Connections Catalog

AFGlobal

Connectors & Sealing Technologies

WIDEST SIZE RANGE ■ ALL ALLOYS ■ VAST INVENTORY ■ QUICK TURNAROUND CAPABILITY ■ AVL APPROVAL

CUSTOM SOLUTIONS ■ GLOBAL AVAILABILITY ■ BROAD PRODUCTION CAPABILITY ■ FULL PRODUCT TESTING

AFGlobal CORPORATION
Turnkey Solutions

About AFGlobal

AFGlobal Corporation is a privately-held Houston-based company with a global footprint across four continents. Our offerings support the Oil and Gas, Petrochemical / Refining, General Industrial, Aerospace and Power Generation markets.

Through innovative design, specialized forging techniques, and versatility of equipment, AFGlobal is uniquely positioned to meet our customers' exacting requirements efficiently and economically. We offer a wide array of forged products manufactured at several AFGlobal facilities across our global network. Our product offering ranges from commodity flanges—both raw forgings and finished flange profiles—to highly engineered connectors and components for all major industries. Our product brands—names like Coffer, TaperLok®, Texas Metal Works, and Forged Vessel Connections—are synonymous with quality and reliability. We also offer everything from squared and contoured rings to large block forgings. Our forging capabilities allow us to provide the correct solutions for your challenges.

Our testing and machining services are backed by ASME and ISO 9001 certifications, along with other industry standards as required. We also feature advanced in-house heat treating capabilities, ensuring the highest quality standards throughout the manufacturing process. As regulations become more stringent within our industries, customers have an escalating challenge to satisfy these requirements. Our engineering team enables AFGlobal to analyze, develop, and implement flexible solutions to complex connection challenges.

Capabilities Overview

FORGING
- Open Die
- Closed Die
- Upsetting
- Hammers
- Seamless Ring Rolling
- Ring Stretching

HEAT TREATING
- Quench and temper
- Anneal
- Normalize
- Stress Relieve

MACHINING
- Rough & Finish Turning
- Rough & Finish Milling
- Drilling

WELDING
- Tubular
- Structural
- Clad Overlay & Inlay
- Electron Beam
- Brazing

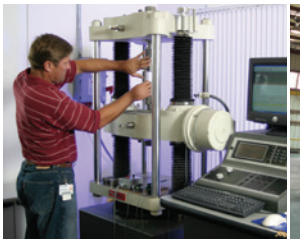
FABRICATION & ASSEMBLY
- Systems & Sub-Systems
- Components

TESTING
- Full Metallurgical Laboratory
  *A2LA accredited testing lab (Cert # 2162.01)

INSPECTION
- Riser Inspection

MISCELLANEOUS
- Shot Blasting
- Grinding
- Coating & Painting

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Flange Types	Face Types	MFG. Standards
Welding Neck	Raised Face	ASTM
Slip-on	Flat Face	ASME
Blind	Large Male & Female	ANSI
Spectacle Blinds	Small Male & Female	ASA
Threaded	Large Tongue & Groove	MSS
Socket Weld	Small Tongue & Groove	API
Lapped Joint	Ring Joint	AGA
Orifice	Lens Joint	NC 3800
Reducing	O-Ring	10CFR21
Expanding	16-500 AARH and RMS	AWWA
Long Weld Neck	Specials per Drawings	
Studding Outlet		
Solids & Special Bores		
Specials per Drawings		

Size Range: Any Size Required

Pressure Range: 75 lb. through 2,500 lb.

Special Forgings:

- Discs or Flat Rounds
- Blocks and Rectangles
- Round Bars
- Custom Shape Forgings
- Wyes, Laterals, Tees

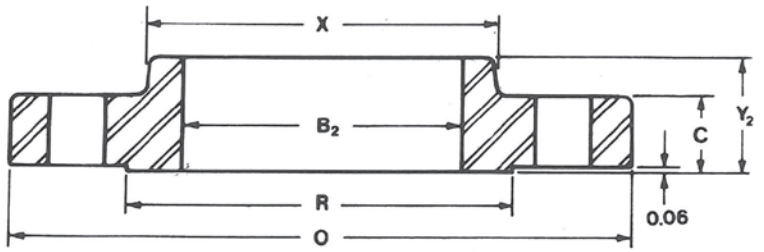
AFGlobal Flanges are available in the following alloy materials

Specification	Grade	Symbol
ASTM A182	1% Chrome, ½% Moly	F-1
ASTM A182	1 ¼% Chrome, ½% Moly	F-11 Class 1, 2 & 3
ASTM A182	2 ¼% Chrome, 1% Moly	F-22 Class 1 & 3
ASTM A182	4-6% Chrome, ½% Moly	F-5 & F-5A
ASTM A182	9% Chrome, 1% Moly	F-9
ASTM A182	13% Chrome	F-6A Class 1,2,3,& 4 (F410)

Specification	Grade	Symbol
Stainless Steels		
ASTM A182	Stainless Steel	F-304
ASTM A182	Stainless Steel	F-304H
ASTM A182	Stainless Steel	F-304L
ASTM A182	Stainless Steel	F-316
ASTM A182	Stainless Steel	F-316H
ASTM A182	Stainless Steel	F-316L
ASTM A182	Stainless Steel	F-321
ASTM A182	Stainless Steel	F-321H
ASTM A182	Stainless Steel	F-347
ASTM A182	Stainless Steel	F-347H
ASTM A182	Stainless Steel	F-310
ASTM A182	Stainless Steel	317
ASTM A182	Stainless Steel	317-L
ASTM A182	Stainless Steel	Duplex F-51 (2205)
ASTM A182	Stainless Steel	F-44 (254-SMO)
For Low Temperatures		
ASTM A105N	Carbon	A105N
ASTM A350	Low Temp	LF-1
ASTM A350	Low Temp	LF-2
ASTM A350	Low Temp	LF-3
Other Types		
ASTM B247	Aluminum Alloy	6061 & 6061T6
ASTM B247	Aluminum Alloy	3003F
ASTM B564, B408	Nickel Alloy	Incoloy 800, H & HT
ASTM B425	Nickel Alloy	Incoloy 825
ASTM B160	Nickel Alloy	Nickel 200
ASTM B160	Nickel Alloy	Nickel 201
ASTM B564, B446	Nickel Alloy	Inconel 625
ASTM B564, B166	Nickel Alloy	Inconel 600
ASTM B564, B164	Nickel Alloy	Monel 400
ASTM B462, CB3	Nickel Alloy	A-20, C-20
ASTM B122	Cupro Nickel	90/10
ASTM B151	Cupro Nickel	70/30
ASTM B691	UNS-N08367	AL-6XN
ASTM B649	UNS-N08904	904L
ASTM A564	UNS-S17400	Grade 630 (17-4-PH)
-	-	INCO 25-6 MO

Other chemistry or materials are available upon request

ANSI B16.5



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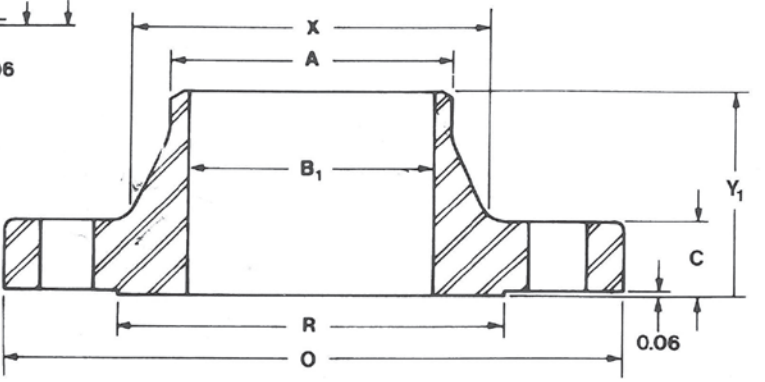
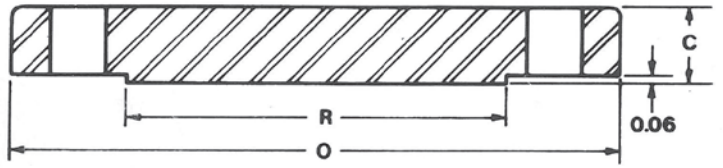


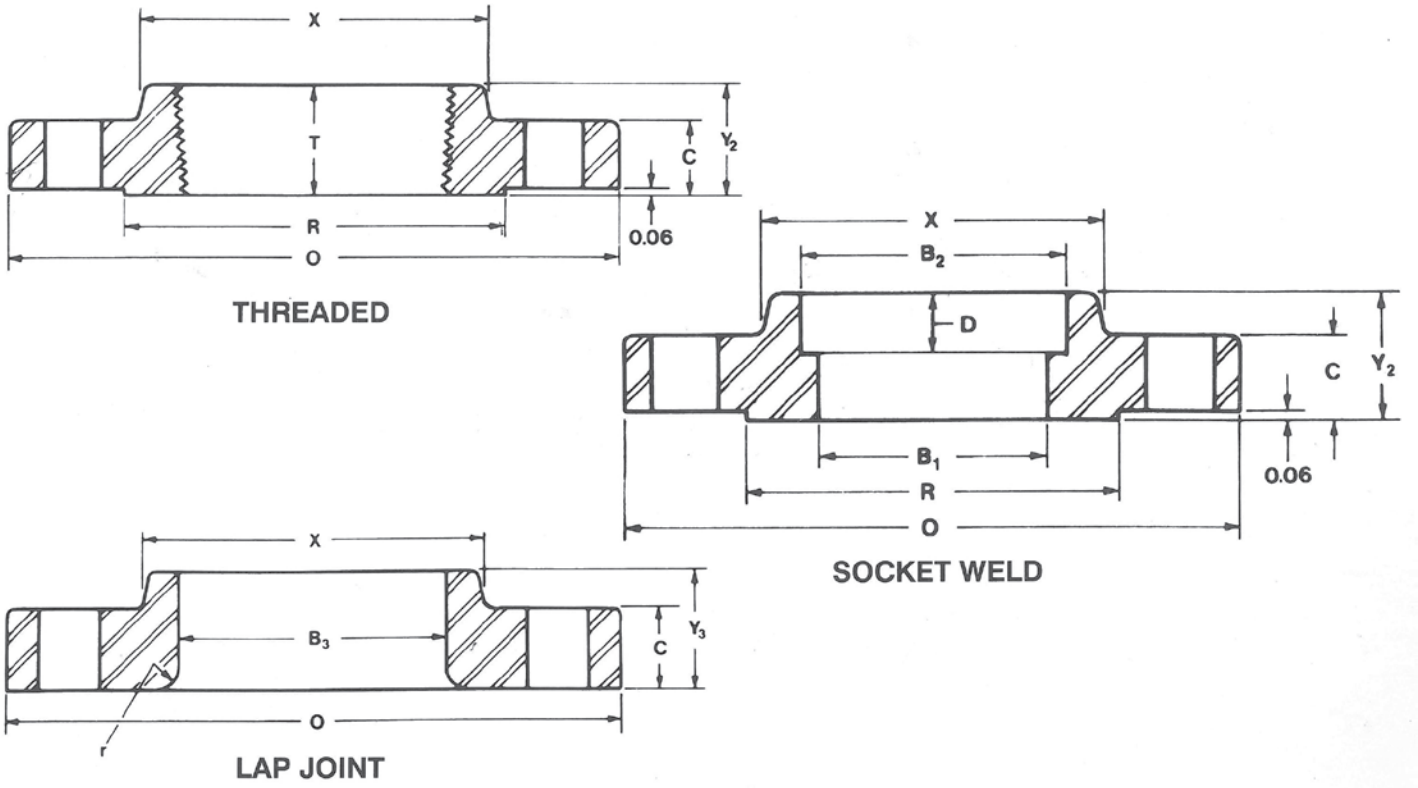
WELDING NECK



BLIND

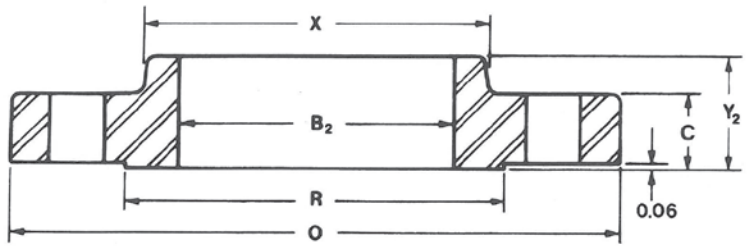
Nominal Size	Common Dimensions				Bore			Length Thru Hub		
	Outside Dia. O	Thk. C	Raised Face Dia. R	Fillet Radius r	Welding Neck Socket B_1	Slip-on B_2	Lap Joint B_3	Welding Neck Y_1	Slip-on Socket Y_2	Lap Joint Y_3
½	3 ½	7/16	1 3/8	1/8	To be specified by purchaser.	0.88	.90	1 7/8	5/8	5/8
¾	3 7/8	½	1 11/16	1/8		1.09	1.11	2 1/16	5/8	5/8
1	4 ¼	9/16	2	1/8		1.36	1.38	2 3/16	11/16	11/16
1 ¼	4 5/8	5/8	2 ½	3/16		1.70	1.72	2 ¼	13/16	13/16
1 ½	5	11/16	2 7/8	¼		1.95	1.97	2 7/16	7/8	7/8
2	6	¾	3 5/8	5/16		2.44	2.46	2 ½	1	1
2 ½	7	7/8	4 1/8	5/16		2.94	2.97	2 ¾	1 1/8	1 1/8
3	7 ½	15/16	5	3/8		3.57	3.60	2 ¾	1 3/16	1 3/16
3 ½	8 ½	15/16	5 ½	3/8		4.07	4.10	2 13/16	1 ¼	1 ¼
4	9	15/16	6 3/16	7/16		4.57	4.60	3	1 5/16	1 5/16
5	10	15/16	7 5/16	7/16		5.66	5.69	3 ½	1 7/16	1 7/16
6	11	1	8 ½	½		6.72	6.75	3 ½	1 9/16	1 9/16
8	13 ½	1 1/8	10 5/8	½		8.72	8.75	4	1 ¾	1 ¾
10	16	1 3/16	12 ¾	½		10.88	10.92	4	1 15/16	1 15/16
12	19	1 ¼	15	½		12.88	12.92	4 ½	2 3/16	2 3/16
14	21	1 3/8	16 ¼	½		14.14	14.18	5	2 ¼	3 1/8
16	23 ½	1 7/16	18 ½	½		16.16	16.19	5	2 ½	3 7/16
18	25	1 9/16	21	½		18.18	18.20	5 ½	2 11/16	3 13/16
20	27 ½	1 11/16	23	½		20.20	20.25	5 11/16	2 7/8	4 1/16
22	29 ½	1 13/16	25 ¼	½		22.22	22.25	5 7/8	3 1/8	4 ¼
24	32	1 7/8	27 ¼	½		24.25	24.25	6	3 ¼	4 3/8

ANSI B16.5



Min. Thread Length T	Depth of Socket D	Dia. Hub at Bevel A	Hub Dia. X	Drilling			Approx. Weight				Nominal Size
				Bolt Circle	Dia. Holes	No. Holes	Welding Neck	Slip-on Thrd. Sock. W.	Lap Joint	Blind	
0.62	3/8	0.84	1 3/16	2 3/8	5/8	4	2	1	1	1	1/2
0.62	7/16	1.05	1 1/2	2 3/4	5/8	4	2	2	2	2	3/4
0.69	1/2	1.32	1 15/16	3 1/8	5/8	4	3	2	2	2	1
0.81	9/16	1.66	2 5/16	3 1/2	5/8	4	3	3	3	3	1 1/4
0.88	5/8	1.90	2 9/16	3 7/8	5/8	4	4	3	3	4	1 1/2
1.00	11/16	2.38	3 1/16	4 3/4	3/4	4	6	5	5	5	2
1.12	3/4	2.88	3 9/16	5 1/2	3/4	4	8	7	7	7	2 1/2
1.19	13/16	3.50	4 1/4	6	3/4	4	10	8	8	9	3
1.25	7/8	4.00	4 13/16	7	3/4	8	12	11	11	13	3 1/2
1.31	15/16	4.50	5 5/16	7 1/2	3/4	8	15	13	13	17	4
1.44	15/16	5.56	6 7/16	8 1/2	7/8	8	19	15	15	20	5
1.56	1 1/16	6.63	7 9/16	9 1/2	7/8	8	24	19	19	26	6
1.75	1 1/4	8.63	9 11/16	11 3/4	7/8	8	39	30	30	45	8
1.94	1 5/16	10.75	12	14 1/4	1	12	52	43	43	70	10
2.19	1 9/16	12.75	14 3/8	17	1	12	80	64	64	110	12
2.25	1 5/8	14.00	15 3/4	18 3/4	1 1/8	12	110	90	105	140	14
2.50	1 3/4	16.00	18	21 1/4	1 1/8	16	140	98	140	180	16
2.69	1 15/16	18.00	19 7/8	22 3/4	1 1/4	16	150	130	160	220	18
2.88	2 1/8	20.00	22	25	1 1/4	20	180	165	195	285	20
–	2 3/8	22.00	24 1/4	27 1/4	1 3/8	20	225	185	245	355	22
3.25	2 1/2	24.00	26 1/8	29 1/2	1 3/8	20	260	220	275	430	24

ANSI B16.5



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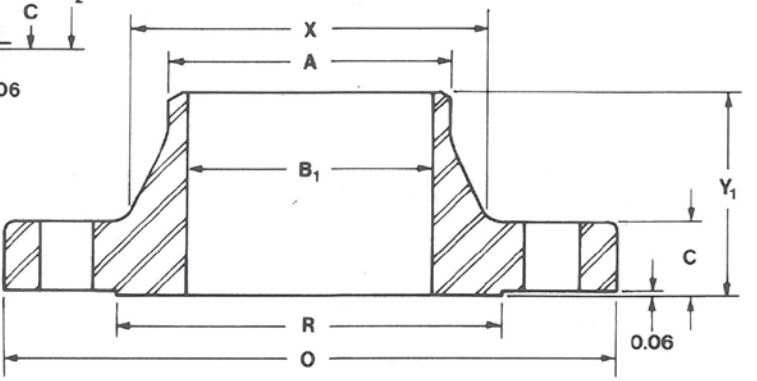
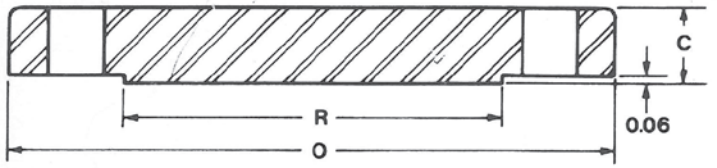


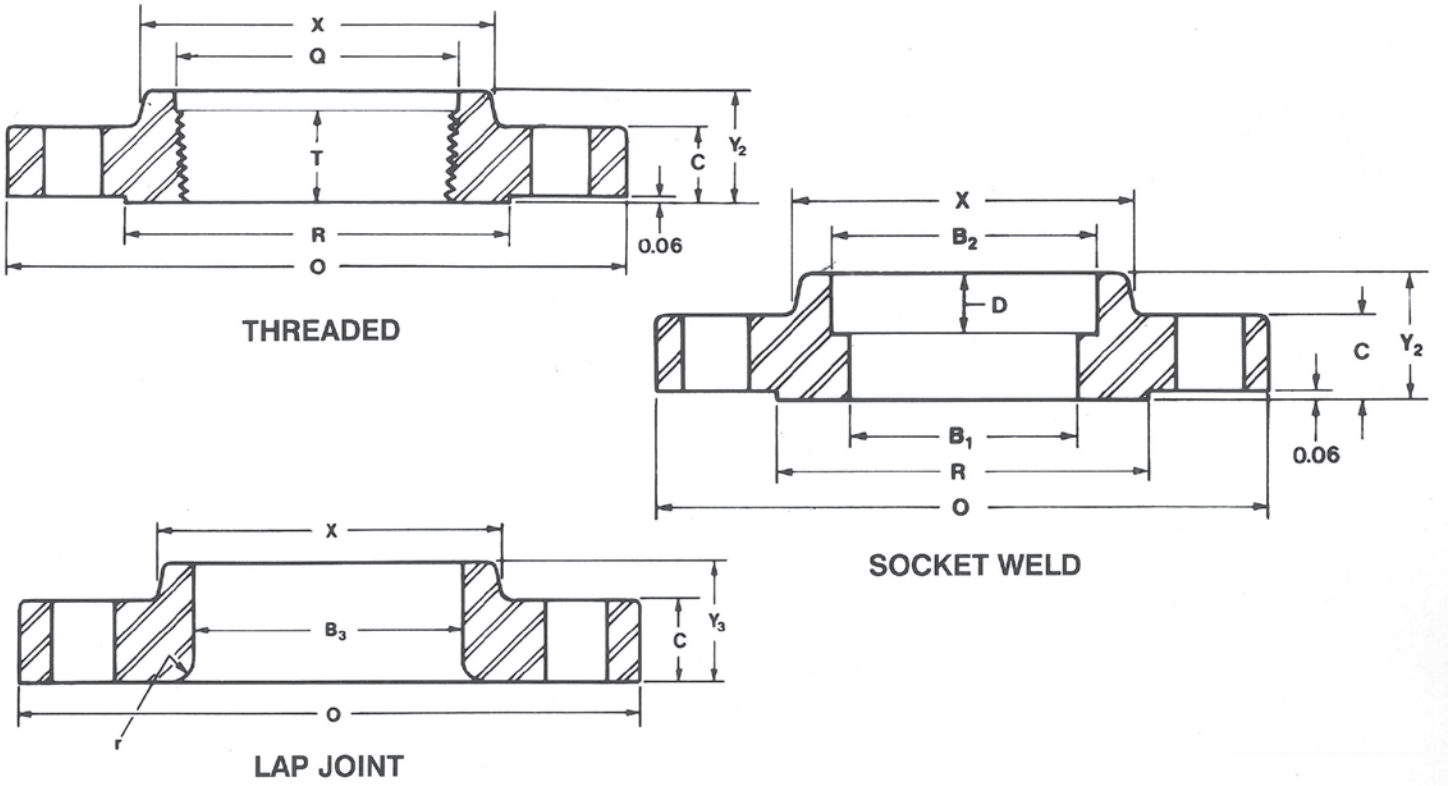
WELDING NECK



BLIND

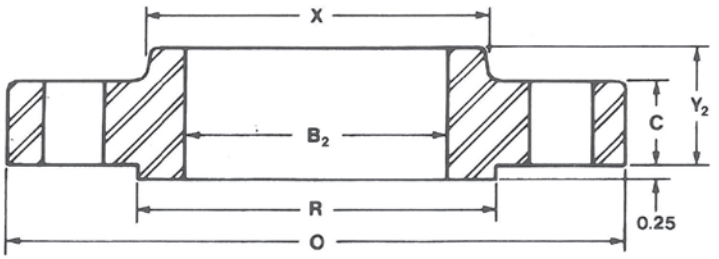
Nominal Size	Common Dimensions				Bore			Length Thru Hub		
	Outside Dia. O	Thk. C	Raised Face Dia. R	Fillet Radius r	Welding Neck Socket B_1	Slip-on B_2	Lap Joint B_3	Welding Neck Y_1	Slip-on Socket Y_2	Lap Joint Y_3
½	3 ¾	9/16	1 ⅜	⅛	To be specified by purchaser.	0.88	.90	2 1/16	⅞	⅞
¾	4 ⅝	⅝	1 11/16	⅛		1.09	1.11	2 ¼	1	1
1	4 ⅞	11/16	2	⅛		1.36	1.38	2 7/16	1 1/16	1 1/16
1 ¼	5 ¼	¾	2 ½	3/16		1.70	1.72	2 9/16	1 1/16	1 1/16
1 ½	6 ⅛	13/16	2 ⅞	¼		1.95	1.97	2 11/16	1 3/16	1 3/16
2	6 ½	⅞	3 ⅝	5/16		2.44	2.46	2 ¾	1 5/16	1 5/16
2 ½	7 ½	1	4 ⅛	5/16		2.94	2.97	3	1 ½	1 ½
3	8 ¼	1 ⅛	5	⅜		3.57	3.60	3 ⅛	1 11/16	1 11/16
3 ½	9	1 3/16	5 ½	⅜		4.07	4.10	3 3/16	1 ¾	1 ¾
4	10	1 ¼	6 3/16	7/16		4.57	4.60	3 ⅜	1 ⅞	1 ⅞
5	11	1 ⅜	7 5/16	7/16		5.66	5.69	3 ⅞	2	2
6	12 ½	1 7/16	8 ½	½		6.72	6.75	3 ⅞	2 1/16	2 1/16
8	15	1 ⅝	10 ⅝	½		8.72	8.75	4 ⅜	2 7/16	2 7/16
10	17 ½	1 ⅞	12 ¾	½		10.88	10.92	4 ⅝	2 ⅝	3 ¾
12	20 ½	2	15	½		12.88	12.92	5 ⅛	2 ⅞	4
14	23	2 ⅛	16 ¼	½		14.14	14.18	5 ¼	3	4 ⅜
16	25 ½	2 ¼	18 ½	½		16.16	16.19	5 ¾	3 ¼	4 ¾
18	28	2 ⅜	21	½		18.18	18.20	6 ¼	3 ½	5 ⅛
20	30 ½	2 ½	23	½		20.20	20.25	6 ⅜	3 ¾	5 ½
22	33	2 ⅝	25 ¼	½		22.22	22.25	6 ⅛	4	5 ¾
24	36	2 ¾	27 ¼	½		24.25	24.25	6 ⅝	4 3/16	6

ANSI B16.5



Min. Thread Length T	Depth of Socket D	Dia. Hub at Bevel A	Hub Dia. X	Drilling			Approx. Weight				Nominal Size
				Bolt Circle	Dia. Holes	No. Holes	Welding Neck	Slip-on Thrd. Sock. W.	Lap Joint	Blind	
0.63	.38	0.84	1 ½	2 ⅝	⅝	4	2	2	2	2	½
0.63	.44	1.05	1 ⅞	3 ¼	¾	4	3	3	3	3	¾
0.69	.50	1.32	2 ⅛	3 ½	¾	4	4	3	3	3	1
0.81	.56	1.66	2 ½	3 ⅞	¾	4	5	4	4	4	1 ¼
0.88	.63	1.90	2 ¾	4 ½	⅞	4	7	6	6	6	1 ½
1.13	.69	2.38	3 5/16	5	¾	8	9	7	7	8	2
1.25	.75	2.88	3 15/16	5 ⅞	⅞	8	12	10	10	12	2 ½
1.25	.81	3.50	4 ⅝	6 ⅝	⅞	8	15	13	13	16	3
1.44	.88	4.00	5 ¼	7 ¼	⅞	8	18	17	17	21	3 ½
1.44	.94	4.50	5 ¾	7 ⅞	⅞	8	25	22	22	27	4
1.69	—	5.56	7	9 ¼	⅞	8	32	28	28	35	5
1.81	—	6.63	8 ⅛	10 ⅝	⅞	12	42	39	39	50	6
2.00	—	8.63	10 ¼	13	1	12	67	58	58	81	8
2.19	—	10.75	12 ⅝	15 ¼	1 ⅛	16	91	81	91	124	10
2.38	—	12.75	14 ¾	17 ¾	1 ¼	16	140	115	140	185	12
2.50	—	14.00	16 ¾	20 ¼	1 ¼	20	180	165	190	250	14
2.69	—	16.00	19	22 ½	1 ⅜	20	250	190	250	295	16
2.75	—	18.00	21	24 ¾	1 ⅜	24	320	250	295	395	18
2.88	—	20.00	23 ⅛	27	1 ⅜	24	400	315	370	505	20
3.13	—	22.00	25 ¼	29 ¼	1 ⅝	24	465	370	435	640	22
3.25	—	24.00	27 ⅝	32	1 ⅝	24	580	475	550	790	24

ANSI B16.5



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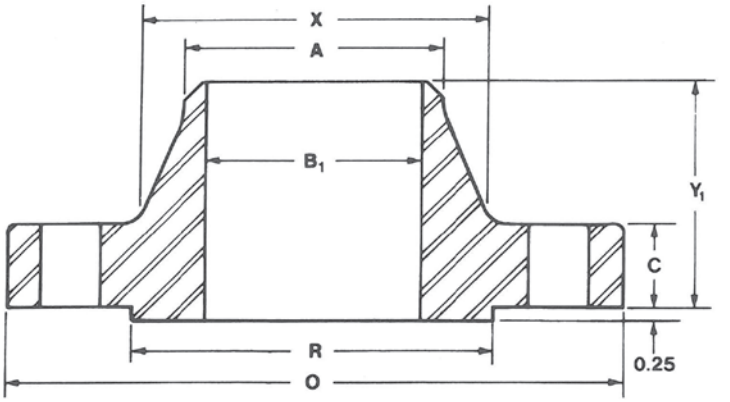
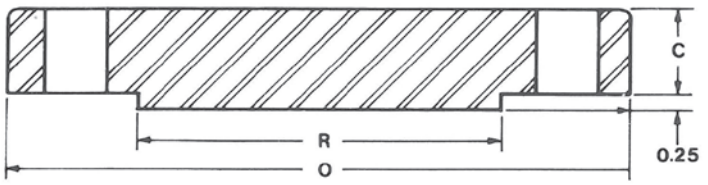


WELDING NECK

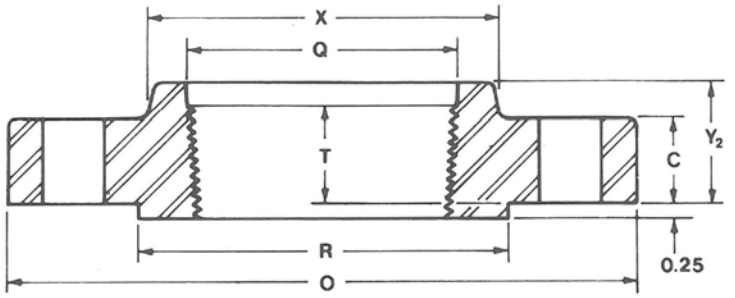


BLIND

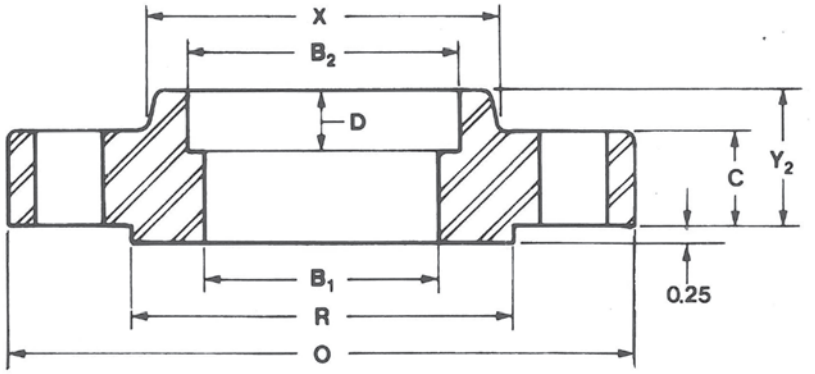
Nominal Size	Common Dimensions				Bore			Length Thru Hub		
	Outside Dia. O	Thk. C	Raised Face Dia. R	Fillet Radius r	Welding Neck Socket B_1	Slip-on B_2	Lap Joint B_3	Welding Neck Y_1	Slip-on Socket Y_2	Lap Joint Y_3
								SIZES ½" THRU 3 ½"		
4	10	1 ⅜	6 ³⁄₁₆	⁷⁄₁₆	To be specified by purchaser.	4.57	4.60	3 ½	2	2
5	11	1 ½	7 ⁵⁄₁₆	⁷⁄₁₆		5.66	5.69	4	2 ⅛	2 ⅛
6	12 ½	1 ⅝	8 ½	½		6.72	6.75	4 ¹⁄₁₆	2 ¼	2 ¼
8	15	1 ⅞	10 ⅝	½		8.72	8.75	4 ⅝	2 ¹¹⁄₁₆	2 ¹¹⁄₁₆
10	17 ½	2 ⅛	12 ¾	½		10.88	10.92	4 ⅞	2 ⅞	4
12	20 ½	2 ¼	15	½		12.88	12.92	5 ⅜	3 ⅛	4 ¼
14	23	2 ⅜	16 ¼	½		14.14	14.18	5 ⅞	3 ⁵⁄₁₆	4 ⅝
16	25 ½	2 ½	18 ½	½		16.16	16.19	6	3 ¹¹⁄₁₆	5
18	28	2 ⅝	21	½		18.18	18.20	6 ½	3 ⅞	5 ⅜
20	30 ½	2 ¾	23	½		20.20	20.25	6 ⅝	4	5 ¾
22	33	2 ⅞	25 ¼	½		22.22	22.25	6 ¾	4 ¼	6
24	36	3	27 ¼	½		24.25	24.25	6 ⅞	4 ½	6 ¼

Thickness and length do not include ¼" raised face.

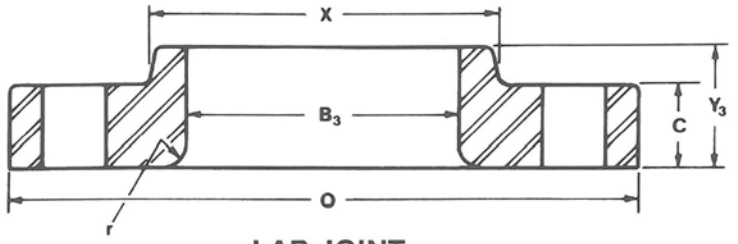
ANSI B16.5



THREADED



SOCKET WELD

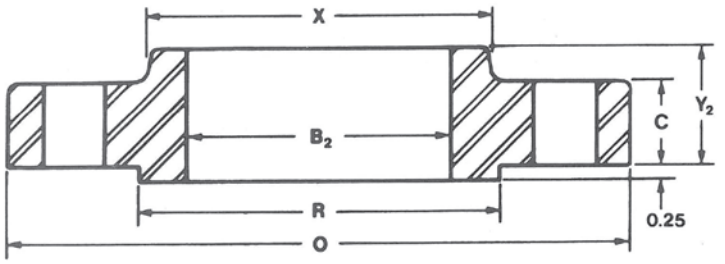


LAP JOINT

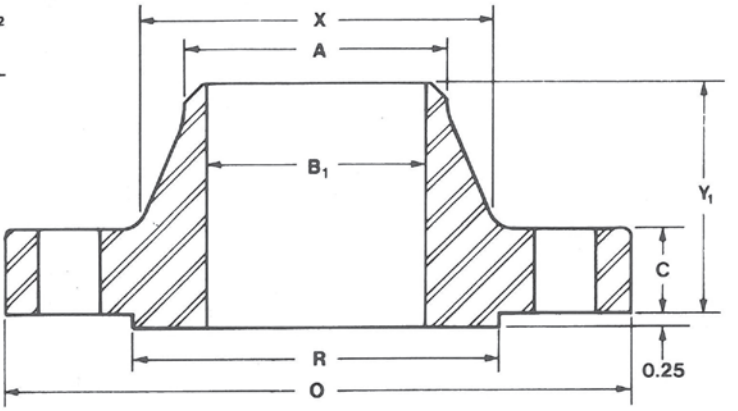
Min. Thread Length T	Dia. Hub at Bevel A	Hub Dia. X	Drilling: Bolt Circle	Drilling: Dia. Holes	Drilling: No. Holes	Approx. Weight: Welding Neck	Approx. Weight: Slip-on Thrd. Sock. W.	Approx. Weight: Lap Joint	Approx. Weight: Blind	Nominal Size
ARE IDENTICAL WITH CLASS 600										
1.44	4.50	5 ¾	7 ⅞	1	8	35	26	25	33	4
1.69	5.56	7	9 ¼	1	8	43	31	29	44	5
1.81	6.63	8 ⅛	10 ⅝	1	12	57	44	42	61	6
2.00	8.63	10 ¼	13	1 ⅛	12	89	67	64	100	8
2.19	10.75	12 ⅝	15 ¼	1 ¼	16	125	91	110	155	10
2.38	12.75	14 ¾	17 ¾	1 ⅜	16	175	130	150	225	12
2.50	14.00	16 ¾	20 ¼	1 ⅜	20	230	180	205	290	14
2.69	16.00	19	22 ½	1 ½	20	295	235	260	370	16
2.75	18.00	21	24 ¾	1 ½	24	350	285	315	455	18
2.88	20.00	23 ⅛	27	1 ⅝	24	425	345	385	587	20
—	22.00	25 ¼	29 ¼	1 ¾	24	505	405	455	720	22
3.25	24.00	27 ⅝	32	1 ⅞	24	620	510	570	890	24

See 300 Class dimensions for dimensions “Q” and “D”.

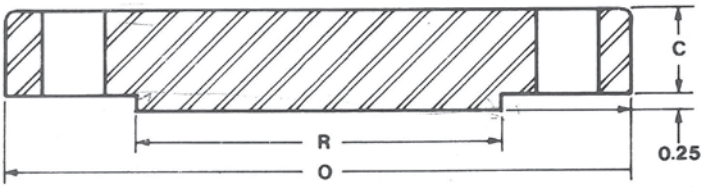
ANSI B16.5



SLIP-ON



WELDING NECK

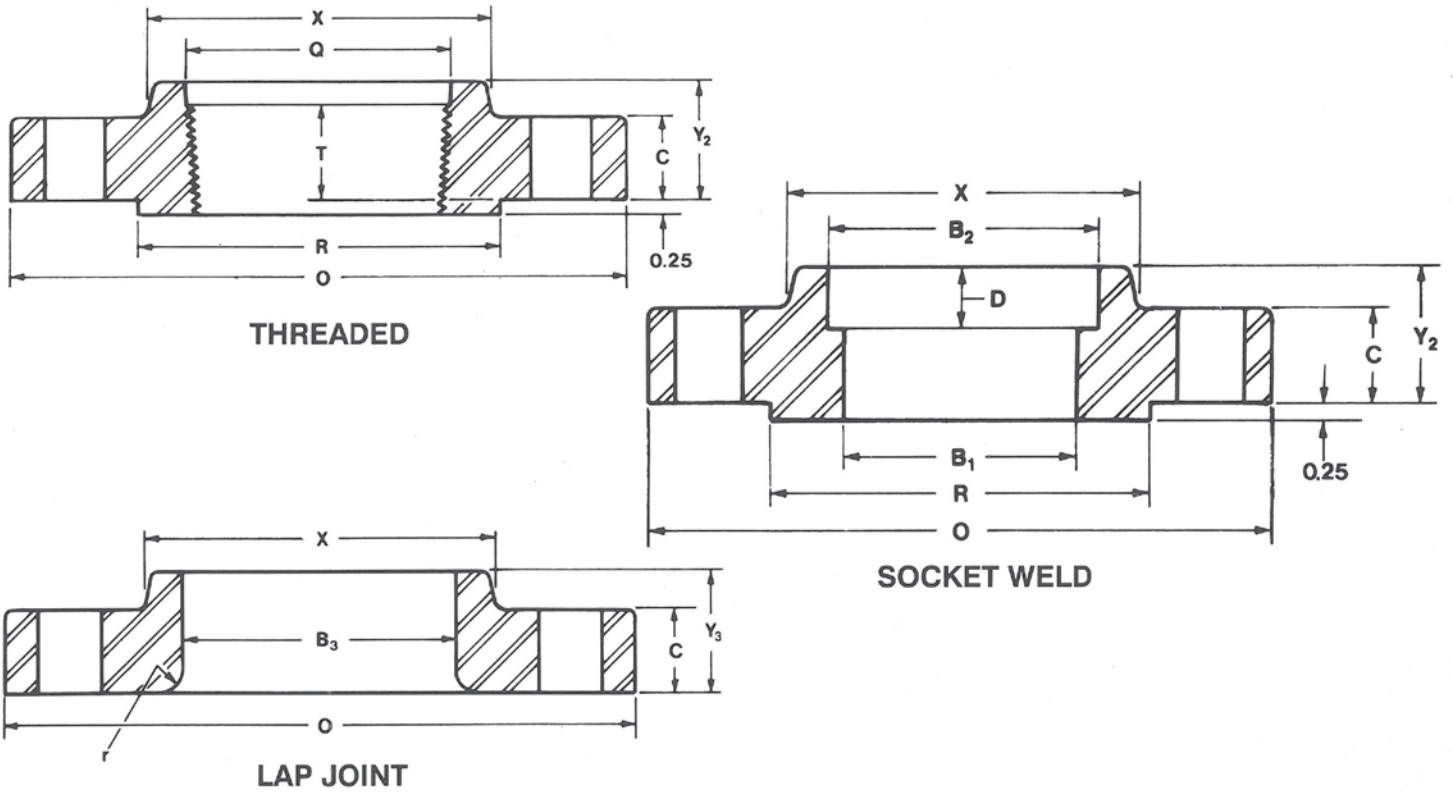


BLIND

Nominal Size	Common Dimensions				Bore			Length Thru Hub		
	Outside Dia. O	Thk. C	Raised Face Dia. R	Fillet Radius r	Welding Neck Socket B_1	Slip-on B_2	Lap Joint B_3	Welding Neck Y_1	Slip-on Socket Y_2	Lap Joint Y_3
½	3 ¾	9/16	1 ⅜	⅛	To be specified by purchaser.	0.88	.90	2 1/16	⅞	⅞
¾	4 ⅝	⅝	1 11/16	⅛		1.09	1.11	2 ¼	1	1
1	4 ⅞	11/16	2	⅛		1.36	1.38	2 7/16	1 1/16	1 1/16
1 ¼	5 ¼	13/16	2 ½	3/16		1.70	1.72	2 ⅝	1 ⅛	1 ⅛
1 ½	6 ⅛	⅞	2 ⅞	¼		1.95	1.97	2 ¾	1 ¼	1 ¼
2	6 ½	1	3 ⅝	5/16		2.44	2.46	2 ⅞	1 7/16	1 7/16
2 ½	7 ½	1 ⅛	4 ⅛	5/16		2.94	2.97	3 ⅛	1 ⅝	1 ⅝
3	8 ¼	1 ¼	5	⅜		3.57	3.60	3 ¼	1 13/16	1 13/16
3 ½	9	1 ⅜	5 ½	⅜		4.07	4.10	3 ⅜	1 15/16	1 15/16
4	10 ¾	1 ½	6 3/16	7/16		4.57	4.60	4	2 ⅛	2 ⅛
5	13	1 ¾	7 5/16	7/16		5.66	5.69	4 ½	2 ⅜	2 ⅜
6	14	1 ⅞	8 ½	½		6.72	6.75	4 ⅝	2 ⅝	2 ⅝
8	16 ½	2 3/16	10 ⅝	½		8.72	8.75	5 ¼	3	3
10	20	2 ½	12 ¾	½		10.88	10.92	6	3 ⅜	4 ⅜
12	22	2 ⅝	15	½		12.88	12.92	6 ⅛	3 ⅝	4 ⅝
14	23 ¾	2 ¾	16 ¼	½		14.14	14.18	6 ½	3 11/16	5
16	27	3	18 ½	½		16.16	16.19	7	4 3/16	5 ½
18	29 ¼	3 ¼	21	½		18.18	18.20	7 ¼	4 ⅝	6
20	32	3 ½	23	½		20.20	20.25	7 ½	5	6 ½
22	34 ¼	3 ¾	25 ¼	½		22.22	22.25	7 ¾	5 ¼	6 ⅞
24	37	4	27 ¼	½		24.25	24.25	8	5 ½	7 ¼

Thickness and length do not include ¼" raised face.

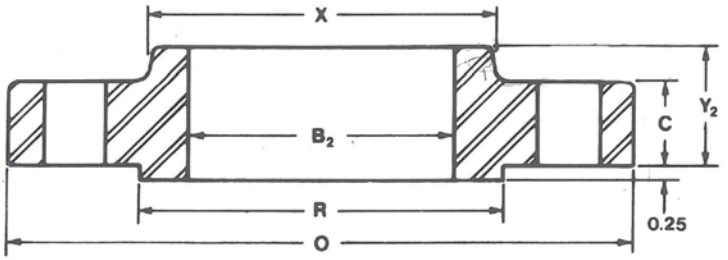
ANSI B16.5



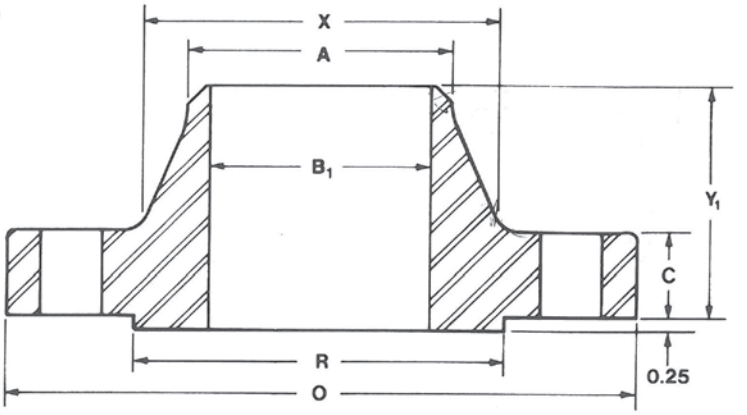
Min. Thread Length T	Depth of Socket D	Dia. Hub at Bevel A	Hub Dia. X	Drilling			Approx. Weight				Nominal Size
				Bolt Circle	Dia. Holes	No. Holes	Welding Neck	Slip-on Thrd. Sock. W.	Lap Joint	Blind	
0.63	3/8	0.84	1 1/2	2 5/8	5/8	4	2	2	2	2	1/2
0.63	7/16	1.05	1 7/8	3 1/4	3/4	4	4	3	3	3	3/4
0.69	1/2	1.32	2 1/8	3 1/2	3/4	4	4	4	4	4	1
0.81	9/16	1.66	2 1/2	3 7/8	3/4	4	6	5	5	5	1 1/4
0.88	5/8	1.90	2 3/4	4 1/2	7/8	4	8	7	7	8	1 1/2
1.13	11/16	2.38	3 5/16	5	3/4	8	12	9	9	10	2
1.25	3/4	2.88	3 15/16	5 7/8	7/8	8	18	13	12	15	2 1/2
1.38	13/16	3.50	4 5/8	6 5/8	7/8	8	23	16	15	20	3
1.56	7/8	4.00	5 1/4	7 1/4	1	8	26	21	20	29	3 1/2
1.63	15/16	4.50	6	8 1/2	1	8	42	37	36	41	4
1.88	15/16	5.56	7 7/16	10 1/2	1 1/8	8	68	63	61	68	5
2.00	1 1/16	6.63	8 3/4	11 1/2	1 1/8	12	81	80	78	86	6
2.25	1 1/4	8.63	10 3/4	13 3/4	1 1/4	12	120	115	110	140	8
2.56	1 5/16	10.75	13 1/2	17	1 3/8	16	190	170	170	230	10
2.75	1 9/16	12.75	15 3/4	19 1/4	1 3/8	20	225	200	200	295	12
2.88	1 5/8	14.00	17	20 3/4	1 1/2	20	280	230	250	355	14
3.06	1 3/4	16.00	19 1/2	23 3/4	1 5/8	20	390	330	365	495	16
3.13	1 15/16	18.00	21 1/2	25 3/4	1 3/4	20	475	400	435	630	18
3.25	2 1/8	20.00	24	28 1/2	1 3/4	24	590	510	570	810	20
—	2 3/8	22.00	26 1/4	30 5/8	1 7/8	24	720	590	670	1000	22
3.63	2 1/2	24.00	28 1/4	33	2	24	830	730	810	1250	24

See 300 Class dimensions for dimensions “Q” and “D”.

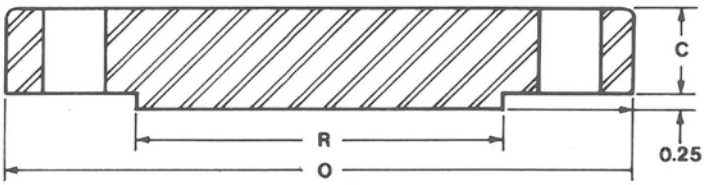
ANSI B16.5



SLIP-ON



WELDING NECK

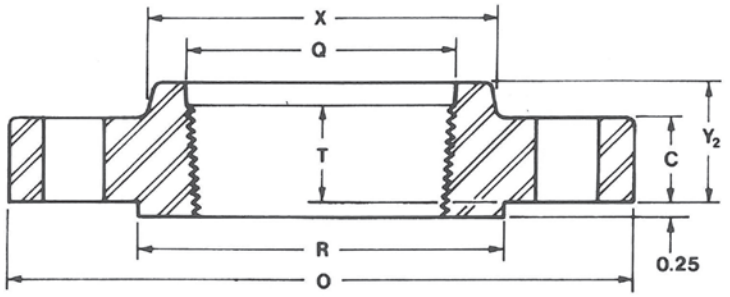


BLIND

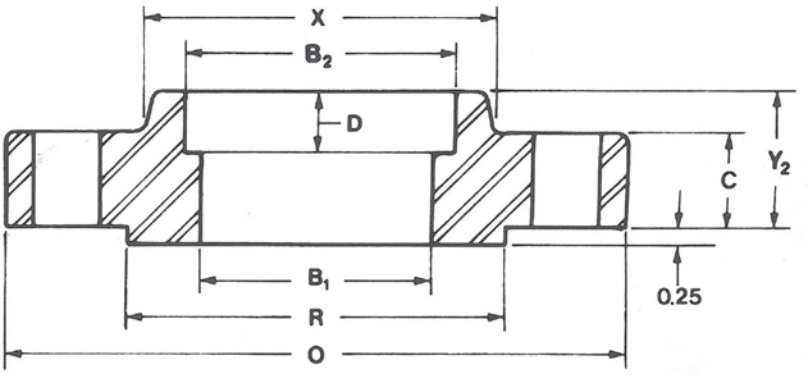
Nominal Size	Common Dimensions				Bore			Length Thru Hub		
	Outside Dia. O	Thk. C	Raised Face Dia. R	Fillet Radius r	Welding Neck Socket B_1	Slip-on B_2	Lap Joint B_3	Welding Neck Y_1	Slip-on Socket Y_2	Lap Joint Y_3
								SIZES ½" THRU 2 ½" ARE		
3	9 ½	1 ½	5	⅜	To be specified by purchaser.	3.57	3.60	4	2 ⅛	2 ⅛
4	11 ½	1 ¾	6 3/16	7/16		4.57	4.60	4 ½	2 ¾	2 ¾
5	13 ¾	2	7 5/16	7/16		5.66	5.69	5	3 ⅛	3 ⅛
6	15	2 3/16	8 ½	½		6.72	6.75	5 ½	3 ⅜	3 ⅜
8	18 ½	2 ½	10 ⅝	½		8.72	8.75	6 ⅜	4	4 ½
10	21 ½	2 ¾	12 ¾	½		10.88	10.92	7 ¼	4 ¼	5
12	24	3 ⅛	15	½		12.88	12.92	7 ⅞	4 ⅝	5 ⅝
14	25 ¼	3 ⅜	16 ¼	½		14.14	14.18	8 ⅜	5 ⅛	6 ⅛
16	27 ¾	3 ½	18 ½	½		16.16	16.19	8 ½	5 ¼	6 ½
18	31	4	21	½		18.18	18.20	9	6	7 ½
20	33 ¾	4 ¼	23	½		20.20	20.25	9 ¾	6 ¼	8 ¼
24	41	5 ½	27 ¼	½		24.25	24.25	11 ½	8	10 ½

Thickness and length do not include ¼" raised face.

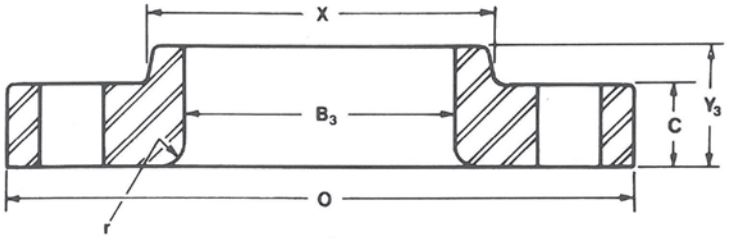
ANSI B16.5



THREADED



SOCKET WELD

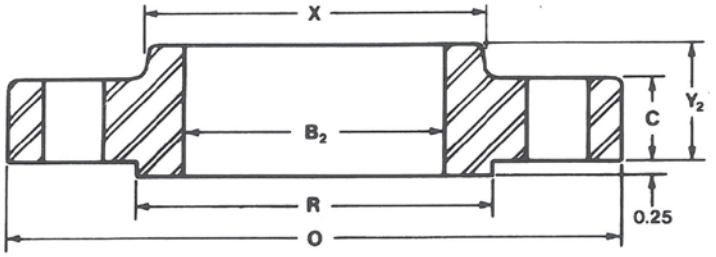


LAP JOINT

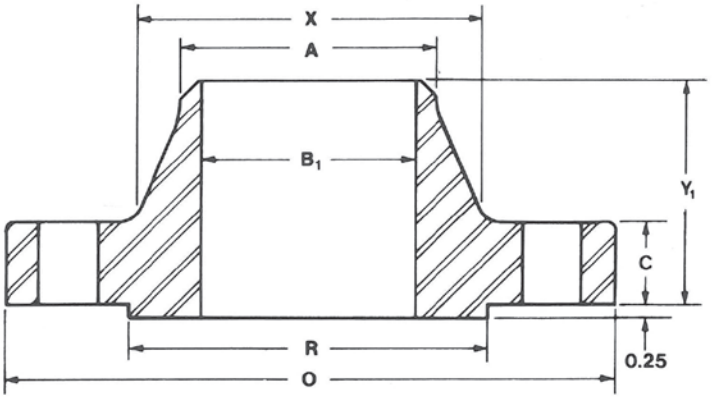
Min. Thread Length T	Dia. Hub at Bevel A	Hub Dia. X	Drilling: Bolt Circle	Drilling: Dia. Holes	Drilling: No. Holes	Approx. Weight: Welding Neck	Approx. Weight: Slip-on Thrd. Sock. W.	Approx. Weight: Lap Joint	Approx. Weight: Blind	Nominal Size
ARE IDENTICAL WITH CLASS 1500										
1.63	3.50	5	7 ½	1	8	31	26	25	29	3
1.88	4.50	6 ¼	9 ¼	1 ¼	8	53	53	51	54	4
2.13	5.56	7 ½	11	1 ⅜	8	86	83	81	87	5
2.25	6.63	9 ¼	12 ½	1 ¼	12	110	110	105	115	6
2.50	8.63	11 ¾	15 ½	1 ½	12	175	170	190	200	8
2.81	10.75	14 ½	18 ½	1 ½	16	260	245	275	290	10
3.00	12.75	16 ½	21	1 ½	20	325	325	370	415	12
3.25	14.00	17	22	1 ⅝	20	400	400	415	520	14
3.38	16.00	20	24 ¼	1 ¾	20	495	425	465	600	16
3.50	18.00	22 ¼	27	2	20	680	600	650	850	18
3.63	20.00	24 ½	29 ½	2 ⅛	20	830	730	810	1075	20
4.00	24.00	29 ½	35 ½	2 ⅝	20	1500	1400	1550	2025	24

See 300 Class dimensions for dimensions “Q” and “D”.

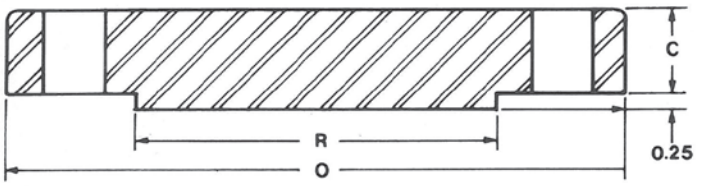
ANSI B16.5



SLIP-ON



WELDING NECK

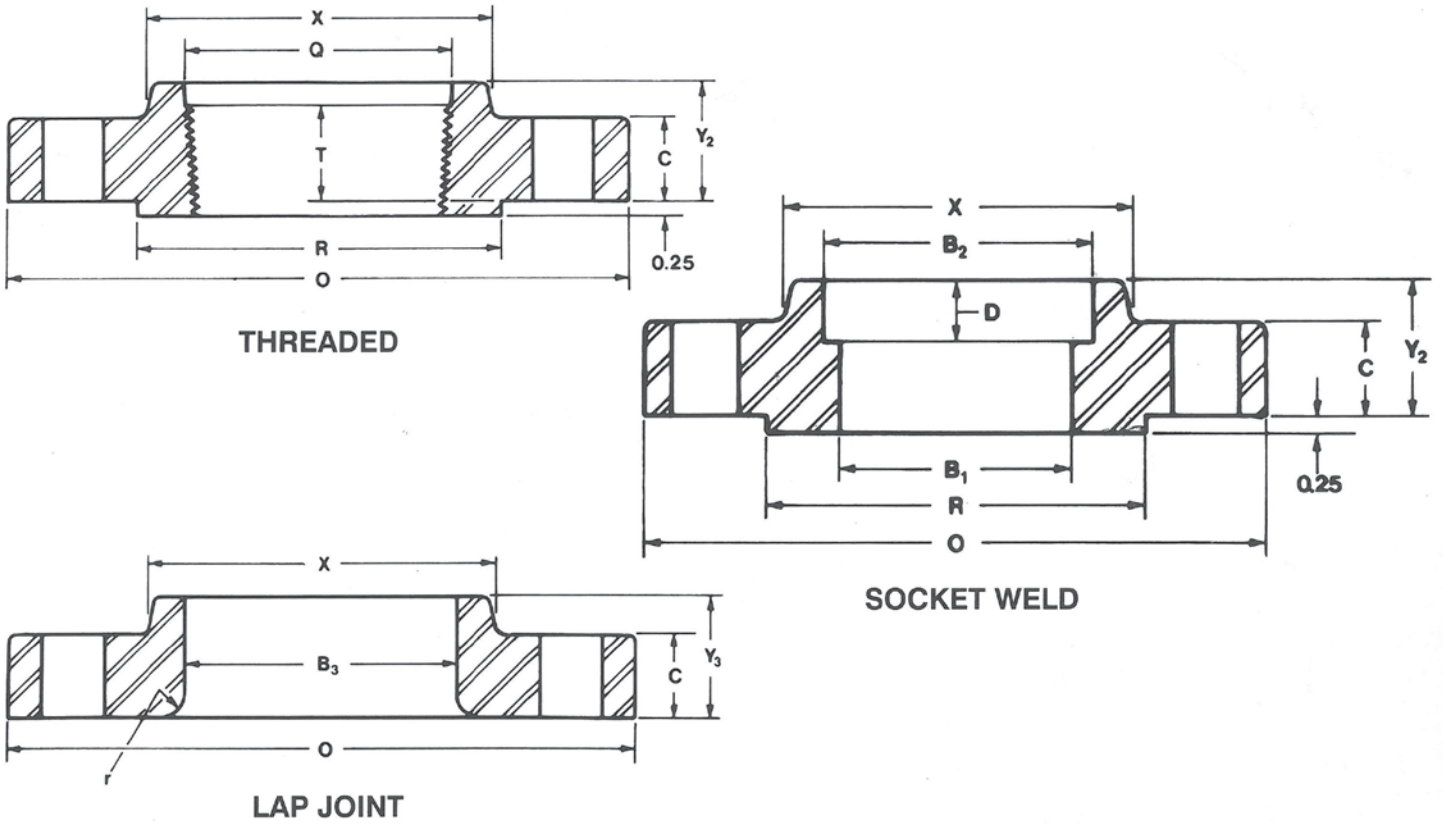


BLIND

Nominal Size	Common Dimensions				Bore			Length Thru Hub		
	Outside Dia. O	Thk. C	Raised Face Dia. R	Fillet Radius r	Welding Neck Socket B_1	Slip-on B_2	Lap Joint B_3	Welding Neck Y_1	Slip-on Socket Y_2	Lap Joint Y_3
½	4 ¾	⅞	1 ⅜	⅛	To be specified by purchaser.	0.88	.90	2 ⅜	1 ¼	1 ¼
¾	5 ⅛	1	1 11/16	⅛		1.09	1.11	2 ¾	1 ⅜	1 ⅜
1	5 ⅞	1 ⅛	2	⅛		1.36	1.38	2 ⅞	1 ⅝	1 ⅝
1 ¼	6 ¼	1 ⅛	2 ½	3/16		1.70	1.72	2 ⅞	1 ⅝	1 ⅝
1 ½	7	1 ¼	2 ⅞	¼		1.95	1.97	3 ¼	1 ¾	1 ¾
2	8 ½	1 ½	3 ⅝	5/16		2.44	2.46	4	2 ¼	2 ¼
2 ½	9 ⅝	1 ⅝	4 ⅛	5/16		2.94	2.97	4 ⅛	2 ½	2 ½
3	10 ½	1 ⅞	5	⅜		3.57	3.60	4 ⅝	2 ⅞	2 ⅞
4	12 ¼	2 ⅛	6 3/16	7/16		4.57	4.60	4 ⅞	3 9/16	3 9/16
5	14 ¾	2 ⅞	7 5/16	7/16		5.66	5.69	6 ⅛	4 ⅛	4 ⅛
6	15 ½	3 ¼	8 ½	½		6.72	6.75	6 ¾	4 11/16	4 11/16
8	19	3 ⅝	10 ⅝	½		8.72	8.75	8 ⅜	5 ⅝	5 ⅝
10	23	4 ¼	12 ¾	½		10.88	10.92	10	6 ¼	7
12	26 ½	4 ⅞	15	½		12.88	12.92	11 ⅛	7 ⅛	8 ⅝
14	29 ½	5 ¼	16 ¼	½		14.14	14.18	11 ¾	—	9 ½
16	32 ½	5 ¾	18 ½	½		16.16	16.19	12 ¼	—	10 ¼
18	36	6 ⅜	21	½		18.18	18.20	12 ⅞	—	10 ⅞
20	38 ¾	7	23	½		20.20	20.25	14	—	11 ½
24	46	8	27 ¼	½		24.25	24.25	16	—	13

Thickness and length do not include ¼" raised face.

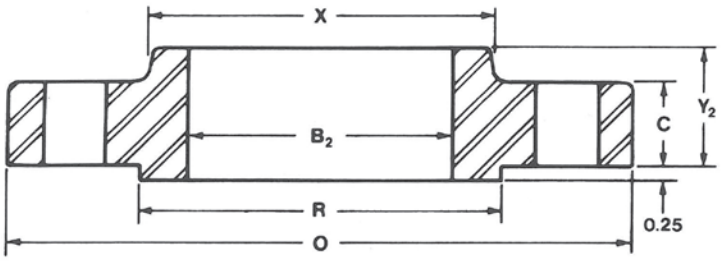
ANSI B16.5



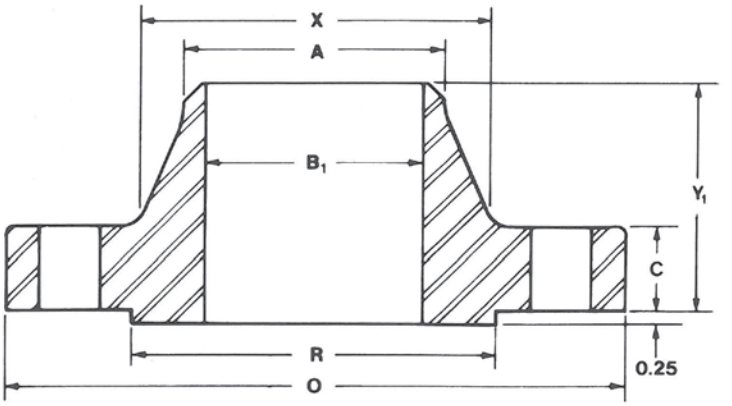
Min. Thread Length T	Depth of Socket D	Dia. Hub at Bevel A	Hub Dia. X	Drilling			Approx. Weight				Nominal Size
				Bolt Circle	Dia. Holes	No. Holes	Welding Neck	Slip-on Threaded	Lap Joint	Blind	
0.88	3/8	0.84	1 1/2	3 1/4	7/8	4	5	4	4	4	1/2
1.00	7/16	1.05	1 3/4	3 1/2	7/8	4	6	5	5	6	3/4
1.13	1/2	1.32	2 1/16	4	1	4	9	8	8	8	1
1.19	9/16	1.66	2 1/2	4 3/8	1	4	10	9	9	9	1 1/4
1.25	5/8	1.90	2 3/4	4 7/8	1 1/8	4	13	12	12	13	1 1/2
1.50	11/16	2.38	4 1/8	6 1/2	1	8	25	25	25	25	2
1.88	3/4	2.88	4 7/8	7 1/2	1 1/8	8	36	36	35	35	2 1/2
2.00	13/16	3.50	5 1/4	8	1 1/4	8	48	48	47	48	3
2.25	15/16	4.50	6 3/8	9 1/2	1 3/8	8	73	73	75	73	4
2.50	15/16	5.56	7 3/4	11 1/2	1 5/8	8	130	130	140	140	5
2.75	1 1/16	6.63	9	12 1/2	1 1/2	12	165	165	170	160	6
3.00	1 1/4	8.63	11 1/2	15 1/2	1 3/4	12	275	260	285	300	8
3.31	1 5/16	10.75	14 1/2	19	2	12	455	435	485	510	10
3.36	1 9/16	12.75	17 3/4	22 1/2	2 1/8	16	690	580	630	690	12
—	1 5/8	14.00	19 1/2	25	2 3/8	16	940	—	890	975	14
—	1 3/4	16.00	21 3/4	27 3/4	2 5/8	16	1250	—	1150	1300	16
—	1 15/16	18.00	23 1/2	30 1/2	2 7/8	16	1625	—	1475	1750	18
—	2 1/8	20.00	25 1/4	32 3/4	3 1/8	16	2050	—	1775	2225	20
—	2 1/2	24.00	30	39	3 5/8	16	3325	—	2825	3625	24

See 300 Class dimensions for dimensions “Q” and “D”.

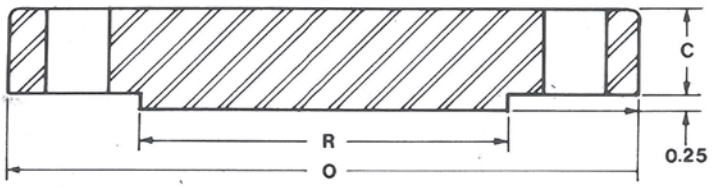
ANSI B16.5



SLIP-ON



WELDING NECK

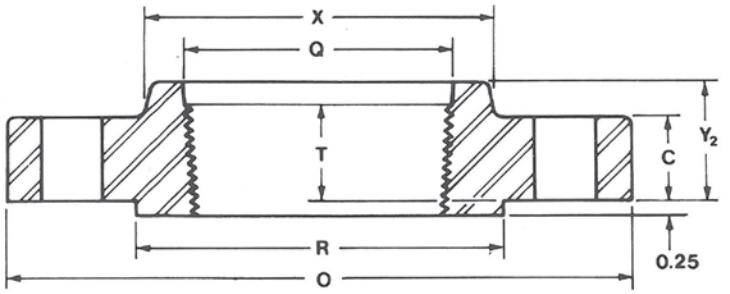


BLIND

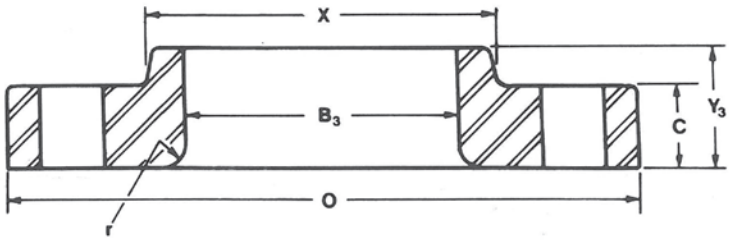
Nominal Size	Common Dimensions				Bore			Length Thru Hub		
	Outside Dia. O	Thk. C	Raised Face Dia. R	Fillet Radius r	Welding Neck Socket B_1	Slip-on B_2	Lap Joint B_3	Welding Neck Y_1	Slip-on Y_2	Lap Joint Y_3
½	5 ¼	1 3/16	1 3/8	⅛	To be specified by purchaser.	0.88	.90	2 7/8	1 9/16	1 9/16
¾	5 ½	1 ¼	1 11/16	⅛		1.09	1.11	3 ⅛	1 11/16	1 11/16
1	6 ¼	1 3/8	2	⅛		1.36	1.38	3 ½	1 7/8	1 7/8
1 ¼	7 ¼	1 ½	2 ½	3/16		1.70	1.72	3 ¾	2 1/16	2 1/16
1 ½	8	1 ¾	2 7/8	¼		1.95	1.97	4 3/8	2 3/8	2 3/8
2	9 ¼	2	3 5/8	5/16		2.44	2.46	5	2 ¾	2 ¾
2 ½	10 ½	2 ¼	4 ⅛	5/16		2.94	2.97	5 5/8	3 ⅛	3 ⅛
3	12	2 5/8	5	3/8		3.57	3.60	6 5/8	3 5/8	3 5/8
4	14	3	6 3/16	7/16		4.57	4.60	7 ½	4 ¼	4 ¼
5	16 ½	3 5/8	7 5/16	7/16		5.66	5.69	9	5 ⅛	5 ⅛
6	19	4 ¼	8 ½	½		6.72	6.75	10 ¾	6	6
8	21 ¾	5	10 5/8	½		8.72	8.75	12 ½	7	7
10	26 ½	6 ½	12 ¾	½		10.88	10.92	16 ½	9	9
12	30	7 ¼	15	½		12.88	12.92	18 ¼	10	10

Class 2500 Slip-Ons are not included in ANSI B16.5 specifications.
Thickness and length do not include ¼" raised face.

ANSI B16.5



THREADED

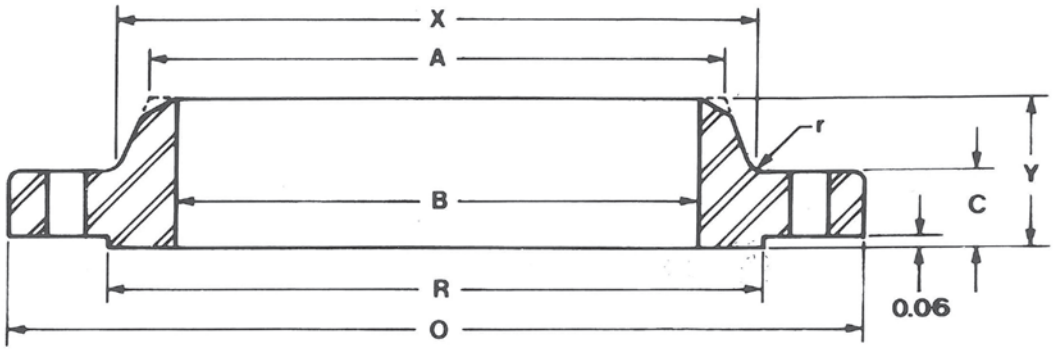


LAP JOINT

Min. Thread Length T	Dia. Hub at Bevel A	Hub Dia. X	Drilling			Approx. Weight				Nominal Size
			Bolt Circle	Dia. Holes	No. Holes	Welding Neck	Slip-on Threaded	Lap Joint	Blind	
1.13	0.84	1 11/16	3 1/2	7/8	4	7	7	7	7	1/2
1.25	1.05	2	3 3/4	7/8	4	8	8	8	8	3/4
1.38	1.32	2 1/4	4 1/4	1	4	12	11	11	11	1
1.50	1.66	2 7/8	5 1/8	1 1/8	4	17	16	16	17	1 1/4
1.75	1.90	3 1/8	5 3/4	1 1/4	4	25	22	22	23	1 1/2
2.00	2.38	3 3/4	6 3/4	1 1/8	8	42	38	37	39	2
2.25	2.88	4 1/2	7 3/4	1 1/4	8	52	55	53	56	2 1/2
2.50	3.50	5 1/4	9	1 3/8	8	94	83	80	86	3
2.75	4.50	6 1/2	10 3/4	1 5/8	8	145	125	120	135	4
3.00	5.56	8	12 3/4	1 7/8	8	245	210	205	225	5
3.25	6.63	9 1/4	14 1/2	2 1/8	8	380	325	315	345	6
3.75	8.63	12	17 1/4	2 1/8	12	580	485	470	530	8
4.25	10.75	14 3/4	21 1/4	2 5/8	12	1075	930	900	1025	10
4.75	12.75	17 3/8	24 3/8	2 7/8	12	1525	1100	1100	1300	12

See 300 Class dimensions for dimensions “Q” and “D”.

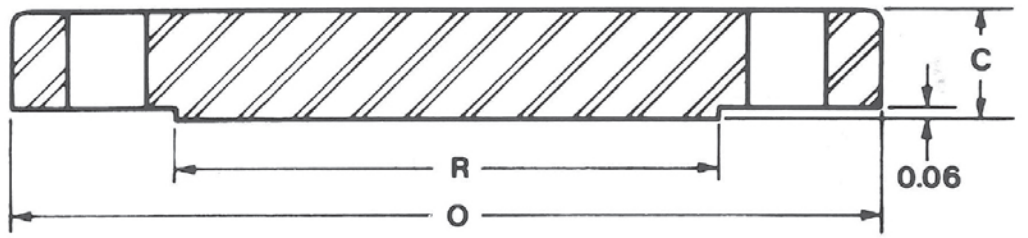
API 605



WELDING NECK

Nominal Size	Outside Dia. O	Thickness C		Raised Face Dia. R	Fillet Radius r	Bore B	Length Thru Hub Y	Dia. Hub at Bevel A	Hub Dia. X
		Welding Neck	Blind						
26	30	1 5/16	1 5/16	27 3/4	3/8		2 5/16	26.06	26 5/8
28	32	1 5/16	1 5/16	29 3/4	3/8		2 7/16	28.06	28 5/8
30	34	1 5/16	1 3/8	31 3/4	3/8		2 9/16	30.06	30 5/8
32	36	1 3/8	1 31/64	33 3/4	3/8		2 3/4	32.06	32 5/8
34	38	1 3/8	1 1/2	35 3/4	1/2		2 7/8	34.06	34 5/8
36	40 11/16	1 7/16	1 5/8	38	1/2		3 3/8	36.06	36 13/16
38	42 11/16	1 1/2	1 11/16	40	1/2		3 1/2	38.06	38 13/16
40	44 11/16	1 1/2	1 3/4	42	1/2		3 5/8	40.06	40 13/16
42	46 11/16	1 9/16	1 7/8	44	1/2		3 3/4	42.06	42 13/16
44	49 1/4	1 11/16	2	46 1/2	1/2		4 1/8	44.06	44 7/8
46	51 1/4	1 3/4	2 1/16	48 1/4	1/2		4 1/4	46.06	46 7/8
48	53 1/4	1 13/16	2 1/8	50 1/4	1/2		4 3/8	48.06	48 7/8
50	55 1/4	1 7/8	2 1/4	52 1/4	1/2		4 9/16	50.06	50 15/16
52	57 3/8	1 7/8	2 5/16	54 1/4	1/2	To be specified by purchaser.	4 3/4	52.06	52 15/16
54	59 3/8	1 15/16	2 3/8	56 1/4	5/8		4 15/16	54.06	55
56	62	2	2 1/2	58 1/2	5/8		5 5/16	56.06	57 1/8
58	64	2 1/16	2 9/16	60 1/2	5/8		5 7/16	58.06	59 1/8
60	66	2 3/16	2 5/8	62 1/2	5/8		5 11/16	60.06	61 1/8

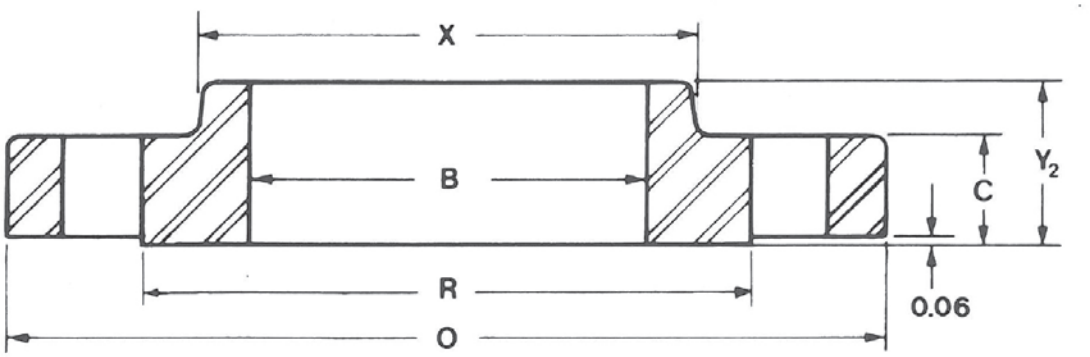
API 605



BLIND

Drilling			Approx. Weight		
Bolt Circle	Dia. Holes	No. Holes	Welding Neck	Blind	Nominal Size
28 ½	¾	36	80	255	26
30 ½	¾	40	85	290	28
32 ½	¾	44	90	330	30
34 ½	¾	48	105	390	32
36 ½	¾	52	110	430	34
39 1/16	⅞	40	145	518	36
41 1/16	⅞	40	160	595	38
43 1/16	⅞	44	170	760	40
45 1/16	⅞	48	185	895	42
47 ⅜	1	36	230	1065	44
49 ⅜	1	40	245	1185	46
51 ⅜	1	44	270	1315	48
53 ⅜	1	44	290	1505	50
55 ½	1	48	310	1665	52
57 ½	1	48	340	1840	54
59 ½	1 ⅛	40	400	2110	56
61 ⅞	1 ⅛	44	430	2300	58
63 ⅞	1 ⅛	44	475	2500	60

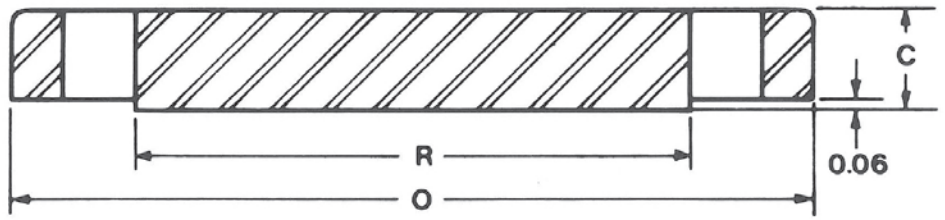
INDUSTRY STANDARD



SLIP-ON

Nominal Size	Outside Dia. O	Thickness C		O.D. Raised Face R	Dia. at Base of Hub X	Bore B	Length Thru Hub Y
		Slip-On	Blind				
26	33	1 ¼	1 ¼	30	28 ½	26.25	2 ¼
28	35	1 ¼	1 ⅜	32	30 ½	28.25	2 ¼
30	37	1 ¼	1 ⅜	34	32 ½	30.25	2 ¼
32	39 ½	1 ¼	1 ½	36 ¼	34 ⅝	32.25	2 ½
34	41 ½	1 ¼	1 ⅝	38 ¼	36 ⅝	34.25	2 ½
36	43 ½	1 ¼	1 ⅝	40 ¼	38 ⅝	36.25	2 ½
42	50	1 ¼	1 ⅞	46 ½	44 ¾	42.25	2 ¾
48	56	1 ¼	2 ⅛	52 ½	50 ¾	48.25	2 ⅞
54	62 ½	1 ⅜	2 ⅜	59	57 ¼	54.25	3 ⅛
60	68 ½	1 ⅝	2 ⅝	65	63 ¼	60.25	3 ⅝
66	75 ½	1 ¾	2 ⅞	71 ⅝	69 ½	66.25	4
72	81 ½	2	3 ⅛	77 ⅝	75 ½	72.25	4 ½

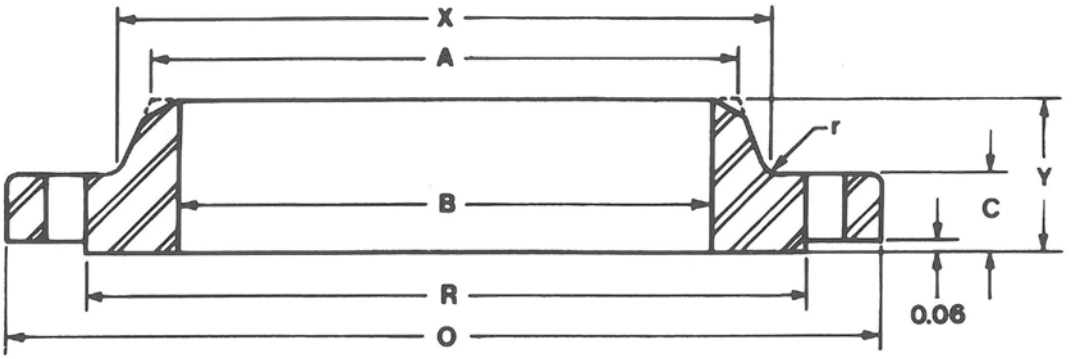
INDUSTRY STANDARD



BLIND

Drilling			Approx. Weight		Nominal Size
Bolt Circle	Dia. Holes	No. Holes	Slip-On	Blind	
31	1	32	120	290	26
33	1	36	140	360	28
35	1	36	150	405	30
37 3/8	1 1/8	40	170	500	32
39 3/8	1 1/8	40	180	600	34
41 3/8	1 1/8	44	190	660	36
47 3/4	1 1/4	48	235	1000	42
53 3/4	1 1/4	56	270	1450	48
60 1/4	1 1/4	68	335	2000	54
66 1/4	1 1/4	72	450	2675	60
73	1 3/8	72	590	3550	66
79	1 3/8	80	730	4500	72

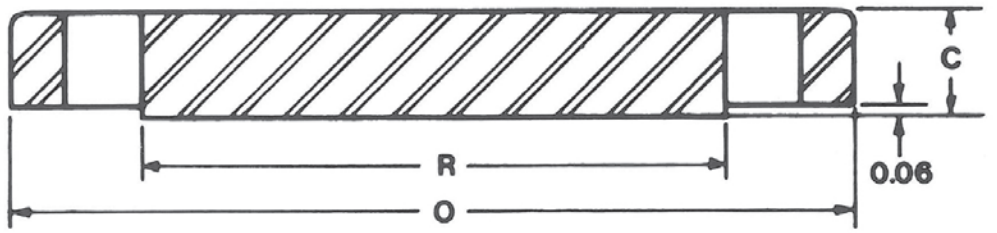
INDUSTRY STANDARD



WELDING NECK

Nominal Size	Outside Dia. O	Thickness C		O.D. Raised Face R	Dia. at Base of Hub X	Bore B	Length Thru Hub Y	Dia. Hub at Bevel Y
		Welding Neck	Blind					
26	31 ½	1 1/64	1 ¼	28 ⅝	27 ⅛	To be specified by purchaser.	3	To be specified by purchaser.
28	33 ½	1 ¼	1 ¼	30 ⅝	19 ⅛		3	
30	35 ½	1 ¼	1 ⅜	32 ⅝	31 ⅛		3	
32	38 ½	1 ¼	1 ½	35	33 ⅜		3 ¼	
34	40 ½	1 ¼	1 ½	37	35 ⅜		3 ¼	
36	42 ½	1 ¼	1 ⅝	39	37 ⅜		3 ¼	
42	49	1 ¼	1 ⅞	45 ½	43 ¾		3 ½	
48	55	1 ¼	2 ⅛	51 ½	49 ¾		3 ¾	
54	61 ¼	1 ⅜	2 ⅜	57 ¾	56		4	
60	67 ¼	1 ⅝	2 ⅝	63 ¾	62		4 ⅜	
66	74	1 ⅞	2 ⅞	70 ⅛	68		4 ⅞	
72	80	2 ¼	3 ⅛	76 ⅛	74		5 ¼	

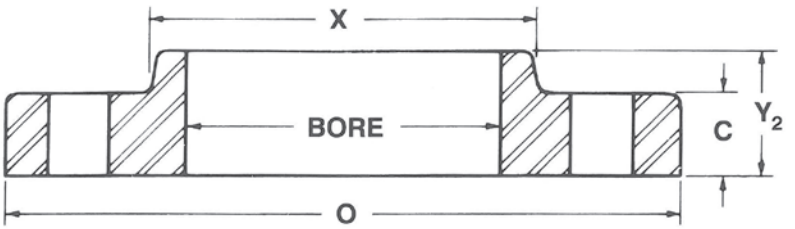
INDUSTRY STANDARD



BLIND

Drilling			Approx. Weight		Nominal Size
Bolt Circle	Dia. Holes	No. Holes	Welding Neck	Blind	
29 5/8	1	32	98	265	26
31 5/8	1	36	105	300	28
33 5/8	1	36	110	370	30
36 1/8	1 1/8	36	140	470	32
38 1/8	1 1/8	40	150	520	34
40 1/8	1 1/8	40	160	620	36
46 3/4	1 1/4	48	210	970	42
52 3/4	1 1/4	52	240	1375	48
59	1 1/4	64	310	1925	54
65	1 1/4	72	400	2575	60
71 1/2	1 3/8	72	560	3400	66
77 1/2	1 3/8	80	700	4350	72

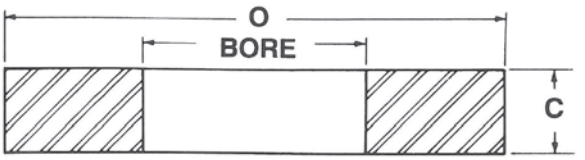
Class125 LW, AWWA C207
CLASSES B, D



SLIP-ON

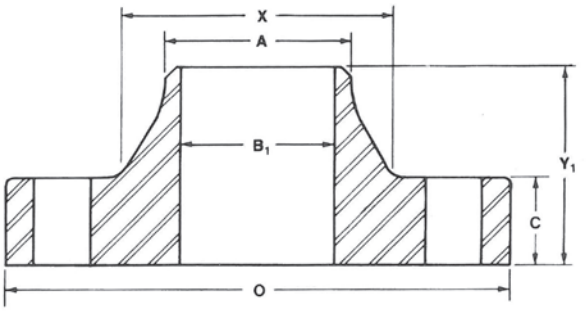
Nominal Size	Outside Dia. O	Thickness C			Hub Dia. X	Bore	Length Thru Hub
		Slip-On 125 LW, B, D	Ring B	Ring D	X		
6	11	9/16	11/16	11/16	7 9/16	6.72	1 1/4
8	13 1/2	9/16	11/16	11/16	9 11/16	8.72	1 1/4
10	16	11/16	11/16	11/16	12	10.88	1 1/4
12	19	11/16	11/16	13/16	14 3/8	12.88	1 1/4
14	21	3/4	11/16	15/16	15 3/4	14.14	1 1/4
16	23 1/2	3/4	11/16	1	18	16.16	1 1/4
18	25	3/4	11/16	1 1/16	19 7/8	18.18	1 1/4
20	27 1/2	3/4	11/16	1 1/8	22	20.20	1 1/4
22	29 1/2	1	3/4	1 3/16	24 1/4	22.22	1 3/4
24	32	1	3/4	1 1/4	26 1/8	24.25	1 3/4
26	34 1/4	1	13/16	1 5/16	28 1/2	26.25	1 3/4
28	36 1/2	1	7/8	1 5/16	30 1/2	28.25	1 3/4
30	38 3/4	1	7/8	1 3/8	32 1/2	30.25	1 3/4
32	41 3/4	1 1/8	15/16	1 1/2	34 3/4	32.25	1 3/4
34	43 3/4	1 1/8	15/16	1 1/2	36 3/4	34.25	1 3/4
36	46	1 1/8	1	1 5/8	38 3/4	36.25	1 3/4
38	48 3/4	1 1/8	1	1 5/8	40 3/4	38.25	1 3/4
40	50 3/4	1 1/8	1	1 5/8	43	40.25	1 3/4
42	53	1 1/4	1 1/8	1 3/4	45	42.25	1 3/4
44	55 1/4	1 1/4	1 1/8	1 3/4	47	44.25	2 1/4
46	57 1/4	1 1/4	1 1/8	1 3/4	49	46.25	2 1/4
48	59 1/2	1 3/8	1 1/4	1 3/4	51	48.25	2 1/2
50	61 3/4	1 3/8	1 1/4	2	53	50.25	2 1/2
52	64	1 3/8	1 1/4	2	55	52.25	2 1/2
54	66 1/4	1 3/8	1 11/32	2 1/8	57	54.25	2 1/2
60	73	1 1/2	1 1/2	2 1/4	63	60.25	2 3/4
66	80	1 1/2	1 5/8	2 1/2	69	66.25	2 3/4
72	86 1/2	1 1/2	1 3/4	2 5/8	75	72.25	2 3/4
84	99 3/4	1 3/4	2	2 3/4	87 1/2	84.25	3
96	113 1/4	2	2 1/4	3	100	96.25	3 1/4

Note: Blind Flanges will be furnished to thicknesses listed above, unless otherwise specified.



RING

Drilling				Approx. Weight			
Bolt Circle	Bolt Hole Dia. Dia. Holes B	Bolt Hole Dia. 125 LW D	No. Holes	Slip-On 125 LW, B & D	Ring Size B	Ring D	Nominal Size
9 ½	¾	⅞	8	13	11	12	6
11 ¾	¾	⅞	8	18	14	15	8
14 ¼	¾	1	12	26	20	20	10
17	¾	1	12	42	30	33	12
18 ¾	⅞	1 ⅛	12	44	36	50	14
21 ¼	⅞	1 ⅛	16	58	43	60	16
22 ¾	⅞	1 ¼	16	59	45	65	18
25	⅞	1 ¼	20	69	50	80	20
27 ¼	⅞	1 ⅜	20	76	60	90	22
29 ½	⅞	1 ⅜	20	115	70	110	24
31 ¾	⅞	1 ⅜	24	125	85	130	26
34	⅞	1 ⅜	28	140	100	145	28
36	1	1 ⅜	28	150	110	165	30
38 ½	1	1 ⅝	28	205	145	210	32
40 ½	1	1 ⅝	32	215	150	220	34
42 ¾	1	1 ⅝	32	235	175	265	36
45 ¼	1	1 ⅝	32	265	200	300	38
47 ¼	1	1 ⅝	36	280	205	315	40
49 ½	1 ⅛	1 ⅝	36	330	250	365	42
51 ¾	1 ⅛	1 ⅝	40	350	265	385	44
53 ¾	1 ⅛	1 ⅝	40	365	275	400	46
56	1 ⅛	1 ⅝	44	425	325	430	48
58 ¼	1 ¼	1 ⅞	44	450	340	500	50
60 ½	1 ¼	1 ⅞	44	475	360	540	52
62 ¾	1 ⅜	1 ⅞	44	500	420	615	54
69 ¼	1 ⅜	1 ⅞	52	640	535	760	60
76	1 ⅜	1 ⅞	52	750	799	1025	66
82 ½	1 ⅜	1 ⅞	60	850	840	1200	72
95 ½	1 ⅝	2 ⅛	64	1225	1200	1575	84
108 ½	1 ⅞	2 ⅜	68	1725	1665	2125	96

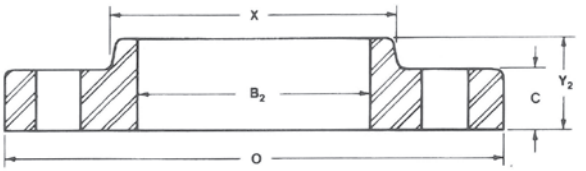


WELDING NECK

Nominal Size	Outside Dia. O	Thickness C	Hub Dia. X	Bore		Length Thru Hub	
		C	X	Welding Neck B_1	Slip-On B_2	Slip-On Y_2	Welding Neck Y_1
6	11	1	7 9/16		6.72	1 9/16	3 1/2
8	13 1/2	1 1/8	9 11/16		8.72	1 3/4	4
10	16	1 3/16	12		10.88	1 15/16	4
12	19	1 1/4	14 3/8		12.88	2 3/16	4 1/2
14	21	1 3/8	15 3/4		14.14	2 1/4	5
16	23 1/2	1 7/16	18		16.16	2 1/2	5
18	25	1 9/16	19 7/8		18.18	2 11/16	5 1/2
20	27 1/2	1 11/16	22		20.20	2 7/8	5 11/16
22	29 1/2	1 13/16	24 1/4		22.22	3 1/8	5 7/8
24	32	1 7/8	26 1/8		24.25	3 1/4	6
26	34 1/4	2	28 1/2		26.25	3 3/8	5
28	36 1/2	2 1/16	30 3/4		28.25	3 7/16	5 1/16
30	38 3/4	2 1/8	32 3/4		30.25	3 1/2	5 1/8
32	41 3/4	2 1/4	35		32.25	3 5/8	5 1/4
34	43 3/4	2 5/16	37		34.25	3 11/16	5 5/16
36	46	2 3/8	39 1/4		36.25	3 3/4	5 3/8
38	48 3/4	2 3/8	41 3/4		38.25	3 3/4	5 3/8
40	50 3/4	2 1/2	43 3/4		40.25	3 7/8	5 1/2
42	53	2 5/8	46		42.25	4	5 5/8
44	55 1/4	2 5/8	48		44.25	4	5 5/8
46	57 1/4	2 11/16	50		46.25	4 1/16	5 11/16
48	59 1/2	2 3/4	52 1/4		48.25	4 1/8	5 3/4
50	61 3/4	2 3/4	54 1/4		50.25	4 1/8	5 3/4
52	64	2 7/8	56 1/2		52.25	4 1/4	5 7/8
54	66 1/4	3	58 3/4		54.25	4 3/8	6
60	73	3 1/8	65 1/4		60.25	4 1/2	6 1/8
66	80	3 3/8	71 1/2		66.25	4 7/8	6 3/8
72	86 1/2	3 1/2	78 1/2		72.25	5	6 1/2
84	99 3/4	3 7/8	90 1/2		84.25	5 3/8	6 7/8
96	113 1/4	4 1/4	102 3/4		96.25	5 3/4	7 1/4

To be specified by purchaser.

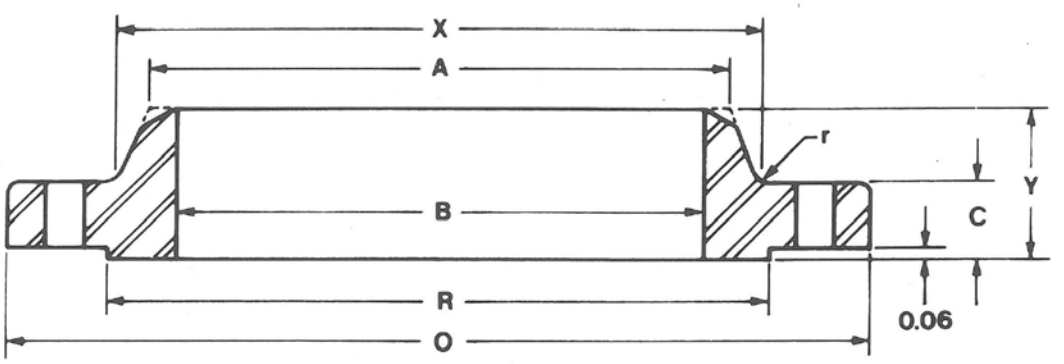
Note: Blind Flanges will be furnished to thicknesses listed above, unless otherwise specified.



SLIP-ON

Dia. Hub at Bevel A	Drilling			Approx. Weight		Nominal Size
	Bolt Circle	Dia. Holes	No. Holes	Slip-On	Welding Neck	
6.63	9 ½	⅞	8	19	24	6
8.63	11 ¾	⅞	8	30	39	8
10.75	14 ¼	1	12	43	52	10
12.75	17	1	12	64	80	12
14.00	18 ¾	1 ⅛	12	85	110	14
16.00	21 ¼	1 ⅛	16	93	140	16
18.00	22 ¾	1 ¼	16	120	150	18
20.00	25	1 ¼	20	155	180	20
22.00	27 ¼	1 ⅜	20	175	225	22
24.00	29 ½	1 ⅜	20	210	255	24
26.00	31 ¾	1 ⅜	24	235	265	26
28.00	34	1 ⅜	28	270	295	28
30.00	36	1 ⅜	28	305	340	30
32.00	38 ½	1 ⅝	28	375	410	32
34.00	40 ½	1 ⅝	32	400	440	34
36.00	42 ¾	1 ⅝	32	450	495	36
38.00	45 ¼	1 ⅝	32	530	570	38
40.00	47 ¼	1 ⅝	36	570	620	40
42.00	49 ½	1 ⅝	36	650	710	42
44.00	51 ¾	1 ⅝	40	690	750	44
46.00	53 ¾	1 ⅝	40	730	800	46
48.00	56	1 ⅝	44	800	870	48
50.00	58 ¼	1 ⅞	44	830	900	50
52.00	60 ½	1 ⅞	44	920	1000	52
54.00	62 ¾	1 ⅞	44	1025	1100	54
60.00	69 ¼	1 ⅞	52	1250	1350	60
66.00	76	1 ⅞	52	1625	1775	66
72.00	82 ½	1 ⅞	60	1925	2100	72
84.00	95 ½	2 ⅛	64	2600	2825	84
96.00	108 ½	2 ⅜	68	3275	3800	96

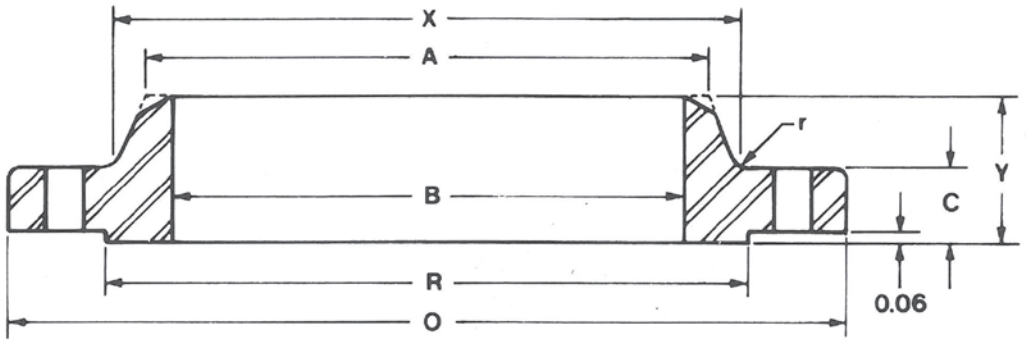
MSS-SP-44



WELDING NECK

Nominal Size	Outside Dia. O	Thickness (Min.) C	Raised Face Dia. R	Hub Dia. X	Bore B	Length Thru Hub Y	Dia. Hub at Bevel A	Fillet Radius r	Drilling			Approx. Wt. WNF
									Bolt Circle	Dia. Holes	No. Holes	
26	34 ¼	2 11/16	29 ½	26 5/8		4 ¾		3/8	31 ¾	1 3/8	24	300
28	36 ½	2 13/16	31 ½	28 5/8		4 15/16		7/16	34	1 3/8	28	345
30	38 ¾	2 15/16	33 ¾	30 5/8		5 3/8		7/16	36	1 3/8	28	400
32	41 ¾	3 3/16	36	32 5/8		5 11/16		7/16	38 ½	1 5/8	28	505
34	43 ¾	3 ¼	38	34 5/8		5 7/8		½	40 ½	1 5/8	32	540
36	46	3 9/16	40 ¼	36 13/16		6 3/16		½	42 ¾	1 5/8	32	640
38	48 ¾	3 7/16	42 ¼	38 13/16		6 3/16		½	45 ¼	1 5/8	32	720
40	50 ¾	3 9/16	44 ¼	40 13/16		6 7/16		½	47 ¼	1 5/8	36	775
42	53	3 13/16	47	42 13/16		6 ¾		½	49 ½	1 5/8	36	890
44	55 ¼	4	49	44 7/8		7		½	51 ¾	1 5/8	40	990
46	57 ¼	4 1/16	51	46 7/8		7 15/16		½	53 ¾	1 5/8	40	1060
48	59 ½	4 ¼	53 ½	48 7/8		7 9/16		½	56	1 5/8	44	1185
50	61 ¾	4 3/8	55 ½	50 15/16		8		½	58 ¼	1 7/8	44	1270
52	64	4 9/16	57 ½	52 15/16	To be specified by purchaser.	8 ¼	To be specified by purchaser.	½	60 ½	1 7/8	44	1410
54	66 ¼	4 ¾	59 ½	55		8 ½		½	62 ¾	1 7/8	44	1585
56	68 ¾	4 7/8	62	57 1/8		9		½	65	1 7/8	48	1760
58	71	5 1/16	64	59 1/8		9 ¼		½	67 ¼	1 7/8	48	1915
60	73	5 3/16	66	61 1/8		9 7/16		½	69 ¼	1 7/8	52	2045

API 605



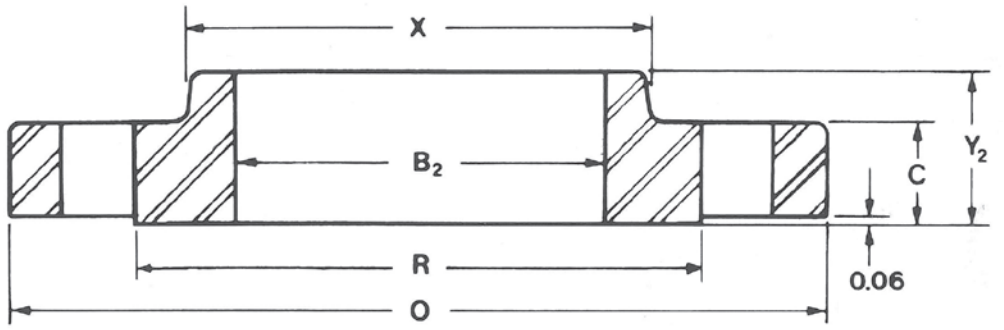
WELDING NECK

Nominal Size	Outside Dia. O	Thickness (Min.) C	Raised Face Dia. R	Hub Dia. X	Bore B	Length Thru Hub Y	Dia. Hub at Bevel A	Fillet Radius r	Drilling			Approx. Wt. WNF
									Bolt Circle	Dia. Holes	No. Holes	
26	30 15/16	1 5/8	28	26 15/8		3 1/2		3/8	29 3/8	7/8	36	120
28	32 15/16	1 3/4	30	28 15/16		3 3/4		3/8	31 5/16	7/8	40	140
30	34 15/16	1 3/4	32	31		3 15/16		3/8	33 5/16	7/8	44	150
32	37 1/16	1 13/16	34	33 1/16		4 1/4		3/8	35 7/16	7/8	48	170
34	39 9/16	1 15/16	36 1/4	35 1/8		4 11/32		3/8	37 11/16	1	40	210
36	41 5/8	1 13/16	38 1/4	37 3/16		4 5/8		3/8	39 3/4	1	44	240
38	44 1/4	2 1/16	40 1/4	39 1/4		4 7/8		3/8	42 1/8	1 1/8	40	290
40	46 1/4	2 1/8	42 1/2	41 5/16		5 1/16		3/8	44 1/8	1 1/8	44	310
42	48 1/4	2 3/16	44 1/2	43 3/8		5 1/4		7/16	46 1/8	1 1/8	48	345
44	50 1/4	2 5/16	46 1/2	45 3/8		5 3/8		7/16	48 1/8	1 1/8	52	370
46	52 13/16	2 7/16	48 5/8	47 1/16		5 11/16		7/16	50 9/16	1 1/4	40	435
48	54 13/16	2 9/16	50 3/4	49 1/2		5 7/8		7/16	52 9/16	1 1/4	44	480
50	56 13/16	2 11/16	52 3/4	51 1/2		6 1/16		7/16	54 9/16	1 1/4	48	520
52	58 13/16	2 3/4	54 3/4	53 9/16		6 3/16		7/16	56 9/16	1 1/4	52	550
54	61	2 13/16	56 3/4	55 5/8		6 3/8		7/16	58 3/4	1 1/4	56	620
56	63	2 7/8	58 3/8	57 11/16		6 9/16		9/16	60 3/4	1 1/4	60	650
58	65 15/16	2 15/16	60 3/4	59 11/16		6 7/8		9/16	63 7/16	1 3/8	48	780
60	67 15/16	3	63	61 13/16		7 1/16		9/16	65 7/16	1 3/8	52	850

To be specified by purchaser.

To be specified by purchaser.

MSS-SP-44

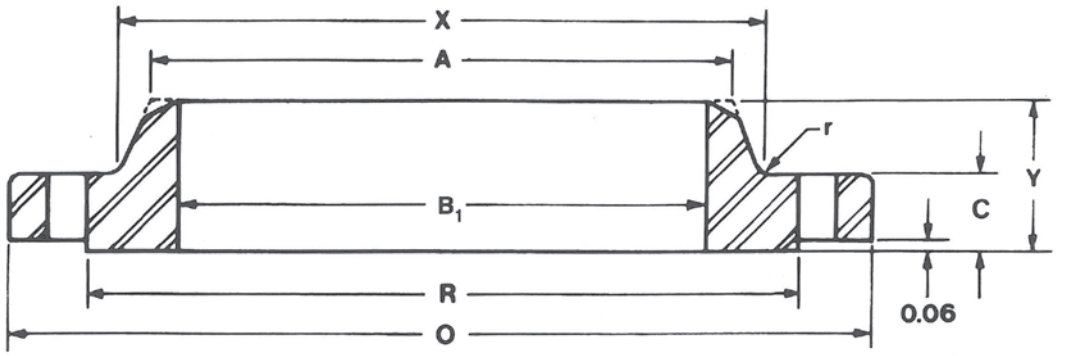


SLIP-ON

Nominal Size	Flange O.D. O	Flange Thickness C	Length Thru Hub Y²	Hub Dia. X	No. Holes	Dia. Holes	Bolt Circle	Raised Face Dia. R	Fillet Radius r	Flange Bore B²
26	34 1/4	2 11/16	3 11/16	28 1/4	24	1 3/8	31 3/4	29 1/2	3/8	26.25
28	36 1/2	3 1/16	3 13/16	30 1/2	28	1 3/8	34	31 1/2	7/16	28.25
30	38 3/4	3 5/16	3 15/16	32 1/2	28	1 3/8	36	33 3/4	7/16	30.25
32	41 3/4	3 27/64	4 3/16	34 1/2	28	1 5/8	38 1/2	36	7/16	32.25
34	43 3/4	3 11/16	4 1/4	36 1/2	32	1 5/8	40 1/2	38	1/2	34.25
36	46	3 31/32	4 9/16	38 3/4	32	1 5/8	42 3/4	40 1/4	1/2	36.25
38	48 3/4	4 1/16	4 9/16	41 1/4	32	1 5/8	45 1/4	42 1/4	1/2	38.25
40	50 3/4	4 3/16	4 13/16	43 1/4	36	1 5/8	47 1/4	44 1/4	1/2	40.25
42	53	4 7/16	5 1/16	45 1/2	36	1 5/8	49 1/2	47	1/2	42.25
44	55	4 11/16	5 3/16	47 3/4	40	1 5/8	51 3/4	49	1/2	44.25
46	57 1/4	4 55/64	5 5/16	49 3/4	40	1 5/8	53 3/4	51	1/2	46.25
48	59 1/2	5 1/16	5 9/16	52	44	1 5/8	56	53 1/2	1/2	48.25

FACING AND DRILLING MATCHES MSS-SP-44 CLASS 150 FLANGES

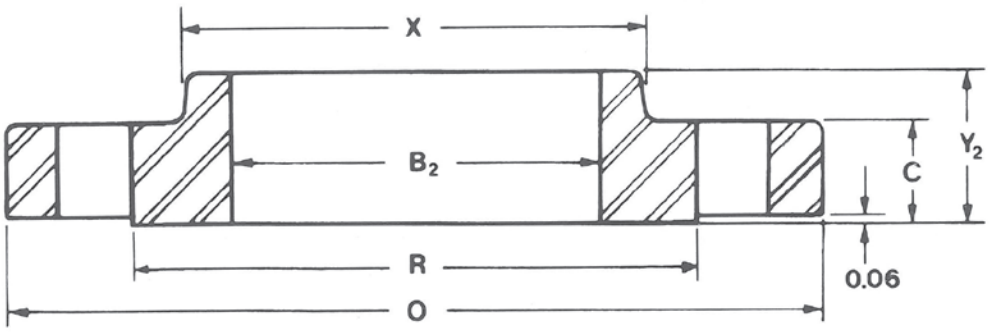
INDUSTRY STANDARD



WELDING NECK

Nominal Size	Outside Dia. O	Thickness C			Raised Face Dia. R	Hub Dia. X	Bore		Length Thru Hub Y		Dia. Hub at Bevel A
		Welding Neck	Slip-On	Blind			B_1	B_2	Welding Neck	Slip-On	
26	31 ½	1 ⅜	1 ⅜	1 ⅞	29	27 ⅝	To be specified by purchaser.	26.25	3 ⅜	2 ¾	To be specified by purchaser.
28	33 ½	1 ⅜	1 ⅜	2	31	29 ⅝		28.25	3 ⅜	2 ¾	
30	35 ¾	1 ⅜	1 ⅜	2 ⅛	33 ¼	31 ⅞		30.25	3 ⅝	2 ¾	
32	37 ¾	1 ⅜	1 ⅜	2 ¼	35 ¼	33 ⅞		32.25	3 ⅝	2 ¾	
34	40 ¼	1 ½	1 ¾	2 ⅜	37 ⅜	35 ⅞		34.25	3 ¾	3 ⅜	
36	42 ¼	1 ½	1 ¾	2 ½	39 ⅜	37 ⅞		36.25	3 ¾	3 ⅜	
38	44 ¼	1 ¾	2	2 ⅝	41 ⅜	39 ⅞		38.25	4 ⅛	3 ¾	
40	46 ¼	1 ¾	2	2 ¾	43 ⅜	41 ⅞		40.25	4 ⅛	4	
42	49	2	2 ⅜	2 ⅞	45 ¾	44 ⅛		42.25	4 ½	4 ⅜	
44	51	2	2 ⅜	3	47 ¾	46 ⅛		44.25	4 ½	4 ⅜	
46	53	2	2 ⅜	3 ⅛	49 ¾	48 ⅛		46.25	4 ½	4 ⅝	
48	55	2 ¼	2 ⅝	3 ⅜	51 ¾	50 ⅛		48.25	4 ⅞	4 ⅞	
50	57	2 ¼	2 ⅝	3 ⅜	53 ¾	52 ⅛		50.25	4 ⅞	4 ⅞	
52	59 ½	2 ⅝	3	3 ⅝	56	54 ¼		52.25	5 ⅜	5 ⅜	
54	61 ½	2 ⅝	3	3 ⅝	58	56 ¼		54.25	5 ⅜	5 ⅜	
60	67 ½	2 ¾	3 ⅛	4	64	62 ¼		60.25	5 ¾	5 ⅞	
66	73 ½	3 ⅛	4	4 ⅜	70	68 ½		66.25	6 ⅛	6 ⅞	
72	80	3 ⅝	5	4 ¾	76 ½	74 ½		72.25	6 ⅝	8	

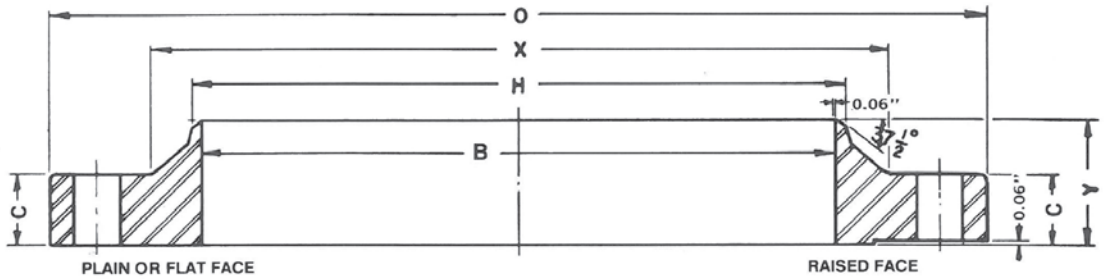
INDUSTRY STANDARD



SLIP-ON

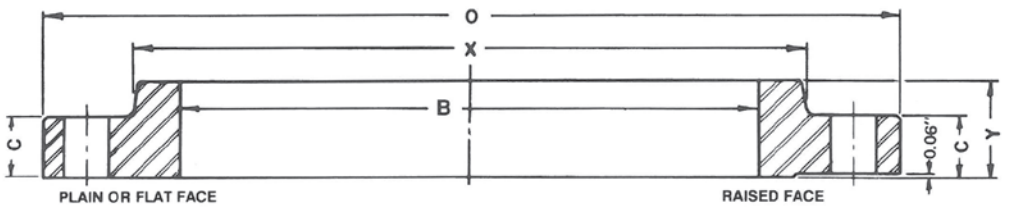
Drilling			Approx. Weight			Nominal Size
Bolt Circle Dia.	Dia. Holes	No. Holes	Welding Neck	Slip-On	Blind	
29 7/8	7/8	28	120	105	405	26
31 7/8	7/8	28	130	115	490	28
34 1/8	7/8	36	150	130	590	30
36 1/8	7/8	36	160	140	700	32
38 3/8	1	36	195	200	840	34
40 3/8	1	36	205	210	970	36
42 3/8	1	36	245	250	1125	38
44 3/8	1	40	255	270	1300	40
46 7/8	1 1/8	40	340	365	1500	42
48 7/8	1 1/8	40	360	380	1700	44
50 7/8	1 1/8	40	375	410	1925	46
52 7/8	1 1/8	44	430	460	2225	48
54 7/8	1 1/8	44	450	480	2400	50
57 1/4	1 1/4	44	560	600	2800	52
59 1/4	1 1/4	44	580	620	3000	54
65 1/4	1 1/4	48	680	730	4000	60
71 1/4	1 1/4	56	830	1000	5175	66
77 3/4	1 1/4	64	1075	1400	6650	72

B 16.1



Nominal Size	Dia. of Flange O	Large Dia. of Hub X	Dia. of Bore B	Thick. of Flange C	Length Thru Hub Y	No. Bolt Holes	Dia. Bolt Holes	Bolt Circle Dia.	Dia. of Std. Raised Face Per ANSI B16.1	Dia. of Std. Raised Face Per ANSI B16.1	Approx. Weight Per Flange
26	38 ¼	30 ½	To be specified by purchaser.	2 13/16	5 13/16	28	1 ⅞	34 ½	32 7/16	29 ½	534
28	40 ¾	33		2 15/16	5 15/16	28	1 ⅞	37	34 15/16	31 ½	629
30	43	35 ¼		3	6	28	1 ⅞	39 ¼	37 3/16	33 ¾	702
32	45 ¼	37 ½		3 ⅛	6 ⅛	28	1 ⅞	41 ½	39 7/16	36	793
34	47 ⅔	39 ½		3 ¼	6 ¼	28	1 ⅞	43 ½	41 7/16	38	882
36	50	41 ½		3 ⅜	6 ⅜	32	2 ⅛	46	43 11/16	40 ¼	969
38	53 ¾	43 ½		3 7/16	6 7/16	32	2 ⅛	48	45 11/16	42 ¼	1057
40	54 ½	45 ¾		3 9/16	6 9/16	36	2 ⅛	50 ¼	47 15/16	44 ¼	1158
42	57	47 ¾		3 11/16	6 15/16	36	2 ⅛	52 ¾	50 7/16	47	1318
44	59 ¼	49 ¾		3 ¾	7	36	2 ⅛	55	52 11/16	49	1423
46	61 ¼	51 ¾		3 ⅞	7 ⅛	40	2 ⅛	57 ¼	54 ¼	51	1536
48	65	55		4	7 ¼	40	2 ⅛	60 ¾	58 7/16	53 ½	1824

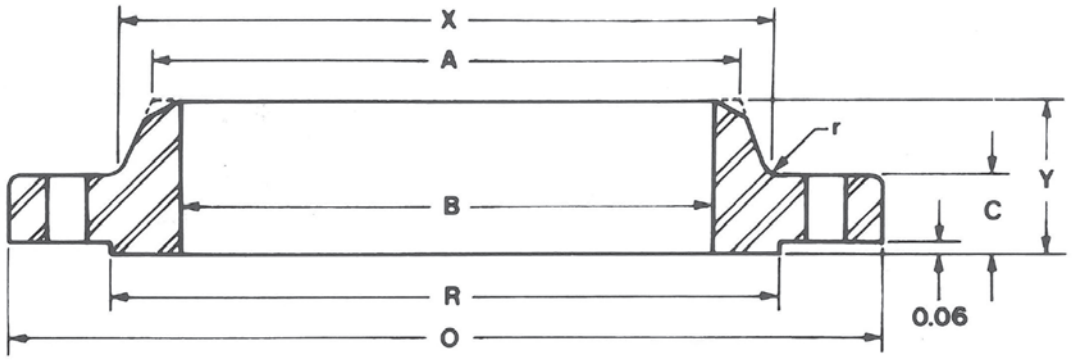
B 16.1



Nominal Size	Dia. of Flange O	Large Dia. of Hub X	Dia. of Bore B	Thick. of Flance C	Length Thru Hub Y	No. Bolt Holes	Dia. Bolt Holes	Bolt Circle Dia.	Dia. of Std. Raised Face Per ANSI B16.1	Dia. of Std. Raised Face Per ANSI B16.1	Approx. Weight Per Flange
26	38 1/4	30 1/2	26 1/4	2 13/16	4 3/4	28	1 7/8	34 1/2	32 7/16	29 1/2	531
28	40 3/4	33	28 1/4	2 15/16	5	28	1 7/8	37	34 15/16	31 1/2	637
30	43	35 1/4	30 1/4	3	5	28	1 7/8	39 1/4	37 3/16	33 3/4	707
32	45 3/4	37 1/2	32 1/4	3 1/8	5 1/8	28	1 7/8	41 1/2	39 7/16	36	810
34	47 2/3	39 1/2	34 1/4	3 1/4	5 1/4	28	1 7/8	43 1/2	41 7/16	38	889
36	50	41 1/2	36 1/4	3 3/8	5 3/8	32	2 1/8	46	43 11/16	40 1/4	970
38	53 3/4	43 1/2	38 1/4	3 7/16	5 1/2	32	2 1/8	48	45 11/16	42 1/4	1062
40	54 1/2	45 3/4	40 1/4	3 9/16	5 1/2	36	2 1/8	50 1/4	47 15/16	44 1/4	1172
42	57	47 3/4	42 1/4	3 11/16	5 5/8	36	2 1/8	52 3/4	50 7/16	47	1288
44	59 1/4	49 3/4	44 1/4	3 3/4	5 3/4	36	2 1/8	55	52 11/16	49	1397
46	61 1/4	51 3/4	46 1/4	3 7/8	5 7/8	40	2 1/8	57 1/4	54 1/4	51	1510
48	65	55	48 1/4	4	6	40	2 1/8	60 3/4	58 7/16	53 1/2	1797

Blinds available upon request.

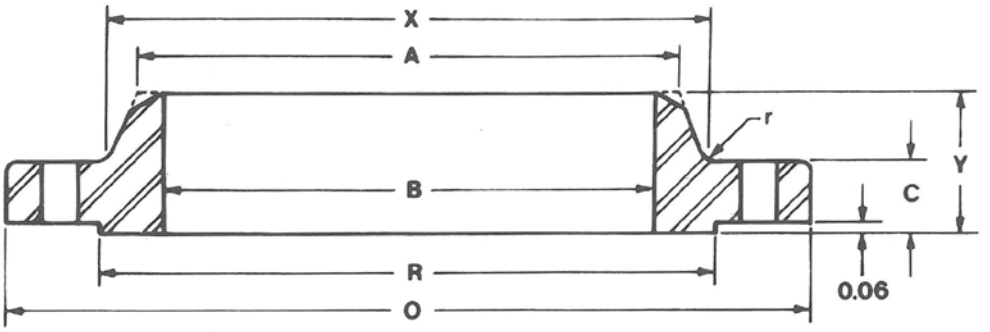
MSS-SP-44



WELDING NECK

Nominal Size	Outside Dia. O	Thickness C		Raised Face Dia. R	Hub Dia. X	Bore B	Length Thru Hub Y	Dia. Hub at Bevel A	Fillet Radius r	Drilling			Approx. Wt. WNF
		WNF	BF							Bolt Circle	Dia. Holes	No. Holes	
Sizes 12" thru 24" identical to ANSI B16.5 except when a single taper hub is required.													
26	38 1/4	3 1/8	3 5/16	29 1/2	28 3/8	To be specified by purchaser.	7 1/4	To be specified by purchaser.	3/8	34 1/2	1 3/4	28	605
28	40 3/4	3 3/8	3 9/16	31 1/4	30 1/2		7 3/4		7/16	37	1 3/4	28	745
30	43	3 5/8	3 3/4	33 3/4	32 9/16		8 1/4		7/16	39 1/4	1 7/8	28	870
32	45 1/4	3 7/8	3 15/16	36	34 11/16		8 3/4		7/16	41 1/2	2	28	1005
34	47 1/2	4	4 1/8	38	36 7/8		9 1/8		1/2	43 1/2	2	28	1145
36	50	4 1/8	4 3/8	40 1/8	39		9 1/2		1/2	46	2 1/8	32	1275
38	46	4 1/4	4 1/4	40 1/2	39 1/8		7 1/8		1/2	43	1 5/8	32	695
40	48 3/4	4 1/2	4 1/2	42 3/4	41 1/4		7 5/8		1/2	45 1/2	1 3/4	32	840
42	50 3/4	4 11/16	4 11/16	44 3/4	43 1/4		7 7/8		1/2	47 1/2	1 3/4	32	950
44	53 1/4	4 7/8	4 7/8	47	45 1/4		8 1/8		1/2	49 3/4	1 7/8	32	1055
46	55 1/4	5 1/16	5 1/16	49	47 3/8		8 1/2		1/2	52	2	28	1235
48	57 3/4	5 1/4	5 1/4	51 1/4	49 3/8		8 13/16		1/2	54	2	32	1380
50	60 1/4	5 1/2	5 1/2	53 1/2	51 3/8		9 1/8		1/2	56 1/4	2 1/8	32	1530
52	62 1/4	5 11/16	5 11/16	55 1/2	53 3/8		9 3/8		1/2	58 1/4	2 1/8	32	1660
54	65 1/4	6	6	57 3/4	55 1/2		9 15/16		1/2	61	2 3/8	28	2050
56	67 1/4	6 1/16	6 1/16	59 3/4	57 5/8		10 1/4		1/2	63	2 3/8	28	2155
58	69 1/4	6 1/4	6 1/4	62	59 5/8		10 1/2		1/2	65	2 3/8	32	2270
60	71 1/4	6 7/16	6 7/16	64	61 5/8		10 3/4		1/2	67	2 3/8	32	2470

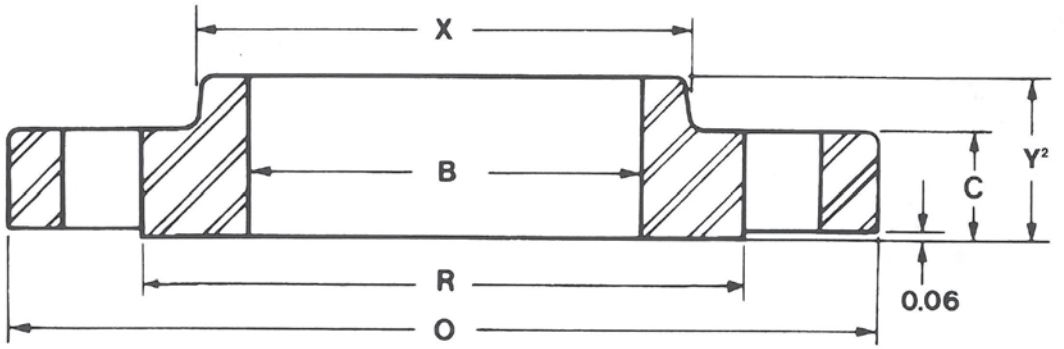
API 605



WELDING NECK

Nominal Size	Outside Dia. O	Thickness (Min.) C	Raised Face Dia. R	Hub Dia. X	Bore B	Length Thru Hub Y	Dia. Hub at Bevel A	Fillet Radius r	Drilling			Approx. Wt. WNF
									Bolt Circle	Dia. Holes	No. Holes	
26	34 1/8	3 1/2	29	27 5/8	To be specified by purchaser.	5 11/16	To be specified by purchaser.	9/16	31 5/8	1 3/8	32	400
28	36 1/4	3 1/2	31	29 3/4		5 7/8		9/16	33 3/4	1 3/8	36	450
30	39	3 11/16	33 1/4	32		6 15/64		9/16	36 1/4	1 1/2	36	550
32	41 1/2	4 1/16	35 1/2	34		6 5/8		5/8	38 1/2	1 5/8	32	685
34	43 5/8	4 1/16	37 1/2	36 1/8		6 13/16		5/8	40 5/8	1 5/8	36	750
36	46 1/8	4 1/16	39 3/4	38		7 1/8		5/8	42 7/8	1 3/4	32	840
38	48 1/8	4 3/8	41 3/4	40		7 9/16		5/8	44 7/8	1 3/4	36	915
40	50 1/8	4 9/16	43 7/8	42		7 13/16		5/8	46 7/8	1 3/4	40	990
42	52 1/2	4 11/16	46	44		8 1/16		5/8	49	1 7/8	36	1135
44	54 1/2	5	48	46 3/16		8 7/16		5/8	51	1 7/8	40	1235
46	57 1/2	5 1/16	50	48 3/8		8 3/4		5/8	53 3/4	2	36	1470
48	59 1/2	5 1/16	52 1/4	50 5/16		8 13/16		5/8	55 3/4	2	40	1575
50	61 1/2	5 7/16	54 1/4	52 3/8		9 1/4		5/8	57 3/4	2	44	1710
52	63 1/2	5 5/8	56 1/4	54 7/16		9 9/16		5/8	59 3/4	2	48	1840
54	65 7/8	5 3/8	58 1/4	56 1/2		9 7/16		5/8	62 1/8	2	48	1980
56	69 1/2	6 1/16	60 1/2	58 1/2		10 9/16		11/16	65	2 3/8	36	2595
58	71 15/16	6 1/16	62 3/4	60 15/16		10 13/16		11/16	67 7/16	2 3/8	40	2770
60	73 15/16	5 15/16	65	62 15/16		10 11/16		11/16	69 7/16	2 3/8	40	2870

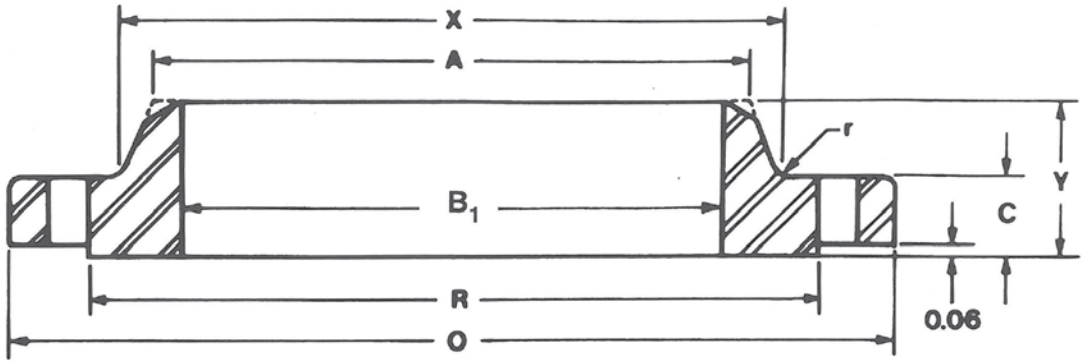
MSS-SP-44



SLIP-ON

Pipe Size	Flange O.D. O	Flange Thickness C	Flange Length Y²	Hub Dia. X	No. Bolt Holes	Dia. Bolt Holes	Dia. Bolt Circle	Dia. Face R	Fillet Rad. Min.	Flange Bore B²
26	38 ¼	3 ⅛	5 ⅜	30 ¼	28	1 ¾	34 ½	29 ½	⅜	26.25
28	40 ¾	3 ⅜	5 11⁄16	32 ¾	28	1 ¾	37	31 ½	7⁄16	28.25
30	43	3 ⅝	6 ⅛	34 ¾	28	1 ⅞	39 ¼	33 ¾	7⁄16	30.25
32	45 ¼	3 ⅞	6 9⁄16	36 ¾	28	2	41 ½	36	7⁄16	32.25
34	47 ½	4	6 13⁄16	38 ¾	28	2	43 ½	38	½	34.25
36	50	4 ⅛	7 1⁄16	41	32	2 ⅛	46	40 ¼	½	36.25
38	46	5 5⁄16	6 1⁄16	39	32	1 ⅝	43	42 ¼	½	38.25
40	48 ¾	5 9⁄16	6 9⁄16	41 ¼	32	1 ¾	45 ½	44 ¼	½	40.25
42	50 ¾	5 13⁄16	6 13⁄16	43 ¼	32	1 ¾	47 ½	47	½	42.25
44	53 ¼	6 1⁄16	6 ⅞	45 ¼	32	1 ⅞	49 ¾	49	½	44.25
46	55 ¾	6 5⁄16	7 1⁄16	47 ¼	28	2	52	51	½	46.25
48	57 ¾	6 9⁄16	7 3⁄16	49 ¼	32	2	54	53 ½	½	48.25

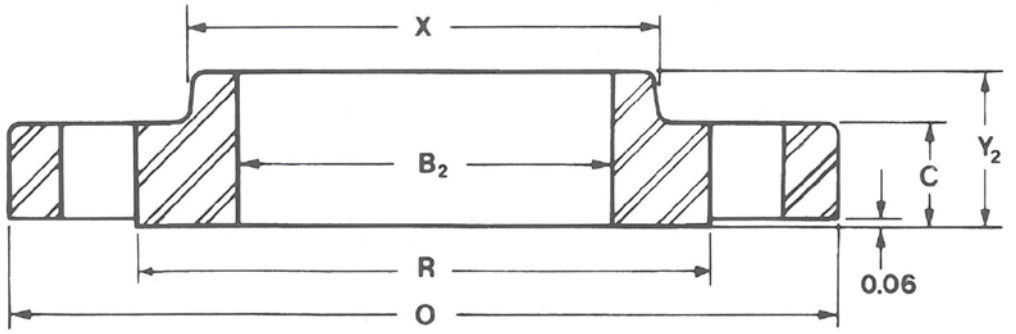
INDUSTRY STANDARD



WELDING NECK

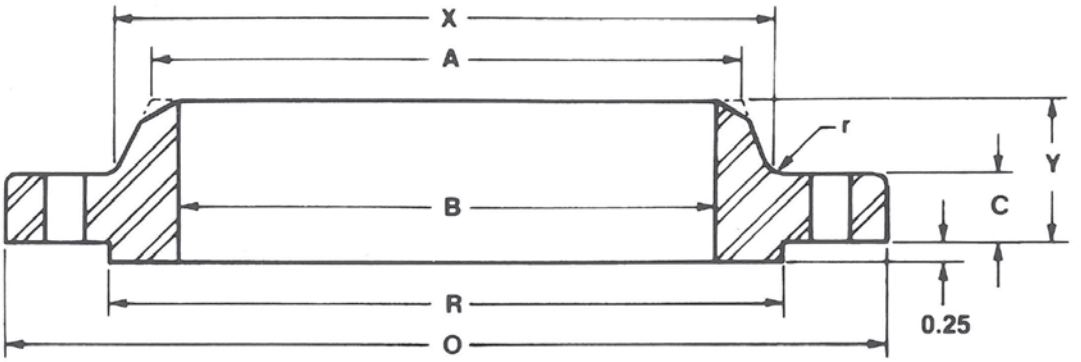
Nominal Size	Outside Dia. O	Thickness C			Raised Face Dia. R	Bore		Length Thru Hub Y		
		Welding Neck	Slip-On	Blind		Hub Dia. X	B_1	B_2	Welding Neck	Slip-On
26	32 ¾	2 ½	2 ½	2 ¾	29 ½	27 ⅞	To be specified by purchaser.	26.25	5	4 ½
28	34 ¾	2 ½	2 ½	2 ⅞	31 ½	29 ⅞		28.25	5	4 ½
30	37	2 ⅝	2 ⅝	3	33 ¾	32 ⅛		30.25	5 ¼	4 ¾
32	39	2 ¾	2 ¾	3 ¼	35 ¾	34 ⅛		32.25	5 ½	5
34	41	2 ⅞	2 ⅞	3 ⅜	37 ¾	36 ⅛		34.25	5 ¾	5 ⅛
36	43 ¾	3 ⅛	3 ⅛	3 ⅝	40 ¼	38 ½		36.25	6 ⅛	5 ⅝
38	45 ¾	3 ⅛	3 ⅛	3 ¾	42 ¼	40 ½		38.25	6 ⅛	5 ⅝
40	47 ¾	3 ¼	3 ¼	4	44 ¼	42 ½		40.25	6 ¼	5 ⅞
42	50	3 ½	3 ½	4 ⅛	46 ½	44 ¾		42.25	6 ½	6 ⅛
44	52 ¾	3 ¾	3 ¾	4 ⅜	48 ⅞	46 ¾		44.25	6 ¾	6 ¾
46	54 ¾	4 ¼	4 ¼	4 ¾	50 ⅞	48 ¾		46.25	7 ¼	7 ¼
48	56 ¾	4 ¼	4 ¼	4 ¾	52 ⅞	50 ¾		48.25	7 ¼	7 ¼
52	61 ½	4 ¼	—	—	57 ¼	55		52.25	7 ½	—
54	63 ½	4 ½	4 ¾	—	59 ¼	57		54.25	7 ¾	8 ¼
60	69 ½	4 ½	5	—	65 ¼	63		60.25	8	8 ½
66	77	4	—	—	72 ¼	70		66.25	8 ½	—
72	83	4	—	—	78 ¼	76		72.25	9	—

INDUSTRY STANDARD



SLIP-ON

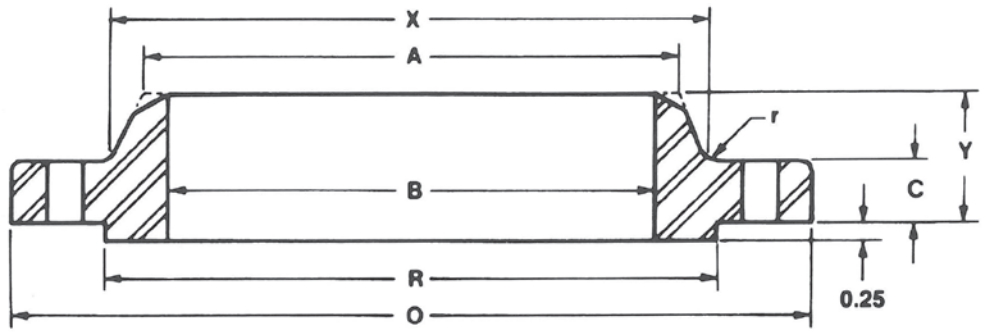
Drilling			Approx. Weight			Nominal Size
Bolt Circle Dia.	Dia. Holes	No. Holes	Welding Neck	Slip-On	Blind	
30 5/8	1 1/8	28	245	225	580	26
32 5/8	1 1/8	28	260	250	750	28
34 7/8	1 1/8	32	305	295	890	30
36 7/8	1 1/8	36	340	325	1050	32
38 7/8	1 1/8	40	375	355	1225	34
41 1/2	1 1/4	40	480	465	1500	36
43 1/2	1 1/4	40	510	490	1700	38
45 1/2	1 1/4	44	540	530	1975	40
47 3/4	1 1/4	48	640	620	2225	42
50 1/4	1 3/8	44	760	760	2625	44
52 1/4	1 3/8	48	880	880	2950	46
54 1/4	1 3/8	48	920	920	3300	48
58 3/4	1 1/2	52	1075	—	—	52
60 3/4	1 1/2	52	1200	1150	—	54
66 3/4	1 1/2	60	1325	1450	—	60
74	1 5/8	60	1675	—	—	66
80	1 5/8	72	1850	—	—	72



WELDING NECK

Nominal Size	Outside Dia. O	Thickness C WNF	Thickness C BF	Raised Face Dia. R	Hub Dia. X	Bore B	Length Thru Hub Y	Dia. Hub at Bevel A	Fillet Radius r	Drilling Bolt Circle	Drilling Dia. Holes	Drilling No. Holes	Approx. Wt. WNF
MSS-SP-44 Sizes 12" thru 24" identical to ANSI B16.5 except when a single taper hub is required.													
26	38 ¼	3 ½	3 ⅞	29 ½	28 ⅝	To be specified by purchaser.	7 ⅝	To be specified by purchaser.	7/16	34 ½	1 ⅞	28	650
28	40 ¾	3 ¾	4 ⅛	31 ¼	30 13/16		8 ⅛		½	37	2	28	785
30	43	4	4 ⅜	33 ¾	32 15/16		8 ⅝		½	39 ¼	2 ⅛	28	905
32	45 ¼	4 ¼	4 9/16	36	35		9 ⅛		½	41 ½	2 ⅛	28	1065
34	47 ½	4 ⅜	4 13/16	38	37 3/16		9 ½		9/16	43 ½	2 ⅛	28	1200
36	50	4 ½	5 1/16	40 ⅛	39 ⅜		9 ⅞		9/16	46	2 ⅛	32	1340
API 605*													
26	33 ½	3 ½	—	28	27 ⅛		5 ⅞		7/16	30 ¾	1 ½	28	360
28	36	3 ¾	—	30	29 ⅛		6 ¼		½	33	1 ⅝	24	450
30	38 ¼	4	—	32 ¼	31 ¼		6 11/16		½	35 ¼	1 ⅝	28	530
32	40 ¾	4 ¼	—	34 ⅜	33 ¼		7 11/16		½	37 ½	1 ¾	28	635
34	42 ¾	4 ⅜	—	36 ½	35 ⅜		7 ⅜		9/16	39 ½	1 ¾	32	690
36	45 ½	4 1/16	—	38 ⅝	37 ½		7 ⅞		9/16	42	1 ⅞	28	855

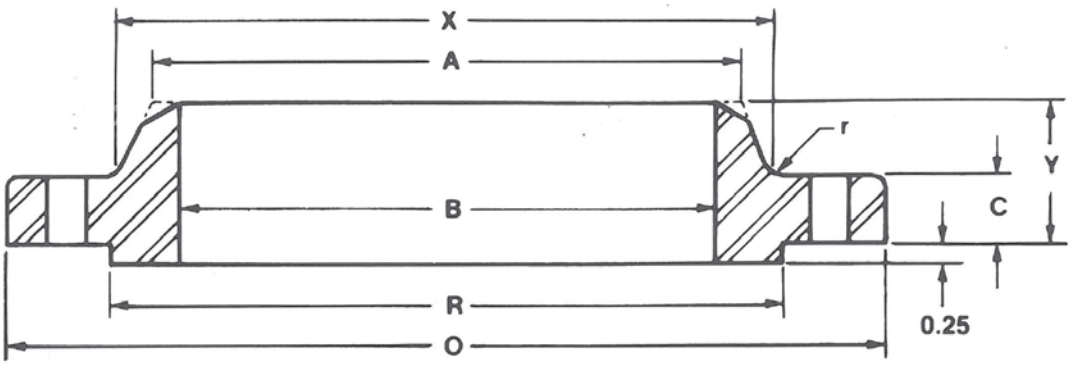
Length thru Hub does not include ½" Raised Face.
*Blind Flanges available upon request.



WELDING NECK

Nominal Size	Outside Dia. O	Thickness C WNF	Thickness C BF	Raised Face Dia. R	Hub Dia. X	Bore B	Length Thru Hub Y	Dia. Hub at Bevel A	Fillet Radius r	Drilling Bolt Circle	Drilling Dia. Holes	Drilling No. Holes	Approx. Wt. WNF
MSS-SP-44 and **API 605** identical in sizes 38" thru 60".													
38	47 ½	4 ⅞	4 ⅞	40 ⅞	39 ½	To be specified by purchaser.	8 ⅛	To be specified by purchaser.	9/16	44	1 ⅞	32	935
40	50	5 ⅛	5 ⅛	43	41 ½		8 ½		9/16	46 ¼	2	32	1090
42	52	5 ¼	5 ¼	45	43 ⅝		8 13/16		9/16	48 ¼	2	32	1190
44	54 ½	5 ½	5 ½	47 ¼	45 ⅝		9 3/16		9/16	50 ½	2 ⅛	32	1375
46	56 ¾	5 ¾	5 ¾	49 ½	47 ¾		9 ⅝		9/16	52 ¾	2 ⅛	36	1525
48	59 ½	6	6	51 ½	49 ⅞		10 ⅛		9/16	55 ¼	2 ⅜	28	1790
50	61 ¾	6 3/16	6 ¼	53 ⅝	52		10 9/16		9/16	57 ½	2 ⅜	32	1950
52	63 ¾	6 ⅜	6 7/16	55 ⅝	54		10 ⅞		9/16	59 ½	2 ⅜	32	2125
54	67	6 11/16	6 ¾	57 ⅞	56 ⅛		11 ⅜		9/16	62 ¼	2 ⅝	28	2565
56	69	6 ⅞	6 15/16	60 ⅛	58 ¼		11 ¾		9/16	64 ¼	2 ⅝	32	2710
58	71	7	7 ⅛	62 ⅛	60 ¼		12 1/16		9/16	66 ¼	2 ⅝	32	3230
60	74 ¼	7 5/16	7 7/16	64 ⅛	62 ⅜		12 9/16		9/16	69	2 ⅝	32	3820

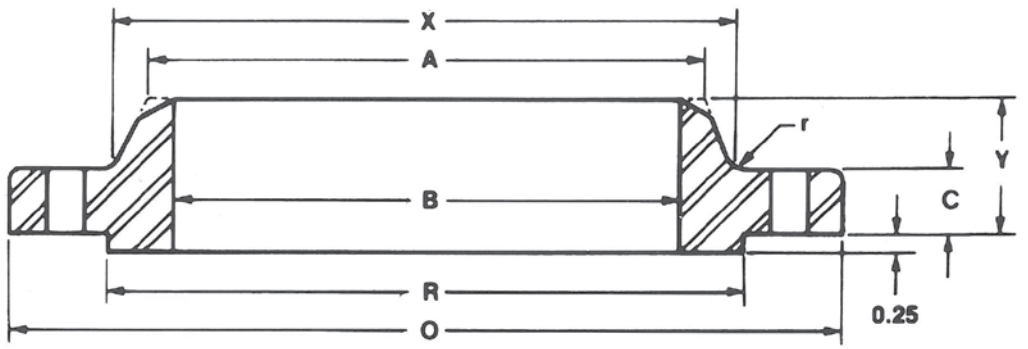
Length thru Hub does not include ½" Raised Face.



WELDING NECK

Nominal Size	Outside Dia. O	Thickness C WNF	Thickness C BF	Raised Face Dia. R	Hub Dia. X	Bore B	Length Thru Hub Y	Dia. Hub at Bevel A	Fillet Radius r	Drilling Bolt Circle	Drilling Dia. Holes	Drilling No. Holes	Approx. Wt. WNF
MSS-SP-44 Sizes 12" thru 24" identical to ANSI B16.5 except when a single taper hub is required.													
26	40 ¼	4 ¼	4 15/16	29 ½	29 7/16	To be specified by purchaser.	8 ¾	To be specified by purchaser.	½	36	2	28	940
28	42 ¼	4 ⅜	5 3/16	31 ½	31 ⅝		9 ¼		½	38	2 ⅛	28	1060
30	44 ½	4 ½	5 ½	33 ¾	33 15/16		9 ¾		½	40 ¼	2 ⅛	28	1210
32	47	4 ⅝	5 13/16	36	36 ⅛		10 ¼		½	42 ½	2 ⅜	28	1375
34	49	4 ¾	6 1/16	38	38 3/16		10 ⅝		9/16	44 ½	2 ⅜	28	1540
36	51 ¾	4 ⅞	6 ⅜	40 ¼	40 ⅝		11 ⅛		9/16	47	2 ⅝	28	1705
API 605*													
26	35	4 ⅜	—	28 ⅝	27 ½		7 ⅛		½	31 ¾	1 ¾	28	550
28	37 ½	4 9/16	—	30 ⅞	29 ⅝		7 ½		½	34	1 ⅞	28	650
30	40 ¼	4 15/16	—	33 ⅛	31 ¾		8 1/16		½	36 ½	2	28	810
32	42 ¾	5 ⅜	—	35 ¼	33 ⅞		8 ½		½	38 ¾	2 ⅛	28	950
34	45 ¾	5 9/16	—	37 ½	36		9 3/16		9/16	41 ½	2 ⅜	24	1205
36	47 ¾	5 ¾	—	39 ¾	38 ⅛		9 9/16		9/16	43 ½	2 ⅜	28	1340

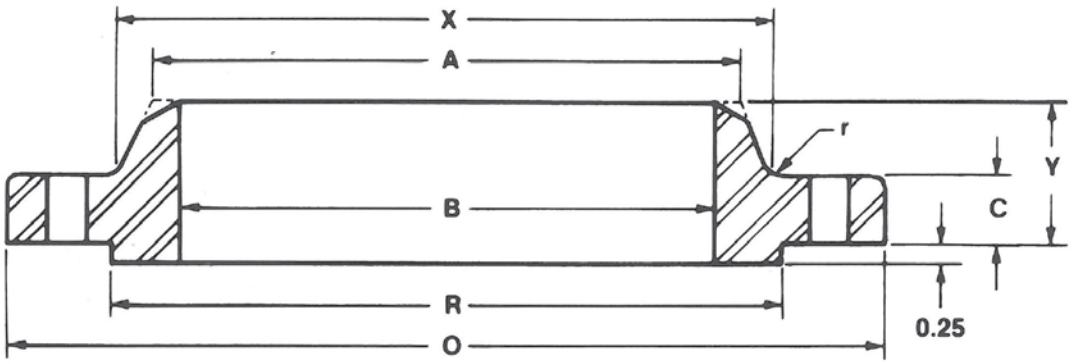
Length thru Hub does not include ½" Raised Face.
*Blind Flanges available upon request.



WELDING NECK

Nominal Size	Outside Dia. O	Thickness C		Raised Face Dia. R	Hub Dia. X	Bore B	Length Thru Hub Y	Dia. Hub at Bevel A	Fillet Radius r	Drilling			Approx. Wt. WNF
		WNF	BF							Bolt Circle	Dia. Holes	No. Holes	
MSS-SP-44 and **API 605** identical in sizes 38" thru 60".													
38	50	6	6 1/8	41 1/2	40 1/4	To be specified by purchaser.	10	To be specified by purchaser.	9/16	45 3/4	2 3/8	28	1470
40	52	6 1/4	6 3/8	43 3/4	43 3/4		10 3/8		9/16	47 3/4	2 3/8	32	1630
42	55 1/4	6 5/8	6 3/4	46	46		11		9/16	50 1/2	2 5/8	28	2030
44	57 1/4	6 13/16	7	48 1/4	48 1/4		11 3/8		9/16	52 1/2	2 5/8	32	2160
46	59 1/2	7 1/16	7 5/16	50 1/4	50 1/4		11 13/16		9/16	54 3/4	2 5/8	32	2410
48	62 3/4	7 7/16	7 11/16	52 1/2	52 1/2		12 7/16		9/16	57 1/2	2 7/8	32	2855
50	65 3/4	7 3/4	8	54 1/2	54 1/2		12 15/16		9/16	60	3 1/8	28	3330
52	67 3/4	8	8 1/4	56 1/2	56 1/2		13 1/4		9/16	62	3 1/8	32	3560
54	70	8 1/4	8 9/16	58 3/4	58 3/4		13 3/4		9/16	64 1/4	3 1/8	32	3920
56	73	8 9/16	8 7/8	60 3/4	60 3/4		14 1/4		5/8	66 3/4	3 3/8	32	4280
58	75	8 3/4	9 1/8	63	63		14 9/16		5/8	68 3/4	3 3/8	32	4640
60	78 1/2	9 3/16	9 9/16	65 1/4	65 1/4		15 5/16		11/16	71 3/4	3 5/8	28	5000

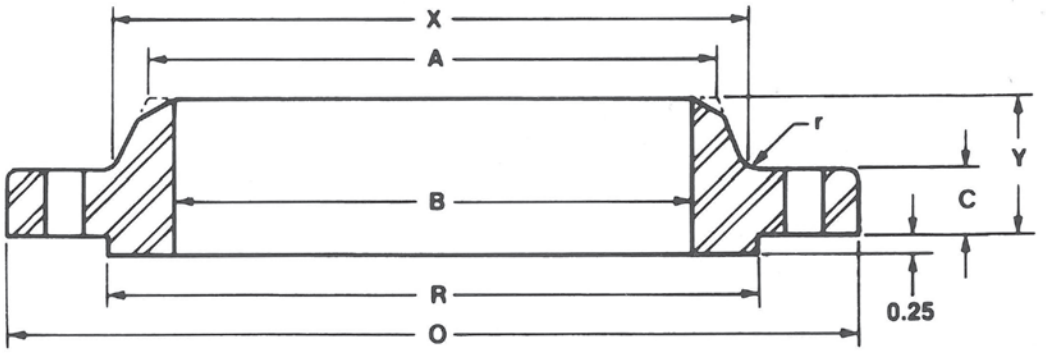
Length thru Hub does not include 1/2" Raised Face.



WELDING NECK

Nominal Size	Outside Dia. O	Thickness C WNF	Thickness C BF	Raised Face Dia. R	Hub Dia. X	Bore B	Length Thru Hub Y	Dia. Hub at Bevel A	Fillet Radius r	Drilling Bolt Circle	Drilling Dia. Holes	Drilling No. Holes	Approx. Wt. WNF
MSS-SP-44 Sizes 12" thru 24" identical to ANSI B16.5 except when a single taper hub is required.													
26	42 ¾	5 ½	6 5/16	29 ½	30 ½	To be specified by purchaser.	11 ¼	To be specified by purchaser.	⅞	37 ½	2 ⅞	20	1525
28	46	5 ⅝	6 ¾	31 ½	32 ¾		11 ¾		½	40 ¼	3 ⅛	20	1810
30	48 ½	5 ⅞	7 3/16	33 ¾	35		12 ¼		½	42 ¾	3 ⅛	20	2120
32	51 ¾	6 ¼	7 ⅝	36	37 ¼		13		½	45 ½	3 ⅜	20	2545
34	55	6 ½	8 1/16	38	39 ⅝		13 ¾		9/16	48 ¼	3 ⅝	20	2970
36	57 ½	6 ¾	8 7/16	40 ¼	41 ⅞		14 ¼		9/16	50 ¾	3 ⅝	20	3395
API 605*													
26	40 ¼	5 5/16	—	30	29 ¼		10 3/16		7/16	35 ½	2 ⅝	20	1050
28	43 ½	5 13/16	—	32 ¼	31 ⅜		10 ⅞		½	38 ½	2 ⅞	20	1520
30	46 ½	6 ⅛	—	34 ½	33 ½		11 ⅜		½	40 ¾	3 ⅛	20	1820
32	48 ¾	6 5/16	—	36 ½	35 ¾		11 15/16		½	43 ¾	3 ⅛	20	2065
34	51 ¾	6 ¾	—	39	37 ⅞		12 9/16		9/16	45 ½	3 ⅜	20	2450
36	53	6 13/16	—	40 ½	40		12 13/16		9/16	47 ¼	3 ⅛	24	2520

Length thru Hub does not include ½" Raised Face.
*Blind Flanges available upon request.

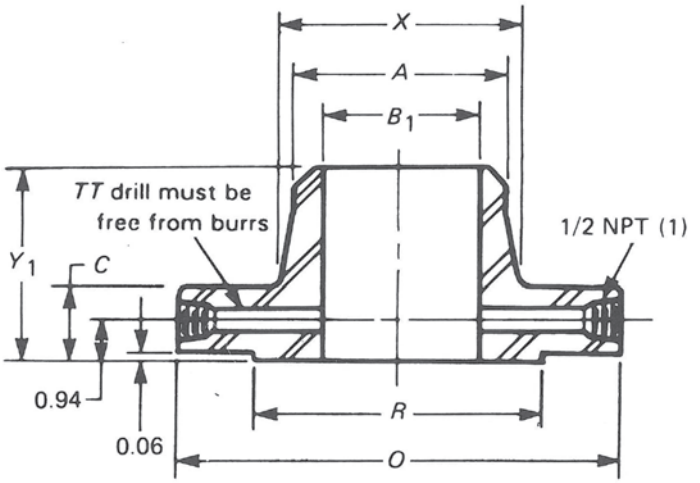


WELDING NECK

Nominal Size	Outside Dia. O	Thickness C WNF	Thickness C BF	Raised Face Dia. R	Hub Dia. X	Bore B	Length Thru Hub Y	Dia. Hub at Bevel A	Fillet Radius r	Drilling Bolt Circle	Drilling Dia. Holes	Drilling No. Holes	Approx. Wt. WNF
MSS-SP-44 and **API 605** identical in sizes 38" thru 48".													
38	57 ½	7 ½	8 ½	43 ¼	42 ¼	To be specified by purchaser.	13 ⅞	To be specified by purchaser.	¾	50 ¾	3 ⅝	20	3385
40	59 ½	7 ¾	8 13/16	45 ¾	44 ⅜		14 5/16		13/16	52 ¾	3 ⅝	24	3620
42	61 ½	8 ⅛	9 ⅛	47 ¾	46 5/16		14 ⅝		13/16	54 ¾	3 ⅝	24	3960
44	64 ⅞	8 7/16	9 9/16	50	48 ⅝		15 ⅜		⅞	57 ⅝	3 ⅞	24	4300
46	68 ¼	8 ⅞	10 1/16	52 ½	50 ⅞		16 3/16		⅞	60 ½	4 ⅛	24	4640
48	70 ¼	9 3/16	10 ⅜	54 ½	52 ⅞		16 ½		15/16	62 ½	4 ⅛	24	4980

Length thru Hub does not include ½" Raised Face.

ANSI B16.36 Orifice Flanges



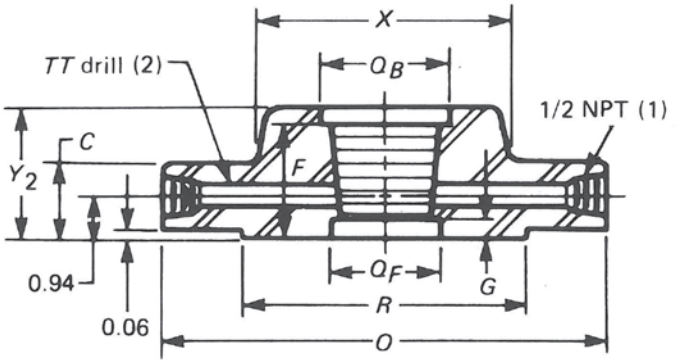
WELDING NECK

Nominal Pipe Size	Outside Dia. of Flange O	Thickness of Flange Min. C	Outside Dia. of Raised Face R	Length Thru Hub		Dia. of Hub	Hub Dia. Beginning of Chamfer (W.N.) B_1	Dia. of Counterbore	
				Slip-On and Threaded Y_2	Weld Neck Y_1			Back Q_B	Face Q_F
1	4 7/8	1 1/2	2	1 7/8	3 1/4	2 1/8	1.32	1.41	1.30
1 1/2	6 1/8	1 1/2	2 7/8	1 7/8	3 3/8	2 3/4	1.90	1.99	1.89
2	6 1/2	1 1/2	3 5/8	1 15/16	3 3/8	3 5/16	2.38	2.50	2.36
2 1/2	7 1/2	1 1/2	4 1/8	2	3 1/2	3 15/16	2.88	3.00	2.84
3	8 1/2	1 1/2	5	2 1/16	3 1/2	4 5/8	3.50	3.63	3.46
4	10	1 1/2	6 3/16	2 1/8	3 5/8	5 3/4	4.50	4.63	4.45
6	12 1/2	1 1/2	8 1/2	2 1/8	3 15/16	8 1/8	6.63	6.75	6.57
8	15	1 5/8	10 5/8	2 7/16	4 3/8	10 1/4	8.63	8.75	8.55
10	17 1/2	1 7/8	12 3/4	2 5/8	4 5/8	12 5/8	10.75		
12	20 1/2	2	15	2 7/8	5 1/8	14 3/4	12.75		
14	23	2 1/8	16 1/4	3	5 5/8	16 3/4	14.00		
16	25 1/2	2 1/4	18 1/2	3 1/4	5 3/4	19	16.00		
18	28	2 3/8	21	3 1/2	6 1/4	21	18.00	See Note (8).	
20	30 1/2	2 1/2	23	3 3/4	6 3/8	23 1/8	20.00		
24	36	2 3/4	27 1/4	4 3/16	6 5/8	27 5/8	24.00		

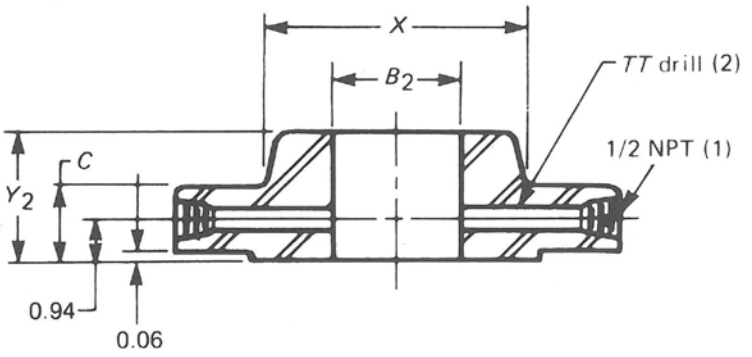
GENERAL NOTE: Dimensions are in inches.

NOTES:
(1) Other NPT sizes may be furnished if required.
(2) For slip-on and thread flanges, verify that TT drilling extends to inside diameter of pipe after assembly and is free from burrs.
Weld neck flanges NPS 3 and smaller are identical to Class 600 flanges and may be so marked.
All other dimensions are in accordance with ASME/ANSI B16.5.

ANSI B16.36 Orifice Flanges



THREADED

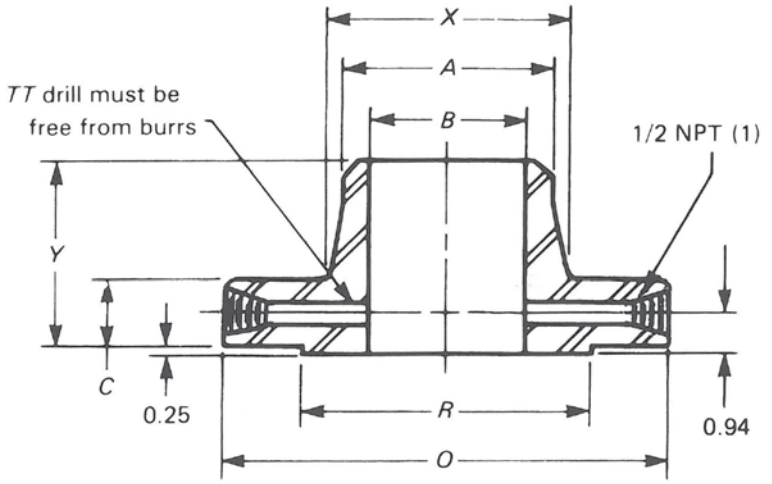


SLIP-ON

Counterbore Depth (From Face)		Bore			Drilling Template				Bolt Length [(5), (6)]	
F	G	Slip-On B_2	Weld Neck B_1	Dia. of Pressure Connection TT	Bolt Circle	No. of Holes	Dia. of Holes	Dia. of Bolts	Machine Bolts	Stud Bolts
1.44	0.75	1.36		¼	3 ½	4	11/16	⅝	4 ½	5
1.47	0.72	1.95		¼	4 ½	4	13/16	¾	4 ¾	5 ¼
1.50	0.69	2.44		¼	5	8	11/16	⅝	4 ½	5
1.75	0.56	2.94		¼	5 ⅞	8	13/16	¾	4 ¾	5 ¼
1.81	0.56	3.57		⅜	6 ⅝	8	13/16	¾	4 ¾	5 ¼
1.88	0.56	4.57		½	7 ⅞	8	13/16	¾	4 ¾	5 ¼
1.88	0.31	6.72	See Note (7).	½	10 ⅝	12	⅞	¾	4 ¾	5 ¼
2.19	0.44	8.72		½	13	12	1	⅞	5	5 ¾
		10.88		½	15 ¼	16	1 ⅛	1	5 ¾	6 ½
		12.88		½	17 ¾	16	1 ¼	1 ⅛	6 ¼	7
		14.14		½	20 ¼	20	1 ¼	1 ⅛	6 ½	7 ¼
		16.16		½	22 ½	20	1 ⅜	1 ¼	7	7 ¾
See Note (8).		18.18		½	24 ¾	24	1 ⅜	1 ¼	7 ¼	8
		20.20		½	27	24	1 ⅜	1 ¼	7 ½	8 ½
		24.25		½	32	24	1 ⅝	1 ½	8 ¼	9 ½

NOTES:
(5) Bolt lengths include allowance for orifice and gasket thickness of 0.25 in. for NPS 1-12 and 0.38 in. for NPS 14-24.
(6) In conformance with ASME/ANSI B16.5, stud bolt lengths do not include point heights.
(7) Bore diameter of weld neck flanges is to be specified by the purchaser.
(8) Threaded flanges are furnished in NPS 1-8 only.

ANSI B16.36 Orifice Flanges



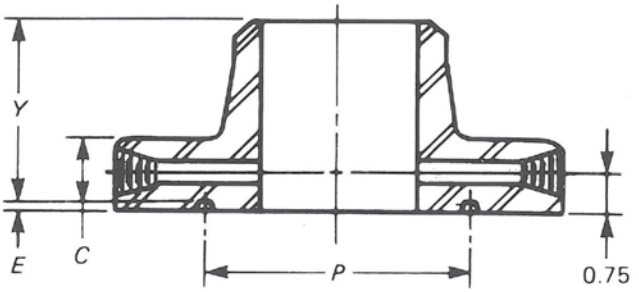
RAISED FACE

Nominal Pipe Size	Outside Dia. of Flange O	Thickness of Flange Min. C	Outside Dia. of Raised Face R	Length Thru Hub Y	Ring Type Joint					
					Groove Number	Pitch Dia. P	Groove Depth E	Groove Width F	Radius at Bottom r_{max}	Special Oval Ring Height W
1 1 ½ 2 2 ½ 3	For NPS 3 and smaller, use Class 600.									
4	10	1 ½	6 3/16	3 ½	R37	5.875	0.312	0.469	0.03	1.06
6	12 ½	1 5/8	8 ½	4 1/16	R45	8.312	0.312	0.469	0.03	1.06
8	15	1 7/8	10 5/8	4 5/8	R49	10.625	0.312	0.469	0.03	1.06
10	17 ½	2 1/8	12 ¾	4 7/8	R53	12.750	0.312	0.469	0.03	1.06
12	20 ½	2 ¼	15	5 3/8	R57	15.000	0.312	0.469	0.03	1.06
14	23	2 25/64	16 ¼	5 7/8	R61	16.500	0.312	0.469	0.03	1.06
16	25 ½	2 ½	18 ½	6	R65	18.500	0.312	0.469	0.03	1.19
18	28	2 5/8	21	6 ½	R69	21.000	0.312	0.469	0.03	1.19
20	30 ½	2 ¾	23	6 5/8	R73	23.000	0.312	0.531	0.06	1.25
24	36	3	27 ¼	6 7/8	See Note (6).					

GENERAL NOTE: Dimensions are in inches.

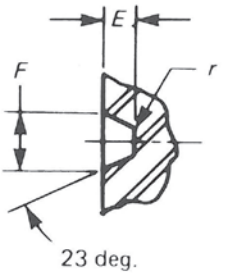
NOTES:
(1) Other NPT sizes may be furnished if required.
(2) All other dimensions are in accordance with ASME/ANSI B16.5.
(3) In conformance with ASME/ANSI B16.5, stud bolt lengths do not include point heights.

ANSI B16.36 Orifice Flanges



RING TYPE JOINT

Special One or Two Piece Ring and Orifice Plate Assembly

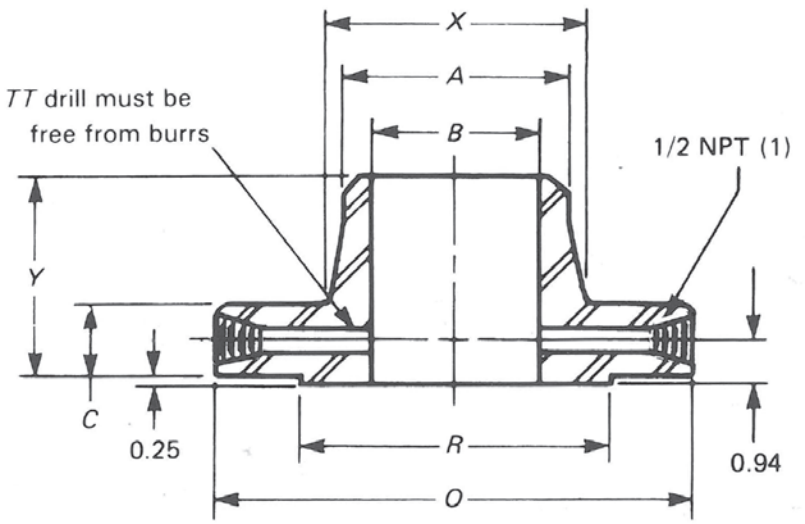


Groove Detail

Dia. of Hub X	Hub Dia. Beginning of Chamfer A	Bore B	Dia. of Pressure Connection TT	Drilling Template: Dia. of Bolt Circle	Drilling Template: No. of Holes	Drilling Template: Dia. of Holes	Drilling Template: Dia. of Bolts	Length of Stud Bolts [(3), (4)]: Raised Face	Length of Stud Bolts [(3), (4)]: Ring Joint
For NPS 3 and smaller, use Class 600.									
5 ¾	4.50	See Note (5).	½	7 ⅞	8	1	⅞	5 ½	6
8 ⅛	6.63		½	10 ⅝	12	1	⅞	6 ¼	6 ½
10 ¼	8.63		½	13	12	1 ⅛	1	6 ¾	7 ¼
12 ⅝	10.75		½	15 ¼	16	1 ¼	1 ⅛	7 ½	8
14 ¾	12.75		½	17 ¾	16	1 ⅜	1 ¼	8	8 ½
16 ¾	14.00		½	20 ¼	20	1 ⅜	1 ¼	8 ¼	9
19	16.00		½	22 ½	20	1 ½	1 ⅜	8 ¾	9 ¼
21	18.00		½	24 ¾	24	1 ½	1 ½	9 ¼	9 ½
23 ⅛	20.00		½	27	24	1 ⅝	1 ½	9 ¾	10 ¼
23 ⅝	24.00		½	32	24	1 57/64	1 ¾	11	—

(4) Bolt lengths for raised face flanges include allowance for orifice and gasket thickness of 0.25 in. for NPS 4-12 and 0.38 in. for NPS 14-24. Bolt lengths for ring type joint flanges include allowance of 0.62 in. for NPS -10, 0.75 for NPS 12-18, and 0.88 in. for NPS 20.
(5) Bore is to be specified by purchaser.
(6) Ring joint flange is not shown in NPS 24 due to insufficient metal between groove and pressure tap hole.
(7) All Texas Metal Works RTJ orifice flanges are 0.94 pressure tap center.

ANSI B16.36 Orifice Flanges



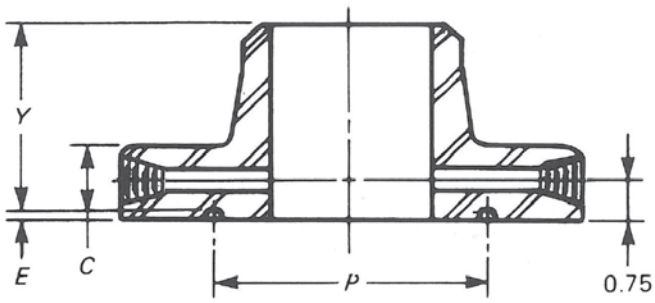
RAISED FACE

Nominal Pipe Size	Outside Dia. of Flange O	Thickness of Flange (4) Min. C	Outside Dia. of Raised Face R	Length Thru Hub Y	Height of Raised Face H	Ring Type Joint					
						Groove Number	Pitch Dia. P	Groove Depth E	Groove Width F	Radius at Bottom r_{max}	Special Oval Ring Height W
1	4 7/8	1 1/2	2	3 1/4	0.06	R16	2.000	0.250	0.344	0.03	1.00
1 1/2	6 1/8	1 1/2	2 7/8	3 3/8	0.06	R20	2.688	0.250	0.344	0.03	1.00
2	6 1/2	1 1/2	3 5/8	3 3/8	0.06	R23	3.250	0.312	0.469	0.03	1.06
2 1/2	7 1/2	1 1/2	4 1/8	3 1/2	0.06	R26	4.000	0.312	0.469	0.03	1.06
3	8 1/4	1 1/2	5	3 1/2	0.06	R31	4.875	0.312	0.469	0.03	1.06
4	10 3/4	1 1/2	6 3/16	4	0.25	R37	5.875	0.312	0.469	0.03	1.06
6	14	1 7/8	8 1/2	4 5/8	0.25	R45	8.312	0.312	0.469	0.03	1.06
8	16 1/2	2 3/16	10 5/8	5 1/4	0.25	R49	10.625	0.312	0.469	0.03	1.06
10	20	2 1/2	12 3/4	6	0.25	R53	12.750	0.312	0.469	0.03	1.06
12	22	2 5/8	15	6 1/8	0.25	R57	15.000	0.312	0.469	0.03	1.06
14	23 3/4	2 3/4	16 1/4	6 1/2	0.25	R61	16.500	0.312	0.469	0.03	1.06
16	27	3	18 1/2	7	0.25	R65	18.500	0.312	0.469	0.03	1.19
18	29 1/4	3 1/4	21	7 1/4	0.25	R69	21.000	0.312	0.469	0.03	1.19
20	32	3 1/2	23	7 1/2	0.25	R73	23.000	0.375	0.531	0.06	1.25
24	37	4	27 1/4	8	0.25	See Note (8).					

GENERAL NOTE: Dimensions are in inches.

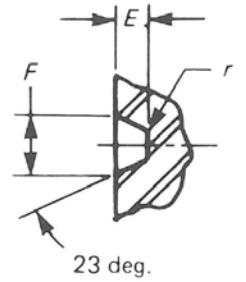
NOTES:
(1) Other NPT sizes may be furnished if required.
(2) Weldneck flanges NPS 3 and smaller are identical to Class 300 flanges except for bolting and may be used for such service.
(3) All other dimensions are in accordance with ASME/ANSI B16.5.
(4) 0.06 in. height of raised face in NPS 1-3 is included in dimensions *C* and *Y*.

ANSI B16.36 Orifice Flanges



RING TYPE JOINT

Special One or Two Piece Ring and Orifice Plate Assembly

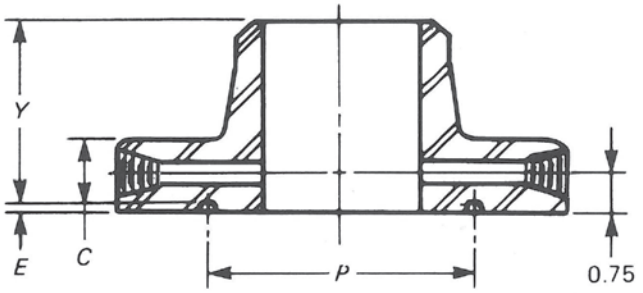


Groove Detail

Dia. of Hub X	Hub Dia. Beginning of Chamfer A	Bore B	Dia. of Pressure Connection TT	Drilling Template					Length of Stud Bolts [(5), (6)]		Nominal Pipe Size
				Dia. of Bolt Circle	No. of Holes	Dia. of Holes		Dia. of Bolts	Raised Face	Ring Joint	
						Raised Face	Ring Joint				
2 1/8	1.32	See Note (7).	1/4	3 1/2	4	11/16	3/4	5/8	5	5 1/2	1
2 3/4	1.90		1/4	4 1/2	4	13/16	7/8	3/4	5 1/4	5 1/2	1 1/2
3 5/16	2.38		1/4	5	8	11/16	3/4	5/8	5	5 1/2	2
3 15/16	2.88		1/4	5 7/8	8	13/16	7/8	3/4	5 1/4	5 3/4	2 1/2
4 5/8	3.50		3/8	6 5/8	8	13/16	7/8	3/4	5 1/4	5 1/4	3
6	4.50		1/2	8 1/2	8	1	1	7/8	6	6 1/2	4
8 3/4	6.63		1/2	11 1/2	12	1 1/8	1 1/8	1	7	7 1/2	6
10 3/4	8.63		1/2	13 3/4	12	1 1/4	1 1/4	1 1/8	7 3/4	8 1/4	8
13 1/2	10.75		1/2	17	16	1 3/8	1 3/8	1 1/4	8 3/4	9 1/4	10
15 3/4	12.75		1/2	19 1/4	16	1 3/8	1 3/8	1 1/4	9	9 1/2	12
17	14.00		1/2	20 3/4	20	1 1/2	1 1/2	1 3/8	9 1/2	10	14
19 1/2	16.00		1/2	23 3/4	20	1 5/8	1 5/8	1 1/2	10 1/4	10 3/4	16
21 1/2	18.00		1/2	25 3/4	24	1 3/4	1 3/4	1 5/8	11	11 1/2	18
24	20.00		1/2	28 1/2	24	1 3/4	1 3/4	1 5/8	11 3/4	12 1/2	20
28 1/4	24.00		1/2	33	24	2	2	1 7/8	13 1/4	—	24

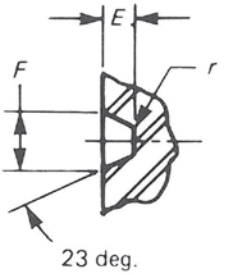
(5) Bolt lengths for raised face flanges include allowance for orifice and gasket thickness of 0.25 in. for NPS 1-12 and 0.38 in. for NPS 14-24. Bolt lengths for ring type joint flanges include allowance of 0.62 in. for NPS 1-10, 0.75 for NPS 12-18, and 0.88 in. for NPS 20.
(6) In conformance with ASME/ANSI B16.5, stud bolt lengths do not include point heights.
(7) Bore is to be specified by purchaser.
(8) Ring joint flange is not shown in NPS 24 due to insufficient metal between groove and pressure tap hole.
(9) All Texas Metal Works RTJ orifice flanges are 0.94 pressure tap center.

ANSI B16.36 Orifice Flanges



RING TYPE JOINT

Special One or Two Piece Ring and Orifice Plate Assembly



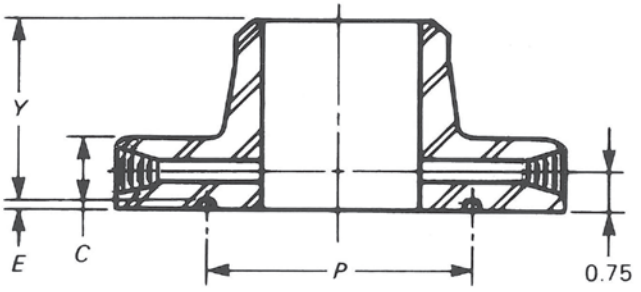
Groove Detail

Nominal Pipe Size	Outside Dia. of Flange O	Thickness of Flange Min. C	Outside Dia. of Raised Face R	Length Thru Hub Y	Ring Type Joint					
					Groove Number	Pitch Dia. P	Groove Depth E	Groove Width F	Radius at Bottom r_{max}	Special Oval Ring Height W
1										
1 ½					For NPS 2 ½ and smaller, use Class 1500.					
2										
2 ½										
3	9 ½	1 ½	5	4	R31	4.875	0.312	0.469	0.03	1.06
4	11 ½	1 ¾	6 3/16	4 ½	R37	5.875	0.312	0.469	0.03	1.06
6	15	2 3/16	8 ½	5 ½	R45	8.312	0.312	0.469	0.03	1.06
8	18 ½	2 ½	10 ⅝	6 ¾	R49	10.625	0.312	0.469	0.03	1.06
10	21 ½	2 ¾	12 ¾	7 ¼	R53	12.750	0.312	0.469	0.03	1.06
12	24	3 ⅛	15	7 ⅞	R57	15.000	0.312	0.469	0.03	1.06
14	25 ¼	3 ⅜	16 ¼	8 ⅜						
16	27 ¾	3 ½	18 ½	8 ½						
18	31	4	21	9			See Note (6).			
20	33 ¾	4 ¼	23	9 ¾						
24	41	5 ½	27 ¼	11 ½						

GENERAL NOTE: Dimensions are in inches.

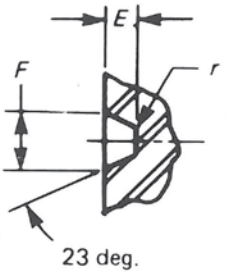
NOTES:
(1) Other NPT sizes may be furnished if required.
(2) All other dimensions are in accordance with ASME/ANSI B16.5.
(3) In conformance with ASME/ANSI B16.5, stud bolt lengths do not include point heights.

ANSI B16.36 Orifice Flanges



RING TYPE JOINT

Special One or Two Piece Ring and Orifice Plate Assembly

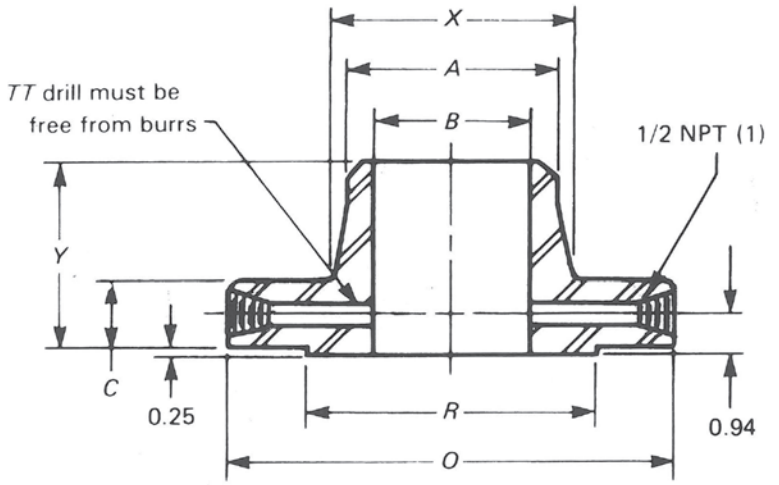


Groove Detail

Dia. of Hub X	Hub Dia. Beginning of Chamfer A	Bore B	Dia. of Pressure Connection TT	Drilling Template: Dia. of Bolt Circle	Drilling Template: No. of Holes	Drilling Template: Dia. of Holes	Drilling Template: Dia. of Bolts	Length of Stud Bolts [(3), (4)]: Raised Face	Length of Stud Bolts [(3), (4)]: Ring Joint
For NPS 2 ½ and smaller, use Class 1500.									
5	3.50	See Note (5).	⅜	7 ½	8	1	⅞	6	6 ½
6 ¼	4.50		½	9 ¼	8	1 ¼	1 ⅛	7	7 ½
9 ¼	6.63		½	12 ½	12	1 ¼	1 ⅛	7 ¾	8 ¼
11 ¾	8.63		½	15 ½	12	1 ½	1 ⅜	9	8 ½
14 ½	10.75		½	18 ½	16	1 ½	1 ⅜	9 ½	10
16 ½	12.75		½	21	20	1 ½	1 ⅜	10 ¼	10 ¾
17 ¾	14.00		½	22	20	1 ⅝	1 ½	11	—
20	16.00		½	24 ¼	20	1 ¾	1 ⅝	11 ½	—
22 ¼	18.00		½	27	20	2	1 ⅞	13	—
24 ½	20.00		½	29 ½	20	2 ⅛	2	14	—
29 ½	24.00		½	35 ½	20	2 ⅝	2 ½	17 ½	—

(4) Bolt lengths for raised face flanges include allowance for orifice and gasket thickness of 0.25 in. for NPS 3-12 and 0.38 in. for NPS 14-24. Bolt lengths for ring type joint flanges include allowance of 0.62 in. for NPS 3-10, 0.75 for NPS 12-18, and 0.75 in. for NPS 12.
(5) Bore is to be specified by purchaser.
(6) Ring joint flanges larger than 12 are not shown due to insufficient metal between groove and pressure tap hole.
(7) All Texas Metal Works RTJ orifice flanges are 0.94 pressure tap center.

ANSI B16.36 Orifice Flanges



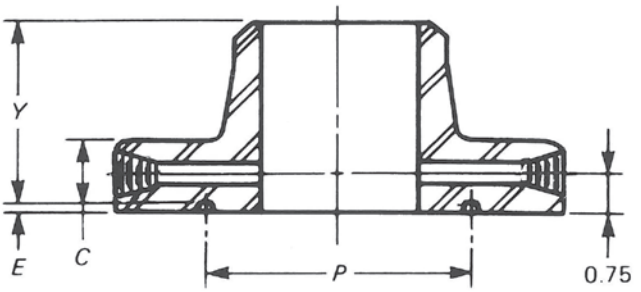
RAISED FACE

Nominal Pipe Size	Outside Dia. of Flange O	Thickness of Flange Min. C	Outside Dia. of Raised Face R	Length Thru Hub Y	Ring Type Joint					
					Groove Number	Pitch Dia. P	Groove Depth E	Groove Width F	Radius at Bottom r_{max}	Special Oval Ring Height W
1	5 7/8	1 1/2	2	3 1/4	R16	2.000	0.250	0.344	0.03	1.00
1 1/2	7	1 1/2	2 7/8	3 1/2	R20	2.688	0.250	0.344	0.03	1.00
2	8 1/2	1 1/2	3 5/8	4	R24	3.750	0.312	0.469	0.03	1.06
2 1/2	9 5/8	1 5/8	4 1/8	4 1/8	R27	4.250	0.312	0.469	0.03	1.06
3	11 1/2	1 7/8	5	4 5/8	R35	5.375	0.312	0.469	0.03	1.06
4	12 1/4	2 1/8	6 3/16	4 7/8	R39	6.375	0.312	0.469	0.03	1.06
6	15 1/2	3 1/4	8 1/2	6 3/4	R46	8.312	0.375	0.531	0.06	1.12
8	19	3 5/8	10 5/8	8 3/8						
10	23	4 1/4	12 3/4	10						
12	26 1/2	4 7/8	15	11 1/8						
14	29 1/2	5 1/4	16 1/4	11 3/4			See Note (6).			
16	32 1/2	5 3/4	18 1/2	12 1/4						
18	36	6 3/8	21	12 7/8						
20	38 3/4	7	23	14						
24	46	8	27 1/4	16						

GENERAL NOTE: Dimensions are in inches.

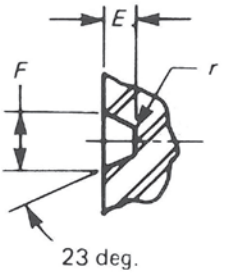
NOTES:
(1) Other NPT sizes may be furnished if required.
(2) All other dimensions are in accordance with ASME/ANSI B16.5.
(3) In conformance with ASME/ANSI B16.5, stud bolt lengths do not include point heights.

ANSI B16.36 Orifice Flanges



RING TYPE JOINT

Special One or Two Piece Ring and Orifice Plate Assembly

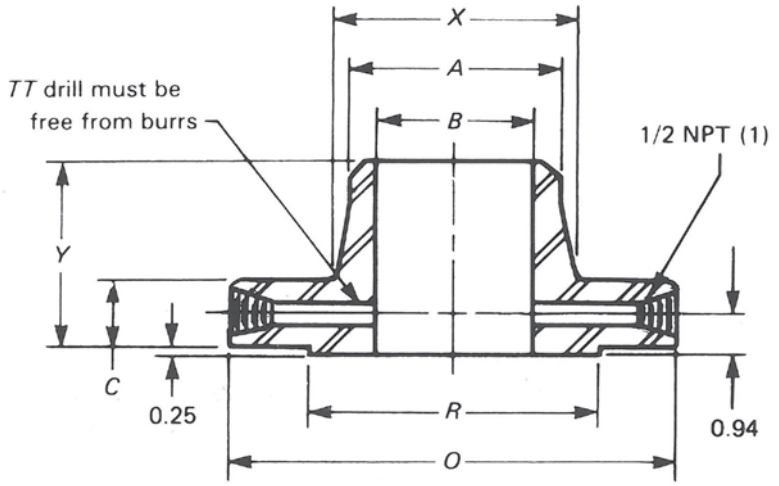


Groove Detail

Dia. of Hub X	Hub Dia. Beginning of Chamfer A	Bore B	Dia. of Pressure Connection TT	Drilling Template				Length of Stud Bolts [(3), (4)]	
				Dia. of Bolt Circle	No. of Holes	Dia. of Holes	Dia. of Bolts	Raised Face	Ring Joint
2 1/16	1.32	See Note (5).	1/4	4	4	1	7/8	6	6 1/4
2 3/4	1.90		1/4	4 7/8	4	1 1/8	1	6 1/4	6 1/2
4 1/8	2.38		1/4	6 1/2	8	1	7/8	6	6 1/2
4 7/8	2.88		1/4	7 1/2	8	1 1/8	1	6 1/2	7
5 1/4	3.50		3/8	8	8	1 1/4	1 1/8	7 1/4	7 1/4
6 3/8	4.50		1/2	9 1/2	8	1 3/8	1 1/4	8	8 1/2
9	6.63		1/2	12 1/2	12	1 1/2	1 3/8	10 1/2	11
11 1/2	8.63		1/2	15 1/2	12	1 3/4	1 5/8	11 3/4	—
14 1/2	10.75		1/2	19	12	2	1 7/8	13 1/2	—
17 3/4	12.75		1/2	22 1/2	16	2 1/8	2	15	—
19 1/2	14.00		1/2	25	16	2 3/8	2 1/4	16 1/4	—
21 3/4	16.00		1/2	27 3/4	16	2 5/8	2 1/2	17 3/4	—
23 1/2	18.00		1/2	30 1/2	16	2 7/8	2 3/4	19 3/4	—
25 1/5	20.00		1/2	32 3/4	16	3 1/8	3	21 1/2	—
30	24.00		1/2	39	16	3 5/8	3 1/2	24 1/2	—

(4) Bolt lengths for raised face flanges include allowance for orifice and gasket thickness of 0.25 in. for NPS 1-12 and 0.38 in. for NPS 14-24. Bolt lengths for ring type joint flanges include allowance of 0.62 in. for NPS 1-6.
(5) Bore is to be specified by purchaser.
(6) Ring joint flanges larger than NPS 6 are not shown due to insufficient metal between groove and pressure tap hole.
(7) All Texas Metal Works RTJ orifice flanges are 0.94 pressure tap center.

ANSI B16.36 Orifice Flanges



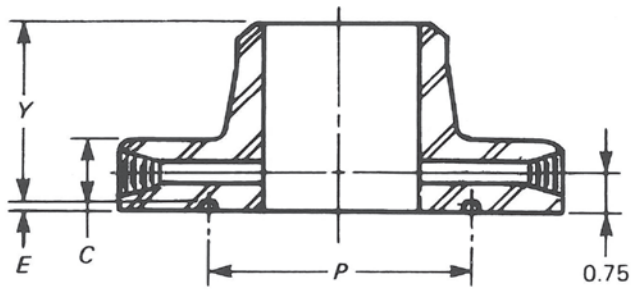
RAISED FACE

Nominal Pipe Size	Outside Dia. of Flange O	Thickness of Flange Min. C	Outside Dia. of Raised Face R	Length Thru Hub Y	Ring Type Joint					
					Groove Number	Pitch Dia. P	Groove Depth E	Groove Width F	Radius at Bottom r_{max}	Special Oval Ring Height W
1	6 ¼	1 ½	2	3 ⅝	R18	2.375	0.250	0.344	0.03	1.00
1 ½	8	1 ¾	2 ⅞	4 ⅜	R23	3.250	0.312	0.469	0.03	1.06
2	9 ¼	2	3 ⅝	5	R26	4.000	0.312	0.469	0.03	1.06
2 ½	10 ½	2 ¼	4 ⅛	5 ⅝	R28	4.375	0.375	0.531	0.06	1.19
3	12	2 ⅝	5	6 ⅝	R32	5.000	0.375	0.531	0.06	1.19
4	14	3	6 3⁄16	7 ½						
6	19	4 ¼	8 ½	10 ¾						
8	21 ¾	5	10 ⅝	12 ½			See Note (6).			
10	26 ½	6 ½	12 ¾	16 ½						
12	30	7 ¼	15	18 ¼						

GENERAL NOTE: Dimensions are in inches.

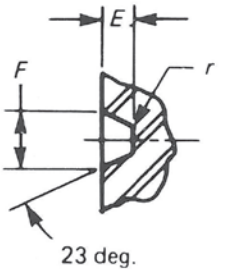
NOTES:
(1) Other NPT sizes may be furnished if required.
(2) All other dimensions are in accordance with ASME/ANSI B16.5.
(3) In conformance with ASME/ANSI B16.5, stud bolt lengths do not include point heights.

ANSI B16.36 Orifice Flanges



RING TYPE JOINT

Special One or Two Piece Ring and Orifice Plate Assembly



Groove Detail

Dia. of Hub X	Hub Dia. Beginning of Chamfer A	Bore B	Dia. of Pressure Connection TT	Drilling Template: Dia. of Bolt Circle	Drilling Template: No. of Holes	Drilling Template: Dia. of Holes	Drilling Template: Dia. of Bolts	Length of Stud Bolts [(3), (4)]: Raised Face	Length of Stud Bolts [(3), (4)]: Ring Joint
2 ¼	1.32	See Note (5).	¼	4 ¼	4	1	⅞	6	6 ¼
3 ⅛	1.90		¼	5 ¾	4	1 ¼	1 ⅛	7	7 ½
3 ¾	2.38		¼	6 ¾	8	1 ⅛	1	7 ¼	7 ¾
4 ½	2.88		¼	7 ¾	8	1 ¼	1 ⅛	8	8 ½
5 ¼	3.50		⅜	9	8	1 ⅜	1 ¼	9	9 ½
6 ½	4.50		½	10 ¾	8	1 ⅝	1 ½	10 ¼	—
9 ¼	6.63		½	14 ½	8	2 ⅛	2	13 ¾	—
12	8.63		½	17 ¼	12	2 ⅛	2	15 ¼	—
14 ¾	10.75		½	21 ¼	12	2 ⅝	2 ½	19 ¼	—
17 ⅜	12.75		½	24 ⅜	12	2 ⅞	2 ¾	21 ¼	—

(4) Bolt lengths for raised face flanges include allowance for orifice and gasket thickness of 0.25 in. for NPS 1-12.
Bolt lengths for ring type joint flanges include allowance of 0.62 in. for NPS 1-3.
(5) Bore is to be specified by purchaser.
(6) Ring joint flanges larger than NPS 3 are not shown due to insufficient metal between groove and pressure tap hole.
(7) All Texas Metal Works RTJ orifice flanges are 0.94 pressure tap center.

Typical Facings

For Steel Pipe Flanges

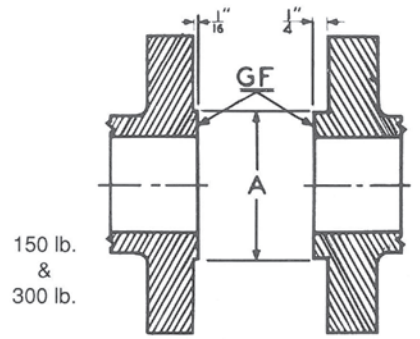


Fig. 1. RAISED FACE

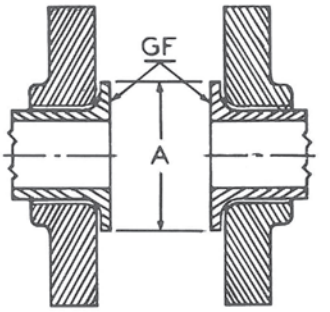


Fig. 2. LAP JOINT

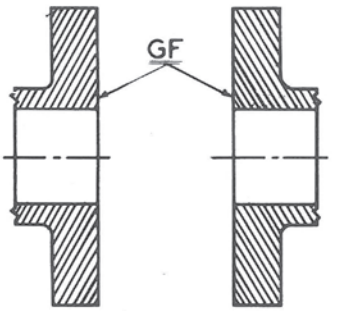


Fig. 3. FLAT FACE

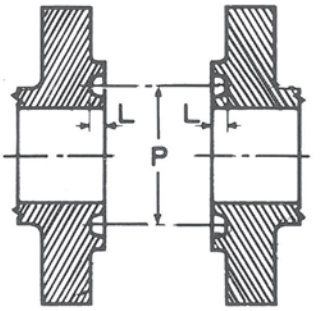


Fig. 4. RING JOINT

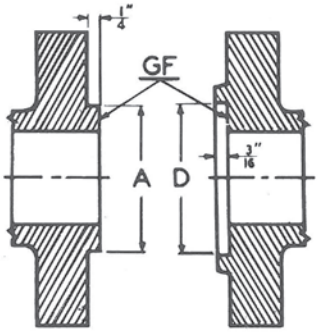


Fig. 5. LARGE MALE AND FEMALE

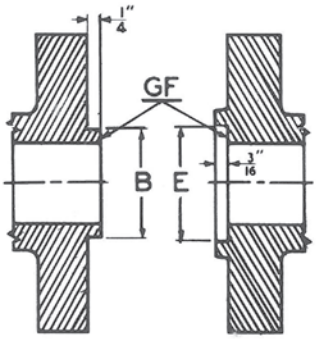


Fig. 6. SMALL MALE AND FEMALE

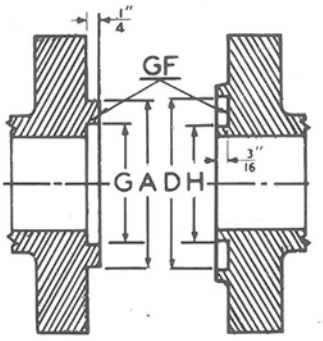


Fig. 7. LARGE TONGUE AND GROOVE

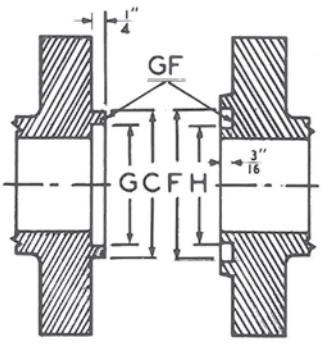
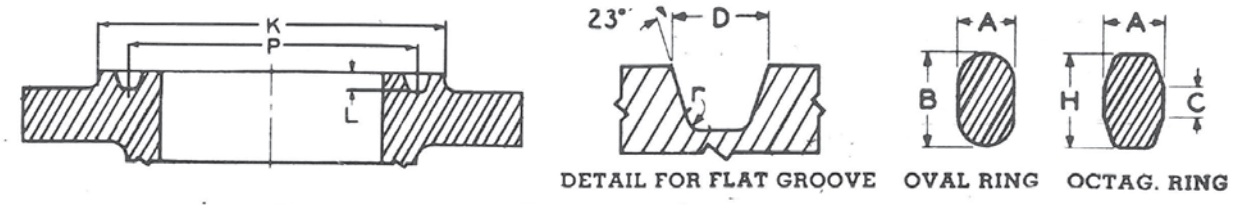


Fig. 8. SMALL TONGUE AND GROOVE

See Dimensions and Notes

ANSI B16.5



For 150 LB. Flanges								
Nominal Pipe Size	Pitch Dia. of Ring and Groove P	Dia. of Raised Face K	Groove		Ring			Approx. Distance Between Flanges When Joint is Compressed
			Width D	Depth L	Ring No.	Width A	Height of Oval Ring B	
1	1 7/8	2 1/2	11/32	*1/4	R15	5/16	9/16	5/32
1 1/4	2 1/4	2 7/8	11/32	*1/4	R17	5/16	9/16	5/32
1 1/2	2 9/16	3 1/4	11/32	*1/4	R19	5/16	9/16	5/32
2	3 1/4	4	11/32	1/4	R22	5/16	9/16	5/32
2 1/2	4	4 3/4	11/32	1/4	R25	5/16	9/16	5/32
3	4 1/2	5 1/4	11/32	1/4	R29	5/16	9/16	5/32
3 1/2	5 3/16	6 1/16	11/32	1/4	R33	5/16	9/16	5/32
4	5 7/8	6 3/4	11/32	1/4	R36	5/16	9/16	5/32
5	6 3/4	7 5/8	11/32	1/4	R40	5/16	9/16	5/32
6	7 5/8	8 5/8	11/32	1/4	R43	5/16	9/16	5/32
8	9 3/4	10 3/4	11/32	1/4	R48	5/16	9/16	5/32
10	12	13	11/32	1/4	R52	5/16	9/16	5/32
12	15	16	11/32	1/4	R56	5/16	9/16	5/32
14	15 5/8	16 3/4	11/32	1/4	R59	5/16	9/16	1/8
16	17 7/8	19	11/32	1/4	R64	5/16	9/16	1/8
18	20 3/8	21 1/2	11/32	1/4	R68	5/16	9/16	1/8
20	22	23 1/2	11/32	1/4	R72	5/16	9/16	1/8
24	26 1/2	28	11/32	1/4	R76	5/16	9/16	1/8

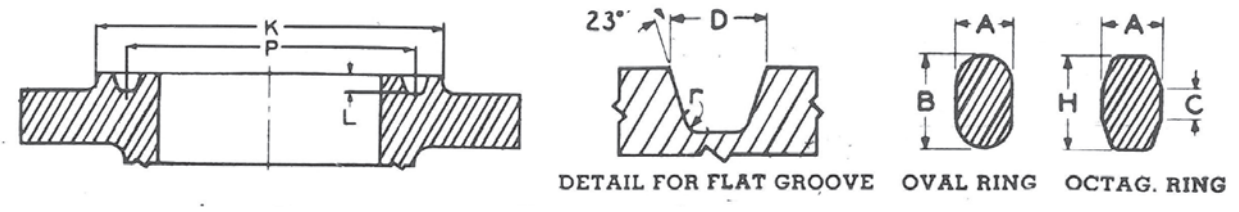
DIMENSIONS are shown in inches, and conform to ASA Specification B 16.5, and API 5-G3.

RING JOINT flanges will be furnished in accordance with these details, unless otherwise specified by the purchaser. Lap joint stubs will also conform to these dimensions, except where designed for use with 3", 300, 400 & 600 lb. flances (such lap joint stubs will be made for Ring No. R30: pitch diameter 4 5/8").

DEPTH of groove is added to flange thickness except that on sizes marked (*), the groove will cut 1/32" into the minimum flange thickness.

Facing Dimensions For Ring Joints

ANSI B16.5



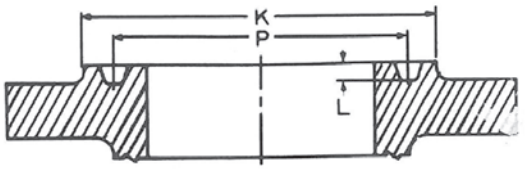
For 300, 400 and 600 LB. Flanges												
Nominal Pipe Size	Pitch Dia. of Ring and Groove P	Dia. of Raised Face K	Groove			Ring				Approx. Distance Between Flanges When Joint is Compressed		
			Width D	Depth L	Ring Number	Width A	Height Oval B	Height Octag. H	Height of Flat on Oct. Ring C	300 lb.	400 lb.	600 lb
½	1 11/32	2	9/32	*7/32	R11	1/4	7/16	3/8		1/8	1/8	1/8
3/4	1 11/16	2 1/2	11/32	*1/4	R13	5/16	9/16	1/2		5/32	5/32	5/32
1	2	2 3/4	11/32	*1/4	R16	5/16	9/16	1/2		5/32	5/32	5/32
1 1/4	2 3/8	3 1/8	11/32	*1/4	R18	5/16	9/16	1/2		5/32	5/32	5/32
1 1/2	2 11/16	3 9/16	11/32	*1/4	R20	5/16	9/16	1/2		5/32	5/32	5/32
2	3 1/4	4 1/4	15/32	5/16	R23	7/16	11/16	5/8		7/32	3/16	3/16
2 1/2	4	5	15/32	5/16	R26	7/16	11/16	5/8		7/32	3/16	3/16
3	4 7/8	5 3/4	15/32	5/16	R31	7/16	11/16	5/8		7/32	3/16	3/16
3 1/2	5 3/16	6 1/4	15/32	5/16	R34	7/16	11/16	5/8		7/32	3/16	3/16
4	5 7/8	6 7/8	15/32	5/16	R37	7/16	11/16	5/8		7/32	7/32	3/16
5	7 1/8	8 1/4	15/32	5/16	R41	7/16	11/16	5/8		7/32	7/32	3/16
6	8 5/16	9 1/2	15/32	5/16	R45	7/16	11/16	5/8		7/32	7/32	3/16
8	10 5/8	11 7/8	15/32	5/16	R49	7/16	11/16	5/8		7/32	7/32	3/16
10	12 3/4	14	15/32	5/16	R53	7/16	11/16	5/8		7/32	7/32	3/16
12	15	16 1/4	15/32	5/16	R57	7/16	11/16	5/8		7/32	7/32	3/16
14	16 1/2	18	15/32	5/16	R61	7/16	11/16	5/8		7/32	7/32	3/16
16	18 1/2	20	15/32	5/16	R65	7/16	11/16	5/8		7/32	7/32	3/16
18	21	22 5/8	15/32	5/16	R69	7/16	11/16	5/8		7/32	7/32	3/16
20	23	25	17/32	3/8	R73	1/2	3/4	11/16	5/16	7/32	7/32	3/16
24	27 1/4	29 1/2	21/32	7/16	R77	5/8	7/8	13/16	5/16	1/4	1/4	7/32

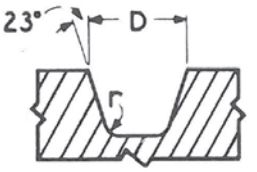
DIMENSIONS are shown in inches, and conform to ASA Specification B 16.5, and API 5-G3.

RING JOINT flanges will be furnished in accordance with these details, unless otherwise specified by the purchaser. Lap joint stubs will also conform to these dimensions, except where designed for use with 3", 300, 400 & 600 lb. flances (such lap joint stubs will be made for Ring No. R30: pitch diameter 4 5/8").

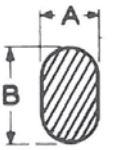
DEPTH of groove is added to flange thickness except that on sizes marked (*), the groove will cut 1/32" into the minimum flange thickness.

ANSI B16.5

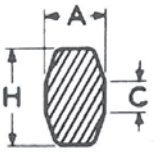




DETAIL FOR FLAT GROOVE



OVAL RING



OCTAG. RING

For 900 LB. Flanges										
Nominal Pipe Size	Pitch Dia. of Ring and Groove P	Dia. of Raised Face K	Groove		Ring		Height		Height of Flat on Oct. Ring C	Approx. Distance Between Flanges When Joint is Compressed
			Width D	Depth L	Ring Number	Width A	Oval B	Octag. H		
½	1 9/16	2 3/8	11/32	*7/32	R12	5/16	9/16			5/32
¾	1 ¾	2 5/8	11/32	*¼	R14	5/16	9/16			5/32
1	2	2 13/16	11/32	*¼	R16	5/16	9/16			5/32
1 ¼	2 3/8	3 3/16	11/32	*¼	R18	5/16	9/16			5/32
1 ½	2 11/16	3 5/8	11/32	*¼	R20	5/16	9/16			5/32
2	3 ¾	4 7/8	15/32	5/16	R24	7/16	11/16			1/8
2 ½	4 ¼	5 3/8	15/32	5/16	R27	7/16	11/16			1/8
3	4 7/8	6 1/8	15/32	5/16	R31	7/16	11/16	5/8		5/32
4	5 7/8	7 1/8	15/32	5/16	R37	7/16	11/16	5/8		5/32
5	7 1/8	8 ½	15/32	5/16	R41	7/16	11/16	5/8		5/32
6	8 5/16	9 ½	15/32	5/16	R45	7/16	11/16	5/8		5/32
8	10 5/8	12 1/8	15/32	5/16	R49	7/16	11/16	5/8		5/32
10	12 ¾	14 ¼	15/32	5/16	R53	7/16	11/16	5/8		5/32
12	15	16 ½	15/32	5/16	R57	7/16	11/16	5/8		5/32
14	16 ½	18 3/8	21/32	7/16	R62	5/8	7/8	13/16	5/16	5/32
16	18 ½	20 5/8	21/32	7/16	R66	5/8	7/8	13/16	5/16	5/32
18	21	23 3/8	25/32	½	R70	¾	1	15/16	5/16	3/16
20	23	25 ½	25/32	½	R74	¾	1	15/16	5/16	3/16
24	27 ¼	30 3/8	1 1/8	5/8	R78	1	1 5/16	1 5/16	½	7/32

CORNER RADIUS "r" is 1/32" for ring width 7/16" and smaller; 1/16" for ring widths ½" to 7/8" inclusive and 3/32" for ring widths 1" and larger.

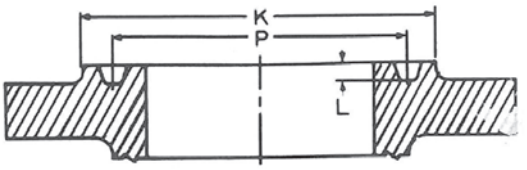
FLAT-BOTTOMED GROOVE, as shown in detail above, will be furnished unless otherwise specified.

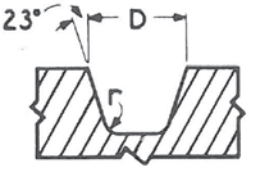
TOLERANCES:

P ± .005" B ± 1/64" H ± 1/64"
A ± .008" D ± 1/64" L ± 1/64"

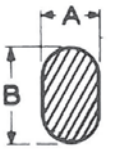
Facing Dimensions For Ring Joints

ANSI B16.5

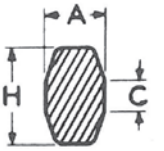




DETAIL FOR FLAT GROOVE



OVAL RING



OCTAG. RING

For 1500 LB. Flanges

Nominal Pipe Size	Pitch Dia. of Ring and Groove P	Dia. of Raised Face K	Groove		Ring				Height of Flat on Oct. Ring C	Approx. Distance Between Flanges When Joint is Compressed
			Width D	Depth L	Ring Number	Width A	Height Oval B	Height Octag. H		
½	1 9/16	2 3/8	11/32	*1/4	R12	5/16	9/16	½		5/32
¾	1 ¾	2 5/8	11/32	*1/4	R14	5/16	9/16	½		5/32
1	2	2 13/16	11/32	*1/4	R16	5/16	9/16	½		5/32
1 ¼	2 3/8	3 3/16	11/32	*1/4	R18	5/16	9/16	½		5/32
1 ½	2 11/16	3 5/8	11/32	*1/4	R20	5/16	9/16	½		5/32
2	3 ¾	4 7/8	15/32	5/16	R24	7/16	11/16	5/8		1/8
2 ½	4 ¼	5 3/8	15/32	5/16	R27	7/16	11/16	5/8		1/8
3	4 7/8	6 5/8	15/32	5/16	R35	7/16	11/16	5/8		1/8
4	5 7/8	7 5/8	15/32	5/16	R39	7/16	11/16	5/8		1/8
5	7 1/8	9	15/32	5/16	R44	7/16	11/16	5/8		1/8
6	8 5/16	9 ¾	17/32	3/8	R46	½	¾	11/16	5/16	1/8
8	10 5/8	12 ½	21/32	7/16	R50	5/8	7/8	13/16	5/16	5/32
10	12 ¾	14 5/8	21/32	7/16	R54	5/8	7/8	13/16	5/16	5/32
12	15	17 ¼	29/32	9/16	R58	7/8	1 1/8	1 1/16	3/8	3/16
14	16 ½	19 ¼	1 1/16	5/8	R63	1	1 5/16	1 ¼	½	7/32
16	18 ½	21 ½	1 3/16	11/16	R67	1 1/8	1 7/10	1 3/8	9/16	5/16
18	21	24 1/8	1 3/16	11/16	R71	1 1/8	1 7/16	1 3/8	9/16	5/16
20	23	26 ½	1 5/16	11/16	R75	1 ¼	1 9/16	1 ½	5/8	3/16
24	27 ¼	31 ¼	1 7/16	13/16	R79	1 3/8	1 ¾	1 5/8	11/16	7/16

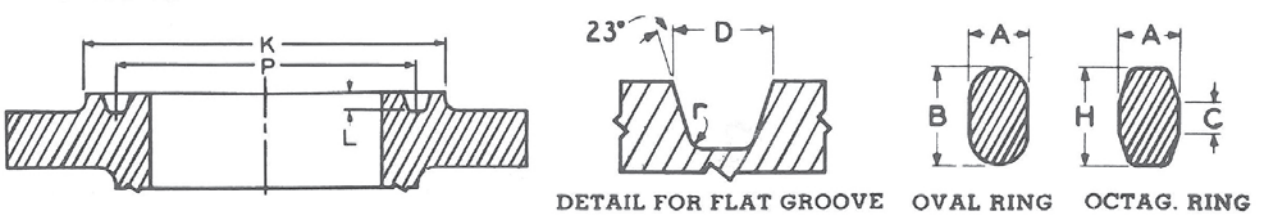
CORNER RADIUS "r" is 1/32" for ring width 7/16" and smaller; 1/16" for ring widths ½" to 7/8" inclusive and 3/32" for ring widths 1" and larger.

FLAT-BOTTOMED GROOVE, as shown in detail above, will be furnished unless otherwise specified.

TOLERANCES:

P ± .005" B ± 1/64" H ± 1/64"
A ± .008" D ± 1/64" L ± 1/64"

ANSI B16.5



For 2500 LB. Flanges										
Nominal Pipe Size	Pitch Dia. of Ring and Groove P	Dia. of Raised Face K	Groove		Ring				Height of Flat on Oct. Ring C	Approx. Distance Between Flanges When Joint is Compressed
			Width D	Depth L	Ring Number	Width A	Height Oval B	Height Octag. H		
½	1 1/16	2 9/16	11/32	*1/4	R13	5/16	9/16			5/32
¾	2	2 7/8	11/32	*1/4	R16	5/16	9/16			5/32
1	2 3/8	2 27/32	11/32	*1/4	R18	5/16	9/16			5/32
1 ¼	2 27/32	3 ¼	15/32	5/16	R21	7/16	11/16			1/8
1 ½	3 ¼	4	15/32	5/16	R23	7/16	11/16			1/8
2	4	4 3/8	15/32	5/16	R26	7/16	11/16			1/8
2 ½	4 3/8	5	17/32	3/8	R28	½	¾			1/8
3	5	6 3/16	17/32	3/8	R32	½	¾	11/16	5/16	1/8
4	6 3/16	7 ½	21/32	7/16	R38	5/8	7/8	11/16	5/16	5/32
5	7 ½	9	25/32	½	R42	¾	1	13/16	5/16	5/32
6	9	11	25/32	½	R47	¾	1	15/16	5/16	5/32
8	11	13 ½	29/32	9/16	R51	7/8	1 1/8	1 1/16	3/8	3/16
10	13 ½	16 ¾	1 3/16	11/16	R55	1 1/8	1 7/16	1 3/8	9/16	¼
12	16	19 ½	1 5/16	11/16	R60	1 ¼	1 9/16	1 ½	5/8	5/16

DIMENSIONS are shown in inches, and conform to ASA Specification B 16.5, and API 5-G3.

RING JOINT flanges will be furnished in accordance with these details, unless otherwise specified by the purchaser. Lap joint stubs will also conform to these dimensions.

DEPTH of groove is added to flange thickness except that on sizes marked (*), the groove will cut 1/32" into the minimum flange thickness.

CORNER RADIUS "r" is 1/32" for ring width 7/16" and smaller; 1/16" for ring widths ½" to 7/8" inclusive and 3/32" for ring widths 1" and larger.

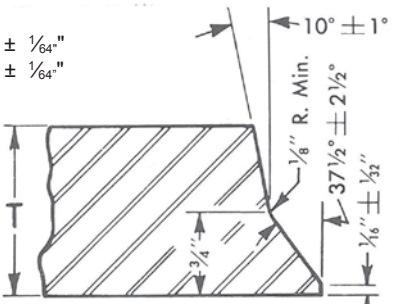
FLAT-BOTTOMED GROOVE, as shown in detail above, will be furnished unless otherwise specified.

TOLERANCES:

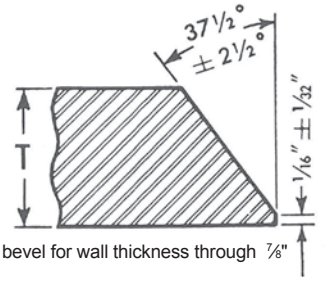
P ± .005"	B ± 1/64"	H ± 1/64"
A ± .008"	D ± 1/64"	L ± 1/64"

BEVELING STANDARDS

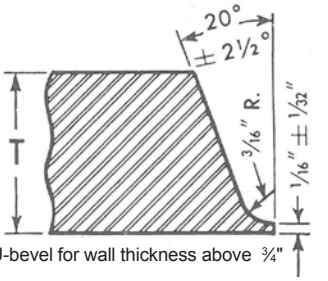
For wall thicknesses through 7/8", a straight 37 ½° bevel with a 1/16" land is provided for fittings and flanges. For wall thicknesses greater than 7/8", a compound bevel is furnished. Also, for wall thicknesses above ¾" a U-bevel can be furnished if specified. U-bevels, while not included in B16.9, are often used when welding is done by the Tungsten-Inert Gas Method. Fittings with compound bevels can be satisfactorily welded to the pipe and fittings with U-bevels.



Compound bevel for thicknesses greater than 7/8"



37½° bevel for wall thickness through 7/8"

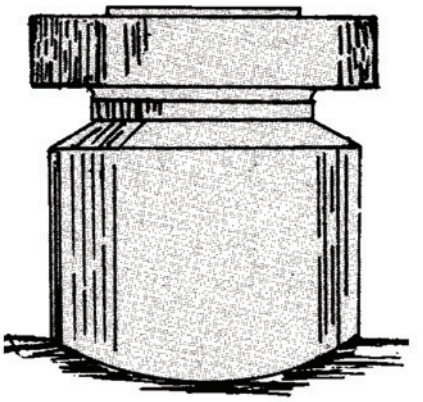


20° U-bevel for wall thickness above ¾"

Note: All nominal Pipe Sizes in materials covered by ANSI B16.9 are beveled as shown. Other bevels available upon request.

Long Weld Neck

Evaluate a few of the advantages provided by AFGlobal integrally reinforced standard connections:



1. Contour forged close to the finished profile for aligned grain flow of material, resulting in maximum strength and toughness.
2. Less possibility of distortion from heat of welding.
3. Reduction of total time required for vessel fabrication, therefore speeding up delivery and cash flow of each job.
4. Easier traceability of material, only one piece vs. two or more pieces required for "built-up" construction—many times test certificates can be a large additional hidden cost.
5. "Ready to install" convenience.
6. Larger manway bore diameters—when a 16-inch I.D. is required you only pay for a 16-inch AFGlobal nozzle and 16-inch mating components, but if you use a "built-up" construction you pay for an 18-inch weld neck flange, 18-inch pipe and an 18-inch blind. Therefore you save by not paying for the larger blind flange gasket as well as the larger or more nuts and studs associated with "built-up" nozzles, For larger minimum I.D.'s the savings become even greater.
7. Integral reinforcement lowers overall fabrication cost by reducing or eliminating the cost in the following areas:

(A) Purchasing and Expediting: One part vs. pipe, flange, and plate.

(B) Material Handling: One piece to unload, stock, and move to shop for final installation.

(C) Inventory Control: Fewer parts to stock, trace, and locate on plant site.

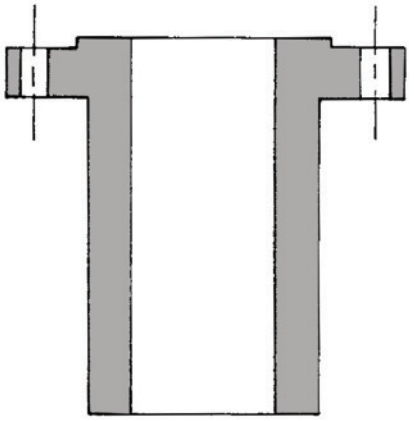
(D) Production Scheduling: AFGlobal Seamless Schedule System of "Reduce & Eliminate" saves time and money…

Department	Fabrication Process	Scheduled Time
1) Layout	Layout of reinforcing pad	Eliminated
2) Burning	Pipe & pad	Eliminated
3) Fitting	Sub-assembly fitting pipe, flange & pad	Eliminated
4) Welding	Sub-assembly welding pipe & flange Main bay welding of pad	Eliminated Eliminated
5) Grinding	Neck-to-shell or head weld Grinding pupe to flange weld Grinding pad OD weld	Reduced Eliminated Eliminated
6) Testing	X-Ray of pipe to flange weld U/T, MP & air test of pad Neck-to-vessel joint repairs	Eliminated Eliminated Reduced

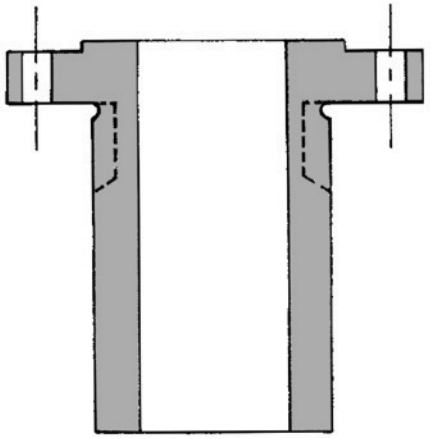
(E) Quality Control: Time spent verifying all the material certifications, testing procedures, vendor compliance, accompanying customer inspectors witnessing testing and vendor certificates is reduced.

(F) Sales & Marketing: The on-time shipment and the aesthetic appeal of a vessel fabricated using AFGlobal seamless connections creates an atmosphere which reduces the sales effort required to obtain the next order from your customer.

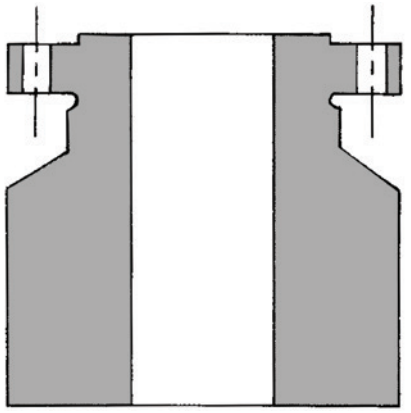
Compound these advantages with other disadvantages of "built-up" construction and it is easy to see why AFGlobal standard seamless connections should be used for all of your flanged nozzle requirements.



Long Welding Neck
Type **"LWN"**



Heavy Barrel Connection
Type **"HB"**



Full Barrel Connection
Type **"F"**

Standard Connections

AFGlobal flanged connections are available in a large variety of standard barrel thicknesses. These styles include the AFGlobal LWN, the HB, the Variable Body Connections V_1, V_2 and V_3 and the F connections. This wide variety of standard barrel thicknesses was developed in order to provide a AFGlobal standard product that fulfills your individual reinforcement applications. All AFGlobal standard flanged connections are:

1. Seamless forged construction.
2. Manufactured in strict accordance with ASME Sec. VIII, Div. 1.
3. Manufactured in all of the sizes and pressure classes covered by ASME B16.5.
4. Manufactured and stocked in SA-105, SA-350-LF2, SA-182-F1, SA-182-F11, SA-182-F304(L), and SA-182-F316(L).

Other materials can be provided, upon request.
The following describes the variety of standard connections offered by AFGlobal, progressing from the thinnest standard neck to the thickest standard connection:

The AFGlobal Type "LWN" – "Long Welding Neck"

The "LWN" is AFGlobal's basic standard flanged connection. This seamless product offers a nominal bore as well as a heavy wall thickness, making it ideal for highly corrosive applications.

The AFGlobal Type "HB" Neck – "Heavy Barrel"

The "HB" neck furnishes more integral reinforcement than the corresponding size AFGlobal "LWN" which is accomplished with a thicker barrel neck section.
There are additional features on this style neck:

1. On AFGlobal "HB" necks an automatic "nut stop" is provided by the standard barrel O.D. This eliminates the need for a second holding wrench. An optional "nut relief" in the barrel will allow two wrench operation.
2. AFGlobal "HB" necks, sizes 12 inch and below are furnished with Sch 80 bores. Manway sizes 14 inch and above have bores equal to the nominal size.

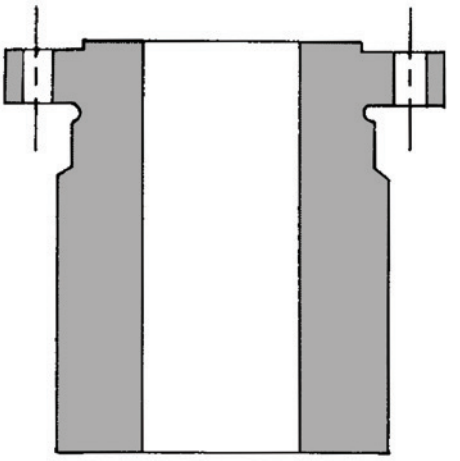
The AFGlobal Type "F" Nozzle – "Full Body"

The AFGlobal Type "F" body connection provides the most reinforcement among the standard connections. The barrel O.D. is the same as the flange O.D.

Variable Body Connections

The AFGlobal Type "V" Nozzle – "Variable Body"

Never before has a manufacturer offered so many standard barrel thicknesses in seamless connections. This variety enables AFGlobal to provide a sufficient amount of integral reinforcement required while keeping nozzle weight and cost down to a minimum. Don't compromise with an expensive "custom" forging when you can find the required barrel diameter in the standard AFGlobal "Variable Body" charts on the following pages. The AFGlobal "Variable Body" connections provide more integral reinforcement than an "HB" neck, without the added cost of a custom forging or the added cost and weight of an "F" connection.

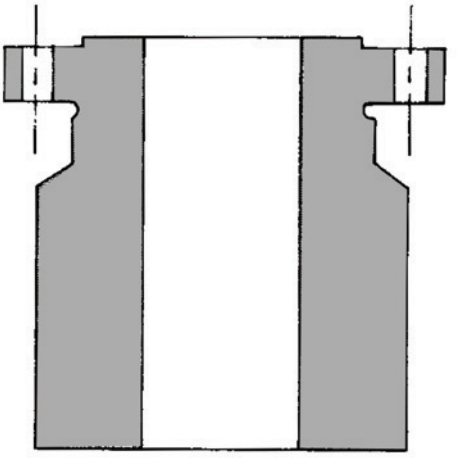


Type "V_1"

Optional Features

All AFGlobal connections are available with the following optional features:

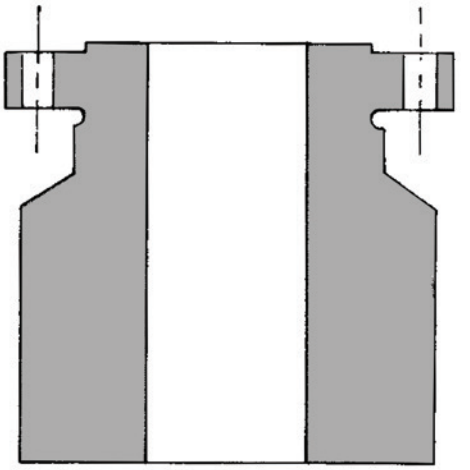
1. contoured bottoms: "cylindrical", "spherical," or "hillside".
2. special lengths, longer or shorter than the standard lengths listed in the price list are no problem for AFGlobal.
3. insert lips, contour forged or contour machined.
4. additional facings, standard B16.5 or custom designs.
5. "nut stop" barrel, (except on LWN'S).
6. optional Barrel O.D. and I.D.
7. AFGlobal can also make LWNs, HBs, Variable Body Nozzles, and F Nozzles to ASME B16.47 Series A and Series B.



Type "V_2"

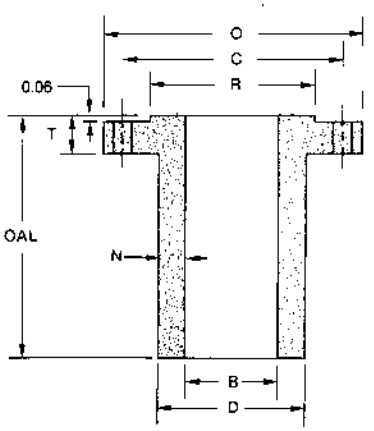
Don't Compromise

If your reinforcement requirements cannot be met with these standard AFGlobal products, please call our sales department at 713-393-4200 or visit us on the web at www.afglobalcorp.com

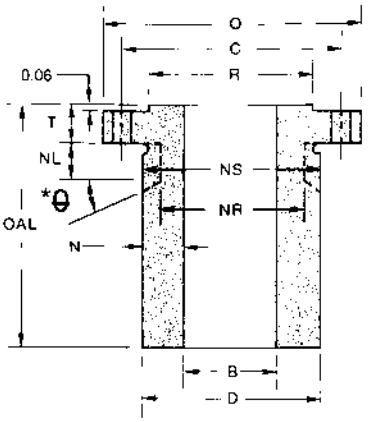


Type "V_3"

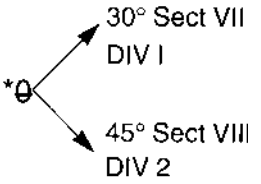
FVC Standard Connections



FVC "LWN"



FVC Heavy Barrel Connection "HB"



Size	Flange O.D.	Flange Thick.	RF O.D.	Bolt Holes	Hole Size	Bolt Circle	Bore		Barrel O.D.		
							LWN/F	HB	LWN	HB	F
	O	T	R	-	-	C	B	B	D	D	D
½	3.50	0.44	1.38	4	0.62	2.38	0.50	0.55	1.25	1.50	3.50
¾	3.88	0.50	1.69	4	0.62	2.75	0.75	0.74	1.62	1.88	3.88
1	4.25	0.56	2.00	4	0.62	3.12	1.00	0.96	2.00	2.25	4.25
1¼	4.62	0.62	2.50	4	0.62	3.50	1.25	1.28	2.38	2.62	4.63
1½	5.00	0.69	2.88	4	0.62	3.88	1.50	1.50	2.62	3.00	5.00
2	6.00	0.75	3.62	4	0.75	4.75	2.00	1.94	3.06	3.69	6.00
2½	7.00	0.88	4.12	4	0.75	5.50	2.50	2.32	3.75	4.44	7.00
3	7.50	0.94	5.00	4	0.75	6.00	3.00	2.90	4.25	4.94	7.50
3½	8.50	0.94	5.50	8	0.75	7.00	3.50	3.36	4.88	5.94	8.50
4	9.00	0.94	6.19	8	0.75	7.50	4.00	3.83	5.50	6.44	9.00
5	10.00	0.94	7.31	8	0.88	8.50	5.00	4.81	6.50	7.25	10.00
6	11.00	1.00	8.50	8	0.88	9.50	6.00	5.76	7.75	8.25	11.00
8	13.50	1.12	10.62	8	0.88	11.75	8.00	7.62	9.75	10.50	13.50
10	16.00	1.19	12.75	12	1.00	14.25	10.00	9.56	12.00	12.81	16.00
12	19.00	1.25	15.00	12	1.00	17.00	12.00	11.38	14.38	15.56	19.00
14	21.00	1.38	16.25	12	1.12	18.75	14.00	14.00	16.00	17.12	21.00
16	23.50	1.44	18.50	16	1.12	21.25	16.00	16.00	18.00	19.62	23.50
18	25.00	1.56	21.00	16	1.25	22.75	18.00	18.00	20.00	20.94	25.00
20	27.50	1.69	23.00	20	1.25	25.00	20.00	20.00	22.00	23.19	27.50
24	32.00	1.88	27.25	20	1.38	29.50	24.00	24.00	26.25	27.50	32.00

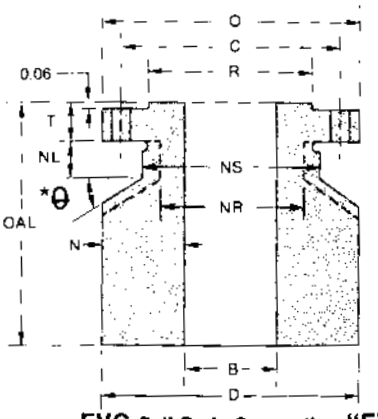
Material: FVC forged connections are made from SA-105 in compliance with ASME Section II. FVC connections are available in other material compositions upon request. See "Technical Section" on page 59 for stocked materials.

Length: The length of all connections includes the barrel, flange and facing. See the current FVC price sheet for standard lengths. **Intermediate lengths and longer are available upon request.**

Facing: The FVC flange thickness "T" includes 0.06 inch raised face per ASME B16.5. This differs on Class 400 and above. FVC can supply any special facing as needed upon request.

Notes continued on following page.

FVC Standard Connections



FVC Full Body Connection "F"

DON'T COMPROMISE!

If your reinforcement requirements are in between the "HB" and "F" connections see the following page for Class 150 FVC Variable Body Connections

Size	Nut Stop Dia.	Nut Relief Dia.	Nut Relief Lngth.	Neck Thickness			Weights						Base Wt. Lngth.
				LWN	HB	F	LWN		HB		F		
	NS	NR	NL	N	N	N	Base Wt.	Wt./1"	Base Wt.	Wt./1"	Base Wt.	Wt./1"	
½	1.50	1.25	0.75	0.38	0.48	1.50	3	0.3	5	0.4	21	2.7	9
¾	1.88	1.62	0.75	0.44	0.57	1.56	5	0.5	7	0.7	27	3.2	9
1	2.25	2.00	0.75	0.50	0.65	1.62	7	0.7	10	0.9	30	3.8	9
1¼	2.62	2.38	0.75	0.56	0.67	1.69	10	0.9	12	1.2	36	4.4	9
1½	3.00	2.62	0.75	0.56	0.75	1.75	12	1.0	16	1.5	41	5.1	9
2	3.69	3.06	0.88	0.53	0.88	2.00	15	1.2	23	2.2	57	7.1	9
2½	4.44	3.75	0.88	0.62	1.06	2.25	22	1.7	34	3.2	79	10	9
3	4.94	4.25	0.88	0.62	1.02	2.25	25	2.0	38	3.6	86	11	9
3½	5.94	4.88	0.88	0.69	1.29	2.50	32	2.6	55	5.3	110	13	9
4	6.44	5.50	0.88	0.75	1.31	2.50	47	3.2	78	6.0	164	14	12
5	7.25	6.50	1.00	0.75	1.22	2.50	57	3.8	87	6.5	189	17	12
6	8.25	7.75	1.00	0.88	1.25	2.50	75	5.4	103	7.8	216	19	12
8	10.50	9.75	1.00	0.88	1.44	2.75	102	6.9	157	11	292	26	12
10	12.81	12.00	1.12	1.00	1.63	3.00	143	9.8	214	16	382	35	12
12	15.56	14.38	1.12	1.19	2.09	3.50	205	14	329	25	535	48	12
14	17.12	16.00	1.25	1.00	1.56	3.50	211	13	296	22	585	55	12
16	19.62	18.00	1.25	1.00	1.81	3.75	246	15	388	29	714	66	12
18	20.94	20.00	1.38	1.00	1.47	3.50	270	17	362	25	711	67	12
20	23.19	22.00	1.38	1.00	1.60	3.75	311	19	434	31	840	79	12
24	27.50	26.25	1.50	1.12	1.75	4.00	423	25	574	40	1046	100	12

Bolting and Tolerances: FVC flanges are furnished to ASME B16.5 specifications unless otherwise specified.

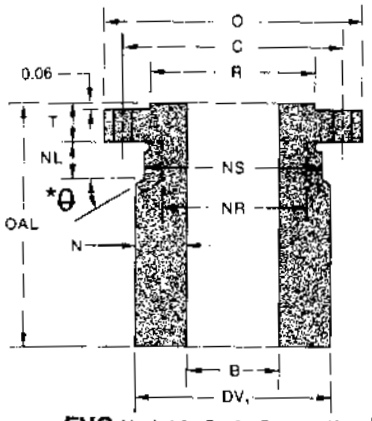
Nut Relief: All FVC connections except standard LWN's will be supplied with a "nut stop O.D." unless a "nut relief O.D." is specified.

Bore: Bore sizes shown above are standard, other sizes can be furnished upon request.

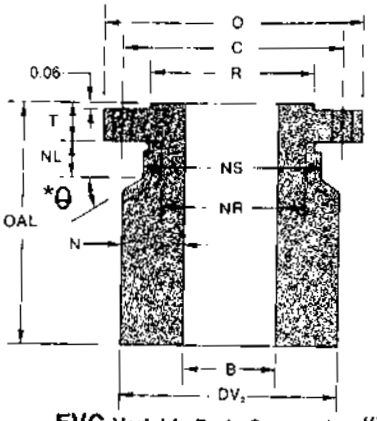
Curving: All FVC connections can be furnished contoured to fit any shell, head or cone at a minimal cost.

See page 97 for complete general notes.

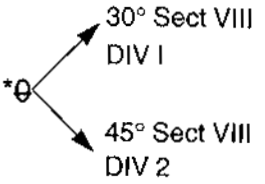
FVC Variable Body Connections



FVC Variable Body Connection "V_1"



FVC Variable Body Connection "V_2"



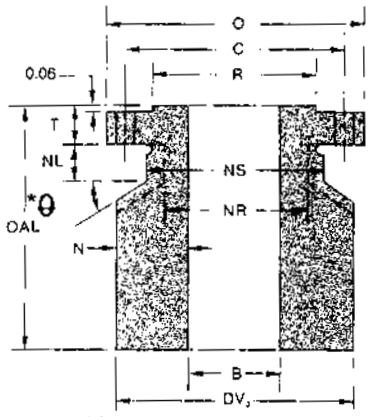
Size	Flange O.D.	Flange Thick.	RF O.D.	Bolt Holes	Hole Size	Bolt Circle	Bore	Barrel O.D.		
								V_1	V_2	V_3
	O	T	R	-	-	C	B	DV_1	DV_2	DV_3
1	4.25	0.56	2.00	4	0.62	3.12	0.96	2.75	3.25	4.00
1½	5.00	0.69	2.88	4	0.62	3.88	1.50	3.25	4.00	4.62
2	6.00	0.75	3.62	4	0.75	4.75	1.94	4.00	4.62	5.50
2½	7.00	0.88	4.12	4	0.75	5.50	2.32	4.62	5.75	6.00
3	7.50	0.94	5.00	4	0.75	6.00	2.90	5.75	6.00	6.38
3½	8.50	0.94	5.50	8	0.75	7.00	3.36	6.38	7.00	7.75
4	9.00	0.94	6.19	8	0.75	7.50	3.83	7.00	7.75	8.25
5	10.00	0.94	7.31	8	0.88	8.50	4.81	7.75	8.25	8.88
6	11.00	1.00	8.50	8	0.88	9.50	5.76	8.88	9.88	10.38
8	13.50	1.12	10.62	8	0.88	11.75	7.62	11.00	11.50	12.12
10	16.00	1.19	12.75	12	1.00	14.25	9.56	13.50	14.25	15.12
12	19.00	1.25	15.00	12	1.00	17.00	11.38	16.25	17.38	18.25
14	21.00	1.38	16.25	12	1.12	18.75	14.00	18.25	19.38	20.12
16	23.50	1.44	18.50	16	1.12	21.25	16.00	20.12	21.00	22.25
18	25.00	1.56	21.00	16	1.25	22.75	18.00	22.25	23.25	24.12
20	27.50	1.69	23.00	20	1.25	25.00	20.00	24.12	25.00	26.25
24	32.00	1.88	27.25	20	1.38	29.50	24.00	27.75	29.25	30.75

Material: FVC forged connections are made from SA-105 in compliance with ASME Section II. FVC connections are available in other material compositions upon request. See "Technical Section" on page 59 for stocked materials.

Length: The length of all connections includes the barrel, flange and facing. See the current FVC price sheet for standard lengths. **Intermediate lengths and longer are available upon request.**

Facing: The FVC flange thickness "T" includes 0.06 inch raised face per ASME B16.5. This differs on Class 400 and above. FVC can supply any special facing as needed upon request.

Variable Body Connections



FVC Variable Body Connection "V_3"

DON'T COMPROMISE!

If your reinforcement requirements have not been met with these standard FVC connections, please see "Custom Products", pages 54 to 56.

Size	Nut Stop Dia.	Nut Relief Dia.	Nut Relief Lngth.	Neck Thickness			Weights						Base Wt. Lngth.
				V_1	V_2	V_3	V_1		V_2		V_3		
	NS	NR	NL	N	N	N	Base Wt.	Wt./1"	Base Wt.	Wt./1"	Base Wt.	Wt./1"	
1	2.25	2.00	0.75	0.90	1.15	1.52	19	1.5	26	2.2	38	3.4	12
1½	3.00	2.62	0.75	0.88	1.25	1.56	25	1.9	37	3.1	49	4.3	12
2	3.69	3.06	0.88	1.03	1.34	1.78	35	2.7	48	3.9	67	5.9	12
2½	4.44	3.75	0.88	1.15	1.72	1.84	48	3.5	73	6	81	7	12
3	4.94	4.25	0.88	1.43	1.55	1.74	69	5.5	75	6	85	7	12
3½	5.94	4.88	0.88	1.51	1.82	2.20	83	7	102	8	126	11	12
4	6.44	5.50	0.88	1.59	1.96	2.21	95	8	119	10	137	12	12
5	7.25	6.50	1.00	1.47	1.72	2.04	104	8	121	10	144	12	12
6	8.25	7.75	1.00	1.56	2.06	2.31	126	10	167	14	188	17	12
8	10.50	9.75	1.00	1.69	1.94	2.25	180	14	205	17	236	20	12
10	12.81	12.00	1.12	1.97	2.35	2.78	337	20	399	25	474	31	16
12	15.56	14.38	1.12	2.44	3.00	3.44	494	30	606	38	696	45	16
14	17.12	16.00	1.25	2.13	2.69	3.06	501	31	622	40	705	47	16
16	19.62	18.00	1.25	2.06	2.50	3.13	562	33	666	41	820	53	16
18	20.94	20.00	1.38	2.13	2.63	3.06	624	38	751	48	864	57	16
20	23.19	22.00	1.38	2.06	2.50	3.13	684	41	804	50	978	64	16
24	27.50	26.25	1.50	1.88	2.63	3.38	772	43	1007	62	1246	82	16

Bolting and Tolerances: FVC flanges are furnished to ASME B16.5 specifications unless otherwise specified.

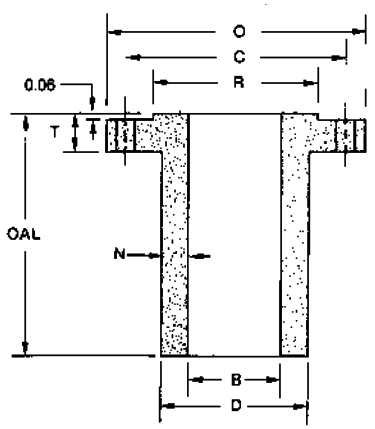
Nut Relief: All FVC connections except standard LWN's will be supplied with a "nut stop O.D." unless a "nut relief O.D." is specified.

Bore: Bore sizes shown above are standard, other sizes can be furnished upon request.

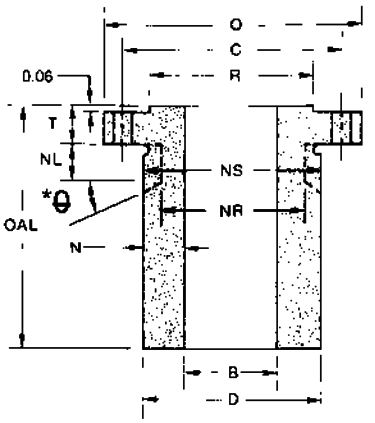
Curving: All FVC connections can be furnished contoured to fit any shell, head or cone at a minimal cost.

See page 97 for complete general notes.

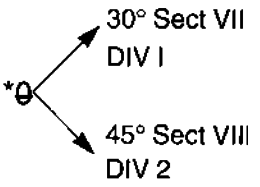
FVC Standard Connections



FVC "LWN"



FVC Heavy Barrel Connection "HB"



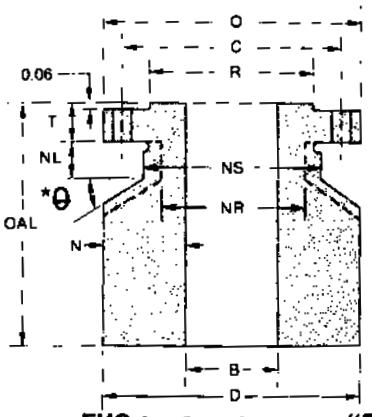
Size	Flange O.D.	Flange Thick.	RF O.D.	Bolt Holes	Hole Size	Bolt Circle	Bore		Barrel O.D.		
							LWN/F	HB	LWN	HB	F
	O	T	R	-	-	C	B	B	D	D	D
½	3.75	0.56	1.38	4	0.62	2.62	0.50	0.55	1.50	1.75	3.75
¾	4.62	0.62	1.69	4	0.75	3.25	0.75	0.74	1.88	2.19	4.62
1	4.88	0.69	2.00	4	0.75	3.50	1.00	0.96	2.12	2.44	4.88
1¼	5.25	0.75	2.50	4	0.75	3.88	1.25	1.28	2.50	2.81	5.25
1½	6.12	0.81	2.88	4	0.88	4.50	1.50	1.50	2.75	3.25	6.12
2	6.50	0.88	3.62	8	0.75	5.00	2.00	1.94	3.31	3.94	6.50
2½	7.50	1.00	4.12	8	0.88	5.88	2.50	2.32	3.94	4.62	7.50
3	8.25	1.12	5.00	8	0.88	6.62	3.00	2.90	4.62	5.38	8.25
3½	9.00	1.19	5.50	8	0.88	7.25	3.50	3.36	5.25	6.00	9.00
4	10.00	1.25	6.19	8	0.88	7.88	4.00	3.83	5.75	6.62	10.00
5	11.00	1.38	7.31	8	0.88	9.25	5.00	4.81	7.00	8.00	11.00
6	12.50	1.44	8.50	12	0.88	10.62	6.00	5.76	8.12	9.38	12.50
8	15.00	1.62	10.62	12	1.00	13.00	8.00	7.62	10.25	11.56	15.00
10	17.50	1.88	12.75	16	1.12	15.25	10.00	9.56	12.62	13.62	17.50
12	20.50	2.00	15.00	16	1.25	17.75	12.00	11.38	14.75	15.94	20.50
14	23.00	2.12	16.25	20	1.25	20.25	14.00	14.00	16.75	18.44	23.00
16	25.50	2.25	18.50	20	1.38	22.50	16.00	16.00	19.00	20.50	25.50
18	28.00	2.38	21.00	24	1.38	24.75	18.00	18.00	21.00	22.75	28.00
20	30.50	2.50	23.00	24	1.38	27.00	20.00	20.00	23.12	25.00	30.50
24	36.00	2.75	27.25	24	1.62	32.00	24.00	24.00	27.62	29.62	36.00

Material: FVC forged connections are made from SA-105 in compliance with ASME Section II. FVC connections are available in other material compositions upon request. See "Technical Section" on page 59 for stocked materials.

Length: The length of all connections includes the barrel, flange and facing. See the current FVC price sheet for standard lengths. **Intermediate lengths and longer are available upon request.**

Facing: The FVC flange thickness "T" includes 0.06 inch raised face per ASME B16.5. This differs on Class 400 and above. FVC can supply any special facing as needed upon request.

FVC Standard Connections



FVC Full Body Connection "F"

DON'T COMPROMISE!

If your reinforcement requirements are in between the "HB" and "F" connections see the following page for Class 300 FVC Variable Body Connections

Size	Nut Stop Dia.	Nut Relief Dia.	Nut Relief Lngth.	Neck Thickness			Weights						Base Wt. Lngth.
				LWN	HB	F	LWN		HB		F		
	NS	NR	NL	N	N	N	Base Wt.	Wt./1"	Base Wt.	Wt./1"	Base Wt.	Wt./1"	
½	1.75	1.50	0.75	0.50	0.60	1.63	5	0.4	7	0.6	24	3.1	9
¾	2.19	1.88	0.88	0.57	0.73	1.94	9	0.7	11	0.9	37	4.6	9
1	2.44	2.12	0.88	0.56	0.74	1.94	9	0.8	12	1.1	40	5.1	9
1¼	2.81	2.50	0.88	0.63	0.77	2.00	13	1.0	15	1.4	45	5.8	9
1½	3.25	2.75	1.00	0.63	0.88	2.31	15	1.2	21	1.9	61	7.8	9
2	3.94	3.31	0.88	0.66	1.00	2.25	20	1.5	28	2.6	68	8.5	9
2½	4.62	3.94	1.00	0.72	1.15	2.50	25	2.1	38	3.6	89	11	9
3	5.38	4.62	1.00	0.81	1.24	2.63	35	2.7	49	4.6	106	13	9
3½	6.00	5.25	1.00	0.88	1.32	2.75	42	3.4	59	5.5	122	15	9
4	6.62	5.75	1.00	0.88	1.40	3.00	62	3.8	91	6.5	207	19	12
5	8.00	7.00	1.00	1.00	1.60	3.00	84	5.3	124	9.1	241	21	12
6	9.38	8.12	1.00	1.06	1.81	3.25	105	6.7	165	12	303	27	12
8	11.56	10.25	1.12	1.13	1.97	3.50	148	9.1	228	17	405	36	12
10	13.62	12.62	1.25	1.31	2.03	3.75	210	13	291	21	499	46	12
12	15.94	14.75	1.38	1.38	2.28	4.25	275	16	392	28	651	61	12
14	18.44	16.75	1.38	1.38	2.22	4.50	324	19	456	32	785	74	12
16	20.50	19.00	1.50	1.50	2.25	4.75	404	23	529	37	914	88	12
18	22.75	21.00	1.50	1.50	2.38	5.00	465	26	630	43	1066	102	12
20	25.00	23.12	1.50	1.56	2.50	5.25	549	30	741	50	1228	118	12
24	29.62	27.62	1.75	1.81	2.81	6.00	778	42	1016	67	1627	160	12

Bolting and Tolerances: FVC flanges are furnished to ASME B16.5 specifications unless otherwise specified.

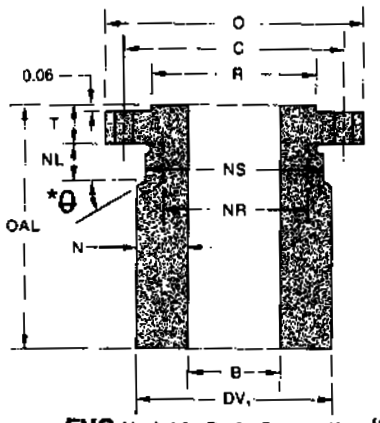
Nut Relief: All FVC connections except standard LWN's will be supplied with a "nut stop O.D." unless a "nut relief O.D." is specified.

Bore: Bore sizes shown above are standard, other sizes can be furnished upon request.

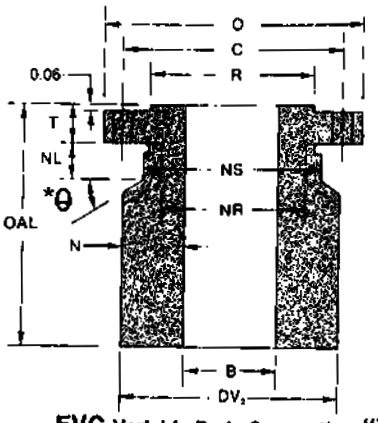
Curving: All FVC connections can be furnished contoured to fit any shell, head or cone at a minimal cost.

See page 97 for complete general notes.

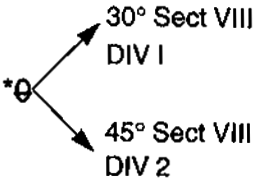
FVC Variable Body Connections



FVC Variable Body Connection "V_1"



FVC Variable Body Connection "V_2"



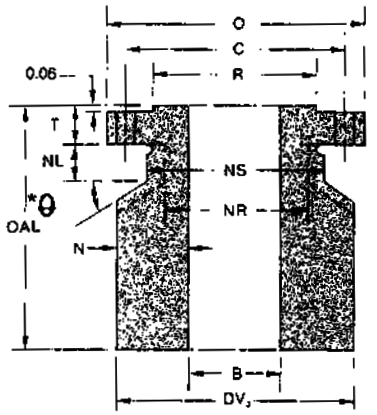
Size	Flange O.D.	Flange Thick.	RF O.D.	Bolt Holes	Hole Size	Bolt Circle	Bore	Barrel O.D.		
								V_1	V_2	V_3
	O	T	R	-	-	C	B	DV_1	DV_2	DV_3
1	4.88	0.69	2.00	4	0.75	3.50	0.96	2.75	3.75	4.00
1½	6.12	0.81	2.88	4	0.88	4.50	1.50	4.00	4.62	5.50
2	6.50	0.88	3.62	8	0.75	5.00	1.94	4.62	5.50	6.00
2½	7.50	1.00	4.12	8	0.88	5.88	2.32	5.75	6.00	6.38
3	8.25	1.12	5.00	8	0.88	6.62	2.90	6.00	6.38	7.00
3½	9.00	1.19	5.50	8	0.88	7.25	3.36	7.00	7.75	8.25
4	10.00	1.25	6.19	8	0.88	7.88	3.83	7.00	7.75	8.88
5	11.00	1.38	7.31	8	0.88	9.25	4.81	8.25	8.88	9.88
6	12.50	1.44	8.50	12	0.88	10.62	5.76	9.88	10.38	11.00
8	15.00	1.62	10.62	12	1.00	13.00	7.62	12.12	13.50	14.25
10	17.50	1.88	12.75	16	1.12	15.25	9.56	14.25	15.12	16.25
12	20.50	2.00	15.00	16	1.25	17.75	11.38	16.25	17.38	18.25
14	23.00	2.12	16.25	20	1.25	20.25	14.00	19.38	20.12	22.25
16	25.50	2.25	18.50	20	1.38	22.50	16.00	22.25	23.25	24.12
18	28.00	2.38	21.00	24	1.38	24.75	18.00	24.12	25.12	26.75
20	30.50	2.50	23.00	24	1.38	27.00	20.00	26.75	27.75	29.25
24	36.00	2.75	27.25	24	1.62	32.00	24.00	30.75	32.00	33.62

Material: FVC forged connections are made from SA-105 in compliance with ASME Section II. FVC connections are available in other material compositions upon request. See "Technical Section" on page 59 for stocked materials.

Length: The length of all connections includes the barrel, flange and facing. See the current FVC price sheet for standard lengths. **Intermediate lengths and longer are available upon request.**

Facing: The FVC flange thickness "T" includes 0.06 inch raised face per ASME B16.5. This differs on Class 400 and above. FVC can supply any special facing as needed upon request.

FVC Variable Body Connections



FVC Variable Body Connection "V_3"

DON'T COMPROMISE!

If your reinforcement requirements have not been met with these standard FVC connections, please see "Custom Products", pages 54 to 56.

Size	Nut Stop Dia.	Nut Relief Dia.	Nut Relief Lngth.	Neck Thickness			Weights						Base Wt. Lngth.
				V_1	V_2	V_3	V_1		V_2		V_3		
	NS	NR	NL	N	N	N	Base Wt.	Wt./1"	Base Wt.	Wt./1"	Base Wt.	Wt./1"	
1	2.44	2.12	0.88	0.90	1.40	1.52	20	1.5	34	2.9	39	3.4	12
1½	3.25	2.75	1.00	1.25	1.56	2.00	39	3.1	51	4.3	70	6.2	12
2	3.94	3.31	0.88	1.34	1.78	2.03	49	3.9	69	5.9	81	7.2	12
2½	4.62	3.94	1.00	1.72	1.84	2.03	72	6.2	80	6.8	90	7.8	12
3	5.38	4.62	1.00	1.55	1.74	2.05	78	6.1	88	7.2	106	9	12
3½	6.00	5.25	1.00	1.82	2.20	2.45	104	8.4	127	11	144	13	12
4	6.62	5.75	1.00	1.59	1.96	2.52	102	7.6	125	10	164	14	12
5	8.00	7.00	1.00	1.72	2.04	2.54	133	10	155	12	194	17	12
6	9.38	8.12	1.00	2.06	2.31	2.62	185	14	206	17	233	20	12
8	11.56	10.25	1.12	2.25	2.94	3.32	255	20	324	28	364	32	12
10	13.62	12.62	1.25	2.35	2.78	3.35	425	25	498	31	591	38	16
12	15.94	14.75	1.38	2.44	3.00	3.44	532	30	636	38	720	45	16
14	18.44	16.75	1.38	2.69	3.06	4.13	681	40	761	47	996	67	16
16	20.50	19.00	1.50	3.13	3.63	4.06	877	53	988	63	1099	73	16
18	22.75	21.00	1.50	3.06	3.56	4.38	982	57	1102	68	1314	87	16
20	25.00	23.12	1.50	3.38	3.88	4.63	1176	70	1316	82	1525	101	16
24	29.62	27.62	1.75	3.38	4.00	4.81	1455	82	1647	100	1899	123	16

Bolting and Tolerances: FVC flanges are furnished to ASME B16.5 specifications unless otherwise specified.

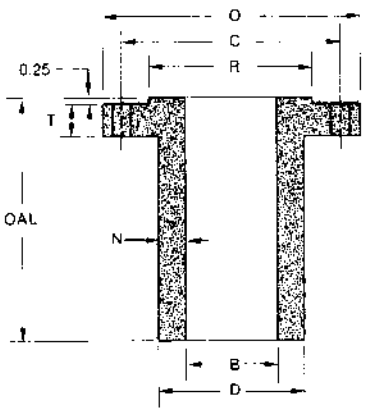
Nut Relief: All FVC connections except standard LWN's will be supplied with a "nut stop O.D." unless a "nut relief O.D." is specified.

Bore: Bore sizes shown above are standard, other sizes can be furnished upon request.

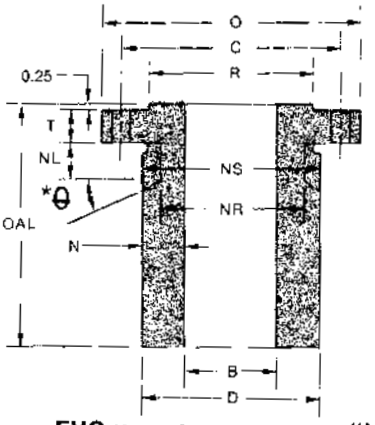
Curving: All FVC connections can be furnished contoured to fit any shell, head or cone at a minimal cost.

See page 97 for complete general notes.

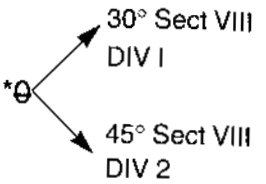
FVC Standard Connections



FVC "LWN"



FVC Heavy Barrel Connection "HB"



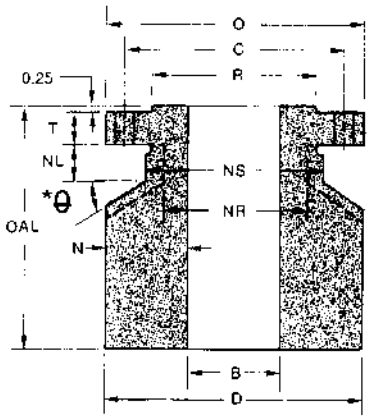
Size	Flange O.D.	Flange Thick.	RF O.D.	Bolt Holes	Hole Size	Bolt Circle	Bore		Barrel O.D.		
							LWN/F	HB	LWN	HB	F
	O	T	R	-	-	C	B	B	D	D	D
½	3.75	0.56	1.38	4	0.62	2.62	0.50	0.55	1.50	1.75	3.75
¾	4.62	0.62	1.69	4	0.75	3.25	0.75	0.74	1.88	2.19	4.62
1	4.88	0.69	2.00	4	0.75	3.50	1.00	0.96	2.12	2.44	4.88
1¼	5.25	0.81	2.50	4	0.75	3.88	1.25	1.28	2.50	2.81	5.25
1½	6.12	0.88	2.88	4	0.88	4.50	1.50	1.50	2.75	3.25	6.12
2	6.50	1.00	3.62	8	0.75	5.00	2.00	1.94	3.31	3.94	6.50
2½	7.50	1.12	4.12	8	0.88	5.88	2.50	2.32	3.94	4.62	7.50
3	8.25	1.25	5.00	8	0.88	6.62	3.00	2.90	4.62	5.38	8.25
3½	9.00	1.38	5.50	8	1.00	7.25	3.50	3.36	5.25	5.81	9.00
4	10.00	1.38	6.19	8	1.00	7.88	4.00	3.83	5.75	6.44	10.00
5	11.00	1.50	7.31	8	1.00	9.25	5.00	4.81	7.00	7.81	11.00
6	12.50	1.62	8.50	12	1.00	10.62	6.00	5.76	8.12	9.19	12.50
8	15.00	1.88	10.62	12	1.12	13.00	8.00	7.62	10.25	11.38	15.00
10	17.50	2.12	12.75	16	1.25	15.25	10.00	9.56	12.62	13.44	17.50
12	20.50	2.25	15.00	16	1.38	17.75	12.00	11.38	14.75	15.75	20.50
14	23.00	2.38	16.25	20	1.38	20.25	14.00	14.00	16.75	18.25	23.00
16	25.50	2.50	18.50	20	1.50	22.50	16.00	16.00	19.00	20.31	25.50
18	28.00	2.62	21.00	24	1.50	24.75	18.00	18.00	21.00	22.56	28.00
20	30.50	2.75	23.00	24	1.62	27.00	20.00	20.00	23.12	24.63	30.50
24	36.00	3.00	27.25	24	1.88	32.00	24.00	24.00	27.62	29.25	36.00

Material: FVC forged connections are made from SA-105 in compliance with ASME Section II. FVC connections are available in other material compositions upon request. See "Technical Section" on page 59 for stocked materials.

Length: The length of all connections includes the barrel, flange and facing. See the current FVC price sheet for standard lengths. **Intermediate lengths and longer are available upon request.**

Facing: The FVC flange thickness "T" excludes 0.25 inch raised face per ASME B16.5. This differs on Classes 150 and 300. FVC can supply any special facing as needed upon request.

FVC Standard Connections



FVC Full Body Connection "F"

DON'T COMPROMISE!

If your reinforcement requirements are in between the "HB" and "F" connections see the following page for Class 400 FVC Variable Body Connections

Size	Nut Stop Dia.	Nut Relief Dia.	Nut Relief Lngth.	Neck Thickness			Weights						Base Wt. Lngth.
				LWN	HB	F	LWN		HB		F		
	NS	NR	NL	N	N	N	Base Wt.	Wt./1"	Base Wt.	Wt./1"	Base Wt.	Wt./1"	
½	1.75	1.50	0.75	0.50	0.60	1.63	5	0.4	7	0.6	24	3.1	9
¾	2.19	1.88	0.88	0.57	0.73	1.94	8	0.7	11	0.9	37	4.6	9
1	2.44	2.12	0.88	0.56	0.74	1.94	9	0.8	12	1.1	40	5.1	9
1¼	2.81	2.50	0.88	0.63	0.77	2.00	13	1.0	15	1.4	45	5.8	9
1½	3.25	2.75	1.00	0.63	0.88	2.31	16	1.2	21	1.9	61	7.8	9
2	3.94	3.31	0.88	0.66	1.00	2.25	20	1.5	29	2.6	68	8.5	9
2½	4.62	3.94	1.00	0.72	1.15	2.50	27	2.1	39	3.6	88	11	9
3	5.38	4.62	1.00	0.81	1.24	2.63	36	2.7	50	4.6	104	13	9
3½	5.81	5.25	1.12	0.88	1.23	2.75	45	3.4	61	5.5	116	15	9
4	6.44	5.75	1.12	0.88	1.31	3.00	65	3.8	93	6.5	197	19	12
5	7.81	7.00	1.12	1.00	1.50	3.00	88	5.3	127	9.1	229	22	12
6	9.19	8.12	1.12	1.06	1.72	3.25	110	6.7	169	12	286	27	12
8	11.38	10.25	1.25	1.13	1.88	3.50	154	9.1	233	17	379	36	12
10	13.44	12.62	1.38	1.31	1.94	3.75	218	13	298	21	475	46	12
12	15.75	14.75	1.50	1.38	2.19	4.25	285	16	401	28	627	62	12
14	18.25	16.75	1.50	1.38	2.13	4.50	336	19	467	32	758	74	12
16	20.31	19.00	1.62	1.50	2.16	4.75	418	23	542	37	884	88	12
18	22.56	21.00	1.62	1.50	2.28	5.00	482	26	645	43	1033	102	12
20	24.63	23.12	1.75	1.56	2.32	5.25	568	30	759	50	1165	118	12
24	29.25	27.62	2.00	1.81	2.63	6.00	804	42	1040	67	1540	160	12

Bolting and Tolerances: FVC flanges are furnished to ASME B16.5 specifications unless otherwise specified.

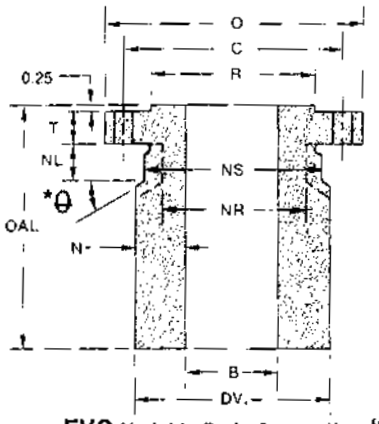
Nut Relief: All FVC connections except standard LWN's will be supplied with a "nut stop O.D." unless a "nut relief O.D." is specified.

Bore: Bore sizes shown above are standard, other sizes can be furnished upon request.

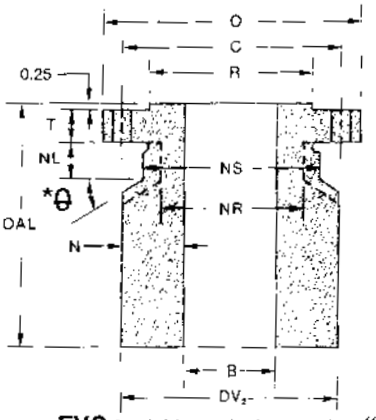
Curving: All FVC connections can be furnished contoured to fit any shell, head or cone at a minimal cost.

See page 97 for complete general notes.

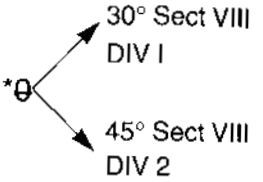
FVC Variable Body Connections



FVC Variable Body Connection "V_1"



FVC Variable Body Connection "V_2"



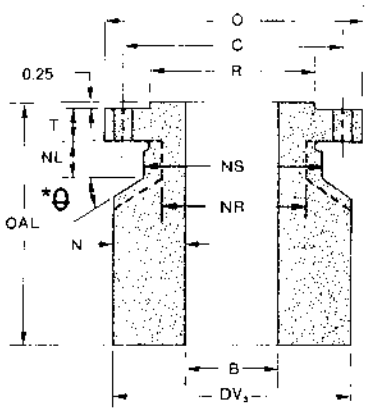
Size	Flange O.D.	Flange Thick.	RF O.D.	Bolt Holes	Hole Size	Bolt Circle	Bore	Barrel O.D.		
								V_1	V_2	V_3
	O	T	R	-	-	C	B	DV_1	DV_2	DV_3
1	4.88	0.69	2.00	4	0.75	3.50	0.96	2.75	3.25	4.00
1½	6.12	0.88	2.88	4	0.88	4.50	1.50	4.00	4.62	5.50
2	6.50	1.00	3.62	8	0.75	5.00	1.94	4.62	5.50	6.00
2½	7.50	1.13	4.12	8	0.88	5.88	2.32	5.75	6.00	6.38
3	8.25	1.25	5.00	8	0.88	6.62	2.90	6.00	6.38	7.00
3½	9.00	1.38	5.50	8	1.00	7.25	3.36	7.00	7.75	8.25
4	10.00	1.38	6.19	8	1.00	7.88	3.83	7.00	7.75	8.88
5	11.00	1.50	7.31	8	1.00	9.25	4.81	8.25	8.88	9.88
6	12.50	1.62	8.50	12	1.00	10.62	5.76	9.88	10.38	11.00
8	15.00	1.88	10.62	12	1.12	13.00	7.62	12.12	13.50	14.25
10	17.50	2.12	12.75	16	1.25	15.25	9.56	14.25	15.12	16.25
12	20.50	2.25	15.00	16	1.38	17.75	11.38	16.25	17.38	18.25
14	23.00	2.38	16.25	20	1.38	20.25	14.00	19.38	20.12	22.25
16	25.50	2.50	18.50	20	1.50	22.50	16.00	22.25	23.25	24.12
18	28.00	2.62	21.00	24	1.50	24.75	18.00	24.12	25.12	26.75
20	30.50	2.75	23.00	24	1.62	27.00	20.00	26.75	27.75	29.25
24	36.00	3.00	27.25	24	1.88	32.00	24.00	30.75	32.00	33.62

Material: FVC forged connections are made from SA-105 in compliance with ASME Section II. FVC connections are available in other material compositions upon request. See "Technical Section" on page 59 for stocked materials.

Length: The length of all connections includes the barrel, flange and facing. See the current FVC price sheet for standard lengths. **Intermediate lengths and longer are available upon request.**

Facing: The FVC flange thickness "T" excludes 0.25 inch raised face per ASME B16.5. This differs on Classes 150 and 300. FVC can supply any special facing as needed upon request.

FVC Variable Body Connections



FVC Variable Body Connection "V_3"

DON'T COMPROMISE!

If your reinforcement requirements have not been met with these standard FVC connections, please see "Custom Products", pages 54 to 56.

Size	Nut Stop Dia.	Nut Relief Dia.	Nut Relief Lngth.	Neck Thickness			Weights						Base Wt. Lngth.
				V_1	V_2	V_3	V_1		V_2		V_3		
	NS	NR	NL	N	N	N	Base Wt.	Wt./1"	Base Wt.	Wt./1"	Base Wt.	Wt./1"	
1	2.44	2.12	0.88	0.90	1.15	1.52	20	1.5	27	2.2	39	3.4	12
1½	3.25	2.75	1.00	1.25	1.56	2.00	39	3.1	51	4.3	69	6.2	12
2	3.94	3.31	0.88	1.34	1.78	2.03	49	3.9	69	5.9	95	8.9	12
2½	4.62	3.94	1.00	1.72	1.84	2.03	73	6.2	81	6.8	90	7.8	12
3	5.38	4.62	1.00	1.55	1.74	2.05	79	6.1	89	7.2	106	9	12
3½	5.81	5.25	1.12	1.82	2.20	2.45	106	8.4	128	11	145	13	12
4	6.44	5.75	1.12	1.59	1.96	2.53	104	7.6	126	10	165	14	12
5	7.81	7.00	1.12	1.72	2.04	2.54	135	10	157	12	195	17	12
6	9.19	8.12	1.12	2.06	2.31	2.62	188	14	208	17	235	20	12
8	11.38	10.25	1.25	2.25	2.94	3.31	259	20	327	28	366	32	12
10	13.44	12.62	1.38	2.35	2.78	3.35	431	25	502	31	594	38	16
12	15.75	14.75	1.50	2.44	3.00	3.44	539	30	641	38	724	45	16
14	18.25	16.75	1.50	2.69	3.06	4.13	690	40	768	47	974	67	16
16	20.31	19.00	1.62	3.12	3.63	4.06	887	53	980	63	1078	73	16
18	22.56	21.00	1.62	3.06	3.56	4.38	982	57	1102	68	1284	87	16
20	24.63	23.12	1.75	3.38	3.88	4.63	1176	70	1283	82	1476	101	16
24	29.25	27.62	2.00	3.38	4.00	4.81	1437	82	1614	100	1844	123	16

Bolting and Tolerances: FVC flanges are furnished to ASME B16.5 specifications unless otherwise specified.

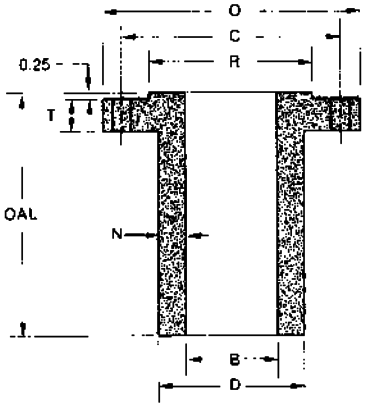
Nut Relief: All FVC connections except standard LWN's will be supplied with a "nut stop O.D." unless a "nut relief O.D." is specified.

Bore: Bore sizes shown above are standard, other sizes can be furnished upon request.

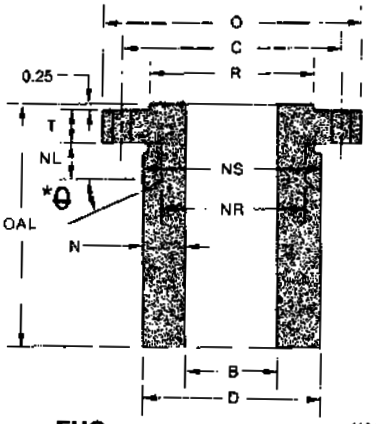
Curving: All FVC connections can be furnished contoured to fit any shell, head or cone at a minimal cost.

See page 97 for complete general notes.

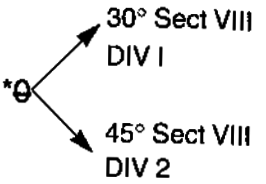
FVC Standard Connections



FVC "LWN"



FVC Heavy Barrel Connection "HB"



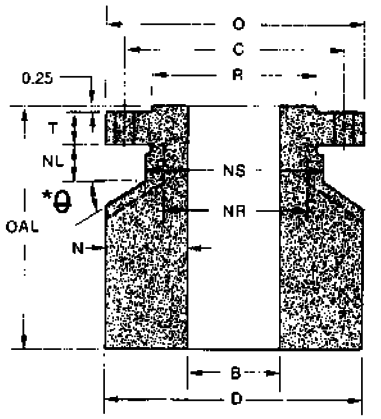
Size	Flange O.D.	Flange Thick.	RF O.D.	Bolt Holes	Hole Size	Bolt Circle	Bore		Barrel O.D.		
							LWN/F	HB	LWN	HB	F
	O	T	R	-	-	C	B	B	D	D	D
½	3.75	0.56	1.38	4	0.62	2.62	0.50	0.55	1.50	1.75	3.75
¾	4.62	0.62	1.69	4	0.75	3.25	0.75	0.74	1.88	2.19	4.62
1	4.88	0.69	2.00	4	0.75	3.50	1.00	0.96	2.12	2.44	4.88
1¼	5.25	0.81	2.50	4	0.75	3.88	1.25	1.28	2.50	2.81	5.25
1½	6.12	0.88	2.88	4	0.88	4.50	1.50	1.50	2.75	3.25	6.12
2	6.50	1.00	3.62	8	0.75	5.00	2.00	1.94	3.31	3.94	6.50
2½	7.50	1.12	4.12	8	0.88	5.88	2.50	2.32	3.94	4.62	7.50
3	8.25	1.25	5.00	8	0.88	6.62	3.00	2.90	4.62	5.38	8.25
3½	9.00	1.38	5.50	8	1.00	7.25	3.50	3.36	5.25	5.81	9.00
4	10.75	1.50	6.19	8	1.00	8.50	4.00	3.83	6.00	7.06	10.75
5	13.00	1.75	7.31	8	1.12	10.50	5.00	4.81	7.50	8.88	13.00
6	14.00	1.88	8.50	12	1.12	11.50	6.00	5.76	8.75	9.88	14.00
8	16.50	2.19	10.62	12	1.25	13.75	8.00	7.62	10.75	11.94	16.50
10	20.00	2.50	12.75	16	1.38	17.00	10.00	9.56	13.50	15.00	20.00
12	22.00	2.62	15.00	20	1.38	19.25	12.00	11.38	15.75	17.25	22.00
14	23.75	2.75	16.25	20	1.50	20.75	14.00	14.00	17.00	18.56	23.75
16	27.00	3.00	18.50	20	1.62	23.75	16.00	16.00	19.50	21.38	27.00
18	29.25	3.25	21.00	20	1.75	25.75	18.00	18.00	21.50	23.19	29.25
20	32.00	3.50	23.00	24	1.75	28.50	20.00	20.00	24.00	25.94	32.00
24	37.00	4.00	27.25	24	2.00	33.00	24.00	24.00	28.25	30.06	37.00

Material: FVC forged connections are made from SA-105 in compliance with ASME Section II. FVC connections are available in other material compositions upon request. See "Technical Section" on page 59 for stocked materials.

Length: The length of all connections includes the barrel, flange and facing. See the current FVC price sheet for standard lengths. **Intermediate lengths and longer are available upon request.**

Facing: The FVC flange thickness "T" excludes 0.25 inch raised face per ASME B16.5. This differs on Classes 150 and 300. FVC can supply any special facing as needed upon request.

FVC Standard Connections



FVC Full Body Connection "F"

DON'T COMPROMISE!

If your reinforcement requirements are in between the "HB" and "F" connections see the following page for Class 600 FVC Variable Body Connections

Size	Nut Stop Dia.	Nut Relief Dia.	Nut Relief Lngth.	Neck Thickness			Weights						Base Wt. Lngth.
				LWN	HB	F	LWN		HB		F		
	NS	NR	NL	N	N	N	Base Wt.	Wt./1"	Base Wt.	Wt./1"	Base Wt.	Wt./1"	
½	1.75	1.50	0.75	0.50	0.60	1.63	5	0.4	7	0.6	24	3.1	9
¾	2.19	1.88	0.88	0.57	0.73	1.94	8	0.7	11	0.9	36	4.6	9
1	2.44	2.12	0.88	0.56	0.74	1.94	9	0.8	12	1.1	39	5.1	9
1¼	2.81	2.50	0.88	0.63	0.77	2.00	13	1.0	15	1.4	44	5.8	9
1½	3.25	2.75	1.00	0.63	0.88	2.31	16	1.2	21	1.9	59	7.8	9
2	3.94	3.31	0.88	0.66	1.00	2.25	20	1.5	29	2.6	67	8.5	9
2½	4.62	3.94	1.00	0.72	1.15	2.50	27	2.1	39	3.6	85	11	9
3	5.38	4.62	1.00	0.81	1.24	2.63	36	2.7	50	4.6	104	13	9
3½	5.81	5.25	1.12	0.88	1.23	2.75	45	3.4	57	5	116	15	9
4	7.06	6.00	1.13	1.00	1.62	3.38	77	4.5	113	7.8	238	22	12
5	8.88	7.50	1.25	1.25	2.04	4.00	123	7	180	12	336	32	12
6	9.88	8.75	1.25	1.38	2.06	4.00	152	9	207	14	373	36	12
8	11.94	10.75	1.38	1.38	2.16	4.25	207	11	277	19	478	46	12
10	15.00	13.50	1.50	1.75	2.72	5.00	324	18	433	30	683	67	12
12	17.25	15.75	1.50	1.88	2.94	5.00	393	23	533	37	779	76	12
14	18.56	17.00	1.62	1.50	2.28	4.88	471	21	631	33	1149	82	16
16	21.38	19.50	1.75	1.75	2.69	5.50	638	28	856	45	1471	105	16
18	23.19	21.50	1.88	1.75	2.60	5.63	731	31	941	48	1628	118	16
20	25.94	24.00	1.88	2.00	2.97	6.00	916	39	1180	61	1920	139	16
24	30.06	28.25	2.12	2.13	3.03	6.50	1210	49	1486	73	2376	176	16

Bolting and Tolerances: FVC flanges are furnished to ASME B16.5 specifications unless otherwise specified.

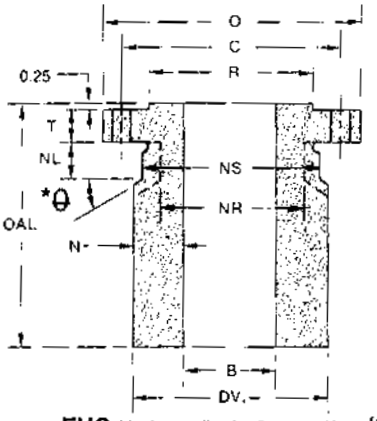
Nut Relief: All FVC connections except standard LWN's will be supplied with a "nut stop O.D." unless a "nut relief O.D." is specified.

Bore: Bore sizes shown above are standard, other sizes can be furnished upon request.

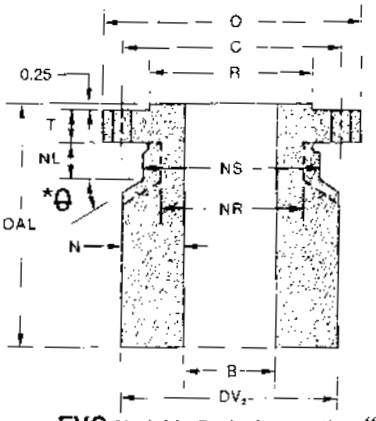
Curving: All FVC connections can be furnished contoured to fit any shell, head or cone at a minimal cost.

See page 97 for complete general notes.

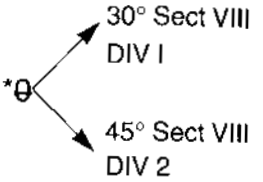
FVC Variable Body Connections



FVC Variable Body Connection "V_1"



FVC Variable Body Connection "V_2"



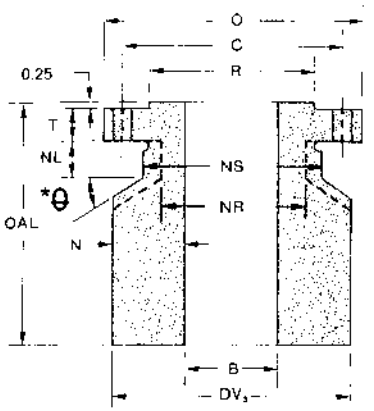
Size	Flange O.D.	Flange Thick.	RF O.D.	Bolt Holes	Hole Size	Bolt Circle	Bore	Barrel O.D.		
								V_1	V_2	V_3
	O	T	R	-	-	C	B	DV_1	DV_2	DV_3
1	4.88	0.69	2.00	4	0.75	3.50	0.96	3.25	4.00	4.63
1½	6.12	0.88	2.88	4	0.88	4.50	1.50	4.00	4.62	5.50
2	6.50	1.00	3.62	8	0.75	5.00	1.94	4.62	5.50	6.00
2½	7.50	1.12	4.12	8	0.88	5.88	2.32	5.75	6.38	7.00
3	8.25	1.25	5.00	8	0.88	6.62	2.90	6.38	7.00	7.75
3½	9.00	1.38	5.50	8	1.00	7.25	3.36	7.00	7.75	8.25
4	10.75	1.50	6.19	8	1.00	8.50	3.83	7.75	8.88	9.88
5	13.00	1.75	7.31	8	1.12	10.50	4.81	9.88	11.00	12.12
6	14.00	1.88	8.50	12	1.12	11.50	5.76	11.00	12.12	13.25
8	16.50	2.19	10.62	12	1.25	13.75	7.62	13.25	15.12	16.00
10	20.00	2.50	12.75	16	1.38	17.00	9.56	16.25	17.38	18.25
12	22.00	2.62	15.00	20	1.38	19.25	11.38	18.25	19.38	20.12
14	23.75	2.75	16.25	20	1.50	20.75	14.00	19.38	20.12	22.25
16	27.00	3.00	18.50	20	1.62	23.75	16.00	23.25	24.12	25.00
18	29.25	3.25	21.00	20	1.75	25.75	18.00	24.12	26.25	27.75
20	32.00	3.50	23.00	24	1.75	28.50	20.00	27.75	29.25	30.75
24	37.00	4.00	27.25	24	2.00	33.00	24.00	30.75	32.00	33.62

Material: FVC forged connections are made from SA-105 in compliance with ASME Section II. FVC connections are available in other material compositions upon request. See "Technical Section" on page 59 for stocked materials.

Length: The length of all connections includes the barrel, flange and facing. See the current FVC price sheet for standard lengths. **Intermediate lengths and longer are available upon request.**

Facing: The FVC flange thickness "T" excludes 0.25 inch raised face per ASME B16.5. This differs on Classes 150 and 300. FVC can supply any special facing as needed upon request.

FVC Variable Body Connections



FVC Variable Body Connection "V_3"

DON'T COMPROMISE!

If your reinforcement requirements have not been met with these standard FVC connections, please see "Custom Products", pages 54 to 56.

Size	Nut Stop Dia.	Nut Relief Dia.	Nut Relief Lngth.	Neck Thickness			Weights						Base Wt. Lngth.
				V_1	V_2	V_3	V_1		V_2		V_3		
	NS	NR	NL	N	N	N	Base Wt.	Wt./1"	Base Wt.	Wt./1"	Base Wt.	Wt./1"	
1	2.44	2.12	0.88	1.15	1.52	1.83	26	2.2	38	3.4	50	4.6	12
1½	3.25	2.75	1.00	1.25	1.56	2.00	39	3.1	50	4.3	69	6.2	12
2	3.94	3.31	0.88	1.34	1.78	2.03	50	3.9	69	5.9	81	7.2	12
2½	4.62	3.94	1.00	1.72	2.03	2.34	83	6.2	98	7.9	105	9.7	9
3	5.38	4.62	1.00	1.74	2.05	2.43	88	7.2	105	9.0	127	11.5	12
3½	5.81	5.25	1.12	1.82	2.20	2.45	103	8.4	124	10.9	140	12.6	12
4	7.06	6.00	1.12	1.96	2.53	3.03	132	10.1	169	14.2	205	18.4	12
5	8.88	7.50	1.25	2.54	3.10	3.66	216	16.5	259	21.8	305	27.5	12
6	9.88	8.75	1.25	2.62	3.18	3.75	235	20	300	25	350	32	12
8	11.94	10.75	1.38	2.82	3.75	4.19	335	26	427	38	478	44	12
10	15.00	13.50	1.50	3.35	3.91	4.35	650	38	747	47	824	54	16
12	17.25	15.75	1.50	3.44	4.00	4.37	771	45	877	55	949	61	16
14	18.56	17.00	1.62	2.69	3.06	4.13	708	40	781	47	994	67	16
16	21.38	19.50	1.75	3.63	4.06	4.50	1055	63	1151	73	1248	82	16
18	23.19	21.50	1.88	3.06	4.13	4.88	1044	57	1283	81	1456	99	16
20	25.94	24.00	1.88	3.88	4.63	5.38	1398	82	1582	101	1767	121	16
24	30.06	28.25	2.12	3.38	4.00	4.81	1574	82	1736	100	1946	123	16

Bolting and Tolerances: FVC flanges are furnished to ASME B16.5 specifications unless otherwise specified.

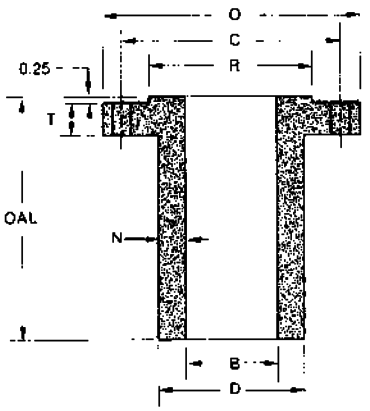
Nut Relief: All FVC connections except standard LWN's will be supplied with a "nut stop O.D." unless a "nut relief O.D." is specified.

Bore: Bore sizes shown above are standard, other sizes can be furnished upon request.

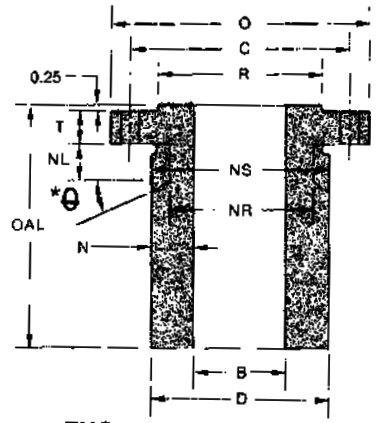
Curving: All FVC connections can be furnished contoured to fit any shell, head or cone at a minimal cost.

See page 97 for complete general notes.

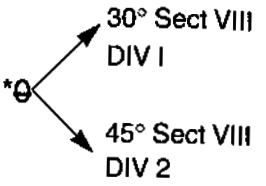
FVC Standard Connections



FVC "LWN"



FVC Heavy Barrel Connection "HB"



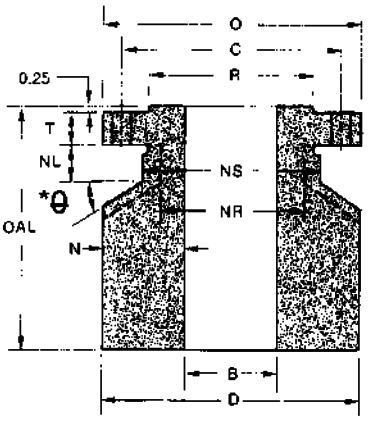
Size	Flange O.D.	Flange Thick.	RF O.D.	Bolt Holes	Hole Size	Bolt Circle	Bore		Barrel O.D.		
							LWN/F	HB	LWN	HB	F
	O	T	R	-	-	C	B	B	D	D	D
½	4.75	0.88	1.38	4	0.88	3.25	0.50	0.55	1.56	2.00	4.75
¾	5.12	1.00	1.69	4	0.88	3.50	0.75	0.74	1.81	2.25	5.12
1	5.88	1.12	2.00	4	1.00	4.00	1.00	0.96	2.12	2.56	5.88
1¼	6.25	1.12	2.50	4	1.00	4.38	1.25	1.28	2.50	2.94	6.25
1½	7.00	1.25	2.88	4	1.12	4.88	1.50	1.50	2.75	3.25	7.00
2	8.50	1.50	3.62	8	1.00	6.50	2.00	1.94	4.12	5.06	8.50
2½	9.62	1.62	4.12	8	1.12	7.50	2.50	2.32	4.88	5.88	9.62
3	9.50	1.50	5.00	8	1.00	7.50	3.00	2.90	5.00	6.06	9.50
4	11.50	1.75	6.19	8	1.25	9.25	4.00	3.83	6.25	7.44	11.50
5	13.75	2.00	7.31	8	1.38	11.00	5.00	4.81	7.50	9.00	13.75
6	15.00	2.19	8.50	12	1.25	12.50	6.00	5.76	9.25	10.69	15.00
8	18.50	2.50	10.62	12	1.50	15.50	8.00	7.63	11.75	13.31	18.50
10	21.50	2.75	12.75	16	1.50	18.50	10.00	9.56	14.50	16.31	21.50
12	24.00	3.12	15.00	20	1.50	21.00	12.00	11.38	16.50	18.81	24.00
14	25.25	3.38	16.25	20	1.62	22.00	14.00	14.00	17.75	19.62	25.25
16	27.75	3.50	18.50	20	1.75	24.25	16.00	16.00	20.00	21.69	27.75
18	31.00	4.00	21.00	20	2.00	27.00	18.00	18.00	22.25	24.06	31.00
20	33.75	4.25	23.00	20	2.12	29.50	20.00	20.00	24.50	26.38	33.75
24	41.00	5.50	27.25	20	2.62	35.50	24.00	24.00	29.50	31.62	41.00

Material: FVC forged connections are made from SA-105 in compliance with ASME Section II. FVC connections are available in other material compositions upon request. See "Technical Section" on page 59 for stocked materials.

Length: The length of all connections includes the barrel, flange and facing. See the current FVC price sheet for standard lengths. **Intermediate lengths and longer are available upon request.**

Facing: The FVC flange thickness "T" excludes 0.25 inch raised face per ASME B16.5. This differs on Classes 150 and 300. FVC can supply any special facing as needed upon request.

FVC Standard Connections



FVC Full Body Connection "F"

DON'T COMPROMISE!

If your reinforcement requirements are in between the "HB" and "F" connections see the following page for Class 900 FVC Variable Body Connections

Size	Nut Stop Dia.	Nut Relief Dia.	Nut Relief Lngth.	Neck Thickness			Weights						Base Wt. Lngth.
				LWN	HB	F	LWN		HB		F		
	NS	NR	NL	N	N	N	Base Wt.	Wt./1"	Base Wt.	Wt./1"	Base Wt.	Wt./1"	
½	2.00	1.56	1.00	0.53	0.73	2.13	8	0.5	10	0.8	37	5.0	9
¾	2.25	1.81	1.00	0.53	0.76	2.19	10	0.6	13	1.0	42	5.7	9
1	2.56	2.12	1.12	0.56	0.80	2.44	13	0.8	17	1.3	54	7.5	9
1¼	2.94	2.50	1.12	0.63	0.83	2.50	17	1.0	20	1.6	61	8.3	9
1½	3.25	2.75	1.25	0.63	0.88	2.75	21	1.2	26	1.9	77	10	9
2	5.06	4.12	1.12	1.06	1.56	3.25	42	2.9	56	4.9	115	15	9
2½	5.88	4.88	1.25	1.19	1.78	3.56	56	3.9	75	6.5	144	19	9
3	6.06	5.00	1.12	1.00	1.58	3.25	51	3.6	71	6.3	139	18	9
4	7.44	6.25	1.38	1.13	1.81	3.75	93	5.1	133	9.1	270	26	12
5	9.00	7.50	1.50	1.25	2.10	4.38	135	7	194	13	376	37	12
6	10.69	9.25	1.38	1.63	2.47	4.50	191	11	259	18	436	42	12
8	13.31	11.75	1.62	1.88	2.85	5.25	297	16	389	27	626	62	12
10	16.31	14.50	1.62	2.25	3.38	5.75	422	25	558	39	824	81	12
12	18.81	16.50	1.62	2.25	3.72	6.00	518	29	715	50	984	96	12
14	19.62	17.75	1.75	1.88	2.81	5.63	624	26	817	42	1368	98	16
16	21.69	20.00	1.88	2.00	2.85	5.88	750	32	942	48	1573	114	16
18	24.06	22.25	2.12	2.13	3.03	6.50	950	38	1169	57	1898	142	16
20	26.38	24.50	2.25	2.25	3.19	6.88	1121	43	1378	66	2182	164	16
24	31.62	29.50	2.75	2.75	3.81	8.50	1865	65	2160	94	3084	246	16

Bolting and Tolerances: FVC flanges are furnished to ASME B16.5 specifications unless otherwise specified.

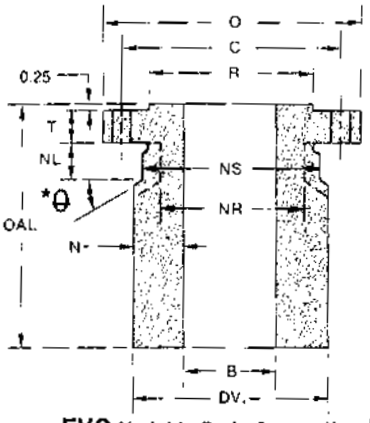
Nut Relief: All FVC connections except standard LWN's will be supplied with a "nut stop O.D." unless a "nut relief O.D." is specified.

Bore: Bore sizes shown above are standard, other sizes can be furnished upon request.

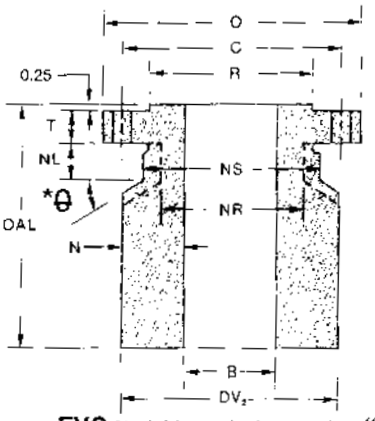
Curving: All FVC connections can be furnished contoured to fit any shell, head or cone at a minimal cost.

See page 97 for complete general notes.

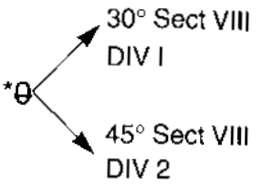
FVC Variable Body Connections



FVC Variable Body Connection "V_1"



FVC Variable Body Connection "V_2"



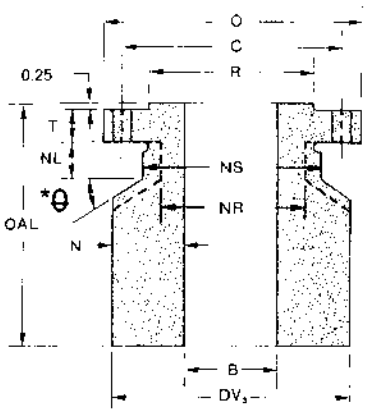
Size	Flange O.D.	Flange Thick.	RF O.D.	Bolt Holes	Hole Size	Bolt Circle	Bore	Barrel O.D.		
								V_1	V_2	V_3
	O	T	R	-	-	C	B	DV_1	DV_2	DV_3
1	5.88	1.12	2.00	4	1.00	4.00	0.96	3.25	4.00	4.62
1 ½	7.00	1.25	2.88	4	1.12	4.88	1.50	4.00	5.50	6.00
2	8.50	1.50	3.62	8	1.00	6.50	1.94	5.50	6.00	7.00
2 ½	9.62	1.62	4.12	8	1.12	7.50	2.32	6.38	7.00	8.25
3	9.50	1.50	5.00	8	1.00	7.50	2.90	7.00	7.75	8.25
4	11.50	1.75	6.19	8	1.25	9.25	3.83	8.88	9.88	10.38
5	13.75	2.00	7.31	8	1.38	11.00	4.81	10.38	11.00	12.12
6	15.00	2.19	8.50	12	1.25	12.50	5.76	11.00	12.12	13.50
8	18.50	2.50	10.62	12	1.50	15.50	7.62	15.12	16.25	17.38
10	21.50	2.75	12.75	16	1.50	18.50	9.56	17.38	18.25	20.12
12	24.00	3.12	15.00	20	1.50	21.00	11.38	20.12	22.25	23.25
14	25.25	3.38	16.25	20	1.62	22.00	14.00	22.25	23.25	24.12
16	27.75	3.50	18.50	20	1.75	24.25	16.00	23.25	25.00	26.50
18	31.00	4.00	21.00	20	2.00	27.00	18.00	26.00	27.75	29.25
20	33.75	4.25	23.00	20	2.12	29.50	20.00	27.75	30.75	32.00
24	41.00	5.50	27.25	20	2.62	35.50	24.00	33.62	35.00	36.00

Material: FVC forged connections are made from SA-105 in compliance with ASME Section II. FVC connections are available in other material compositions upon request. See "Technical Section" on page 59 for stocked materials.

Length: The length of all connections includes the barrel, flange and facing. See the current FVC price sheet for standard lengths. **Intermediate lengths and longer are available upon request.**

Facing: The FVC flange thickness "T" excludes 0.25 inch raised face per ASME B16.5. This differs on Classes 150 and 300. FVC can supply any special facing as needed upon request.

FVC Variable Body Connections



FVC Variable Body Connection "V_3"

DON'T COMPROMISE!

If your reinforcement requirements have not been met with these standard FVC connections, please see "Custom Products", pages 54 to 56.

Size	Nut Stop Dia.	Nut Relief Dia.	Nut Relief Lngth.	Neck Thickness			Weights						Base Wt. Lngth.
				V_1	V_2	V_3	V_1		V_2		V_3		
	NS	NR	NL	N	N	N	Base Wt.	Wt./1"	Base Wt.	Wt./1"	Base Wt.	Wt./1"	
1	2.56	2.12	1.12	1.15	1.52	1.83	29	2.2	41	3.4	51	4.6	12
1½	3.25	2.75	1.25	1.25	2.00	2.25	43	3.1	71	6.2	82	7.5	12
2	5.06	4.12	1.12	1.78	2.03	2.53	80	5.9	92	7.2	117	10.1	12
2½	5.88	4.88	1.25	2.03	2.34	2.97	107	8	123	10	158	14	12
3	6.06	5.00	1.12	2.05	2.43	2.68	114	9	136	12	151	13	12
4	7.44	6.25	1.38	2.53	3.03	3.28	177	14	211	18	228	21	12
5	9.00	7.50	1.50	2.79	3.10	3.66	242	19	265	22	309	28	12
6	10.69	9.25	1.38	2.62	3.18	3.87	271	20	317	25	377	33	12
8	13.31	11.75	1.62	3.75	4.32	4.88	474	38	528	46	584	54	12
10	16.31	14.50	1.62	3.91	4.35	5.28	804	47	880	54	1049	70	16
12	18.81	16.50	1.62	4.37	5.44	5.94	1038	61	1245	81	1345	92	16
14	19.62	17.75	1.75	4.13	4.63	5.06	1068	67	1166	77	1254	86	16
16	21.69	20.00	1.88	3.63	4.50	5.25	1100	63	1282	82	1451	99	16
18	24.06	22.25	2.12	4.00	4.88	5.62	1365	78	1555	99	1715	118	16
20	26.38	24.50	2.25	3.88	5.38	6.00	1525	82	1857	121	1994	139	16
24	31.62	29.50	2.75	4.81	5.50	6.00	2360	123	2515	144	2625	160	16

Bolting and Tolerances: FVC flanges are furnished to ASME B16.5 specifications unless otherwise specified.

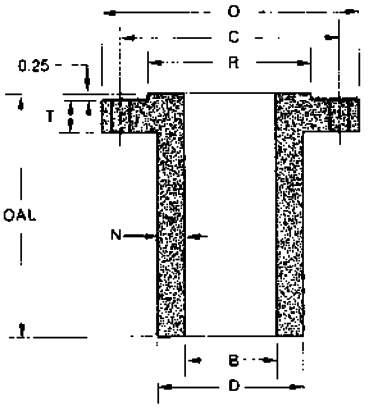
Nut Relief: All FVC connections except standard LWN's will be supplied with a "nut stop O.D." unless a "nut relief O.D." is specified.

Bore: Bore sizes shown above are standard, other sizes can be furnished upon request.

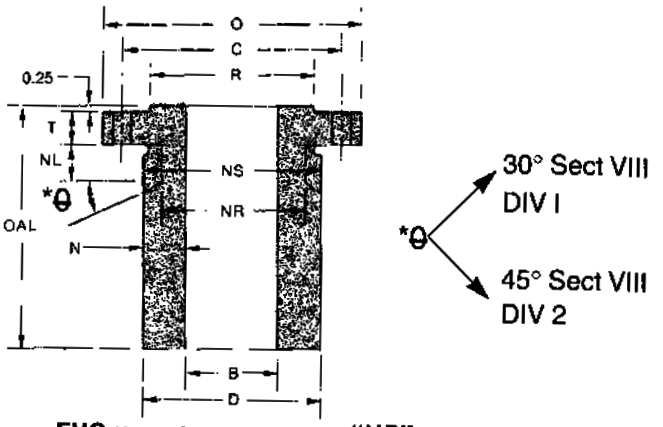
Curving: All FVC connections can be furnished contoured to fit any shell, head or cone at a minimal cost.

See page 97 for complete general notes.

FVC Standard Connections



FVC "LWN"



FVC Heavy Barrel Connection "HB"

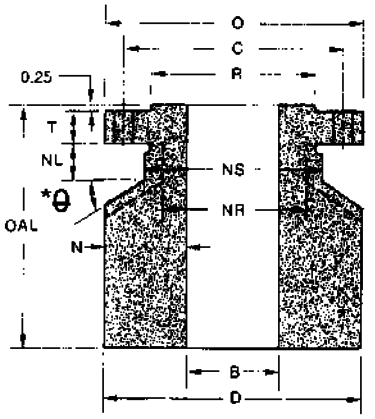
Size	Flange O.D.	Flange Thick.	RF O.D.	Bolt Holes	Hole Size	Bolt Circle	Bore		Barrel O.D.		
							LWN/F	HB	LWN	HB	F
	O	T	R	-	-	C	B	B	D	D	D
½	4.75	0.88	1.38	4	0.88	3.25	0.50	0.55	1.56	2.00	4.75
¾	5.12	1.00	1.69	4	0.88	3.50	0.75	0.74	1.81	2.25	5.12
1	5.88	1.12	2.00	4	1.00	4.00	1.00	0.96	2.12	2.56	5.88
1¼	6.25	1.12	2.50	4	1.00	4.38	1.25	1.28	2.50	2.94	6.25
1½	7.00	1.25	2.88	4	1.12	4.88	1.50	1.50	2.75	3.25	7.00
2	8.50	1.50	3.62	8	1.00	6.50	2.00	1.94	4.12	5.06	8.50
2½	9.62	1.62	4.12	8	1.12	7.50	2.50	2.32	4.88	5.88	9.62
3	10.50	1.88	5.00	8	1.25	8.00	3.00	2.90	5.25	6.19	10.50
4	12.25	2.12	6.19	8	1.38	9.50	4.00	3.83	6.38	7.50	12.25
5	14.75	2.88	7.31	8	1.62	11.50	5.00	4.81	7.75	9.12	14.75
6	15.50	3.25	8.50	12	1.50	12.50	6.00	5.76	9.00	10.31	15.50
8	19.00	3.62	10.62	12	1.75	15.50	8.00	7.62	11.50	12.94	19.00
10	23.00	4.25	12.75	12	2.00	19.00	10.00	9.56	14.50	16.06	23.00
12	26.50	4.88	15.00	16	2.12	22.50	12.00	11.38	17.75	19.38	26.50
14	29.50	5.25	16.25	16	2.38	25.00	14.00	14.00	19.50	21.50	29.50
16	32.50	5.75	18.50	16	2.62	27.75	16.00	16.00	21.75	23.88	32.50
18	36.00	6.38	21.00	16	2.88	30.50	18.00	18.00	23.50	26.25	36.00
20	38.75	7.00	23.00	16	3.12	32.75	20.00	20.00	25.25	28.12	38.75
24	46.00	8.00	27.25	16	3.62	39.00	24.00	24.00	30.00	33.62	46.00

Material: FVC forged connections are made from SA-105 in compliance with ASME Section II. FVC connections are available in other material compositions upon request. See "Technical Section" on page 59 for stocked materials.

Length: The length of all connections includes the barrel, flange and facing. See the current FVC price sheet for standard lengths. **Intermediate lengths and longer are available upon request.**

Facing: The FVC flange thickness "T" excludes 0.25 inch raised face per ASME B16.5. This differs on Classes 150 and 300. FVC can supply any special facing as needed upon request.

FVC Standard Connections



FVC Full Body Connection "F"

DON'T COMPROMISE!

If your reinforcement requirements are in between the "HB" and "F" connections see the following page for Class 1500 FVC Variable Body Connections

Size	Nut Stop Dia.	Nut Relief Dia.	Nut Relief Lngth.	Neck Thickness			Weights						Base Wt. Lngth.
				LWN	HB	F	LWN		HB		F		
	NS	NR	NL	N	N	N	Base Wt.	Wt./1"	Base Wt.	Wt./1"	Base Wt.	Wt./1"	
½	2.00	1.56	1.00	0.53	0.73	2.13	8	0.5	10	0.8	37	5.0	9
¾	2.25	1.81	1.00	0.53	0.76	2.19	10	0.6	13	1.0	42	5.7	9
1	2.56	2.12	1.12	0.56	0.80	2.44	13	0.8	17	1.3	54	7.5	9
1¼	2.94	2.50	1.12	0.63	0.83	2.50	17	1.0	20	1.6	61	8.3	9
1½	3.25	2.75	1.25	0.63	0.88	2.75	21	1.2	26	1.9	77	10	9
2	5.06	4.12	1.12	1.06	1.56	3.25	42	2.9	56	4.9	115	15	9
2½	5.88	4.88	1.25	1.19	1.78	3.56	56	3.9	75	6.5	144	19	9
3	6.19	5.25	1.38	1.13	1.65	3.75	67	4.1	84	6.7	161	23	9
4	7.50	6.38	1.50	1.19	1.84	4.13	110	5.5	147	9.3	302	30	12
5	9.12	7.75	1.75	1.38	2.16	4.88	181	7.8	233	13	414	43	12
6	10.31	9.00	1.62	1.50	2.28	4.75	215	10	272	16	445	46	12
8	12.94	11.50	1.88	1.75	2.66	5.50	337	15	417	24	629	67	12
10	16.06	14.50	2.12	2.25	3.25	6.50	546	25	651	37	888	97	12
12	19.38	17.75	2.25	2.88	4.00	7.25	946	38	1148	55	1683	127	16
14	21.50	19.50	2.50	2.75	3.75	7.75	1116	41	1308	59	1929	150	16
16	23.88	21.75	2.75	2.88	3.94	8.25	1371	48	1588	70	2238	178	16
18	26.25	23.50	3.00	2.75	4.13	9.00	1674	51	1959	81	2629	216	16
20	28.12	25.25	3.25	2.63	4.06	9.38	1943	53	2241	87	2868	245	16
24	33.62	30.00	3.75	3.00	4.81	11.00	2936	72	3334	123	3819	343	16

Bolting and Tolerances: FVC flanges are furnished to ASME B16.5 specifications unless otherwise specified.

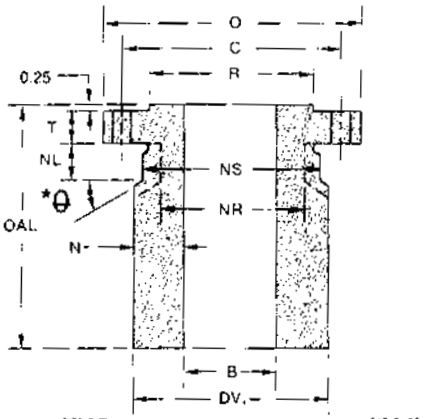
Nut Relief: All FVC connections except standard LWN's will be supplied with a "nut stop O.D." unless a "nut relief O.D." is specified.

Bore: Bore sizes shown above are standard, other sizes can be furnished upon request.

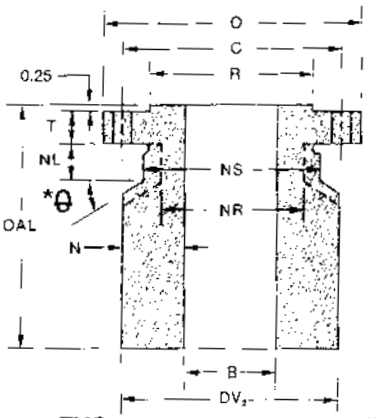
Curving: All FVC connections can be furnished contoured to fit any shell, head or cone at a minimal cost.

See page 97 for complete general notes.

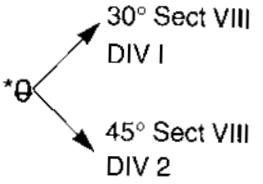
FVC Variable Body Connections



FVC Variable Body Connection "V_1"



FVC Variable Body Connection "V_2"



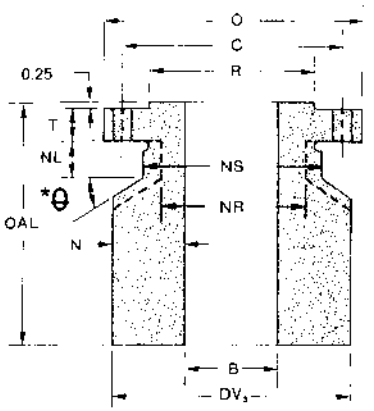
Size	Flange O.D.	Flange Thick.	RF O.D.	Bolt Holes	Hole Size	Bolt Circle	Bore	Barrel O.D.		
								V_1	V_2	V_3
	O	T	R	-	-	C	B	DV_1	DV_2	DV_3
1	5.88	1.12	2.00	4	1.00	4.00	0.96	3.25	4.00	4.62
1½	7.00	1.25	2.88	4	1.12	4.88	1.50	4.62	5.50	6.00
2	8.50	1.50	3.62	8	1.00	6.50	1.94	5.50	6.00	7.00
2½	9.62	1.62	4.12	8	1.12	7.50	2.32	6.38	7.00	8.25
3	10.50	1.88	5.00	8	1.25	8.00	2.90	7.00	7.75	8.88
4	12.25	2.12	6.19	8	1.38	9.50	3.83	8.88	9.88	11.00
5	14.75	2.88	7.31	8	1.62	11.50	4.81	10.38	12.12	13.50
6	15.50	3.25	8.50	12	1.50	12.50	5.76	12.12	13.50	14.25
8	19.00	3.62	10.62	12	1.75	15.50	7.62	15.12	16.25	17.38
10	23.00	4.25	12.75	12	2.00	19.00	9.56	17.38	20.12	22.25
12	26.50	4.88	15.00	16	2.12	22.50	11.38	22.25	23.25	24.12
14	29.50	5.25	16.25	16	2.38	25.00	14.00	23.25	25.00	27.75
16	32.50	5.75	18.50	16	2.62	27.75	16.00	26.25	29.25	30.75
18	36.00	6.38	21.00	16	2.88	30.50	18.00	27.75	30.75	33.62
20	38.75	7.00	23.00	16	3.12	32.75	20.00	30.75	33.00	36.00
24	46.00	8.00	27.25	16	3.62	39.00	24.00	36.00	37.50	40.50

Material: FVC forged connections are made from SA-105 in compliance with ASME Section II. FVC connections are available in other material compositions upon request. See "Technical Section" on page 59 for stocked materials.

Length: The length of all connections includes the barrel, flange and facing. See the current FVC price sheet for standard lengths. **Intermediate lengths and longer are available upon request.**

Facing: The FVC flange thickness "T" excludes 0.25 inch raised face per ASME B16.5. This differs on Classes 150 and 300. FVC can supply any special facing as needed upon request.

FVC Variable Body Connections



FVC Variable Body Connection "V_3"

DON'T COMPROMISE!

If your reinforcement requirements have not been met with these standard FVC connections, please see "Custom Products", pages 54 to 56.

Size	Nut Stop Dia.	Nut Relief Dia.	Nut Relief Lngth.	Neck Thickness			Weights						Base Wt. Lngth.
				V_1	V_2	V_3	V_1		V_2		V_3		
	NS	NR	NL	N	N	N	Base Wt.	Wt./1"	Base Wt.	Wt./1"	Base Wt.	Wt./1"	
1	2.56	2.12	1.12	1.15	1.52	1.83	29	2.2	41	3.4	51	4.6	12
1½	3.25	2.75	1.25	1.56	2.00	2.25	54	4.3	71	6.2	82	7.5	12
2	5.06	4.12	1.12	1.78	2.03	2.53	80	5.9	92	7.2	117	10.1	12
2½	5.88	4.88	1.25	2.03	2.34	2.97	107	8	123	10	158	14	12
3	6.19	5.25	1.38	2.05	2.43	2.99	124	9	144	12	177	16	12
4	7.50	6.38	1.50	2.53	3.03	3.59	187	14	218	18	257	24	12
5	9.12	7.75	1.75	2.79	3.66	4.34	271	19	328	28	376	35	12
6	10.31	9.00	1.62	3.18	3.87	4.25	332	25	380	33	408	38	12
8	12.94	11.50	1.88	3.75	4.32	4.88	498	38	541	46	585	54	12
10	16.06	14.50	2.12	3.91	5.28	6.35	889	47	1088	70	1243	90	16
12	19.38	17.75	2.25	5.44	5.94	6.37	1348	81	1426	92	1495	101	16
14	21.50	19.50	2.50	4.63	5.50	6.88	1443	77	1579	95	1794	128	16
16	23.88	21.75	2.75	5.13	6.63	7.38	1771	96	1999	133	2111	153	16
18	26.25	23.50	3.00	4.88	6.38	7.81	2070	99	2285	138	2481	180	16
20	28.12	25.25	3.25	5.38	6.50	8.00	2417	121	2558	153	2727	200	16
24	33.62	30.00	3.75	6.00	6.75	8.25	3470	160	3545	185	3675	237	16

Bolting and Tolerances: FVC flanges are furnished to ASME B16.5 specifications unless otherwise specified.

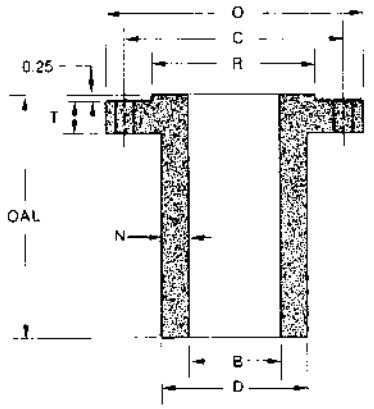
Nut Relief: All FVC connections except standard LWN's will be supplied with a "nut stop O.D." unless a "nut relief O.D." is specified.

Bore: Bore sizes shown above are standard, other sizes can be furnished upon request.

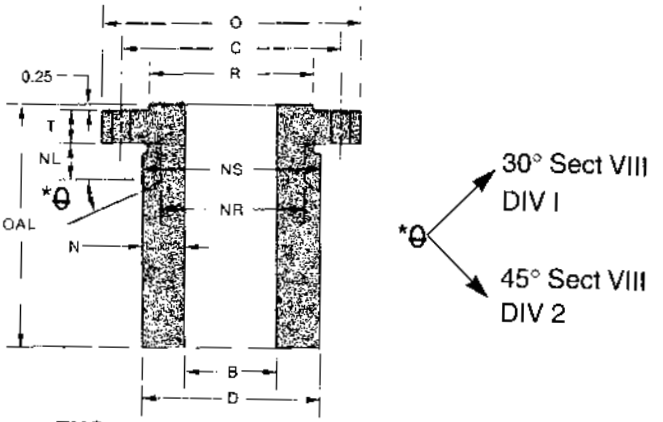
Curving: All FVC connections can be furnished contoured to fit any shell, head or cone at a minimal cost.

See page 97 for complete general notes.

FVC Standard Connections



FVC "LWN"



FVC Heavy Barrel Connection "HB"

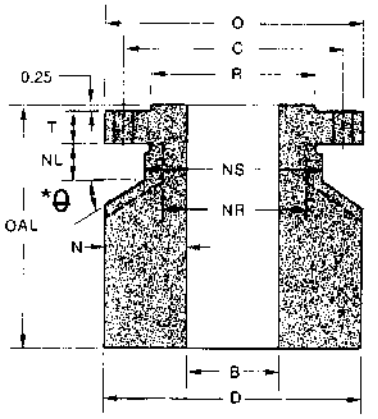
Size	Flange O.D.	Flange Thick.	RF O.D.	Bolt Holes	Hole Size	Bolt Circle	Bore		Barrel O.D.		
							LWN/F	HB	LWN	HB	F
	O	T	R	-	-	C	B	B	D	D	D
½	5.25	1.19	1.38	4	0.88	3.50	0.50	0.55	1.81	2.25	5.25
¾	5.50	1.25	1.69	4	0.88	3.75	0.75	0.74	2.06	2.50	5.50
1	6.25	1.38	2.00	4	1.00	4.25	1.00	0.96	2.25	2.81	6.25
1¼	7.25	1.50	2.50	4	1.12	5.12	1.25	1.28	2.88	3.50	7.25
1½	8.00	1.75	2.88	4	1.25	5.75	1.50	1.50	3.12	3.94	8.00
2	9.25	2.00	3.62	8	1.12	6.75	2.00	1.94	3.75	5.12	9.25
2½	10.50	2.25	4.12	8	1.25	7.75	2.50	2.32	4.50	5.94	10.50
3	12.00	2.62	5.00	8	1.38	9.00	3.00	2.90	5.25	7.00	12.00
4	14.00	3.00	6.19	8	1.62	10.75	4.00	3.83	6.50	8.38	14.00
5	16.50	3.62	7.31	8	1.88	12.75	5.00	4.81	8.00	10.00	16.50
6	19.00	4.25	8.50	8	2.12	14.50	6.00	5.76	9.25	11.38	19.00
8	21.75	5.00	10.62	12	2.12	17.25	8.00	7.63	12.00	14.12	21.75
10	26.50	6.50	12.75	12	2.62	21.25	10.00	9.56	14.75	17.38	26.50
12	30.00	7.25	15.00	12	2.88	24.38	12.00	11.38	17.38	20.12	30.00

Material: FVC forged connections are made from SA-105 in compliance with ASME Section II. FVC connections are available in other material compositions upon request. See "Technical Section" on page 59 for stocked materials.

Length: The length of all connections includes the barrel, flange and facing. See the current FVC price sheet for standard lengths. **Intermediate lengths and longer are available upon request.**

Facing: The FVC flange thickness "T" excludes 0.25 inch raised face per ASME B16.5. This differs on Classes 150 and 300. FVC can supply any special facing as needed upon request.

FVC Standard Connections



FVC Full Body Connection "F"

DON'T COMPROMISE!

If your reinforcement requirements are in between the "HB" and "F" connections see the following page for Class 2500 FVC Variable Body Connections

Size	Nut Stop Dia.	Nut Relief Dia.	Nut Relief Lngth.	Neck Thickness			Weights						Base Wt. Lngth.
				LWN	HB	F	LWN		HB		F		
	NS	NR	NL	N	N	N	Base Wt.	Wt./1"	Base Wt.	Wt./1"	Base Wt.	Wt./1"	
½	2.25	1.81	1.00	0.66	0.85	2.38	11	0.7	14	1.1	45	6.1	9
¾	2.50	2.06	1.00	0.66	0.88	2.38	13	0.8	17	1.3	49	6.6	9
1	2.81	2.25	1.12	0.63	0.93	2.63	18	0.9	22	1.6	62	8.5	9
1¼	3.50	2.88	1.25	0.82	1.11	3.00	27	1.5	32	2.4	84	11	9
1½	3.94	3.12	1.38	0.81	1.22	3.25	33	1.7	42	3	94	14	9
2	5.12	3.75	1.25	0.88	1.59	3.63	48	2.2	66	5	131	18	9
2½	5.94	4.50	1.38	1.00	1.81	4.00	66	3.1	90	6.7	165	23	9
3	7.00	5.25	1.50	1.13	2.05	4.50	97	4.1	127	9	210	30	9
4	8.38	6.50	1.75	1.25	2.28	5.00	159	5.8	218	12	391	40	12
5	10.00	8.00	2.00	1.50	2.60	5.75	248	8.7	319	17	518	55	12
6	11.38	9.25	2.25	1.63	2.81	6.50	358	11	441	21	641	73	12
8	14.12	12.00	2.25	2.00	3.25	6.88	589	18	743	31	1167	92	16
10	17.38	14.75	2.75	2.38	3.91	8.25	997	26	1202	47	1625	134	16
12	20.12	17.38	3.00	2.69	4.37	9.00	1363	35	1609	61	1995	168	16

Bolting and Tolerances: FVC flanges are furnished to ASME B16.5 specifications unless otherwise specified.

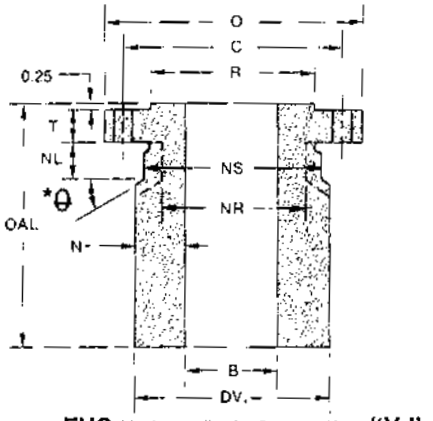
Nut Relief: All FVC connections except standard LWN's will be supplied with a "nut stop O.D." unless a "nut relief O.D." is specified.

Bore: Bore sizes shown above are standard, other sizes can be furnished upon request.

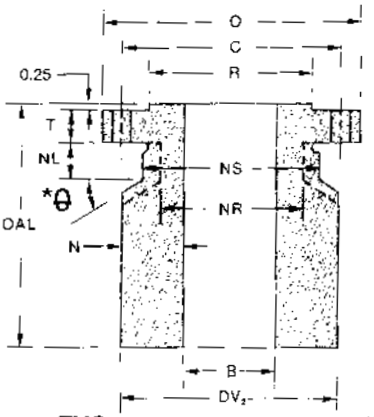
Curving: All FVC connections can be furnished contoured to fit any shell, head or cone at a minimal cost.

See page 97 for complete general notes.

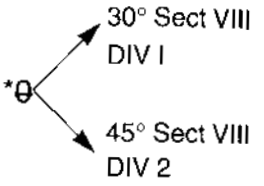
FVC Variable Body Connections



FVC Variable Body Connection "V_1"



FVC Variable Body Connection "V_2"



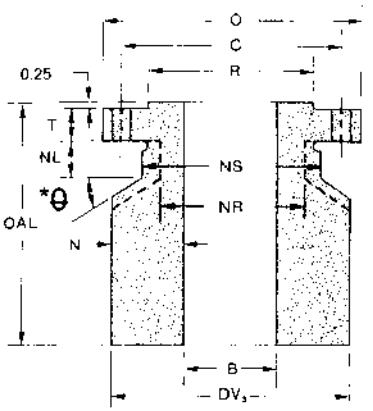
Size	Flange O.D.	Flange Thick.	RF O.D.	Bolt Holes	Hole Size	Bolt Circle	Bore	Barrel O.D.		
								V_1	V_2	V_3
	O	T	R	-	-	C	B	DV_1	DV_2	DV_3
1	6.25	1.38	2.00	4	1.00	4.25	0.96	4.00	4.62	5.50
1½	8.00	1.75	2.88	4	1.25	5.75	1.50	5.50	6.00	7.00
2	9.25	2.00	3.62	8	1.12	6.75	1.94	6.00	7.00	8.00
2½	10.50	2.25	4.12	8	1.25	7.75	2.32	7.00	7.75	8.88
3	12.00	2.62	5.00	8	1.38	9.00	2.90	8.25	9.88	11.00
4	14.00	3.00	6.19	8	1.62	10.75	3.83	9.88	11.00	12.12
5	16.50	3.62	7.31	8	1.88	12.75	4.81	11.00	13.50	15.25
6	19.00	4.25	8.50	8	2.12	14.50	5.76	13.50	15.12	17.38
8	21.75	5.00	10.62	12	2.12	17.25	7.62	15.12	18.25	20.12
10	26.50	6.50	12.75	12	2.62	21.25	9.56	20.12	22.25	24.12
12	30.00	7.25	15.00	12	2.88	24.38	11.38	22.25	25.00	27.75

Material: FVC forged connections are made from SA-105 in compliance with ASME Section II. FVC connections are available in other material compositions upon request. See "Technical Section" on page 59 for stocked materials.

Length: The length of all connections includes the barrel, flange and facing. See the current FVC price sheet for standard lengths. **Intermediate lengths and longer are available upon request.**

Facing: The FVC flange thickness "T" excludes 0.25 inch raised face per ASME B16.5. This differs on Classes 150 and 300. FVC can supply any special facing as needed upon request.

FVC Variable Body Connections



FVC Variable Body Connection "V_3"

DON'T COMPROMISE!

If your reinforcement requirements have not been met with these standard FVC connections, please see "Custom Products", pages 54 to 56.

Size	Nut Stop Dia.	Nut Relief Dia.	Nut Relief Lngth.	Neck Thickness			Weights						Base Wt. Lngth.
				V_1	V_2	V_3	V_1		V_2		V_3		
	NS	NR	NL	N	N	N	Base Wt.	Wt. / 1"	Base Wt.	Wt. / 1"	Base Wt.	Wt. / 1"	
1	2.81	2.25	1.12	1.52	1.83	2.27	43	3.4	54	4.6	71	6.5	12
1½	3.94	3.12	1.38	2.00	2.25	2.75	79	6.2	89	7.5	112	10.4	12
2	5.12	3.75	1.25	2.03	2.53	3.03	99	7.2	123	10	149	13.4	12
2½	5.94	4.50	1.38	2.34	2.72	3.28	135	10	153	12	184	16	12
3	7.00	5.25	1.50	2.68	3.49	4.05	186	13	232	20	267	25	12
4	8.38	6.50	1.75	3.03	3.59	4.15	259	18	293	24	328	29	12
5	10.00	8.00	2.00	3.10	4.35	5.22	347	22	422	35	477	47	12
6	11.38	9.25	2.25	3.87	4.68	5.81	499	33	545	44	609	60	12
8	14.12	12.00	2.25	3.75	5.32	6.25	647	38	735	61	785	77	12
10	17.38	14.75	2.75	5.28	6.35	7.28	1342	70	1451	90	1545	109	16
12	20.12	17.38	3.00	5.44	6.81	8.19	1713	81	1844	110	1966	143	16

Bolting and Tolerances: FVC flanges are furnished to ASME B16.5 specifications unless otherwise specified.

Nut Relief: All FVC connections except standard LWN's will be supplied with a "nut stop O.D." unless a "nut relief O.D." is specified.

Bore: Bore sizes shown above are standard, other sizes can be furnished upon request.

Curving: All FVC connections can be furnished contoured to fit any shell, head or cone at a minimal cost.

See page 97 for complete general notes.

Notes for FVC Standard and Variable Body Connections

Codes:

Material and manufacturing practices for FVC connections are in compliance with ASME Section II, Section VIII Division 1, ASME B16.5, ASME B31.3, and ASME B31.4. Other requirements can be met when specified.

Materials:

FVC forged connections are made from SA-105 in compliance with ASME Section II. FVC connections are available in other material compositions upon request. See the "Technical Section" on page 59 for materials stocked by FVC.

Lengths:

The length of all connections includes the barrel, flange and facing. See the current FVC price sheet for standard lengths. Intermediate lengths and lengths longer than standard are available upon request.

Facings:

All FVC flanges are furnished with a raised face per ASME B16.5. A 0.06-inch raised face is provided on CLASS 150 and 300 flanges and it is included in the "T" dimension. A 0.25-inch raised face is provided on CLASS 400 and above flanges and it is excluded from the "T" dimension. See the "Technical Section," pages 62 through 65, for other types of facings available on FVC flanges. Gaskets are not furnished by FVC.

Bolting and Tolerances:

FVC flanges are furnished to ASME B16.5 specifications unless otherwise specified. See the "Technical Section," pages 60 and 61, for complete FVC tolerances. Bolting is not furnished by FVC.

Nut Relief:

All FVC connections, except standard LWN's, will be supplied with a "nut stop O.D." unless a "nut relief O.D." is specified.

Nut Stop:

All FVC "HB", "V_1", "V_2", "V_3" and "F" style connections are furnished with "nut stop O.D." (not available on "LWN" barrels). This barrel O.D. acts as an automatic nut stop, preventing the nut from turning, thus only requiring one wrench to loosen or tighten bolting on the connecting pipe side.

Bore:

Standard bores on all FVC connections are to the nominal flange size except for 12" and smaller "HB" and "Variable Body" connections which are bored to match schedule 80 pipe. Larger or smaller bores can be provided on all FVC connections upon request.

Underside Curvatures:

All FVC connections can be furnished contoured to fit any shell, head or cone at a minimal cost. Unless otherwise specified, all connections will be furnished with flat bottom.

Flanges and Drilling:

All flanges are drilled unless otherwise specified. Bolt holes are drilled 1/8" larger than bolts. Bolt holes will straddle natural centerlines, unless otherwise specified. Bolts, nuts, studs, inserts and gaskets are not furnished by FVC.

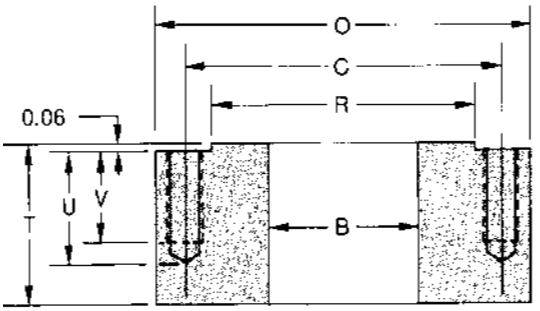
Press-Temp Ratings:

All FVC flanges are furnished to conform to ASME B16.5 pressure-temperature ratings. See the "Technical Section," pages 68 through 72, for rating charts and notes regarding allowable design pressures and hydrotest pressures.

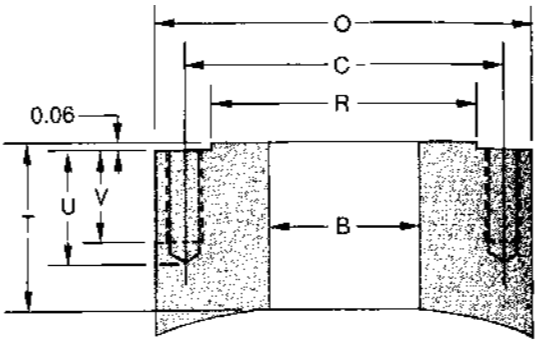
Heat Treatment:

All standard FVC connections over CLASS 300 rating and CLASS 300 "HB", "V_1", "V_2", "V_3" and "F" connections are supplied in the normalized condition. Additional heat treating requirements can be furnished upon request.

FVC Studding Outlets



FLAT



HEAD MOUNT

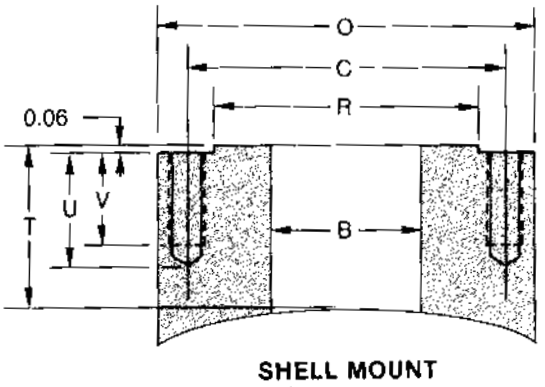
Size	Outside Dia.	Thick.	R.F. O.D.	Stud Holes	Hole Size	Hole Depth	Stud Circle	Tap Size	T.P.I.	Tap Depth	Wall Thick.	Approx. Weight
B	O	T	R	-	-	U	C	-	-	V	-	-
½	3.50	1.25	1.38	4	27/64	0.88	2.38	1/2	13	0.56	1.50	3.05
¾	3.88	1.25	1.69	4	27/64	0.88	2.75	1/2	13	0.56	1.56	3.71
1	4.25	1.25	2.00	4	27/64	0.88	3.12	1/2	13	0.56	1.62	4.41
1¼	4.62	1.25	2.50	4	27/64	0.88	3.50	1/2	13	0.56	1.69	5.16
1½	5.00	1.25	2.88	4	27/64	0.88	3.88	1/2	13	0.56	1.75	5.96
2	6.00	1.50	3.62	4	17/32	1.12	4.75	5/8	11	0.75	2.00	10.08
2½	7.00	1.50	4.12	4	17/32	1.12	5.50	5/8	11	0.75	2.25	13.54
3	7.50	1.50	5.00	4	17/32	1.12	6.00	5/8	11	0.75	2.25	15.05
3½	8.50	1.50	5.50	8	17/32	1.12	7.00	5/8	11	0.75	2.50	18.88
4	9.00	1.50	6.19	8	17/32	1.12	7.50	5/8	11	0.75	2.50	20.54
5	10.00	1.75	7.31	8	21/32	1.31	8.50	3/4	10	0.88	2.50	27.55
6	11.00	1.75	8.50	8	21/32	1.31	9.50	3/4	10	0.88	2.50	31.41
8	13.50	1.75	10.62	8	21/32	1.31	11.75	3/4	10	0.88	2.75	44.07
10	16.00	1.81	12.75	12	49/64	1.44	14.25	7/8	9	1.00	3.00	59.27
12	19.00	1.81	15.00	12	49/64	1.44	17.00	7/8	9	1.00	3.50	83.25
14	21.00	2.00	16.25	12	7/8	1.56	18.75	1	8	1.12	3.50	103.38
16	23.50	2.00	18.50	16	7/8	1.56	21.25	1	8	1.12	3.75	124.66
18	25.00	2.25	21.00	16	1	1.81	22.75	1 1/8	8	1.25	3.50	141.69
20	27.50	2.25	23.00	20	1	1.81	25.00	1 1/8	8	1.25	3.75	167.13
24	32.00	2.50	27.25	20	1 1/8	2.12	29.50	1 1/4	8	1.44	4.00	245.14

Material: FVC forged studding outlets are made from SA-105 in compliance with ASME Section II. FVC studding outlets are available in other material compositions upon request. See “Technical Section” on page 59 for stocked materials.

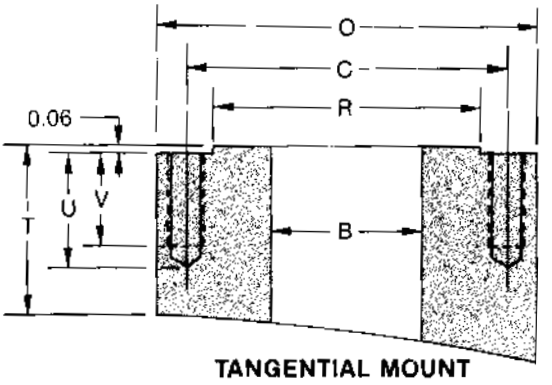
Thickness: The standard thickness shown in charts for all FVC studding outlets is the minimum required per ASME Section VIII Division 1 Paragraph UG-43(d) for thread engagement and an I.D. mount (Fig. A, page 50). It is important to note that each individual application should be analyzed for proper thickness. See general notes for more details.

Facing: The FVC studding outlet minimum thickness “T” includes proper raised face per ASME B16.5. FVC can supply any special facing as needed upon request.

FVC Studding Outlets



SHELL MOUNT



TANGENTIAL MOUNT

Size	Outside Dia.	Thick.	R.F. O.D.	Stud Holes	Hole Size	Hole Depth	Stud Circle	Tap Size	T.P.I.	Tap Depth	Wall Thick.	Approx. Weight
B	O	T	R	-	-	U	C	-	-	V	-	-
½	3.75	1.25	1.38	4	27/64	0.88	2.62	1/2	13	0.56	1.62	3.53
¾	4.62	1.50	1.69	4	17/32	1.12	3.25	5/8	11	0.75	1.94	6.41
1	4.88	1.50	2.00	4	17/32	1.12	3.50	5/8	11	0.75	1.94	7.04
1¼	5.25	1.50	2.50	4	17/32	1.12	3.88	5/8	11	0.75	2.00	8.10
1½	6.12	1.75	2.88	4	21/32	1.31	4.50	3/4	10	0.88	2.31	12.82
2	6.50	1.50	3.62	8	17/32	1.12	5.00	5/8	11	0.75	2.25	11.80
2½	7.50	1.75	4.12	8	21/32	1.31	5.88	3/4	10	0.88	2.50	17.92
3	8.25	1.75	5.00	8	21/32	1.31	6.62	3/4	10	0.88	2.62	21.39
3½	9.00	1.75	5.50	8	21/32	1.31	7.25	3/4	10	0.88	2.75	25.06
4	10.00	1.75	6.19	8	21/32	1.31	7.88	3/4	10	0.88	3.00	30.85
5	11.00	1.75	7.31	8	21/32	1.31	9.25	3/4	10	0.88	3.00	35.44
6	12.50	1.75	8.50	12	21/32	1.31	10.62	3/4	10	0.88	3.25	44.15
8	15.00	1.88	10.62	12	49/64	1.44	13.00	7/8	9	1.00	3.50	63.53
10	17.50	2.12	12.75	16	7/8	1.56	15.25	1	8	1.12	3.75	91.04
12	20.50	2.25	15.00	16	1	1.81	17.75	1 1/8	8	1.25	4.25	129.14
14	23.00	2.25	16.25	20	1	1.81	20.25	1 1/8	8	1.25	4.50	154.97
16	25.50	2.50	18.50	20	1 1/8	2.12	22.50	1 1/4	8	1.44	4.75	214.87
18	28.00	2.50	21.00	24	1 1/8	2.12	24.75	1 1/4	8	1.44	5.00	250.93
20	30.50	2.50	23.00	24	1 1/8	2.12	27.00	1 1/4	8	1.44	5.25	289.19
24	36.00	2.88	27.25	24	1 3/8	2.38	32.00	1 1/2	8	1.69	6.00	453.48

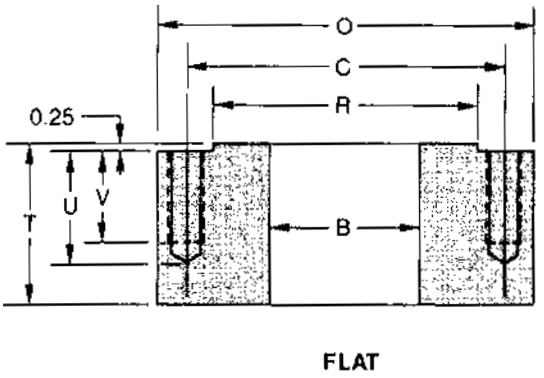
Drilling and Tapping: FVC studding outlets are furnished to ASME B16.5 specifications unless otherwise specified. Thread depth is in accordance with ASME Section VIII Division 1 Para. UG-43(g) for a design temperature not to exceed 650°F, a base metal stress of 17,500 psi, and a stud stress of 25,000 psi. All other materials exceeding these stresses should be checked for UG-43 compliance.

Bore: Bore sizes shown above are standard, other sizes can be furnished upon request.

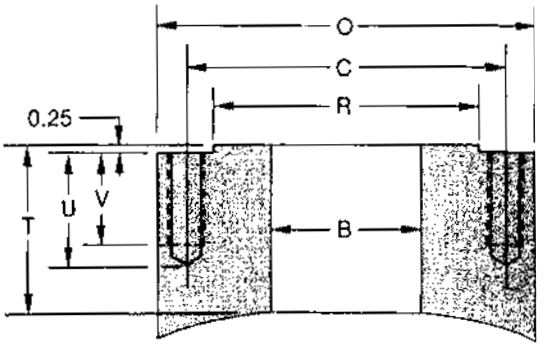
Curving: All FVC connections can be furnished contoured to fit any shell, head or cone at a minimal cost.

See page 104-106 for complete general notes.

FVC Studding Outlets



FLAT



HEAD MOUNT

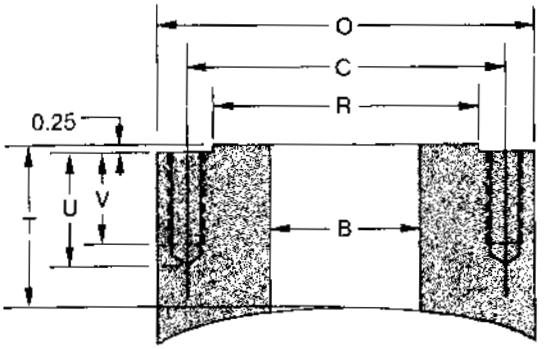
Size	Outside Dia.	Thick.	R.F. O.D.	Stud Holes	Hole Size	Hole Depth	Stud Circle	Tap Size	T.P.I.	Tap Depth	Wall Thick.	Approx. Weight
B	O	T	R	-	-	U	C	-	-	V	-	-
½	3.75	1.50	1.38	4	27/64	0.88	2.62	1/2	13	0.56	1.62	3.79
¾	4.62	1.75	1.69	4	17/32	1.12	3.25	5/8	11	0.75	1.94	6.80
1	4.88	1.75	2.00	4	17/32	1.12	3.50	5/8	11	0.75	1.94	7.48
1¼	5.25	1.75	2.50	4	17/32	1.12	3.88	5/8	11	0.75	2.00	8.66
1½	6.12	1.94	2.88	4	21/32	1.31	4.50	3/4	10	0.88	2.31	13.09
2	6.50	1.75	3.62	8	17/32	1.12	5.00	5/8	11	0.75	2.25	12.71
2½	7.50	2.00	4.12	8	21/32	1.31	5.88	3/4	10	0.88	2.50	19.06
3	8.25	2.00	5.00	8	21/32	1.31	6.62	3/4	10	0.88	2.62	22.88
3½	9.00	2.12	5.50	8	49/64	1.44	7.25	7/8	9	1.00	2.75	28.10
4	10.75	2.12	6.19	8	49/64	1.44	8.50	7/8	9	1.00	3.38	41.16
5	13.00	2.25	7.31	8	7/8	1.56	10.50	1	8	1.12	4.00	63.54
6	14.00	2.25	8.50	12	7/8	1.56	11.50	1	8	1.12	4.00	70.03
8	16.50	2.50	10.62	12	1	1.81	13.75	1 1/8	8	1.25	4.25	102.14
10	20.00	2.75	12.75	16	1 1/8	2.12	17.00	1 1/4	8	1.44	5.00	170.24
12	22.00	2.75	15.00	20	1 1/8	2.12	19.25	1 1/4	8	1.44	5.00	193.48
14	23.75	2.88	16.25	20	1 1/4	2.25	20.75	1 3/8	8	1.56	4.88	218.54
16	27.00	3.00	18.50	20	1 3/8	2.38	23.75	1 1/2	8	1.69	5.50	294.05
18	29.25	3.25	21.00	20	1 1/2	2.56	25.75	1 5/8	8	1.88	5.62	358.48
20	32.00	3.25	23.00	24	1 1/2	2.56	28.50	1 5/8	8	1.88	6.00	420.28
24	37.00	3.75	27.25	24	1 3/4	3.00	33.00	1 7/8	8	2.12	6.50	625.81

Material: FVC forged studding outlets are made from SA-105 in compliance with ASME Section II. FVC studding outlets are available in other material compositions upon request. See “Technical Section” on page 59 for stocked materials.

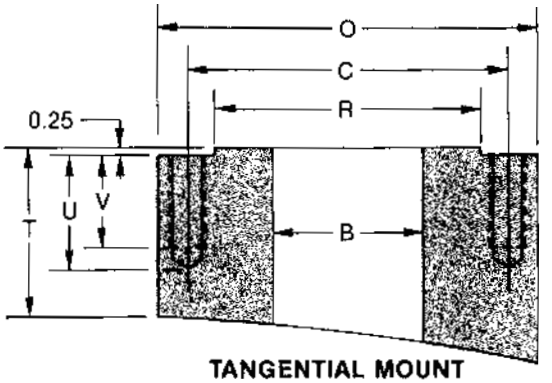
Thickness: The standard thickness shown in charts for all FVC studding outlets is the minimum required per ASME Section VIII Division 1 Paragraph UG-43(d) for thread engagement and an I.D. mount (Fig. A, page 50). It is important to note that each individual application should be analyzed for proper thickness. See general notes for more details.

Facing: The FVC studding outlet minimum thickness “T” includes proper raised face per ASME B16.5. FVC can supply any special facing as needed upon request.

FVC Studding Outlets



SHELL MOUNT



TANGENTIAL MOUNT

Size	Outside Dia.	Thick.	R.F. O.D.	Stud Holes	Hole Size	Hole Depth	Stud Circle	Tap Size	T.P.I.	Tap Depth	Wall Thick.	Approx. Weight
B	O	T	R	-	-	U	C	-	-	V	-	-
½	4.75	2.00	1.38	4	21/32	1.31	3.25	3/4	10	0.88	2.12	8.28
¾	5.12	2.00	1.69	4	21/32	1.31	3.50	3/4	10	0.88	2.19	9.63
1	5.88	2.12	2.00	4	49/64	1.44	4.00	7/8	9	1.00	2.44	13.36
1¼	6.25	2.12	2.50	4	49/64	1.44	4.38	7/8	9	1.00	2.50	15.11
1½	7.00	2.25	2.88	4	7/8	1.56	4.88	1	8	1.12	2.75	20.08
2	8.50	2.12	3.62	8	49/64	1.44	6.50	7/8	9	1.00	3.25	27.40
2½	9.62	2.25	4.12	8	7/8	1.56	7.50	1	8	1.12	3.56	36.91
3	9.50	2.12	5.00	8	49/64	1.44	7.50	7/8	9	1.00	3.25	33.19
4	11.50	2.50	6.19	8	1	1.81	9.25	1 1/8	8	1.25	3.75	56.22
5	13.75	2.75	7.31	8	1 1/8	2.12	11.00	1 1/4	8	1.44	4.38	92.78
6	15.00	2.50	8.50	12	1	1.81	12.50	1 1/8	8	1.25	4.50	91.8
8	18.50	3.00	10.62	12	1 1/4	2.25	15.50	1 3/8	8	1.56	5.25	172.59
10	21.50	3.00	12.75	16	1 1/4	2.25	18.50	1 3/8	8	1.56	5.75	224.63
12	24.00	3.00	15.00	20	1 1/4	2.25	21.00	1 3/8	8	1.56	6.00	268.21
14	25.25	3.25	16.25	20	1 3/8	2.38	22.00	1 1/2	8	1.69	5.62	298.36
16	27.75	3.50	18.50	20	1 1/2	2.56	24.25	1 5/8	8	1.88	5.88	373.68
18	31.00	3.88	21.00	20	1 3/4	3.00	27.00	1 7/8	8	2.12	6.50	520.16
20	33.75	4.25	23.00	20	1 7/8	3.31	29.50	2	8	2.25	6.88	664.71
24	41.00	5.12	27.25	20	2 3/8	4.00	35.50	2 1/2	8	2.81	8.50	1205.50

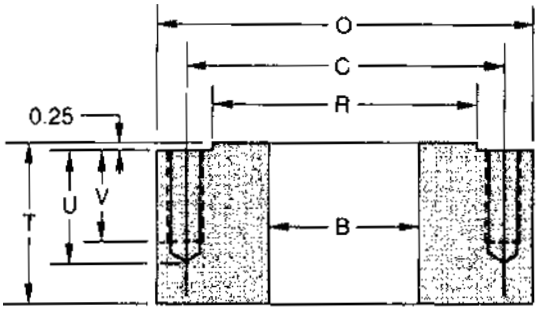
Drilling and Tapping: FVC studding outlets are furnished to ASME B16.5 specifications unless otherwise specified. Thread depth is in accordance with ASME Section VIII Division 1 Para. UG-43(g) for a design temperature not to exceed 650°F, a base metal stress of 17,500 psi, and a stud stress of 25,000 psi. All other materials exceeding these stresses should be checked for UG-43 compliance.

Bore: Bore sizes shown above are standard, other sizes can be furnished upon request.

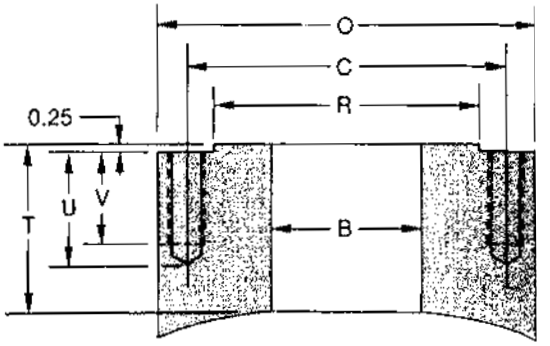
Curving: All FVC connections can be furnished contoured to fit any shell, head or cone at a minimal cost.

See page 104-106 for complete general notes.

FVC Studding Outlets



FLAT



HEAD MOUNT

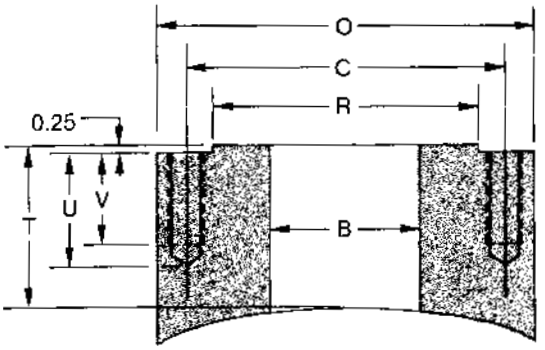
Size	Outside Dia.	Thick.	R.F. O.D.	Stud Holes	Hole Size	Hole Depth	Stud Circle	Tap Size	T.P.I.	Tap Depth	Wall Thick.	Approx. Weight
B	O	T	R	-	-	U	C	-	-	V	-	-
½	4.75	2.00	1.38	4	21/32	1.31	3.25	3/4	10	0.88	2.13	8.28
¾	5.13	2.00	1.69	4	21/32	1.31	3.50	3/4	10	0.88	2.19	9.63
1	5.88	2.12	2.00	4	49/64	1.44	4.00	7/8	9	1.00	2.44	13.36
1¼	6.25	2.12	2.50	4	49/64	1.44	4.38	7/8	9	1.00	2.50	15.11
1½	7.00	2.25	2.88	4	7/8	1.56	4.88	1	8	1.12	2.75	20.08
2	8.50	2.12	3.62	8	49/64	1.44	6.50	7/8	9	1.00	3.25	27.40
2½	9.63	2.25	4.12	8	7/8	1.56	7.50	1	8	1.12	3.56	36.91
3	10.50	2.50	5.00	8	1	1.81	8.00	1 1/8	8	1.25	3.75	48.36
4	12.25	2.75	6.19	8	1 1/8	2.12	9.50	1 1/4	8	1.44	4.13	75.75
5	14.75	3.12	7.31	8	1 3/8	2.38	11.50	1 1/2	8	1.69	4.88	124.48
6	15.50	3.00	8.50	12	1 1/4	2.25	12.50	1 3/8	8	1.56	4.75	126.62
8	19.00	3.50	10.62	12	1 1/2	2.56	15.50	1 5/8	8	1.88	5.50	215.77
10	23.00	3.88	12.75	12	1 3/4	3.00	19.00	1 7/8	8	2.12	6.50	349.47
12	26.50	4.12	15.00	16	1 7/8	3.31	22.50	2	8	2.25	7.25	485.02
14	29.50	4.25	16.25	16	2 1/8	3.56	25.00	2 1/4	8	2.56	7.75	603.08
16	32.50	5.00	18.50	16	2 3/8	4.00	27.75	2 1/2	8	2.81	8.25	849.67
18	36.00	5.50	21.00	16	2 5/8	4.38	30.50	2 3/4	8	3.12	9.00	1140.95
20	38.75	5.88	23.00	16	2 7/8	4.62	32.75	3	8	3.44	9.38	1386.05
24	46.00	6.75	27.25	16	3 3/8	5.38	39.00	3 1/2	8	4.00	11.00	2233.80

Material: FVC forged studding outlets are made from SA-105 in compliance with ASME Section II. FVC studding outlets are available in other material compositions upon request. See “Technical Section” on page 59 for stocked materials.

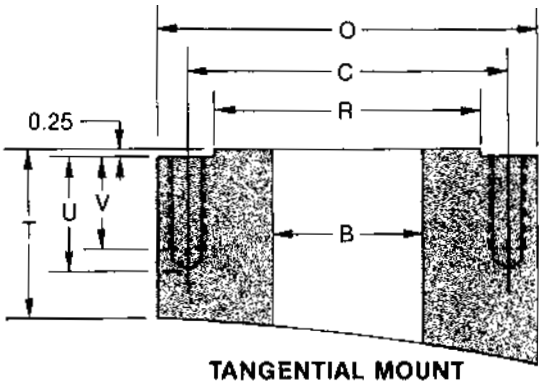
Thickness: The standard thickness shown in charts for all FVC studding outlets is the minimum required per ASME Section VIII Division 1 Paragraph UG-43(d) for thread engagement and an I.D. mount (Fig. A, page 50). It is important to note that each individual application should be analyzed for proper thickness. See general notes for more details.

Facing: The FVC studding outlet minimum thickness “T” includes proper raised face per ASME B16.5. FVC can supply any special facing as needed upon request.

FVC Studding Outlets



SHELL MOUNT



TANGENTIAL MOUNT

Size	Outside Dia.	Thick.	R.F. O.D.	Stud Holes	Hole Size	Hole Depth	Stud Circle	Tap Size	T.P.I.	Tap Depth	Wall Thick.	Approx. Weight
B	O	T	R	-	-	U	C	-	-	V	-	-
½	5.25	2.00	1.38	4	21/32	1.31	3.50	3/4	10	0.88	2.38	10.22
¾	5.50	2.00	1.69	4	21/32	1.31	3.75	3/4	10	0.88	2.38	11.19
1	6.25	2.12	2.00	4	49/64	1.44	4.25	7/8	9	1.00	2.63	15.25
1¼	7.25	2.25	2.50	4	7/8	1.56	5.12	1	8	1.12	3.00	21.89
1½	8.00	2.50	2.88	4	1	1.81	5.75	1 1/8	8	1.25	3.25	29.64
2	9.25	2.25	3.62	8	7/8	1.56	6.75	1	8	1.12	3.63	34.68
2½	10.50	2.50	4.12	8	1	1.81	7.75	1 1/8	8	1.25	4.00	49.44
3	12.00	2.75	5.00	8	1 1/8	2.12	9.00	1 1/4	8	1.44	4.50	75.92
4	14.00	3.25	6.19	8	1 3/8	2.38	10.75	1 1/2	8	1.69	5.00	121.33
5	16.50	3.75	7.31	8	1 5/8	2.81	12.75	1 3/4	8	2.00	5.75	194.05
6	19.00	4.12	8.50	8	1 7/8	3.31	14.50	2	8	2.25	6.50	281.77
8	21.75	4.38	10.62	12	1 7/8	3.31	17.25	2	8	2.25	6.88	378.47
10	26.50	5.12	12.75	12	2 3/8	4.00	21.25	2 1/2	8	2.81	8.25	655.40
12	30.00	5.50	15.00	12	2 5/8	4.38	24.38	2 3/4	8	3.12	9.00	886.88

Drilling and Tapping: FVC studding outlets are furnished to ASME B16.5 specifications unless otherwise specified. Thread depth is in accordance with ASME Section VIII Division 1 Para. UG-43(g) for a design temperature not to exceed 650°F, a base metal stress of 17,500 psi, and a stud stress of 25,000 psi. All other materials exceeding these stresses should be checked for UG-43 compliance.

Bore: Bore sizes shown above are standard, other sizes can be furnished upon request.

Curving: All FVC connections can be furnished contoured to fit any shell, head or cone at a minimal cost.

See page 104-106 for complete general notes.

General Notes for FVC Standard Studding Outlets

Codes:

Material and manufacturing practices for FVC studding outlets are in compliance with ASME Section II, Section VIII Division 1, and B16.5. Other requirements can be met when specified.

Materials:

FVC forged studding outlets are made from SA-105 in compliance with ASME Section II. FVC studding outlets are available in other material compositions upon request. See "Technical Section" on page 59 for materials stocked by FVC.

Thickness:

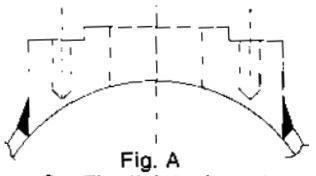


Fig. A
"Set Thru" Attachment

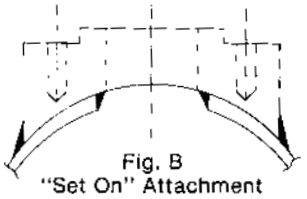


Fig. B
"Set On" Attachment

The standard thickness shown in charts for all FVC studding outlets is the minimum required for ASME Section VIII Division 1 for thread engagement and thickness required for mounting the studding outlet to the I.D. as shown in FIG. A. It is important to note that for studding outlets which are set through a vessel (FIG. A), the thickness of the studding outlet may need to be increased to comply with ASME Code, Section VIII Division 1, paragraph UG-43(d) requirements. For studding outlets mounted to the O.D. as shown in FIG. B, a reduction of thickness is possible. If the required minimum thickness is greater than FVC standard due to the ASME reinforcing requirements, FVC will increase the studding outlet thickness as necessary at the buyer's request or when design data is supplied with an order. The minimum thickness is measured at the points in FIG. C and FIG. D.

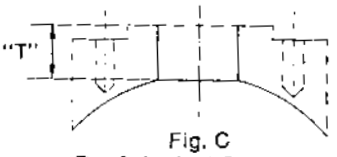


Fig. C
For Spherical Curvature

Fig. D
For Cylindrical Curvature

Facings:

All FVC studding outlets are furnished with a raised face per ASME B16.5. A 0.06-inch raised face is provided on CLASS 150 and 300 flanges. A 0.25-inch raised face is provided on CLASS 400 and above flanges. These facing thicknesses are included in the "T" dimension. See the "Technical Section" on pages 62 through 65 for other types of facings available on FVC flanges. Gaskets are not furnished by FVC.

Bolting and Tolerances:

FVC flanges are furnished to ASME B16.5 specifications unless otherwise specified. See the "Technical Section" on pages 60 and 61 for complete FVC tolerances.

Bore:

Standard bores on all FVC studding outlets are to the nominal flange size. Larger or smaller bores can be provided on all FVC studding outlets upon request.

General Notes for FVC Standard Studding Outlets

Underside Curvatures:

Unless otherwise specified, all FVC studding outlets will be furnished with flat bottom. Undersides of FVC studding outlets are furnished with a maximum roughness of 500 microinches. This maximum roughness applies to curved as well as flat bottom studding outlets.

When curving at the underside is required, it will be curved to fit flush on an I.D. mount (FIG. A) at the O.D. perimeter of the studding outlet. When mounted to the vessel I.D., some variation from a true radius may occur on transverse centerline of cylindrical radius. The amount of variance will not exceed the maximum out-of-roundness tolerance per ASME Section VIII Division 1 paragraph UG-80. An outside shell mount (FIG. B) must be specified by the customer as it requires special contouring.

When a "Wrap Around" configuration exists and the outside diameter of the studding outlet exceeds the outside diameter of the shell to which it is mounted, the pad will be square as shown in FIG. E.

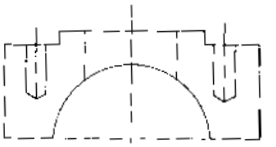


Fig. E
"Wrap Around"

FVC studding outlets for hillside, inclined and conical locations will be provided in the same manner as curvatures. There are no restrictions to the severity of curvature which FVC can provide. Studding outlets requiring a curvature of less than 0.09 inch will be furnished flat, unless otherwise requested by the customer.

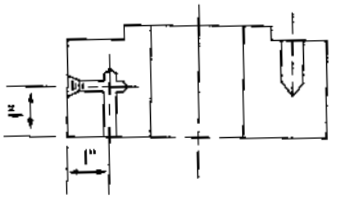


Fig. F
"Standard Test Hole"

Drilling and Tapping:

All standard FVC studding outlets are drilled and tapped unless otherwise specified. The drilling and tapping is furnished in accordance with ASME B16.5. The depth of tapping is in accordance with ASME Section VIII Division 1 paragraph UG-43(g). Stud holes will straddle centerlines, unless otherwise specified. Studs, nuts, inserts, and gaskets are not furnished by FVC.

Test Holes:

Test holes can be provided on FVC studding outlets upon request. The test hole will be provided per FIG. F unless other specific details are supplied by the customer with a 1/4" diameter drilling and a 1/8" N.P.T. tapping.

Pressure-Temperature Ratings:

All standard FVC studding outlets are furnished in accordance with ASME B16.5. See the "Technical Section" on pages 68 through 72 for rating charts and notes regarding allowable design pressures and hydrotest pressures.

General Notes for FVC Standard Studding Outlets

Heat Treatment:

All standard FVC connections CLASS 400 and above are supplied in the normalized condition in accordance with the requirements of ASME Section II. Additional heat treatment requirements can be furnished upon request.

Reinforcement:

Particular attention must be paid to the area required for reinforcing an opening using a studding outlet because of the voids created by the tapped holes. Paragraph UG-37 of ASME Section VIII Division 1 addresses the planes of reinforcement and the "F" factor. This reduction of available reinforcement must not be overlooked. See the following table for area of various tapped holes. The area lost from the tapped holes can be provided by increasing the "T" dimension or the O.D. when required.

LOSS OF REINFORCEMENT DUE TO 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

Material Specifications For FVC Products

Chemical Composition (%)

Specification	C	Mn	P (Max)	S (Max)	Si	Ni	Cr	Mo	V (Max)	Al (Max)	Cu (Max)
SA-105* **	0.35 (Max)	0.6-1.05	0.04	0.05	0.35 (Max)	-	-	-	-	-	-
SA-182-F1	0.28 (Max)	0.6-0.9	0.045	0.045	0.15-0.35	-	-	0.44-0.65	-	-	-
SA-182-F5	0.15 (Max)	0.3-0.6	0.03	0.03	0.5 (Max)	0.5 (Max)	4.0-6.0	0.44-0.65	-	-	-
SA-182-F11	0.1-0.2	0.3-0.8	0.04	0.04	0.5-1.0	-	1.0-1.5	0.44-0.65	-	-	-
SA-182-F12	0.1-0.2	0.3-0.8	0.04	0.04	0.1-0.6	-	0.8-1.25	0.44-0.65	-	-	-
SA-182-F22	0.15 (Max)	0.3-0.6	0.04	0.04	0.5 (Max)	-	2.0-2.5	0.87-1.13	-	-	-
SA-182-F304	0.08 (Max)	2.0 (Max)	0.04	0.03	1.0 (Max)	8.0-11.0	18.0-20.0	-	-	-	-
SA-182-F304L	0.035 (Max)	2.0 (Max)	0.04	0.03	1.0 (Max)	8.0-13.0	18.0-20.0	-	-	-	-
SA-182-F316	0.08 (Max)	2.0 (Max)	0.04	0.03	1.0 (Max)	10.0-14.0	16.0-18.0	2.0-3.0	-	-	-
SA-182-F316L	0.035 (Max)	2.0 (Max)	0.04	0.03	1.0 (Max)	10.0-15.0	16.0-18.0	2.0-3.0	-	-	-
SA-182-F321	0.08 (Max)	2.0 (Max)	0.04	0.03	1.0 (Max)	9.0-12.0	17.0 (Min)	-	-	-	-
SA-350-LF1 *	0.3 (Max)	1.35 (Max)	0.035	0.04	0.15-0.3	-	-	-	-	-	-
SA-350-LF2 *	0.3 (Max)	1.35 (Max)	0.035	0.04	0.15-0.3	-	-	-	-	-	-
SA-350-LF3 *	0.2 (Max)	0.9 (Max)	0.035	0.04	0.2-0.35	3.25-3.75	-	-	-	-	-
SA-508 GR2	0.27 (Max)	0.50-1.00	0.025	0.025	0.15-0.40	0.50-1.00	0.25-0.45	0.55-0.70	0.05	-	-
SA-508 GR3	0.25 (Max)	1.20-1.50	0.025	0.025	0.15-0.40	0.40-1.00	0.25 (Max)	0.45-0.60	0.05	-	-
SA-765 GR2	0.30 (Max)	0.60-1.05	0.020	0.020	0.15-0.35	0.50 (Max)	0.40 (Max)	0.25 (Max)	0.05	0.05	0.35
SAE-4130	0.28-0.33	0.4-0.6	0.04	0.04	0.2-0.35	-	0.8-1.10	0.15-0.25	-	-	-

* FVC stocks chemistries which comply with “Sour Service” requirements (NACE).

** For each reduction of 0.01% below the specified carbon maximum (0.35%), an increase of 0.06% manganese above the specified maximum (1.05%) will be permitted up to a maximum of 1.35%.

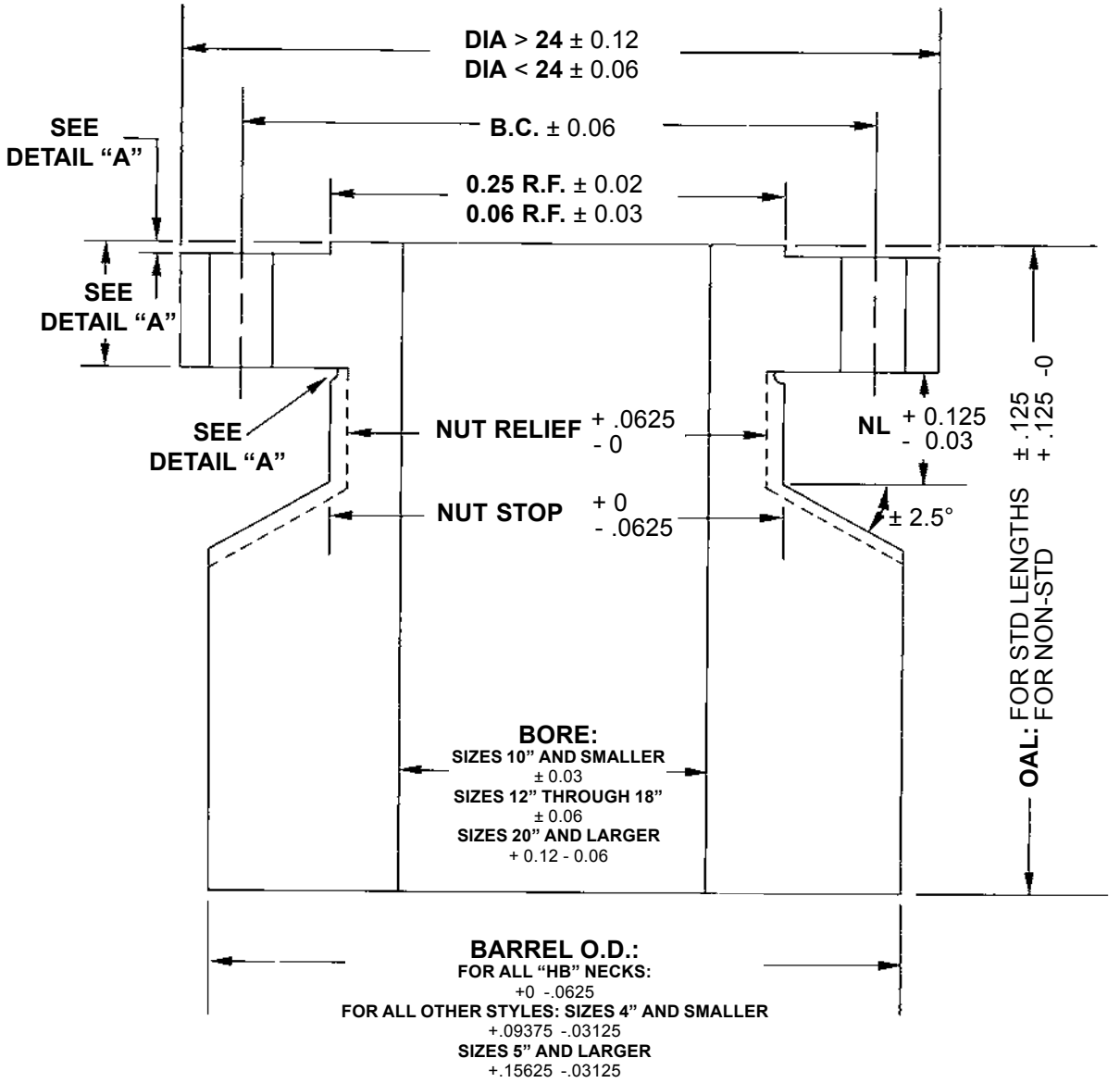
Notes:

1. The materials listed above are typical of FVC inventory and are subject to availability.
2. Other materials can be provided based on special orders which may be subject to prior sale and quantity minimums.

ASME Material Compatibility

Forging Spec.	P.V.Q. Plate Spec.	Pipe Spec.	Fitting Spec.
SA-105	SA-285, SA-515	SA-53, SA-106	SA-234WPB
SA-350-LF1	SA-515, SA-516	SA-333-GR 6	SA-420WPL6
SA-350-LF2	SA-516	SA-333-GR 6	SA-420WPL6
SA-350-LF3	SA-203-GR D	SA-333-GR 3	SA-420WPL3
SA-182-F1	SA-204	SA-335-P1	SA-234-WP1
SA-182-F5	SA-387-GR 5	SA-335-P5	SA-234-WP5
SA-182-F11	SA-387-GR 11	SA-335-P11	SA-234-WP11
SA-182-F12	SA-387-GR 12	SA-335-P12	SA-234-WP12
SA-182-F22	SA-387-GR 22	SA-335-P22	SA-234-WP22
SA-182-F304	SA-240-304	SA-312-TP304	SA-403-WP304
SA-182-F304L	SA-240-304L	SA-312-TP304L	SA-403-WP304L
SA-182-F316	SA-240-316	SA-312-TP316	SA-403-WP316
SA-182-F316L	SA-240-316L	SA-312-TP316L	SA-403-WP316L
SA-182-F321	SA-240-321	SA-312-TP321	SA-403-WP321

FVC Connection Tolerances

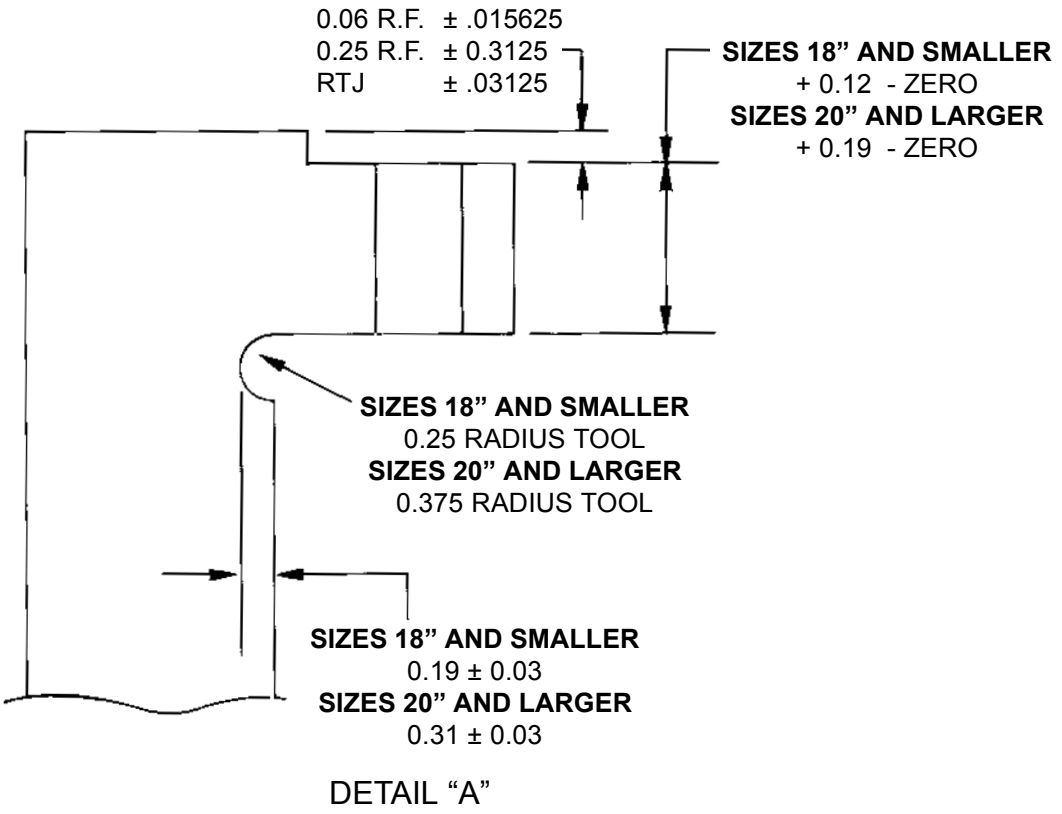


General Notes: 1) All dimensions are in inches.

2) FVC connections are manufactured in accordance with the tolerances set forth by ASME B16.5.

3) Tolerances may be modified to meet customer requirements when specified.

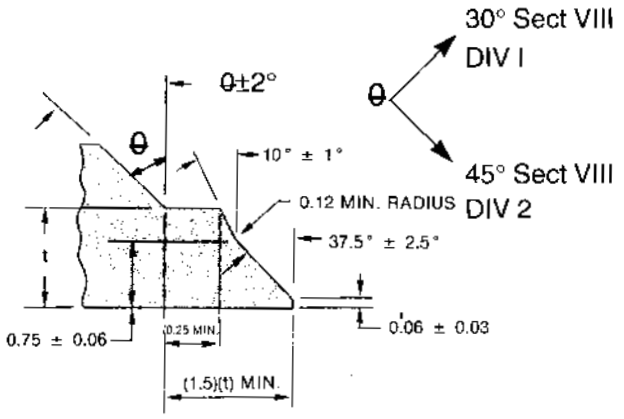
FVC Connection Tolerances



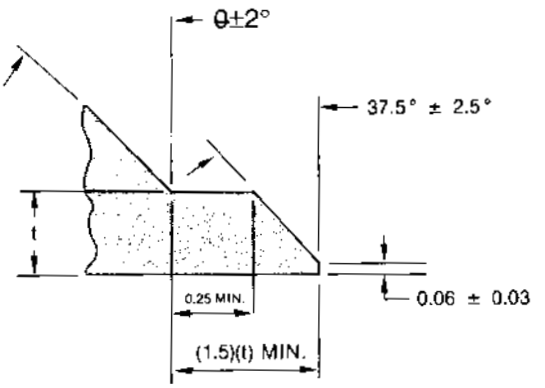
DETAIL "A"

Note: Undercut dimensions and tolerances comply with ASME Section VIII Division1, Fig 2-4

FVC Welding Bevel Details



COMPOUND BEVEL ($t \geq 0.88$)



SINGLE BEVEL ($t \leq 0.88$)

Bevel dimension and tolerances are based on ASME B16.5. The above details will be provided unless otherwise specified. Other bevels are available upon request.

General Notes For FVC Flange Facings

FVC connections are available with numerous standard and special facings. The more popular standard facings are described on the following pages. Customers are requested to furnish details for any special facings desired.

Raised Face:

The facing height and outside diameter are specified in the standard product dimensional tables. The serrations are spiral and are in accordance with the requirements of the latest issue of ASME B16.5 and MSS-SP6.

Flat Face:

All pressure class flanges may be ordered flat faced. On 150# and 300# rated flanges, the raised face normally furnished will be removed by machining. The resulting minimum flange thickness will be 0.06 inch less than that specified as dimension “T” in the standard product dimensional tables. On flanges rated 400# and above, the raised face normally furnished will also be removed by machining. However, the resulting flange thickness will not be less than the specified dimension “T”.

As an alternate, all flat face flanges may be ordered as “full-face”-”flat face”. In this case, 150# and 300# rated flanges will have a resulting minimum flange thickness of no less than that specified as dimension “T”. Any 400# and higher rated flanges will be provided with a minimum flange thickness of that specified as dimension “T” plus 0.25 inch.

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

All options mentioned above are per ASME B16.5 Standards.

Rough Face:

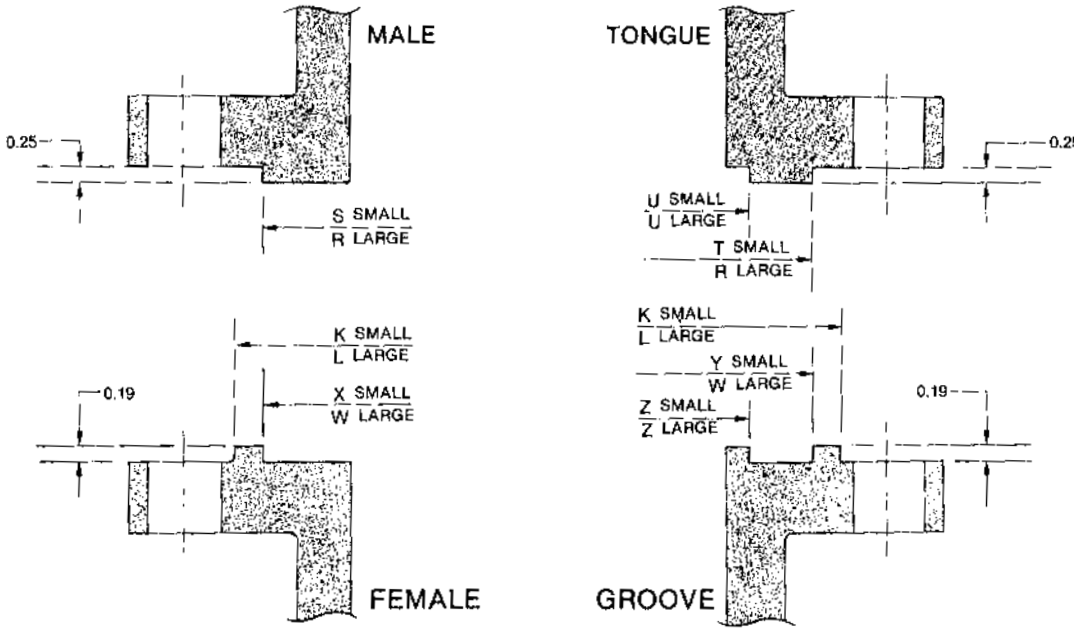
Except as otherwise specified, no finish machining will be performed on rough forgings. No holes will be drilled. A minimum of 0.12 inch will be provided on all surfaces for customer machining. Facing heights exceeding those of a standard raised face must be indicated.

RTJ:

The table on pages 64 and 65 gives the dimensions applicable to ring type joint facings. The side walls of the gasket groove are finished to a surface roughness not exceeding 63 microinches.

Other Standard Facings:

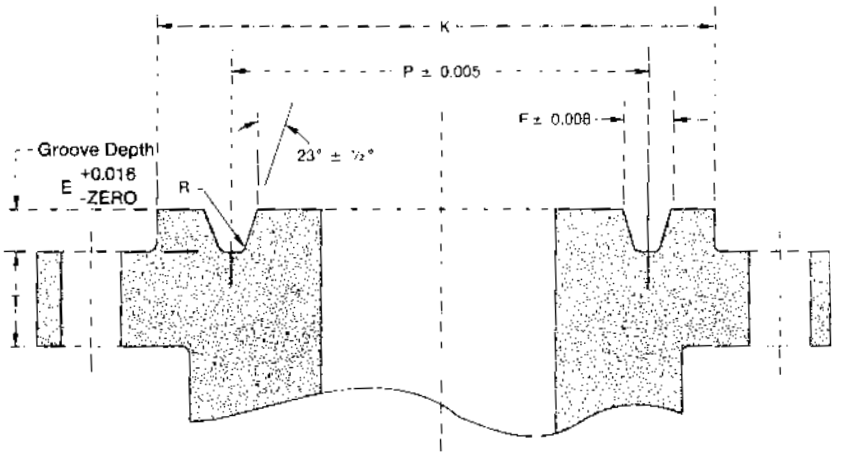
The dimensional details of other standard facings are presented in the table on the following page.



THIS TABLE LISTS THE DIMENSIONS FOR STANDARD MALE, FEMALE, TONGUE AND GROOVE FACINGS AVAILABLE ON ALL FVC CONNECTIONS.

FLG Size	R	S	T	U	W	X	Y	Z	K	L
½	1.38	0.72	1.38	1.00	1.44	0.78	1.44	0.94	1.75	1.81
¾	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
1¼	2.50	1.50	2.25	1.88	2.56	1.56	2.31	1.81	2.62	2.94
1½	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
2½	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
3½	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

Notes:
1. These dimensions apply to all ASME pressure classes except that the **large** facings are not available on Class 150 flanges.
2. Facing heights and groove depths must be added to basic "T" dimensions but they are included in overall length "OAL".



Ring Type Joint facings are available on all FVC connections per ASME B16.5

Ring Type Joint Facings

SIZE	CLASS	GROOVE NUMBER	P	E	F	R	K
½	300-600 900-1500 2500	R 11 R 12 R 13	1.344 1.562 1.688	0.219 0.250 0.250	0.281 0.344 0.344	0.03 0.03 0.03	2.00 2.38 2.56
¾	300-600 900-1500 2500	R 13 R 14 R 16	1.688 1.750 2.000	0.250 0.250 0.250	0.344 0.344 0.344	0.03 0.03 0.03	2.50 2.62 2.88
1	150 300-600 900-1500 2500	R 15 R 16 R 16 R 18	1.875 2.000 2.000 2.375	0.250 0.250 0.250 0.250	0.344 0.344 0.344 0.344	0.03 0.03 0.03 0.03	2.50 2.75 2.81 3.25
1¼	150 300-600 900-1500 2500	R 17 R 18 R 18 R 21	2.250 2.375 2.375 2.844	0.250 0.250 0.250 0.312	0.344 0.344 0.344 0.469	0.03 0.03 0.03 0.03	2.88 3.12 3.19 4.00
1½	150 300-600 900-1500 2500	R 19 R 20 R 20 R 23	2.562 2.688 2.688 3.250	0.250 0.250 0.250 0.312	0.344 0.344 0.344 0.469	0.03 0.03 0.03 0.03	3.25 3.56 3.62 4.50
2	150 300-600 900-1500 2500	R 22 R 23 R 24 R 26	3.250 3.250 3.750 4.000	0.250 0.312 0.312 0.312	0.344 0.469 0.469 0.469	0.03 0.03 0.03 0.03	4.00 4.25 4.88 5.25
2½	150 300-600 900-1500 2500	R 25 R 26 R 27 R 28	4.000 4.000 4.250 4.375	0.250 0.312 0.312 0.375	0.344 0.469 0.469 0.531	0.03 0.03 0.03 0.06	4.75 5.00 5.38 5.88
3	150 300-600 900 1500 2500	R 29 R 31 R 31 R 35 R 32	4.500 4.875 4.875 5.375 5.000	0.250 0.312 0.312 0.312 0.375	0.344 0.469 0.469 0.469 0.531	0.03 0.03 0.03 0.03 0.06	5.25 5.75 6.12 6.62 6.62

See notes on next page.

Ring Type Joint Facings

SIZE	CLASS	GROOVE NUMBER	P	E	F	R	K
3½	150 300-600	R 33 R 34	5.188 5.188	0.250 0.312	0.344 0.469	0.03 0.03	6.06 6.25
4	150 300-600 900 1500 2500	R 36 R 37 R 37 R 39 R 38	5.875 5.875 5.875 6.375 6.188	0.250 0.312 0.312 0.312 0.438	0.344 0.469 0.469 0.469 0.656	0.03 0.03 0.03 0.03 0.06	6.75 6.88 7.12 7.62 8.00
5	150 300-600 900 1500 2500	R 40 R 41 R 41 R 44 R 42	6.750 7.125 7.125 7.625 7.500	0.250 0.312 0.312 0.312 0.500	0.344 0.469 0.469 0.469 0.781	0.03 0.03 0.03 0.03 0.06	7.62 8.25 8.50 9.00 9.50
6	150 300-900 1500 2500	R 43 R 45 R 46 R 47	7.625 8.312 8.312 9.000	0.250 0.312 0.375 0.500	0.344 0.469 0.531 0.781	0.03 0.03 0.06 0.06	8.62 9.50 9.75 11.00
8	150 300-600 900 1500 2500	R 48 R 49 R 49 R 50 R 51	9.750 10.625 10.625 10.625 11.000	0.250 0.312 0.312 0.438 0.562	0.344 0.469 0.469 0.656 0.906	0.03 0.03 0.03 0.06 0.06	10.75 11.88 12.12 12.50 13.38
10	150 300-600 900 1500 2500	R 52 R 53 R 53 R 54 R 55	12.000 12.750 12.750 12.750 13.500	0.250 0.312 0.312 0.438 0.688	0.344 0.469 0.469 0.656 1.188	0.03 0.03 0.03 0.06 0.09	13.00 14.00 14.25 14.62 16.75
12	150 300-600 900 1500 2500	R 56 R 57 R 57 R 58 R 60	15.000 15.000 15.000 15.000 16.000	0.250 0.312 0.312 0.562 0.688	0.344 0.469 0.469 0.906 1.312	0.03 0.03 0.03 0.06 0.09	16.00 16.25 16.50 17.25 19.50
14	150 300-600 900 1500	R 59 R 61 R 62 R 63	15.625 16.500 16.500 16.500	0.250 0.312 0.438 0.625	0.344 0.469 0.656 1.062	0.03 0.03 0.06 0.09	16.75 18.00 18.38 19.25
16	150 300-600 900 1500	R 64 R 65 R 66 R 67	17.875 18.500 18.500 18.500	0.250 0.312 0.438 0.688	0.344 0.469 0.656 1.188	0.03 0.03 0.06 0.09	19.00 20.00 20.62 21.50
18	150 300-600 900 1500	R 68 R 69 R 70 R 71	20.375 21.000 21.000 21.000	0.250 0.312 0.500 0.688	0.344 0.469 0.781 1.188	0.03 0.03 0.06 0.09	21.50 22.62 23.38 24.12
20	150 300-600 900 1500	R 72 R 73 R 74 R 75	22.000 23.000 23.000 23.000	0.250 0.375 0.500 0.688	0.344 0.531 0.781 1.312	0.03 0.06 0.06 0.09	23.50 25.00 25.50 26.50
24	150 300-600 900 1500	R 76 R 77 R 78 R 79	26.500 27.250 27.250 27.250	0.250 0.438 0.625 0.812	0.344 0.656 1.062 1.438	0.03 0.06 0.09 0.09	28.00 29.50 30.38 31.25

Notes: (A) Dimensions and tolerances are per ASME B16.5. (B) The facing thickness “E” is in addition to “T” dimension. “E” is included in overall length “OAL”. (C) “K” and “R” dimensions are minimum dimensions.

Properties of Pipe

Nominal Pipe Size	O.D.	Pipe Sched.	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
1¼	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
1½	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
2½	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
3½	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
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

* SCH 40, SCH 40S, and STD. WT. are the same 1/8" N.P.S. thru 10" N.P.S. inclusive

** SCH 80, SCH 80S, and X-STG are the same 1/8" N.P.S. thru 8" N.P.S. inclusive

s Includes STD. WT.

t Includes X-STG

Properties of Pipe

Nominal Pipe Size	O.D.	Pipe Sched.	Wall Thk.	I.D.	Weight per Foot
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
		ŧ 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
		s 40S	0.375	12.000	50
		40	0.406	11.938	54
		60	0.562	11.626	73
		ŧ 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

Notes:

A) All dimensions are in inches.

B) All weights are in pounds.

C) Dimensions for STD WT., X-STG, XX-STG, SCH 10, 20, 30, 40, 60, 80, 100, 120, 140 and 160 are in conformance with ANSI B36.10.

D) Dimensions for SCH 5S, 10S, 40S and 80S are in conformance with ANSI B36.19.

Pressure-Temperature Ratings

THE FOLLOWING TABLE AND NOTES DETAIL THE MATERIALS FOR THE ASME B16.5 PRESSURE-TEMPERATURE CHARTS:

Material Group	Material	See Notes
1.1	A-105	a,h,j
	A-515-70	a,h
	A-516-70	a,g
	A-350-LF2,A-537 C1.1	d
1.2	A-203-B, A-203-E	a,h
	A-350-LF3	d
1.4	A-515-60	a,h
	A-516-60	a,g
	A-350-LF1	d
1.5	A-182-F1, A-204-A, A-204-B	b,h
1.7	A-204-C	g
	A-182-F2	h
1.9	A-182-F11 C1.2, A-182-F12	c,k
	A-387-11 C1.2	c
1.10	A-182-F22 C1.3, A-387-22 C1.2	c
1.13	A-182-F5A, A-182-F5	-
1.14	A-182-F9	-

Material Group	Material	See Notes
2.1	A-182-F304	l
	A-182-F304H	-
	A-240-304, A-240-304H	l,m
2.2	A-182-F316	l
	A-182-F316H	-
	A-240-316, A-240-316H, A-240-317	l,m
2.3	A-182-F304L, A-240-304L	f
	A-182-F316L, A-240-316L	g
2.4	A-182-F321	h,l
	A-240-321	h,l,m
	A-182-F321H	-
	A-240-321H	m
2.5	A-182-F347	h,i
	A-240-347	h,l,m
	A-182-F347H	-
	A-240-347H	m
	A-182-F348	h,l
	A-240-348	h,l,m
	A-182-F348H	-
	A-240-348H	m
2.6	A-240-309S, A-240-309H	l,m
2.7	A-182-F310, A-240-310S, A-240-310H	i,l,n

General Note:
Plate materials are listed only for use as blind flanges. For more details see ASME B16.5.

Notes:
a. Permissible but not recommended for prolonged use above about 800°F (425°C).
b. Permissible but not recommended for prolonged use above about 850°F (455°C).
c. Permissible but not recommended for prolonged use above about 1100°F (593°C).
d. Not to be used over 650°F (343°C).
f. Not to be used over 800°F (425°C).
g. Not to be used over 850°F (455°C).
h. Not to be used over 1000°F (540°C).
i. For service temperature 1050°F (566°C) and above, assurance must be provided that grain size is not finer than ASTM No. 6.
j. Only killed steel may be used above 850°F (455°C).
k. Use normalized and tempered material only.
l. At temperatures over 1000°F (540°C), use only when the carbon content is 0.04 percent or higher.
m. For temperatures over 1000°F (540°C), use only if the material is heat treated by heating it to a temperature of at least 1900°F (1040°C) and quenching in water or rapidly cooling by other means.
n. For service temperatures of 1050°F (566°C) and above, assurance must be provided that grain size is not finer than ASTM No. 6.
o. To be used only for Class 150 and Class 300 flanges.

Pressure-Temperature Ratings — Class 150

Material Group	1.1*	1.2	1.4	1.5	1.7	1.9	1.10	1.13	1.14	2.1	2.2	2.3	2.4	2.5	2.6	2.7	
-20° to 100°	285	290	235	265	290	290	290	290	290	275	275	230	275	275	260	260	100°
200°	260	260	215	260	260	260	260	260	260	235	240	195	235	245	230	230	200°
300°	230	230	210	230	230	230	230	230	230	205	215	175	210	225	220	220	300°
400°	200	200	200	200	200	200	200	200	200	180	195	160	190	200	200	200	400°
500°	170	170	170	170	170	170	170	170	170	170	170	145	170	170	1.70	170	500°
600°	140	140	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	125	125	125	125	650°
700°	110	110	110	110	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	95	95	95	95	750°
800°	80	80	80	80	80	80	50	80	80	80	80	80	80	80	80	80	800°
850°	65	65	65	65	65	65	65	65	65	65	65	[t]65	65	65	65	65	850°
900°	50	50	50	50	50	50	50	50	50	50	50	-	50	50	50	50	900°
950°	35	35	35	35	35	35	35	35	35	35	35	-	35	35	35	35	950°
1000°	20	20	20	20	20	20	20	20	20	20	20	-	20	20	20	20	1000°

Temperature (Fahrenheit)

Notes: 1. See temperature notes for all materials (page 68).
2. Pressures are in pounds per square inch, gage (psig)
[t] 316L ONLY
* material Group 1.1 includes: SA-105, SA-515-70, SA-516-70, SA-350-LF2, SA-537 C1.1

Pressure-Temperature Ratings — Class 300

Material Group	1.1[s]	1.2	1.4	1.5	1.7	1.9	1.10	1.13	1.14	2.1	2.2	2.3	2.4	2.5	2.6	2.7	
-20° to 100°	740	750	620	695	750	750	750	750	750	720	720	600	720	720	670	670	100°
200°	675	750	560	680	750	710	715	750	750	600	620	505	610	635	605	605	200°
300°	655	730	550	655	730	675	675	730	730	530	560	455	545	590	570	570	300°
400°	635	705	530	640	705	660	650	705	705	470	515	415	495	555	535	535	400°
500°	600	665	500	620	665	640	640	665	665	435	480	380	460	520	505	505	500°
600°	550	605	455	605	605	605	605	605	605	415	450	360	435	490	480	480	600°
650°	535	590	450	590	590	590	590	590	590	410	445	350	430	480	465	465	650°
700°	535	570	450	570	570	570	570	570	570	405	430	345	420	470	455	455	700°
750°	505	505	445	530	530	530	530	530	530	400	425	335	415	460	445	445	750°
800°	410	410	370	510	510	510	510	500	510	395	415	330	415	455	435	435	800°
850°	270	270	270	485	485	485	485	440	485	390	405	[t]320	410	445	425	425	850°
900°	170	170	170	450	450	450	450	355	450	385	395	-	405	430	415	415	900°
950°	105	105	105	280	345	380	380	260	370	375	385	-	385	385	385	385	950°
1000°	50	50	50	165	215	225	270	190	290	325	365	-	355	365	335	350	1000°
1050°					190	140	200	140	190	310	360	-	345	360	290	335	1050°
1100°						95	115	105	115	260	325	-	300	325	225	290	1100°
1150°						50	105.	70	75	195	275	-	235	275	170	245	1150°
1200°						35	55	45	50	155	205	-	180	170	130	205	1200°
1250°										110	180	-	140	125	100	160	1250°
1300°										85	140	-	105	95	80	120	1300°
1350°										60	105	-	80	70	60	80	1350°
1400°										50	75	-	60	50	45	55	1400°
1450°										35	60	-	50	40	30	40	1450°
1500°										25	40	-	40	35	25	25	1500°

Temperature (Fahrenheit)

[t] 316L ONLY
[s] Material Group 1.1 includes: SA-105, SA-515-70, SA-516-70, SA-350-LF2, SA-537 C1.1

Notes:
1. See temperature notes for all materials (page 68)
2. Pressures are in pounds per square inch, gage (psig)

Pressure-Temperature Ratings — Class 400

Material Group	1.1$_s$	1.2	1.4	1.5	1.7	1.9	1.10	1.13	1.14	2.1	2.2	2.3	2.4	2.5	2.6	2.7	
-20° to 100°	990	1000	825	925	1000	1000	1000	1000	1000	960	960	800	960	960	895	895	100°
200°	900	1000	750	905	1000	950	955	1000	1000	800	825	675	815	850	805	805	200°
300°	875	970	730	870	970	895	905	970	970	705	745	605	725	785	760	760	300°
400°	845	940	705	855	940	880	865	940	940	630	685	550	660	740	710	710	400°
500°	800	885	665	830	885	855	855	885	885	585	635	510	610	690	670	670	500°
600°	730	805	610	805	805	805	805	805	805	555	600	480	585	655	635	635	600°
650°	715	785	600	785	785	785	785	785	785	545	590	470	570	640	620	620	650°
700°	710	755	600	755	755	755	755	755	755	540	575	460	560	625	610	610	700°
750°	670	670	590	710	710	710	710	710	710	530	565	450	555	615	595	595	750°
800°	550	550	495	675	675	675	675	665	675	525	555	440	550	610	580	580	800°
850°	355	355	355	650	650	650	650	585	650	520	540	[t]430	545	590	565	565	850°
900°	230	230	230	600	600	600	600	470	600	510	525	-	540	575	555	555	900°
950°	140	140	140	375	460	505	505	350	495	500	515	-	515	515	515	515	950°
1000°	70	70	70	220	285	300	355	255	390	430	485	-	475	485	450	465	1000°
1050°					250	185	265	190	250	410	480	-	460	480	390	445	1050°
1100°						130	150	140	150	345	430	-	400	430	300	390	1100°
1150°						70	140	90	100	260	365	-	315	365	230	330	1150°
1200°						45	75	60	70	205	275	-	240	230	175	275	1200°
1250°										145	245	-	185	165	135	215	1250°
1300°										110	185	-	140	125	105	160	1300°
1350°										85	140	-	110	90	80	105	1350°
1400°										65	100	-	80	70	60	75	1400°
1450°										45	80	-	65	55	40	50	1450°
1500°										30	55	-	50	45	30	30	1500°

Temperature (Fahrenheit)

[t] 316L ONLY
[s] Material Group 1.1 includes: SA-105, SA-515-70, SA-516-70, SA-350-LF2, SA-537 C1.1

Notes:
1. See temperature notes for all materials (page 68)
2. Pressures are in pounds per square inch, gage (psig)

Pressure-Temperature Ratings — Class 600

Material Group	1.1$_s$	1.2	1.4	1.5	1.7	1.9	1.10	1.13	1.14	2.1	2.2	2.3	2.4	2.5	2.6	2.7	
-20° to 100°	1480	1500	1235	1390	1500	1500	1500	1500	1500	1440	1440	1200	1440	1440	1345	1345	100°
200°	1350	1500	1125	1360	1500	1425	1430	1500	1500	1200	1240	1015	1220	1270	1210	1210	200°
300°	1315	1455	1095	1305	1455	1345	1355	1455	1455	1055	1120	910	1090	1175	1140	1140	300°
400°	1270	1410	1060	1280	1410	1315	1295	1410	1410	940	1030	825	990	1110	1065	1065	400°
500°	1200	1330	995	1245	1330	1285	1280	1330	1330	875	955	765	915	1035	1010	1010	500°
600°	1095	1210	915	1210	1210	1210	1210	1210	1210	830	905	720	875	985	955	955	600°
650°	1075	1175	895	1175	1175	1175	1175	1175	1175	815	890	700	855	960	930	930	650°
700°	1065	1135	895	1135	1135	1135	1135	1135	1135	805	865	685	840	935	910	910	700°
750°	1010	1010	885	1065	1065	1065	1065	1065	1065	795	845	670	830	920	895	895	750°
800°	825	825	740	1015	1015	1015	1015	995	1015	790	830	660	825	910	870	870	800°
850°	535	5.35	535	975	975	975	975	880	975	780	810	[t]645	815	860	850	850	850°
900°	345	345	345	900	900	900	900	705	900	770	790	-	810	865	830	830	900°
950°	205	205	205	560	685	755	755	520	740	750	775	-	775	775	775	775	950°
1000°	105	105	105	330	425	445	535	385	585	645	725	-	715	725	670	700	1000°
1050°					380	275	400	280	380	620	720	-	695	720	585	665	1050°
1100°						190	225	205	225	515	645	-	605	645	445	585	1100°
1150°						105	205	140	150	390	550	-	475	550	345	495	1150°
1200°						70	110	90	105	310	410	-	365	345	260	410	1200°
1250°										220	365	-	280	245	200	325	1250°
1300°										165	275	-	210	185	160	240	1300°
1350°										125	205	-	165	135	115	160	1350°
1400°										90	150	-	125	105	90	110	1400°
1450°										70	115	-	95	80	60	75	1450°
1500°										50	85	-	75	70	50	50	1500°

Temperature (Fahrenheit)

[t] 316L ONLY
[s] Material Group 1.1 includes: SA-105, SA-515-70, SA-516-70, SA-350-LF2, SA-537 C1.1

Notes:
1. See temperature notes for all materials (page 68)
2. Pressures are in pounds per square inch, gage (psig)

Pressure-Temperature Ratings — Class 900

Material Group	1.1$_s$	1.2	1.4	1.5	1.7	1.9	1.10	1.13	1.14	2.1	2.2	2.3	2.4	2.5	2.6	2.7	
-20° to 100°	2220	2250	1850	2085	2250	2250	2250	2250	2250	2160	2160	1800	2160	2160	2015	2015	100°
200°	2025	2250	1685	2035	2250	2135	2150	2250	2250	1800	1860	1520	1830	1910	1815	1815	200°
300°	1970	2185	1640	1955	2185	2020	2030	2185	2185	1585	1680	1360	1635	1765	1705	1705	300°
400°	1900	2115	1585	1920	2115	1975	1945	2115	2115	1410	1540	1240	1485	1665	1600	1600	400°
500°	1795	1995	1495	1865	1995	1925	1920	1995	1995	1310	1435	1145	1375	1555	1510	1510	500°
600°	1640	1815	1370	1815	1815	1815	1815	1815	1815	1245	1355	1080	1310	1475	1435	1435	600°
650°	1610	1765	1345	1765	1765	1765	1765	1765	1765	1225	1330	1050	1280	1440	1395	1395	650°
700°	1600	1705	1345	1705	1705	1705	1705	1705	1705	1210	1295	1030	1260	1405	1370	1370	700°
750°	1510	1510	1325	1595	1595	1595	1595	1595	1595	1195	1270	1010	1245	1385	1340	1340	750°
800°	1235	1235	1110	1525	1525	1525	1525	1490	1525	1180	1245	985	1240	1370	1305	1305	800°
850°	805	805	805	1460	1460	1460	1460	1315	1460	1165	1215	[t]965	1225	1330	1275	1275	850°
900°	515	515	515	1350	1350	1350	1350	1060	1350	1150	1180	-	1215	1295	1245	1245	900°
950°	310	310	310	845	1030	1130	1130	780	1110	1125	1160	-	1160	1160	1160	1160	950°
1000°	155	155	155	495	640	670	805	575	875	965	1090	-	1070	1090	1010	1050	1000°
1050°					565	410	595	420	565	925	1080	-	1040	1080	875	1000	1050°
1100°						290	340	310	340	770	965	-	905	965	670	875	1100°
1150°						155	310	205	225	585	825	-	710	825	515	740	1150°
1200°						105	165	135	155	465	620	-	545	515	390	620	1200°
1250°										330	545	-	420	370	300	485	1250°
1300°										245	410	-	320	280	235	360	1300°
1350°										185	310	-	245	205	175	235	1350°
1400°										145	225	-	185	155	135	165	1400°
1450°'										105	175	-	145	125	95	115	1450°
1500°										70	125	-	115	105	70	70	1500°

Temperature (Fahrenheit)

Temperature (Fahrenheit)

[t] 316L ONLY
[s] Material Group 1.1 includes: SA-105, SA-515-70, SA-516-70, SA-350-LF2, SA-537 C1.1

Notes:
1. See temperature notes for all materials (page 68)
2. Pressures are in pounds per square inch, gage (psig)

Pressure-Temperature Ratings — Class 1500

Material Group	1.1$_s$	1.2	1.4	1.5	1.7	1.9	1.10	1.13	1.14	2.1	2.2	2.3	2.4	2.5	2.6	2.7	
-20° to 100°	3705	3750	3085	3470	3750	3750	3750	3750	3750	3600	3600	3000	3600	3600	3360	3360	100°
200°	3375	3750	2810	3395	3750	3560	3580	3750	3750	3000	3095	2530	3050	3180	3025	3025	200°
300°	3280	3640	2735	3260	3640	3365	3385	3640	3640	2640	2795	2270	2725	2940	2845	2845	300°
400°	3170	3530	2645	3200	3530	3290	3240	3530	3530	2350	2570	2065	2470	2770	2665	2665	400°
500°	2995	3325	2490	3105	3325	3210	3200	3325	3325	2185	2390	1910	2290	2590	2520	2520	500°
600°	2735	3025	2285	3025	3025	3025	3025	3025	3025	2075	2255	1800	2185	2460	2390	2390	600°
650°	2685	2940	2245	2940	2940	2940	2940	2940	2940	2040	2220	1750	2135	2400	2330	2330	650°
700°	2665	2840	2245	2840	2840	2840	2840	2840	2840	2015	2160	1715	2100	2340	2280	2280	700°
750°	2520	2520	2210	2660	2660	2660	2660	2660	2660	1990	2110	1680	2075	2305	2230	2230	750°
800°	2060	2060	1850	2540	2540	2540	2540	2485	2540	1970	2075	1645	2065	2280	2170	2170	800°
850°	1340	1340	1340	2435	2435	2435	2435	2195	2435	1945	2030	[t]1610	2040	2220	2125	2125	850°
900°	860	860	860	2245	2245	2245	2245	1765	2245	1920	1970	-	2030	2160	2075	2075	900°
950°	515	515	515	1405	1715	1885	1885	1305	1850	1870	1930	-	1930	1930	1930	1930	950°
1000°	260	260	260	825	1065	1115	1340	960	1460	1610	1820	-	1785	1820	1680	1750	1000°
1050°					945	685	995	705	945	1545	1800	-	1730	1800	1460	1665	1050°
1100°						480	565	515	565	1285	1610	-	1510	1610	1115	1460	1100°
1150°						260	515	345	380	980	1370	-	1185	1370	860	1235	1150°
1200°						170	275	225	260	770	1030	-	910	855	650	1030	1200°
1250°										550	910	-	705	615	495	805	1250°
1300°										410	685	-	530	465	395	600	1300°
1350°										310	515	-	410	345	290	395	1350°
1400°										240	380	-	310	255	225	275	1400°
1450°										170	290	-	240	205	155	190	1450°
1500°										120	205	-	190	170	120	120	1500°

Temperature (Fahrenheit)

Temperature (Fahrenheit)

[t] 316L ONLY
[s] Material Group 1.1 includes: SA-105, SA-515-70, SA-516-70, SA-350-LF2, SA-537 C1.1

Notes:
1. See temperature notes for all materials (page 68)
2. Pressures are in pounds per square inch, gage (psig)

Pressure-Temperature Ratings — Class 2500

Material Group	1.1$_s$	1.2	1.4	1.5	1.7	1.9	1.10	1.13	1.14	2.1	2.2	2.3	2.4	2.5	2.6	2.7	
-20° to 100°	6170	6250	5145	5785	6250	6250	6250	6250	6250	6000	6000	5000	6000	6000	5600	5600	100°
200°	5625	6250	4680	5660	6250	5930	5965	6250	6250	5000	5160	4220	5080	5300	5040	5040	200°
300°	5470	6070	4560	5435	6070	5605	5640	6070	6070	4400	4660	3780	4540	4900	4740	4740	300°
400°	5280	5880	4405	5330	5880	5485	5400	5880	5880	3920	4280	3440	4120	4620	4440	4440	400°
500°	4990	5540	4150	5180	5540	5350	5330	5540	5540	3640	3980	3180	3820	4320	4200	4200	500°
600°	4560	5040	3805	5040	5040	5040	5040	5040	5040	3460	3760	3000	3640	4100	3980	3980	600°
650°	4475	4905	3740	4905	4905	4905	4905	4905	4905	3400	3700	2920	3560	4000	3880	3880	650°
700°	4440	4730	3740	4730	4730	4730	4730	4730	4730	3360	3600	2860	3500	3900	3800	3800	700°
750°	4200	4200	3685	4430	4430	4430	4430	4430	4430	3320	3520	2800	3460	3840	3720	3720	750°
800°	3430	3430	3085	4230	4230	4230	4230	4145	4230	3280	3460	2740	3440	3800	3620	3620	800°
850°	2230	2230	2230	4060	4060	4060	4060	3660	4060	3240	3380	[t]2680	3400	3700	3540	3540	850°
900°	1430	1430	1430	3745	3745	3745	3745	2945	3745	3200	3280	-	3380	3600	3460	3460	900°
950°	860	860	860	2345	2860	3145	3145	2170	3085	3120	3220	-	3220	3220	3220	3220	950°
1000°	430	430	430	1370	1770	1860	2230	1600	2430	2685	3030	-	2970	3030	2800	2915	1000°
1050°					1570	1145	1660	1170	1570	2570	3000	-	2885	3000	2430	2770	1050°
1100°						800	945	860	945	2145	2685	-	2515	2685	1860	2430	1100°
1150°						430	860	570	630	1630	2285	-	1970	2285	1430	2060	1150°
1200°						285	460	370	430	1285	1715	-	1515	1430	1085	1715	1200°
1250°										915	1515	-	1170	1030	830	1346	1250°
1300°										685	1145	-	885	770	660	1000	1300°
1350°										515	860	-	685	570	485	660	1350°
1400°										400	630	-	515	430	370	460	1400°
1450°										285	485	-	400	345	260	315	1450°
1500°										200	345	-	315	285	200	200	1500°

Temperature (Fahrenheit) — Temperature (Fahrenheit)

[t] 316L ONLY
[s] Material Group 1.1 includes: SA-105, SA-515-70, SA-516-70, SA-350-LF2, SA-537 C1.1

Notes:
1. See temperature notes for all materials (page 68)
2. Pressures are in pounds per square inch, gage (psig)

Maximum Allowable Hydrostatic Test Pressures
(At Ambient Temperature)

Material Group	Shell Test Pressures (All Pressures Are Gage)						
	CLASS 150	CLASS 300	CLASS 400	CLASS 600	CLASS 900	CLASS 1500	CLASS 2500
1.1	450	1125	1500	2225	3350	5575	9275
1.2	450	1125	1500	2250	3375	5625	9375
1.4	375	950	1250	1875	2775	4650	7725
1.5	400	1050	1400	2100	3150	5225	8700
1.7	450	1125	1500	2250	3375	5625	9375
1.9	450	1125	1500	2250	3375	5625	9375
1.10	450	1125	1500	2250	3375	5625	9375
1.13	450	1125	1500	2250	3375	5625	9375
1.14	450	1125	1500	2250	3375	5625	9375
2.1	425	1100	1450	2175	3250	5400	9000
2.2	425	1100	1450	2175	3250	5400	9000
2.3	350	900	1200	1800	2700	4500	7500
2.4	425	1100	1450	2175	3250	5400	9000
2.5	425	1100	1450	2175	3250	5400	9000
2.6	400	1025	1350	2025	3025	5050	8400
2.7	400	1025	1350	2025	3025	5050	8400

Flange Bolting Information

Dimensions of Bolts with Heavy Hex Heads and Nuts (ASME B18.2)

Bolt Size	Thread Dimensions		Nut Dimensions		Nom. Nut Thick.	FVC Nut Stop Dia. = Flange Bolt Circle Less:
	Threads Per Inch	Root Area	Across Flats	Across Corners		
½	13	0.126	0.875	0.969	0.484	0.875
5/8	11	0.202	1.063	1.175	0.609	1.063
¾	10	0.302	1.250	1.383	0.734	1.250
7/8	9	0.419	1.438	1.589	0.859	1.438
1	8	0.551	1.625	1.796	0.984	1.625
1 1/8	8	0.728	1.813	2.002	1.109	1.813
1¼	8	0.929	2.000	2.209	1.219	2.000
1 3/8	8	1.155	2.188	2.416	1.344	2.188
1½	8	1.405	2.375	2.622	1.469	2.375
1 5/8	8	1.680	2.563	2.828	1.594	2.563
1¾	8	1.980	2.750	3.035	1.719	2.750
1 7/8	8	2.300	2.938	3.242	1.844	2.938
2	8	2.650	3.125	3.449	1.969	3.125
2¼	8	3.420	3.500	3.862	2.203	3.500
2½	8	4.290	3.875	4.275	2.453	3.875
2¾	8	5.260	4.250	4.688	2.703	4.250
3	8	6.320	4.625	5.102	2.953	4.625
3¼	8	7.490	5.000	5.515	3.188	5.000
3½	8	8.750	5.375	5.928	3.438	5.375
3¾	8	10.110	5.750	6.341	3.688	5.750
4	8	11.570	6.125	6.755	3.938	6.125

Bolting Materials

Nominal Composition	Specification Number	Grade	Application
Carbon and Low Alloy Steels			
C	SA-307	B	Structural
C	SA-325	Type 1, 2, 3	Structural
C	SA-354	BC, BD	High Strength Service (650°F max.)
Cr-Mo	SA-193	65	High Strength Service (1200°F max.)
Cr-Mo	SA-193	B7	High Strength Service (1000°F max.)
Cr-Mo-V	SA-193	B16	High Strength Service (1100°F max.)
Cr-Mo	SA-320	L7	Low Temperature Service
High Alloy Steels			
Cr-Ni	SA-193	B8, B8M	Stainless Steel Flanges
Cr-Ni	SA-320	B8, B8M	Structural
Cr-Ni-Mo	SA-453	660	High Strength Stainless Steel

Conversions

Change	To	Multiply by
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
bars	atmospheres	0.9869
btu	foot-lbs	778.3
btu	joules	1,054.8
btu	kilowatt-hrs	2.928×10^{-4}
calories, gram (mean)	btu (mean)	3.9685×10^{-3}
centigrade	fahrenheit	(C°x9/5) + 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
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^{-6}
ergs	BTU	9.480×10^{-11}
ergs	foot-pounds	7.367×10^{-8}
ergs	joules	10^{-7}
ergs/sec	horsepower	1.341×10^{-10}
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	poundsisq 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}

Change	To	Multiply by
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
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
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
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/meters (newtons)	100.0
joules/cm	poundals	723.3
joules/cm	pounds	22.48
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
kilograms	tons (long)	9.842×10^{-4}
kilograms	tons (short)	1.102×10^{-3}
kilograms/cu meter	grams/cu cm	0.001

Conversions

Change	To	Multiply by
kilograms/cu meter	pounds/cu ft	0.06243
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	atmospheres	0.9678
kilograms/sq cm	feet of water	32.81
kilograms/sq cm	Inches of mercury	28.96
kilograms/sq cm	pounds/sq ft	2,048.0
kilograms/sq cm	pounds/sq in	14.22
kilograms/sq meter	atmospheres	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	Inches 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	1,000.0
kilowatt-hrs	BTU	3,413.0
kilowatt-hrs	ergs	3.600×10^{13}
kilowatt-hrs	foot-lbs	2.655×10^{6}
kilowatt-hrs	joules	3.6×10^{6}
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
meters	centimeters	100.0
meters	feet	3.281
meters	inches	39.37
meters	millimeters	1,000.0
miles (statute)	feet	5,280.0
miles (statute)	meters	1,609.0
millimeters	centimeters	0.1
millimeters	feet	3.281×10^{-3}
millimeters	inches	0.03937
mils	inches	0.001
newtons	dynes	10^{5}
ounces	grams	28.349527
ounces	pounds	0.0625
ounces	ounces (troy)	0.9115
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
pounds	kilograms	0.4536

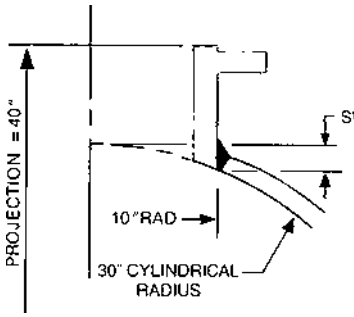
Change	To	Multiply by
pounds	ounces	16.0
pounds	ounces (troy)	14.5833
pounds	poundals	32.17
pounds	pounds (troy)	1.21528
pounds	tons (short)	0.0005
pounds of water	cu feet	0.01602
pounds of water	cuinches	27.68
pounds of water	gallons	0.1198
pounds-feet	cm-dynes	1.356×10^{7}
pounds-feet	cm-grams	13,825.0
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 ft	144.0
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 ft	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}
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
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

"Sweep Loss" Chart

The charts below will assist in developing the "drop" at the intersection of connections and shells or heads.

"Sweep Loss" calculation is based on $R - \sqrt{R^2-r^2}$

Where: R = Vessel Radius
and r = Connection Radius



Example #1

Finding the length of an 18" — 150# LWN set thru a 60" ID Shell

From chart find column with shell radius (30") and then move down to connection radius (10") to find "Sweep Loss" (1.72").

Nozzle Length = Proj. - Shell Rad. + "Sweep Loss" + Internal Proj.

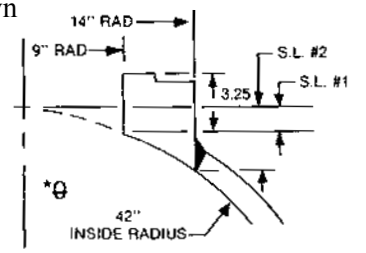
= 40" - 30" + 1.72" + 0 = 11.72"

		SHELL RADIUS OR HEAD CROWN RADIUS											
		5.375	6.375	7	8	9	10	1.2	15	18	21	24	27
CONNECTION RADIUS	2	0.39	0.32	0.29	0.25	0.23	0.20	0.17	0.13	0.11	0.10	0.08	0.07
	3	0.92	0.75	0.68	0.58	0.51	0.46	0.38	0.30	0.25	0.22	0.19	0.17
	4	1.78	1.41	1.26	1.07	0.94	0.83	0.69	0.54	0.45	0.38	0.34	0.30
	5	3.40	2.42	2.10	1.76	1.52	1.34	1.09	0.86	0.71	0.60	0.53	0.47
	6	-	4.22	3.39	2.71	2.29	2.00	1.61	1.25	1.03	0.88	0.76	0.68
	7	-	-	7.00	4.13	3.34	2.86	2.25	1.73	1.42	1.20	1.04	0.92
	8	-	-	-	8.00	4.88	4.00	3.06	2.31	1.88	1.58	1.37	1.21
	9	-	-	-	-	9.00	5.64	4.06	3.00	2.41	2.03	1.75	1.54
	10	-	-	-	-	-	10.00	5.37	3.82	3.03	2.53	2.18	1.92
	11	-	-	-	-	-	-	7.20	4.80	3.75	3.11	2.67	2.34
	12	-	-	-	-	-	-	12.00	6.00	4.58	3.77	3.22	2.81
	13	-	-	-	-	-	-	-	7.52	5.55	4.51	3.83	3.34
	14	-	-	-	-	-	-	-	9.61	6.69	5.35	4.51	3.91
	15	-	-	-	-	-	-	-	15.00	8.05	6.30	5.27	4.55
	16	-	-	-	-	-	-	-	-	9.75	7.40	6.11	5.25
	17	-	-	-	-	-	-	-	-	12.08	8.67	7.06	6.02
	18	-	-	-	-	-	-	-	-	18.00	10.18	8.13	6.88
	19	-	-	-	-	-	-	-	-	-	12.06	9.34	7.82
	20	-	-	-	-	-	-	-	-	-	14.60	10.73	8.86
	21	-	-	-	-	-	-	-	-	-	21.00	12.38	10.03

Example #2

Finding the total thickness of an 18" — 300# studding outlet set thru a 48" OD ASME F&D head with 42" DISH Radius. *Maintaining minimum thickness is priority*. Minimum thickness for this example will be established as 3.25 inches.

From chart find column with head crown radius (42") and move down to bore radius (9") to find "Sweep Loss" #1 (0.98"). Then move down to connection radius (14") to find "Sweep Loss" #2 (2.40").



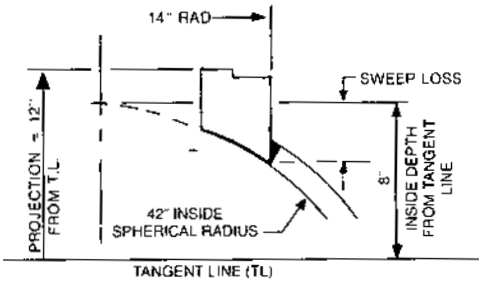
Thickness = Min. Req'd Thk + "Sweep Loss" #2 - "Sweep Loss" #1

= 3.25" + 2.40" - 0.98" = 4.67"

Example #3

Finding the total thickness of an 18" — 300# studding outlet set through a 48" OD ASME F&D head. *Projection is priority*.

From chart find column with head crown radius (42") and move down to connection radius (14") to find "Sweep Loss" (2.40").



Thickness = Proj. - Inside Depth of Head + "Sweep Loss"

= 12" - 8" + 2.40" = 6.40"

		SHELL RADIUS OR HEAD CROWN RADIUS												
		30	33	36	39	42	45	48	54	60	66	72	78	84
CONNECTION RADIUS	2	0.07	0.06	0.06	0.05	0.05	0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.02
	3	0.15	0.14	0.13	0.12	0.11	0.10	0.09	0.08	0.08	0.07	0.06	0.06	0.05
	4	0.27	0.24	0.22	0.21	0.19	0.18	0.17	0.15	0.13	0.12	0.11	0.10	0.10
	5	0.42	0.38	0.35	0.32	0.30	0.28	0.26	0.23	0.21	0.19	0.17	0.16	0.15
	6	0.61	0.55	0.50	0.46	0.43	0.40	0.38	0.33	0.30	0.27	0.25	0.23	0.21
	7	0.83	0.75	0.69	0.63	0.59	0.55	0.51	0.46	0.41	0.37	0.34	0.31	0.29
	8	1.09	0.98	0.90	0.83	0.77	0.72	0.67	0.60	0.54	0.49	0.45	0.41	0.38
	9	1.38	1.25	1.14	1.05	0.98	0.91	0.85	0.76	0.68	0.62	0.56	0.52	0.48
	10	1.72	1.55	1.42	1.30	1.21	1.13	1.05	0.93	0.84	0.76	0.70	0.64	0.60
	11	2.09	1.89	1.72	1.58	1.47	1.37	1.28	1.13	1.02	0.92	0.85	0.78	0.72
	12	2.50	2.26	2.06	1.89	1.75	1.63	1.52	1.35	1.21	1.10	1.01	0.93	0.86
	13	2.96	2.67	2.43	2.23	2.06	1.92	1.79	1.59	1.43	1.29	1.18	1.09	1.01
	14	3.47	3.12	2.83	2.60	2.40	2.23	2.09	1.85	1.66	1.50	1.37	1.27	1.17
	15	4.02	3.61	3.27	3.00	2.77	2.57	2.40	2.13	1.91	1.73	1.58	1.46	1.35
	16	4.62	4.14	3.75	3.43	3.17	2.94	2.75	2.42	2.17	1.97	1.80	1.66	1.54
	17	5.28	4.72	4.27	3.90	3.59	3.33	3.11	2.75	2.46	2.23	2.04	1.88	1.74
	18	6.00	5.34	4.82	4.40	4.05	3.76	3.50	3.09	2.76	2.50	2.29	2.11	1.95
	19	6.78	6.02	5.42	4.94	4.54	4.21	3.92	3.45	3.09	2.79	2.55	2.35	2.18
	20	7.64	6.75	6.07	5.52	5.07	4.69	4.37	3.84	3.43	3.10	2.83	2.61	2.42
	21	8.58	7.54	6.76	6.14	5.63	5.20	4.84	4.25	3.80	3.43	3.13	2.88	2.67

Conversion Table

Inch Fractions to Decimals and Millimeters

Inches		MM
Fraction	Decimal	
1/64	0.0156	0.397
1/32	0.0313	0.794
	0.0394	**1.000**
3/64	0.0469	1.191
1/16	0.0625	1.588
5/64	0.0781	1.984
	0.0787	**2.000**
3/32	0.0938	2.381
7/64	0.1094	2.778
	0.1181	**3.000**
1/8	0.1250	3.175
9/64	0.1406	3.572
5/32	0.1563	3.969
	0.1575	**4.000**
11/64	0.1719	4.366
3/16	0.1875	4.763
	0.1969	**5.000**
13/64	0.2031	5.159
7/32	0.2188	5.556
15/64	0.2344	5.953
	0.2362	**6.000**
1/4	0.2500	6.350
17/64	0.2656	6.747
	0.2756	**7.000**
9/32	0.2813	7.144
19/64	0.2969	7.541
5/16	0.3125	7.938
	0.3150	**8.000**
21/64	0.3281	8.334
11/32	0.3438	8.731
	0.3543	**9.000**
23/64	0.3594	9.128
3/8	0.3750	9.525
25/64	0.3906	9.922
	0.3937	**10.000**
13/32	0.4063	10.319
27/64	0.4219	10.716
	0.4331	**11.000**
7/16	0.4375	11.113
29/64	0.4531	11.509
15/32	0.4688	11.906
	0.4724	**12.000**
31/64	0.4844	12.303
1/2	0.5000	12.700

Inches		MM
Fraction	Decimal	
	0.5118	**13.000**
33/64	0.5156	13.097
17/32	0.5313	13.494
35/64	0.5469	13.891
	0.5512	**14.000**
9/16	0.5625	14.288
37/64	0.5781	14.684
	0.5906	**15.000**
19/32	0.5938	15.081
39/64	0.6094	15.478
5/8	0.6250	15.875
	0.6299	**16.000**
41/64	0.6406	16.272
21/32	0.6563	16.669
	0.6693	**17.000**
43/64	0.6719	17.066
11/16	0.6875	17.463
45/64	0.7031	17.859
	0.7087	**18.000**
23/32	0.7188	18.256
47/64	0.7344	18.653
	0.7480	**19.000**
3/4	0.7500	19.050
49/64	0.7656	19.447
25/32	0.7813	19.844
	0.7874	**20.000**
51/64	0.7969	20.241
13/16	0.8125	20.638
	0.8268	**21.000**
53/64	0.8281	21.034
27/32	0.8438	21.431
55/64	0.8594	21.828
	0.8661	**22.000**
7/8	0.8750	22.225
57/64	0.8906	22.622
	0.9055	**23.000**
29/32	0.9063	23.019
59/64	0.9219	23.416
15/16	0.9375	23.813
	0.9449	**24.000**
61/64	0.9531	24.209
31/32	0.9688	24.606
	0.9843	**25.000**
1	1.0000	25.400

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	376.32	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	246.00	41 1/4	378.61	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	380.91	49 3/8	542.50
1 1/2	0.50	9 1/2	20.08	17 1/2	68.14	25 1/2	144.69	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	251.58	41 5/8	385.53	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	387.85	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	390.17	49 7/8	553.55
2	0.89	10	22.25	18	72.09	26	150.42	34	257.22	42	392.51	50	556.33
2 1/8	1.00	10 1/8	22.81	18 1/8	73.09	26 1/8	151.87	34 1/8	259.12	42 1/8	394.85	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	261.02	42 1/4	397.19	50 1/4	561.90
2 3/8	1.26	10 3/8	23.95	18 3/8	75.13	26 3/8	154.79	34 3/8	262.93	42 3/8	399.55	50 3/8	564.70
2 1/2	1.39	10 1/2	24.53	18 1/2	76.15	26 1/2	156.26	34 1/2	264.84	42 1/2	401.91	50 1/2	567.51
2 5/8	1.53	10 5/8	25.12	18 5/8	77.18	26 5/8	157.74	34 5/8	266.77	42 5/8	404.28	50 5/8	570.32
2 3/4	1.68	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	26.31	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	2.00	11	26.92	19	80.32	27	162.21	35	272.57	43	411.42	51	578.80
3 1/8	2.17	11 1/8	27.54	19 1/8	81.38	27 1/8	163.72	35 1/8	274.53	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	165.23	35 1/4	276.48	43 1/4	416.22	51 1/4	584.49
3 3/8	2.54	11 3/8	28.79	19 3/8	83.52	27 3/8	166.75	35 3/8	278.45	43 3/8	418.63	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	280.42	43 1/2	421.04	51 1/2	590.21
3 5/8	2.93	11 5/8	30.07	19 5/8	85.69	27 5/8	169.81	35 5/8	282.40	43 5/8	423.47	51 5/8	593.07
3 3/4	3.14	11 3/4	30.72	19 3/4	86.79	27 3/4	171.35	35 3/4	284.38	43 3/4	425.90	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	428.34	51 7/8	598.83
4	3.56	12	32.04	20	89.00	28	174.45	36	288.37	44	430.78	52	601.72
4 1/8	3.79	12 1/8	32.71	20 1/8	90.12	28 1/8	176.01	36 1/8	290.38	44 1/8	433.23	52 1/8	604.62
4 1/4	4.02	12 1/4	33.39	20 1/4	91.24	28 1/4	177.58	36 1/4	292.39	44 1/4	435.69	52 1/4	607.52
4 3/8	4.26	12 3/8	34.07	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	4.51	12 1/2	34.77	20 1/2	93.51	28 1/2	180.73	36 1/2	296.44	44 1/2	440.63	52 1/2	613.35
4 5/8	4.76	12 5/8	35.46	20 5/8	94.65	28 5/8	182.32	36 5/8	298.47	44 5/8	443.10	52 5/8	616.27
4 3/4	5.02	12 3/4	36.17	20 3/4	95.80	28 3/4	183.92	36 3/4	300.51	44 3/4	445.59	52 3/4	619.20
4 7/8	5.29	12 7/8	36.88	20 7/8	96.96	28 7/8	185.52	36 7/8	302.56	44 7/8	448.08	52 7/8	622.14
5	5.56	13	37.60	21	98.12	29	187.13	37	304.62	45	450.58	53	625.09
5 1/8	5.84	13 1/8	38.33	21 1/8	99.29	29 1/8	188.75	37 1/8	306.68	45 1/8	453.09	53 1/8	628.04
5 1/4	6.13	13 1/4	39.06	21 1/4	100.47	29 1/4	190.37	37 1/4	308.75	45 1/4	455.60	53 1/4	631.00
5 3/8	6.43	13 3/8	39.80	21 3/8	101.66	29 3/8	192.00	37 3/8	310.82	45 3/8	458.12	53 3/8	633.96
5 1/2	6.73	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	7.04	13 5/8	41.31	21 5/8	104.05	29 5/8	195.28	37 5/8	314.99	45 5/8	463.19	53 5/8	639.92
5 3/4	7.36	13 3/4	42.07	21 3/4	105.26	29 3/4	196.94	37 3/4	317.09	45 3/4	465.73	53 3/4	642.90
5 7/8	7.68	13 7/8	42.83	21 7/8	106.47	29 7/8	198.59	37 7/8	319.19	45 7/8	468.28	53 7/8	645.90
6	8.01	14	43.61	22	107.69	30	200.26	38	321.30	46	470.83	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	473.39	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	325.55	46 1/4	475.96	54 1/4	654.92
6 3/8	9.04	14 3/8	45.98	22 3/8	111.39	30 3/8	205.30	38 3/8	327.68	46 3/8	478.54	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	481.12	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	331.96	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	210.40	38 3/4	334.11	46 3/4	486.31	54 3/4	667.05
6 7/8	10.52	14 7/8	49.23	22 7/8	116.43	30 7/8	212.11	38 7/8	336.27	46 7/8	488.91	54 7/8	670.10
7	10.90	15	50.06	23	117.70	31	213.83	39	338.44	47	491.52	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	494.14	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	496.77	55 1/4	679.29
7 3/8	12.10	15 3/8	52.60	23 3/8	121.57	31 3/8	219.04	39 3/8	344.98	47 3/8	499.40	55 3/8	682.36
7 1/2	12.52	15 1/2	53.46	23 1/2	122.88	31 1/2	220.79	39 1/2	347.17	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	504.68	55 5/8	688.54
7 3/4	13.36	15 3/4	55.19	23 3/4	125.50	31 3/4	224.30	39 3/4	351.58	47 3/4	507.34	55 3/4	691.64
7 7/8	13.80	15 7/8	56.07	23 7/8	126.83	31 7/8	226.07	39 7/8	353.79	47 7/8	510.00	55 7/8	694.74
8	14.24	16	56.96	24	128.16	32	227.85	40	356.02	48	512.66	56	697.85
8 1/8	14.69	16 1/8	57.85	24 1/8	129.50	32 1/8	229.63	40 1/8	358.24	48 1/8	515.34	56 1/8	700.97
8 1/4	15.14	16 1/4	58.75	24 1/4	130.84	32 1/4	231.42	40 1/4	360.48	48 1/4	518.02	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	362.72	48 3/8	520.70	56 3/8	707.23
8 1/2	16.08	16 1/2	60.58	24 1/2	133.56	32 1/2	235.03	40 1/2	364.97	48 1/2	523.40	56 1/2	710.37
8 5/8	16.55	16 5/8	61.50	24 5/8	134.92	32 5/8	236.84	40 5/8	367.23	48 5/8	526.10	56 5/8	713.52
8 3/4	17.04	16 3/4	62.43	24 3/4	136.30	32 3/4	238.66	40 3/4	369.49	48 3/4	528.81	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	371.76	48 7/8	531.52	56 7/8	719.83

AFGlobal
Connectors & Sealing Technologies

AFGlobal Corporation
945 Bunker Hill, Suite 500, Houston, TX 77024
Tel: 713-393-4200

afglobalcorp.com