

SERVICE MANUAL

COMMAND CV11-16, CV460-465, CV490-495

VERTICAL CRANKSHAFT



KOHLER
engines

**BORN
TO RUN™**

Section 1

Safety and General Information

Safety Precautions

To insure safe operations please read the following statements and understand their meaning. Also refer to your equipment manufacturer's manual for other important safety information. This manual contains safety precautions which are explained below. Please read carefully.

 **WARNING**

Warning is used to indicate the presence of a hazard that *can* cause *severe* personal injury, death, or substantial property damage if the warning is ignored.

 **CAUTION**

Caution is used to indicate the presence of a hazard that *will* or *can* cause *minor* personal injury or property damage if the caution is ignored.

NOTE

Note is used to notify people of installation, operation, or maintenance information that is important but not hazard-related.



For Your Safety!

These precautions should be followed at all times. Failure to follow these precautions could result in injury to yourself and others.



 WARNING

<p>Accidental Starts can cause severe injury or death.</p> <p>Disconnect and ground spark plug leads before servicing.</p>

Accidental Starts!
Disabling engine. Accidental starting can cause severe injury or death. Before working on the engine or equipment, disable the engine as follows: 1) Disconnect the spark plug lead(s). 2) Disconnect negative (-) battery cable from battery.

 WARNING

<p>Rotating Parts can cause severe injury.</p> <p>Stay away while engine is in operation.</p>



Rotating Parts!
Keep hands, feet, hair, and clothing away from all moving parts to prevent injury. Never operate the engine with covers, shrouds, or guards removed.

 WARNING

<p>Hot Parts can cause severe burns.</p> <p>Do not touch engine while operating or just after stopping.</p>

Hot Parts!
Engine components can get extremely hot from operation. To prevent severe burns, do not touch these areas while the engine is running—or immediately after it is turned off. Never operate the engine with heat shields or guards removed.



Section 1

Safety and General Information

 WARNING

Explosive Fuel can cause fires and severe burns.
Stop engine before filling fuel tank.



Explosive Fuel!

Gasoline is extremely flammable and its vapors can explode if ignited. Store gasoline only in approved containers, in well ventilated, unoccupied buildings, away from sparks or flames. Do not fill the fuel tank while the engine is hot or running, since spilled fuel could ignite if it comes in contact with hot parts or sparks from ignition. Do not start the engine near spilled fuel. Never use gasoline as a cleaning agent.

 WARNING

Cleaning Solvents can cause severe injury or death.
Use only in well ventilated areas away from ignition sources.

Flammable Solvents!

Carburetor cleaners and solvents are extremely flammable. Keep sparks, flames, and other sources of ignition away from the area. Follow the cleaner manufacturer's warnings and instructions on its proper and safe use. Never use gasoline as a cleaning agent.

 WARNING

Carbon Monoxide can cause severe nausea, fainting or death.
Do not operate engine in closed or confined area.

Lethal Exhaust Gases!



Engine exhaust gases contain poisonous carbon monoxide. Carbon monoxide is odorless, colorless, and can cause death if inhaled. Avoid inhaling exhaust fumes, and never run the engine in a closed building or confined area.

 WARNING

Uncoiling Spring can cause severe injury.
Wear safety goggles or face protection when servicing retractable starter.

Spring Under Tension!



Retractable starters contain a powerful, recoil spring that is under tension. Always wear safety goggles when servicing retractable starters and carefully follow instructions in "Retractable Starter" Section 7 for relieving spring tension.

 WARNING

Explosive Gas can cause fires and severe acid burns.
Charge battery only in a well ventilated area. Keep sources of ignition away.

Explosive Gas!

Batteries produce explosive hydrogen gas while being charged. To prevent a fire or explosion, charge batteries only in well ventilated areas. Keep sparks, open flames, and other sources of ignition away from the battery at all times. Keep batteries out of the reach of children. Remove all jewelry when servicing batteries.

Before disconnecting the negative (-) ground cable, make sure all switches are OFF. If ON, a spark will occur at the ground cable terminal which could cause an explosion if hydrogen gas or gasoline vapors are present.

 CAUTION

Electrical Shock can cause injury.
Do not touch wires while engine is running.

Electrical Shock!

Never touch electrical wires or components while the engine is running. They can be sources of electrical shock.

Engine Identification Numbers

When ordering parts, or in any communication involving an engine, always give the **Model, Specification, and Serial Numbers** of the engine.

The engine identification numbers appear on a decal (or decals) affixed to the engine shrouding. See Figure 1-1. An explanation of these numbers is shown in Figure 1-2.



Figure 1-1. Engine Identification Decal Location.

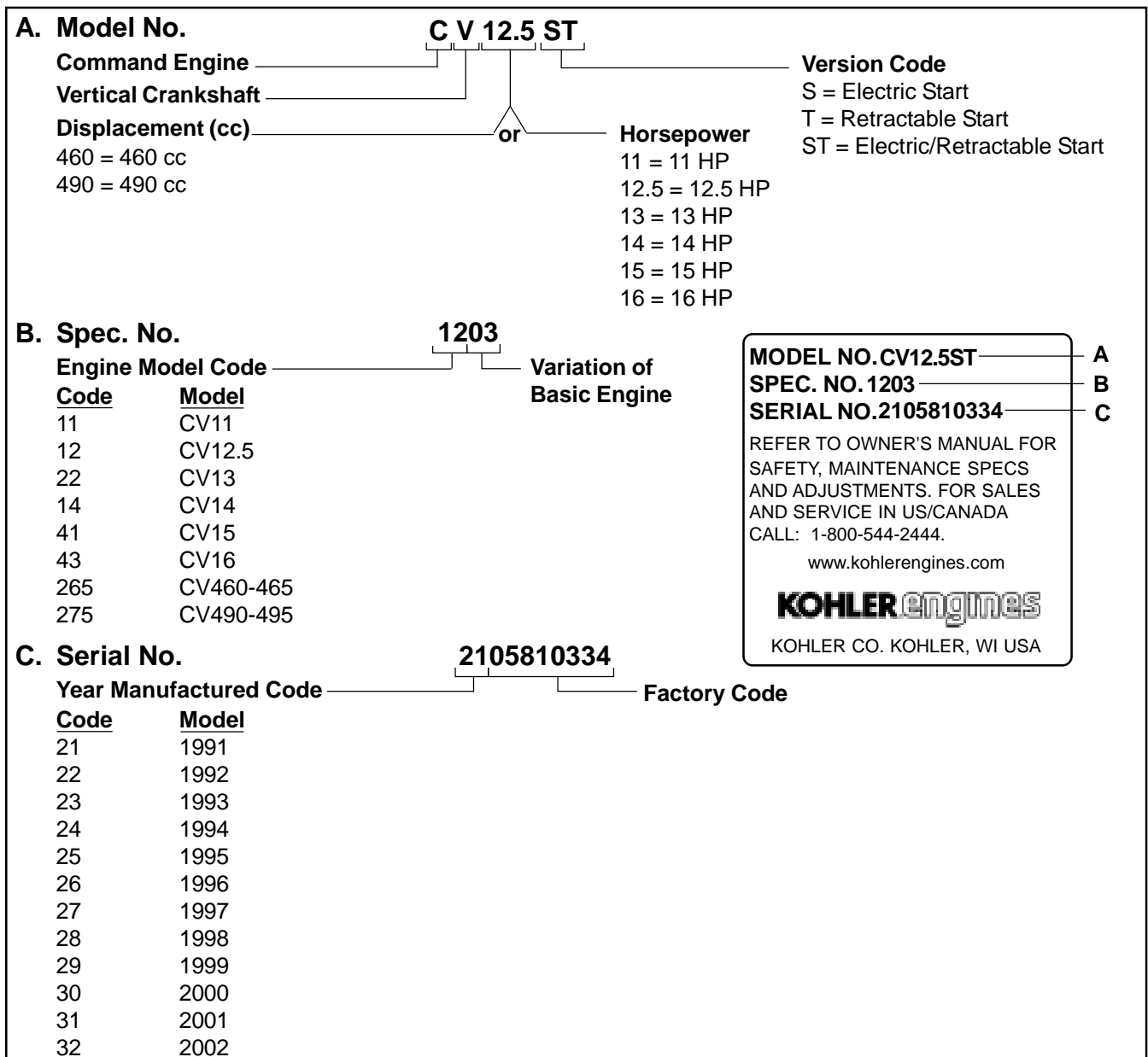


Figure 1-2. Explanation of Engine Identification Numbers.

Section 1

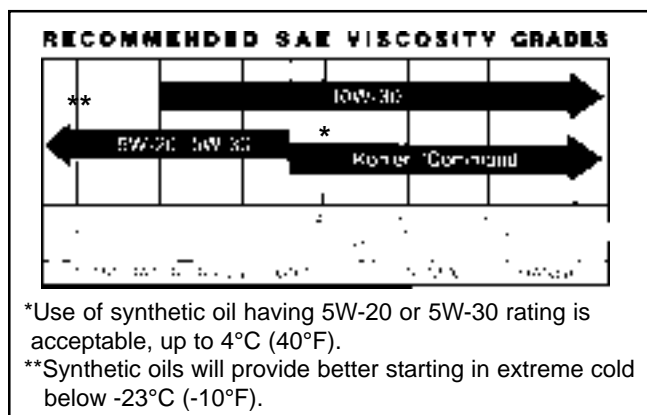
Safety and General Information

Oil Recommendations

Using the proper type and weight of oil in the crankcase is extremely important, as is checking oil daily, and changing oil regularly. Failure to use the correct oil, or using dirty oil, causes premature engine wear and failure. **Synthetic oil** is recommended for use in LPG-fueled engines because there is less oxidation or thickening, and deposit accumulation on intake valves is substantially reduced.

Oil Type

Use high-quality detergent oil of **API (American Petroleum Institute) service class SG, SH, SJ or higher**. Select the viscosity based on the air temperature at the time of operation as shown below.



NOTE: Using other than service class SG, SH, SJ or higher oil, or extending oil change intervals longer than recommended, can cause engine damage.

A logo or symbol on oil containers identifies the API service class and SAE viscosity grade. See Figure 1-3.



Figure 1-3. Oil Container Logo.

Refer to Section 6 - "Lubrication System" for detailed oil check, oil change, and oil filter change procedures.

Fuel Recommendations



WARNING: Explosive Fuel!

Gasoline is extremely flammable and its vapors can explode if ignited. Store gasoline only in approved containers, in well ventilated, unoccupied buildings, away from sparks or flames. Do not fill the fuel tank while the engine is hot or running, since spilled fuel could ignite if it comes in contact with hot parts or sparks from ignition. Do not start the engine near spilled fuel. Never use gasoline as a cleaning agent.

General Recommendations

Purchase gasoline in small quantities and store in clean, approved containers. A container with a capacity of 2 gallons or less with a pouring spout is recommended. Such a container is easier to handle and helps eliminate spillage during refueling.

Do not use gasoline left over from the previous season, to minimize gum deposits in your fuel system and to insure easy starting.

Do not add oil to the gasoline.

Do not overfill the fuel tank. Leave room for the fuel to expand.

Fuel Type

For best results, use only clean, fresh, unleaded gasoline with a pump sticker octane rating of 87 or higher. In countries using the Research method, it should be 90 octane minimum.

Unleaded gasoline is recommended, as it leaves less combustion chamber deposits. Leaded gasoline may be used in areas where unleaded is not available and exhaust emissions are not regulated. Be aware however, that the cylinder head will require more frequent service.

Gasoline/Alcohol blends

Gasohol (up to 10% ethyl alcohol, 90% unleaded gasoline by volume) is approved as a fuel for Kohler engines. Other gasoline/alcohol blends are not approved.

Gasoline/Ether blends

Methyl Tertiary Butyl Ether (MTBE) and unleaded gasoline blends (up to maximum of 15% MTBE by volume) are approved as a fuel for Kohler engines. Other gasoline/ether blends are not approved.

Periodic Maintenance



WARNING: Accidental Starts!

Disabling engine. Accidental starting can cause severe injury or death. Before working on the engine or equipment, disable the engine as follows: 1) Disconnect the spark plug lead(s). 2) Disconnect negative (-) battery cable from battery.

Maintenance Schedule

These required maintenance procedures should be performed at the frequency stated in the table. They should also be included as part of any seasonal tune-up.

Frequency	Maintenance Required	Refer to:
Daily or Before Starting Engine	<ul style="list-style-type: none"> • Fill fuel tank. • Check oil level. • Check air cleaner for dirty¹, loose, or damaged parts. • Check air intake and cooling areas, clean as necessary¹. 	Section 5 Section 6 Section 4 Section 4
Every 25 Hours	<ul style="list-style-type: none"> • Service precleaner element¹. 	Section 4
Every 100 Hours	<ul style="list-style-type: none"> • Replace air cleaner element¹. • Change oil¹. • Remove cooling shrouds and clean cooling areas¹. 	Section 4 Section 6 Section 4
Every 200 Hours	<ul style="list-style-type: none"> • Change oil filter¹. • Check spark plug condition and gap. 	Section 6 Section 8
Annually or Every 500 Hours	<ul style="list-style-type: none"> • Have bendix starter drive serviced². • Have solenoid shift starter disassembled and cleaned². 	Section 8 Section 8

¹Perform these maintenance procedures more frequently under extremely dusty, dirty conditions.

²Have a Kohler Engine Service Dealer perform this service. Not necessary on Delco Starters.

Storage

If the engine will be out of service for two months or more, use the following storage procedure.

1. Clean the exterior surfaces of the engine.
2. Change the oil and oil filter while the engine is still warm from operation. See "Change Oil and Oil Filter" in Section 6.
3. The fuel system must be completely emptied, or the gasoline must be treated with a stabilizer to prevent deterioration. If you choose to use a stabilizer, follow the manufacturers recommendations, and add the correct amount for the capacity of the fuel system. Fill the fuel tank with clean, fresh gasoline. Run the engine for 2-3 minutes to get stabilized fuel into the carburetor.

To empty the system, run the engine until the tank and system are empty.

4. Remove the spark plug. Add one tablespoon of engine oil into the spark plug hole. Install the plug, but do not connect the plug lead. Crank the engine two or three revolutions.
5. Remove the spark plug. Cover the spark plug hole with your thumb, and turn the engine over until the piston is at the top of its stroke. (Pressure against thumb is greatest.) Reinstall the plug, but do not connect the plug lead.
6. Store the engine in a clean, dry place.

Section 1

Safety and General Information

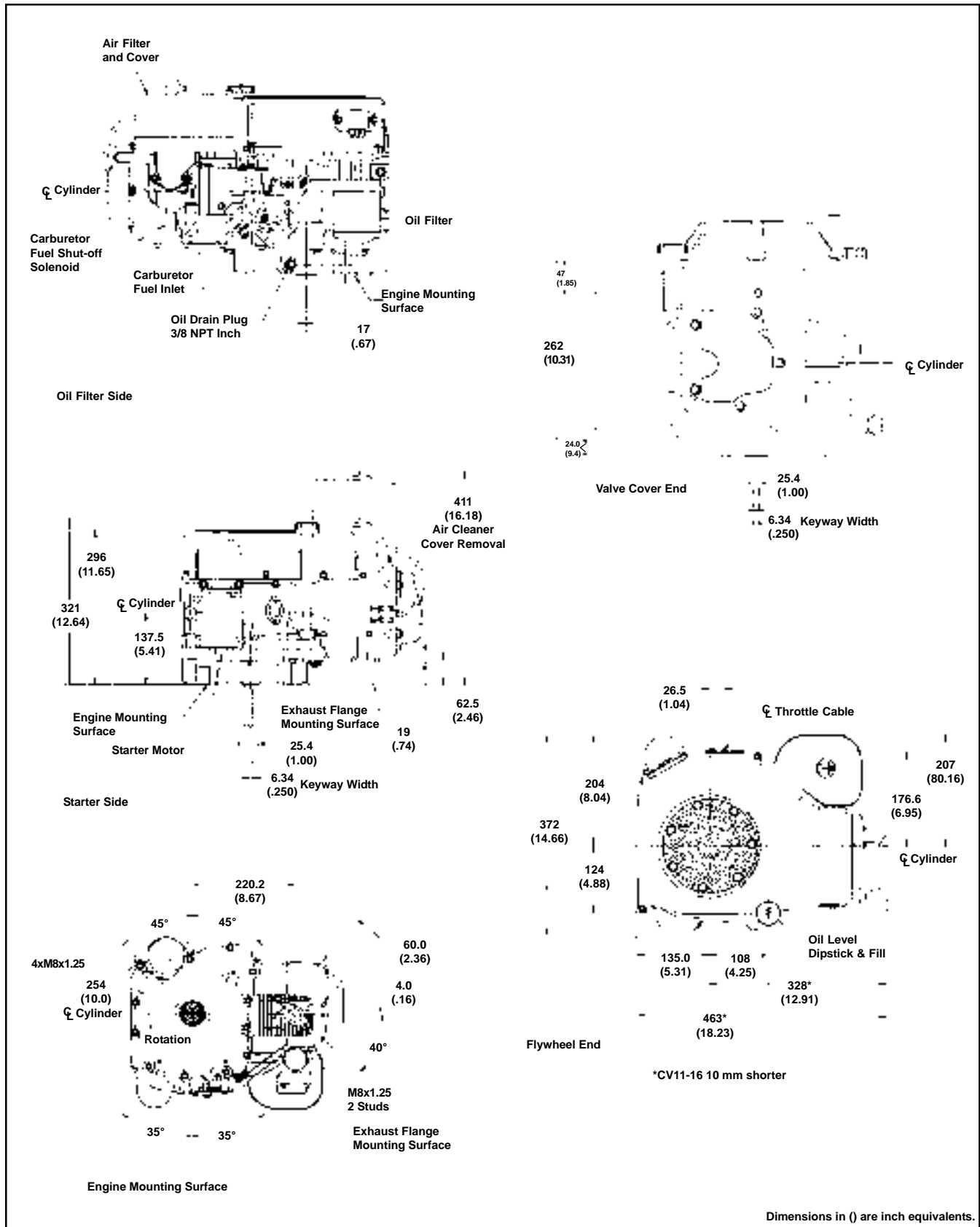


Figure 1-4. Typical Engine Dimensions.

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

Safety and General Information

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.)
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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.)
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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.)

Section 1

Safety and General Information

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.)
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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.)
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Stator

Stator Mounting Screw Torque	6.2 N·m (55 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	10.7 N·m (95 in. lb.) Into new as-cast hole 7.3 N·m (65 in. lb.) Into used hole
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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
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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.)

Non-Adjustable Valve Lash Configuration

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