



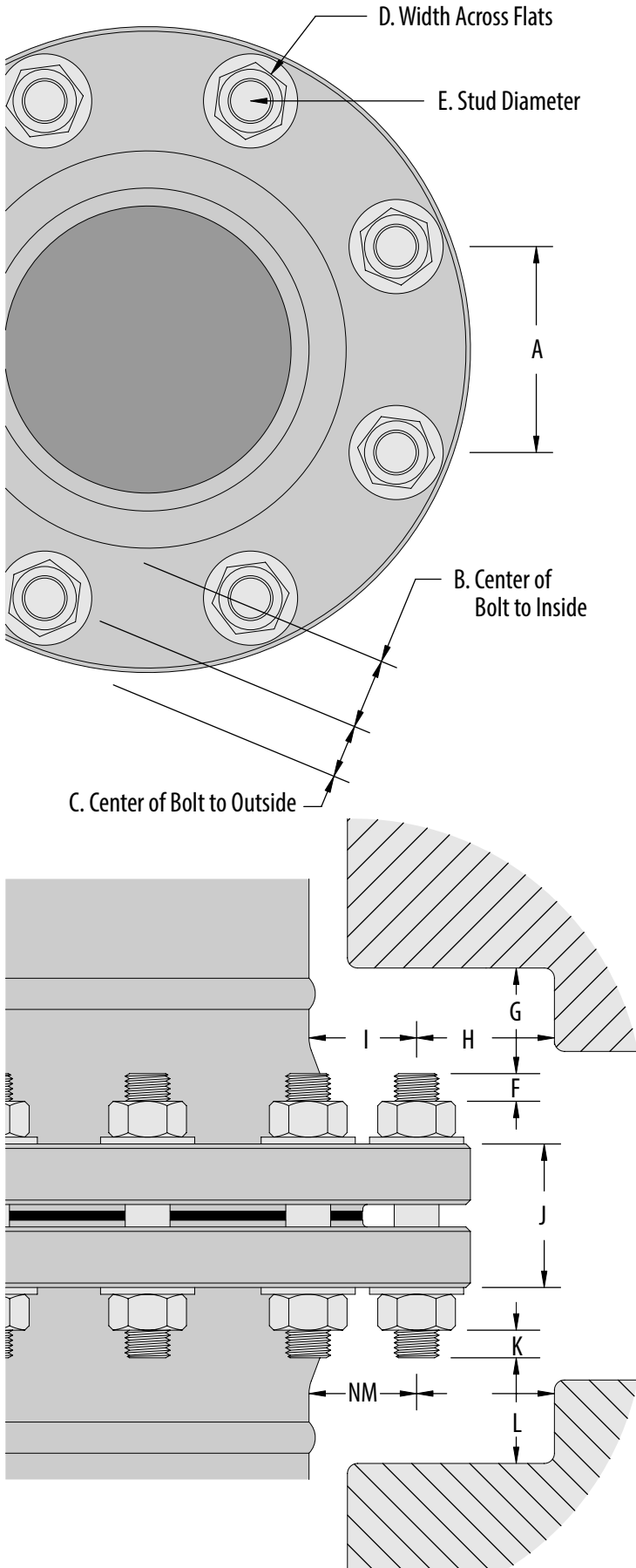
BOLTING TECHNOLOGY

LEADING PROVIDER OF BOLT LOADING & REMOVAL SOLUTIONS

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2013

Application Worksheet



A. Center of One Bolt to The Next: _____

B. Center of Bolt to Inside: _____

D. Size of Nut (Width Across Flats): _____

C. Center of Bolt to Outside: _____

E. Diameter of Stud: _____

* Number of Bolts: _____

Top Side of Flange

F. Length of Stud Above Nut: _____

G. Vertical Clearance Above Stud: _____

H. Horizontal Clearance to Outside: _____

I. Horizontal Clearance to Inside: _____

J. Grip Length: _____

Bottom Side of Flange

K. Length of Stud Below Nut: _____

L. Vertical Clearance Below Stud: _____

M. Horizontal Clearance to Outside: _____

N. Horizontal Clearance to Inside: _____

Bolt & Additional Flange Info

1. Bolt Material: _____

2. Yield Strength: _____

3. Operating Temp. (If Known): _____

4. Gasket(s) (Type & Material): _____

5. ANSI or API Designation: _____



Definition of Torque

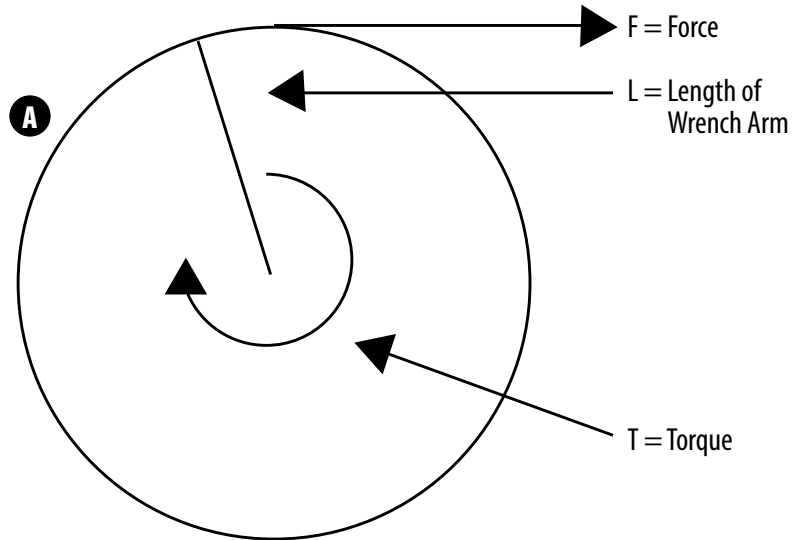
BOLTING TERMS

TENSION: The act of stretching tight or state of being stretched tight. Stress of a pulling force on a body.

TORQUE: The measure of the tendency of a force to rotate the body upon which it acts about an axis.

STRESS: Forces exerted against each other by two surfaces in contact.

PRELOAD: Initial clamping force or tension in a fastener.



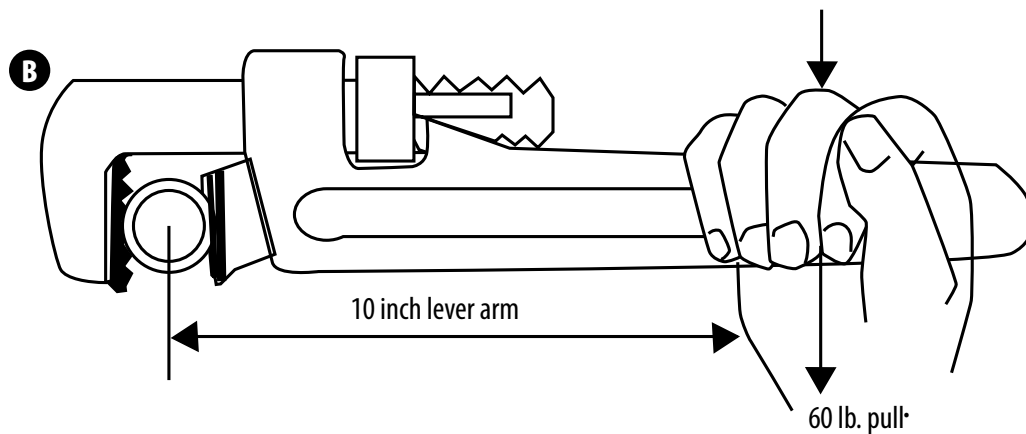
BOLTING CALCULATIONS

A: The formula for torque may be expressed as:

$$T = F \times L$$

T = Torque F = Force L = Length

B: In this example we substitute real numbers for the letters in the previous example. If a hand is pulling at the end of a 10" wrench arm and exerting 60 pounds of force, the resulting torque will be 600 in-lbs ($600 = 60 \times 10$). To convert to ft-lbs we merely divide the result by 12. Thus we obtain 50 ft-lbs.



WHAT HAPPENS WHEN WE TIGHTEN A BOLT?

The bolt acts as a heavy spring that clamps two or more pieces together.

When we turn a nut we stretch the bolt. Stretch or elongation provides clamping force.

Clamping force increases on a straight line until yield is reached.

Not enough clamping force allows the nuts to vibrate loose and causes leaks.

Too much clamping force causes gasket damage, bolt galling, flange damage and even bolt breakage.



Tool and Application Choices

TOOL	APPLICATION	PROBLEM TO SOLVE	ADVANTAGES
Spin-Torq 360° Rotating Wrench	Breaking down Making up Continuous rotation of bolts & shafts	Need for: Speed Continuous rotation Reversible rotation SubSea / ROV	360° Continuous Rotation of Nut, clockwise and counter-clockwise 36 times faster than ratchet wrenches Continuous full power in both directions
Auto-Torq Thinline Hydraulic Torque Wrench	Breaking down Making up	Clearance issues	60° turn of nut before resetting Cylinder engaged during power & retraction strokes Wrench profile is narrower than the nut height
IU-XL Ratchet Wrench	Breaking down Making up	Limited Space	Low profile Direct fit over the nut
SU-XL Ratchet Wrench	Breaking down Making up	Need for high torque Use of one tool on multiple nut sizes	Desired torque at the touch of a button Accurate to +/- 3% Many socket sizes fit each wrench
Auto-Splitter Nut Splitter	Breaking down Removing nuts	Corroded fasteners Galled threads	Won't damage stud Each model cuts multiple nuts sizes (from 3 to 9 per model) Fits into tight spaces NO Hot Permit required Quick, safe & economical
Auto-Tension Stud Tensioner	Breaking down Making up	Many studs Large studs Large flanges	Equal & simultaneous bolt load Compact & lightweight Reduces risk of galling fasteners
Auto-Spreader Flange Spreader	Replacing gaskets Leveling machinery Separating flanges	Frozen flanges Need to replace gasket	Allows quick replacement of gaskets One size fits all flanges Only 3/32" clearance needed to fit spreader



Tool and Application Choices

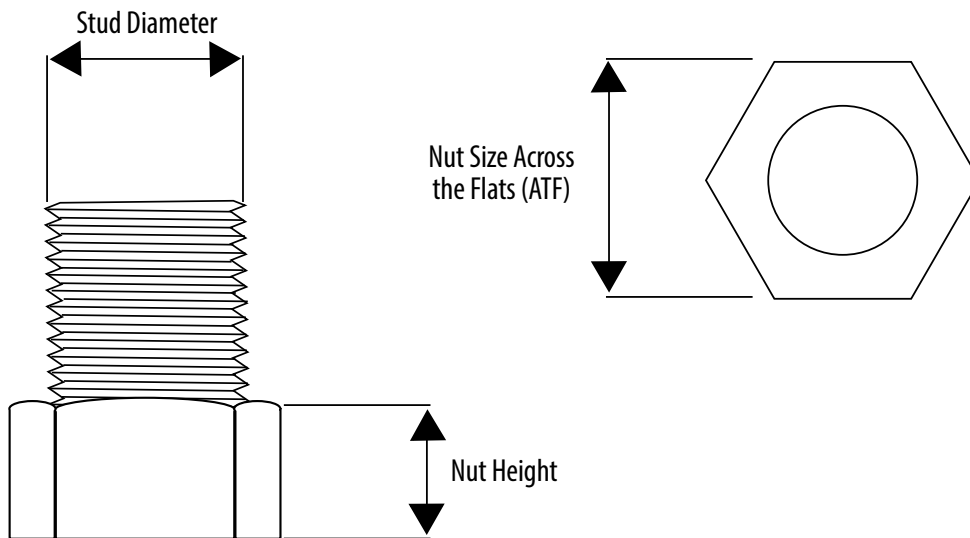
TOOL	APPLICATION	PROBLEM TO SOLVE	ADVANTAGES
Zip-Lift Robotic Crane Grapple	Retrieve and abandon loads in hazardous environments	Connect and release lines to and from loads without human intervention	Zip-Lift pushes-on and pulls-off threaded lifting eyes
Auto-Zip Robotic Stud Tensioner	Connect bolted joints in deep water or other hazardous environments	Place stud tensioners on studs, pull studs into tension, rotate nuts and remove tensioner without human intervention	Auto-Zip pushes-on and pulls-off using ROVs or hardsuits Hydraulic motor rotates nuts
Auto-Zip Flange Pullers	Pull flanged pipelines together SubSea	Heavy loads to pull and hold without human intervention	Double Zip-Nuts on each end of the pulling cylinder provide robotic control
DTIs - Direct Tension Indicators	Measure bolt load induced in each bolt in a flange	Inspect for bolt load without the use of strain gauges or instruments	DTIs measure bolt load using a feeler gauge
Auto-Gripper Stud Remover	Breaking down	Unable to remove studs from threaded hole	Especially useful on blind flanges Eliminates flame cutting & machining



Standard Stud & Heavy Hex Nut Specifications

Stud Diameter Inches	Nut Size ATF / Hvy Hex - Inches	Nut Height Hvy Hex - Inches
3/4	1-1/4	3/4
7/8	1-7/16	7/8
1	1-5/8	1
1-1/8	1-13/16	1-1/8
1-1/4	2	1-1/4
1-3/8	2-3/16	1-3/8
1-1/2	2-3/8	1-1/2
1-5/8	2-9/16	1-5/8
1-3/4	2-3/4	1-3/4
1-7/8	2-15/16	1-7/8
2	3-1/8	2
2-1/4	3-1/2	2-1/4
2-1/2	3-7/8	2-1/2
2-3/4	4-1/4	2-3/4

Stud Diameter Inches	Nut Size ATF / Hvy Hex - Inches	Nut Height Hvy Hex - Inches
3	4-5/8	3
3-1/4	5	3-1/4
3-1/2	5-3/8	3-1/2
3-3/4	5-3/4	3-3/4
4	6-1/8	4
4-1/4	6-1/2	4-1/4
4-1/2	6-7/8	4-1/2
4-3/4	7-1/4	4-3/4
5	7-5/8	5
5-1/4	8	5-1/4
5-1/2	8-3/8	5-1/2
5-3/4	8-3/4	5-3/4
6	9-1/8	6



Bolt Sizes & Quantities for Flanges

ANSI B16.5 FLANGES

Nominal Pipe Size (in.)	Class 150 Flanges		Class 300 Flanges		Class 400 Flanges		Class 600 Flanges		Class 900 Flanges		Class 1500 Flanges		Class 2500 Flanges	
	No. of Bolts	Bolt Dia. (in.)	No. of Bolts	Bolt Dia. (in.)	No. of Bolts	Bolt Dia. (in.)	No. of Bolts	Bolt Dia. (in.)	No. of Bolts	Bolt Dia. (in.)	No. of Bolts	Bolt Dia. (in.)	No. of Bolts	Bolt Dia. (in.)
1/2	4	1/2	4	1/2	4	1/2	4	1/4	4	3/4	4	3/4	4	3/4
3/4	4	1/2	4	5/8	4	5/8	4	5/8	4	3/4	4	3/4	4	3/4
1	4	1/2	4	5/8	4	5/8	4	5/8	4	7/8	4	7/8	4	7/8
1-1/4	4	1/2	4	5/8	4	5/8	4	5/8	4	7/8	4	7/8	4	1
1-1/2	4	1/2	4	3/4	4	3/4	4	3/4	4	1	4	1	4	1-1/8
2	4	5/8	8	5/8	8	5/8	8	5/8	8	7/8	8	7/8	8	1
2-1/2	4	5/8	8	3/4	8	3/4	8	3/4	8	1	8	1	8	1-1/8
3	4	5/8	8	3/4	8	3/4	8	3/4	8	7/8	8	1-1/8	8	1-1/4
3-1/2	8	5/8	8	3/4	8	7/8	8	7/8	*	*	*	*	*	*
4	8	5/8	8	3/4	8	7/8	8	7/8	8	1-1/8	8	1-1/4	8	1-1/2
5	8	3/4	8	3/4	8	1	8	1	8	1-1/4	8	1-1/2	8	1-3/4
6	8	3/4	12	3/4	12	1	12	1	12	1-1/8	12	1-3/8	8	2
8	8	3/4	12	7/8	12	1-1/8	12	1-1/8	12	1-3/8	12	1-5/8	12	2
10	12	7/8	16	1	16	1-1/4	16	1-1/4	16	1-3/8	12	1-7/8	12	2-1/2
12	12	7/8	16	1-1/8	20	1-1/4	20	1-1/4	20	1-3/8	16	2	12	2-3/4
14	12	1	20	1-1/8	20	1-3/8	20	1-3/8	20	1-1/2	16	2-1/4	*	*
16	16	1	20	1-1/4	20	1-1/2	20	1-1/2	20	1-5/8	16	2-1/2	*	*
18	16	1-1/8	24	1-1/4	20	1-5/8	20	1-5/8	20	1-7/8	16	2-3/4	*	*
20	20	1-1/8	24	1-1/4	24	1-5/8	24	1-5/8	20	2	16	3	*	*
24	20	1-1/8	24	1-1/2	24	1-7/8	24	1-7/8	20	2-1/2	16	3-1/2	*	*



Bolt Sizes & Quantities for Flanges, Cont.

B16.47 & M.S.S. SP 44 FLANGES										
Nominal Pipe Size (in.)	Class 150 Flanges		Class 300 Flanges		Class 400 Flanges		Class 600 Flanges		Class 900 Flanges	
	No. of Bolts	Bolt Dia. (in.)	No. of Bolts	Bolt Dia. (in.)	No. of Bolts	Bolt Dia. (in.)	No. of Bolts	Bolt Dia. (in.)	No. of Bolts	Bolt Dia. (in.)
22	20	1-1/4	24	1-1/2	24	1-5/8	24	1-3/4	*	*
26	24	1-1/4	28	1-5/8	28	1-3/4	28	1-7/8	20	2-3/4
28	28	1-1/4	28	1-5/8	28	1-7/8	28	2	20	3
30	28	1-1/4	28	1-3/4	28	2	28	2	20	3
32	28	1-1/2	28	1-7/8	28	2	28	2-1/4	20	3-1/4
34	32	1-1/2	28	2	28	2	28	2-1/4	20	3-1/2
36	32	1-1/2	32	1-1/2	32	2	28	2-1/2	20	3-1/2
38	32	1-1/2	32	1-5/8	32	1-3/4	28	2-1/4	20	3-1/2
40	36	1-1/2	32	1-5/8	32	1-7/8	32	2-1/4	24	3-1/2
42	36	1-1/2	32	1-3/4	32	1-7/8	28	2-1/2	24	3-1/2
44	40	1-1/2	32	1-7/8	32	2	32	2-1/2	24	3-3/4
46	40	1-1/2	28	1-7/8	36	2	32	2-1/2	24	4
48	44	1-1/2	32	2	28	2-1/4	32	2-3/4	24	4
50	44	1-3/4	32	2	32	2-1/4	28	3	*	*
52	44	1-3/4	32	2-1/4	32	2-1/4	32	3	*	*
54	44	1-3/4	28	2-1/4	28	2-1/8	32	3	*	*
56	48	1-3/4	28	2-1/4	32	2-1/8	32	3-1/4	*	*
58	48	1-3/4	32	2-1/4	32	2-1/8	32	3-1/4	*	*
60	52	1-3/4	32	2-1/4	32	2-3/4	28	3-1/2	*	*



BOLT SPECIFICATIONS

For Standard ANSI Flanges

Flange Designation	Bolt Qty.	Bolt Dia. (in.)	Bolt Length (in.)		
			Raised Face	Ring Joint	
1/2" - 150#	4	1/2	2-1/2		
1/2" - 300#	4	1/2	2-3/4	3	
1/2" - 400#	4	1/2	3-1/4	3	3
1/2" - 600#	4	1/2	3-1/4	3	3
1/2" - 900#	4	3/4	4-1/4	4-1/4	4
1/2" - 1500#	4	3/4	4-1/4	4-1/4	4
1/2" - 2500#	4	3/4	5-1/4	5-1/4	5
3/4" - 150#	4	1/2	2-1/2		
3/4" - 300#	4	5/8	3	3-1/2	
3/4" - 400#	4	5/8	3-1/2	3-1/2	3-1/4
3/4" - 600#	4	5/8	3-1/2	3-1/2	3-1/4
3/4" - 900#	4	3/4	4-1/2	4-1/2	4-1/4
3/4" - 1500#	4	3/4	4-1/2	4-1/2	4-1/4
3/4" - 2500#	4	3/4	5-1/4	5-1/4	5
1" - 150#	4	1/2	2-3/4	3-1/4	
1" - 300#	4	5/8	3-1/4	3-3/4	
1" - 400#	4	5/8	3-3/4	3-3/4	3-1/2
1" - 600#	4	5/8	3-3/4	3-3/4	3-1/2
1" - 900#	4	7/8	5	5	4-3/4
1" - 1500#	4	7/8	5	5	4-3/4
1" - 2500#	4	7/8	5-3/4	5-3/4	5-1/2
1-1/4" - 150#	4	1/2	2-3/4	3-1/4	
1-1/4" - 300#	4	5/8	3-1/4	3-3/4	
1-1/4" - 400#	4	5/8	4	4	3-3/4
1-1/4" - 600#	4	5/8	4	4	3-3/4
1-1/4" - 900#	4	7/8	5	5	4-3/4
1-1/4" - 1500#	4	7/8	5	5	4-3/4
1-1/4" - 2500#	4	1	6-1/4	6-1/2	6

Flange Designation	Bolt Qty.	Bolt Dia. (in.)	Bolt Length (in.)		
			Raised Face	Ring Joint	
1-1/2" - 150#	4	1/2	3	3-1/2	
1-1/2" - 300#	4	3/4	3-3/4	4-1/4	
1-1/2" - 400#	4	3/4	4-1/4	4-1/4	4
1-1/2" - 600#	4	3/4	4-1/4	4-1/4	4
1-1/2" - 900#	4	1	5-1/2	5-1/2	5-1/4
1-1/2" - 1500#	4	1	5-1/2	5-1/2	5-1/4
1-1/2" - 2500#	4	1-1/8	7-1/4	7-1/4	6-3/4
2" - 150#	4	5/8	3-1/4	3-3/4	
2" - 300#	8	5/8	3-1/2	4-1/4	
2" - 400#	8	5/8	4-1/4	4-1/2	4
2" - 600#	8	5/8	4-1/4	4-1/2	4
2" - 900#	8	7/8	5-3/4	5-3/4	5-1/2
2" - 1500#	8	7/8	5-3/4	5-3/4	5-1/2
2" - 2500#	8	1	7-1/4	7-1/2	7
2-1/2" - 150#	4	5/8	3-1/2	4	
2-1/2" - 300#	8	3/4	4	4-3/4	
2-1/2" - 400#	8	3/4	4-3/4	5	4-1/2
2-1/2" - 600#	8	3/4	4-3/4	5	4-1/2
2-1/2" - 900#	8	1	6-1/4	6-1/4	6
2-1/2" - 1500#	8	1	6-1/4	6-1/4	6
2-1/2" - 2500#	8	1-1/8	8	8-1/4	7-3/4
3" - 150#	4	5/8	3-3/4	4-1/4	
3" - 300#	8	3/4	4-1/4	5	
3" - 400#	8	3/4	5	5-1/4	4-3/4
3" - 600#	8	3/4	5	5-1/4	4-3/4
3" - 900#	8	7/8	5-3/4	6	5-1/2
3" - 1500#	8	1-1/8	7	7	6-3/4
3" - 2500#	8	1-1/4	9	9-1/4	8-3/4



BOLT SPECIFICATIONS

For Standard ANSI Flanges Cont.

Flange Designation	Bolt Qty.	Bolt Dia. (in.)	Bolt Length (in.)		
			Raised Face	Ring Joint	
3-1/2" - 150#	8	5/8	3-3/4	5-1/4	
3-1/2" - 300#	8	3/4	4-1/2	5-1/4	
3-1/2" - 400#	8	7/8	5-1/2	5-3/4	5-1/4
3-1/2" - 600#	8	7/8	5-1/2	5-3/4	5-1/4
4" - 150#	8	5/8	3-3/4	4-1/4	
4" - 300#	8	3/4	4-1/2	5-1/4	
4" - 400#	8	7/8	5-1/2	5-3/4	5-1/4
4" - 600#	8	7/8	5-3/4	6	5-1/2
4" - 900#	8	1-1/8	6-3/4	7	6-1/2
4" - 1500#	8	1-1/4	7-3/4	7-3/4	7-1/2
4" - 2500#	8	1-1/2	10-1/4	10-3/4	10
5" - 150#	8	3/4	4	4-1/4	
5" - 300#	8	3/4	4-3/4	5-1/2	
5" - 400#	8	7/8	5-3/4	6	5-1/2
5" - 600#	8	1	6-1/2	6-3/4	6-1/4
5" - 900#	8	1-1/4	7-1/2	7-3/4	7-1/4
5" - 1500#	8	1-1/2	9-3/4	9-3/4	9-1/2
5" - 2500#	8	1-3/4	12	12-3/4	11-3/4
6" - 150#	8	3/4	4	4-1/2	
6" - 300#	12	3/4	5	5-3/4	
6" - 400#	12	7/8	6	6-1/4	5-3/4
6" - 600#	12	1	6-3/4	7	6-1/2
6" - 900#	12	1-1/8	7-3/4	7-3/4	7-1/2
6" - 1500#	12	1-3/8	10-1/4	10-1/2	10
6" - 2500#	8	2	13-3/4	14-1/2	13-1/2
8" - 150#	8	3/4	4-1/4	4-3/4	
8" - 300#	12	7/8	5-1/2	6-1/4	
8" - 400#	12	1	6-3/4	7	6-1/2
8" - 600#	12	1-1/8	7-3/4	7-3/4	7-1/2
8" - 900#	12	1-3/8	8-3/4	9	8-1/2
8" - 1500#	12	1-5/8	11-1/2	12	11-1/4
8" - 2500#	12	2	15-1/4	16	15

Flange Designation	Bolt Qty.	Bolt Dia. (in.)	Bolt Length (in.)		
			Raised Face	Ring Joint	
10" - 150#	12	7/8	4-3/4	5-1/4	
10" - 300#	16	1	6-1/4	7	
10" - 400#	16	1-1/8	7-1/2	7-3/4	7-1/4
10" - 600#	16	1-1/4	8-1/2	8-3/4	8-1/4
10" - 900#	16	1-3/8	9-1/4	9-1/2	9
10" - 1500#	12	1-7/8	13-1/4	13-3/4	13
10" - 2500#	12	2-1/2	19-1/2	20-1/2	19-1/4
12" - 150#	12	7/8	4-3/4	5-1/4	
12" - 300#	16	1-1/8	6-3/4	7-1/2	
12" - 400#	16	1-1/4	8	8-1/4	7-3/4
12" - 600#	20	1-1/4	8-3/4	9	8-1/2
12" - 900#	20	1-3/8	10	10-1/4	9-3/4
12" - 1500#	16	2	14-3/4	15-1/2	14-1/2
12" - 2500#	12	2-3/4	21-1/2	22-1/2	21-1/4
14" - 150#	12	1	5-1/4	5-3/4	
14" - 300#	20	1-1/8	7	7-3/4	
14" - 400#	20	1-1/4	8-1/4	8-1/2	8
14" - 600#	20	1-3/8	9-1/4	9-1/2	9
14" - 900#	20	1-1/2	10-3/4	11-1/4	10-1/2
14" - 1500#	16	2-1/4	16	17	15-3/4
16" - 150#	16	1	5-1/2	6	
16" - 300#	20	1-1/4	7-1/2	8-1/4	
16" - 400#	20	1-3/8	8-3/4	9	8-1/2
16" - 600#	20	1-1/2	10	10-1/4	9-3/4
16" - 900#	20	1-5/8	11-1/4	11-3/4	11
16" - 1500#	16	2-1/2	17-1/2	18-1/2	17-1/4
18" - 150#	16	1-1/8	6	6-1/2	
18" - 300#	24	1-1/4	7-3/4	8-1/2	
18" - 400#	24	1-3/8	9	9-1/4	8-3/4
18" - 600#	20	1-5/8	10-3/4	11	10-1/2
18" - 900#	20	1-7/8	12-3/4	13-1/2	12-1/2
18" - 1500#	16	2-3/4	19-1/2	20-1/2	19



BOLT SPECIFICATIONS

For Standard ANSI Flanges Cont.

Flange Designation	Bolt Qty.	Bolt Dia. (in.)	Bolt Length (in.)		
			Raised Face	Ring Joint	
20" - 150#	20	1-1/8	6-1/4	6-3/4	
20" - 300#	24	1-1/4	8-1/4	9	
20" - 400#	24	1-1/2	9-3/4	10	9-1/2
20" - 600#	24	1-5/8	11-1/2	11-3/4	11-1/4
20" - 900#	20	2	13-1/2	14-1/4	13-1/2
20" - 1500#	16	3	21-1/2	22-1/2	21
22" - 300#	24	1-1/2			
22" - 400#	24	1-5/8			
22" - 600#	24	1-3/4			
24" - 150#	20	1-1/4	5-1/4	5-3/4	
24" - 300#	24	1-1/2	9-1/4	10-1/4	
24" - 400#	24	1-3/4	10-3/4	11-1/4	10-1/2
24" - 600#	24	1-7/8	13	13-1/4	12-3/4
24" - 900#	20	2-1/2	17-1/4	17-3/4	17
24 - 1500#	16	3-1/2	24-1/2	25-3/4	24
26" - 150#	24	1-1/4			
26" - 300#	28	1-5/8			
26" - 400#	28	1-3/4			
26" - 600#	28	1-7/8			
26" - 900#	20	2-3/4			
28" - 600#	24	1-7/8			
30" - 150#	28	1-1/4			
30" - 300#	28	1-3/4			
30" - 400#	28	2			
30" - 600#	28	2			
30" - 900#	20	3			

Flange Designation	Bolt Qty.	Bolt Dia. (in.)	Bolt Length (in.)		
			Raised Face	Ring Joint	
34" - 150#	32	1-1/2			
34" - 300#	28	1-7/8			
34" - 400#	28	2			
34" - 600#	28	2-1/4			
34" - 900#	20	3-1/2			
36" - 150#	32	1-1/2			
36" - 300#	32	2			
36" - 400#	32	2			
36" - 600#	28	2-1/2			
36" - 900#	20	3-1/2			
38" - 300#	28	1-7/8			
42" - 300#	36	2			
42" - 400#	32	2-1/2			
42" - 600#	28	2-3/4			



API FLANGES

Bolt Sizes & Quantities

PIPE SIZE	2,000 PSI			3,000 PSI			5,000 PSI		
	No. of Studs	Stud Diameter	Nut Size "ATF"	No. of Studs	Stud Diameter	Nut Size "ATF"	No. of Studs	Stud Diameter	Nut Size "ATF"
1-13/16									
2-1/16	8	5/8	1-1/16	8	7/8	1-7/16	8	7/8	1-7/16
2-9/16	8	3/4	1-1/4	8	1	1-5/8	8	1	1-5/8
3-1/16									
3-1/8	8	3/4	1-1/4	8	7/8	1-7/16	8	1-7/16	1-13/16
4-1/16	8	7/8	1-7/16	8	1-1/8	1-13/16	8	1-1/4	2
5-1/8									
7-1/16	12	1	1-5/8	12	1-1/8	1-13/16	12	1-3/8	2-3/16
9	12	1-1/8	1-13/16	12	1-3/8	2-3/16	12	1-5/8	2-9/16
11	16	1-1/4	2	16	1-3/8	2-3/16	12	1-7/8	2-15/16
13-5/8	20	1-1/4	2	20	1-3/8	2-3/16	16	1-5/8	2-9/16
16-3/4	20	1-1/2	2-3/8	20	1-5/8	2-9/16	16	1-7/8	2-15/16
18-3/4							20	2	3-1/8
20-3/4				20	2	3-1/8			
21-1/4	24	1-5/8	2-9/16				24	2	3-1/8
26-3/4	20	1-3/4	2-3/4	24	2	3-1/8			



API FLANGES

Bolt Sizes & Quantities Cont.

PIPE SIZE	10,000 PSI			15,000 PSI			20,000 PSI		
	No. of Studs	Stud Diameter	Nut Size "ATF"	No. of Studs	Stud Diameter	Nut Size "ATF"	No. of Studs	Stud Diameter	Nut Size "ATF"
1-13/16	8	3/4	1-1/4	8	7/8	1-7/16	8	1	1-5/8
2-1/16	8	3/4	1-1/4	8	7/8	1-7/16	8	1-1/8	1-13/16
2-9/16	8	7/8	1-7/16	8	1	1-5/8	8	1-1/4	2
3-1/16	8	1	1-5/8	8	1-1/8	1-13/16	8	1-3/8	2-3/16
3-1/8									
4-1/16	8	1-1/8	1-13/16	8	1-3/8	2-3/16	8	1-3/4	2-3/4
5-1/8	12	1-1/8	1-13/16						
7-1/16	12	1-1/2	2-3/8	16	1-1/2	2-3/8	16	2	3-1/8
9	16	1-1/2	2-3/8	16	1-7/8	2-15/16	16	2-1/2	3-7/8
11	16	1-3/4	2-3/4	20	2	3-1/8	16	2-3/4	4-1/4
13-5/8	20	1-7/8	2-15/16	20	2-1/4	3-1/2	20	3-1/8	4-13/16
16-3/4	24	1-7/8	2-15/16						
18-3/4	24	2-1/4	3-1/2	20	3	4-5/8			
20-3/4									
21-1/4	24	2-1/2	3-7/8						
26-3/4									



TORQUE ESTIMATING CHART

ASTM A193, GRADE "B7" STUDS | LUBRICANT: MOLY PASTE | NUT FACTORS (K): 0.14, 0.18 or 0.20

TORQUE VALUES CALCULATED USING MECHANICAL ENGINEERING "SHORT FORMULA":

$$T = K (\text{Nut Factor}) \times \text{Clamp Load (Lbs)} \times \frac{D (\text{Bolt Diameter - Inches})}{12}$$

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Stud Diameter (Inches)	Nut Size (ATF)	Torque Values (Ft-Lbs)								
		40% Yield			50% Yield			60% Yield		
		K=.14	K=.18	K=.20	K=.14	K=.18	K=.20	K=.14	K=.18	K=.20
1/2	7/8	35	45	50	43	56	62	52	67	75
5/8	1-1/16	69	89	99	87	111	124	104	134	148
3/4	1-1/4	123	158	175	153	197	219	184	237	263
7/8	1-7/16	198	255	283	248	318	354	297	382	424
1	1-5/8	297	382	424	371	477	530	445	573	636
1-1/8	1-13/16	435	560	622	544	700	778	653	840	933
1-1/4	2	613	788	875	766	984	1,094	919	1,181	1,313
1-3/8	2-3/16	831	1,068	1,187	1,038	1,335	1,483	1,245	1,602	1,780
1-1/2	2-3/8	1,097	1,410	1,567	1,371	1,762	1,958	1,645	2,115	2,350
1-5/8	2-9/16	1,417	1,822	2,025	1,772	2,278	2,531	2,126	2,733	3,037
1-3/4	2-3/4	1,784	2,293	2,548	2,230	2,867	3,185	2,675	3,440	3,822
1-7/8	2-15/16	2,214	2,847	3,163	2,768	3,559	3,954	3,321	4,270	4,745
2	3-1/8	2,715	3,490	3,878	3,393	4,090	4,848	4,072	5,235	5,817
2-1/4	3-1/2	3,925	5,046	5,607	4,906	6,308	7,009	5,887	7,569	8,411
2-1/2	3-7/8	4,921	6,327	7,030	6,151	7,909	8,788	7,382	9,491	10,545
2-3/4	4-1/4	6,620	8,512	9,457	8,275	10,639	11,822	9,930	12,767	14,186
3	4-5/8	8,658	11,132	12,369	10,823	13,915	15,461	12,987	16,698	18,554
3-1/4	5	11,080	14,246	15,829	13,850	17,807	19,786	16,620	21,369	23,743
3-1/2	5-3/8	13,903	17,875	19,861	17,379	22,344	24,827	20,854	26,813	29,792
3-3/4	5-3/4	17,190	22,102	24,558	21,488	27,627	30,697	25,785	33,153	36,836
4	6-1/8	20,943	26,927	29,919	26,179	33,659	37,398	31,415	40,390	44,878

Material Yield Strength:

1/2" - 2-1/4" Diameter Studs: 105,000 PSI

2-1/2" - 4" Diameter Studs: 95,000 PSI

Number of Threads:

1/2" Diameter Studs: 13 TPI 7/8" Diameter Studs: 9 TPI

5/8" Diameter Studs: 11 TPI 1" - 4" Diameter Studs: 8 TPI

3/4" Diameter Studs: 10 TPI

The K Factor is an experimentally determined constant that relates the torque applied to the load induced in the fastener. This factor is affected by the condition of the fastener, the lubricant used and the condition of the flange.

For example, the 0.18 K Factor listed above is based on the following conditions:

1. New condition of flanges, studs and nuts.
2. Thorough application of lubricant on all mating surfaces of flange, nut and stud.
3. Use of hardened steel washers.

