

APPENDIX H
TORQUE DATA

H-1. GENERAL.

H-1.1 This appendix provides the general torque information listed below. Except where a specific torque value is contained in the text, these torque values should be used to tighten fasteners removed when performing the repair procedures covered in this manual.

Table H-1 — Standard Torque Data for Inch Nuts and Bolts - Given In Foot Pounds.

Table H-2 — Standard Torque Data for Inch Nuts and Bolts - Given In Newton Meters.

Table H-3 — Conversion Table - Inches to Millimeters.

Table H-4 — Conversion Table - Millimeters to Inches.

Table H-1. Standard Torque Data for Inch Nuts and Bolts - Foot Pounds

Recommended torque for all standard unplated nuts and bolts, provided:

- A. Surface finish is oxide coated, oil quenched or bright.
- B. All threaded surfaces are clean and lubricated with SAE-30 engine oil or equivalent (see NOTE).
- C. Joints are rigid, that is, no gaskets or compressible materials are used.
- D. When reusing nuts or bolts, use minimum torque values.

NOTE: Multiply the standard torque by:
.65 when finished jam nuts are used.
.70 when Molykote, white lead or similar mixtures are used as lubricants.
.75 when phosphate coated and oiled bolts or nuts are used.
.85 when cadmium or zinc dichromate bolts or nuts are used.
.90 when hardened surfaces are used under the nut or bolt head.
(this applies to standard unplated hardware only)

1 Foot Pound = 1.355 Newton Meters

Bolt or Stud Diameter	Type 2 Studs Only		Type 2 Bolts 6" Length or Less		Type 2 Bolts Longer Than 6"		Type 5 All Lengths		Type 8 - All Lengths			
									† Only When Used In Cast (gray) Iron		All Other Applications	
Inches	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
1/4	5	6	6	7	4	4	9	10	11	13	13	14
5/16	12	13	11	13	7	8	18	20	22	25	25	28
3/8	21	24	21	24	13	14	33	37	41	46	45	50
7/16	35	38	35	38	20	23	53	60	65	74	75	85
1/2	52	58	52	59	31	35	80	90	100	112	115	130
9/16	70	80	75	85	45	51	115	130	145	160	165	185
5/8	98	110	104	117	62	70	160	180	200	225	225	255
3/4	174	195	185	205	180	200	285	320	355	400	400	450
7/8	280	315	265	300	265	300	460	575	570	640	645	725
1	420	470	380	425	380	425	685	720	855	960	970	1090
1-1/8	595	670	535	600	535	600	850	950	1210	1360	1375	1545
1-1/4	840	945	700	785	700	785	1200	1350	1705	1920	1940	2180
1-3/8	1100	1240	925	1045	925	1045	1570	1760	2235	2515	2540	2860

† When bolt penetration is 1-1/2 times the diameter of the bolt.

Bolt Type Identification Chart

SAE Grade	Description	Bolt Head Marking *
2	WILL BE BLANK IN THE CENTER OF THE HEAD Low or Medium Carbon Steel Not Heat Treated	
5	WILL HAVE 3 RADIAL LINES Quenched and Tempered Medium Carbon Steel	
8	WILL HAVE 6 RADIAL LINES Quenched and Tempered Special Carbon or Alloy Steel	

* The center marking identifies the bolt manufacturer.

Table H-2. Standard Torque Data for Inch Nuts and Bolts - Newton Meters

Recommended torque for all standard unplated nuts and bolts, provided:

- A. Surface finish is oxide coated, oil quenched or bright.
- B. All threaded surfaces are clean and lubricated with SAE-30 engine oil or equivalent (see NOTE).
- C. Joints are rigid, that is, no gaskets or compressible materials are used.
- D. When reusing nuts or bolts, use minimum torque values.

NOTE: Multiply the standard torque by:
.65 when finished jam nuts are used.
.70 when Molykote, white lead or similar mixtures are used as lubricants.
.75 when phosphate coated and oiled bolts or nuts are used.
.85 when cadmium or zinc dichromate bolts or nuts are used.
.90 when hardened surfaces are used under the nut or bolt head.
(this applies to standard unplated hardware only)

1 Newton Meter = 0.738 Foot Pound

Bolt or Stud Diameter	Type 2 Studs Only		Type 2 Bolts 6" Length or Less		Type 2 Bolts Longer Than 6"		Type 5 All Lengths		Type 8 - All Lengths			
									† Only When Used In Cast (gray) Iron		All Other Applications	
Inches	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
1/4	7	8	8	9	5	5	12	14	15	18	18	19
5/16	16	18	15	18	9	11	24	27	30	34	34	38
3/8	28	33	28	33	18	19	45	50	56	62	61	68
7/16	47	52	47	52	27	31	72	81	88	100	102	115
1/2	71	79	71	80	42	47	109	122	136	152	156	176
9/16	95	109	102	115	61	69	156	176	197	217	224	251
5/8	133	149	141	159	84	95	217	244	271	305	305	346
3/4	236	265	251	278	244	271	387	434	482	543	543	611
7/8	380	427	360	407	360	407	624	780	773	868	875	984
1	570	638	516	577	516	577	929	977	1160	1303	1316	1479
1-1/8	807	909	726	814	726	814	1153	1289	1642	1845	1866	2096
1-1/4	1140	1282	950	1065	950	1065	1628	1832	2313	2605	2632	2958
1-3/8	1492	1682	1255	1418	1255	1418	2130	2388	3033	3412	3446	3881

† When bolt penetration is 1-1/2 times the diameter of the bolt.

Bolt Type Identification Chart

SAE Grade	Description	Bolt Head Marking *
2	WILL BE BLANK IN THE CENTER OF THE HEAD Low or Medium Carbon Steel Not Heat Treated	
5	WILL HAVE 3 RADIAL LINES Quenched and Tempered Medium Carbon Steel	
8	WILL HAVE 6 RADIAL LINES Quenched and Tempered Special Carbon or Alloy Steel	

* The center marking identifies the bolt manufacturer.

Table H-3. Conversion Table - Inches to Millimeters

Inches	Millimeters	Inches	Millimeters	Inches	Millimeters	Inches	Millimeters
1	25.4	26	660.4	51	1295.4	76	1930.4
2	50.8	27	685.8	52	1320.8	77	1955.8
3	76.2	28	711.2	53	1346.2	78	1981.2
4	101.6	29	736.6	54	1371.6	79	2006.6
5	127.0	30	762.0	55	1397.0	80	2032.0
6	152.4	31	787.4	56	1422.4	81	2057.4
7	177.8	32	812.8	57	1447.8	82	2082.8
8	203.2	33	838.2	58	1473.2	83	2108.2
9	228.6	34	863.6	59	1498.6	84	2133.6
10	254.0	35	889.0	60	1524.0	85	2159.0
11	279.4	36	914.4	61	1549.4	86	2184.4
12	304.8	37	939.8	62	1574.8	87	2209.8
13	330.2	38	965.2	63	1600.2	88	2235.2
14	355.6	39	990.6	64	1625.6	89	2260.6
15	381.0	40	1016.0	65	1651.0	90	2286.0
16	406.4	41	1041.4	66	1676.4	91	2311.4
17	431.8	42	1066.8	67	1701.8	92	2336.8
18	457.2	43	1092.2	68	1727.2	93	2362.2
19	482.6	44	1117.6	69	1752.6	94	2387.6
20	508.0	45	1143.0	70	1778.0	95	2413.0
21	533.4	46	1168.4	71	1803.4	96	2438.4
22	558.8	47	1193.8	72	1828.8	97	2463.8
23	584.2	48	1219.2	73	1854.2	98	2489.2
24	609.6	49	1244.6	74	1879.6	99	2514.6
25	635.0	50	1270.0	75	1905.0	100	2540.0

1 Inch = 25.4 Millimeters

To convert inches to millimeters, the inch value to be converted should be written down, carried to as many decimal places as the desired accuracy requires. It should then be split into groups of not more than two figures each. The equivalent of each group should then be taken from the table, proper regard being given to the position of the decimal point in each case, and the equivalent values of the groups added together. This sum will be the millimeter equivalent of the inch value given.

For example, to convert 2.4635 inches to millimeters

2.0000 inches = 50.80000 millimeters
 .4600 inches = 11.684000
.0035 inches = .08890
 2.4635 inches = 62.57290 millimeters
 Correct to 3 decimal places.
 2.4635 inches = 62.573 millimeters

Table H-4. Conversion Table - Millimeters to Inches

Millimeters	Inches	Millimeters	Inches	Millimeters	Inches	Millimeters	Inches
1	.0393701	26	1.0236220	51	2.0078740	76	2.9921260
2	.0787402	27	1.0629921	52	2.0472441	77	3.0314961
3	.1181102	28	1.1023622	53	2.0866142	78	3.0708661
4	.1574803	29	1.1417323	54	2.1259842	79	3.1102362
5	.1968504	30	1.1811024	55	2.1653543	80	3.1496063
6	.2362205	31	1.2204724	56	2.2047244	81	3.1889764
7	.2755906	32	1.2598425	57	2.2440945	82	3.2283465
8	.3149606	33	1.2992126	58	2.2834646	83	3.2677165
9	.3543307	34	1.3385827	59	2.3228346	84	3.3070866
10	.3937008	35	1.3779528	60	2.3622047	85	3.3464567
11	.4330709	36	1.4173228	61	2.4015748	86	3.3858268
12	.4724409	37	1.4566929	62	2.4409449	87	3.4251968
13	.5118110	38	1.4960630	63	2.4803150	88	3.4645669
14	.5511811	39	1.5354331	64	2.5196850	89	3.5039370
15	.5905512	40	1.5748031	65	2.5590551	90	3.5433071
16	.6299213	41	1.6141732	66	2.5984252	91	3.5826772
17	.6692913	42	1.6535433	67	2.6377953	92	3.6220472
18	.7086614	43	1.6929134	68	2.6771654	93	3.6614173
19	.7480315	44	1.7322835	69	2.7165354	94	3.7007874
20	.7874016	45	1.7716535	70	2.7559055	95	3.7401575
21	.8267717	46	1.8110236	71	2.7952756	96	3.7795276
22	.8661417	47	1.8503937	72	2.8346457	97	3.8188976
23	.9055118	48	1.8897638	73	2.8740157	98	3.8582677
24	.9448819	49	1.9291339	74	2.9133858	99	3.8976378
25	.9842520	50	1.9685039	75	2.9527559	100	3.9370080

1 Millimeter = .03937008 Inch

To convert millimeters to inches, the millimeter value to be converted should be written down, carried to as many decimal places as the desired accuracy requires. It should then be split into groups of not more than two figures each. The equivalent of each group should then be taken from the table, proper regard being given to the position of the decimal point in each case, and the equivalent values of the groups added together. This sum will be the inch equivalent of the millimeter value given.

For example, to convert 75.384 millimeters to inches:

75.000 millimeters = 2.9527559 inches

.380 millimeters = .0149606

.004 millimeters = .0001574

75.384 millimeters = 2.9678739 inches

Correct to 5 decimal places.

75.384 millimeters = 2.96787 inches