.

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

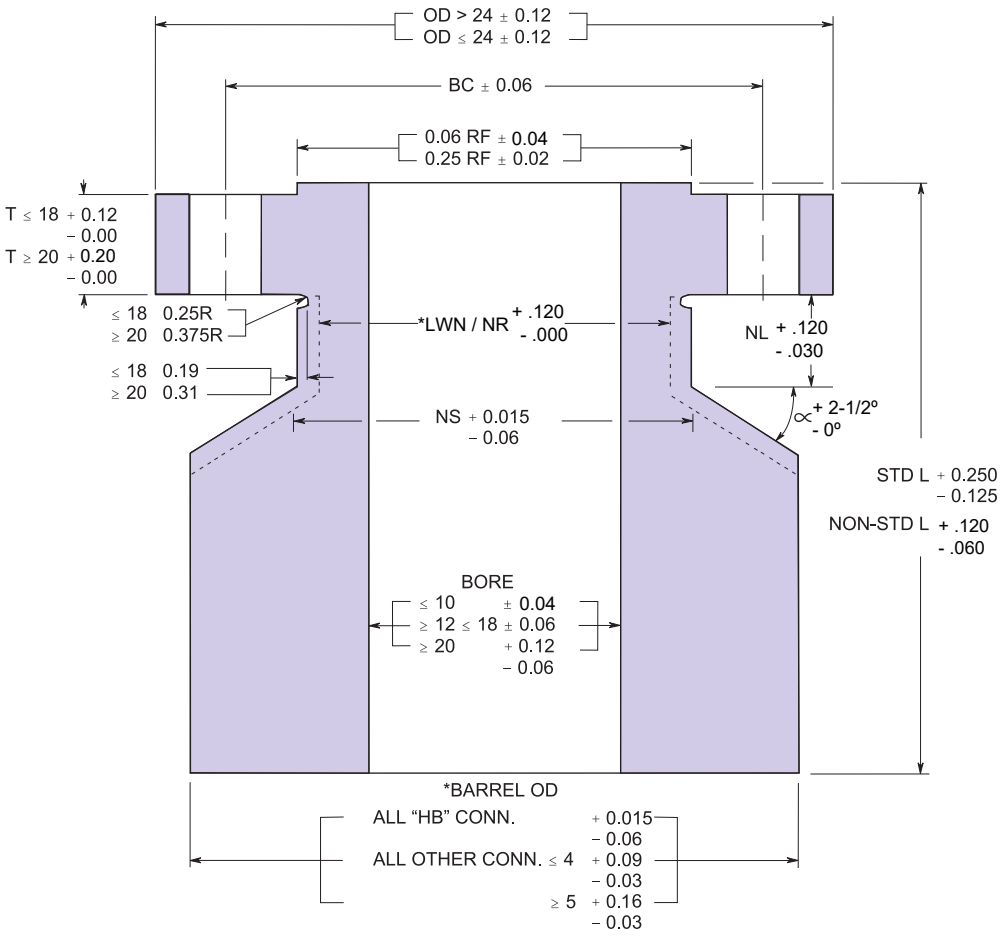
All materials comply with the applicable ASME, ASTM, API and AISI Codes and/or Specifications.

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

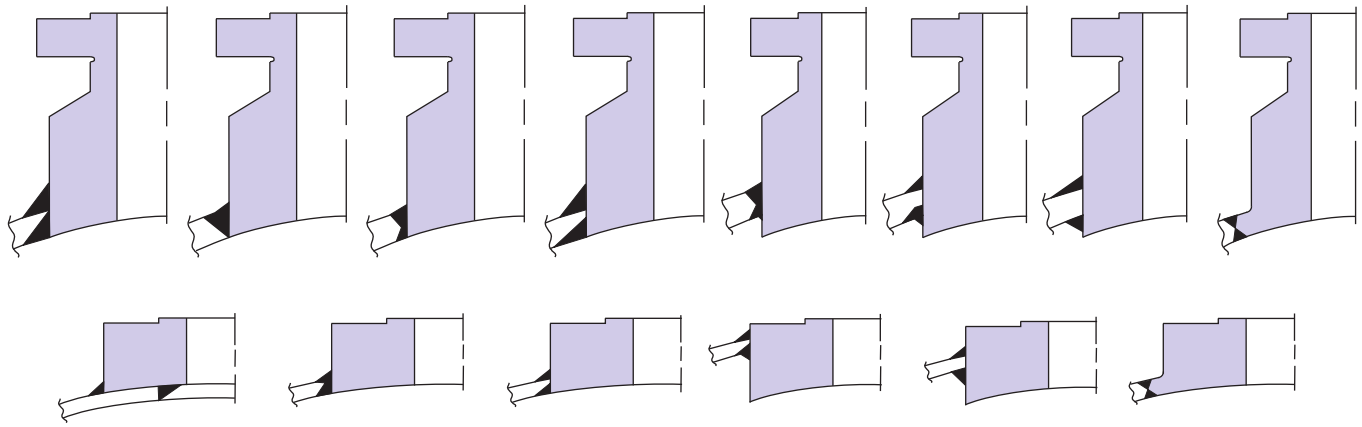


NOTE

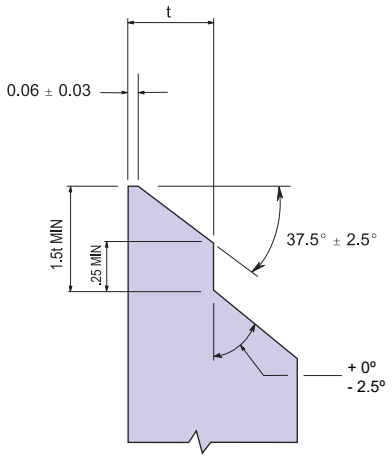
1. All dimensions are in inches.
2. Tolerances and undercut dimensions are in accordance with ASME B16.5 and ASME Section VIII, Div. 1, App. 2, Fig. 2-4.
3. Tolerances for FCI products will be modified as necessary to maintain compliance with latest Code updates.
4. Tolerances may be modified to meet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

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

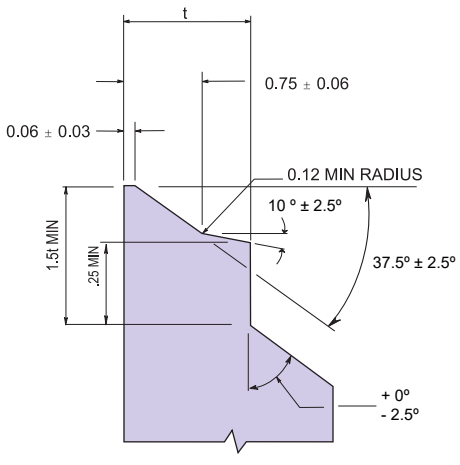
COMMON METHODS OF CONNECTION ATTACHMENTS



STANDARD WELD END PREPARATIONS



"t" TO 0.88 INCHES



"t" OVER 0.88 INCHES

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:

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".

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

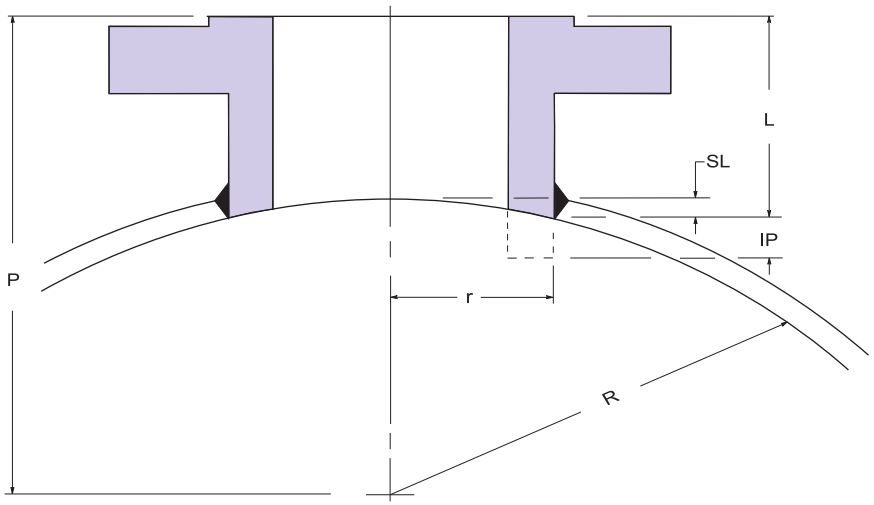


Fig. 1 Radially Installed Connection In Shell

CALCULATION OF CONNECTION "SWEEP LOSS"

Formula for "Sweep Loss" Calculation of Studding Outlet Connections:

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

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

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

Determine the required overall connection length "L".

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

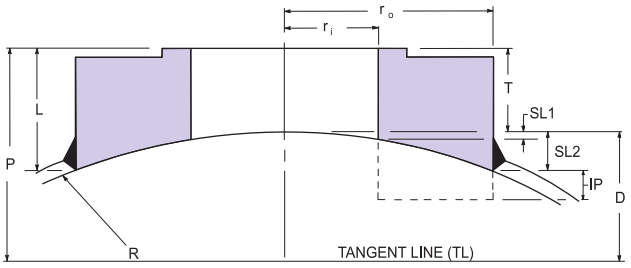
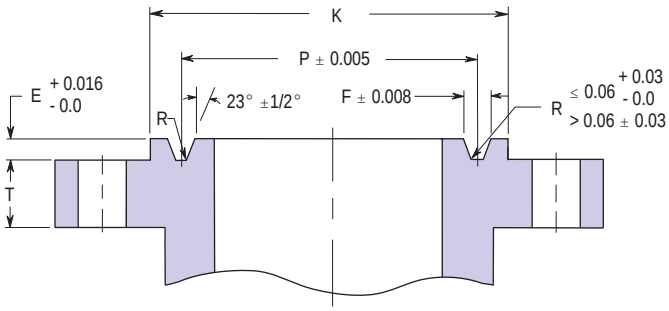


Fig. 2 Radially Installed Connection In Sphere

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.

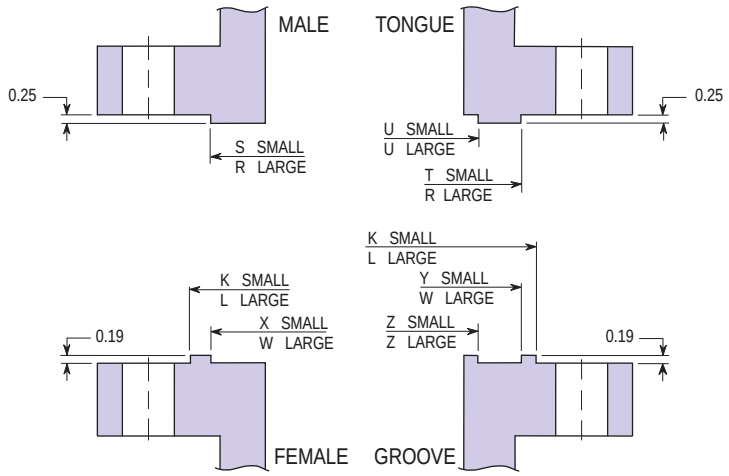
FACING DIMENSIONS FOR RING JOINT FLANGES

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

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.

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
	B564 N08825	B424 N08825	5,13
3.15	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

1. 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.
2. Only killed steel shall be used above 850ºF.
3. 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.
4. Use normalized and tempered material only.
5. Use annealed material only.
6. Use solution annealed material only.
7. Not to be used over 500°F.
8. Not to be used over 600°F. Steel may become brittle after service at moderately elevated temperatures.
9. Not to be used over 650°F.
10. Not to be used over 700°F.
11. Not to be used over 800ºF.
12. Not to be used over 850ºF.
13. Not to be used over 1000ºF.
14. Not to be used over 1250ºF.
15. Permissible, but not recommended for prolonged use above 1100°F.
16. At temperatures over 1000°F, use only when the carbon content is 0.04% or higher.
17. At temperatures over 1000°F, use only if the material is heat treated by heating to a minimum temperature of 2000°F.
18. Not to be used over 1,200ºF. Alloy N06625 in the annealed condition is subject to severe loss of impact strength at room temperatures after exposure in the range of 1,000ºF to 1,400ºF

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

Temperature (Fahrenheit) °F

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

Temperature (Fahrenheit) °F

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

Temperature (Fahrenheit) °F

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

Temperature (Fahrenheit) °F

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

Temperature (Fahrenheit) °F

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

Temperature (Fahrenheit) °F

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

Temperature (Fahrenheit) °F

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

Temperature (Fahrenheit) °F

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

Temperature (Fahrenheit) °F

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

Temperature (Fahrenheit) °F

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

Temperature (Fahrenheit) °F

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

Temperature (Fahrenheit) °F

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

Temperature (Fahrenheit) °F

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

Temperature (Fahrenheit) °F

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 K = .223	Lubed K = .167
			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	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 K = .223	Lubed K = .167
			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	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
1/8	0.405	10S	0.049	0.307	0.186
		* 40	0.068	0.269	0.244
		** 80	0.095	0.215	0.314
1/4	0.540	10S	0.065	0.410	0.330
		* 40	0.088	0.364	0.424
		** 80	0.119	0.302	0.535
3/8	0.675	10S	0.065	0.545	0.423
		* 40	0.091	0.493	0.567
		** 80	0.126	0.423	0.738
1/2	0.840	5S	0.065	0.710	0.538
		10S	0.083	0.674	0.671
		* 40	0.109	0.622	0.850
		** 80	0.147	0.546	1.087
		160	0.188	0.464	1.310
		XX-STG	0.294	0.252	1.714
3/4	1.050	5S	0.065	0.920	0.684
		10S	0.083	0.884	0.857
		* 40	0.113	0.824	1.130
		** 80	0.154	0.742	1.473
		160	0.219	0.612	1.940
		XX-STG	0.308	0.434	2.440
1	1.315	5S	0.065	1.185	0.868
		10S	0.109	1.097	1.404
		* 40	0.133	1.049	1.678
		** 80	0.179	0.957	2.171
		160	0.250	0.815	2.850
		XX-STG	0.358	0.599	3.659
1 1/4	1.660	5S	0.065	1.530	1.107
		10S	0.109	1.442	1.806
		* 40	0.140	1.380	2.272
		** 80	0.191	1.278	2.996
		160	0.250	1.160	3.764
		XX-STG	0.382	0.896	5.214
1 1/2	1.900	5S	0.065	1.770	1.274
		10S	0.109	1.682	2.085
		* 40	0.145	1.610	2.717
		** 80	0.200	1.500	3.631
		160	0.281	1.338	4.862
		XX-STG	0.400	1.100	6.408
2	2.375	5S	0.065	2.245	1.604
		10S	0.109	2.157	2.638
		* 40	0.154	2.067	3.652
		** 80	0.218	1.939	5.022
		160	0.344	1.687	7.450
		XX-STG	0.436	1.503	9.029
2 1/2	2.875	5S	0.083	2.709	2.48
		10S	0.120	2.635	3.53
		* 40	0.203	2.469	5.79
		** 80	0.276	2.323	7.66
		160	0.375	2.125	10.01
		XX-STG	0.552	1.771	13.69
3	3.500	5S	0.083	3.334	3.03
		10S	0.120	3.260	4.33
		* 40	0.216	3.068	7.57
		** 80	0.300	2.900	10.25
		160	0.438	2.624	14.32
		XX-STG	0.600	2.300	18.58
3 1/2	4.000	5S	0.083	3.834	3.47
		10S	0.120	3.760	4.97
		* 40	0.226	3.548	9.11
		** 80	0.318	3.364	12.51
4	4.500	5S	0.083	4.334	3.92
		10S	0.120	4.260	5.61
		* 40	0.237	4.026	10.79
		** 80	0.337	3.826	14.98
		120	0.438	3.624	19.00
		160	0.531	3.438	22.60
		XX-STG	0.674	3.152	27.54
5	5.563	5S	0.109	5.345	6.35
		10S	0.134	5.295	7.77
		* 40	0.258	5.047	14.62
		** 80	0.375	4.813	20.78
		120	0.500	4.563	27.10
		160	0.625	4.313	32.96
		XX-STG	0.750	4.063	38.55
6	6.625	5S	0.109	6.407	7.59
		10S	0.134	6.357	9.29
		* 40	0.280	6.065	18.97
		** 80	0.432	5.761	28.57
		120	0.562	5.501	36.40
		160	0.719	5.187	45.30
		XX-STG	0.864	4.897	53.16

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.

PROPERTIES OF SEAMLESS AND WELDED STEEL PIPE

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

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: Standard ball	Brinell Hardness No., 3000-kg load, 10-mm ball: Tungsten carbide ball	Rockwell Hardness No.: A scale, 60-kg load, Brale Indenter	Rockwell Hardness No.: B scale, 100-kg load, 1/16-in. diam. ball	Rockwell Hardness No.: C scale 150-kg load, Brale Indenter	Rockwell Hardness No.: D scale, 100-kg load, Brale Indenter	Rockwell Superficial Hardness No., Superficial Brale Indenter: 15M scale 15-kg load	Rockwell Superficial Hardness No., Superficial Brale Indenter: 30M scale 30-kg load	Rockwell Superficial Hardness No., Superficial Brale Indenter: 45M sale, 45-kg load	Tensile strength (approx) MPs	Tensile strength (approx) ksi
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	77.4440	**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	19 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
	A	
atmospheres	ft of water (at 4 °C)	33.90
atmospheres	in of mercury (at 0 °C)	29.92
atmospheres	kgs/sq cm	1.0333
atmospheres	pounds/sq in	14.70
	B	
bars	atmospheres	0.9869
BTU	foot-lbs	778.3
BTU	joules	1.054.8
BTU	kilowatt-hrs	2.298×10^{-4}
	C	
calories, gram (mean)	BTU (mean)	3.9685×10^{-3}
Centigrade	Fahrenheit	(C° x 9/5) + 32
centimeters	feet	3.281×10^{-2}
centimeters	inches	0.3937
centimeters	kilometers	10^{-5}
centimeters	meters	0.01
centimeters	millimeters	10.0
cubic centimeters	cu feet	3.531×10^{-5}
cubic centimeters	cu inches	0.06102
cubic centimeters	cu meters	10^{-6}
cubic centimeters	gallons (U.S. liq)	2.642×10^{-4}
cubic centimeters	liters	0.001
cubic feet	cu inches	1,728.0
cubic feet	cu meters	0.02832
cubic feet	gallons (U.S. liq)	7.48052
cubic feet	liters	28.32
cubic inches	cu cms	16.39
cubic inches	cu feet	5.787×10^{-4}
cubic inches	cu meters	1.639×10^{-5}
cubic inches	gallons	4.329×10^{-3}
cubic meters	cu cms	10^{6}
cubic meters	cu feet	35.31
cubic meters	cu inches	61,023.0
cubic meters	gallons (U.S. liq)	264.2
cubic meters	liters	1,000.0
	D	
dynes	joules/cm	10^{-7}
dynes	joules/meter (newtons)	10^{-5}
dynes	kilograms	1.020×10^{-6}
dynes	poundals	7.233×10^{-5}
dynes	pounds	2.248×10^{-5}
	E	
ergs	BTU	9.480×10^{-11}
ergs	foot-pounds	7.367×10^{-8}
ergs	joules	10^{-7}
ergs/sec	horsepower	1.341×10^{-10}
	F	
feet	centimeters	30.48
feet	meters	0.3048
feet	millimeters	304.8
feet	inches	12.0
feet of water	atmospheres	0.02950
feet of water	in of mercury	0.8826
feet of water	pounds/sq ft	62.43
feet of water	pounds/sq in	0.4335
Fahrenheit	Centigrade	(° F - 32) x 5/9
foot-pounds	BTU	1.286×10^{-3}
foot-pounds	ergs	1.356×10^{7}
foot-pounds	joules	1.356
foot-pounds	kilowatt-hrs	3.766×10^{-7}
kilograms	tons (short)	1.102×10^{-3}
kilograms/cu meter	grams/cu cm	0.001
kilograms/cu meter	pounds/cu ft	0.06243

Change	To	Multiply By
	G	
gallons	cu cms	3,785.0
gallons	cu feet	0.1337
gallons	cu inches	231.0
gallons	cu meters	3.785×10^{-3}
gallons	liters	3.785
gallons (liq Br. Imp.)	gallons (U.S. liq)	1.20095
gallons (U.S.)	gallons (Imp.)	0.83267
gallons of water	pounds of water	8.3453
grams	dynes	980.7
grams	kilograms	0.001
grams	milligrams	1,000.0
grams	ounces (avdp)	0.03527
grams	ounces (troy)	0.03215
grams	poundals	0.07093
grams	pounds	2.205×10^{-3}
grams/cu cm	pounds/cu ft	62.43
grams/cu cm	pounds/cu in	0.03613
grams/sq cm	pounds/sq ft	2.0481
	H	
horsepower	BTU//min	42.44
horsepower	foot-lbs/min	33,000.0
horsepower	foot-lbs/sec	550.0
horsepower	kilowatts	0.7457
horsepower	watts	745.7
	I	
inches	centimeters	2.540
inches	meters	2.540×10^{-2}
inches	millimeters	25.40
inches	mils	1,000.0
inches	feet	0.0833
inches of mercury	atmospheres	0.03342
inches of mercury	inches of water	13.6
inches of mercury	feet of water	1.1333
inches of mercury	kgs/sq cm	0.03453
inches of mercury	kgs/sq meter	345.3
inches of mercury	pounds/sq ft	70.73
inches of mercury	pounds/sq in	0.4912
inches of water (at 4°C)	atmospheres	2.458×10^{-3}
inches of water (at 4°C)	inches of mercury	0.07355
inches of water (at 4°C)	kgs/sq cm	2.540×10^{-3}
inches of water (at 4°C)	ounces/sq in	0.5781
inches of water (at 4°C)	pounds/sq ft	5.204
inches of water (at 4°C)	pounds/sq in	0.03613
	J	
joules	BTU	9.480×10^{-4}
joules	ergs	10^{7}
joules	foot-pounds	0.7376
joules	watt-hrs	2.778×10^{-4}
joules/cm	grams	1.020×10^{4}
joules/cm	dynes	10^{7}
joules/cm	joules/meter (newtons)	100.0
joules/cm	poundals	723.3
joules/cm	pounds	22.48
	K	
kilograms	dynes	980,665.0
kilograms	grams	1,000.0
kilograms	joules/cm	0.09807
kilograms	joules/meter (newtons)	9.807
kilograms	poundals	70.93
kilograms	pounds	2.205
pounds	kilograms	0.4536
pounds	ounces	16.0
pounds	ounces (troy)	14.5833

CONVERSION FACTORS

Change	To	Multiply By
	K	
kilograms/cu meter	pounds/cu in	3.613×10^{-5}
kilograms/cu meter	pounds/mil-foot	3.405×10^{-10}
kilograms/meter	pounds/ft	0.6720
kilograms/sq cm	dynes	980,665.0
kilograms/sq cm	atmosphere	0.9678
kilograms/sq cm	feet of water	32.81
kilograms/sq cm	inces of mercury	28.96
kilograms/sq cm	pounds/sq ft	2,048.0
kilograms/sq cm	pounds/sq in	14.22
kilograms/sq meter	atmosphere	9.678×10^{-5}
kilograms/sq meter	bars	98.07×10^{-6}
kilograms/sq meter	feet of water	3.281×10^{-3}
kilograms/sq meter	inces of mercury	2.896×10^{-3}
kilograms/sq meter	pounds/sq ft	0.2048
kilograms/sq meter	pounds/sq in	1.422×10^{-3}
kilograms/sq mm	kgs/sq meter	10^{6}
kilowatts	BTU/min	56.92
kilowatts	foot-lbs/min	4.426×10^{4}
kilowatts	foot-lbs/sec	737.6
kilowatts	horsepower	1.341
kilowatts	watts	1000.0
kilowatt-hrs	BTU	3413.0
kilowatt-hrs	ergs	3.600×10^{13}
kilowatt-hrs	foot-pounds	2.655×10^{6}
kilowatt-hrs	joules	3.6×10^{6}
	L	
liters	cu cm	1,000.0
liters	cu feet	0.03531
liters	cu inches	61.02
liters	cu meters	0.001
liters	gallons (U.S. liq)	0.2642
long tons	pounds	2,240.0
	M	
meters	centmeters	100.0
meters	feet	3.281
meters	inches	39.37
meters	millimeters	1,000.0
miles (statue)	feet	5,280.0
miles (statue)	meters	1,609.0
millimeters	centimeters	0.1
millimeters	feet	3.281×10^{-3}
millimeters	inches	0.03937
mils	inches	0.001
	N	
newtons	dynes	10^{5}
	O	
ounces	grams	28.349527
ounces	pounds	0.06250
ounces	ounces (troy)	0.9115
	P	
Poise	gram/cm sec	1.0
pounds (avoirdupois)	ounces (troy)	14.5833
poundals	dynes	13,826.0
poundals	joules/cm	1.383×10^{-3}
poundals	joules/meter (newtons)	0.1383
poundals	kilograms	0.01410
poundals	pounds	0.03108
pounds	dynes	44.4823×10^{4}
pounds	grams	453.5924
pounds	joules/cm	0.04448
pounds	joules/meter (newtons)	4.448

Change	To	Multiply By
	P	
pounds	poundals	32.17
pounds	pounds (troy)	1.21528
pounds	tons (short)	0.0005
pounds of water	cu feet	0.01602
pounds of water	cu inches	27.68
pounds of water	gallons	0.1198
pounds-feet	cm-dynes	1.356×10^{7}
pounds-feet	cm-grams	13,825.0
pounds-feet	meter-kgs	0.1383
pounds/ft	kgs/meter	1.488
pounds/in	gms/cm	178.6
pounds/sq ft	atmospheres	4.725×10^{-4}
pounds/sq ft	feet of water	0.01602
pounds/sq ft	inches of mercury	0.01414
pounds/sq ft	kgs/sq meter	4.882
pounds/sq ft	pounds/sq in	6.944×10^{-3}
pounds/sq in	atmospheres	0.06804
pounds/sq in	inches of water	27.68
pounds/sq in	feet of water	2.307
pounds/sq in	inches of mercury	2.036
pounds/sq in	kgs/sq meter	703.1
pounds/sq in	pounds/sq in	144.0
	S	
short tons	pounds	2,000.0
short tons	long tons	0.89285
slug	kilogram	14.59
slug	pounds	32.17
square centimeters	sq feet	1.076×10^{-3}
square centimeters	sq inches	0.1550
square centimeters	sq meters	0.0001
square centimeters	sq millimeters	100.0
square feet	sq cms	929.0
square feet	sq inches	144.0
square feet	sq meters	0.09290
square feet	sq millimeters	9.290×10^{4}
square inches	sq cms	6.452
square inches	sq feet	6.944×10^{-3}
square inches	sq millimeters	645.2
square kilometers	sq cms	10^{10}
square kilometers	sq feet	10.76×10^{6}
square kilometers	sq inches	1.550×10^{9}
square kilometers	sq meters	10^{6}
square meters	sq cms	10^{4}
square meters	sq feet	10.76
square meters	sq inches	1,550.0
square meters	sq millimeters	10^{6}
square millimeters	sq cms	0.01
square millimeters	sq feet	1.076×10^{-5}
square millimeters	sq inches	1.550×10^{-3}
	T	
tons (long)	kilograms	1,016.0
tons (long)	pounds	2,240.0
tons (long)	tons (short)	1.120
tons (metric)	kilograms	1,000.0
tons (metric)	pounds	2,205.0
	W	
watts	BTU/hr	3.4129
watts	BTU/min	0.05688
watts	ergs/sec	10^{7}
watts	horsepower	1.341×10^{-3}
watts	kilowatts	0.001

FCI Forged Components
A OneWest Company