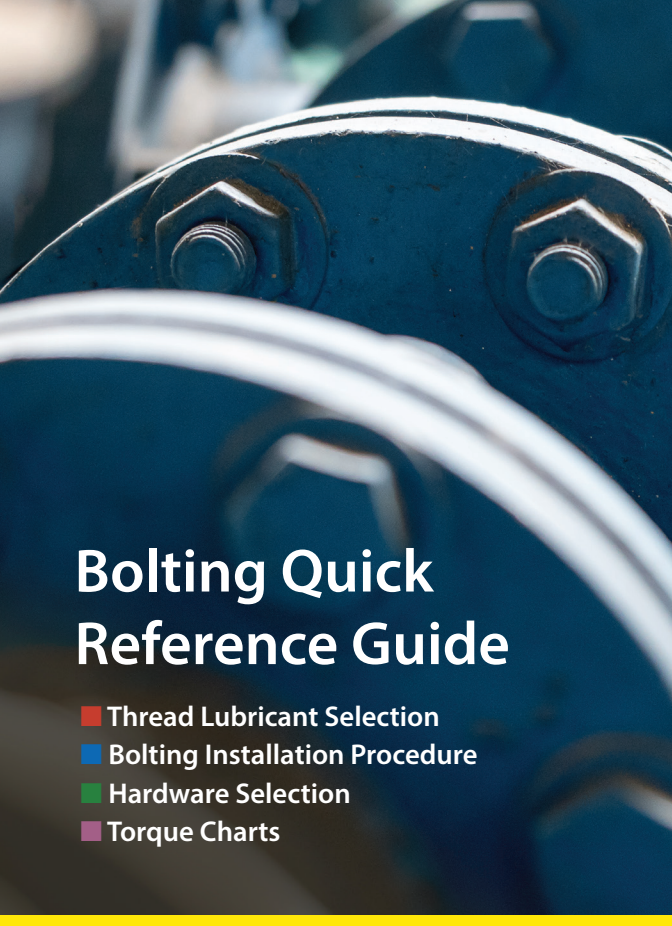


Bolting Quick Reference Guide

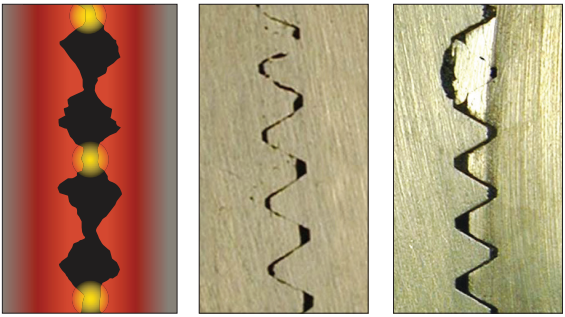
- Thread Lubricant Selection
- Bolting Installation Procedure
- Hardware Selection
- Torque Charts

CHESTERTON®

Global Solutions, Local Service.

Why Use Chesterton Thread Paste?

- Preserves bolt/stud integrity (controlled coefficient of friction [Kf-nut] at contact points)
- Accurate bolt/stud tension
- Insures correct flange sealing force
- Prevents thread galling
- Inhibits intergranular corrosion
- Safe operation of equipment
- Reduces disassembly time



a **b** **c**

Excess stress (a) without proper lubrication causes galling (b). This concentrates force and leads to thread fracture/seizure (c).

Chesterton Thread Lubricant Selection Guide

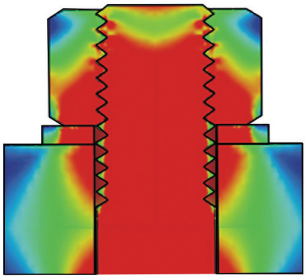
Product	Kf	Max Temp	Water	pH	Oil	Steam	Alloy
725	0.18	1425°C (2600°F)	B	B	B	B	A
772	0.16	1425°C (2600°F)	B	B	B	B	A
783	0.16	900°C (1650°F)	A	A	B	A	B
785	0.17	1204°C (2200°F)	B	B	B	A	B
785FG	0.20	1204°C (2200°F)	B	A	B	B	A
787	0.18*	538°C (1000°F)	A	B	A	A	B
900	0.16	260°C (500°F)	B	B	A	A	A

*0.10 for hydraulic torque devices.

Key: A=Best, B=Good, C=Fair

Areas of High Stress

Areas of high stress, shown in red, require use of thread lubricants. Fully coat threads, washers, and nut surfaces.



Flange and Bolt Installation

All components must be correct to achieve a seal. The most common cause of leaky gasketed joints is improper installation.

1. Clean the flange faces and check for scars; the faces must be clean and free of defects (burrs, pits, dents, etc.).
2. Inspect all bolts and nuts for damaged or corroded threads. Remove burrs by "chasing" threads or wire brush to remove rust. Replace if components are heavily damaged.
3. Lubricate, the full length of threads, the surface of the nut face adjacent to the flange or washer. Hardened washers are recommended. **Assemble per diagram to the right.**
4. Install the new gasket and be sure gasket is properly centered. DO NOT REUSE old gasket. Use new gasket/gaskets only.
5. Check flange alignment. Flange faces must be parallel within 1/16" per foot of diameter, and flange bolt holes must be aligned to within 1/8" maximum offset.
6. Adjust the position of the nuts to insure that 2-3 threads are visible above the top of the nut.

Recommended Tightening Procedures

Up to 8 Bolts– Use 4-Pass Method

Pass 1: Set the torque wrench to the 30% torque value and apply the torque wrench in the crisscross pattern for that particular flange until all bolts have been tightened once.

Pass 2: Set the torque wrench to the 60% torque value and repeat step 1.

Pass 3: Set the torque wrench to the 100% torque value and repeat the crisscross pattern a 3rd time.

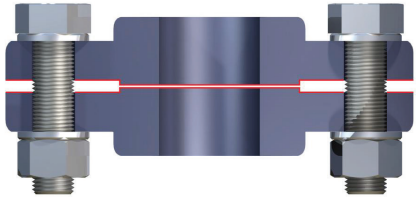
Pass 4: Check all bolts at 100% torque with a circular pattern.

12 Bolts or More– Use 5-Pass Method

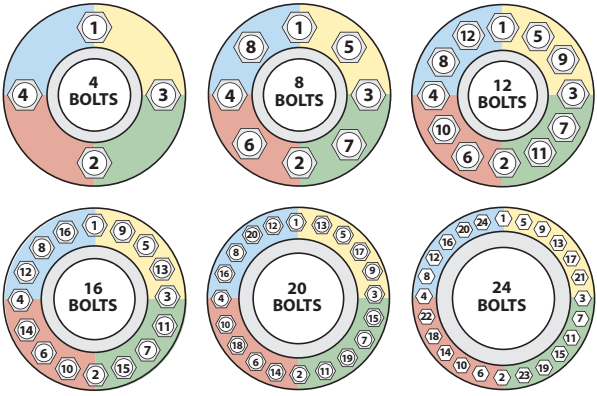
Pass 1-3: Set the torque wrench to 20%, 40%, 80% of final torque value and apply torque in a crisscross pattern. Repeat until bolts have been successively tightened.

Pass 4: Set the torque wrench to 100% torque value and repeat crisscross pattern for a 4th time.

Pass 5: Check all bolts at 100% torque with a circular pattern.



Bolt Tightening Sequence: Crisscross pattern: divide the flange into 4 quadrants. Over 40 bolts: tighten two adjacent bolts at the same time.



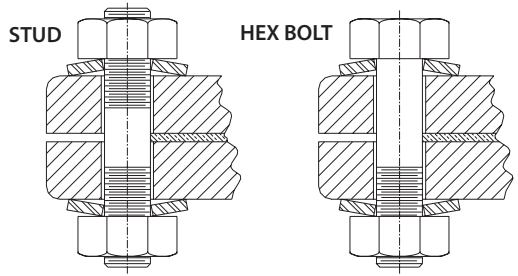
Useful Service Temperature Design Limits

Grade	Specs	Material	Minimum Heat Treat Temp	Low Temp Limit*	High Temp Limit*
5	SAE J429	Medium Carbon Steel	425°C (800°F)	-45°C (-50°F)	232°C (450°F)
7	SAE J429	Medium Carbon Steel	425°C (800°F)	-45°C (-50°F)	232°C (450°F)
8	SAE J429	Medium Carbon Alloy Steel	425°C (800°F)	-45°C (-50°F)	232°C (450°F)
B5	ASTM A193	Cr-Mo Alloy Steel	590°C (1100°F)	-45°C (-50°F)	400°C (750°F)
B6	ASTM A193	Cr-Mo Alloy Steel	590°C (1100°F)	-45°C (-50°F)	400°C (750°F)
B7	ASTM A193	Cr-Mo Alloy Steel	590°C (1100°F)	-45°C (-50°F)	400°C (750°F)
B7M	ASTM A193	Cr-Mo Alloy Steel	620°C (1150°F)	-45°C (-50°F)	454°C (850°F)
B8 Class 1	ASTM A193	304 Stainless Steel	NA	-195°C (-320°F)	593°C (1100°F)
B8 Class 2	ASTM A193	304 Stainless Steel	NA	-195°C (-320°F)	593°C (1100°F)
B8M Class 1	ASTM A193	316 Stainless Steel	NA	-195°C (-320°F)	593°C (1100°F)
B16	ASTM A193	Cr-Mo-Va Alloy Steel	650°C (1200°F)	-45°C (-50°F)	480°C (900°F)

**These values represent useful design limits. Use of these fastener materials close to or outside of these limits should be evaluated closely. Reference: Fastenal Company*

Live Loading Selection Guide

Description	5500	5500I	5505H
Material	Stainless Steel Alloy	Inconel	Carbon Steel
Color	Grey	Grey	Black
Max Temp °C (°F)	302 (575)	704 (1300)	593 (1100)
Cryogenic Capabilities	Yes	Yes	No
Manufacturing Technique	Stamped/ Machined	Stamped/ Machined	Machined
Size Range	3/8" to 2-3/4" (M8 to M64)	3/8" to 2-3/4" (M8 to M64)	1/2" to 3" (M16 to M72)
Recommended Size Range	3/8" to 1-1/8" (M8 to M30)	3/8" to 2-3/4" (M8 to M64)	1-1/4" to 3" (M33 to M72)
Arrangement	2 in parallel	2 in parallel	Single Disc
Stress Designs	Standard	Standard	30K, 45K, 60K



Carbon/Carbon Alloy Torque Settings (FT-LBS)

Bolt Diameter		Grade 5	Grade 7	Grade 8
Yield Strength		80,000	105,000	120,000
Tensile Strength		105,000	130,000	150,000
1/4"	M6	5.1	6.7	7.6
5/16"	M8	10.5	13.8	15.7
3/8"	-	18.6	24.4	27.9
7/16"	M10	31.2	40.9	46.8
1/2"	M12	48.3	63.4	72.5
9/16"	M14	71.3	93.6	106.9
5/8"	M16	100.0	131.3	150.0
11/16"	-	135.5	177.9	203.3
3/4"	M20	179.0	235.0	268.6
13/16"	-	230.9	303.0	346.3
7/8"	M22	291.8	382.9	437.6
15/16"	-	362.4	475.7	543.6
1"	M24	443.5	582.1	665.3
1-1/8"	M27	567.4	744.7	851.0
1-1/4"	M30	888.8	1166.6	1333.2
1-3/8"	-	1193.3	1566.2	1789.9
1-1/2"	M36	1564.8	2053.8	2347.2
1-5/8"	-	1996.8	2620.8	2995.2
1-3/4"	M42	2508.8	3292.8	3763.2
1-7/8"	-	3096.0	4063.5	4644.0
2"	M48	3776.0	4956.0	5664.0
2-1/8"	-	4556.0	5979.8	6834.0
2-1/4"	M56	5414.4	7106.4	8121.6
2-3/8"	-	6399.2	8399.0	9598.8
2-1/2"	M64	7472.0	9807.0	11208.0
2-5/8"	-	8668.8	11377.8	13003.2
2-3/4"	M72	9996.8	13120.8	14995.2
2-7/8"	-	11444.8	15021.3	17167.2
3"	M76	13017.6	17085.6	19526.4

Torque using Cf of 0.16 (783, 772, 787, 900). Add 10% for 725/785. Add 20% for 710.

Ferretic Torque Settings (FT-LBS)

Bolt Diameter		B5	B6	B7 B16	B7 B16
Yield Strength		80,000	85,000	105,000	95,000
Tensile Strength		100,000	110,000	125,000	115,000
1/4"	M6	5.1	5.4	6.7	
5/16"	M8	10.5	11.1	13.8	
3/8"	-	18.6	19.8	24.4	
7/16"	M10	31.2	33.1	40.9	
1/2"	M12	48.3	51.3	63.4	
9/16"	M14	71.3	75.7	93.6	
5/8"	M16	100.0	106.3	131.3	
11/16"	-	135.5	144.0	177.9	
3/4"	M20	179.0	190.2	235.0	
13/16"	-	230.9	245.3	303.0	
7/8"	M22	291.8	310.0	382.9	
15/16"	-	362.4	385.1	475.7	
1"	M24	443.5	471.2	582.1	
1-1/8"	M27	567.4	602.8	744.7	
1-1/4"	M30	888.8	944.4	1166.6	
1-3/8"	-	1193.3	1267.9	1566.2	
1-1/2"	M36	1564.8	1662.6	2053.8	
1-5/8"	-	1996.8	2121.6	2620.8	
1-3/4"	M42	2508.8	2665.6	3292.8	
1-7/8"	-	3096.0	3289.5	4063.5	
2"	M48	3776.0	4012.0	4956.0	
2-1/8"	-	4556.0	4840.8		5410.3
2-1/4"	M56	5414.4	5752.8		6429.6
2-3/8"	-	6399.2	6799.2		7599.1
2-1/2"	M64	7472.0	7939.0		8873.0
2-5/8"	-	8668.8	9210.6		10294.2
2-3/4"	M72	9996.8	10621.6		11871.2
2-7/8"	-	11444.8	12160.1		13590.7
3"	M76	13017.6	13831.2		15458.4

Torque using Cf of 0.16 (783, 772, 787, 900). Add 10% for 725/785. Add 20% for 710.

Austenitic Torque Wrench Settings (FT-LBS)

Bolt Diameter		B8, B8M, (1 &1D)	B8-2, B8M2	F593G	F593H
Yield Strength		30,000	80,000	65,000	50,000
Tensile Strength		75,000	115,000	105,000	90,000
1/4"	M6	1.9	5.1	4.1	
5/16"	M8	3.9	10.5	8.5	
3/8"	-	7.0	18.6	15.1	
7/16"	M10	11.7	31.2	25.3	
1/2"	M12	18.1	48.3	39.3	
9/16"	M14	26.7	71.3	57.9	
5/8"	M16	37.5	100.0	81.3	
11/16"	-	50.8	135.5		84.7
3/4"	M20	67.1	179.0		111.9
13/16"	-	86.6	230.9		144.3
7/8"	M22	109.4	291.8		182.4
15/16"	-	135.9	362.4		226.5
1"	M24	166.3	**360.4***		277.2
1-1/8"	M27	212.8	**461.0***		354.6
1-1/4"	M30	333.3	**722.2***		555.5
1-3/8"	-	447.5	**745.8***		745.8
1-1/2"	M36	586.8	**978.0***		978.0
1-5/8"	-	748.8			
1-3/4"	M42	940.8			
1-7/8"	-	1161.0			
2"	M48	1416.0			
2-1/8"	-	1708.5			
2-1/4"	M56	2030.4			
2-3/8"	-	2399.7			
2-1/2"	M64	2802.0			
2-5/8"	-	3250.8			
2-3/4"	M72	3748.8			
2-7/8"	-	4291.8			
3"	M76	4881.6			

Torque using Cf of 0.16 (783, 772, 787, 900). Add 10% for 725/785. Add 20% for 710.
Tensile strength changed at bolt diameters.

Chesterton ISO certificates available on chesterton.com/corporate/iso

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