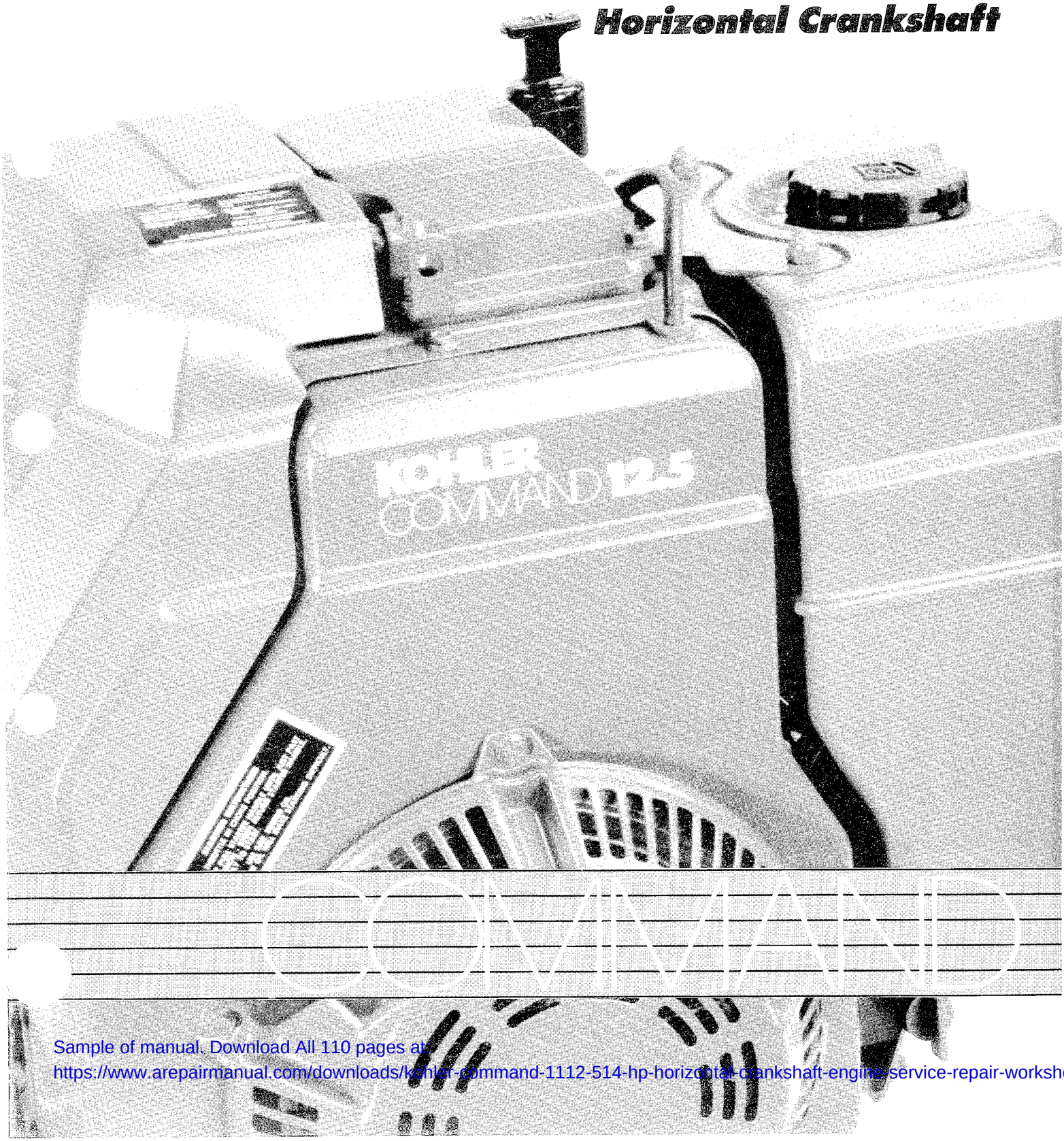
KOHLER® engines

# SERVICE MANUAL
# COMMAND 11,12.5,14 HP
## Horizontal Crankshaft



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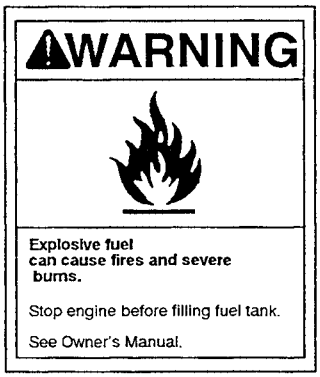
# SECTION 1
# GENERAL INFORMATION

## FOR YOUR SAFETY

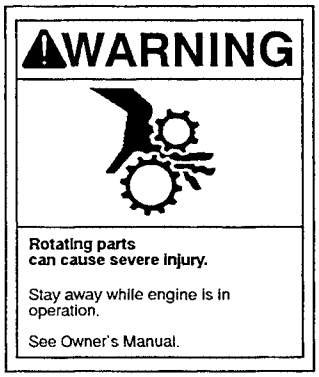
**WARNING: For Your Safety!**

*This symbol points out important safety Warnings and Cautions throughout this manual. These Warnings and Cautions should be followed at all times. Failure to follow Warnings and Cautions could result in injury to yourself and others nearby.*



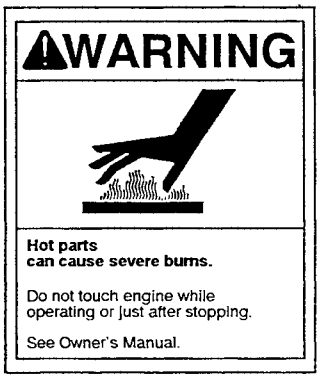

**WARNING: Explosive Fuel!**

*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.*




**WARNING: 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: 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
# GENERAL INFORMATION

**WARNING: Accidental Starts!**

*Before servicing the engine or equipment, always disconnect the spark plug lead to prevent the engine from starting accidentally. Ground the lead to prevent sparks that could cause fires. Make sure the equipment is in neutral.*

**CAUTION: Electrical Shock!**

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

**WARNING: 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: Overspeed Is Hazardous!**

*Do not tamper with the governor setting. Overspeed is hazardous and could cause personal injury.*

**WARNING: Dangerous Acid, Explosive Gases!**

*Batteries contain sulfuric acid. To prevent acid burns, avoid contact with skin, eyes, and clothing. 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.*

**WARNING: 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: Spring Under Tension!**

*Retractable starters contain a powerful, flat wire recoil spring that is under tension. Do not remove the center screw from the starter until the spring tension is released. Removing the center screw before releasing spring tension, or improper starter disassembly, can cause the sudden and potentially dangerous release of the spring.*

*Always wear safety goggles when servicing retractable starters—full face protection is recommended.*

*To ensure personal safety and proper starter disassembly and reassembly, follow the procedures in this section carefully.*

## ENGINE IDENTIFICATION NUMBERS

When ordering parts, or in any communication involving an engine, always give the **Model, Specification, and Serial Numbers** of the engine. Include letter suffixes, if there are any.

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

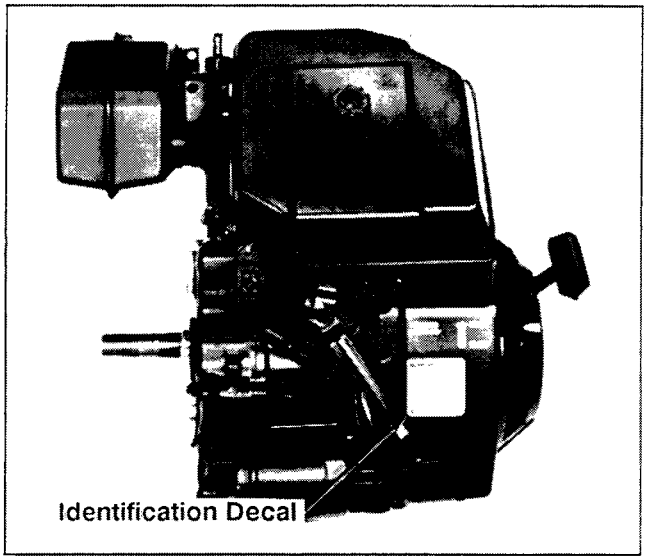



Figure 1-1. Engine Identification Plate Location.

**A. MODEL NO.** C H 125 ST

- **Command Engine**
- **Horizontal Crankshaft**
- **Horsepower**
  125 = 12.5 hp
- **Version Code**
  S = Electric Start
  T = Retractable Start
  ST = Electric/Retractable Start

**B. SPEC. NO.** 1203

- **Engine Model Code**

| Code | Model |
|---|---|
| 12 | CH12.5 |

- **Variation Of Basic Engine**

**C. SERIAL NO.** 2005810334

- **Year Manufactured**

| | |
|---|---|
| 20 | 1990 |
| 21 | 1991 |
| 22 | 1992 |
| 23 | 1993 |
| 24 | 1994 |
| 25 | 1995 |

- **Factory Code**

KOHLERengine

MODEL NO. CH125ST (A)
SPEC. NO. 1203 (B)
SERIAL NO. 2005810334 (C)

REFER TO OWNER'S MANUAL FOR OPERATION/MAINTENANCE INSTRUCTIONS AND SAFETY PRECAUTIONS.

KOHLER COMPANY
KOHLER WISCONSIN USA

Figure 1-2. Significance Of Engine Identification Numbers.

# SECTION 1
# GENERAL INFORMATION

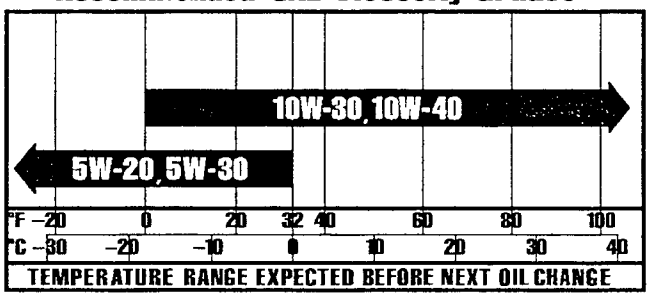
## OIL RECOMMENDATIONS

Using the proper type and weight of oil in the crankcase is extremely important. So is checking oil daily and changing oil regularly. Failure to use the correct oil, or using dirty oil, causes premature engine wear and failure.

### Oil Type

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

**Recommended SAE Viscosity Grades**




NOTE: Using other than service class SF or SG 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


**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 spoilage 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 a 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!**

*Before servicing the engine or equipment, always disconnect the spark plug lead to prevent the engine from starting accidentally. Ground the lead to prevent sparks that could cause fires.*

### 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** | Fill fuel tank.<br>Check oil level.<br>Check air cleaner for dirty[1], loose, or damaged parts.<br>Check air intake and cooling areas, clean as necessary[1]. | SECTION 5<br>SECTION 6<br>SECTION 4<br>SECTION 4 |
| **Every 25 Hours** | Service precleaner element[1]. | SECTION 4 |
| **Every 100 Hours** | Service air cleaner element[1].<br>Change oil.<br>Check spark plug condition and gap.<br>Remove cooling shrouds and clean cooling areas[1]. | SECTION 4<br>SECTION 6<br>SECTION 8<br>SECTION 4 |
| **Every 200 Hours** | Change oil filter. | SECTION 6 |
| **Annually Or Every 500 Hours** | Service starter motor drive. | SECTION 8 |

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

## STORAGE

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

1. Change the oil and oil filter while the engine is still warm from operation. See "Change Oil And Oil Filter" in Section 6.
2. Drain the fuel tank and fuel system (or run the engine until the fuel tank and fuel system are empty).
3. 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.
4. Remove the spark plug and rotate the crankshaft until the piston is at the top of its stroke. Reinstall the plug, but do not connect the plug lead.
5. Clean the exterior surfaces of the engine.
6. Store the engine in a clean, dry place.

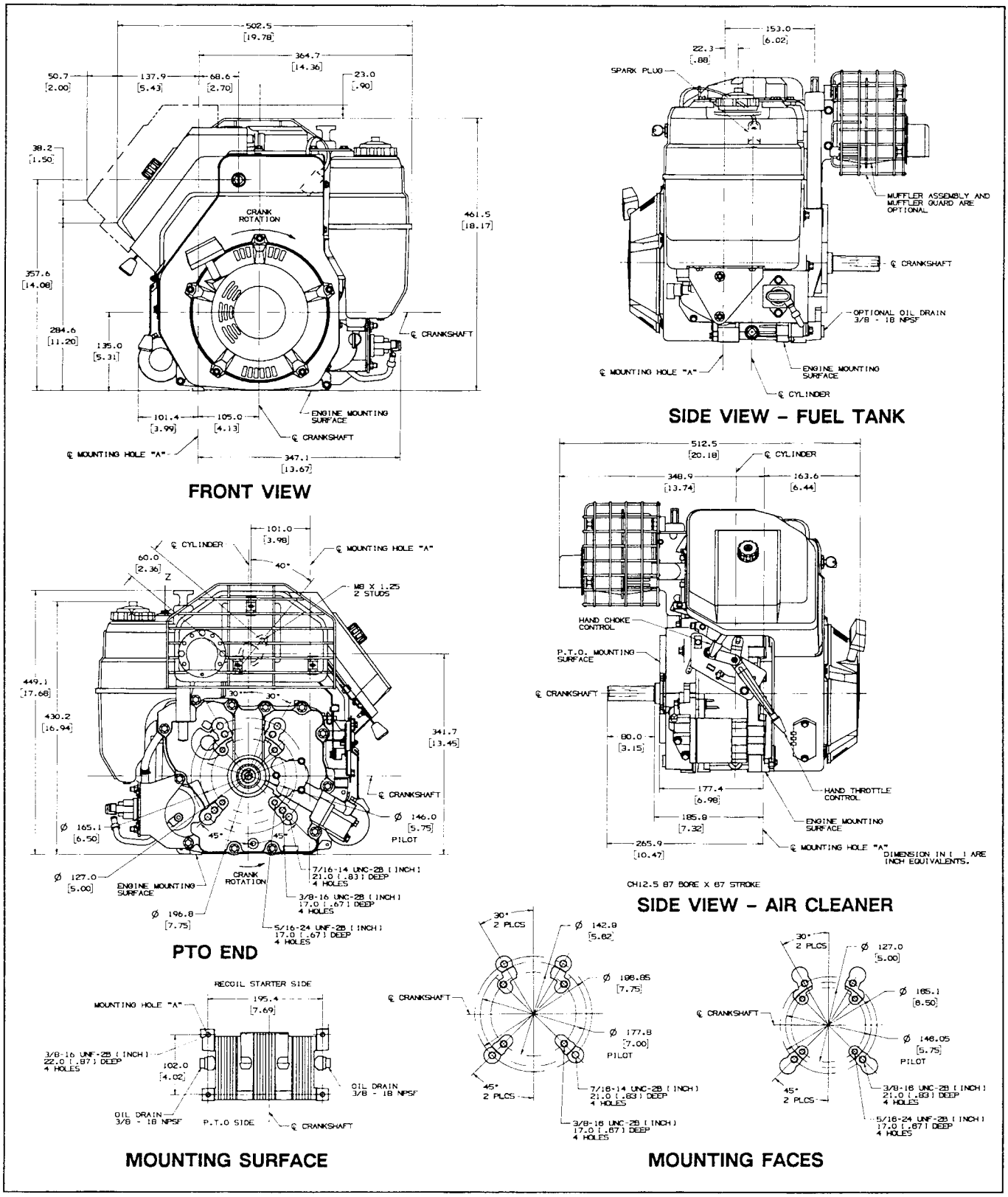
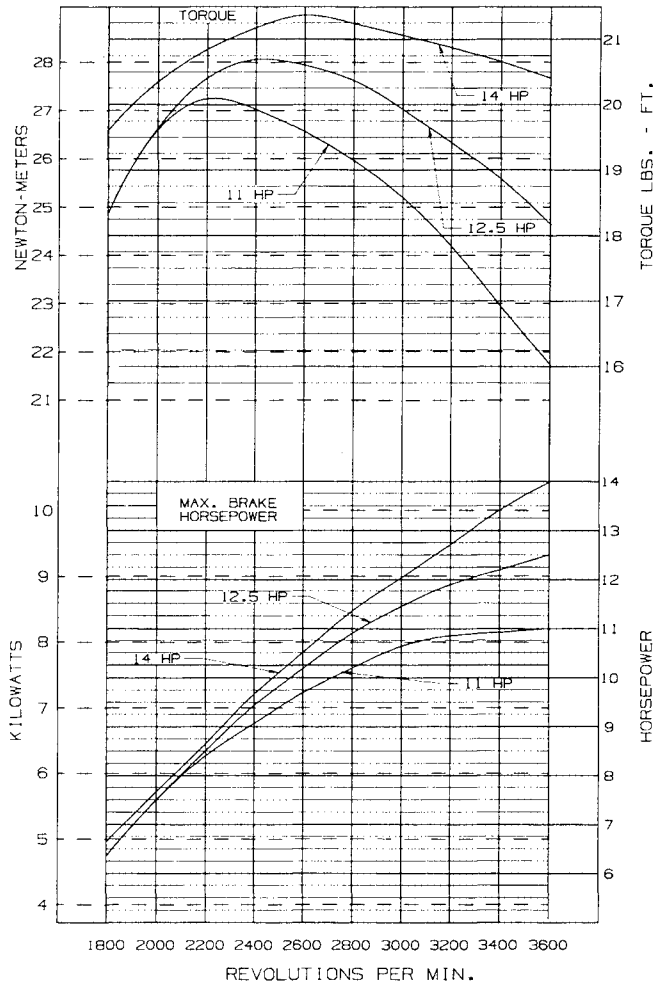



Figure 1-4. Typical Engine Dimensions.

## TORQUE

## HORSEPOWER




## FUEL

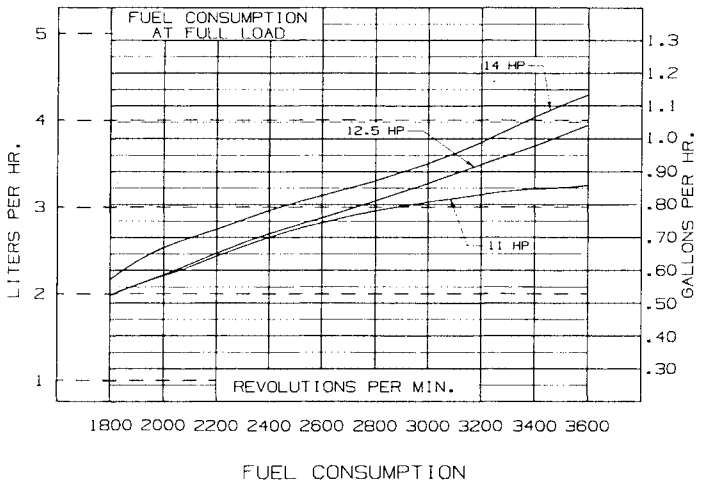



**Figure 1-5. Power, Torque, And Fuel Data.**

## TORQUE INFORMATION, SPECIFICATIONS, AND TOLERANCES

### Metric Fastener Torque Recommendations For Standard Applications

**Tightening Torque: N•m (lbf•in) + or – 10%**

| | Property Class | | | | | Noncritical Fasteners Into Aluminum |
|---|---|---|---|---|---|---|
| | 4.8 | 5.8 | 8.8 | 10.9 | 12.9 | |
| 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 (lbf•ft) + or – 10%**

| | Property Class | | | | | Noncritical Fasteners Into Aluminum |
|---|---|---|---|---|---|---|
| | 4.8 | 5.8 | 8.8 | 10.9 | 12.9 | |
| 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 lbf•in) |
| 1/4" | 17.0 (150 lbf•in) | 11.3 (100 lbf•in) |
| 3/8" | 20.3 (180 lbf•in) | 13.6 (120 lbf•in) |
| 1/2" | 27.1 (20 lbf•ft) | 17.6 (13 lbf•ft) |
| 3/4" | 33.9 (25 lbf•ft) | 21.7 (16 lbf•ft) |
| X-708-1 | 27.1/33.9 (20/25 lbf•ft) | 27.1/33.9 (20/25 lbf•ft) |

### Torque Conversions

N•m = lbf•in x 0.113
N•m = lbf•ft x 1.356
lbf•in = N•m x 8.85
lbf•ft = N•m x 0.737

## SPECIFICATIONS, TOLERANCES, AND SPECIAL TORQUE VALUES[1]

| DESCRIPTION | Command 11, 12.5, 14 Hp |
|---|---|
| **General Specifications** | |
| Power (@ 3600 rpm, corrected to SAE J1349) | |
| Command 11 | 8.20 kW (11 hp) |
| Command 12.5 | 9.33 kW (12.5 hp) |
| Command 14 | 10.50 kW (14 hp) |
| Peak Torque | |
| Command 11 | 27.4 N•m (20.2 lbf•ft) |
| Command 12.5 | 27.8 N•m (20.5 lbf•ft) |
| Command 14 | 28.9 N•m (21.3 lbf•ft) |
| Bore | 87 mm (3.43 in) |
| Stroke | 67 mm (2.64 in) |
| Displacement | 398 $cm^3$ (24.3 $in^3$) |
| Compression Ratio | 8.5:1 |
| Approx. Weight | 36.3 kg (80 lb) |
| Approx. Oil Capacity | 1.9 L (2.0 U.S. qt) |
| **Air Cleaner** | |
| Base Nut Torque | 9.9 N•m (88 lbf•in) |
| **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 (0.0023/0.0143 in) |
| Running Clearance | 0.025/0.063 mm (0.0009/0.0025 in) |
| Bore I.D. — New | 20.000/20.025 mm (0.7874/0.7884 in) |
| Bore I.D. — 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) |
| Balance Shaft Bearing Surface O.D. — Max. Wear Limit | 19.959 mm (0.7858 in) |
| **Camshaft** | |
| End Play (With Shims) | 0.076/0.127 mm (0.003/0.005 in) |
| Running Clearance | 0.025/0.063 mm (0.0010/0.0025 in) |
| Bore I.D. — New | 20.000/20.025 mm (0.7874/0.7884 in) |
| Bore I.D. — 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) |
| Camshaft Bearing Surface O.D. — Max. Wear Limit | 19.959 mm (0.7858 in) |

### Carburetor

Preliminary Low Idle Fuel Needle Setting
- Command 11 ..... 1-1/4 Turn
- Command 12.5 ..... 1-1/4 Turn
- Command 14 ..... 1-3/4 Turn

Fuel Bowl Nut Torque ..... 5.1/6.2 N•m (45/55 lbf•in)

### Charging

Stator Mounting Screw Torque ..... 4.0 N•m (35 lbf•in)

### Closure Plate

Oil Filter Torque ..... 5.7/9.0 N•m (50/80 lbf•in)
Oil Filter Drain Plug (1/8" NPT) Torque ..... 7.3/9.0 N•m (65/80 lbf•in)
Closure Plate Fastener Torque ..... 24.4 N•m (216 lbf•in)
Oil Sentry Pressure Switch Torque ..... 7.9 N•m (70 lbf•in)
Oil Pump Cover Fastener Torque[2] ..... 4.0*6.2 N•m (35*55 lbf•in)
Oil Filter Adapter Fastener Torque ..... 11.3 N•m (100 lbf•in)

### Connecting Rod

Connecting Rod Cap Fastener Torque ..... 22.6 N•m (200 lbf•in)
Connecting Rod To Crankpin Running Clearance – New ..... 0.030/0.055 mm (0.0012/0.0022 in)
Connecting Rod To Crankpin Running Clearance –
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 ..... 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)
Piston Pin End I.D. – 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)
Governor Cross Shaft Bore I.D. – Max. Wear Limit ..... 6.063 mm (0.2387 in)

### Crankshaft

End Play (Free) ..... 0.0575/0.4925 mm (0.0023/0.0194 in)
Crankshaft Sleeve Bearing I.D. – (Installed) New ..... 44.965/45.003 mm (1.7703/1.7718 in)
Crankshaft Sleeve Bearing I.D. – Max. Wear Limit ..... 45.016 mm (1.7723 in)
Crankshaft To Sleeve Bearing Running Clearance – New ..... 0.03/0.09 mm (0.0012/0.0035 in)
Crankshaft Bore (In Oil Pan) To Crankshaft Running
Clearance – New ..... 0.03/0.09 mm (0.0012/0.0035 in)
Flywheel End Main Bearing
- (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) ..... 0.15 mm (0.0059 in)
- (Entire Crank, In V-Blocks) ..... 0.10 mm (0.0039 in)

### Cylinder Bore

Cylinder Bore I.D. – New ..... 87.000/87.025 mm (3.4252/3.4262 in)
Cylinder Bore I.D. – Max. Wear Limit ..... 87.063 mm (3.4277 in)
Cylinder Bore I.D. – Max. Out Of Round ..... 0.12 mm (0.0047 in)
Cylinder Bore I.D. – Max. Taper ..... 0.05 mm (0.0020 in)

### Cylinder Head

Cylinder Head Fastener Torque ..... 40.7 N•m (30 lbf•ft)
Max. Out Of Flatness ..... 0.076 mm (0.003 in)
Rocker Pedestal Fastener Torque ..... 9.9 N•m (88 lbf•in)

### Electric Starter

Drive Pinion Fastener Torque ..... 15.3 N•m (135 lbf•in)
Drive Pinion To Flywheel Ring Gear Backlash ..... 0.025/1.56 mm (0.001/0.061 in)

### Fan/Flywheel

Fan Fastener Torque ..... 9.9 N•m (88 lbf•in)
Flywheel Retaining Screw Torque ..... 66.4 N•m (49 lbf•ft)

### Fuel Pump

Fuel Pump/Cover Fastener Screw Torque[2] ..... 7.3*9.0 N•m (65*80 lbf•in)

### Fuel Tank

Fuel Tank Fastener Torque ..... 7.3 N•m (65 lbf•in)

### 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) |
| Governor Cross Shaft O.D. — 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) |
| Governor Gear Shaft O.D. — Max. Wear Limit | 5.977 mm (0.2353 in) |

### Ignition

| | |
|---|---|
| Spark Plug Type (Champion Or Equiv.) | RC12YC |
| Spark Plug Gap | 1.02 mm (0.040 in) |
| Spark Plug Torque | 38.0/43.4 N•m (28/32 lbf•ft) |
| Ignition Module Air Gap | 0.203/0.305 mm (0.008/0.012 in) |
| Ignition Module Fastener Torque[2] | 4.0*6.2 N•m (35*55 lbf•in) |

### Muffler

| | |
|---|---|
| Muffler Retaining Nuts | 24.4 N•m (216 lbf•in) |

### 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) |
| Piston Pin Bore I.D. — Max. Wear Limit | 19.025 mm (0.7490 in) |
| Piston Pin O.D. — New | 18.995/19.000 mm (0.7478/0.7480 in) |
| Piston Pin O.D. — Max. Wear Limit | 18.994 mm (0.74779 in) |
| Top Compression Ring To Groove Side Clearance | 0.040/0.105 mm (0.0016/0.0041 in) |
| Middle Compression Ring To Groove Side Clearance | 0.040/0.072 mm (0.0016/0.0028 in) |
| Oil Control Ring To Groove Side Clearance | 0.551/0.675 mm (0.0217/0.0266 in) |
| Top And Center Compression Ring End Gap — New Bore | 0.3/0.5 mm (0.012/0.020 in) |
| Top And Center Compression Ring End Gap — Used Bore (Max.) | 0.77 mm (0.030 in) |
| Piston Thrust Face (@$D_1$) To Cylinder Bore Running Clearance — New[3] | 0.041/0.044 mm (0.0016/0.0017 in) |

### Retractable Starter

Center Screw Torque ..... 7.4/8.5 N•m (65/75 lbf•in)

### Throttle/Choke Controls

Governor Control Lever Fastener Torque ..... 9.9 N•m (88 lbf•in)
Speed Control Bracket Assembly Fastener Torque[2] ..... 7.3*10.7 N•m (65*95 lbf•in)

### Valve Cover/Rocker Arms

Valve Cover Fastener Torque[2] ..... 7.3*10.7 N•m (65*95 lbf•in)
Rocker Arm I.D. — New ..... 15.837/16.127 mm (0.63/0.64 in)
Rocker Arm I.D. — Max. Wear Limit ..... 16.13 mm (0.640 in)
Rocker Shaft O.D. — New ..... 15.90/15.85 mm (0.63 in)
Rocker Shaft O.D. — 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)
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)
Intake Valve Guide I.D. — 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)
Exhaust Valve Guide I.D. — Max. Wear Limit ..... 7.159 mm (0.2819 in)
Valve Guide Reamer Size — STD ..... 7.048 mm (0.2775 in)
Valve Guide Reamer Size — 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°

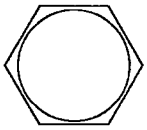
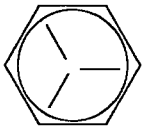
**NOTES:**

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

[2] For self-tapping (thread forming) fasteners: the higher torque value is for initial installation into a new cored hole*the lower torque value is for subsequent installation and installation into tapped holes and weld nuts.

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

## English Fastener Torque Recommendations For Standard Applications

| Tightening Torque: N•m (lbf•in) + or – 20% | | | | |
|---|---|---|---|---|
| Bolts, Screws, Nuts And Fasteners Assembled Into Cast Iron Or Steel | | | | Grade 2 Or 5 Fasteners Into Aluminum |
| |  Grade 2 |  Grade 5 |  Grade 8 |  |
| Size | | | | |
| 8–32 | 2.3 (20) | 2.8 (25) | ——— | 2.3 (20) |
| 10–24 | 3.6 (32) | 4.5 (40) | ——— | 3.6 (32) |
| 10–32 | 3.6 (32) | 4.5 (40) | ——— | ——— |
| 1/4–20 | 7.9 (70) | 13.0 (115) | 18.7 (165) | 7.9 (70) |
| 1/4–28 | 9.6 (85) | 15.8 (140) | 22.6 (200) | ——— |
| 5/16–18 | 17.0 (150) | 28.3 (250) | 39.6 (350) | 17.0 (150) |
| 5/16–24 | 18.7 (165) | 30.5 (270) | ——— | ——— |
| 3/8–16 | 29.4 (260) | ——— | ——— | ——— |
| 3/8–24 | 33.9 (300) | ——— | ——— | ——— |
| **Tightening Torque N•m (lbf•ft) + or – 20%** | | | | |
| Size | | | | |
| 5/16–24 | ——— | ——— | 40.7 (30) | ——— |
| 3/8–16 | ——— | 47.5 (35) | 67.8 (50) | ——— |
| 3/8–24 | ——— | 54.2 (40) | 81.4 (60) | ——— |
| 7/16–14 | 47.5 (35) | 74.6 (55) | 108.5 (80) | ——— |
| 7/16–20 | 61.0 (45) | 101.7 (75) | 142.4 (105) | ——— |
| 1/2–13 | 67.8 (50) | 108.5 (80) | 155.9 (115) | ——— |
| 1/2–20 | 94.9 (70) | 142.4 (105) | 223.7 (165) | ——— |
| 9/16–12 | 101.7 (75) | 169.5 (125) | 237.3 (175) | ——— |
| 9/16–18 | 135.6 (100) | 223.7 (165) | 311.9 (230) | ——— |
| 5/8–11 | 149.2 (110) | 244.1 (180) | 352.6 (260) | ——— |
| 5/8–18 | 189.8 (140) | 311.9 (230) | 447.5 (330) | ——— |
| 3/4–10 | 199.3 (150) | 332.2 (245) | 474.6 (350) | ——— |
| 3/4–16 | 271.2 (200) | 440.7 (325) | 637.3 (470) | ——— |

# SECTION 2
# SPECIAL TOOLS



## SPECIAL SERVICE TOOL KITS

These quality tools are designed to help you perform specific disassembly, repair, and reassembly procedures. By using tools designed for the job, you can service engines easier, faster, and safer! In addition, you'll increase your service capabilities and customer satisfaction by decreasing engine down time.

**Tool Kit No. KO-3211-A** – This basic tool kit includes tools necessary to service Kohler K-Series and Magnum engines. It includes the tools originally sold as kit NU-3211 and the new tools kit no. KO-3212.

**Tool Kit No. KO-3212** – This kit updates original tool kit No. NU-3211 to include all new tools released in 1986 and 1987. Specifically, the kit includes fixed jet carburetor welch plug removal and installation, camshaft pin and camshaft pin cup plug installation, MV oil seal installation tools, and a tool board.

**COMMAND Tool Kit No. KO-3213** – This kit is designed for the current Kohler Engine Service Dealer already having the KO-3211-A basic tool kit. This kit includes all additional tools necessary to service current Command series engines.

**COMMAND Tool Kit No. KO-3214** – This kit is for the new Kohler Dealer servicing the Command series engines *only*.

**COMMAND Tool Kit No. KO-3215** – This kit is for the new Kohler Dealer servicing the Command *11, 12.5, 14 models only*.

*To avoid tool duplication, and to ensure you have all necessary tools, refer to the following table:*

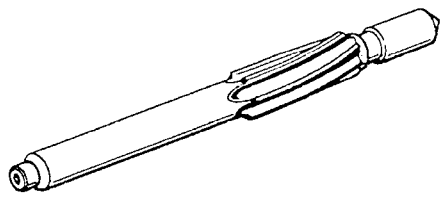
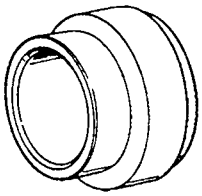
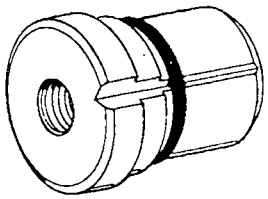
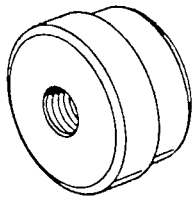
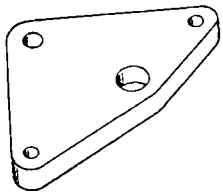
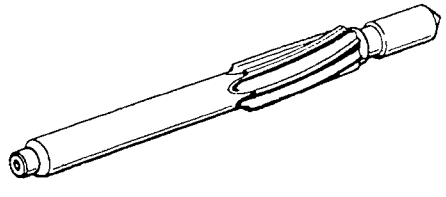
| IF YOU ARE CURRENTLY | SERVICING | ORDER KIT NO. | | | | |
|---|---|---|---|---|---|---|
| | | KO-3211-A | KO-3212 | KO-3213 | KO-3214 | KO-3215 |
| New/Existing Kohler Dealer "No Tools" | K, M, & C | X | | X | | |
| Existing Kohler Dealer With NU-3211 Kit | K & M | | X | | | |
| Existing Kohler Dealer With NU-3211 Kit | K, M, & C | | X | X | | |
| Existing Kohler Dealer With KO-3211-A Kit | K, M, & C | | | X | | |
| Existing Kohler Dealer Command Only | C | | | | X | |
| Existing Kohler Dealer Command 11, 12.5, 14 Only | C | | | | | X |

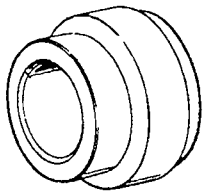
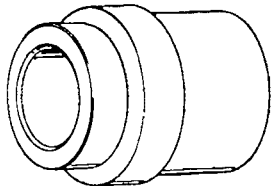
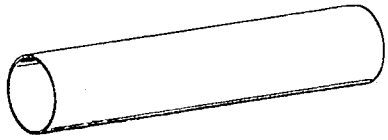
K = K-Series Engines
M = Magnum Engines
C = Command Engines

KO-3211-A = Standard Tool Kit For K-Series And Magnum Engines (Includes Kits NU-3211 And KO-3212)
KO-3212 = Add On Kit For NU-3211 (Kit KO-3212 + Kit NU-3211 = Kit KO-3211-A)
KO-3213 = Add On Kit For Command Series Engines (To Be Used With Kit KO-3211-A)
KO-3214 = Command Dealer Tool Kit
KO-3215 = Command 11, 12.5, 14 Dealer Tool Kit

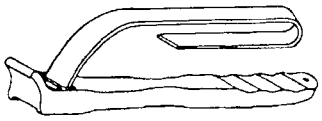
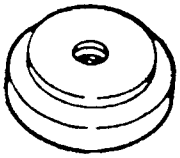
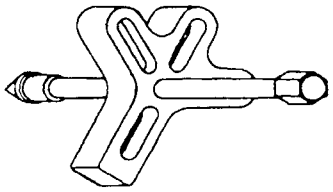
# SECTION 2
# SPECIAL TOOLS

## Kit KO-3213 Includes:

| Tool No. | Description | Application | Illustration |
|---|---|---|---|
| KO-1026 | REAMER (Oversize Valve Guide) | Used to ream valve guides. |  |
| KO-1027 | OIL SEAL INSTALLER (Flywheel, PTO ) | Used to install oil seals to the proper depth. Use with KO-1036 handle. |  |
| KO-1028 | CRANKSHAFT BEARING INSTALLER | Used to install main bearing. Use with NU-4747 handle. |  |
| KO-1029 | CRANKSHAFT BEARING REMOVER | Used to remove main bearing. Use with NU-4747 handle. |  |
| KO-1030 | GOVERNOR SHAFT SEAL INSTALLER | Used to install governor shaft seal. |  |
| KO-1031 | CAMSHAFT ENDPLAY PLATE | Used to check camshaft endplay. (All necessary hardware is included.) |  |
| KO-1033 | REAMER (Oversize Valve Guide) | Used to ream valve guides – CH5. |  |

| Tool No. | Description | Application | Illustration |
|---|---|---|---|
| KO-1034 | OIL SEAL INSTALLER (Flywheel, PTO) | Used to install oil seals to the proper depth—CH5. Use with KO-1036 handle. |  |
| KO-1035 | CAMSHAFT PTO OIL SEAL INSTALLER | Used to install the camshaft PTO oil seal to the proper depth—CH5. Use with KO-1036 handle. |  |
| KO-1036 | DRIVING HANDLE | Used with oil seal installers. |  |
| KO-1037 | SEAL PROTECTOR SLEEVE | Used on crankshaft when installing oil seals. |  |
| 208665 | HEX CAP SCREW | Used with flywheel puller kit (NU-3226)—All. (M8x1.25x70 mm) | NOT ILLUSTRATED |
| 10257 | FLAT WASHER | Used with flywheel puller kit—All. | |
| KO-1039 | SILO PACK, HOOKS, SCREWS | Used with KO-3213 kit. | |

## Kit KO-3214 Includes All Of The Above Tools Plus The Following:

| Tool No. | Description | Application | Illustration |
|---|---|---|---|
| NU-4747 | HANDLE | Used to install and remove bearings. |  |
| NU-10357 | FLYWHEEL STRAP WRENCH | Used to hold flywheel. (For replacement strap, order part no. 305085.) |  |
| NU-12018 | BEARING INSTALLER | Used to install main bearings – CH5. Use with NU-4747 handle. |  |
| NU-12021 | SEAL PROTECTOR SLEEVE | Used on crankshaft when installing oil seals – CH5. |  |
| NU-3226 | FLYWHEEL PULLER KIT | Used to remove flywheel. (All hardware included.) |  |
| KO-1038<br>KO-1040 | TOOL BOARD<br>SILO PACK, HOOKS, SCREWS | Used with KO-3214 kit. | NOT ILLUSTRATED |

## Kit No. KO-3214 Tool Usage Chart

| Tool Number | Description | C5 | CV and CH 11,12.5, 14 |
|---|---|---|---|
| KO-1026 | Reamer, Oversized Valve Guide | | X |
| KO-1027 | Oil Seal Installer (Flywheel) | | X |
| KO-1028 | Crankshaft Bearing Installer | | X |
| KO-1029 | Crankshaft Bearing Remover | | X |
| KO-1030 | Governor Shaft Seal Installer | | X |
| KO-1031 | Camshaft Endplay Plate | | X |
| KO-1033 | Reamer, Oversized Valve Guide | X | |
| KO-1034 | Oil Seal Installer (Flywheel, PTO) | X | |
| KO-1035 | Camshaft PTO Oil Seal Installer | X | |
| KO-1036 | Driving Handle | X | X |
| KO-1037 | Seal Protector Sleeve | | X |
| 208665 | Hex Cap Screw (M8x1.25x70 mm) | X | X |
| 10257 | Flat Washers | X | X |
| 208562 | Hex Cap Screws (M8x1.25x20 mm) | | X |
| KO-1039 | Silo Pack, Hooks, And Screws (KO-3213) | X | X |
| NU-3226 | Flywheel Puller Kit | X | X |
| NU-4747 | Handle | X | X |
| NU-10357 | Flywheel Strap Wrench | X | X |
| NU-12018 | Bearing Installer | X | |
| NU-12021 | Seal Protector Sleeve | X | |
| KO-1038 | Tool Board | X | X |
| KO-1040 | Silo Pack, Hooks, And Screws (KO-3214) | X | X |

Service tool kits can be ordered complete or the tools can be ordered individually. Contact your Kohler Distributor for price and availability.

## ENGINE ANALYSIS KIT NO. KO 25 800 01

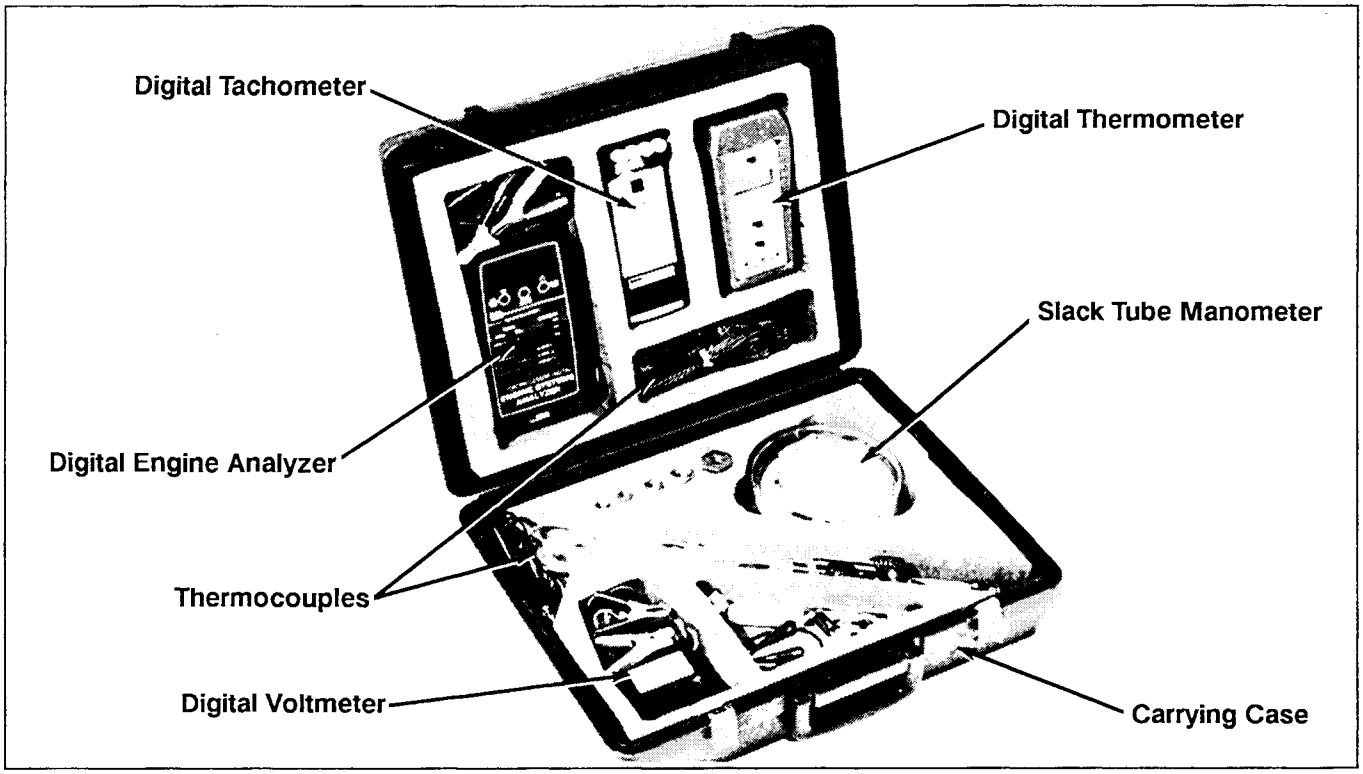



Figure 2-1. Engine Analysis Kit – 25 800 01

The Kohler Engine Analysis Kit contains a selection of instruments that will enable you to measure critical items that relate to engine performance. You will find many uses for these instruments – from basic crankcase vacuum checks to sopisticated application tests.

### The Engine Analysis Kit Includes:

| Qty. | Description | Part No. |
|---|---|---|
| 1 | Digital Voltmeter | KO 25 800 02 |
| 1 | Digital Tachometer | KO 25 800 03 |
| 1 | Digital Thermometer | KO 25 800 04 |
| 1 | Digital Engine Analyzer | KO 25 800 05 |
| 1 | Slack Tube Manometer | KO 25 800 06 |
| 1 | 8 Ft. Lead With Plug | KO 25 800 07 |
| 3 | 14mm Spark Plug Thermocouple | KO 25 800 08 |
| 2 | Head Bolt Thermocouple | KO 25 800 09 |
| 1 | Oil Sump Thermocouple | KO 25 800 10 |
| 1 | 1/4" x 1/8" Bushing | KO 25 800 11 |
| 1 | 3/8" x 1/8" Bushing | KO 25 800 12 |
| 1 | 1/2" x 1/8" Bushing | KO 25 800 13 |
| 1 | 3/4" x 1/8" Bushing | KO 25 800 14 |
| 1 | Tube With Fittings | KO 25 800 15 |
| 1 | Carrying Case | KO 25 800 16 |
| 3 | Plain Thermocouple | KO 25 800 17 |

The voltmeter, tachometer, and engine analyzer feature electronic circuitry and digital readouts. Guidelines for using the instruments and testing are included.

Using the instruments in the kit you will be able to:

1. Measure the temperatures of the:
   a. spark plug base gasket/cylinder head bolt,
   b. oil sump, and
   c. air into flywheel and carburetor.
2. Measure engine speed (rpm).
3. Measure crankcase vacuum and exhaust system back pressure.
4. Measure voltage.
5. Measure charging system current.
6. Measure electric starter current (Amp) draw.

The Engine Analysis Kit can be ordered complete as shown, or the instruments can be ordered individually. Contact your Kohler Distributor for price and availability.

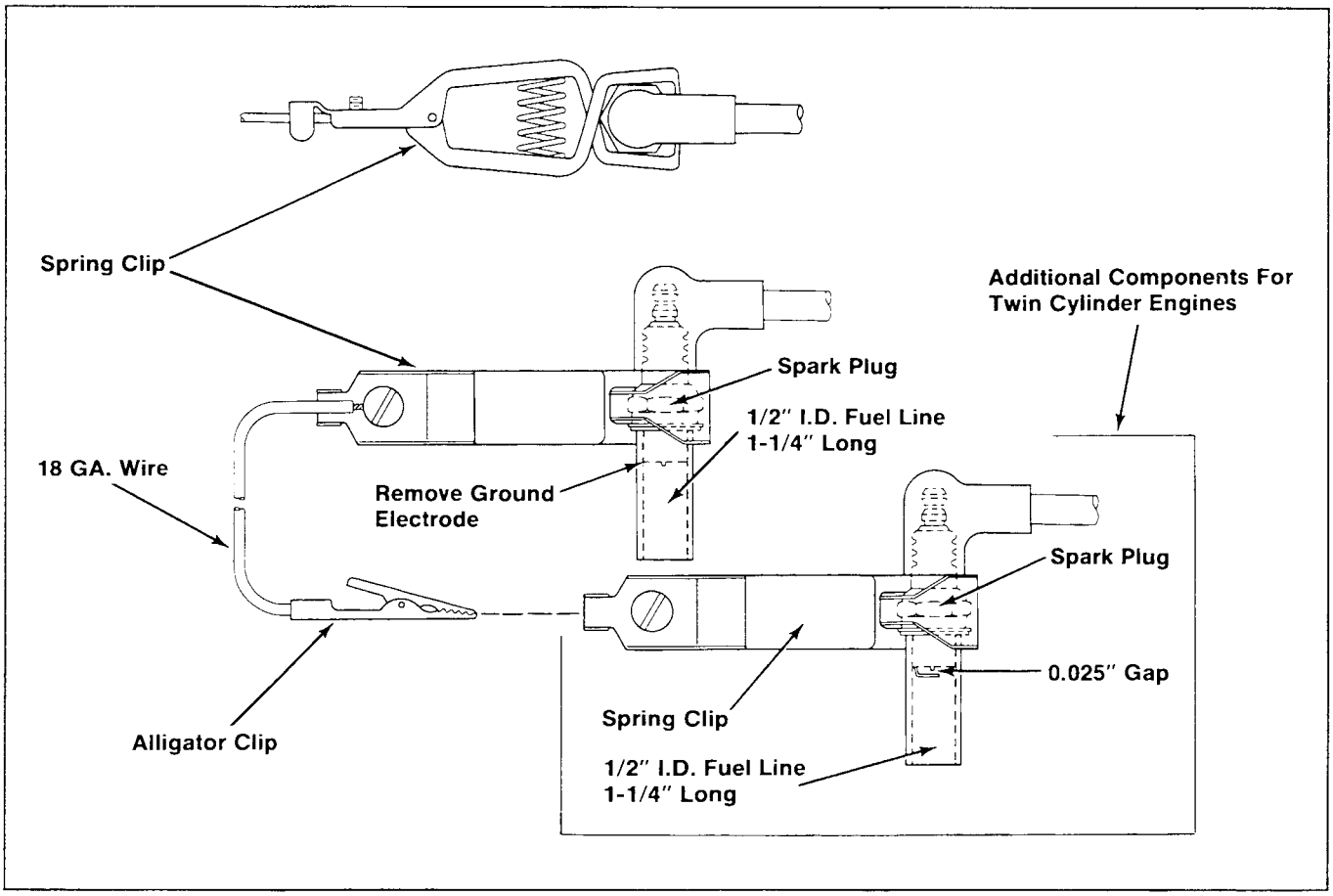



Figure 2-2. Electronic Magneto Ignition System Tester.

## IGNITION SYSTEM TESTER

These engines are equipped with a dependable electronic magneto ignition system. A simple tester can be used to determine if the ignition module is functioning properly. See Figure 2-2.

### Tester Construction

1. Obtain a new RJ-8 or RCJ-8 spark plug.
2. Remove the ground electrode from the spark plug. This gives a spark gap of approx. 3.3 mm (0.13 in). This large gap simulates the spark required under actual engine conditions.
3. Make a lead assembly using a large spring clip, an alligator clip, and 18 gauge wire.
4. Cut a 32 mm (1-1/4 in) length of 13 mm (1/2 in) I.D. fuel line. Slide it onto the threads of the test plug. The fuel line shades the firing tip to make the spark more visible.

### Using The Tester

Follow the instructions given in Section 8 – "Electrical System And Components."

## ELECTRIC STARTER BRUSH HOLDER TOOL

The electric starter motor brush holder will make the installation of the commutator end cap to the starter frame much easier. The brush holder tool can easily be made from thin sheet metal. See Figure 2-3.

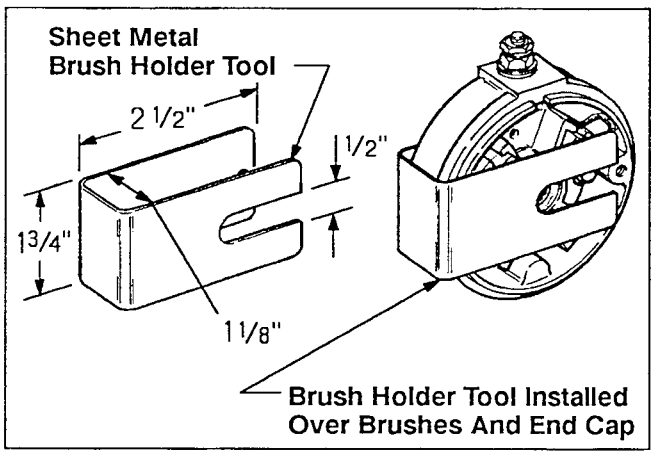



**Figure 2-3. Brush Holder Tool.**

## RTV SILICONE SEALANT

RTV silicone sealant is used as a gasket between the crankcase and oil pan and between the rocker cover and cylinder head. **General Electric Silmate™ type RTV-1473, or RTV-108** (or equivalent) silicone sealant is recommended.

### Silicone Sealant Dispenser

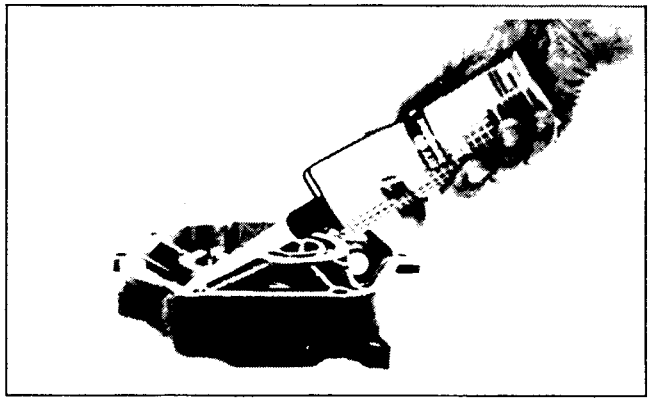


**Figure 2-4. Silicone Sealant Dispenser.**

An easy-to-use silicone sealant dispenser, **part no. 52 597 01**, is available. This dispenser contains 142cc (4.8 fl.oz.) of RTV-108. See Figure 2-4.

This dispenser also features easy-to-use One Touch℠ control, precise dispensing of the correct bead and amount of sealant, and a 1-year shelf life for an un-opened can – 6 months shelf life after can has been opened.

To order, contact your source of supply.

# SECTION 3
# TROUBLESHOOTING



## TROUBLESHOOTING GUIDE

When troubles occur, be sure to check the simple causes which, at first, may seem too obvious to be considered. For example, a starting problem could be caused by an empty fuel tank.

Some common causes of engine troubles are listed below. Use these to locate the causing factors.

**Engine Cranks But Will Not Start**

1. Empty fuel tank
2. Fuel shutoff valve closed
3. Dirt or water in the fuel system
4. Clogged fuel line
5. Spark plug lead disconnected
6. Keyswitch or kill switch in "off" position
7. Faulty spark plug
8. Faulty ignition module

**Engine Starts But Does Not Keep Running**

1. Restricted fuel tank vent
2. Dirt or water in the fuel system
3. Faulty choke or throttle controls/cables
4. Loose wires or connections that short the kill terminal of ignition module to ground
5. Faulty cylinder head gasket
6. Faulty fuel pump
7. Faulty carburetor

**Engine Starts Hard**

1. Hydrostatic transmission not in neutral/PTO drive is engaged
2. Dirt or water in the fuel system
3. Clogged fuel line
4. Loose or faulty wires or connections
5. Faulty choke or throttle controls/cables
6. Faulty spark plug
7. Low compression
8. Faulty ACR mechanism

**Engine Will Not Crank**

1. Hydrostatic transmission not in neutral/PTO drive is engaged
2. Battery is discharged
3. Safety interlock switch is engaged
4. Loose or faulty wires or connections
5. Faulty keyswitch or ignition switch
6. Faulty electric starter/starter solenoid
7. Retractable starter not engaging in drive cup
8. Seized internal engine components

**Engine Runs But Misses**

1. Dirt or water in the fuel system
2. Spark plug lead disconnected
3. Loose wires or connections that intermittently short the kill terminal of ignition module to ground
4. Engine overheated
5. Faulty ignition module

# SECTION 3
# TROUBLESHOOTING

**Engine Will Not Idle**

1. Restricted fuel tank vent
2. Dirt or water in the fuel system
3. Faulty spark plug
4. Idle fuel adjusting needle improperly set
5. Idle speed adjusting screw improperly set
6. Low compression

**Engine Overheats**

1. Air intake/grass screen, cooling fins, or cooling shrouds clogged
2. Excessive engine load
3. Low crankcase oil level
4. High crankcase oil level

**Engine Knocks**

1. Excessive engine load
2. Low crankcase oil level
3. Old/improper fuel
4. Internal wear or damage

**Engine Loses Power**

1. Low crankcase oil level
2. High crankcase oil level
3. Dirty air cleaner element
4. Dirt or water in the fuel system
5. Excessive engine load
6. Engine overheated
7. Faulty spark plug
8. Low compression

**Engine Uses Excessive Amount Of Oil**

1. Incorrect oil viscosity/type
2. Clogged or improperly assembled breather
3. Worn or broken piston rings
4. Worn cylinder bore
5. Worn valve stems/valve guides

## EXTERNAL ENGINE INSPECTION

Before cleaning or disassembling the engine, make a thorough inspection of its external appearance and condition. This inspection can give clues to what might be found inside the engine (and the cause) when it is disassembled.

☐ Check for buildup of dirt and debris on the crankcase, cooling fins, grass screen and other external surfaces. Dirt or debris on these areas are causes of overheating.

☐ Check for obvious fuel and oil leaks, and damaged components. Excessive oil leakage can indicate a clogged or improperly assembled breather, worn or damaged seals and gaskets, or loose or improperly torqued fasteners.

☐ Check the air cleaner cover and base for damage or indications of improper fit and seal.

☐ Check the air cleaner element. Look for holes, tears, cracked or damaged sealing surfaces, or other damage that could allow unfiltered air into the engine. Also note if the element is dirty or clogged. These could indicate that the engine has been underserviced.

☐ Check the carburetor throat for dirt. Dirt in the throat is further indication that the air cleaner is not functioning properly.

☐ Check the oil level. Note if the oil level is within the operating range on the dipstick, or if it is low or overfilled.

☐ Check the condition of the oil. Drain the oil into a container—the oil should flow freely. Check for metal chips and other foreign particles.

Sludge is a natural by-product of combustion; a small accumulation is normal. Excessive sludge formation could indicate the oil has not been changed at the recommended intervals, the incorrect type or weight of oil was used, overrich carburetion, and weak ignition, to name a few.

NOTE: It is good practice to drain oil at a location away from the workbench. Be sure to allow ample time for complete drainage.

## CLEANING THE ENGINE

After inspecting the external condition of the engine, clean the engine thoroughly before disassembling it. Also clean individual components as the engine is disassembled. Only clean parts can be accurately inspected and gauged for wear or damage. There are many commercially available cleaners that will quickly remove grease, oil, and grime from engine parts. When such a cleaner is used, *follow the manufacturer's instructions and safety precautions carefully.*

Make sure all traces of the cleaner are removed before the engine is reassembled and placed into opera-

tion. Even small amounts of these cleaners can quickly break down the lubricating properties of engine oil.

## BASIC ENGINE TESTS

### Crankcase Vacuum Test

A partial vacuum should be present in the crankcase when the engine is operating at normal temperatures. Pressure in the crankcase (normally caused by a clogged or improperly assembled breather) can cause oil to be forced out at oil seals, gaskets, or other available spots.

Crankcase vacuum is best measured with a water manometer. The manometer included in the Kohler Engine Analysis Kit is recommended. Refer to Section 2 — "Special Tools" for more information.

Test the crankcase vacuum with the manometer as follows:

1. Insert the stopper/hose into the oil fill hole. Leave the other vent hose of manometer open to atmosphere. Make sure the shutoff clamp is closed.
2. Start the engine and run at no-load high idle speed (3200 to 3750 rpm).
3. Open the clamp and note the water level in the tube.

   The level in the engine side should be a minimum of **10.2 cm (4 in)** above the level in the open side.

   If the level in the engine side is the same as the open side (no vacuum), or the level in the engine side is lower than the level in the open side (pressure), check for the conditions in the table below.
4. Close the shutoff clamp **before** stopping the engine.

### Compression Test

These engines are equipped with an automatic compression release (ACR) mechanism. Because of the ACR mechanism, it is difficult to obtain an accurate compression reading.

To check the condition of the combustion chamber and related mechanisms, physical inspection and a crankcase vacuum test are recommended.

**NO CRANKCASE VACUUM/PRESSURE IN CRANKCASE**

| Possible Cause | Solution |
|---|---|
| 1. Crankcase breather clogged or inoperative. | 1. Disassemble breather, clean parts thoroughly, reassemble, and recheck pressure. |
| 2. Seals and/or gaskets leaking. Loose or improperly torqued fasteners. | 2. Replace all worn or damaged seals and gaskets. Make sure all fasteners are tightened securely. Use appropriate torque values and sequences when necessary. |
| 3. Piston blowby or leaky valves. (Confirm by inspecting components.) | 3. Recondition piston, rings, cylinder bore, valves, and valve guides. |
| 4. Restricted exhaust. | 4. Repair/replace restricted muffler/exhaust system. |

# SECTION 3
# TROUBLESHOOTING

# SECTION 4
# AIR CLEANER & AIR INTAKE SYSTEM



## AIR CLEANER

These engines are equipped with a replaceable, high-density paper air cleaner element. Some engines are also equipped with an oiled-foam precleaner which surrounds the paper element. See Figures 4-1 and 4-2.

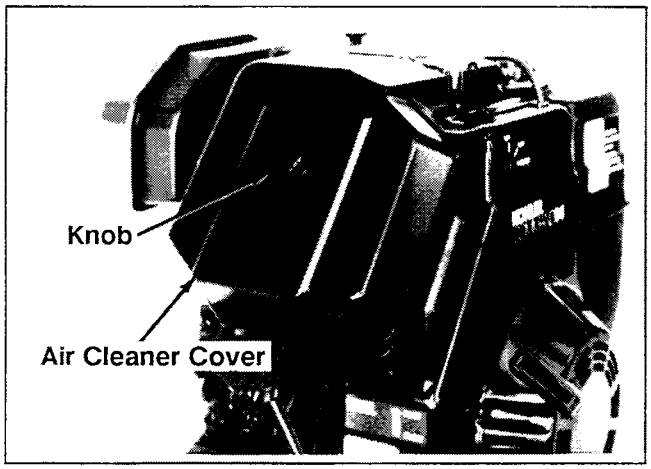



**Figure 4-1. Air Cleaner Housing Components.**

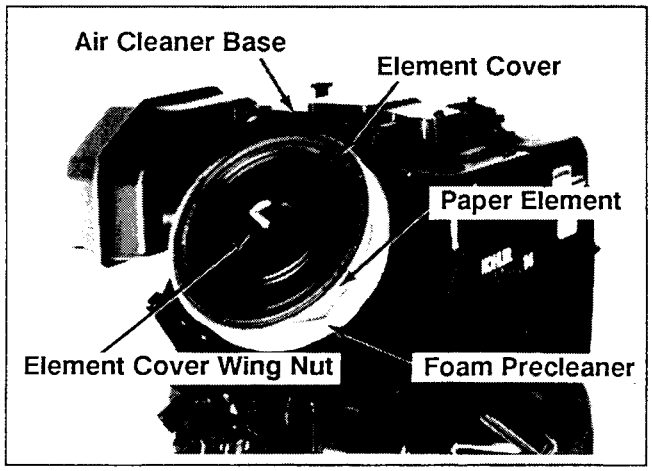



**Figure 4-2. Air Cleaner Elements.**

### Air Cleaner Service

Check the air cleaner **daily or before starting the engine**. Check for and correct heavy buildup of dirt and debris, and loose or damaged components.

NOTE: Operating the engine with loose or damaged air cleaner components could allow unfiltered air into the engine causing premature wear and failure.

### Service Precleaner

If so equipped, wash and reoil the precleaner every **25 hours** of operation (more often under extremely dusty or dirty conditions).

1. Remove the precleaner from the paper element.
2. Wash the precleaner in warm water with detergent. Rinse the precleaner thoroughly until all traces of detergent are eliminated. Squeeze out excess water (do not wring). Allow the precleaner to air-dry.
3. Saturate the precleaner with new engine oil. Squeeze out all excess oil.
4. Reinstall the precleaner over the paper element.
5. Reinstall air cleaner cover, and air cleaner cover retaining knob. Make sure the knob is tightened securely.

### Service Paper Element

Every **100 hours** of operation (more often under extremely dusty or dirty conditions), check the paper element. Replace the element as necessary.

1. Remove the precleaner (if so equipped) from the paper element.
2. Remove the wing nut, washer, element cover, and air cleaner element.

3. Do not wash the paper element or use pressurized air, as this will damage the element. Replace a dirty, bent, or damaged element with a genuine Kohler element. Handle new elements carefully; do not use of the sealing surfaces are bent or damaged.

4. Reinstall the paper element, element cover, washer, wing nut, precleaner, air cleaner cover, and air cleaner cover retaining knob. Make sure the knob is tightened securely.

## Inspect Air Cleaner Components

Whenever the air cleaner cover is removed, or the paper element or precleaner are serviced, check the following areas/components:

**Covered Air Cleaner Element** — Inspect the rubber grommet in the hole of the air cleaner element cover. Replace the grommet if it is worn or damaged.

**Air Cleaner Base** — Make sure the base is secured and not cracked or damaged. Since the air cleaner base and carburetor are secured to the intake port with common hardware, it is extremely important that the nuts securing these components are tight at all times.

**Breather Tube** — Make sure the tube is installed to both the air cleaner base *and* valve cover.

NOTE: Damaged, worn, or loose air cleaner components can allow unfiltered air into the engine causing premature wear and failure. Tighten or replace all loose or damaged components.

## Disassembly

The following procedure is for complete disassembly of all air cleaner components.

1. Remove the air cleaner cover retaining knob and air cleaner cover.

2. If so equipped, remove the precleaner from paper element.

3. Remove the wing nut, washer, element cover, and air cleaner element.

4. Disconnect the breather hose from the valve cover.

5. Remove the air cleaner base mounting nuts, air cleaner base, and gasket.

6. If necessary, remove the self-tapping screws and elbow from air cleaner base.

## Reassembly

The following procedure is for complete assembly of all air cleaner components.

1. Install the elbow and self-tapping screws to air cleaner base.

2. Install the gasket, air cleaner base, and base mounting nuts. Torque the nuts to **9.9 N·m (88 lbf·in)**.

3. Connect the breather hose to the air cleaner base (and valve cover). Secure with hose clamps.

4. If necessary, install the grommet into the cover of air cleaner element. Install the air cleaner element, element cover, washer, and wing nut.

5. If so equipped, install the precleaner (washed and oiled) over the paper element.

6. Install the air cleaner cover and air cleaner cover retaining knob. Tighten the knob securely.

# AIR INTAKE/COOLING SYSTEM

## Clean Air Intake/Cooling Areas

To ensure proper cooling, make sure the grass screen, cooling fins, and other external surfaces of the engine are kept clean **at all times**.

Every **100 hours** of operation (more often under extremely dusty, dirty conditions), remove the blower housing and other cooling shrouds. Clean the cooling fins and external surfaces as necessary. Make sure the cooling shrouds are reinstalled.

NOTE: Operating the engine with a blocked grass screen, dirty or plugged cooling fins, and/or cooling shrouds removed, will cause engine damage due to overheating.