

ENGINE MOUNTING HARDWARE

TYPES OF BOLTS

- **Standard Bolts**
Standard Bolts are used for mounting the equipment to the flange, driven members to the crankshaft end bolt and the engine to the base (all h/s and some v/s). For most applications, an SAE grade 5 bolt is sufficient. For chipper shredder application, an SAE grade 8 bolt must be used on the crankshaft end due to the higher shock loads.
- **Thread Forming Bolts**
Thread forming bolts are typically used on vertical shaft engines which utilize blind holes – holes that are not completely drilled through – for mounting the engine to the application. After a considerable amount of testing at the EAC, it is highly recommended that a thread forming screw of the tri-roundular type be used (this type is also called a tri-lobe and tri-flow screw). This design features a modest assembly torque, a high strip torque, and tends to be self-aligning if assembled on an angle.

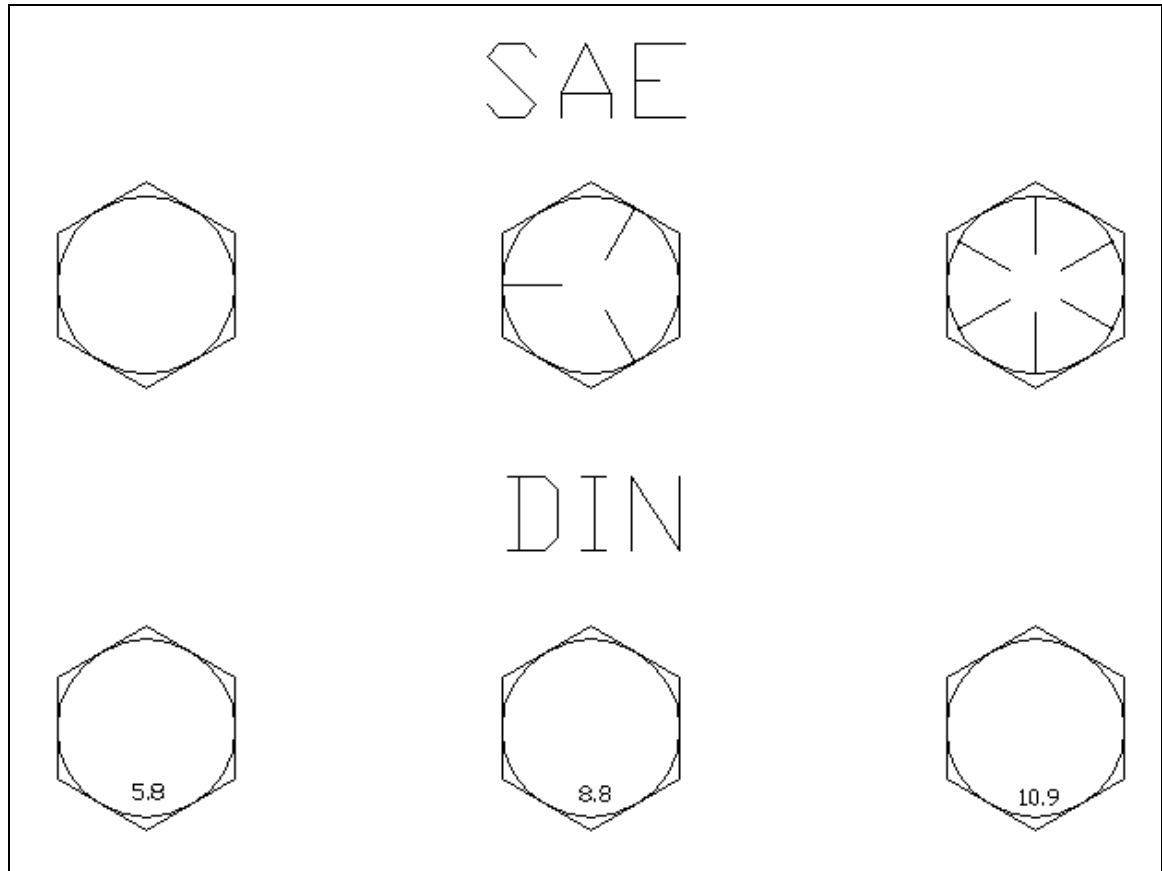
HOW TO USE A FASTENER

- Lock washers, either a split or star type, should always be used. They help make sure that the nut does not loosen.
- Never use a lock washer directly onto an aluminum surface. Lock washers have the tendency to “eat” their way into the aluminum and loose torque. Always make sure that steel is on both sides of the lock washer.
- A flat washer should be used in between the head of the bolt and the aluminum casting when the bolt is inserted from the top side of the engine. This provides for an even distribution of the bolt load.
- Lock nuts, such as a ny-lock or crushed nut, are appropriate for any installation.

ASSEMBLY TORQUE SHEET

For your convenience, a table listing the recommended assembly torque values is provided below.

Bolt Torque Values



SIZE	SAE - GRADE 2	SAE - GRADE 5	SAE - GRADE
	DIN # 5.8	DIN # 8.8	DIN # 10.9
8			
1/4-20	65 (7)	95 (11)	140 (16)
1/4-28	75 (8.5)	120 (14)	165 (18.5)
5/16-18	130 (15)	200 (23)	300 (34)
5/16-24	140 (16)	225 (25)	325 (37)
3/8-16	240 (27)	360 (41)	540 (61)
3/8-24	275 (31)	420 (47.5)	600 (68)
7/16-14	360 (41)	600 (68)	840 (95)
7/16-20	420 (47.5)	660 (75.5)	960 (97)
1/2-13	600 (68)	900 (102)	1320 (149)
1/2-20	660 (75.5)	1080 (122)	1440 (163)

M4x0.7	24 (3)	35 (4)
M5x0.8	48 (39)	72 (8)

Bolt Torque Values

SIZE 8	SAE - GRADE 2	SAE - GRADE 5	SAE - GRADE
	DIN # 5.8	DIN # 8.8	DIN # 10.9
M6x1.0		10 (11)	132 (15)
M8x1.25 M8x1.00		240 (27)	324 (36.5)
M10x1.5 M10x1.25		468 (53)	636 (72)
M12x1.75 M12x1.25		816 (92)	1116 (126)

NOTES:

- The above listed torque values are in **inch-pounds** and (Newton meters).
- Non-oiled and non-plated bolts are assumed.
- If the bolt is cadmium plated, multiply torque value by 0.9.
- If the nut and bolt are cadmium plated, multiply torque values by 0.8.
- If an anti-seize compound or oil is used, multiply torque values by 0.9.
- Thread engagement for steel must be at least 1 bolt diameter.
- Thread engagement for cast iron must be at least 1.5 times the bolt diameter.
- Thread engagement for aluminum must be at least 2 times the bolt diameter.

Example:

If a Grade 5, cadmium plated 5/16-24 bolt is threaded into aluminum, and an anti-seize compound is used on the threads, what should the bolt be torqued to? What should the thread engagement be?

Answers:

Torque: $225 \times 0.9 \times 0.9 = 180$ inch pounds.

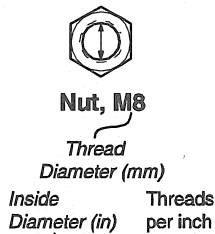
Thread engagement: $5/16 \times 2 = 5/8$ inch.

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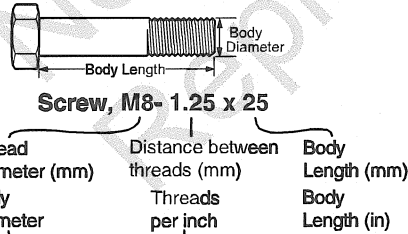
Hardware Identification & Torque Specifications

Torque Specification Chart FOR STANDARD METRIC MACHINE HARDWARE (Tolerance ± 20%)								
Property Class	5.6 Class 5.6		8.8 Class 8.8		10.9 Class 10.9		12.9 Class 12.9	
	in/lbs ft/lbs	Nm.	in/lbs ft/lbs	Nm.	in/lbs ft/lbs	Nm.	in/lbs ft/lbs	Nm.
M3	5.88	.56	13.44	1.28	19.2	1.80	22.92	2.15
M4	13.44	1.28	30.72	2.90	43.44	4.10	52.56	4.95
M5	26.4	2.50	60.96	5.75	5.97	8.10	7.15	9.7
M6	44.64	4.3	7.3	9.9	10.3	14	12.1	16.5
M7	5.2	7.1	12.1	16.5	16.9	23	19.9	27
M8	7.7	10.5	17.7	24	25	34	29	40
M10	15	21	35	48	50	67	59	81
M12	26	36	61	83	86.2	117	103	140
M14	42	58	101	132	136	185	162	220
M16	64	88	147	200	210	285	250	340
M18	89	121	202	275	287	390	346	470
M20	126	171	290	390	405	550	486	660
M22	169	230	390	530	559	745	656	890
M24	217	295	497	375	708	960	840	1140
M27	320	435	733	995	1032	1400	1239	1680
M30	435	590	995	1350	1401	1900	1681	2280
M33	590	800	1349	1830	1902	2580	2278	3090
M36	759	1030	1740	2360	2441	3310	2935	3980
M39	988	1340	2249	3050	3163	4290	3798	5150

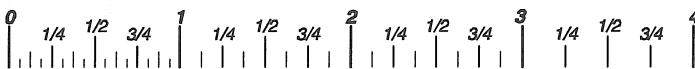
The guides and ruler furnished below are designed to help you select the appropriate hardware.



Nut, 1/2-16



Screw, 1/2-16 x 2



Standard Hardware Sizing

When a washer or nut is identified as 1/2" (M8), this is the *Nominal size*, meaning the *inside diameter* is 1/2 inch (8mm metric thread diameter); if a second number is present it represents the *threads per inch* (distance between threads).

When bolt or capscrew is identified as 1/2 - 16 x 2" (M8 - 1.25 x 50), this means the *Nominal size*, or body diameter is 1/2 inch (8mm metric thread diameter), the second number, 16, represents the *threads per inch*, (1.25 thread diameter). The final number is the body length of the bolt or screw, 2 inches (50mm).

Torque Specification Chart FOR STANDARD MACHINE HARDWARE (Tolerance ± 20%)						
Hardware Grade	No Marks SAE Grade 2		SAE Grade 5		SAE Grade 8	
	in/lbs ft/lbs	Nm.	in/lbs ft/lbs	Nm.	in/lbs ft/lbs	Nm.
8-32	19	2.1	30	3.4	41	4.6
8-36	20	2.3	31	3.5	43	4.9
10-24	27	3.1	43	4.9	60	6.8
10-32	31	3.5	49	5.5	68	7.7
1/4-20	66	7.6	8	10.9	12	16.3
1/4-28	76	8.6	10	13.6	14	19.0
5/16-18	11	15.0	17	23.1	25	34.0
5/16-24	12	16.3	19	25.8	29	34.0
3/8-16	20	27.2	30	40.8	45	61.2
3/8-24	23	31.3	35	47.6	50	68.0
7/16-14	30	40.8	50	68.0	70	95.2
7/16-20	35	47.6	55	74.8	80	108.8
1/2-13	50	68.0	75	102.0	110	149.6
1/2-20	55	74.8	90	122.4	120	163.2
9/16-12	65	88.4	110	149.6	150	204.0
9/16-18	75	102.0	120	163.2	170	231.2
5/8-11	90	122.4	150	204.0	220	299.2
5/8-18	100	136	180	244.8	240	326.4
3/4-10	160	217.6	260	353.6	386	525.0
3/4-16	180	244.8	300	408.0	420	571.2
7/8-9	140	190.4	400	544.0	600	816.0
7/8-14	155	210.8	440	598.4	660	897.6
1-8	220	299.2	580	788.8	900	1,244.0
1-12	240	326.4	640	870.4	1,000	1,360.0

NOTES

- These torque values are to be used for all hardware excluding: locknuts, self-tapping screws, thread forming screws, sheet metal screws and socket head setscrews.
- Recommended seating torque values for locknuts:
 - for prevailing torque locknuts - use 65% of grade 5 torques.
 - for flange whizlock nuts and screws - use 135% of grade 5 torques.
- Unless otherwise noted on assembly drawings, all torque values must meet this specification.

Common Hardware Types

Hex Head Capscrew



Washer



Carriage Bolt



Lockwasher



Hex Nut



Wrench & Fastener Size Guide

1/4" Bolt or Nut Wrench—7/16"	5/16" Bolt or Nut Wrench—1/2"	3/8" Bolt or Nut Wrench—9/16"	7/16" Bolt or Nut Wrench (Bolt)—5/8" Wrench (Nut)—11/16"	1/2" Bolt or Nut Wrench—3/4"
M6 Bolt or Nut Wrench—10mm	M8 Bolt or Nut Wrench—13mm	M10 Bolt or Nut Wrench—17mm	M12 Bolt or Nut Wrench—19mm	M14 Bolt or Nut Wrench—22mm