

Section 1

Safety and General Information

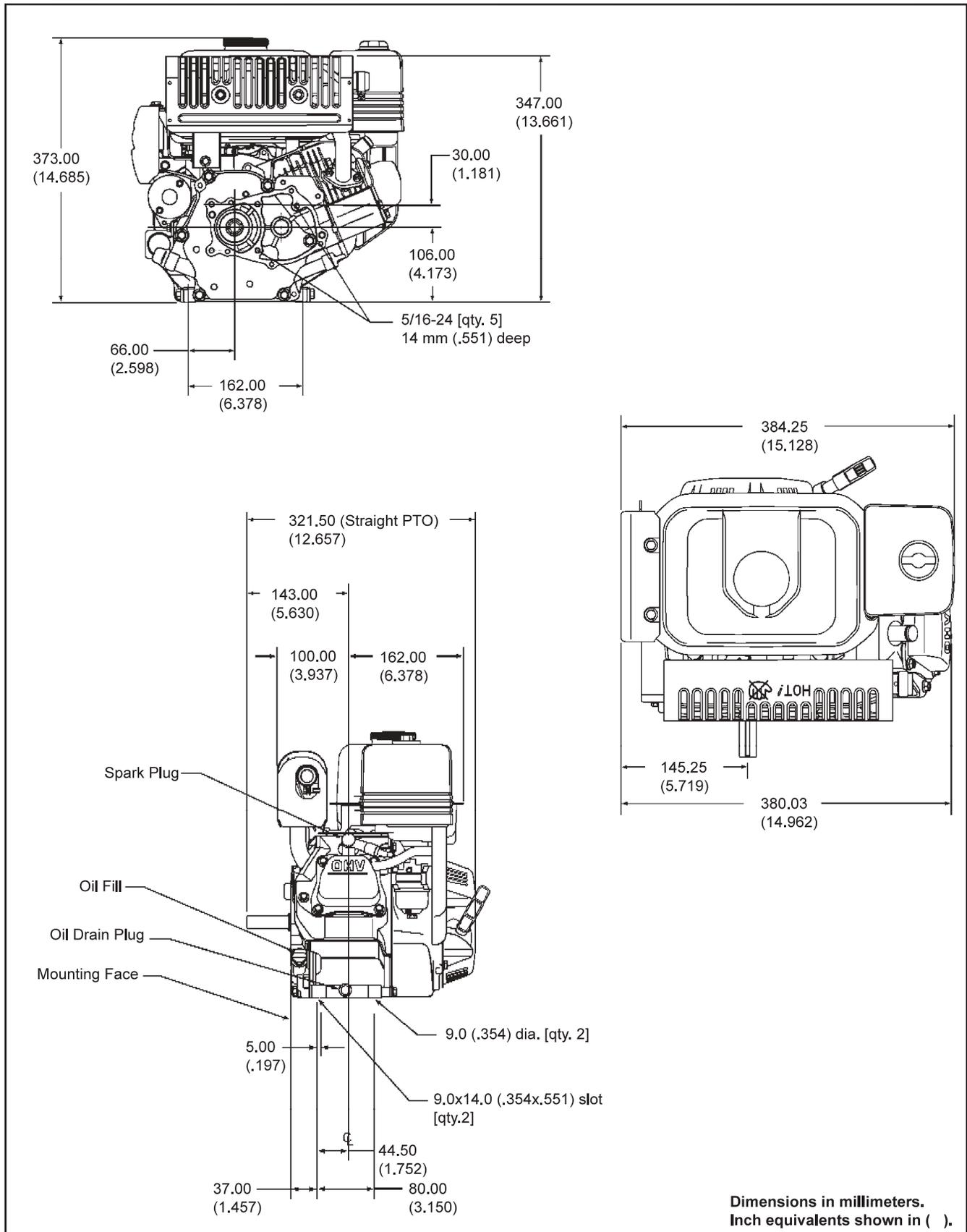


Figure 1-7. Typical Engine Dimensions CS4 and CS6.

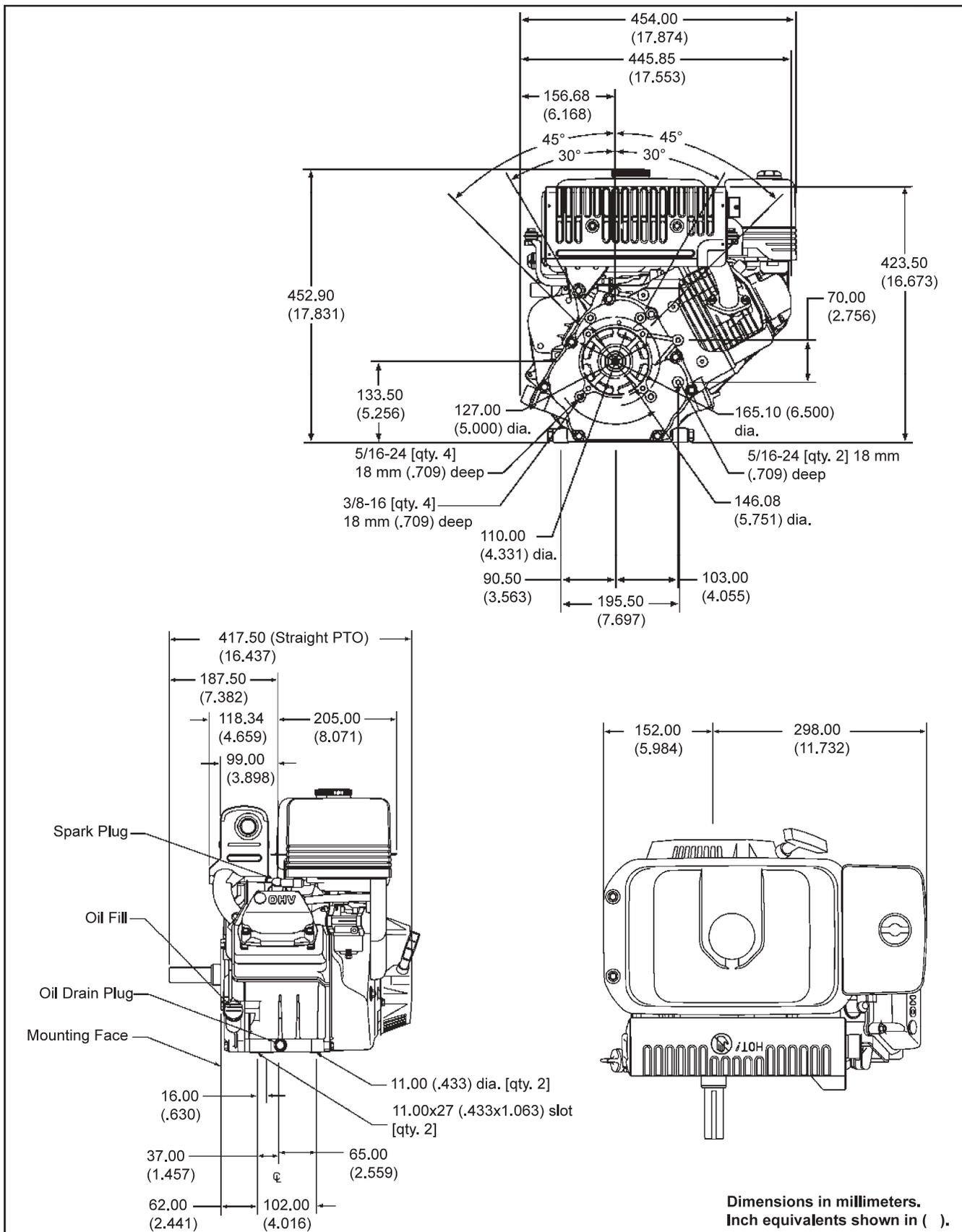


Figure 1-8. Typical Engine Dimensions CS8.5 (spec. 92xxxx), CS10, and CS12 - 12.75.

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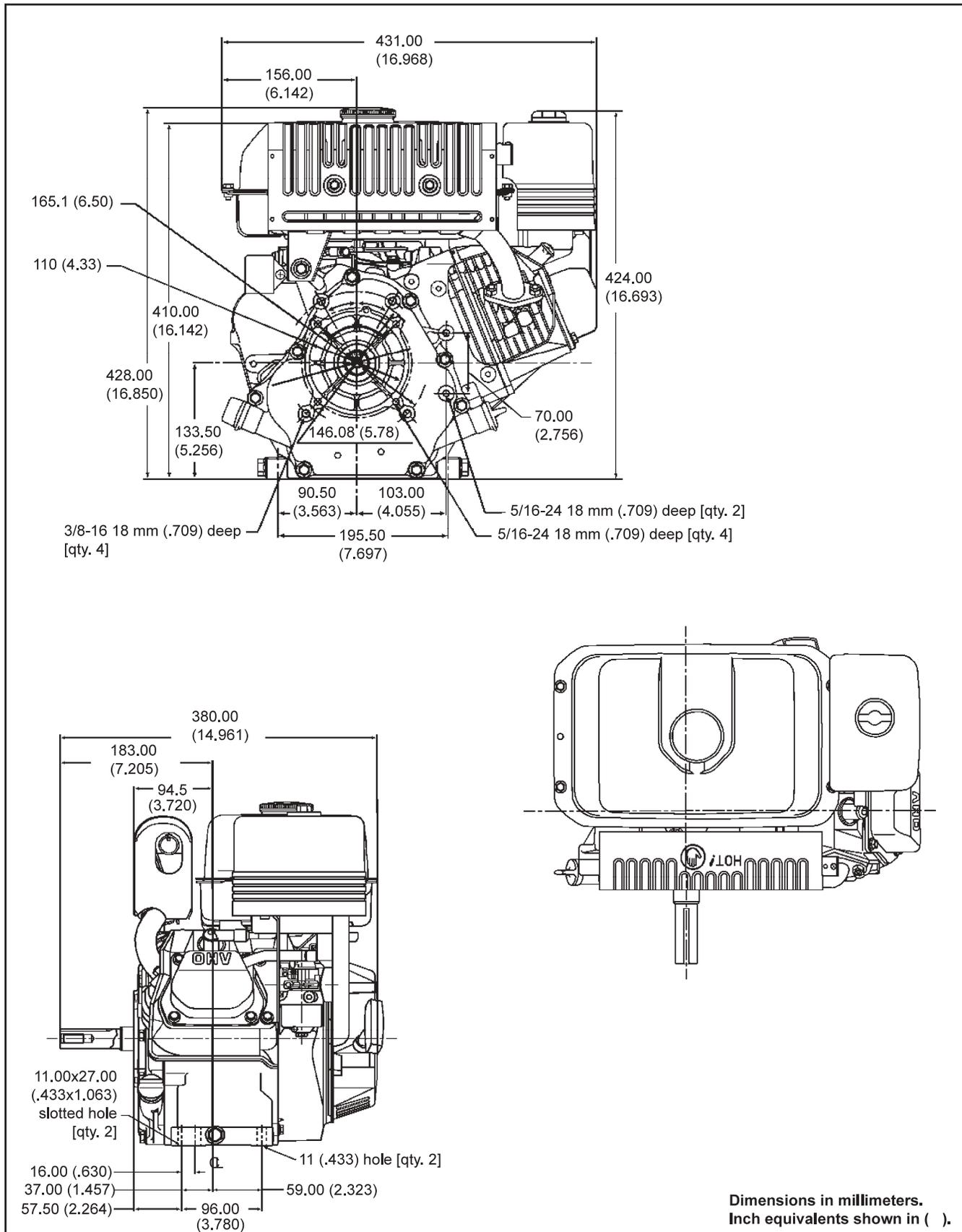


Figure 1-9. Typical Engine Dimensions CS8.5 (spec. 95xxxx).

General Specifications

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

CS4	2.9 kW (4 HP)
CS6	4.47 kW (6 HP)
CS8.5 (spec. 95xxxx).....	5.40 kW (8.5 HP)
CS8.5 (spec. 92xxxx).....	6.33 kW (8.5 HP)
CS10	7.45 kW (10 HP)
CS12	8.95 kW (12 HP)
Hydro 12.75.....	9.5 kW (12.75 HP)

Peak Torque

CS4 (@ 2000 RPM)	7.6 N·m (5.6 ft. lb.)
CS6 (@ 2000 RPM)	10.8 N·m (8 ft. lb.)
CS8.5 (spec. 95xxxx @ 2400 RPM)	16.5 N·m (12.1 ft. lb.)
CS8.5 (spec. 92xxxx @ 2000 RPM)	19.66 N·m (14.5 ft. lb.)
CS10 (@ 2000 RPM)	19.66 N·m (14.5 ft. lb.)
CS12 (spec. 9415xx @ 2000 RPM)	22.6 N·m (16.7 ft. lb.)
CS12 (spec. 9416xx @ 2400 RPM)	24.9 N·m (18.4 ft. lb.)
Hydro 12.75 (@ 2400 RPM)	30.6 N·m (22.6 ft. lb.)

Bore

CS4	56.0 mm (2.20 in.)
CS6	66.0 mm (2.60 in.)
CS8.5 (spec. 95xxxx).....	75.0 mm (2.95 in.)
CS8.5 (spec. 92xxxx).....	78.0 mm (3.07 in.)
CS10	78.0 mm (3.07 in.)
CS12	85.0 mm (3.35 in.)

Stroke

CS4,CS6	50.0 mm (1.97 in.)
CS8.5 (spec. 95xxxx).....	57.0 mm (2.44 in.)
CS8.5 (spec. 92xxxx).....	63.0 mm (2.48 in.)
CS10-12.....	63.0 mm (2.48 in.)

Displacement

CS4	123 cc (7.50 cu. in.)
CS6	171 cc (10.43 cu. in.)
CS8.5 (spec. 95xxxx).....	251 cc (15.30 cu. in.)
CS8.5 (spec. 92xxxx).....	301 cc (18.37 cu. in.)
CS10	301 cc (18.37 cu. in.)
CS12	357 cc (21.79 cu. in.)

Compression Ratio

CS4	8.3:1
CS6	8.5:1
CS8.5 (spec. 95xxxx).....	8.3:1
CS8.5 (spec. 92xxxx).....	8.1:1
CS10-12.....	8.1:1

Weight (Approx.)

CS4,CS6	15.4 kg (35 lb.)
CS8.5 (spec. 95xxxx).....	26 kg (57.2 lb.)
CS8.5 (spec. 92xxxx).....	31.9 kg (70.5 lb.)
CS10-12.....	31.9 kg (70.5 lb.)

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General Specifications cont.

Oil Capacity (Approx.)

CS4,CS6	0.6 L (0.64 U.S. qt.)
CS8.5 (spec. 95xxxx).....	1.0 L (1.1 U.S. qt.)
CS8.5 (spec. 92xxxx).....	1.1 L (1.2 U.S. qt.)
CS10-12	1.1 L (1.2 U.S. qt.)

Fuel Tank Capacity

CS4,CS6	3.9 L (4.1 U.S. qt.)
CS8.5 (spec. 95xxxx).....	6.0 L (6.3 U.S. qt.)
CS8.5 (spec. 92xxxx).....	6.9 L (7.3 U.S. qt.)
CS10-12	6.9 L (7.3 U.S. qt.)

Angle of Operation – Maximum (At Full Oil Level) All Directions 20°

Air Cleaner

Base Bolt Torque..... 5-8 N·m (44-71 in. lb.)

Base Nut Torque

CS4,CS6	5-8 N·m (44-71 in. lb.)
CS8.5 (spec. 95xxxx).....	5-8 N·m (44-71 in. lb.)
CS8.5 (spec. 92xxxx).....	10-12 N·m (88-106 in. lb.)
CS10-12	10-12 N·m (88-106 in. lb.)

Camshaft

End Play..... 0.05 mm (0.0020 in.)

Bore I.D. – Max. Wear Limit

CS4,CS6	14.95 mm (0.583 in.)
CS8.5-12.....	15.95 mm (0.627 in.)

Camshaft Bearing Surface O.D. – Max. Wear Limit

CS4,CS6	15.05 mm (0.592 in.)
CS8.5-12.....	16.05 mm (0.649 in.)

Carburetor

Fuel Bowl Retaining Screw Torque

CS4,CS6	7 N·m (62 in. lb.)
CS8.5-12.....	9 N·m (79 in. lb.)

Throttle/Choke Plate Screws Torque..... 1.5-2.5 N·m (13-22 in. lb.)

Connecting Rod

Connecting Rod Fastener Torque

CS4,CS6	12 N·m (106 in. lb.)
CS8.5 (spec. 95xxxx).....	12 N·m (106 in. lb.)
CS8.5 (spec. 92xxxx).....	20 N·m (177 in. lb.)
CS10-12	20 N·m (177 in. lb.)

Connecting Rod-to-Crankpin Running Clearance

New.....	0.016/0.046 mm (0.0006/0.0018 in.)
Max. Wear Limit.....	0.1 mm (0.004 in.)

Connecting Rod-to-Crankpin Side Clearance

CS4,CS6	0.2/0.6 mm (0.008/0.024 in.)
CS8.5 (spec. 95xxxx).....	0.2/0.6 mm (0.008/0.024 in.)
CS8.5 (spec. 92xxxx).....	0.2/0.65 mm (0.0079/0.0256 in.)
CS10-12	0.2/0.65 mm (0.0079/0.0256 in.)

Connecting Rod cont.

Connecting Rod-to-Piston Pin Running Clearance..... 0.006/0.025 mm (0.0002/0.0001 in.)

Piston Pin End I.D.

New

CS4,CS6 16.006/16.020 mm (0.6301/0.6307 in.)
 CS8.5 (spec. 95xxxx) 18.006/18.020 mm (0.7089/0.7094 in.)
 CS8.5 (spec. 92xxxx) 20.006/20.020 mm (0.7876/0.7882 in.)
 CS10-12..... 20.006/20.020 mm (0.7876/0.7882 in.)

Max. Wear Limit

CS4,CS6 16.10 mm (0.634 in.)
 CS8.5 (95xxxx) 18.10 mm (0.713 in.)
 CS8.5 (92xxxx) 20.10 mm (0.791 in.)
 CS10-12..... 20.10 mm (0.791 in.)

Connecting Rod Journal End I.D.

New

CS4,CS6 28.000/28.015 mm (1.1023/1.1029 in.)
 CS8.5 (spec. 95xxxx) 32.000/32.015 mm (1.2598/1.2604 in.)
 CS8.5 (spec. 92xxxx) 36.000/36.015 mm (1.4173/1.4179 in.)
 CS10-12..... 36.000/36.015 mm (1.4173/1.4179 in.)

Max. Wear Limit

CS4,CS6 28.115 mm (1.1069 in.)
 CS8.5 (95xxxx) 32.115 mm (1.2644 in.)
 CS8.5 (92xxxx) 36.115 mm (1.4219 in.)
 CS10-12..... 36.115 mm (1.4219 in.)

Crankcase

Closure Plate Fastener Torque

CS4,CS6 22 N·m (195 in. lb.)
 CS8.5-12 30 N·m (265 in. lb.)

Oil Drain Plugs Torque

CS4,CS6 17 N·m (150 in. lb.)
 CS8.5-12 20 N·m (177 in. lb.)

Crankshaft

End Play (Free) 0.04 mm (0.0015 in.)

End Play (Threaded Pump Shaft Models Only)..... 0.0/0.2 mm (0.0/0.007 in.)

Flywheel End Main Bearing Journal O.D.

New

CS4,CS6 52 mm (2.047 in.)
 CS8.5 (spec. 95xxxx) 52 mm (2.047 in.)
 CS8.5 (spec. 92xxxx) 80 mm (3.149 in.)
 CS10-12..... 80 mm (3.149 in.)

Max. Wear Limit

CS4,CS6 52.05 mm (2.0492 in.)
 CS8.5 (spec. 95xxxx) 52.05 mm (2.0492 in.)
 CS8.5 (spec. 92xxxx) 80.05 mm (3.1515 in.)
 CS10-12..... 80.05 mm (3.1515 in.)

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Crankshaft cont.

PTO End Main Bearing Journal O.D.

New

CS4,CS6	52 mm (2.047 in.)
CS8.5 (spec. 95xxxx)	52 mm (2.047 in.)
CS8.5 (spec. 92xxxx)	72 mm (2.834 in.)
CS10-12.....	72 mm (2.834 in.)

Max. Wear Limit

CS4,CS6	52.05 mm (2.0492 in.)
CS8.5 (spec. 95xxxx)	52.05 mm (2.0492 in.)
CS8.5 (spec. 92xxxx)	72.05 mm (2.836 in.)
CS10-12.....	72.05 mm (2.836 in.)

Connecting Rod Journal O.D.

New

CS4,CS6	27.969/27.984 mm (1.011/1.017 in.)
CS8.5 (spec. 95xxxx)	31.969/31.984 mm (1.2586/1.2592 in.)
CS8.5 (spec. 92xxxx)	35.969/35.984 mm (1.4161/1.4167 in.)
CS10-12.....	35.969/35.984 mm (1.4161/1.4167 in.)

Max. Wear Limit

CS4,CS6	27.9 mm (1.098 in.)
CS8.5 (spec. 95xxxx)	31.9 mm (1.2559 in.)
CS8.5 (spec. 92xxxx)	35.9 mm (1.4134 in.)
CS10-12.....	35.9 mm (1.4134 in.)

Crankshaft

Runout (Either End)	0.02 mm (0.0008 in.)
Limit (Either End).....	0.04 mm (0.0016 in.)

Cylinder Bore

Cylinder Bore I.D.

New

CS4	56.005/56.015 mm (2.2049/2.2053 in.)
CS6	66.005/66.015 mm (2.5986/2.5990 in.)
CS8.5 (spec. 95xxxx)	75.005/75.015 mm (2.9530/2.9533 in.)
CS8.5 (spec. 92xxxx)	78.00/78.02 mm (3.0709/3.0717 in.)
CS10	78.00/78.02 mm (3.0709/3.0717 in.)
CS12	85.00/85.02 mm (3.3465/3.3472 in.)

Max. Wear Limit

CS4	56.15 mm (2.211 in.)
CS6	66.15 mm (2.604 in.)
CS8.5 (spec. 95xxxx)	75.15 mm (2.959 in.)
CS8.5 (spec. 92xxxx)	78.65 mm (3.096 in.)
CS10	78.65 mm (3.096 in.)
CS12	85.65 mm (3.372 in.)

Max. Out-of-Round	0.05 mm (0.002 in.)
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Cylinder Head

Cylinder Head Bolt Torque

CS4,CS6	20 N·m (177 in. lb.)
CS8.5-12.....	50 N·m (36 ft. lb.)

Max. Out-of-Flatness	0.1 mm (0.004 in.)
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Electric Starter

Thru Bolt (Case) Torque

CS8.5-12.....	5.3 N·m (47.7 in. lb.)
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Electric Starter cont.

Mounting Bolts (To Block) Torque	
CS8.5-12	16 N·m (141 in. lb.)

Flywheel

Flywheel Retaining Screw Torque	
CS4,CS6	65 N·m (48 ft. lb.)
CS8.5 (spec. 95xxxx).....	65 N·m (48 ft. lb.)
CS8.5 (spec. 92xxxx).....	120 N·m (85 ft. lb.)
CS10-12.....	120 N·m (85 ft. lb.)

Fuel Tank

Fuel Tank Fastener Screws Torque	8-12 N·m (71-106 in. lb.)
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Ignition

Spark Plug Type	
NGK.....	BPR4ES (13/16 hex)
Champion®	RN14YC (13/16 hex)
Champion®	RC14YC (5/8) hex
Spark Plug Gap.....	0.76 mm (0.030 in.)
Spark Plug Torque.....	20 N·m (14.7 ft. lb./177 in. lb.)
Ignition Module Air Gap	0.4/0.6 mm (0.015/0.023 in.)
Ignition Module Mounting Screws Torque	10 N·m (88 in. lb.)
Stator Mounting Screw Torque	5-8 N·m (44-70 in. lb.)

Muffler

Muffler Torque (Flange Nuts & Bracket Bolts)	
CS4,CS6	8-12 N·m (71-106 in. lb.)
CS8.5-12	18-22 N·m (159-195 in. lb.)

Oil Sentry™

Oil Sentry™ Float Switch Torque	10 N·m (88 in. lb.)
Oil Sentry™ Indicator Light Retaining Nut Torque.....	0.6-0.8 N·m (5-7 in. lb.)

Piston, Piston Rings, and Piston Pin

Piston-to-Piston Pin Clearance	
CS4,CS6	0.002/0.018 mm (0.0001/0.0007 in.)
CS8.5-12	0.004/0.020 mm (0.0002/0.0008 in.)

Piston Pin Bore I.D.

New	
CS4,CS6	16.002/16.013 mm (0.6300/0.6304 in.)
CS8.5 (spec. 95xxxx)	18.004/18.015 mm (0.7088/0.7093 in.)
CS8.5 (spec. 92xxxx)	20.004/20.015 mm (0.7876/0.7880 in.)
CS10-12.....	20.004/20.015 mm (0.7876/0.7880 in.)
Max. Wear Limit	
CS4,CS6	16.03 mm (0.6311 in.)
CS8.5 (spec. 95xxxx)	18.03 mm (0.7098 in.)
CS8.5 (spec. 92xxxx)	20.03 mm (0.7886 in.)
CS10-12.....	20.03 mm (0.7886 in.)

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Piston, Piston Rings, and Piston Pin cont.

Piston Pin O.D.

New

CS4,CS6	15.995/16.000 mm (0.6297/0.6299 in.)
CS8.5 (spec. 95xxxx)	17.995/18.000 mm (0.7084/0.7086 in.)
CS8.5 (spec. 92xxxx)	19.995/20.000 mm (0.7872/0.7874 in.)
CS10-12	19.995/20.000 mm (0.7872/0.7874 in.)

Max. Wear Limit

CS4,CS6	15.98 mm (0.6291 in.)
CS8.5 (spec. 95xxxx)	17.98 mm (0.7079 in.)
CS8.5 (spec. 92xxxx)	19.98 mm (0.7866 in.)
CS10-12	19.98 mm (0.7866 in.)

Top Compression Ring-to-Groove Side Clearance 0.04/0.08 mm (0.0016/0.003 in.)

Middle Compression Ring-to-Groove Side Clearance

CS4,CS6	0.02/0.06 mm (0.0008/0.0024 in.)
CS8.5-12	0.03/0.07 mm (0.0012/0.0028 in.)

Top Compression Ring End Gap

CS4,CS6	0.2/0.4 mm (0.008/0.016 in.)
CS8.5 (spec. 95xxxx).....	0.25/0.4 mm (0.010/0.016 in.)
CS8.5 (spec. 92xxxx).....	0.2/0.4 mm (0.008/0.016 in.)
CS10	0.2/0.4 mm (0.008/0.016 in.)
CS12	0.25/0.4 mm (0.010/0.016 in.)

Middle Compression Ring End Gap

CS4,CS6	0.2/0.4 mm (0.008/0.016 in.)
CS8.5 (spec. 95xxxx).....	0.25/0.4 mm (0.010/0.016 in.)
CS8.5 (spec. 92xxxx).....	0.2/0.4 mm (0.008/0.016 in.)
CS10	0.2/0.4 mm (0.008/0.016 in.)
CS12	0.25/0.4 mm (0.010/0.016 in.)

Oil Control Ring End Gap

CS4,CS6	0.2/0.4 mm (0.0079/0.0157 in.)
CS8.5-12	0.2/0.7 mm (0.0079/0.028 in.)

Piston Thrust Face O.D.²

New

CS4 ²	55.975/55.990 mm (2.2037/2.2043 in.)
CS6 ²	65.975/65.990 mm (2.597/2.598 in.)
CS8.5 ³ (spec. 95xxxx)	74.954/74.998 mm (2.9509/2.9527 in.)
CS8.5 ³ (spec. 92xxxx)	77.954/77.998 mm (3.0691/3.0708 in.)
CS10 ³	77.954/77.998 mm (3.0691/3.0708 in.)
CS12 ³	84.954/84.998 mm (3.3446/3.3464 in.)

Max. Wear Limit

CS4	55.900 mm (2.20 in.)
CS6	65.900 mm (2.60 in.)
CS8.5 (spec. 95xxxx)	74.898 mm (2.9487 in.)
CS8.5 (spec. 92xxxx)	77.898 mm (3.0669 in.)
CS10	77.898 mm (3.0669 in.)
CS12	84.898 mm (3.3424 in.)

Piston Thrust Face-to-Cylinder Bore Running Clearance

CS4,CS6 ²	0.015/0.040 mm (0.0006/0.0016 in.)
CS8.5-12 ³	0.002/0.066 mm (0.0001/0.0026 in.)

Reduction System

Case Mounting Bolt(s) Torque

CS4,CS6	10 N·m (88 in. lb.)
CS8.5-12	30 N·m (22 ft. lb.)

Crankshaft Gear Bolt Torque

CS4,CS6	22 N·m (195 in. lb.)
CS8.5 (spec. 95xxxx).....	22 N·m (195 in. lb.)
CS8.5 (spec. 92xxxx).....	65 N·m (48 ft. lb.)
CS10-12.....	65 N·m (48 ft. lb.)

Retractable Starter

Mounting Screws to Blower Housing Torque

CS4,CS6	6.5 N·m (57 in. lb.)
CS8.5-12	7 N·m (62 in. lb.)

Rocker Arm

Stud Into Cylinder Head Torque

CS4,CS6	10 N·m (88 in. lb.)
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Adjusting Jam Nut Torque..... 7 N·m (62 in. lb.)

Throttle Control

Throttle Control Lever Fastener Torque

CS4,CS6	7-9 N·m (62-80 in. lb.)
CS8.5-12	9-11 N·m (80-97 in. lb.)

Valve Cover

Valve Cover Fastener Torque

CS4,CS6	10 N·m (88 in. lb.)
CS8.5-12	11 N·m (97 in. lb.)

Valves and Valve Lifters

Intake Valve Stem-to-Valve Guide Running Clearance

CS4,CS6	0.04/0.06 mm (0.0016/0.0024 in.)
CS8.5-12	0.037/0.064 mm (0.0015/0.0025 in.)

Exhaust Valve Stem-to-Valve Guide Running Clearance

CS4,CS6	0.06/0.08 mm (0.002/0.003 in.)
CS8.5-12.....	0.045/0.072 mm (0.0018/0.0028 in.)

Intake Valve Guide I.D.

New

CS4,CS6	5.5 mm (0.22 in.)
CS8.5-12.....	6.0/6.012 mm (0.2362/0.2367 in.)

Max. Wear Limit

CS4,CS6	5.60 mm (0.220 in.)
CS8.5-12.....	6.10 mm (0.240 in.)

Exhaust Valve Guide I.D.

New

CS4,CS6	5.5 mm (0.22 in.)
CS8.5-12.....	6.0/6.012 mm (0.2362/0.2367 in.)

Max. Wear Limit

CS4,CS6	5.6 mm (0.220 in.)
CS8.5-12.....	6.0 mm (0.236 in.)

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Valves and Valve Lifters

Valve Guide Reamer Size

STD

CS4,CS6	5.5 mm (0.216 in.)
CS8.5-12.....	6.0 mm (0.236 in.)

Intake Valve Minimum Lift

CS4,CS6	2.4 mm (0.094 in.)
CS8.5-12.....	2.7 mm (0.106 in.)

Exhaust Valve Minimum Lift

CS4,CS6	2.7 mm (0.106 in.)
CS8.5-12.....	2.9 mm (0.114 in.)

Nominal Valve Seat Angle..... 45°

Valve-to-Tappet Clearance (Cold)..... 0.1 mm (0.004 in.)

Notes:

1. Values are in Metric units. Values in parenthesis are English equivalents. Lubricate threads with engine oil prior to assembly.
2. Measure 5 mm (0.197 in.) above the bottom of the piston skirt at right angles to the piston pin.
3. Measure 10 mm (0.394 in.) above the bottom of the piston skirt at right angles to the piston pin.

Oil Drain Plugs Tightening Torque: N·m (in. lb.)

Size	Into Aluminum	Model
M10x1.25	17 (150)	CS4, CS6
M12x1.50	20 (177)	CS8.5, CS10, CS12

Torque Conversions

<p>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</p>
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