

Section 1 Safety and General Information

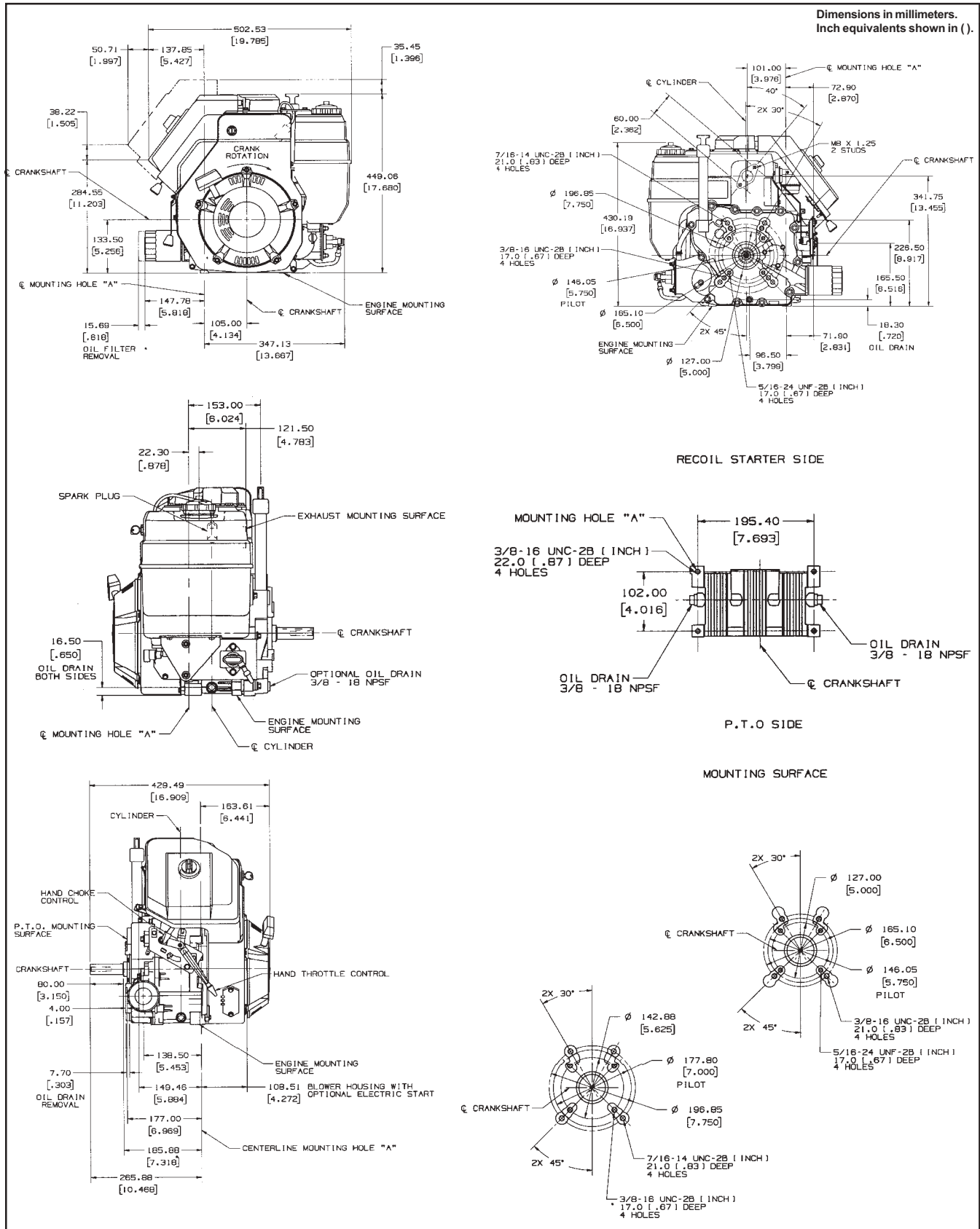


Figure 1-4. Typical Engine Dimensions.

General Specifications¹

Power (@ 3600 RPM, exceeds SAE J1940 HP standards)

CH11	8.20 kW (11 HP)
CH12.5	9.33 kW (12.5 HP)
CH13	9.75 kW (13 HP)
CH14	10.50 kW (14 HP)
CH15	11.20 kW (15 HP)
CH16	11.90 kW (16 HP)

Peak Torque (@ RPM indicated)

CH11 (@ 2400 RPM)	26.7 N·m (19.7 ft. lb)
CH12.5 (@ 2500 RPM)	27.8 N·m (20.5 ft. lb)
CH13 (@ 2400 RPM)	28.8 N·m (21.2 ft. lb)
CH14 (@ 2500 RPM)	27.8 N·m (21.3 ft. lb)
CH15 (@ 2400 RPM)	34.3 N·m (25.3 ft. lb)
CH16 (@ 2400 RPM)	33.9 N·m (25.0 ft. lb)

Bore

CH11, CH12.5, CH13, CH14	87 mm (3.43 in.)
CH15, CH16	90 mm (3.54 in.)

Stroke 67 mm (2.64 in.)

Displacement

CH11, CH12.5, CH13, CH14	398 cc (24.3 cu. in. ³)
CH15, CH16	426 cc (26.0 cu. in. ³)

Compression Ratio 8.5:1

Weight 40 kg (88.3 lb.)

Max. Oil Capacity (w/filter) 1.9 L (2.0 qt.)

Lubrication full pressure w/full flow filter

Air Cleaner

Base Nut Torque 9.9 N·m (88 in. lb.)

Angle of Operation - Maximum (at full oil level)

Intermittent - All Directions 35°

Continuous - All Directions 25°

Balance Shaft

End Play (Free) 0.0575/0.3625 mm (0.0023/0.0137 in.)

Running Clearance 0.025/0.1520 mm (0.0009/0.0059 in.)

Bore I.D.

New 20.000/20.025 mm (0.7874/0.7884 in.)

Max. Wear Limit 20.038 mm (0.7889 in.)

Balance Shaft Bearing Surface O.D.

New 19.962/19.975 mm (0.7859/0.7864 in.)

Max. Wear Limit 19.959 mm (0.7858 in.)

¹Values are in Metric units. Values in parentheses are English equivalents. Lubricate threads with engine oil prior to assembly.

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Camshaft

End Play (Free)	0.0875/0.3925 mm (0.0034/0.0154 in.)
End Play (with Shims)	0.0762/0.1270 mm (0.0030/0.0050 in.)
Running Clearance	0.025/0.1050 mm (0.00098/0.0041 in.)

Bore I.D.

New	20.000/20.025 mm (0.7874/0.7884 in.)
Max. Wear Limit	20.038 mm (0.7889 in.)

Camshaft Bearing Surface O.D.

New	19.962/19.975 mm (0.7859/0.7864 in.)
Max. Wear Limit	19.959 mm (0.7858 in.)

Carburetor

Fuel Bowl Nut Torque	5.1-6.2 N·m (45-55 in. lb.)
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Charging

Stator Mounting Screw Torque	6.2 N·m (55 in. lb.)
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Closure Plate

Oil Filter Tightening	3/4-1 turn after gasket contacts.
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Oil Filter Adapter Fastener Torque	11.3 N·m (100 in. lb.)
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Oil Filter Drain Plug (1/8" NPT) Torque	7.3-9.0 N·m (65-80 in. lb.)
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Closure Plate Fastener Torque	24.4 N·m (216 in. lb.)
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Oil Sentry Pressure Switch Torque	6.8 N·m (60 in. lb.)
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Oil Pump Cover Fastener Torque ²	4.0,6.2 N·m (35,55 in. lb.)
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Connecting Rod

Cap Fastener Torque

6 mm straight shank bolt	11.3 N·m (100 in. lb.)
8 mm straight shank bolt	22.6 N·m (200 in. lb.)
8 mm step-down type bolt	14.7 N·m (130 in. lb.)

Connecting Rod-to-Crankpin Running Clearance at 21°C (70°F)

New	0.030/0.055 mm (0.0012/0.0022 in.)
Max. Wear Limit	0.07 mm (0.0025 in.)

Connecting Rod-to-Crankpin Side Clearance	0.18/0.41 mm (0.007/0.016 in.)
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Connecting Rod-to-Piston Pin Running Clearance 21°C (70°F)	0.015/0.028 mm (0.0006/0.0011 in.)
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Piston Pin End I.D.

New	19.015/19.023 mm (0.7486/0.7489 in.)
Max. Wear Limit	19.036 mm (0.7495 in.)

Crankcase

Governor Cross Shaft Bore I.D.

New	6.025/6.050 mm (0.2372/0.2382 in.)
Max. Wear Limit	6.063 mm (0.2387 in.)

²For self-tapping (thread-forming) fasteners, the higher torque value is for installation into a new cored (non-threaded) hole. The lower torque value is for installation into a used or threaded hole.

Crankshaft

End Play (Free)	0.0575/0.4925 mm (0.0022/0.0193 in.)
End Play (Thrust Bearing with Shims)	0.0500/0.5300 mm (0.0019/0.0208 in.)

Crankshaft Bearing I.D. (In Crankcase)

Sleeve Bearing (Installed) - New	44.965/45.003 mm (1.7703/1.7718 in.)
Sleeve Bearing - Max. Wear Limit	45.016 mm (1.7723 in.)
Parent Material (No Sleeve Bearing) - New	44.965/44.990 mm (1.7703/1.7713 in.)
Parent Material (No Sleeve Bearing) - Max. Wear Limit	45.003 mm (1.7718 in.)

Crankshaft to Bearing Running Clearance - New

Sleeve Bearing	0.030/0.090 mm (0.0011/0.0035 in.)
Parent Material (No Sleeve Bearing)	0.030/0.077 mm (0.0011/0.0030 in.)

Crankshaft Bearing I.D. (In Closure Plate)

Sleeve Bearing (Installed) - New	41.960/42.035 mm (1.6519/1.6549 in.)
Sleeve Bearing - Max. Wear Limit	42.048 mm (1.6554 in.)
Parent Material (No Sleeve Bearing) - New	41.965/42.003 mm (1.6521/1.6536 in.)
Parent Material (No Sleeve Bearing) - Max. Wear Limit	42.015 mm (1.6541 in.)

Crankshaft Bore (In Closure Plate) to Crankshaft Running Clearance - New

Sleeve Bearing	0.025/0.1200 mm (0.00098/0.00472 in.)
Parent Material (No Sleeve Bearing)	0.030/0.0880 mm (0.0011/0.0034 in.)

Flywheel End Main Bearing Journal

O.D. - New	44.913/44.935 mm (1.7682/1.7691 in.)
O.D. - Max. Wear Limit	44.84 mm (1.765 in.)
Max. Taper	0.022 mm (0.0009 in.)
Max. Out-of-Round	0.025 mm (0.0010 in.)

Closure Plate End Main Bearing Journal

O.D. - New	41.915/41.935 mm (1.6502/1.6510 in.)
O.D. - Max. Wear Limit	41.86 mm (1.648 in.)
Max. Taper	0.020 mm (0.0008 in.)
Max. Out-of-Round	0.025 mm (0.0010 in.)

Connecting Rod Journal

O.D. - New	38.958/38.970 mm (1.5338/1.5343 in.)
O.D. - Max. Wear Limit	38.94 mm (1.5328 in.)
Max. Taper	0.012 mm (0.0005 in.)
Max. Out-of-Round	0.025 mm (0.0010 in.)

Crankshaft T.I.R.

PTO End, Crank in Engine	0.304 mm (0.012 in.)
Entire Crank, in V-Blocks	0.10 mm (0.0039 in.)

Cylinder Bore

Cylinder Bore I.D.

New

CH11-14	87.000/87.025 mm (3.4252/3.4262 in.)
CH15, CH16	90.000/90.025 mm (3.5433/3.5442 in.)

Max. Wear Limit

CH11-14	87.063 mm (3.4277 in.)
CH15, CH16	90.063 mm (3.5457 in.)

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Cylinder Bore I.D. cont'd.

Max. Out-of-Round

CH11-14 0.12 mm (0.0047 in.)

CH15, CH16 0.12 mm (0.0047 in.)

Max. Taper

CH11-14 0.05 mm (0.0020 in.)

CH15, CH16 0.05 mm (0.0020 in.)

Cylinder Head

Cylinder Head Fastener Torque (torque in 2 increments) 24,48.9 N·m (18,36 ft. lb.)

Max. Out-of-Flatness 0.076 mm (0.003 in.)

Rocker Pedestal Fastener Torque 9.9 N·m (88 in. lb.)

Electric Starter

Thru Bolt Torque

UTE/Johnson Electric, Eaton (Inertia Drive) 4.5-5.7 N·m (40-50 in. lb.)

Nippondenso (Solenoid Shift) 4.5-7.5 N·m (40-84 in. lb.)

Delco-Remy (Solenoid Shift) 5.6-9.0 N·m (49-79 in. lb.)

Drive Pinion Fastener Torque (some Inertia Drive Starters) 15.3 N·m (135 in. lb.)

Brush Holder Mounting Screw Torque

Delco-Remy Starter 2.5-3.3 N·m (22-29 in. lb.)

Solenoid (Starter)

Mounting Hardware Torque

Nippondenso Starter 6.0-9.0 N·m (53-79 in. lb.)

Delco-Remy Starter 4.0-6.0 N·m (35-53 in. lb.)

Nut, Positive (+) Brush Lead Torque

Nippondenso Starter 8.0-12.0 N·m (71-106 in. lb.)

Delco-Remy Starter 6.0-9.0 N·m (53-79 in. lb.)

Fan/Flywheel

Fan Fastener Torque 9.9 N·m (88 in. lb.)

Flywheel Retaining Screw Torque 66.4 N·m (49 ft. lb.)

Fuel Pump

Fuel Pump/Cover Fastener Screw Torque 9.0 N·m (80 in. lb.) into new holes

4.2-5.1 N·m (37-45 in. lb.) into used holes

Fuel Tank

Fuel Tank Fastener Torque 7.3 N·m (65 in. lb.)

Governor

Governor Cross Shaft to Crankcase Running Clearance 0.025/0.075 mm (0.0010/0.0030 in.)

Governor Cross Shaft O.D.

New 5.975/6.000 mm (0.2352/0.2362 in.)

Max. Wear Limit 5.962 mm (0.2347 in.)

Governor Gear Shaft-to-Governor Gear Running Clearance 0.015/0.140 mm (0.0006/0.0055 in.)

Governor Gear Shaft O.D.

New 5.990/6.000 mm (0.2358/0.2362 in.)

Max. Wear Limit 5.977 mm (0.2353 in.)

Ignition

Spark Plug Type (Champion® or equivalent) RC12YC or Platinum 3071

Spark Plug Gap

CH11-15 1.02 mm (0.040 in.)
CH16 0.76 mm (0.030 in.)

Spark Plug Torque 38.0-43.4 N·m (28-32 ft. lb.)

Ignition Module Air Gap 0.203/0.305 mm (0.008/0.012 in.)

Ignition Module Fastener Torque 4.0 N·m (35 in. lb.) into new holes
6.2 N·m (55 in. lb.) into used holes

Muffler

Muffler Retaining Nuts 24.4 N·m (216 in. lb.)

Piston, Piston Rings, and Piston Pin

Piston-to-Piston Pin (selective fit) 0.006/0.017 mm (0.0002/0.0007 in.)

Piston Pin Bore I.D.

New 19.006/19.012 mm (0.7483/0.7485 in.)
Max. Wear Limit 19.025 mm (0.7490 in.)

Piston Pin O.D.

New 18.995/19.000 mm (0.7478/0.7480 in.)
Max. Wear Limit 18.994 mm (0.74779 in.)

Top Compression Ring-to-Groove Side Clearance

CH11-14 0.040/0.105 mm (0.0016/0.0041 in.)
CH15, CH16 0.060/0.105 mm (0.0023/0.0041 in.)

Middle Compression Ring-to-Groove Side Clearance

CH11-14 0.040/0.072 mm (0.0016/0.0028 in.)
CH15, CH16 0.040/0.085 mm (0.0015/0.0002 in.)

Oil Control Ring-to-Groove Side Clearance

CH11-14 0.551/0.675 mm (0.0217/0.0266 in.)
CH15, CH16 0.176/0.026 (0.0069/0.0010 in.)

Top and Center Compression Ring End Gap

New Bore
CH11-14 0.3/0.5 mm (0.012/0.020 in.)
CH15, CH16 0.27/0.51 mm (0.010/0.020 in.)
Used Bore (Max.) 0.77 mm (0.030 in.)

Piston Thrust Face O.D.

New
CH11-14³ 86.941/86.959 mm (3.4229/3.4236 in.)
CH15, CH16⁴ 89.951/89.969 mm (3.5413/3.5420 in.)
Max. Wear Limit
CH11-14 86.814 mm (3.4179 in.)
CH15, CH16 89.824 mm (3.5363 in.)

³Measure 6 mm (0.236 in.) above the bottom of the piston skirt at right angles to the piston pin.

⁴Measure 8 mm (0.314 in.) above the bottom of the piston skirt at right angles to the piston pin.

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Piston Thrust Face-to-Cylinder Bore Running Clearance - New	
CH11-14	0.041/0.044 mm (0.0016/0.0017 in.)
CH15, CH16	0.031/0.043 mm (0.0012/0.0016 in.)

Retractable Starter

Center Screw Torque	7.4-8.5 N·m (65-75 in. lb.)
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Throttle/Choke Controls

Governor Control Lever Fastener Torque	9.9 N·m (88 in. lb.)
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Speed Control Bracket Assembly Fastener Torque ²	7.3-10.7 N·m (65-95 in. lb.)
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Valve Cover/Rocker Arms

Valve Cover Fastener Torque ²	7.3-10.7 N·m (65-95 in. lb.)
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Rocker Arm I.D.

New	15.837/16.127 mm (0.63/0.64 in.)
Max. Wear Limit	16.13 mm (0.640 in.)

Rocker Shaft O.D.

New	15.90/15.85 mm (0.63 in.)
Max. Wear Limit	15.727 mm (0.619 in.)

Valves and Valve Lifters

Hydraulic Valve Lifter to Crankcase Running Clearance	0.0124/0.0501 mm (0.0005/0.0020 in.)
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Intake Valve Stem-to-Valve Guide Running Clearance	0.038/0.076 mm (0.0015/0.0030 in.)
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Exhaust Valve Stem-to-Valve Guide Running Clearance	0.050/0.088 mm (0.0020/0.0035 in.)
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Intake Valve Guide I.D.

New	7.038/7.058 mm (0.2771/0.2779 in.)
Max. Wear Limit	7.134 mm (0.2809 in.)

Exhaust Valve Guide I.D.

New	7.038/7.058 mm (0.2771/0.2779 in.)
Max. Wear Limit	7.159 mm (0.2819 in.)

Valve Guide Reamer Size

STD	7.048 mm (0.2775 in.)
0.25 mm O.S.	7.298 mm (0.2873 in.)

Intake Valve Minimum Lift	8.96 mm (0.353 in.)
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Exhaust Valve Minimum Lift	9.14 mm (0.360 in.)
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Nominal Valve Seat Angle	45°
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²For self-tapping (thread-forming) fasteners, the higher torque value is for installation into a new cored (non-threaded) hole. The lower torque value is for installation into a used or threaded hole.

General Torque Values

Metric Fastener Torque Recommendations for Standard Applications

Tightening Torque: N·m (in. lb.) + or - 10%						
Property Class						
						Noncritical Fasteners Into Aluminum
Size						
M4	1.2 (11)	1.7 (15)	2.9 (26)	4.1 (36)	5.0 (44)	2.0 (18)
M5	2.5 (22)	3.2 (28)	5.8 (51)	8.1 (72)	9.7 (86)	4.0 (35)
M6	4.3 (38)	5.7 (50)	9.9 (88)	14.0 (124)	16.5 (146)	6.8 (60)
M8	10.5 (93)	13.6 (120)	24.4 (216)	33.9 (300)	40.7 (360)	17.0 (150)

Tightening Torque: N·m (ft. lb.) + or - 10%						
Property Class						
						Noncritical Fasteners Into Aluminum
Size						
M10	21.7 (16)	27.1 (20)	47.5 (35)	66.4 (49)	81.4 (60)	33.9 (25)
M12	36.6 (27)	47.5 (35)	82.7 (61)	116.6 (86)	139.7 (103)	61.0 (45)
M14	58.3 (43)	76.4 (55)	131.5 (97)	184.4 (136)	219.7 (162)	94.9 (70)

Oil Drain Plugs Tightening Torque: N·m (English Equiv.)

Size	Into Cast Iron	Into Aluminum
1/8" NPT	-	4.5 (40 in. lb.)
1/4"	17.0 (150 in. lb.)	11.3 (100 in. lb.)
3/8"	20.3 (180 in. lb.)	13.6 (120 in. lb.)
1/2"	27.1 (20 ft. lb.)	17.6 (13 ft. lb.)
3/4"	33.9 (25 ft. lb.)	21.7 (16 ft. lb.)
X-708-1	27.1/33.9 (20/25 ft. lb.)	27.1/33.9 (20/25 ft. lb.)

Torque Conversions

N·m = in. lb. x 0.113
 N·m = ft. lb. x 1.356
 in. lb. = N·m x 8.85
 ft. lb. = N·m x 0.737