single cylinder engine

SERVICE MANUAL

MAGNUM

MODELS M8, M10, M12, M14, M16

KOHLER engines

TP-2203-A

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KOHLER engines

GENERAL INFORMATION

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 blower housing. Refer to Figure 1-1. The significance of these numbers is shown below:

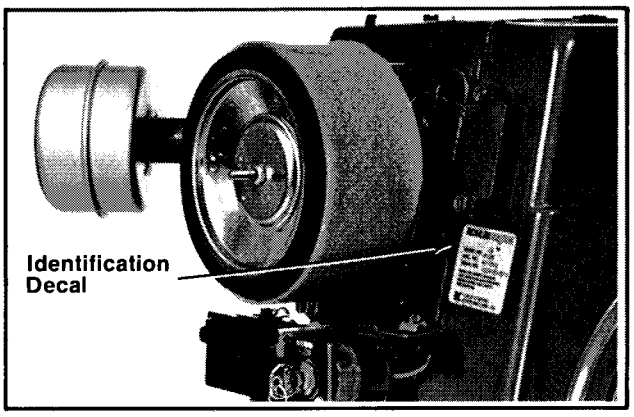


Figure 1-1. Location Of Engine Identification Decal.

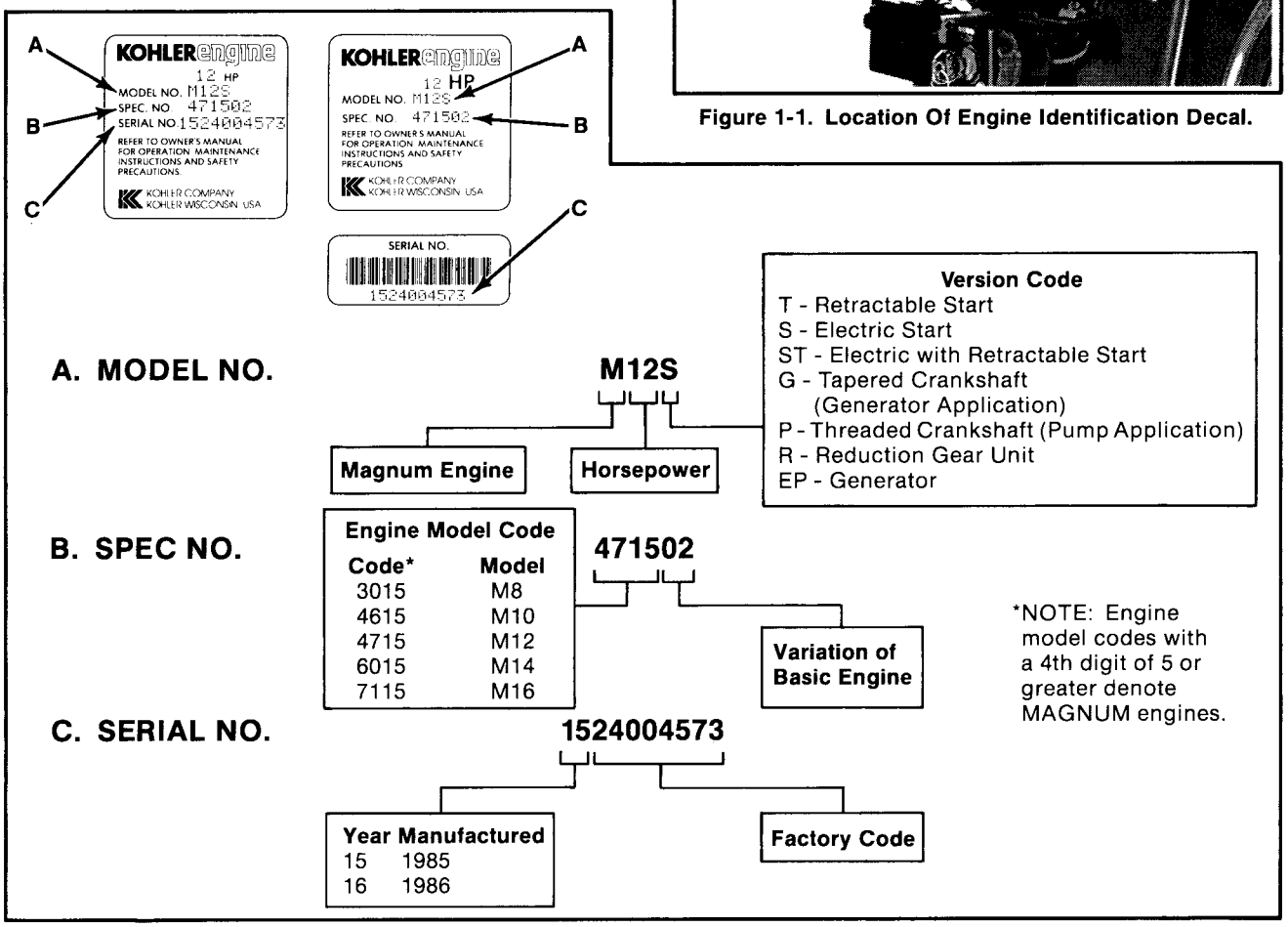
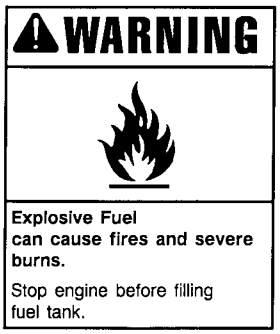


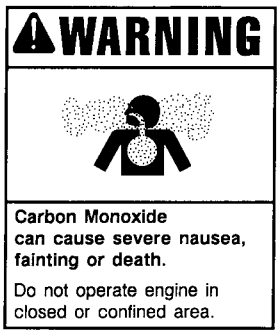
Figure 1-2. Engine Identification Decals.

SAFETY INFORMATION

For Your Safety!

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





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 which could cause fires.

On engines equipped with 12 volt battery and/or electric start, disconnect the battery cables from battery. Always disconnect the negative (-) cable first.

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: High Voltage!
Never touch electrical wires or components while the engine is running. They can be sources of electrical shock which could cause severe injury or burns.

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 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; wipe up spills immediately. Never use gasoline as a cleaning agent.

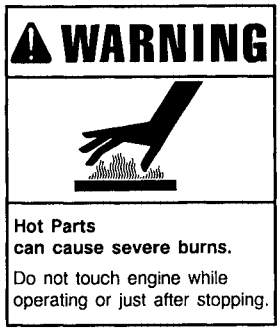
WARNING: Lead-Acid Storage Battery!
Use extreme care when handling or charging the battery. Batteries contain sulfuric acid—avoid contact with skin, eyes, and clothing. Batteries produce explosive hydrogen gas while being charged. Charge batteries only in well-ventilated areas. Keep cigarettes, sparks, open flame, and other sources of ignition away at all times. Keep batteries and acid out of the reach of children.

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: Spring Under Tension!
Retractable starters contain a powerful, flat wire recoil spring that is under tension. Do not remove the center screw from 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.

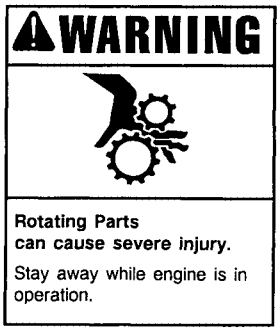
To ensure personal safety and proper starter disassembly and reassembly, the procedures specified in the "Retractable Starters" section must be followed carefully.



Hot Parts!
The crankcase, cylinder head, exhaust system, and other components 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.

WARNING: Explosive Fuel!
Gasoline may be present in the intake manifold, carburetor, and fuel system. Gasoline is extremely flammable, and its vapors can explode if ignited. Keep cigarettes, sparks, open flames, and other sources of ignition away from the engine. Wipe up spilled fuel immediately.

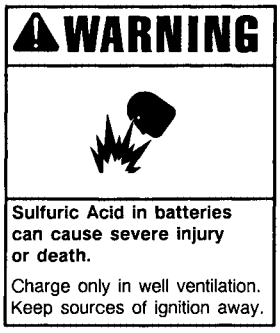
WARNING: Flammable Solvents!
Carburetor cleaners and degreasing solvents are extremely flammable. Keep sparks, flames, and other sources of ignition away from area. Follow the cleaner manufacturer's warnings and instructions on its proper and safe use. Never use gasoline as a cleaning agent.



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: Damaging Crankshaft and Flywheel Could Cause Personal Injury!
Using improper procedures to remove or install the flywheel can crack or damage the crankshaft and/or flywheel. This not only causes extensive engine damage, but also is a serious threat to the safety of persons nearby, since broken fragments could be thrown from the engine. Always observe and use the precautions, procedures, and tools specified in the "Disassembly" and "Reassembly" sections when removing or installing the flywheel.

WARNING: Old Spring Cannot Be Reinstalled!
Do not attempt to rewind or reinstall a spring once it has been removed from the spring retainer or starter housing. Severe personal injury could result from the sudden uncoiling of the spring. Always order and install a new spring which is held in a specially designed spring retainer.



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 the battery only in well-ventilated areas. Keep sparks, open flame, and other sources of ignition away from 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: Ignition Magnet Is Not Removable or Serviceable!
Do not attempt to remove the ignition magnet from flywheel. Loosening or removing the magnet mounting screws could cause the magnet to come loose and be thrown from the engine causing severe injury. Replace the flywheel if magnet is damaged.

WARNING: Prevent Eye Injury!

Suitable eye protection (safety glasses, goggles, or face hood) should be worn for any procedure involving the use of compressed air, punches, hammers, chisels, drills, or grinding tools.

WARNING: Spring Under Tension!

Do not remove the center screw of the M8 retractable starter when replacing pawls. Removal of the center screw can cause the sudden and potentially dangerous release of the recoil spring. It is not necessary to remove the center screw when making this repair.

WARNING: Overspeed Is Hazardous!

The maximum allowable speed for these engines is 3600 RPM, no load. Never tamper with the governor settings to increase the maximum speed. Severe personal injury and damage to the engine or equipment can result if operated at speeds above maximum.

WARNING: Spring Under Tension!

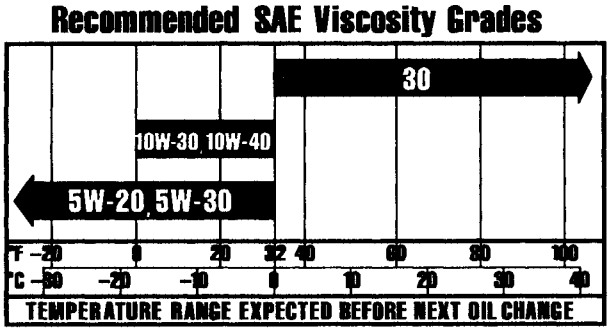
Do not attempt to pull or pry the recoil spring from the starter housing or spring retainer. Doing so can cause the sudden and potentially dangerous release of the spring. Follow the instructions and procedures specified in the "Retractable Starters" section carefully to ensure personal safety and proper spring replacement. Make sure adequate face protection is worn throughout the entire procedure.

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.

Oil Type

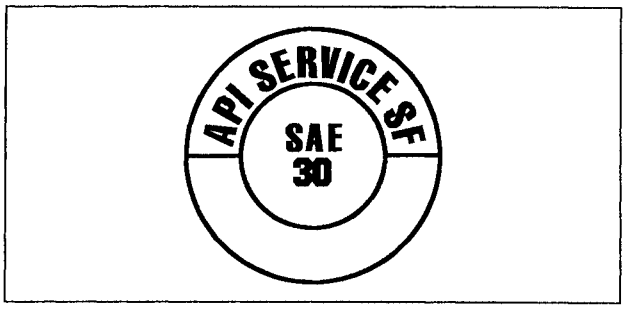
Use high quality detergent oil of API (American Petroleum Institute) service class SF or SG. Select the viscosity based on the air temperature at the time of operation as shown below:



Straight 30-weight oil is recommended. Do not use multi-viscosity oils above 32°F (0°C) as considerable increases in oil consumption and combustion deposits will result.

NOTE: Using other than service class SF or SG oil or extending oil change intervals longer than recommended can cause engine damage which is not covered by the engine warranty.

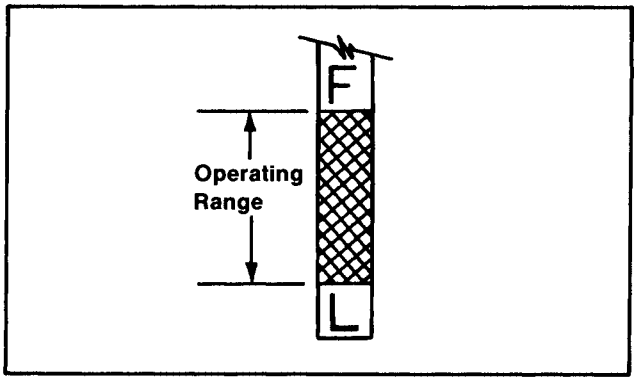
A logo or symbol on oil containers identifies the API service class and SAE viscosity grade.



Check Oil Level

Check oil level BEFORE EACH USE.

CAUTION: Do not operate the engine with the oil level below "L" mark or over "F" mark on dipstick.



Change Oil

For a new engine, change oil after the first 5 hours of operation. Change oil every 25 operating hours thereafter.

For an overhauled engine or those rebuilt with a new shortblock or miniblock, use straight 30-weight Service Class SF oil for the first 5 hours of operation. Change the oil after this initial run-in period. Refill with Service Class SF oil as specified in the table. Change oil every 25 operating hours thereafter.

Refer to the "Periodic Maintenance" section for detailed oil checking and changing 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 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 engine near spilled fuel; wipe up spills immediately. 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.

OVERALL DIMENSIONS

Model M8 With Side Tank

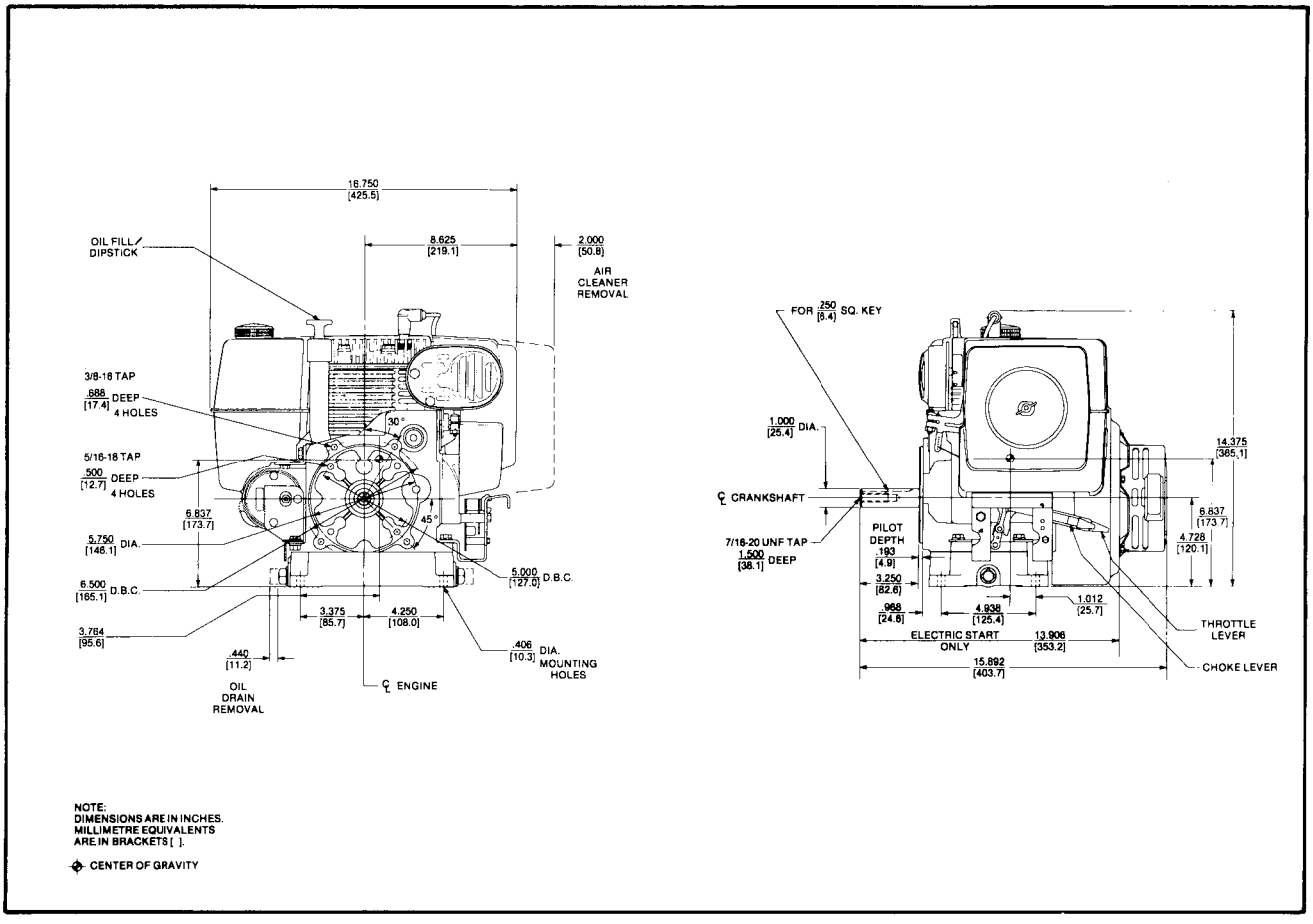


Figure 1-3. Overall Dimensions - Model M8 With Side Tank.

Model M8 With Top Tank

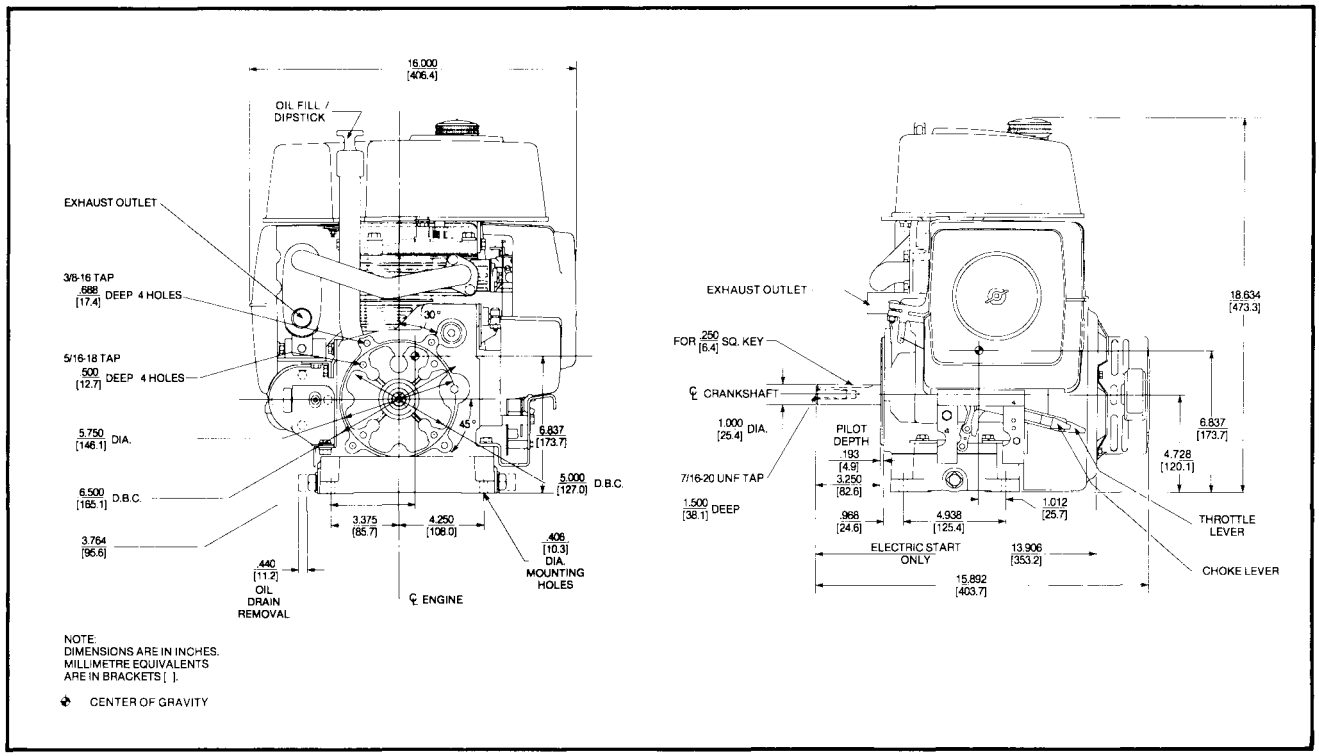


Figure 1-4. Overall Dimensions - Model M8 With Top Tank.

Model M10, M12, M14, And M16

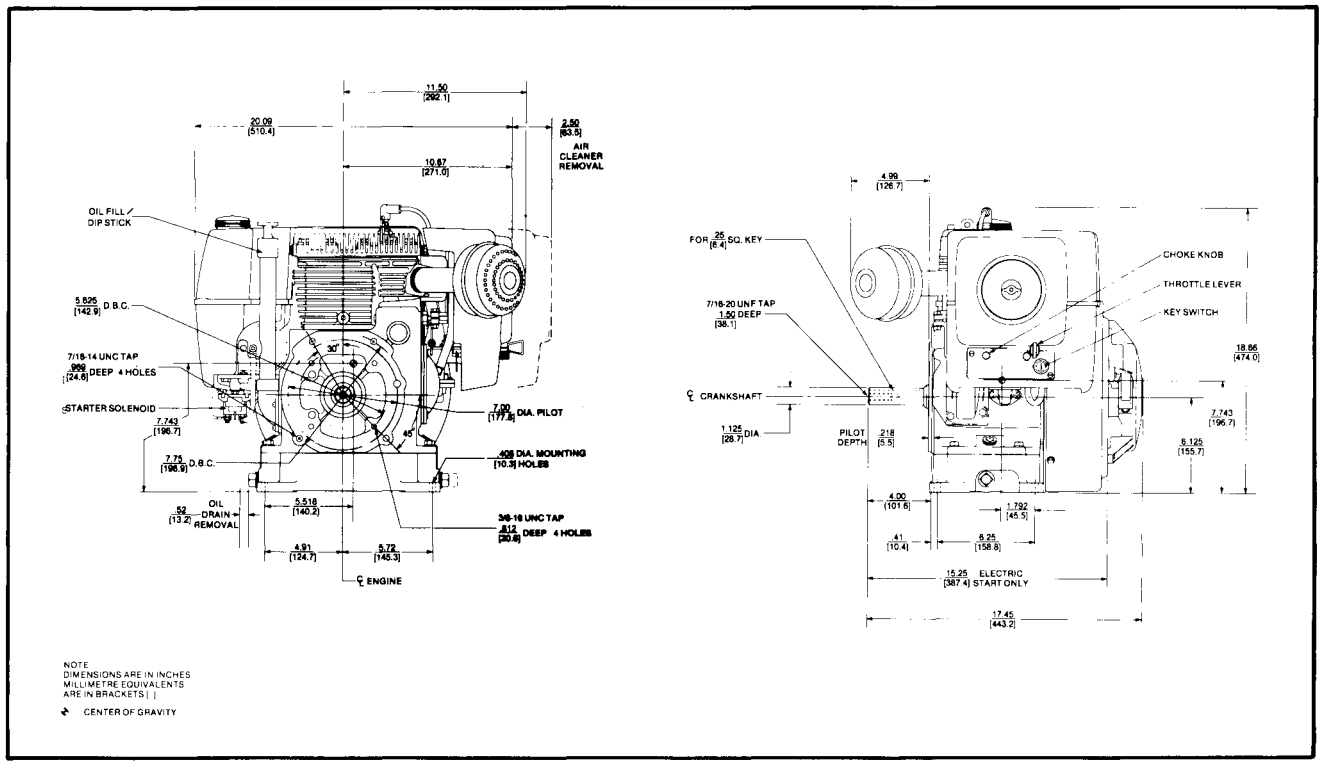


Figure 1-5. Overall Dimensions - Models M10, M12, M14, and M16.

STANDARD TORQUE VALUES[1]

Bolts, Screws, Nuts, and Fasteners Assembled Into Cast Iron or Steel

Size	Grade 2	Grade 5[3]	Grade 8
#8-32	20 in. lb.	25 in. lb.	—
#10-24	32 in. lb.	40 in. lb.	—
#10-32	32 in. lb.	40 in. lb.	—
1/4-20	70 in. lb.	115 in. lb.	165 in. lb.
1/4-28	85 in. lb.	140 in. lb.	200 in. lb.
5/16-18	150 in. lb.	250 in. lb.	350 in. lb.
5/16-24	165 in. lb.	270 in. lb.	30 ft. lb.
3/8-16	260 in. lb.	35 ft. lb.	50 ft. lb.
3/8-24	300 in. lb.	40 ft. lb.	60 ft. lb.
7/16-14	35 ft. lb.	55 ft. lb.	80 ft. lb.
7/16-20	45 ft. lb.	75 ft. lb.	105 ft. lb.
1/2-13	50 ft. lb.	80 ft. lb.	115 ft. lb.
1/2-20	70 ft. lb.	105 ft. lb.	165 ft. lb.
9/16-12	75 ft. lb.	125 ft. lb.	175 ft. lb.
9/16-18	100 ft. lb.	165 ft. lb.	230 ft. lb.
5/8-11	110 ft. lb.	180 ft. lb.	260 ft. lb.
5/8-18	140 ft. lb.	230 ft. lb.	330 ft. lb.
3/4-10	150 ft. lb.	245 ft. lb.	350 ft. lb.
3/4-16	200 ft. lb.	325 ft. lb.	470 ft. lb.

Bolts, Screws, Nuts, and Fasteners Assembled Into Aluminum

Size	Grade 2	Grade 5	Grade 8
#8-32	20 in. lb.	20 in. lb.	20 in. lb.
#10-24	32 in. lb.	32 in. lb.	32 in. lb.
1/4-20	70 in. lb.	70 in. lb.	70 in. lb.
5/16-18	150 in. lb.	150 in. lb.	150 in. lb.

Oil Drain Plugs[4]

Size	Into Cast Iron Pans	Into Aluminum Pans
1/4"	150 in. lb.	100 in. lb.
3/8"	180 in. lb.	120 in. lb.
1/2"	20 ft. lb.	13 ft. lb.
3/4"	25 ft. lb.	16 ft. lb.
X-708-1[5]	20/25 ft. lb.	20/25 ft. lb.

Conversions

ft. lb. = in. lb. x 0.083
in. lb.= ft. lb. x 12
kgm = ft. lb. x 0.1383
Nm. = ft. lb. x 1.3558

SPECIFICATIONS, TOLERANCES, AND SPECIAL TORQUE VALUES[2]

General	Model M8	Model M10	Model M12	Model M14	Model M16
Horsepower (@ 3,600 rpm)	8	10	12	14	16
Displacement (cu. in.)	18.64	23.85	29.07	31.27	35.9
Bore	2.94	3.25	3.38	3.50	3.75
Stroke	2.75	2.88	3.25	3.25	3.25
Compression Ratio	6.8:1	6.2:1	6.6:1	7.0:1	7.3:1
Approx. Weight (lb.)	71	129	129	129	129
Approx. Oil Capacity* (U.S. Quarts)	1	2	2	2	2
Approx. Fuel Tank Capacity (U.S. Gallons)	1.25	1.5	1.5	1.5	1.5

*For best results, fill to "F" mark on dipstick as opposed to adding a given quantity of oil. Always check level on dipstick before adding more oil.

	Model M8	Model M10	Model M12	Model M14	Model M16
Air Cleaner					
Element Cover Nut Torque (in. lb.)	50	50	50	50	50
Angle of Operation - Maximum (At Full Oil Level; Intermittent Operation)					
With Oil Sentry™					
Carb. Side Up	15°	15°	15°	15°	15°
Carb. Side Down	35°	23°	23°	23°	23°
Flywheel End Up	35°	30°	30°	30°	30°
Flywheel End Down	45°	45°	45°	45°	45°
Without Oil Sentry™					
Carb. Side Up	45°	45°	45°	45°	45°
Carb. Side Down	35°	23°	23°	23°	23°
Flywheel End Up	35°	30°	30°	30°	30°
Flywheel End Down	45°	45°	45°	45°	45°
Balance Gear					
End Play	—	.002/.010	.002/.010	.002/.010	.002/.010
New Stub Shaft O.D.	—	.4998/.5001	.4998/.5001	.4998/.5001	.4998/.5001
Stub Shaft O.D. Max Wear Limit	—	.4996	.4996	.4996	.4996
Camshaft					
End Play	.005/.010	.005/.010	.005/.010	.005/.010	.005/.010
Camshaft to Camshaft Pin Running Clearance	.0010/.0035	.0010/.0035	.0010/.0035	.0010/.0035	.0010/.0035
Camgear Cover Fastener Torque (in. lbs.)	—	115	115	115	115
Camshaft Pin Depth From Crankcase Surface	.275/.285	.300/.330	.300/.330	.300/.330	.300/.330
Cup Plug Depth from Crankcase Surface	.055/.065	.000/.030	.000/.030	.000/.030	.000/.030
Carburetor					
Preliminary Main Fuel Screw Setting (Turns)	2	1-1/2	1-1/2	2-1/2	2-1/2
Preliminary Idle Fuel Screw Setting (Turns)	1-1/4	2-1/2	2-1/2	2-1/2	2-1/2
Float Level	11/64 (± 1/32)	11/64 (± 1/32)	11/64 (± 1/32)	11/64 (± 1/32)	11/64 (± 1/32)
Float Drop	1-1/32	1-1/32	1-1/32	1-1/32	1-1/32
Fuel Inlet Seat Torque (in. lb.)	35	35	35	35	35
Bowl Retaining Screw Torque (in. lb.)	50	50	50	50	50
Float to Float Pin Tower Clearance	.010	.010	.010	.010	.010
Connecting Rod (Posi-Lock)					
New Service Rod Nut Torque (in. lb.)[4, 6]	140	260	260	260	260
Used Rod Nut Torque (in. lb.)[4, 6]	100	200	200	200	200
Rod to Crankpin Running Clearance - New	.001/.002	.001/.002	.001/.002	.001/.002	.001/.002
Rod to Crankpin Max. Wear Limit	.0025	.0025	.0025	.0025	.0025
Rod to Piston Pin Running Clearance - New	.0006/.0011	.0003/.0008	.0003/.0008	.0003/.0008	.0003/.0008
Piston Pin End I.D. - New	.6255/.6258	.8596/.8599	.8757/.8760	.8757/.8760	.8757/.8760
Rod Side Play on Crankpin	.005/.016	.007/.016	.007/.016	.007/.016	.007/.016

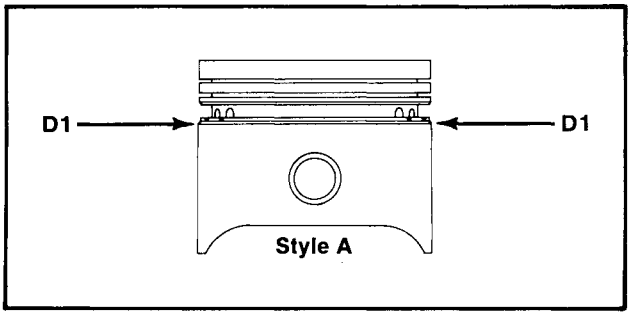
	Model M8	Model M10	Model M12	Model M14	Model M16
Crankshaft					
Crankshaft End Play	.002/.023	.003/.020	.003/.020	.003/.020	.003/.020
Main Bearing Surface O.D. - New	1.1811/1.1814	1.5745/1.5749	1.5745/1.5749	1.5745/1.5749	1.5745/1.5749
Main Bearing Surface Max. Wear Limit	1.1811	1.5745	1.5745	1.5745	1.5745
Crankpin O.D. - New	1.1860/1.1855	1.5000/1.4995	1.5000/1.4995	1.5000/1.4995	1.5000/1.4995
Crankpin O.D. Max. Out of Round	.0005	.0005	.0005	.0005	.0005
Crankpin O.D. Max. Taper	.001	.001	.001	.001	.001
Cylinder Bore					
I.D. - New	2.9380/2.9370	3.2515/3.2505	3.3755/3.3745	3.5005/3.4995	3.7505/3.7495
I.D. Max. Wear Limit	2.941	3.254	3.378	3.503	3.753
I.D. Max. Out of Round	.005	.005	.005	.005	.005
I.D. Max. Taper	.003	.002	.002	.002	.002
Cylinder Head					
Cap Screw Torque (ft. lb.)[4]	15/20	25/30	25/30	25/30	25/30
Max. Out of Flatness	.003	.003	.003	.003	.003
Fan/Flywheel					
Fan Fastener Torque (in. lbs.)	115	115	115	115	115
Flywheel Fastener Torque (ft. lb.)[4]	85/90	40/45	40/45	40/45	40/45
Fuel Pump					
Mounting Screw Torque (in. lb.)	40/45	40/45	40/45	40/45	40/45
Fuel Tank					
Isolation Mount Torque	Hand Tight[7]	Hand Tight	Hand Tight	Hand Tight	Hand Tight
Upper Bracket to Tank Fastener Torque (in. lb.)	90	—	—	—	—
Lower Bracket to Tank Fastener Torque (in. lb.)	90	—	—	—	—
Lower Bracket to Crankcase Bracket Fastener Torque (in. lb.)	70	—	—	—	—
Top Tank Bracket to Cyl. Head Fastener Torque (in. lb.)	150	—	—	—	—
Gear Reduction Unit					
Gear Reduction Shaft End Play	.001/.030	.008/.030	.005/.030	.005/.030	.005/.030
Governor					
Governor Bushing Torque (in. lb.)	100/120	100/120	100/120	100/120	100/120
Governor Bushing to Cross Shaft Running Clearance	.0005/.0020	.0010/.0025	.0010/.0025	.0010/.0025	.0010/.0025
Governor Gear to Stub Shaft Running Clearance	.0005/.0020	.0005/.0020	.0005/.0020	.0005/.0020	.0005/.0020
Governor Cross Shaft End Play	.001/.056	.001/.069	.001/.069	.001/.069	.001/.069

	Model M8	Model M10	Model M12	Model M14	Model M16
Ignition					
Ignition Module to Magnet Air Gap	.012/.016	.012/.016	.012/.016	.012/.016	.012/.016
Spark Plug Type (Champion® or Equiv.)	RCJ-8	RH-10	RH-10	RH-10	RH-10
Spark Plug Gap	.025	.025	.025	.025	.025
Spark Plug Torque (ft. lb.)	18/22	18/22	18/22	18/22	18/22
Ignition Module Mounting Screw Torque (in. lbs.)	32	32	32	32	32
Keyswitch Nut Torque (in. lbs.)	—	90/100	90/100	90/100	90/100
Oil Pan/Oil Sentry™					
Oil Sentry Switch Max. Torque (in. lb.)[10]	90	90	90	90	90
Piston and Piston Rings (Style "A" Pistons)					
Thrust Face O.D. @ D1 - New[11]	2.9297/2.9281	3.2432/3.2413	3.368/3.365	3.4941/3.4925	—
Thrust Face O.D. @ D1 - Max.[11] Wear Limit	2.925	3.238	3.363	3.491	—
Thrust Face to Bore Clearance @ D1 - New[11]	.007/.010	.007/.010	.007/.010	.007/.010	—
Piston Ring End Gap - New	.007/.017	.010/.020	.010/.020	.010/.020	—
Piston Ring End Gap - Used (Max.)	.027	.030	.030	.030	—
Piston Ring Side Clearance - Max.	.006	.006	.006	.006	—
Piston Pin O.D. - New	.6247/.6249	.8591/.8593	.8752/.8754	.8752/.8754	—
Piston and Piston Rings (Styles "C" And "D" Pistons)					
Thrust Face O.D. @ D1 - New[12]	2.9336/2.9329	—	—	—	3.7455/3.7465
Thrust Face O.D. @ D1 - Max. Wear Limit[12]	2.9312	—	—	—	3.7435
Thrust Face to Bore Clearance @ D1 - New[12]	.0034/.0051	—	—	—	.0030/.0050
Piston Ring End Gap - New[9]	.010/.023	—	—	—	.010/.020
Piston Ring End Gap - Used (Max.)[9]	.032	—	—	—	.030
Piston Ring Side Clearance - Max.	.006	—	—	—	.006
Piston Pin O.D. - New	.6247/.6249	—	—	—	.8752/.8754
Valves and Tappets					
Intake Valve to Tappet Clearance - Cold	.006/.008	.008/.010	.008/.010	.008/.010	.008/.010
Exhaust Valve to Tappet Clearance - Cold	.017/.019	.017/.019	.017/.019	.017/.019	.017/.019
Intake Valve Minimum Lift - Zero Lash	.2718	.318	.318	.318	.318
Exhaust Valve Minimum Lift - Zero Lash	.2482	.318	.318	.318	.318
Intake Valve Minimum Stem O.D.	.3103	.3103	.3103	.3103	.3103
Exhaust Valve Minimum Stem O.D.	.3074	.3074	.3074	.3074	.3074

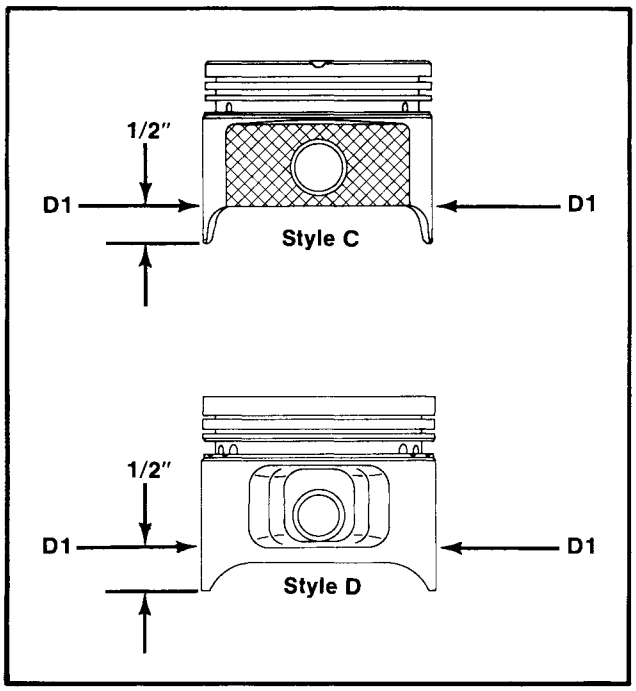
	Model M8	Model M10	Model M12	Model M14	Model M16
Valves and Tappets (Cont.)					
Nominal Valve Seat Angle	45°	45°	45°	45°	45°
Valve Guide Reamer Size	.3125	.3125	.3125	.3125	.3125
Intake Valve Guide I.D.					
Max. Wear Limit	.006	.006	.006	.006	.006
Exhaust Valve Guide I.D.					
Max. Wear Limit	.008	.008	.008	.008	.008
Throttle Control Lever					
Remote Throttle Control					
Nut Torque (in. lb.)[8]	10/15	10/15	10/15	10/15	10/15
Engine Mtd. Throttle Control					
Nut Torque (in. lb.)	15/25	15/25	15/25	15/25	15/25
Fixed Speed Applications					
(Shortened Throttle Control)					
Nut Torque (in. lb.)	70	70	70	70	70

Notes:

1. Use standard torque values when specific values are not given. Standard values have a tolerance of ± 20%.
2. All dimensions are in inches unless otherwise specified.
3. Also applies to self-tapping screws.
4. Lubricate with oil at assembly.
5. 3/8-16 thread with hex head nut and fiber gasket.
6. Torque in increments to the value specified. Do not overtorque—loosen—and retorque hex nuts on Posi-Lock connecting rods.
7. Top tank models only.
8. Torque to value specified; then loosen nut 1/2 turn.
9. Top and center compression rings.
10. Turn the Oil Sentry™ float switch in approx. 5 to 6 full turns until positioned properly. Refer to the "Electrical System And Components" section for specific installation procedures.
11. Measurements @ D1 on Style "A" pistons are made perpendicular to piston pin, just below the oil ring.



12. Measurements @ D1 on Styles "C" and "D" pistons are made perpendicular to piston pin in the position shown.



MAGNUM

Single Cylinder Engine
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KOHLER engines

SECTION 2

SPECIAL TOOLS

SPECIAL SERVICE TOOL KIT NO. 3211

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.

The Special Service Tool Kit No. 3211 can be ordered complete as shown in Figure 2-1 or the tools can be ordered individually. Contact your Kohler Engine Distributor for price and availability.

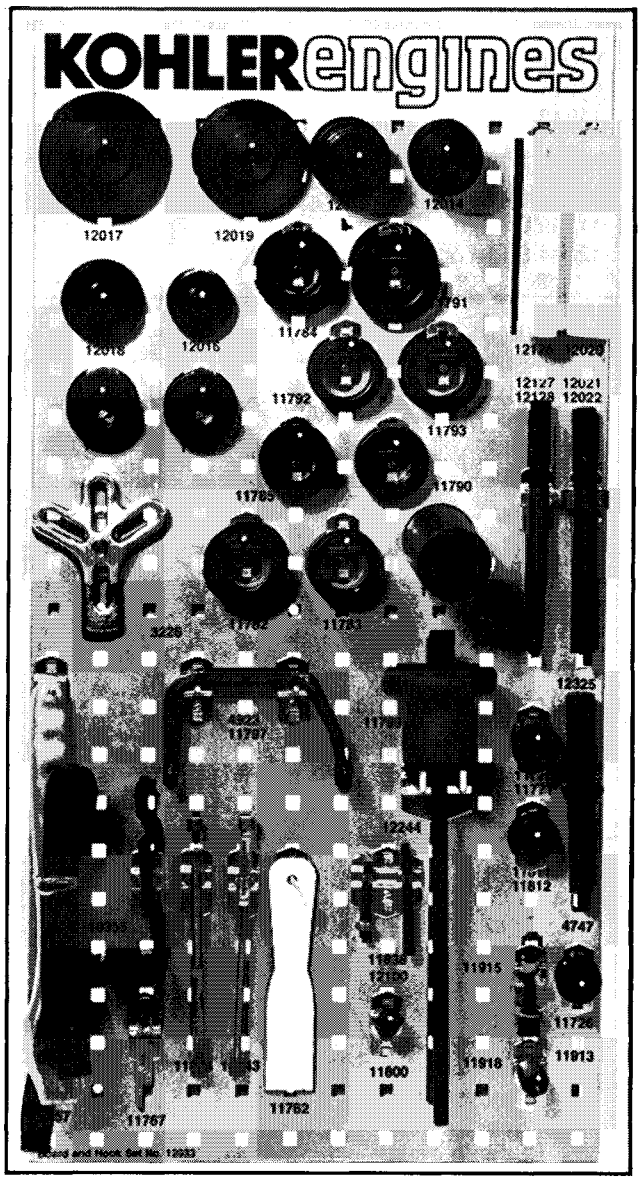
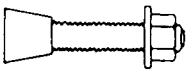
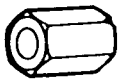
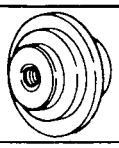
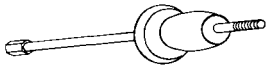
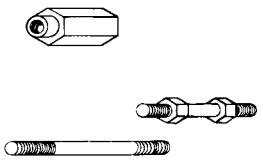
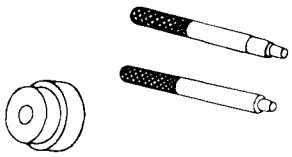
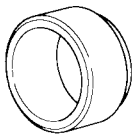
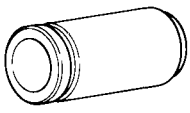


Figure 2-1. Special Service Tool Kit - No. 3211.

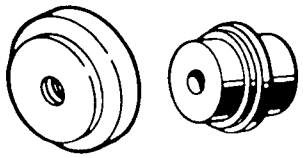
VALVE SERVICE TOOLS

TOOL NO. & NAME	APPLICATION	ILLUSTRATION
VALVE SEAT PULLERS 11726 11913	Removal of valve seats, Use 11918 adapter, 3222 slide hammer & 11915 forcing screw	
FORCING SCREW 11915	Used with valve seat pullers 11726 & 11913	
ADAPTER 11918	Used to connect valve seat pullers to slide hammer	
VALVE SEAT INSTALLER 11811 11812	Used to install intake and exhaust seats. Use with 4747 handle	
3222 SLIDE HAMMER 11799 Weight 12244 Slide Bolt	Provides pulling force for valve seat and guide removal. Use 4747 handle.	
3268 VALVE GUIDE REMOVAL KIT 11838 Stud 3 1/2" 12100 Stud 2 1/2" 11800 Adapter 0917 Nut 12008 Nut	Used to pull valve guides with 3222 slide hammer	
3224 VALVE GUIDE INSTALLER KIT 12325 Driver 11763 Driver 11770 Gage 11771 Gage	Used to install valve guides to proper depth. Use 11763 driver with 11770 & 11771 depth gages	
REAMERS (Valve Guide) 11843 5/16" 11844 1/4"	To ream valve guides	

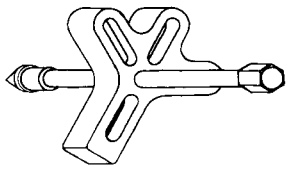
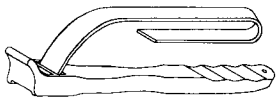
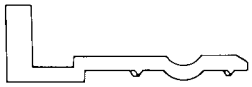
SEAL AND BEARING INSTALLERS

3223 SEAL INSTALLER KIT 11782 Seal Installer 11783 Seal Installer 11784 Seal Installer 11785 Seal Installer 11786 Seal Installer 11787 Seal Installer 11790 Seal Installer 11791 Seal Installer 11792 Seal Installer 11793 Seal Installer 11795 Handle	Used to install seals without damage and to proper depth. Use 11795 handle with installers	 

SEAL AND BEARING INSTALLERS

TOOL NO. & NAME	APPLICATION	ILLUSTRATION
3242 SEAL PROTECTOR SLEEVE KIT 12020 .75" 12021 1.00 12022 1.25 12126 1.12 12127 1.50 12128 1.44	Used on crankshaft when installing seals to prevent damage	
3241 BEARING INSTALLING KIT 12014 Ins. (Crank Bushing) 12015 Ins. (Cam Bushing) 12016, 12017, 12018 & 12109 Brg. Installers	Used to install & remove engine bearings and bushings	

OTHER APPLICATIONS

3226 FLYWHEEL PULLER KIT 12485 Puller w/forcing screw 5108 Bolt - 1/4" w/washer (3) 12505 Bolt - 10-24 w/washer (2) 12504 Bolt - 3/8" w/washer (2) 12506 Storage Bag	Used to remove flywheels and bearing plates from engine	
FLYWHEEL STRAP WRENCH 10357	Used to hold flywheel for nut removal	
OFFSET WRENCH 11797 Wrench 1/2" 4923 Wrench 9/16"	Used to remove & install cylinder barrel retaining nuts	
FEELER GAGE 11767	Used to set oil pump drive gear backlash on twin cylinder engine	
TIMING GAGE 10355 Timing Gage	Used to hold balance gears in timed position when assembling engine	
SCRAPER 11762	Used to scrape machined surfaces without damage	
HANDLE 4747 Handle	Used with bearing installers, slide hammer, and valve seat installers	
TOOL BOARD AND HOOK SET 12033	Used to store and identify tools	**SEE FRONT PAGE**

KIT NO. 3211 TOOL USAGE CHART

PART NO & NAME / VALVE TOOLS	MODEL (" K" SERIES)											MODELS ("M" SERIES)								
	K-91	K-161	K-181	K-241	K-301	K-321	K-341	KT-17	KT-19	K-532	K-582	M-8	M-10	M-12	M-14	M-16	M-18	M-20		
11726 Valve Seat Puller		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		
11913 Valve Seat Puller		●	●	●	●	●						●	●	●	●					
11915 Forcing Screw		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		
11918 Adapter		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		
11811 Valve Seat Installer		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		
11812 Valve Seat Installer	●																			
3222 Slide Hammer		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		
3268 Valve Guide Removal Kit		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		
12325 Valve Guide Driver		●	●	●	●	●	●			●	●	●	●	●	●	●				
11763 Valve Guide Driver (depth)								●	●								●	●		
11770 Valve Guide Depth Gage								●	①								●			
11771 Valve Guide Depth Gage									●									●		
11843 Valve Guide Reamer 5/16"		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		
11844 Valve Guide Reamer 1/4"	●																			

[1] KT19 engines prior to Series II (Spec No. 49199 and lower).

BEARING AND SEAL INSTALLERS

12014 Installer — Crank Bushing										●	●									
12015 Installer — Cam Bushing										●	●									
12016 Installer — Bearing	●																			
12017 Installer — Bearing (PTO)										●	●									
12018 Installer — Bearing		●	●									●								
12019 Installer — Bearing				●	●	●	●						●	●	●	●				
11782 Installer — Seal (PTO)								●	●								●	●		
11783 Installer — Seal (Flywheel)								●	●								●	●		
11784 Installer — Seal (PTO)				●	●	●	●						●	●	●	●				
11785 Installer — Seal (PTO)		●	●									●								
11786 Installer — Seal (Flywheel)	●																			
11787 Installer — Seal (PTO)	●																			
11790 Installer — Seal (Flywheel)		●	●										●							
11791 Installer — Seal (PTO)										●	●									
11792 Installer — Seal (Flywheel)				●	●	●	●						●	●	●	●				
11793 Installer — Seal (Flywheel)										●	●									
11795 Handle — Installer Seal	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		
12020 Seal Sleeve				USE AS REQUIRED									USE AS REQUIRED							
12021 Seal Sleeve				USE AS REQUIRED									USE AS REQUIRED							
12022 Seal Sleeve				USE AS REQUIRED									USE AS REQUIRED							
12126 Seal Sleeve				USE AS REQUIRED									USE AS REQUIRED							
12127 Seal Sleeve				USE AS REQUIRED									USE AS REQUIRED							
12128 Seal Sleeve				USE AS REQUIRED									USE AS REQUIRED							

MISCELLANEOUS TOOLS

10357 Flywheel Strap Wrench 1/2"	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		
11797 Offset Wrench ½"								●	●								●	●		
4923 Offset Wrench 9/16"								●	●											
11767 Feeler Gauge-Crank(Oil Pump)										●	●									
10355 Timing Tool (Balance Gear)				●	●	●	●						●	●	●	●				
11762 Scraper	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		
4747 Drive Handle	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		
3226 Flywheel Puller Kit	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		

ENGINE ANALYSIS KIT NO. 25 800 01

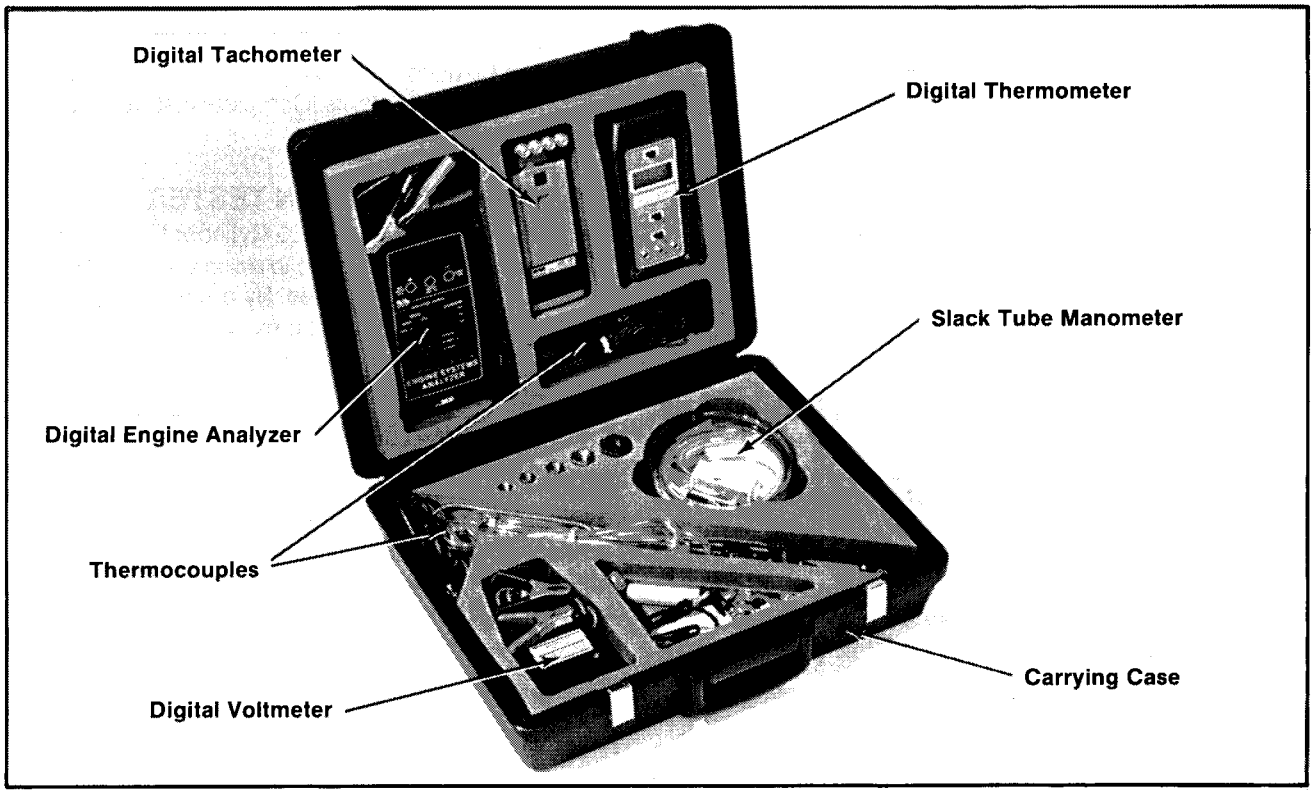


Figure 2-2. Engine Analysis Kit - No. 25 800 01.

The Kohler Engine Analysis Kit contains a selection of instruments which 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 sophisticated application tests.

The kit includes the following:

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

The voltmeter, tachometer, thermometer, and engine analyzer feature state of the art 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:

- Measure temperatures of—
  - spark plug base gasket/cylinder head bolt.
  - oil sump.
  - air into flywheel and carburetor.
- Measure engine speed (RPM).
- Measure crankcase vacuum and exhaust system back pressure.
- Measure voltage.
- Measure charging system current.
- 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.

IGNITION SYSTEM TESTER

These engines are equipped with a dependable electronic magneto ignition system. Ignition tester 25 455 01 can be used to determine if the ignition module is functioning properly. See Figure 2-3.

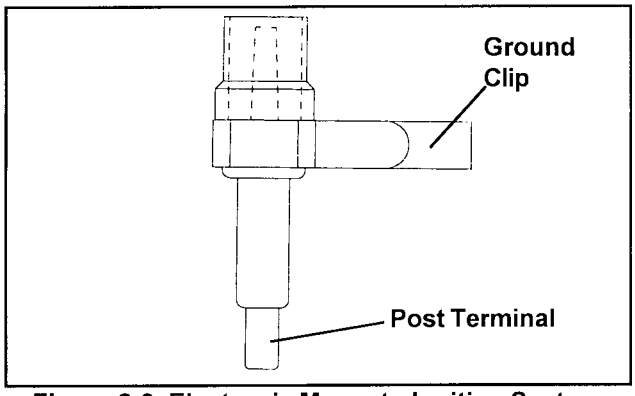


Figure 2-3. Electronic Magneto Ignition System Tester.

Using The Tester

1. Disconnect spark plug lead and connect it to the post terminal of tester. Connect the ground clip to a good ground, not to the spark plug.

NOTE: To maintain engine speeds normally obtained during cranking, do not remove the engine spark plug.

2. Make sure the engine ignition switch, kill switch, or key switch is in the "run" position.

3. Crank the engine and observe the test plug. Visible and audible sparks should be produced. **Do not** touch tester during cranking.

WATER MANOMETER

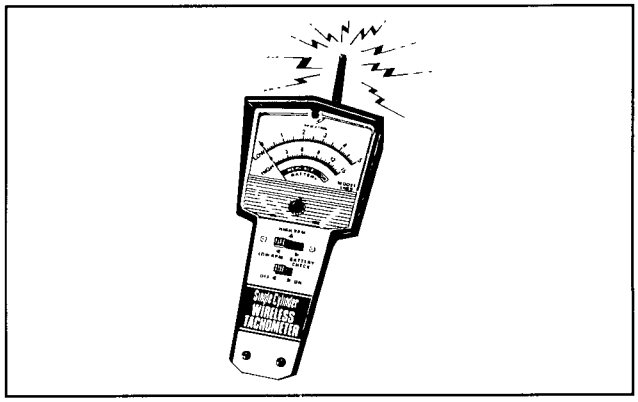
The Kohler Part No. 25 761 02 U-Tube water manometer is a useful tool to check crankcase vacuum (or pressure) and to check for exhaust back pressure It can also be used to adjust primary regulators used with gaseous fuel systems. Complete instructions are provided in the kit.

CYLINDER LEAKDOWN TESTER

The Kohler Part No. 25 761 05 Cylinder Leakdown Tester is a valuable alternate to a compression test on these ACR equipped engines. By pressurizing the combustion chamber from an external air source, this tool can determine if valves or rings are leaking. Instruction for using this tester are included with the tester.

INDUCTANCE TACHOMETER

The Kohler Part No. 25 761 03 is a hand-held inductance tachometer that can be used to obtain accurate RPM readings on all Kohler engines.



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SECTION 3

PERIODIC MAINTENANCE

3

REQUIRED MAINTENANCE

These required maintenance procedures should be performed at the frequency stated in the table:

Required Maintenance	Frequency
Check Oil Level	Daily
Clean Grass Screen	Daily*
Check/Replace Fuel Filter	As Required
Clean Foam Precleaner	25 Hours*
Change Oil	25 Hours
Check Optional Reduction Gear Unit	50 Hours
Clean Cooling Fins and External Surfaces	50 Hours*
Clean Paper Air Cleaner Element	100 Hours*
Check Spark Plug	100 Hours
Check Valve-To-Tappet Clearance	500 Hours
Clean Cylinder Head and Combustion Chamber	500 Hours**
Service Starter Motor Drive	Annually or 500 Hours

*Perform these maintenance procedures more frequently when engine is operated under extremely dusty and dirty conditions.

**250 Hours when leaded gasoline is used.

WARNING: Accidental Starts!

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

CHECK OIL LEVEL

The importance of checking and maintaining the proper oil level in crankcase cannot be overemphasized. Check oil BEFORE EACH USE as follows:

1. Make sure the engine is stopped, level, and is cool so the oil has had time to drain into the sump.
2. Clean the area around oil fill cap/dipstick before removing to keep dirt, grass clippings, etc., out of the engine.

3. Remove oil fill cap/dipstick; wipe oil off. Reinsert dipstick and push it all the way down into tube. Remove dipstick and check the level.

   The oil level should be up to, but not over, the "F" mark on the dipstick. Refer to Figure 3-1.

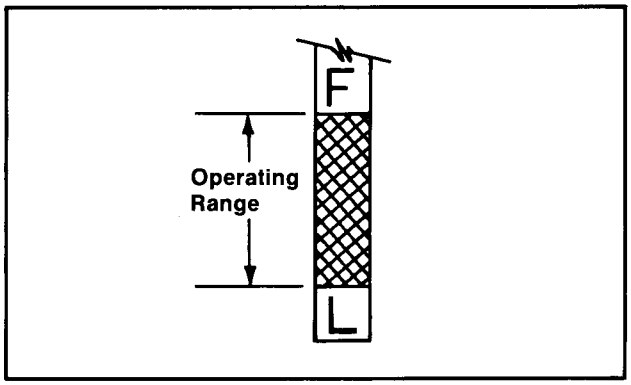

Figure 3-1. Oil Level Range.

4. Add the proper type of oil if the level is low. Always check the level with dipstick before adding more oil.

CAUTION: Never operate the engine with the oil level below "L" mark or over "F" mark on dipstick.

Oil Sentry™

Some engines are equipped with optional Oil Sentry oil level monitor. Oil Sentry will either stop the engine or activate a "low oil" warning light, if the oil level is below the "L" mark on the dipstick. Actual Oil Sentry use will vary depending on the engine application.

CAUTION: Oil Sentry is not a substitute for checking oil BEFORE EACH USE. Make sure the oil level is maintained up to the "F" mark on dipstick.

CHANGE OIL

For a new engine, change oil after the first 5 hours of operation. Change oil every 25 operating hours thereafter.

For an overhauled engine or those rebuilt with a new shortblock or miniblock, use straight 30-weight Service Class SF oil for the first 5 hours of operation. Change the oil after this initial run-in period. Change oil every 25 hours thereafter.

Drain oil while the engine is still warm from operation. The oil will flow more freely and carry away more impurities. Change oil as follows:

1. Remove the oil drain plug and dipstick. Refer to Figure 3-2. Tilt the engine slightly towards the drain hole to obtain better drainage.

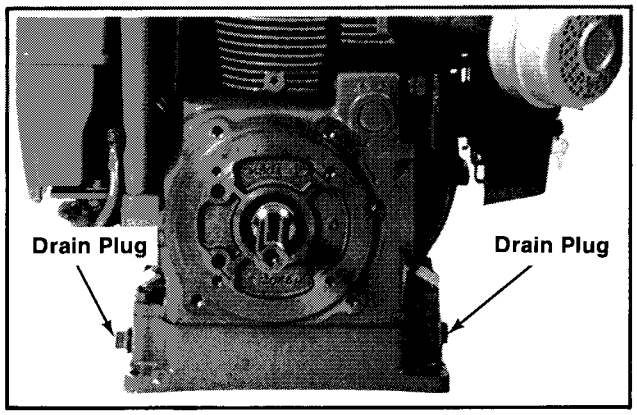

Figure 3-2. Oil Drain Plug Location.

2. Reinstall the drain plug. Make sure it is tightened securely.
3. Fill with new oil of the proper type to the "F" mark on the dipstick. Always check the level on dipstick before adding more oil. Make sure the engine is level when filling and checking oil.

SERVICE AIR CLEANER

Magnum engines are equipped with a high-density paper air cleaner element. Some specifications are also equipped with an oiled foam precleaner which surrounds the paper element. Refer to Figure 3-3.

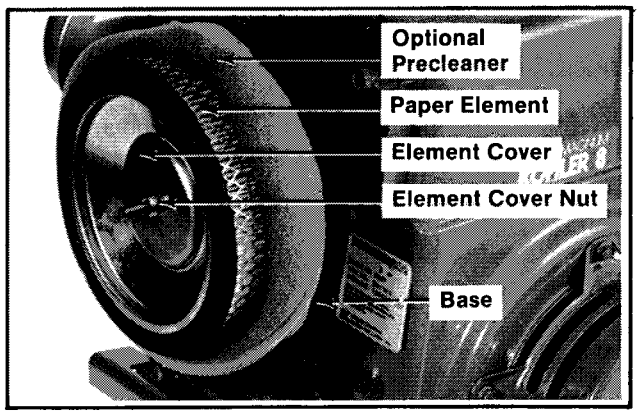

Figure 3-3. Air Cleaner Components.

Precleaner

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

1. Remove precleaner from paper element. Wash the precleaner in warm water with detergent.
2. Rinse precleaner thoroughly until all traces of detergent are eliminated. Squeeze out excess water (do not wring). Allow precleaner to air dry.
3. Saturate precleaner in clean, fresh engine oil. Squeeze out excess oil.
4. Reinstall precleaner over paper element.

Paper Element

Every 100 operating hours (more often under extremely dusty, dirty conditions), check the paper element. Replace the element as follows:

1. Remove the precleaner (if so equipped), element cover, and paper element.
2. Replace a dirty, bent or damaged element with a new genuine Kohler element. Handle new elements carefully; do not use if surfaces are bent or damaged.

   CAUTION: Do not wash the paper element or use compressed air as this will damage element.

3. Reinstall the paper element, element cover, and element cover nut. Make sure element is sealed tightly against the element cover and air cleaner base. Tighten nut to **50 in. lbs.** torque.
4. Install the precleaner (cleaned and oiled) over paper element.
5. Install air cleaner cover and wing nut. Tighten wing nut until it is snug against cover—do not overtighten.

Inspect Air Cleaner Components

Whenever the air cleaner cover is removed, or servicing the element or precleaner, check the following components:

- Air Cleaner Base—Make sure it is secured tightly to carburetor and is not bent or damaged.
- Element Cover and Element Cover Nut—Make sure element cover is not bent or damaged. Make sure element cover nut is secured tightly to seal element between air cleaner base and element cover. Tighten nut to **50 in. lbs.** torque.
- Breather Tube—Make sure it is sealed tightly in air cleaner base and breather cover.

CAUTION: Damaged, worn, or loose air cleaner components could allow unfiltered air into the engine causing premature wear and failure. Replace all damaged or worn components.

CLEAN AIR INTAKE/COOLING AREAS

To ensure proper cooling, make sure the grass screen, cooling fins, and other external surfaces of engine are kept clean at all times. Refer to Figure 3-4.

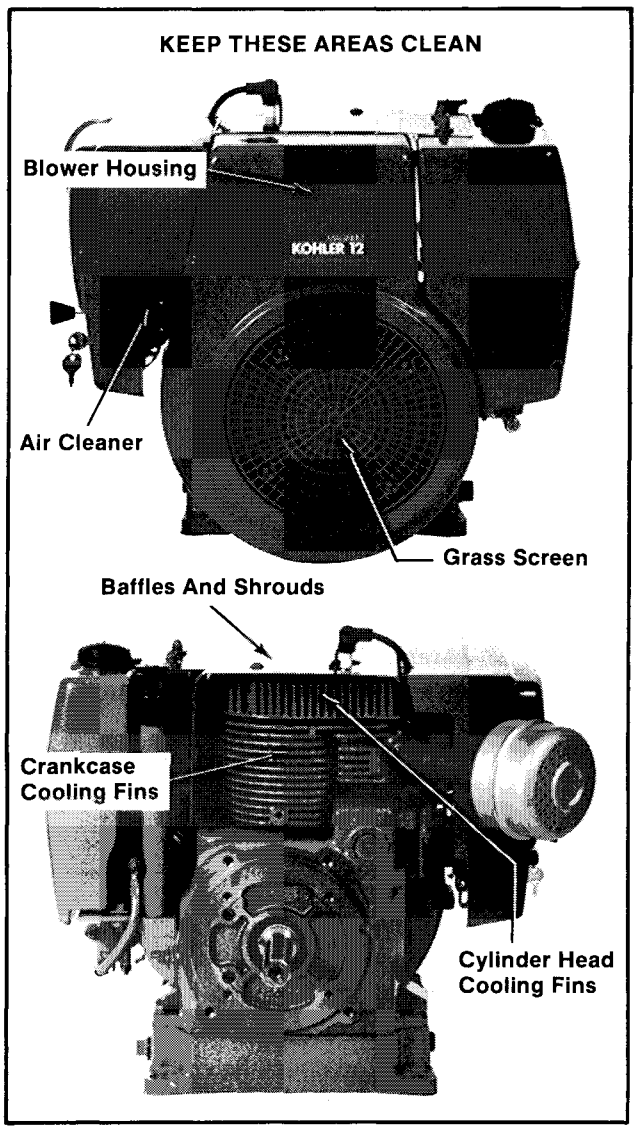

Figure 3-4. Air Intake And Cooling Areas.

Every 50 operating hours (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.

Refer to the "Disassembly" and "Reassembly" sections for cooling shroud removal and installation procedures.

CAUTION: 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.

CHECK SPARK PLUG

Every 100 operating hours, remove the spark plug, check its condition, and reset gap or replace with new plug as necessary. Refer to Figure 3-5.

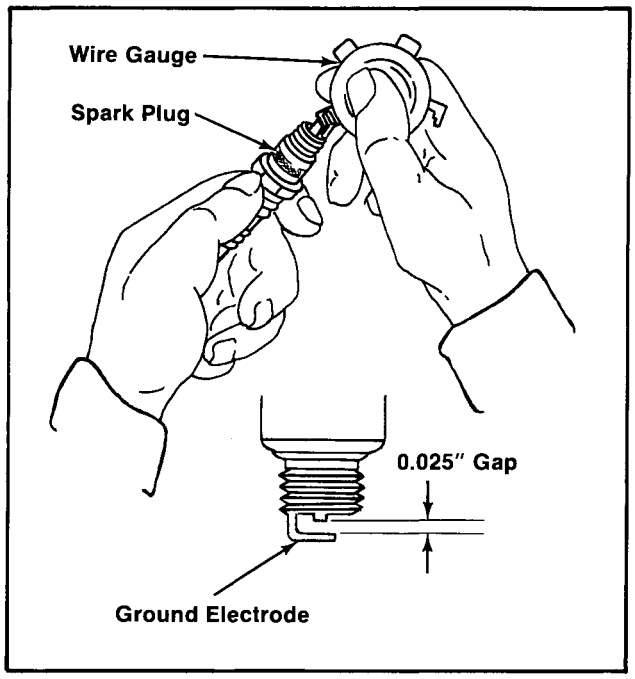

Figure 3-5. Servicing Spark Plug.

1. Before removing spark plug, clean the area around the base of plug to keep dirt and debris out of engine.
2. Remove the plug and check its condition. Replace the plug if worn or if reuse is questionable.

   Use Champion® Type (or equivalent):
   RCJ-8—On Model M8
   RH-10—On Models M10, M12, M14, and M16

CAUTION: Do not clean the spark plug in a machine using abrasive grit. Some grit could remain in spark plug and enter the engine causing extensive wear and damage.

3. Check gap using a wire feeler gauge. Adjust gap to **0.025"** by carefully bending the ground electrode.
4. Reinstall spark plug into cylinder head. Torque plug to **18/22 ft. lb.**

SERVICE OPTIONAL REDUCTION GEAR UNIT

On engines equipped with a reduction gear unit, check the oil level in unit every 50 operating hours. Refer to Figure 3-6.

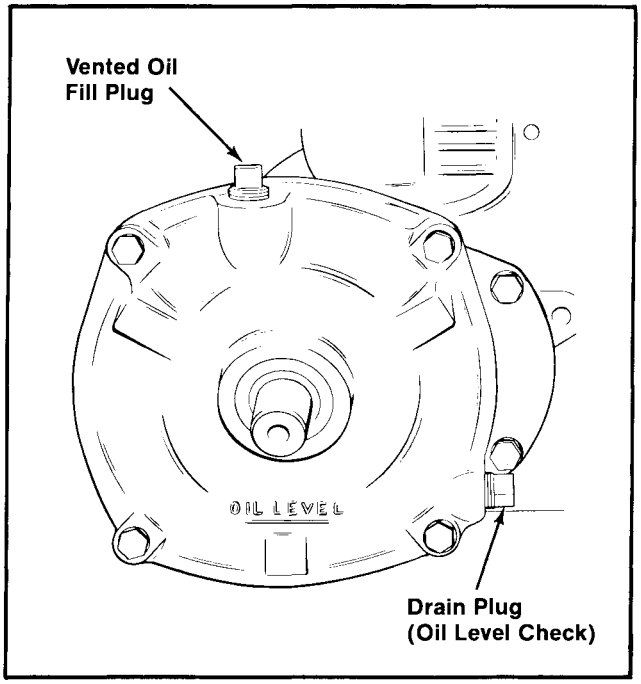

Figure 3-6. Reduction Gear Unit.

1. Remove the plug on the lower part of gear unit cover. With engine level, the oil should be up to the bottom of the plug hole.
2. To add oil, remove the vented fill plug at the top of the unit. Use the same type of oil as used in the engine crankcase.
3. Reinstall and tighten the plugs securely.

IGNITION SYSTEM SERVICE

Magnum engines are equipped with a dependable electronic magneto ignition system. Other than periodically checking/replacing the spark plug, no maintenance, timing, or adjustments are necessary or possible with this system.

CHECK FUEL FILTER

Some engines are equipped with an in-line fuel filter. Visually inspect the filter periodically. Replace when dirty with a genuine Kohler filter.

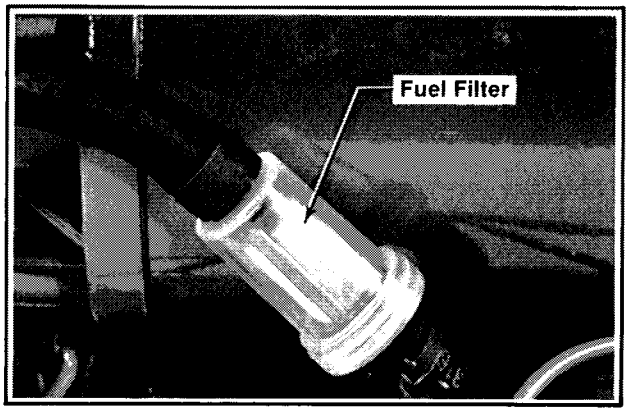

Figure 3-7. In-line Fuel Filter.

SERVICE STARTER MOTOR DRIVE

Every 500 operating hours or annually (whichever occurs first), clean and lubricate the drive splines of the Bendix-drive electric starter motor. Refer to Figure 3-8.

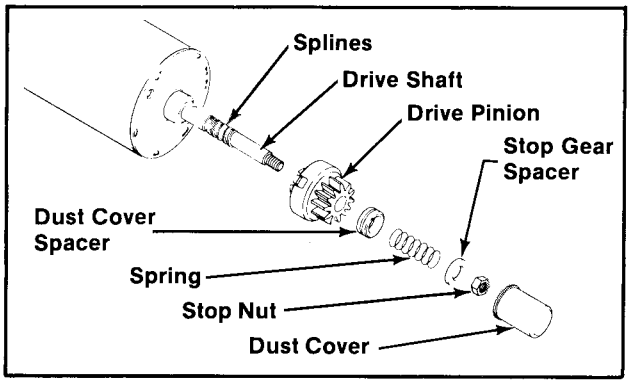

Figure 3-8. Starter Drive Components.

1. Remove starter from bearing plate. (Refer to appropriate "Disassembly" section.)
2. Remove dust cover, stop nut, stop gear spacer, spring, dust cover spacer, and drive pinion.
3. Clean the drive shaft splines with solvent. Dry splines thoroughly.
4. Apply a small amount of Kohler electric starter drive lubricant (Part No. 52 357 01) to splines.

CAUTION: Kohler starter drive lubricant (Part No. 52 357 01) must be used on all Kohler electric starter drives. The use of other lubricants can cause the drive to stick or bind.

5. Apply a small amount of Loctite® No. 271 to stop nut threads. Assemble drive parts in reverse order of removal. Torque stop nut to **160 in. lb**.
6. Reinstall starter to bearing plate. (Refer to appropriate "Reassembly" section.)

CLEAN CYLINDER HEAD AND COMBUSTION CHAMBER

Every 500 operating hours (250 hours when leaded gasoline is used), remove cylinder head and clean combustion chamber. Refer to Figure 3-9.

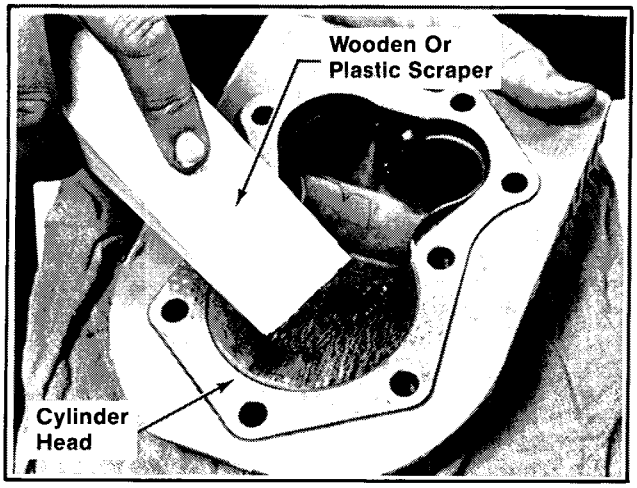

Figure 3-9. Cleaning Cylinder Head And Combustion Chamber.

1. Remove the cylinder head baffle and cylinder head.
2. Clean away combustion deposits using a wooden or plastic scraper.
3. Reinstall the cylinder head using a new gasket. Torque the cylinder head fasteners in sequence to the values specified in Figure 3-10.

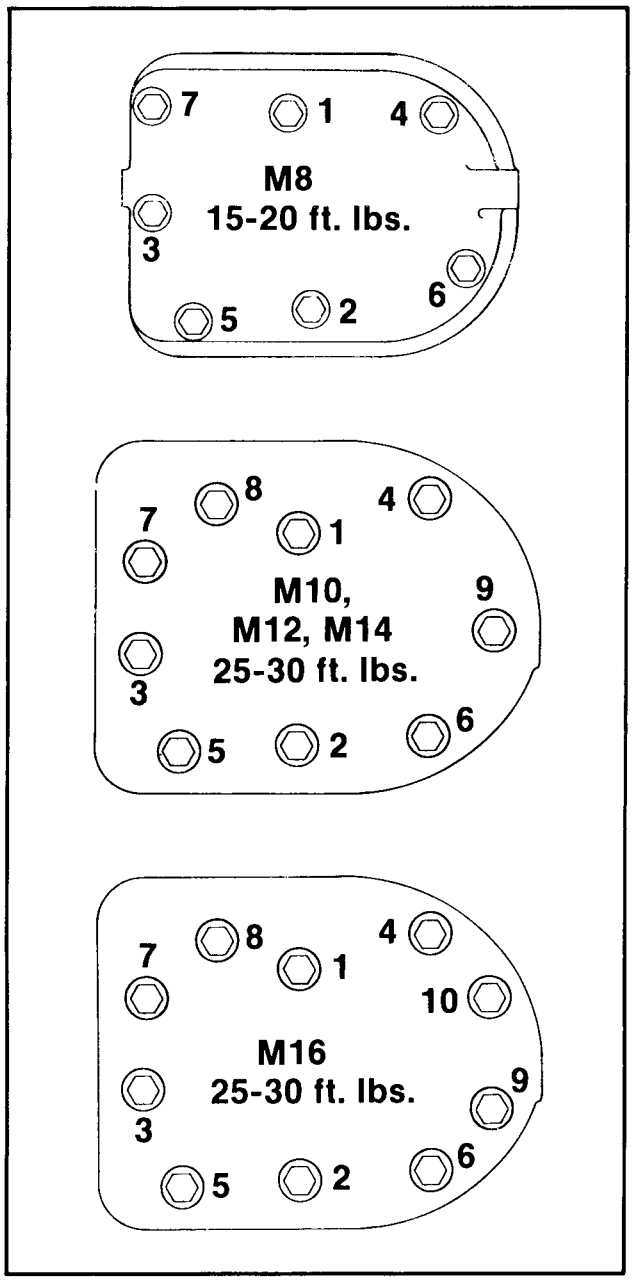

Figure 3-10. Cylinder Head Fastener Tightening Sequence.

CHECK VALVE-TO-TAPPET CLEARANCE

Every 500 operating hours, remove breather/valve cover and check valve-to-tappet clearance with a flat feeler gauge. Refer to Figure 3-11. The engine must be cold when checking this clearance.

1. Remove the air cleaner assembly, carburetor, and breather assembly. (Refer to appropriate "Disassembly" section.)

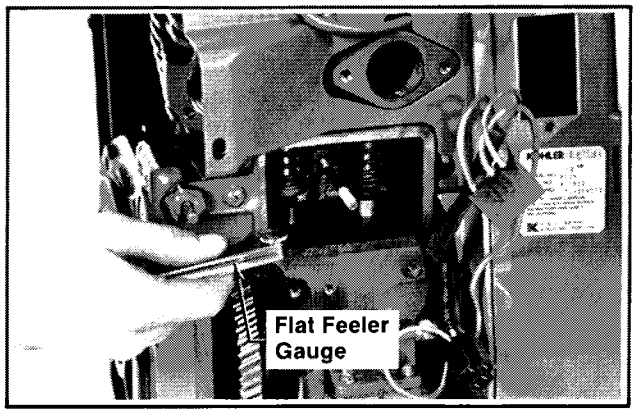

Figure 3-11. Measuring Valve-To-Tappet Clearance.

2. Position the crankshaft so the piston is at top of compression stroke (cam has no effect on tappets).
3. Measure valve-to-tappet clearance with a flat feeler gauge.

Engine Model	Valve-To-Tappet Clearance	
	Intake Valve	Exhaust Valve
M8	.006"/.008"	.017"/.019"
M10, M12, M14, M16	.008"/.010"	.017"/.019"

On Model M8—*If clearance is too small,* remove the valves and grind the valve stems until the correct clearance is obtained. Make sure valve stems are ground perfectly flat and smooth.

If clearance is too large, replace the valves and recheck clearance.

NOTE: Large clearances can also be reduced by grinding the valves and/or valve seats. Refer to the "Inspection And Repair/Reconditioning" section for valve specifications.

On Models M10, M12, M14, and M16—Adjust the clearance by turning the adjusting screw on tappets. Refer to Figure 3-12.

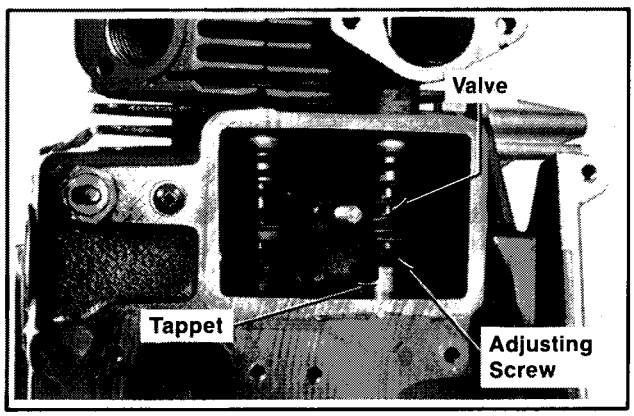

Figure 3-12. Adjusting Valve-To-Tappet Clearance—Models M10, M12, M14, and M16.

STORAGE

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

1. Change the oil when engine is still warm from operation. Refer to "Change Oil."
2. Change the oil in reduction gear unit, if so equipped. Refill with the same oil as used in engine crankcase for season of operation. Refer to "Service Optional Reduction Gear Unit." Run engine for a few minutes to distribute clean oil throughout engine.
3. Drain the fuel tank and fuel system (or run engine until fuel tank and fuel system are empty).
4. Remove the spark plug. Add one tablespoon of engine oil into the spark plug hole. Install plug, but do not connect plug lead. Crank the engine two or three revolutions.
5. Remove the spark plug. Cover the spark plug hole with thumb and turn engine over until the piston is at the top of its stroke (pressure against thumb is greatest). Reinstall plug, but do not connect plug lead.
6. Clean the exterior surfaces of engine. Spread a light film of oil over any exposed metal surfaces of engine to prevent rust.
7. Store the engine in a clean, dry place.

MAGNUM
Single Cylinder Engine
Service Manual
Models M8, M10, M12
M14, M16
TP-2203-A 3/86
KOHLER engines

SECTION 4

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 this as a guide to locate causing factors.

Engine Cranks But Will Not Start
1. Empty fuel tank.
2. Fuel shutoff valve closed.
3. Clogged fuel line.
4. Spark plug lead disconnected.
5. Keyswitch or kill switch in "off" position.
6. Faulty spark plug.
7. Faulty ignition module.
8. Dirt or water in fuel system.

Engine Starts But Does Not Keep Running
1. Restricted fuel tank vent.
2. Dirt or water in fuel system.
3. Faulty choke or throttle controls/cables.
4. Loose wires or connections which short kill terminal of ignition module to ground.
5. Carburetor improperly adjusted.
6. Faulty cylinder head gasket.
7. Faulty fuel pump.

Engine Starts Hard
1. Hydrostatic transmission is not in neutral/PTO drive is engaged.
2. Loose wires or connections.
3. Dirt or water in fuel system.
4. Clogged or restricted fuel lines.
5. Faulty choke or throttle controls/cables.
6. Faulty spark plug.
7. Carburetor improperly adjusted.
8. Incorrect valve-to-tappet clearance.
9. Low compression.
10. Faulty ACR mechanism.

Engine Will Not Crank
1. Hydrostatic transmission is 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 fuel system.
2. Spark plug lead loose.
3. Loose wires or connections which intermittently short kill terminal of ignition module to ground.
4. Carburetor improperly adjusted.
5. Engine overheating.
6. Incorrect valve-to-tappet clearance.
7. Faulty ignition module.

Engine Will Not Idle
1. Idle speed adjusting screw improperly set.
2. Dirt or water in fuel system.
3. Idle fuel adjusting screw improperly set.
4. Restricted fuel tank vent.
5. Faulty spark plug.
6. Incorrect valve-to-tappet clearance.
7. Low compression.

Engine Overheats
1. Grass screen, cooling fins, or shrouding clogged.
2. Excessive engine load.
3. Low crankcase oil level.
4. High crankcase oil level.
5. Carburetor improperly adjusted.

Engine Knocks
1. Low crankcase oil level.
2. Excessive engine load.

Engine Loses Power

1. Low crankcase oil level.
2. High crankcase oil level.
3. Restricted air cleaner element.
4. Dirt or water in fuel system.
5. Excessive engine load.
6. Engine overheating.
7. Faulty spark plug.
8. Carburetor improperly adjusted.
9. Low compression.

Engine Uses Excessive Amount of Oil

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

EXTERNAL ENGINE INSPECTION

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

☐ Check for buildup of dirt and debris on the crankcase, cooling fins, grass screen, and other external surfaces. Dirt or debris in 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, element cover, and air cleaner 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 dirt to enter the engine. Also note if the element is clogged or restricted. These could indicate that the air cleaner 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's low or overfilled.

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

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

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

CLEANING THE ENGINE

After inspecting the external condition of the engine, clean it thoroughly before disassembling. 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 quickly remove grease, oil, and grime from engine parts. When such a cleaner is used, *follow the manufacturer's instructions carefully.* Make sure all traces of the cleaner are removed before the engine is reassembled and placed in operation. Even small amounts of these cleaners quickly break down the lubricating properties of engine oil.

BASIC ENGINE TESTS

Crankcase Vacuum

A partial vacuum should be present in the crankcase when the engine is operating at normal temperatures. Pressure in the crankcase (usually 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 slack tube manometer. The manometer included in the Kohler Engine Analysis kit is recommended. Refer to the "Special Tools" section for more information.

Crankcase Vacuum Test

To test crankcase vacuum with the manometer:

1. Insert the stopper/hose into the oil fill hole. Leave the other vent of manometer open to atmosphere. Make sure the shutoff clamp is closed.
2. Start the engine and run at high speed (3200 to 3600 RPM).

3. Open the clamp and note the water level in the tube. The level in the engine side should be 5 to 10 in. above the level in the open side. If there is no vacuum (level in engine side is the same as open side) or a positive pressure (level in open side is higher than engine side) check for the conditions below.
4. Close the shutoff clamp **before** stopping the engine.

Compression Test

Because single cylinder engines are equipped with an automatic compression release mechanism (ACR), 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 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. Replace restricted muffler/exhaust system.