

Section 1

Safety and General Information

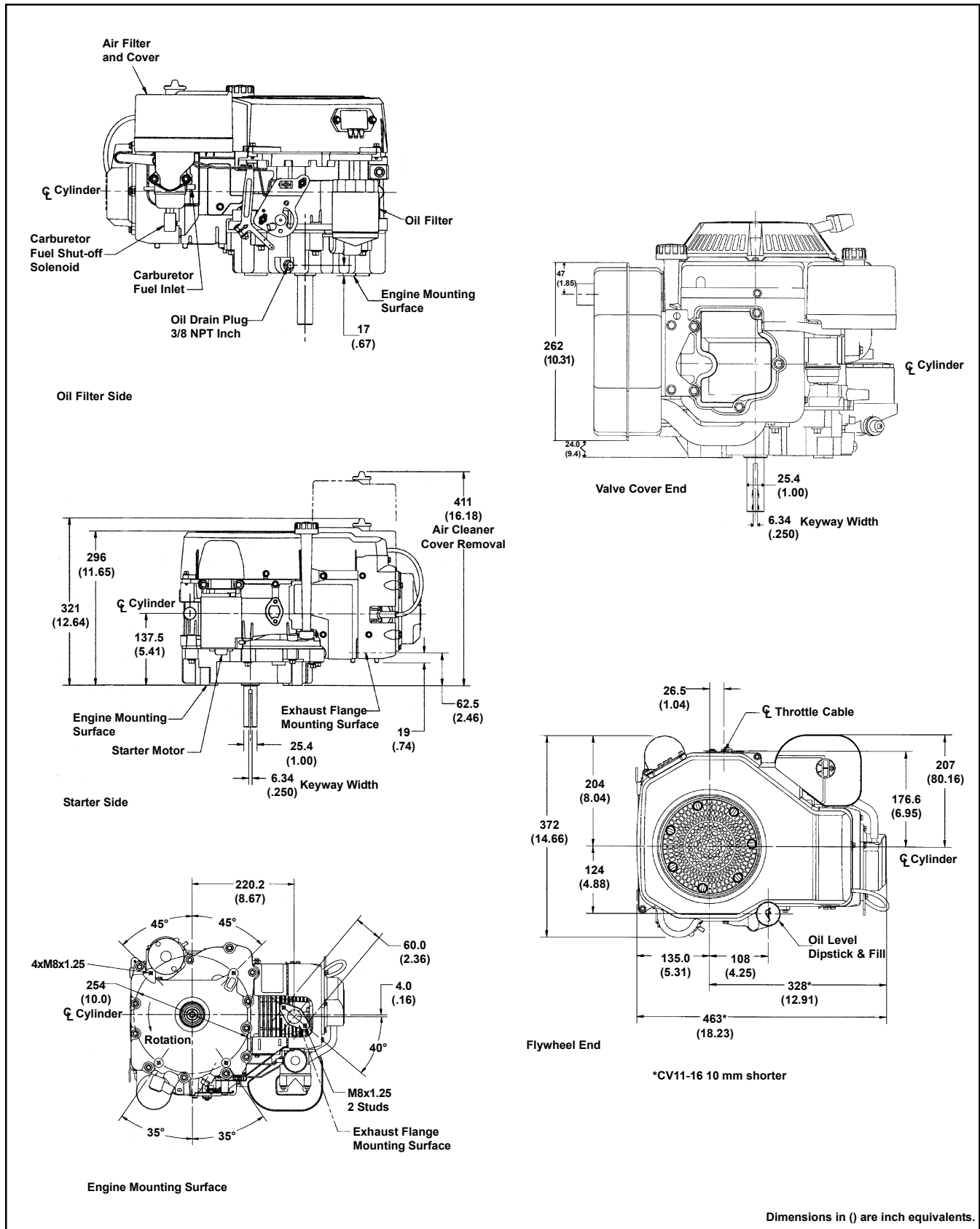


Figure 1-4. Typical Engine Dimensions.

General Specifications¹

Power (@ 3600 RPM, corrected to SAE J1995)

| | |
|-----------------|-----------------------------------|
| CV11 | 8.2 kW (11 HP) |
| CV12.5 | 9.33 kW (12.5 HP) |
| CV13 | 9.75 kW (13 HP) |
| CV14 | 10.5 kW (14 HP) |
| CV15 | 11.19 kW (15 HP) |
| CV16 | 11.9 kW (16 HP) |
| CV460-465 | 11.9 kW (16 HP)-13.0 kW (16.5 HP) |
| CV490-495 | 12.7 kW (17 HP)-13.4 kW (18 HP) |

Max Torque (@ RPM indicated)

| | |
|-----------------|--|
| CV11 | 27.4 N·m (20.2 ft. lb.) @ 2000 |
| CV12.5 | 27.8 N·m (20.5 ft. lb.) @ 2500 |
| CV13 | 27.8 N·m (20.5 ft. lb.) @ 2500 |
| CV14 | 28.9 N·m (21.3 ft. lb.) @ 2500 |
| CV15 | 33.2 N·m (24.5 ft. lb.) @ 2400 |
| CV16 | 35.3 N·m (26.0 ft. lb.) @ 2400 |
| CV460-465 | 36.3 N·m (26.8 ft. lb.) @ 2400 |
| CV490-495 | 37.8 N·m (27.9 ft. lb.)-38.1 N·m (28.1 ft. lb.) @ 2400 |

Bore

| | |
|-----------------------------|------------------|
| CV11-14, CV460-465 | 87 mm (3.43 in.) |
| CV15, CV16, CV490-495 | 90 mm (3.60 in.) |

Stroke

| | |
|----------------------------|------------------|
| CV11-16 | 67 mm (2.64 in.) |
| CV460-465, CV490-495 | 77 mm (3.03 in.) |

Displacement

| | |
|------------------|-------------------------------------|
| CV11-14 | 398 cc (24.3 cu. in. ³) |
| CV15, CV16 | 426 cc (26.0 cu. in. ³) |
| CV460-465 | 460 cc (27.9 cu. in. ³) |
| CV490-495 | 490 cc (29.9 cu. in. ³) |

Compression Ratio 8.5:1

Weight (approx.)

| | |
|----------------------------|-------------------|
| CV11-16 | 39.54 kg (87 lb.) |
| CV460-465, CV490-495 | 41.9 kg (90 lb.) |

Oil Capacity (approx.) 1.9 L (2.0 U.S. qt.)

Air Cleaner

| | |
|-----------------------|----------------------|
| Base Nut Torque | 9.9 N·m (88 in. lb.) |
| Wing Nut Torque | 1.5 N·m (12 in. lb.) |

Angle of Operation - Maximum (at full oil level)

| | |
|-------------------------------------|-----|
| Intermittent - All Directions | 35° |
| Continuous - All Directions | 20° |

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

Section 1

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Balance Shaft

End Play 0.0575/0.3625 mm (0.0027/0.0137 in.)

Running Clearance 0.0250/0.1520 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.)

Camshaft

End Play (free) 0.088/0.393 mm (0.003/0.015 in.)

End Play (with shims) 0.076/0.127 mm (0.003/0.005 in.)

Running Clearance 0.025/0.105 mm (0.0010/0.0041 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

Preliminary Low Idle Fuel Needle Setting 1 Turn

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

Connecting Rod

Cap Fastener Torque (torque in increments)

6 mm straight shank bolt 11.3 N·m (100 in. lb.)

8 mm step-down bolt 14.7 N·m (130 in. lb.)

8 mm straight shank bolt 22.7 N·m (200 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.)

Connecting Rod-to-Piston Pin Running Clearance at 21°C (70°F) 0.015/0.028 mm (0.0006/0.0011 in.)

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.)

Crankshaft

| | |
|--|--------------------------------------|
| End Play (free) | 0.0575/0.4925 mm (0.0022/0.0193 in.) |
| End Play (thrust bearing with shims) | 0.050/0.530 mm (0.0020/0.0209 in.) |

Crankshaft Bore in Crankcase I.D.

| | |
|-----------------------|--|
| New | 44.965/44.990 mm (1.7702/1.7712 in.) |
| Max. Wear Limit | 44.9758/45.0012 mm (1.7707/1.7717 in.) |

Crankshaft Bore in Crankcase Running Clearance

| | |
|-----------|--------------------------------------|
| New | 0.0300/0.0770 mm (0.0011/0.0030 in.) |
|-----------|--------------------------------------|

Crankshaft Bore in Oil Pan I.D.

| | |
|-----------------------|--|
| New | 41.965/42.003 mm (1.6521/1.6536 in.) |
| Max. Wear Limit | 41.9760/42.0141 mm (1.6526/1.6541 in.) |

Crankshaft Bore in Oil Pan Running Clearance

| | |
|-----------|--------------------------------------|
| New | 0.0300/0.0880 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.) |

Oil Pan 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 | 38.958/30.970 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 | 0.30 mm (0.012 in.) |
| Entire Crank, in V-Blocks | 0.10 mm (0.0039 in.) |

Cylinder Bore

Cylinder Bore I.D.

| | |
|-----------------------------|--------------------------------------|
| New | |
| CV11-14, CV460-465 | 87.000/87.025 mm (3.4252/3.4262 in.) |
| CV15, CV16, CV490-495 | 90.000/90.025 mm (3.5433/3.5443 in.) |
| Max. Wear Limit | |
| CV11-14, CV460-465 | 87.063 mm (3.4277 in.) |
| CV15, CV16, CV490-495 | 90.063 mm (3.5458 in.) |
| Max. Out-of-Round | 0.12 mm (0.0047 in.) |
| Max. Taper | 0.05 mm (0.0020 in.) |

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Cylinder Head

| | |
|--|-------------------------------|
| Cylinder Head Fastener Torque (torque in 2 increments) | 20, 40.7 N·m (15, 30 ft. lb.) |
| Max. Out-of-Flatness | 0.076 mm (0.003 in.) |
| Rocker Pedestal Fastener Torque | 11.3 N·m (100 in. lb.) |

Electric Starter

Starter Thru Bolt Torque

| | |
|---|-----------------------------|
| UTE/Johnson Electric, Eaton (Inertia Drive) | 4.5-5.7 N·m (40-50 in. lb.) |
| Nippendenso (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.) |
| Starter Mounting Screw Torque (All) | 15.3 N·m (135 in. lb.) |

Solenoid Mounting Hardware (Nut/Screw) Torque

| | |
|---------------------------|-----------------------------|
| Nippendenso Starter | 6.0-9.0 N·m (53-79 in. lb.) |
| Delco-Remy Starter | 4.0-6.0 N·m (35-53 in. lb.) |

Brush Holder Mounting Screw Torque

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

Nut, Positive (+) Brush Lead Torque

| | |
|---------------------------|-------------------------------|
| Nippendenso 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 Fastener Torque | 9.0 N·m (80 in. lb.) Into new as-cast hole 4.2-5.1 N·m (37-45 in. lb.) Into used hole |
| Fuel Pump Pad Cover Fastener Torque | 10.7 N·m (95 in. lb.) Into new as-cast hole 7.3 N·m (65 in. lb.) Into used hole |

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 ... | 0.050/0.160 mm (0.0019/0.0063 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 (Standard) or Premium Gold 2071 (Pro Series) |
|---|--|

Spark Plug Gap

| | |
|-------------------------------------|---------------------|
| CV11-15, CV460-465, CV490-495 | 1.02 mm (0.040 in.) |
| CV11-14 LP, CV16 | 0.76 mm (0.030 in.) |

Ignition (Cont'd)

| | |
|---------------------------------------|---|
| Spark Plug Torque | 24.4-29.8 N·m (18-22 ft. lb.) |
| Ignition Module Air Gap | 0.200/0.300 mm (0.0078/0.0118 in.) |
| Ignition Module Fastener Torque | 6.2 N·m (55 in. lb.) Into new as-cast hole 4.0 N·m (35 in. lb.) Into used hole |

Muffler

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

Oil Filter/Oil Pan

| | |
|---|---|
| Oil Filter Torque | 10.4-12.7 N·m (90-110 in. lb.) |
| Oil Filter Drain Plug (1/8" NPT) Torque | 7.3-9.0 N·m (65-80 in. lb.) |
| Oil Pan Fastener Torque | 24.4 N·m (216 in. lb.) |
| Oil Sentry™ Pressure Switch Torque | 6.8 N·m (60 in. lb.) |
| Oil Pump Cover Fastener Torque | 6.2 N·m (55 in. lb.) Into new as-cast hole 4.0 N·m (35 in. lb.) Into used hole |

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 | |
| CV11-14, CV460-465 | 0.034/0.100 mm (0.0013/0.0039 in.) |
| CV15, CV16, CV490-495 | 0.060/0.105 mm (0.0023/0.0041 in.) |
| Middle Compression Ring-to-Groove Side Clearance | |
| CV11-14, CV460-465 | 0.040/0.080 mm (0.0016/0.0032 in.) |
| CV15, CV16, CV490-495 | 0.040/0.085 mm (0.0015/0.0033 in.) |
| Oil Control Ring-to-Groove Side Clearance | |
| CV11-14, CV460-465 | 0.036/0.186 mm (0.0014/0.0073 in.) |
| CV15, CV16, CV490-495 | 0.036/0.186 mm (0.0014/0.0073 in.) |
| Top Compression Ring End Gap | |
| New Bore | |
| CV11-14, CV460-465 | 0.250/0.500 mm (0.010/0.020 in.) |
| CV15, CV16, CV490-495 | 0.28/0.51 mm (0.011/0.020 in.) |
| Used Bore (max.) | 0.79 mm (0.031 in.) |

Section 1

Safety and General Information

Piston, Piston Rings, and Piston Pin (Cont'd.)

Center Compression Ring End Gap

New Bore

| | |
|-----------------------------|-----------------------------------|
| CV11-14, CV460-465 | 0.250/0.510 mm (0.0010/0.020 in.) |
| CV15, CV16, CV490-495 | 0.22/0.48 mm (0.008/0.018 in.) |
| Used Bore (max.) | 0.76 mm (0.030 in.) |

Oil Control Ring End Gap

| | |
|-----------------------------|------------------------------------|
| CV11-14, CV460-465 | 0.250/1.020 mm (0.010/0.040 in.) |
| CV15, CV16, CV490-495 | 0.250/0.760 mm (0.0098/0.0299 in.) |

Piston Thrust Face O.D. (See Figure 10-4)

New

| | |
|-----------------------------|--------------------------------------|
| CV11-14, CV460-465 | 86.941/86.959 mm (3.4229/3.4236 in.) |
| CV15, CV16, CV490-495 | 89.951/89.969 mm (3.5413/3.5420 in.) |

Max. Wear Limit

| | |
|-----------------------------|------------------------|
| CV11-14, CV460-465 | 86.814 mm (3.4179 in.) |
| CV15, CV16, CV490-495 | 89.824 mm (3.5363 in.) |

Piston Thrust Face (See Figure 10-4)-to-Cylinder Bore Running Clearance - New

| | |
|-----------------------------|------------------------------------|
| CV11-14, CV460-465 | 0.041/0.044 mm (0.0016/0.0017 in.) |
| CV15, CV16, CV490-495 | 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.) |
|---------------------------|-----------------------------|

Stator

| | |
|------------------------------------|----------------------|
| Stator Mounting Screw Torque | 6.2 N·m (55 in. lb.) |
|------------------------------------|----------------------|

Throttle/Choke Controls

| | |
|--|----------------------|
| Governor Control Lever Fastener Torque | 9.9 N·m (88 in. lb.) |
|--|----------------------|

| | |
|--|--|
| Speed Control Bracket Assembly Fastener Torque | 10.7 N·m (95 in. lb.) Into new as-cast hole 7.3 N·m (65 in. lb.) Into used hole |
|--|--|

Valve Cover/Rocker Arms

| | |
|-----------------------------------|--|
| Valve Cover Fastener Torque | 10.7 N·m (95 in. lb.) Into new as-cast hole 7.3 N·m (65 in. lb.) Into used hole |
|-----------------------------------|--|

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.) |

Non-Adjustable Valve Lash Configuration

| | |
|-------------------------------|------------------------|
| Rocker Arm Screw Torque | 11.3 N·m (100 in. lb.) |
|-------------------------------|------------------------|

Adjustable Valve Lash Configuration

| | |
|------------------------------------|------------------------|
| Rocker Arm Pivot Stud Torque | 11.3 N·m (100 in. lb.) |
| Adjustment Set Screw Torque | 7.3 N·m (65 in. lb.) |

Valves and Valve Lifters






| | |
|---|--------------------------------------|
| Hydraulic Valve Lifter to Crankcase Running Clearance | 0.0124/0.0501 mm (0.0005/0.0020 in.) |
| Intake Valve Stem-to-Valve Guide Running Clearance | 0.038/0.076 mm (0.0015/0.0030 in.) |
| Exhaust Valve Stem-to-Valve Guide Running Clearance | 0.050/0.088 mm (0.0020/0.0035 in.) |
| 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.) |
| Exhaust Valve Minimum Lift | 9.14 mm (0.360 in.) |
| Nominal Valve Seat Angle | 45° |






Section 1

Safety and General Information

General Torque Values

Metric Fastener Torque Recommendations for Standard Applications

| Tightening Torque: N·m (in. lb.) + or - 10% | | | | | | |
|---|---|---|---|---|---|-------------------------------------|
| | Property Class | | | | | |
| |  |  |  |  |  | |
| Size | | | | | | Noncritical Fasteners Into Aluminum |
| 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 |
| 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