Midget Motors introduced the Kohler K-301 almost as soon as it was available—a more modern and more powerful design, at no cost increase.

Section
L
Kohler

L-1 Kohler Engine Specs

GENERAL

This manual covers the Kohler single cylinder, horizontal crankshaft engine models listed in the chart below. These are 4-stroke cycle air-cooled engines. When ordering replacement parts and in any communication involving an engine, always report the MODEL, SERIAL and SPECIFICATION numbers as found on the nameplate which is mounted on the carburetor side of the engine blower housing. The significance of these numbers is explained as follows.*

MODEL NUMBER SIGNIFICANCE

K 3 2 1 P T

- 3 2 — Approximate Displacement (Cu. In.)
- 1 — Single Cylinder

Final Letter(s) designates the Version of the Basic Engine:

A - Special Oil Pan	R - Reduction Gear
C - Clutch Model	S - Electric Start
G - Generator Application	T - Retractable Start
P - Pump Model	ST - Electric Start And Retractable Start
Q - Quiet Model	EP - Electric Plant

SPEC NUMBER SIGNIFICANCE

6 0 1 2 4 B

- 6 0 — First Two Digits:
- 1 2 4 B — Remaining Digits (& Letter): Sequentially numbered variation of Basic Engine

ENGINE MODEL CODE

Single Cylinder			
Code	Model	Code	Model
26, 27, 31	K91	46	K241
28	K161	47	K301
29	K141	60	K321
30	K181	71	K341

SERIAL NUMBER SIGNIFICANCE

(Primarily a source of manufacturing history)

Year of Manufacture* identified by

1. E - 172452 — A Letter
2. 9276430 — First Two Digits/ If Seven Digit Number
3. 10026692 — First Three Digits/ If Eight Digit Number
4. 1501897591 — First Two Digits/ If Ten Digit Number

*Year of Manufacture

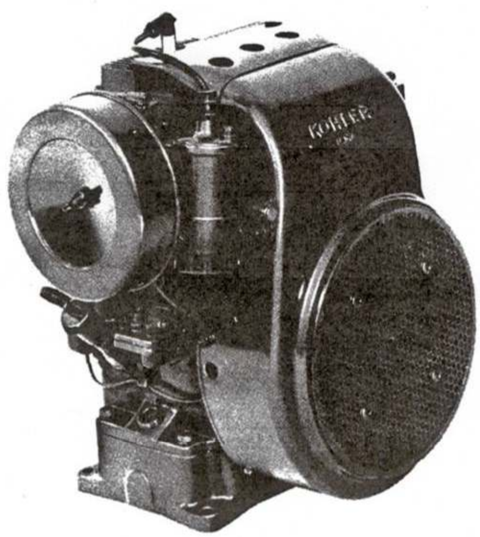
①		②		③		④	
A	1965	10-19	1969	100-109	1980	15	1985
B	1966	20-29	1970	110-119	1981	16	1986
C	1967	30-39	1971	120-129	1982	17	1987
D	1968	40-49	1972	130-139	1983	18	1988
E	1969	50-59	1973	140-149	1984	19	1989
		60-69	1974	150-159	1985		
		70-72	1975				
		73-79	1976				
		80-89	1977				
		90-94	1978				
		95-99	1979				

Remaining digits are a factory code

L-2 Kohler Owner's Manual

KOHLER engines

OWNER'S MANUAL



MODELS

K241, K301
(10 hp) (12 hp)

K321,& K341
(14 hp) (16 hp)

operating & maintenance instructions

Congratulations – You have selected a fine four-cycle, single cylinder, air-cooled engine. Kohler designs long life strength and on-the-job durability into each engine…making a Kohler engine dependable…dependability you can count on. Here are some reasons why:

- Kohler engines are easy to service. All routine service areas (like the points, condenser, air cleaner, spark plug, and carburetor) are easily and quickly accessible.
- Parts subject to the most wear and tear (like the cylinders, crankshafts, and camshaft) are made from precision formulated cast iron. Because the cast iron cylinders can be rebored, these engines can last even longer.
- Every Kohler engine is backed by a worldwide network of over 10,000 distributors and dealers. Service support is just a phone call away. Call 1-800-544-2444 (U.S. & Canada) for Sales & Service assistance.

To keep your engine in top operating condition, follow the maintenance procedures in this manual.

Safety Precautions

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

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

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

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

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

WARNING

Explosive Fuel can cause fires and severe burns.

Stop engine before filling fuel tank.

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

WARNING

Rotating Parts can cause severe injury.

Stay away while engine is in operation.

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.

CAUTION

Electrical Shock can cause injury.

Do not touch wires while engine is running.

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

WARNING

Hot Parts can cause severe burns.

Do not touch engine while operating or just after stopping.

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.

California Proposition 65 Warning

Engine exhaust from this product contains chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm.

Safety Precautions (Cont.)

⚠ WARNING

Accidental Starts can cause severe injury or death.

Disconnect and ground spark plug lead before servicing.

⚠ WARNING

Carbon Monoxide can cause severe nausea, fainting or death.

Do not operate engine in closed or confined area.

⚠ WARNING

Explosive Gas can cause fires and severe acid burns.

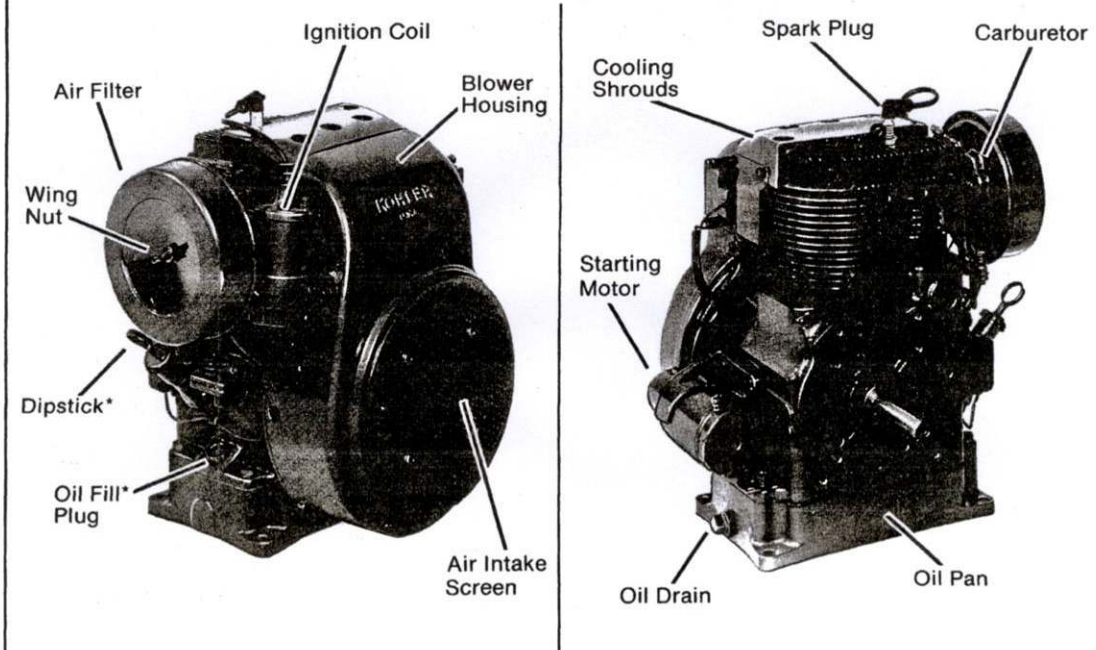
Charge battery only in a well ventilated area. Keep sources of ignition away.

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.

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.

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

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



*NOTE: Dipstick or oil fill plug is optional and may vary depending on engine specification.

Figure 1. Typical Command Horizontal Shaft Engine.

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 SG or SH.** Select the viscosity based on the air temperature at the time of operation as shown in the following table.

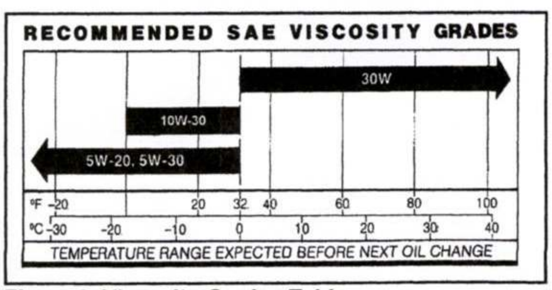


Figure 2. Viscosity Grades Table.

Straight 30-weight oil is preferred. SAE 10W-30 oil is not recommended above 32°F. Using this oil substantially increases oil consumption and combustion chamber deposits.

NOTE: Using other than service class SG or SH 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 3.

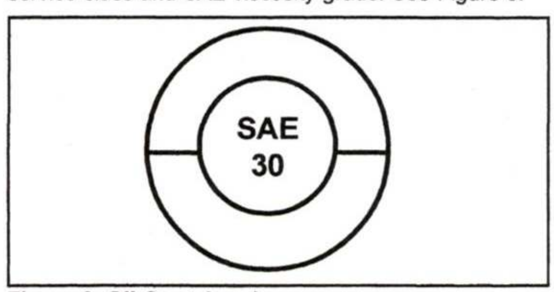


Figure 3. Oil Container Logo.

Refer to "Maintenance Instructions" beginning on page 7 for detailed oil check, oil change, and oil filter change procedures.

Fuel Recommendations

WARNING: Explosive Fuel!

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

General Recommendations

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

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

Do not add oil to the gasoline.

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

Fuel Type

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

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

Gasoline/Alcohol blends

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

Gasoline/Ether blends

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

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 decal (or decals) affixed to the engine shrouding. Include letter suffixes, if there are any.

Record your engine identification numbers on the identification label below (Figure 4) for future reference.

MODEL NO.
SPEC. NO.
DISPL (CC)
SERIAL NO.
REFER TO OWNER'S MANUAL FOR SAFETY, MAINTENANCE SPECS AND ADJUSTMENTS. FOR SALES AND SERVICE IN US/CANADA CALL: 1-800-544-2444

KOHLER engines

KOHLER CO. KOHLER, WI USA

Figure 4. Engine Identification Label.

Operating Instructions

Also read the operating instructions of the equipment this engine powers.

Pre-Start Checklist

- Check oil level. Add oil if low. Do not overfill.
- Check fuel level. Add fuel if low.
- Check cooling air intake areas and external surfaces of engine. Make sure they are clean and unobstructed.
- Check that the air cleaner components and all shrouds, equipment covers, and guards are in place and securely fastened.
- Check that any clutches or transmissions are disengaged or placed in neutral. This is especially important on equipment with hydrostatic drive. The shift lever must be exactly in neutral to prevent resistance which could keep the engine from starting.

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.

Cold Weather Starting Hints

1. Be sure to use the proper oil for the temperature expected. See Figure 2 on page 4.

2. Declutch all possible external loads.

3. Set speed control at part throttle position.

4. A warm battery has much more starting capacity than a cold battery.

5. Use fresh winter grade fuel. NOTE: Winter grade gasoline has a higher volatility to improve starting. Do not use gasoline left over from summer.

Starting

1. **For a Cold Engine** – Place the throttle control **midway** between the **"slow"** and **"fast"** positions. Place the choke control into the **"on"** position.

   For a Warm Engine (normal operating temperatures) – Place the throttle control **midway** between the **"slow"** and **"fast"** positions. Place the choke into the **"off"** position.

2. Start the engine as follows:

   For Rope Start Engines – Place the starting rope knot in the slot in starting pulley. Wrap the rope around the pulley. Pull the starter handle with a smooth, steady motion.

   For a Retractable Start Engine – SLOWLY pull the starter handle until just past compression – STOP! Return starter handle, pull firmly with a smooth, steady motion to start. Pull the handle straight out to avoid excessive rope wear from the starter rope guide.

   Extend the starting rope periodically and check its condition. If the rope is frayed, have it replaced immediately by your Kohler Engine Service Dealer.

WARNING: Accidental Starts!
Before extending and checking the retractable starter rope, remove the spark plug lead to prevent the engine from starting accidentally. Make sure the equipment is in neutral.

   For an Electric Start Engine – Activate the starter switch. Release the switch as soon as the engine starts.

   NOTE: Do not crank the engine continuously for more than 10 seconds at a time. If the engine does not start, allow a 60 second cool down period between starting attempts. Failure to follow these guidelines can burn out the starter motor.

   NOTE: If the engine develops sufficient speed to disengage the starter but does not keep running (a false start), the engine rotation must be allowed to come to a complete stop before attempting to restart the engine. If the start is engaged while the flywheel is rotating, the starter pinion and flywheel ring gear may clash, resulting in damage to the starter.

   If the starter does not turn the engine over, shut off starter immediately. Do not make further attempts to start the engine until the condition is corrected. Do not jump start using another battery (refer to "Battery" below). See your Kohler Engine Service Dealer for trouble analysis.

3. **For a Cold Engine** – Gradually return the choke control to the **"off"** position after the engine starts and warms ups.

Stopping

1. Remove the load by disengaging all PTO attachments.

2. Move the throttle control to the **"slow"** or **"low"** idle position. Allow the engine to run at idle for 30-60 seconds; then stop the engine. If the carburetor on the engine is equipped with a fuel solenoid, move the throttle control back up between half and full throttle just before stopping the engine.

3. Turn ignition switch **"off."** On engines so equipped, press and hold "stop" button until engine comes to a complete stop.

Battery

A 12 volt battery is normally used. Refer to the operating instructions of the equipment this engine powers for specific battery requirements.

If the battery charge is not sufficient to crank the engine, recharge the battery (see page 10).

Operating

Optional spark arrestor mufflers are available from your Kohler Engine Service Dealer. Check your local laws and statutes regarding engine spark arrestor muffler requirements.

Angle of Operation
This engine will operate continuously at angles up to 30°. Check oil level to assure crankcase oil level is at the "F" mark.

Refer to the operating instructions of the equipment this engine powers. Because of equipment design or application, there may be more stringent restrictions regarding the angle of operation.

NOTE: Do not operate this engine continuously at angles exceeding 30° in any direction. Engine damage could result from insufficient lubrication.

Cooling
NOTE: If debris builds up on the grass screen or other cooling air intake areas, stop the engine immediately and clean. Operating the engine with blocked or dirty air intake and cooling areas can cause extensive damage due to overheating.

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.

Engine Speed
NOTE: Do not tamper with the governor setting to increase the maximum engine speed. Overspeed is hazardous and will void the engine warranty.

WARNING: Rope Starting Pulley is not a Drive Pulley!
Do not use backup rope starting pulley as a drive pulley. Using starting pulley as a drive could loosen flywheel fastener, resulting in bodily harm.

Maintenance Instructions

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.

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
Daily or Before Starting Engine	• Fill fuel tank. • Check oil level. • Check air cleaner for dirty[1], loose, or damaged parts. • Check air intake and cooling areas, clean as necessary[1].
Every 25 Hours	• Change oil. • Service precleaner element[1].
Every 50 Hours	• Check gear reduction unit. • Remove cooling shrouds and clean cooling areas[1].
Every 100 Hours	• Replace air cleaner element[1]. • Check spark plug condition and gap.
Annually or Every 500 Hours	• Have bendix starter drive serviced[2,3]. • Have breaker points checked[2]. • Have ignition timing checked[2]. • Have valve and tappet clearance checked[2]. • Have cylinder head serviced[2,4].

[1]*Perform these maintenance procedures more frequently under extremely dusty, dirty conditions.*
[2]*Have a Kohler Engine Service Dealer perform this service.*
[3]*Or annually, whichever occurs first.*
[4]*250 hours when leaded gasoline is used.*

Check Oil Level

The importance of checking and maintaining the proper oil level in the 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. To keep dirt, grass clippings, etc., out of the engine, clean the area around the oil fill tube/ dipstick before removing it.

3. With threaded plug-type dipstick, remove and wipe oil off – reinsert, but do not turn plug in. To check oil level, *shoulder* plug on top of hole. After checking, again turn plug all the way into crankcase. With extended oil fill tube and dipstick, push dipstick all the way down in tube then take reading.

4. If the level is low, add oil of the proper type, up to the "F" mark on the dipstick. (Refer to "Oil Type" on page 4.) Always check the level with the dipstick before adding more oil.

   NOTE: To prevent extensive engine wear or damage, always maintain the proper oil level in the crankcase. Never operate the engine with the oil level below the "L" mark or over the "F" mark on the dipstick.

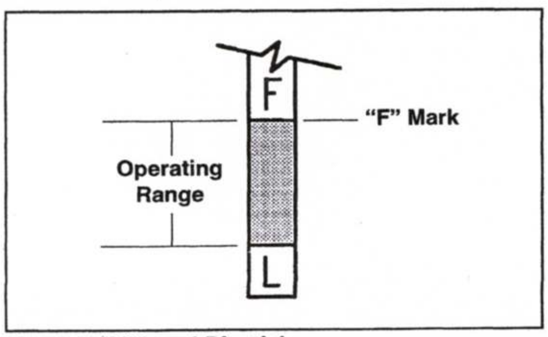


Figure 5. Oil Level Dipstick.

Oil Sentry™

Some engines are equipped with an optional Oil Sentry™ oil level monitor switch. If the oil level drops below an acceptable level, the Oil Sentry™ will either shut off the engine or activate a warning signal, depending on the application.

NOTE: *Make sure the oil level is checked* **BEFORE EACH USE** and is maintained up to the "F" mark on the dipstick. This includes engines equipped with Oil Sentry™.

Change Oil

For a new engine, change oil after the first **5 hours** of operation. Thereafter, change oil after every **25 hours** of operation.

Change the oil while the engine is still warm. The oil will flow freely and carry away more impurities. Make sure the engine is level when filling, checking, or changing the oil.

Change the oil as follows:

1. To keep dirt, grass clippings, etc., out of the engine, clean the area around the drain plug and dipstick before removing it.

2. Remove the oil drain plug and dipstick. Tilt the engine slightly towards the oil drain to obtain better drainage. Be sure to allow ample time for complete drainage.

3. Reinstall the drain plug. Make sure it is tightened securely.

4. Fill the crankcase, with new oil of the proper type, to the "F" mark on the dipstick. Refer to "Oil Type" on page 4. Always check the level with the dipstick before adding more oil.

5. Reinstall the oil fill cap or plug and tighten securely.

   NOTE: To prevent extensive engine wear or damage, always maintain the proper oil level in the crankcase. Never operate the engine with the oil level below the "L" mark or over the "F" mark on the dipstick.

Service Precleaner and Air Cleaner Element

This engine is 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 Figure 6.

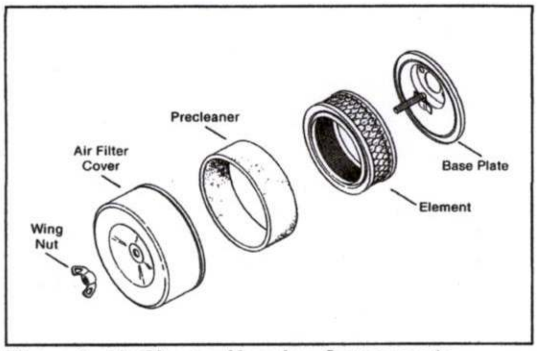


Figure 6. Air Cleaner Housing Components.

Check the air cleaner **daily or before starting the engine.** Check for buildup of dirt and debris around the air cleaner system. Keep this area clean. Also check for loose or damaged components. Replace all bent or damaged air cleaner 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

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

1. Remove the wing nut and air cleaner cover.
2. Remove the precleaner from the paper element.
3. 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.
4. Saturate the precleaner with new engine oil. Squeeze out all excess oil.
5. Reinstall the precleaner over the paper element.
6. When precleaner replacement is necessary always use genuine Kohler parts.

Service Paper Element

Every **100 hours** of operation (more often under extremely dusty or dirty conditions), replace the element.

1. Remove the precleaner (if so equipped) from the paper element.
2. 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 if the sealing surfaces are bent or damaged.
3. When servicing the air cleaner, check the air cleaner base. Make sure it is secured and not bent or damaged. Also check the air cleaner cover, seals and breather tube for damage or improper fit. Replace all damaged air cleaner components.
4. Reinstall the paper element, air cleaner cover and wing nut. Wing nut must be finger tightened to 1/2 to 1 full turn after nut contacts cover. Do not overtighten.
5. When air cleaner element replacement is necessary always use genuine Kohler parts.

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 **50 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.

Check Spark Plug

Every **100 hours** of operation, remove the spark plug, check its condition, and reset the gap or replace with a new plug as necessary. Use a Champion® type RH10 (or equivalent) spark plug.

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

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

3. Check gap using a wire feeler gauge. Spark plug gaps are as follows:

   Battery/Breakerless .... .035"
   Magneto .... .025"
   Gaseous Fuel Engines .... .018"
   (Magneto/Battery Only)

   Adjust the gap as necessary by carefully bending the ground electrode. See Figure 7.

4. Reinstall the spark plug into the cylinder head. Torque the spark plug to **18-22 ft. lbs.**

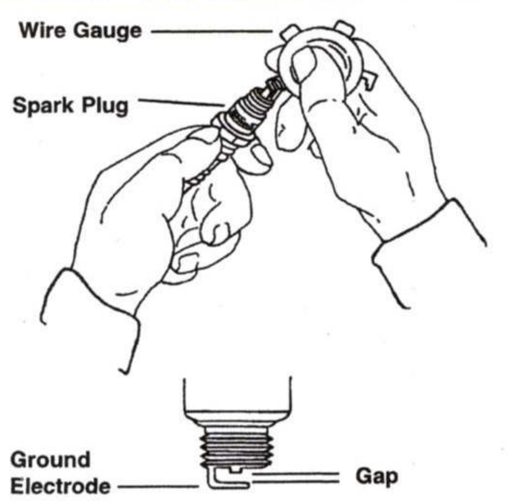


Figure 7. Servicing Spark Plug.

Battery Charging

WARNING: Explosive Gas!

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

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

On engines equipped with an alternator charging system, disconnect plug from rectifier-regulator prior to charging battery.

Fuel Filter

Some engines are equipped with an in-line fuel filter. Periodically inspect the filter and replace when dirty. Use a genuine Kohler filter.

Reduction Gear Units

On engines equipped with a reduction gear unit, remove the oil plug on lower part of cover every **50 hours** of operation to check oil level. With the engine level, the oil level of the unit should be up to the bottom of the oil plug hole. To add oil, remove the vented plug at the top of the unit. Use the same weight and grade of oil as used in the engine crankcase.

Carburetor Troubleshooting and Adjustments

NOTE: Carburetor adjustments should be made only after the engine has warmed up.

Kohler K241 through K341 engines are equipped with one of two basic types of carburetors – *Kohler or Walbro – fixed main jet or adjustable main jet.*

The carburetor is designed to deliver the correct fuel-to-air mixture to the engine under all operating conditions. The main fuel and idle fuel needles on adjustable jet carburetors are set at the factory and normally do not require further adjustment. On fixed jet carburetors, the low idle fuel needle is also set at the factory and normally does not need further adjustment. The main fuel jet is calibrated and installed at the factory and is not adjustable*.

*NOTE: K241 through K341 engines with fixed jet carburetors, operating at altitudes above approximately 6000 ft., may require a special "high altitude" main jet. See your Kohler Engine Service Dealer for further information.

Troubleshooting

If engine troubles are experienced that appear to be fuel system related, check the following areas before adjusting the carburetor.

- Make sure the fuel tank is filled with clean, fresh gasoline.
- Make sure the fuel tank cap vent is not blocked and that it is operating properly.
- If the fuel tank is equipped with a shutoff valve, make sure it is open.
- If the engine is equipped with an in-line fuel filter, make sure it is clean and unobstructed. Replace the filter if necessary.

Walbro Carburetor Adjustment

In general, turning the adjusting needles **in** (clockwise) decreases the supply of fuel to the carburetor. This gives a *leaner* fuel-to-air mixture. Turning the adjusting needles **out** (counterclockwise) increases the supply of fuel to the carburetor.

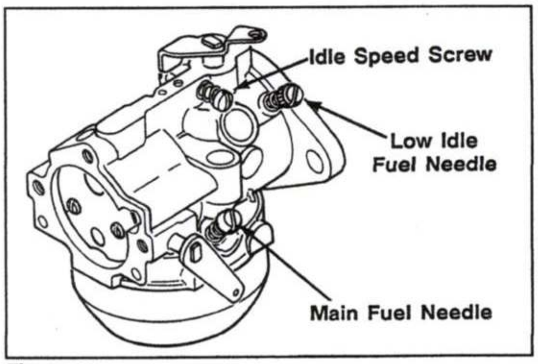


Figure 9.

NOTE: The tip of the low idle fuel and main fuel adjusting needles are tapered to critical dimensions. Damage to the needles and the seats in carburetor body will result if the needles are forced.

1. With the engine stopped, turn the adjusting needle(s) **in** (clockwise) until it bottoms *lightly*.
2. **Preliminary Settings:** Turn the adjusting needle(s) **out** (counterclockwise) from lightly bottomed as follows or to the rich side of adjustment.

Walbro Fixed Jet

	Low Idle
K241	1-1/4 turns
K301	1-1/4 turns
K321	1-1/2 turns
K341	1 turn

Walbro Adjustable Jet

	Low Idle	Main Idle
K241	1-3/4 turns	1-1/8 turns
K301	1-3/4 turns	1-1/8 turns
K321	1-1/8 turns	1-1/4 turns
K341	2-1/2 turns	1-1/4 turns

3. Start the engine and run at half throttle for five to ten minutes to warm up. The engine must be warm before making final settings.
4. **Main Fuel Needle Setting:** *This adjustment is required only for adjustable main jet carburetors. If the carburetor is a fixed main jet type, disregard this setting.*

   Place the throttle into the "fast" position.

   Turn the adjusting needle **in** (clockwise). The engine speed may increase, then it will decrease as the needle is turned in (lean). Note the position of the needle. Back the needle out approximately 1/4 turn. See Figure 10 for best main fuel performance.

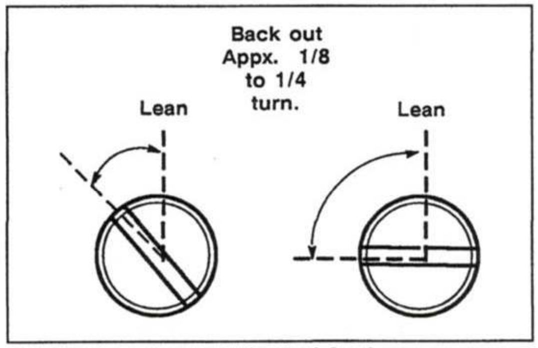


Figure 10. Optimum Main Fuel Setting.

5. **Low Idle Speed Setting:** Place the throttle control into the "idle" or "slow" position. Set the low idle speed to 1200 RPM* (± 75 RPM) by turning the low idle speed adjusting screw in or out. Check the speed using a tachometer.

   *NOTE: The actual low idle speed depends on the application. Refer to the equipment manufacturer's instructions for specific low idle speed settings. To ensure best results when setting the low idle fuel needle, the low idle speed must not exceed 1500 RPM.

6. **Low Idle Fuel Needle Setting:**

   Turn the adjusting needle **in** (clockwise). The engine speed may increase, then it will decrease as the needle is turned in (lean). Note the position of the needle.

   Back the needle out approximately 1/8 to 1/4 turn. See Figure 11 for best low idle fuel performance.

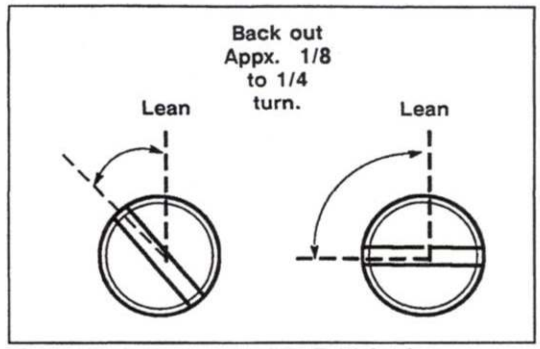


Figure 11. Optimum Low Idle Fuel Setting.

Troubleshooting

When troubles occur, be sure to check the simple causes which, at first, may seem to 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 in the following table.

Do not attempt to service or replace major engine components, or any items that require special timing or adjustment procedures. Have your Kohler Engine Service Dealer do this work.

Possible Cause / Problem	No Fuel	Improper Fuel	Dirt In Fuel Line	Dirty Grass Screen	Incorrect Oil Level	Engine Overloaded	Dirty Air Cleaner	Faulty Spark Plug
Will Not Start	•		•			•	•	•
Hard Starting	•	•	•			•	•	•
Stops Suddenly	•		•	•	•	•	•	
Lacks Power		•	•	•	•	•	•	•
Operates Erratically		•	•	•		•	•	•
Knocks or Pings		•		•		•		•
Skips or Misfires		•	•	•			•	•
Backfires			•			•	•	•
Overheats			•	•	•	•	•	
High Fuel Consumption							•	•

Storage

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

1. Clean the exterior surfaces of the engine.
2. Change the oil and filter while the engine is still warm from operation. See "Change Oil" on page 8.
3. Change oil in reduction gear unit, if so equipped. Refill with the same oil as used in engine crankcase for season of operation. See page 8.
4. The fuel system must be completely emptied, or the gasoline must be treated with a stabilizer to prevent deterioration. If you choose to use a stabilizer, follow the manufacturers recommendations, and add the correct amount for the capacity of the fuel system. Fill the fuel tank with clean, fresh gasoline. Run the engine for 2-3 minutes to get stabilized fuel into the carburetor.

   To empty the system, run the engine until the fuel tank and system are empty.
5. 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.
6. Remove the spark plug. Cover the spark plug hole with your thumb, and turn the engine over until the piston is at the top of its stroke. (Pressure against thumb is greatest.) Reinstall the plug, but do not connect the plug lead.
7. Store the engine in a clean, dry place.

Parts Ordering

The engine Specification, Model, and Serial Numbers are required when ordering replacement parts from your Kohler Engine Service Dealer. These numbers are found on the identification plate which is affixed to the engine shrouding. Include letter suffixes if there are any. See "Engine Identification Numbers" on page 5.

Always insist on genuine Kohler parts. All genuine Kohler parts meet strict standards for fit, reliability, and performance.

Major Repair

Major repair information is available in Kohler Engine Service Manuals. However, major repair generally requires the attention of a trained mechanic and the use of special tools and equipment. Your Kohler Engine Service Dealer has the facilities, training, and genuine Kohler replacement parts necessary to perform this service. For Sales & Service assistance call 1-800-544-2444 (U.S. & Canada) or contact your Kohler Engine Dealer or Service Distributor, they're in the Yellow Pages under Engines-Gasoline.

Model Designation

The model number designates the cubic inch displacement and the number of cylinders – Model K241A, for example designates 24 cubic inch displacement, 1 designates single cylinder. The letter suffix designates a specific version as follows:

Suffix	Designates
A	Oil Pan Type
EP	Generator Set
P	Pump Model
Q	Quiet Model
R	Gear Reduction
S	Electric Start
T	Retractable Start

Specifications

		K241	K301	K321	K341
Model:		K241	K301	K321	K341
Bore:	inches (millimeters)	3.25 (82.6)	3.38 (85.7)	3.50 (88.9)	3.75 (95.3)
Stroke:	inches (millimeters)	2.88 (73.0)	3.25 (82.6)	3.25 (82.6)	3.25 (82.6)
Displacement:	cubic inches (cubic centimeters)	23.9 (391)	29.1 (476)	31.3 (512)	35.9 (588)
Power (@3600 RPM):	horsepower (kilowatts)	10 (7.5)	12 (9.0)	14 (10.4)	16 (11.9)
Approx. Weight:	lbs. (kilograms)	118 (53.5)	118 (53.5)	118 (53.5)	122 (55.4)
Oil Capacity:	U.S. pints (liters)	4 (1.9)	4 (1.9)	4 (1.9)	4 (1.9)
Spark Plug Gap:					
Magneto Ignition:	inches (millimeters)	0.025 (0.65)	0.025 (0.65)	0.025 (0.65)	0.025 (0.65)
Battery, Breakerless:	inches (millimeters)	0.035 (0.90)	0.035 (0.90)	0.035 (0.90)	0.035 (0.90)
Gaseous Fueled Engines:	inches (millimeters)	0.018 (0.45)	0.018 (0.45)	0.018 (0.45)	0.018 (0.45)
Spark Plug Size:	millimeters	14	14	14	14
Spark Plug Type:		Champion RH10 or equivalent			
Breaker Point Gap (Nominal):	inches (millimeters)	0.020 (0.50)	0.020 (0.50)	0.020 (0.50)	0.020 (0.50)

LIMITED 1 YEAR ENGINE WARRANTY

We warrant to the original consumer that each new engine sold by us will be free from manufacturing defects in materials or workmanship in normal service for a period of one (1) year from date of purchase, provided it is operated and maintained in accordance with Kohler Co.'s instructions and manuals.

Our obligation under this warranty is expressly limited, at our option, to the replacement or repair at Kohler Co., Kohler, Wisconsin 53044, or at a service facility designated by us, of such part or parts as inspection shall disclose to have been defective.

EXCLUSIONS:
This warranty does not apply to defects caused by casualty or unreasonable use, including faulty repairs by others and failure to provide reasonable and necessary maintenance.

The following items are not covered by this warranty:

Engine accessories, such as fuel tanks, clutches, transmissions, power drive assemblies, and batteries, unless supplied or installed by Kohler Co. These are subject to the warranties, if any, of their manufacturers.

WE SHALL NOT BE LIABLE FOR SPECIAL, INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES OF ANY KIND, including but not limited to labor costs or transportation charges in connection with the replacement or repair of defective parts.

ANY IMPLIED OR STATUARY WARRANTIES, INCLUDING WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, ARE EXPRESSLY LIMITED TO THE DURATION OF THIS WRITTEN WARRANTY. We make no other express warranty, nor is anyone authorized to make any in our behalf.

Some states do not allow limitations on how long an implied warranty lasts, or the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

TO OBTAIN WARRANTY SERVICE:
Purchaser must bring the engine to an authorized Kohler service facility. For the facility nearest you, consult your Yellow Pages or write Kohler Co., Attn: Engine Warranty Service Dept., Kohler, Wisconsin, 53044.

ENGINE DIVISION, KOHLER CO., KOHLER, WISCONSIN 53044

L-3 Improving the Performance of the Kohler K-301 *By David Kirk—Kirk Engines, Inc.*

Let me introduce David Kirk, who knows a lot about wringing power out of the Kohler that was used in so many of our King Midgets. My database includes over a thousand Model 3s. Of those that are known to be running, about half have been repowered. Dave has an interesting alternative that keeps your car looking like it came from the factory, but boosts its output by as much as a third. That's comparable to chunking in a small Vanguard, but with less cost and a whole lot of pride that comes from fine-tuning an already excellent engine.

As an engine enthusiast and mechanical engineer by profession, I'm always seeking improvements to make the engines I own perform better. This is known in the American vernacular as "Hot Rodding," an undertaking that can be very addictive, and ultimately, very rewarding.

Ten years ago I purchased a used 1975-vintage International Harvester-made Cub Cadet tractor, equipped with the venerable Kohler K301 engine. I restored the tractor and, while the existing engine was in good shape, I couldn't resist building up a hot rod engine for it. Many of the straight-forward procedures that had proven effective on the Ford Flathead hot rod engines of the '50's were applied to my Kohler.

The results of the modifications were immediately apparent! The tractor has much improved power throughout the entire operational rpm range, better throttle response, and real "authority" to its personality. Some nine years later (and 400 hours accrued), the engine still starts and performs as well as the day it was first pressed into service. Enthusiasts that drove my tractor were impressed and wanted to purchase these specialty components that I had designed for my engine; thus my small web-based company was begun.

These modifications would work equally well in the King Midget application and would look totally "stock" from outward appearances.

An increase of 33% in horsepower output (16 to 16.5 BHP at 4,000 rpm) would certainly liven up the performance while not detracting from the visual originality of the vehicle.

A side benefit would be enhanced starting and running quality combined with improved durability.

If you would be interested in learning more about increasing the performance of the Kohler K301, please stay tuned. Bob has asked me to attend the Wisconsin Jamboree next summer and have a look at some of your cars. He's also asked me to adapt what I've learned over the years into a series of articles for this newsletter that can help you breathe new life into your old K-301.

If you can't wait, please visit my website, www.kirkengines.com where the products I offer are listed along with some technical articles on getting the most from these engines.

Remember, hot rodding can become addictive. Owning a King Midget "sleeper" that blows Vanguard-powered retrofits into the weeds is intriguing.

I think I'm catching the KM bug! ◻

L-4 Improving Performance of the Kohler K-301 *By David Kirk, Kirk Engines, Inc.*

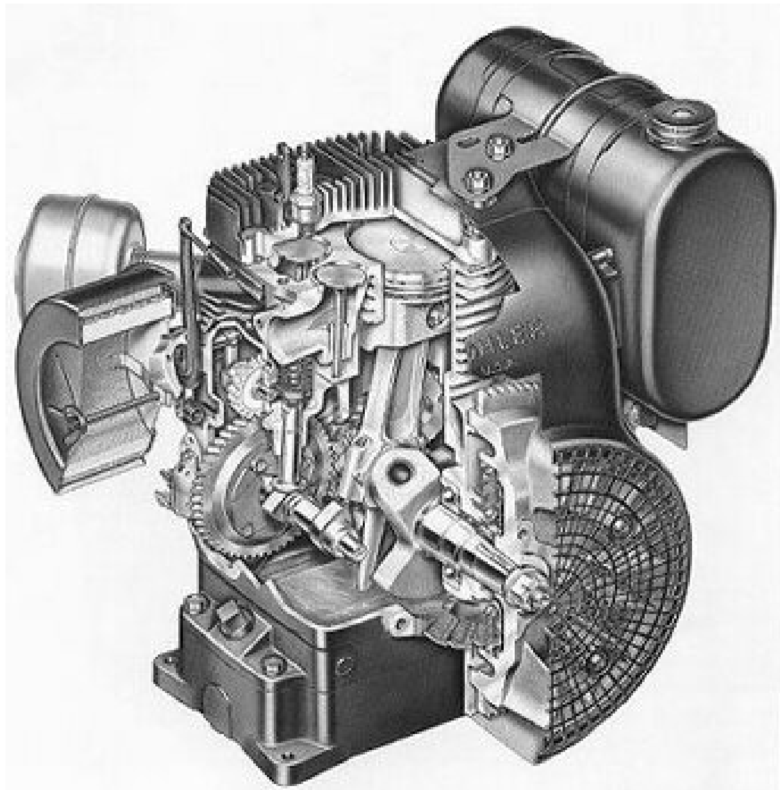
Let's face it, stock King Midgets are underpowered for today's driving. An alternative to extracting and replacing the original engine is to extract more power from it. This is the second installment on Dave Kirk's series on boosting output from your stock Kohler. This series will continue until we've pumped Dave for all his tips on extracting uumph from this popular KM engine. Note: I first met Dave at the Wisconsin Jam and set out to show him a stock M3 with Kohler. To my embarrassment, I couldn't find one.

After attending the King Midget Jamboree recently held in Lake Geneva, Wisconsin, I've become more familiar with the King Midget's history, models, and power sources. Thanks to Bob Vahsholtz' guided tour of the grounds and his knowledgeable explanation of the various cars on display, my interest and enthusiasm for this little car has grown.

Learning that the venerable Kohler K301 was the power plant used to power some Model 3s makes it all the more interesting in that I'm very familiar with this engine. I've modified and assembled them for quarter-scale tractor pullers and even built up a hot-rodded version for my Cub Cadet garden tractor.

I'd like to share some of the information I've learned about the Kohler with those King Midget owners who may want a little more performance, smoothness, and reliability from their engine, while still retaining the stock appearance.

The Kohler K-series single cylinder engines are of the L-head configuration (both inlet and exhaust valves located in the block). Also known as a "flathead," this design allows for a compact and simple mechanical configuration at the expense of lesser performance than an OHV (overhead valve) design, mainly due to inferior breathing. This is caused by the cylinder head masking off about 30% of the valve circumference, and therefore curtain area, of both the intake and exhaust valve.

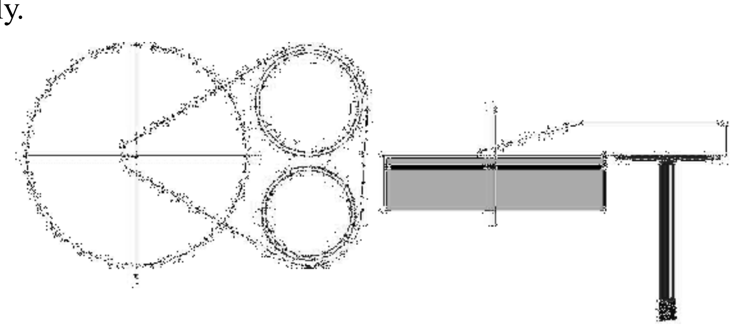


The Kohler K-series single cylinder engines set the standard for a well-engineered product

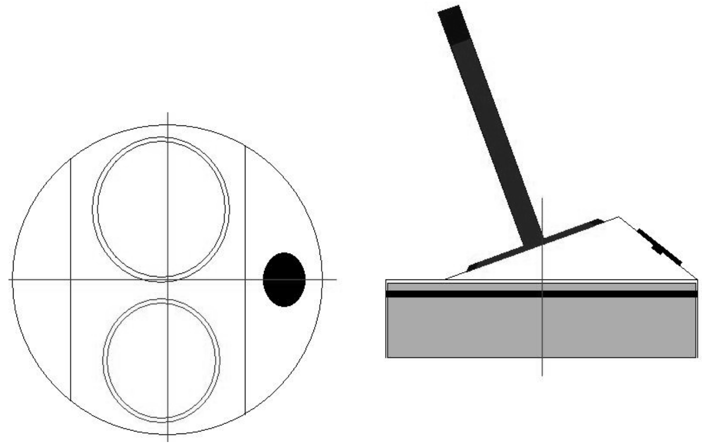
With high compression ratios, another restriction is formed in the "trench" portion of the cylinder head's combustion chamber where it communicates with the bore. In comparison, the overhead valve engine will usually produce about 25% more power from the same displacement and valve size, mostly due to the higher delivery ratio (i.e., volumetric efficiency) that unmasked overhead valves offer.

Other, less significant, advantages of OHV technology are higher combustion efficiency (faster burn with less spark advance), lower surface to volume ratio (less heat loss to the engine structure), and reduced cylinder bore distortion due to the hot exhaust passage being located in the cylinder head, away from the bore.

With all this going against the L-head, things can still be done to improve its performance quite substantially.



L-head - compact but airflow restricted

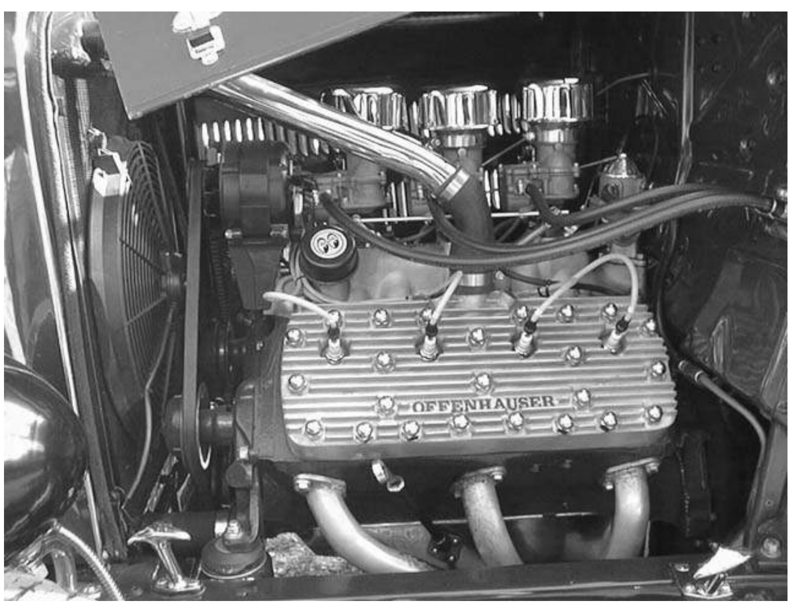


OHV - unrestricted flow paths

K301 model has a bore and stroke of 3.375 X 3.25 respectively, for a displacement of 29.08 cubic inches. Factory rated at 12 bhp (brake horsepower) at 3600 rpm, it certainly cannot be classified as a high-performance machine. However, the relatively mild power rating with this displacement yields reliability and long service life in an industrial type of application, a requirement that the Kohler engineers were striving for.

But realistically, what kind of performance gain can be achieved by employing the usual hop-up methods? By examining similar engines that have responded well to performance modifications, one may make simplistic, yet accurate, estimates.

One of the classic hot-rod engines was the Ford-Mercury flathead V-8, and much can be learned from studying souped-up examples. A really well prepared, streetable, 286 cubic inch Ford flathead equipped with all the available speed equipment of the day would produce about 200 bhp at 4600 rpm on pump gasoline. This translates to .7 bhp per cubic inch, or a BMEP (brake mean effective pressure) of 120 psi at the peak power point.



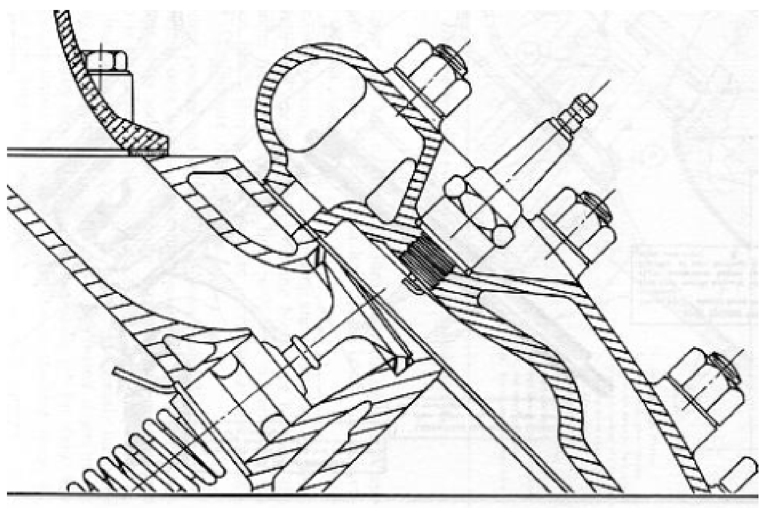
The flathead Ford-Mercury V-8 – A hot rodding classic

BMEP is a specific term, allowing benchmark comparisons between similar types of engines without regard to size, number of cylinders, etc. It is a theoretical *average* cylinder pressure, back-calculated from the torque developed at that rpm. Knowing that a well prepared flathead will produce 120 psi BMEP, we can predict what the souped-up Kohler will make in horsepower potential.

For maintaining a long service life and for safety reasons, we don't want to exceed 4000 rpm in our automotive application. Thus, 120 psi BMEP at 4000 rpm on our 30 cubic inch K301 calculates out to produce 18.2 bhp, or .6 bhp per cubic inch. This is quite respectable for a flathead engine and the 52% increase in power would definitely be noticeable to the operator.

Realistically though, there are a few things working against this performance level being attained from a single cylinder, air-cooled engine. A multi-cylinder V-8 has tuning advantages gained by long inlet runners and exhaust headers that can make use of pressure waves to effectively increase the delivery ratio.

The Kohler, with its carburetor mounted in close proximity to the inlet valve, has no inlet tuning capability due to the short tract length.



Flathead Ford inlet passage, angled valves, and combustion chamber. The Kohler is remarkably similar

The exhaust system can be tuned though, and a non-restrictive muffler (or a glass-pack, straight through muffler) can provide attractive gains.

The other performance robber is the flywheel blower, which provides cooling air. Fans absorb power as the *cube* of their operating rpm. But cutting down the flywheel vanes to reduce this power loss also reduces airflow, and is not recommended for long-term engine durability.

These additive losses reduce the target BMEP to realistically around 110 psi, where, at 4000 rpm, the engine should then produce 16.7 bhp – still a respectable increase from a stock value of 12. ☐

L. Kohler

L-5 Improving the Performance of the Kohler K-301 – Part 3 *By David Kirk—Kirk Engines, Inc.*

The last article in this series discussed the initial preparation and assembly of a hot-rodded K-301 Kohler engine. This article discusses the final buttoning-up and test run of this Killer Kohler.

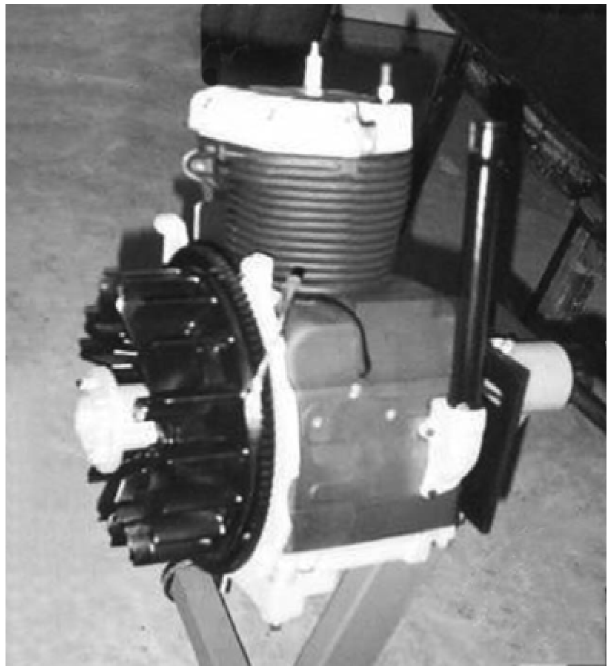
The choice of the camshaft is an important component in a modified, 4-stroke engine. Several performance camshaft grinds are available, as the Kohler's use in quarter scale pulling tractors has become almost universal. Known as a "cheater" grind, the cams are legal to run in a stock class puller because valve lift is held at stock values, which is approximately .320 inch. The difference is the valve duration and overlap has been increased to produce improved breathing and thus power output at the higher end of the rpm range. When researching various cams available, I located a shop right in my home town that regrinds Kohler camshafts to cheater specifications. My camshaft was reground by them and I was impressed by the quality of the work they performed.

Next in the Kohler build-up was the valve train. The springs, retainers, keepers, and valves used were stock Kohler parts as the camshaft grind does not warrant the use of anything more radical. I used the more expensive Stellite exhaust valve, P/N 235838 for good durability.

Both valves were swirl-polished. They were then chucked in the drill press and, using a file, the lower edge corner (that meets with the 45 degree seat surface) was radiused slightly. This has shown to raise airflow some 5% when tested on a flow bench. The valves were then lapped to their seats using a fine-grit compound.

Polished valves

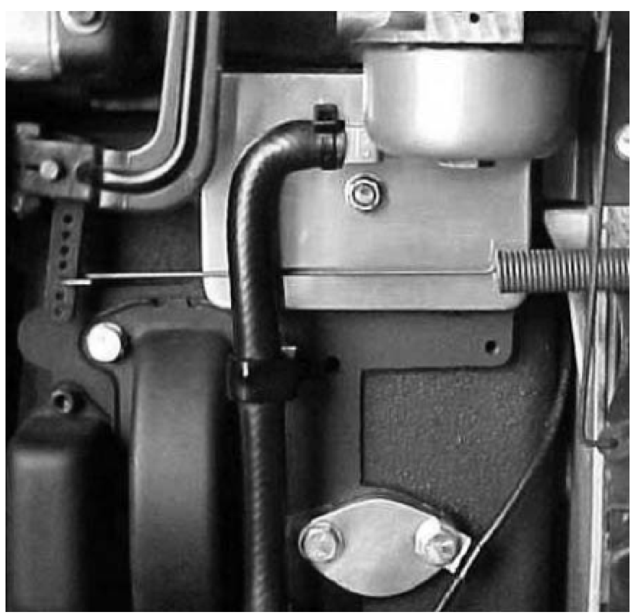
The picture below shows the engine starting to go together. I've found that a standard automotive engine stand works just fine for the Kohler too. Note that the bearing plate was left unpainted as well as the other aluminum components. Bare aluminum parts will dissipate heat more efficiently than when painted.



Engine on stand

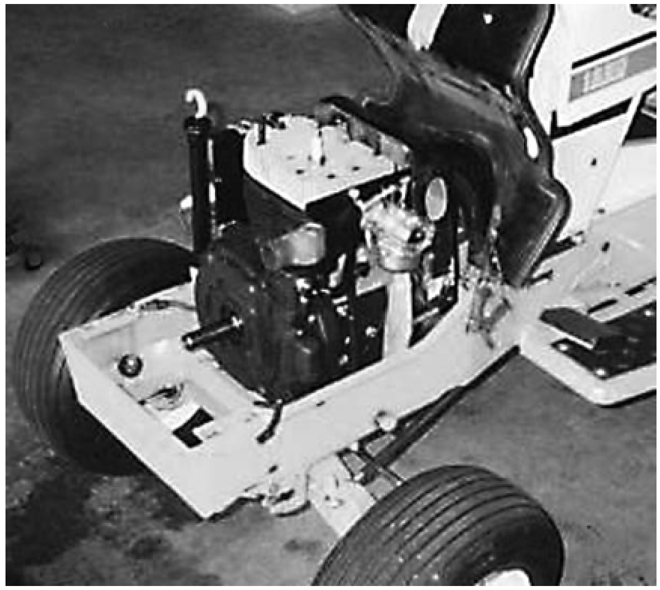
Here the oil pan, dipstick tube, and head are bolted on and carefully torqued to book specs. I know it's anal, but I paint both sides of the iron flywheel. Don't like the thought of bare iron rusting!

Final assembly was now almost complete. Note the billet aluminum breather cover with a "road draft tube"! I got tired of dandelion seeds and grass clippings sticking to the oil film that invariably gets on this side of the engine from the stock breather vent (remember, this engine is going into a garden tractor). I designed the cover and a machinist friend with an N/C milling machine made it for me.



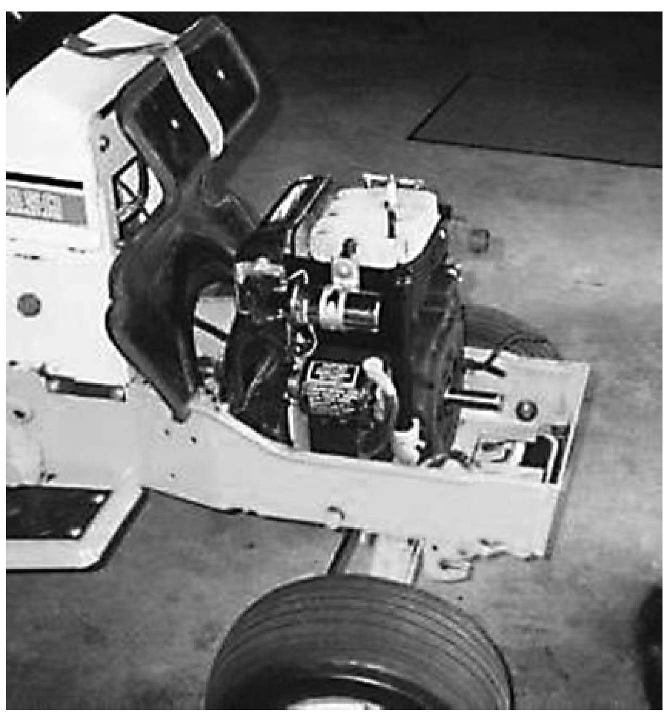
Billet breather cover

The stock spark plug (Champion H-10) was substituted with the next colder heat range H-8, stock number 587 from NAPA. The higher compression ratio dictates a colder heat range spark plug should be used.



Engine installed in tractor

The pictures above and above right show the engine bolted in and getting close to the first run. During this time, the tractor engine bay was thoroughly cleaned and new rubber mounts were installed on the engine mounting rails. The PTO clutch was also inspected and cleaned. Ignition timing was set at the factory-recommended advance of 20 degrees BTDC.



With the crankcase filled to the proper level with 1.5 quarts of Resolute brand non-detergent 30 weight oil, the battery attached and gas in the tank, I'm ready for the first start. Crank thru two compression strokes with full choke – fires and kicks the Bendix drive out. Choke off, cranks thru two more cycles and she lights off with a puff of blue smoke out the stack reminiscent of a Pratt & Whitney radial! That's the excess assembly oil in the cylinder burning off, nothing to worry about. I let it idle at 1500 rpm and warm up for about 15 minutes. Can't resist a blip or two on the throttle – sounds like a 1 cylinder Harley on steroids! Shut her down, let it cool back to room temp and then re-torque the head bolts to proper specs. Now all that's left is to reinstall the head baffling, PTO clutch, and the front end hood assemblies. There is nothing quite like the first start of a new engine, or even a rebuilt one. It is always a magical experience for me.

Break-in oil, when changed at five operating hours, came out almost as clear as went in, a good sign. Another oil change was performed at 10 hours, this time using 30-weight detergent oil. Then oil change intervals were extended to 25 hours, still using the same oil. After approximately 50 hours were obtained on my engine, I switched to Mobil 1, 10W-30 synthetic oil. The chrome top compression ring on a cast iron bore takes a while to break in properly, and 50 hours is considered about average. A full synthetic lubricant in an air-cooled engine is ideal, mainly due to the higher oil temperatures these engines generate when compared to their liquid cooled counterparts. The synthetic maintains a more stable viscosity and offers higher film strengths at temperature plus superior dispersant and detergent additives. Oil is changed every 25 to 30 hour intervals, which for me, works out to one change per year. It's amazing how clean the oil looks after this amount of time – certainly not black, but a dark, amber color. It could easily go to 40 hours, but that's not recommended. The engine needs a slight topping off about every 10 hours but it only takes a few ounces to reach the dipstick "full" mark. This engine will get a steady diet of Mobil 1 throughout its operational life.

At that time, I was using the stock muffler as a straight exhaust pipe was just too noisy. The exhaust note had a noticeably deeper tonal quality under load and the idle, even though steady and misfire-free, has just a hint of being non-stock. The engine power increase was very apparent. Throttle response was immediate and rapid. When mowing I noticed that the engine barely lost any rpm when getting into the high grass. I have the governor set at 3900 rpm no load but still throttle back to 3600 for continuous duty.

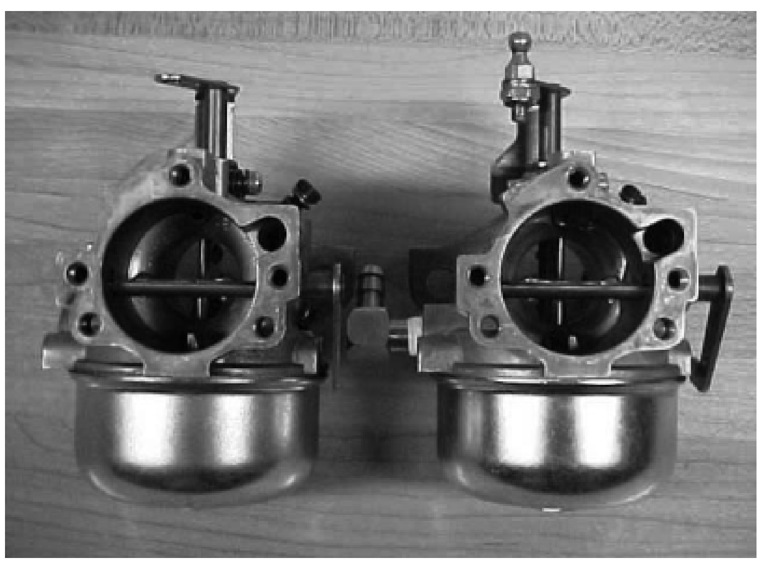
It's hard to believe, but I assembled this engine back in April of 2001. It now has over 400 hours on the meter yet still performs as good as new, with no degradation in power nor increase in oil consumption. It's always started reliably, winter or summer. Over the years I've made other modifications to some external components of this engine which has improved performance even further. One of these mods that really brought out the best qualities in the mildly hot rodded K-301was to the carburetor. I did this to both a Walbro and Kohler carburetor and they both performed well on my engine, with the Kohler carb having the slight edge in good transient response.

The standard Kohler carb for the 12 horsepower K-301engine is the #26, with a 1.067 throttle bore diameter and .81 diameter venturi. The 16-horse carburetor is the #30, with a 1.197 diameter throttle bore and .935 venturi. As I've mentioned before, a relatively broad torque band and good, crisp throttle response was desired. When it comes to carburetion, bigger is not always better and in many cases, can be worse in the part throttle and transient ranges. In putting a #30 on a 12 horsepower block, one discovers that the carb throttle bore is larger than the inlet port diameter. This means grinding the port to match the carb. In my opinion, it's a lot of unnecessary work for an engine that isn't going to turn over 4000 rpm. Basic calculations show that the velocity of the air through the venturi of the stock #26 carb at WOT on the inlet stroke at 3600 rpm yields a Mean Mach Index of .503 (Mean Mach Index is defined as the calculated air velocity divided by the local sonic velocity). For high performance engines, you'd like to stay below .6 and the stock carburetor already is! But now we'd like to turn the souped up engine a little faster to extract more horsepower.

By boring the carb venturi of the #26 carburetor from the original .81 diameter to .875, the area increases from .515 to .601 sq. inches, or a 16.7% increase. Now recalculating the Mach Index at an increased 3900 rpm, we get a value of .467, clearly lower therefore less restrictive than the original at 3600 rpm. One could go bigger yet on diameter and some hot-rodders remove the venturi all together. I think this is unwise for reasons mentioned above.

Proof is in how well it works and this modification seemed to put the finishing touch on the engine. Throttle response is unaffected with crisp, clean acceleration when the throttle is rapidly opened. Full throttle operation is where one will really notice the power increase. To compliment the potential airflow improvement, a K&N high flow air filter element is fitted.

A picture showing a stock Walbro and the identical carb with machined venturi is shown below. It's hard to tell from the picture, but the bored one is on the right. Although the Walbro is an excellent carburetor and can be made to perform well, it is difficult to work on and requires special tools to completely disassemble. The Kohler-made carburetor can be completely torn down with a few common tools, making alterations much easier to execute.



Carb comparison. Stock on left, modified on right

Next installment, a few more modifications are revealed that add even more performance to this hot-rod Kohler! ◻

L. Kohler

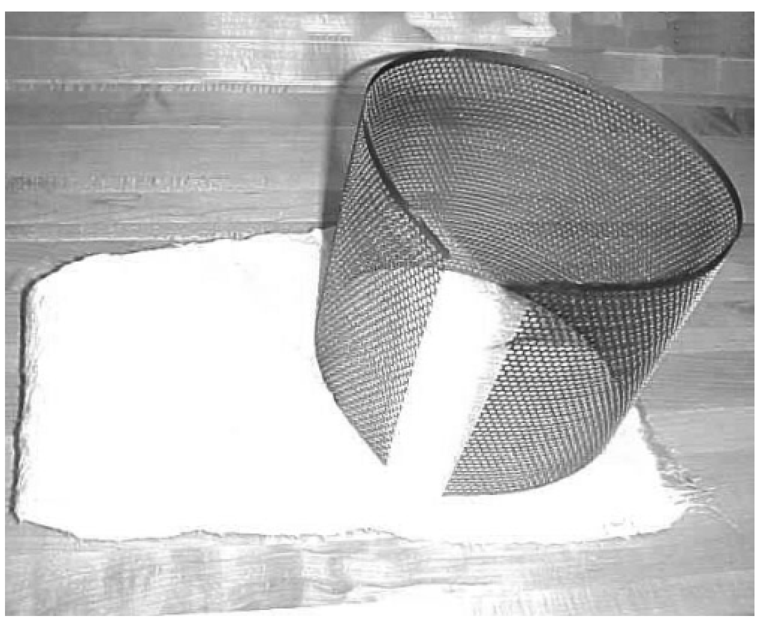
L-6 Improving the Performance of the Kohler K-301 – Part 4

By David Kirk—Kirk Engines, Inc.

The exhaust system was the next component to tackle in my quest for more power from the K-301. A tuned length, straight exhaust stack provides beneficial peak power increases, this being accomplished by a negative pressure wave timed to arrive at the cylinder during the valve overlap period. The sub-atmospheric pressure pulls fresh charge into the cylinder thereby scavenging the remaining exhaust residual, increasing trapped charge purity, and ultimately power output. The downside to all of this is that a straight exhaust is just too noisy to operate for most any form of vehicle. The alternative is to substitute a low-restriction muffler in place of the stock system.

The standard muffler used on the Cub Cadet tractor application was a three-chambered affair, housed in a 12 inch long by 5 inch diameter can. While effective at reducing noise, it is somewhat restrictive to gas flow as compared to a straight through glass pack. Searching several catalogs yielded nothing in a high performance muffler in this size and configuration. So a serviceable, used, standard muffler was obtained and the end cap removed by grinding away the crimp.

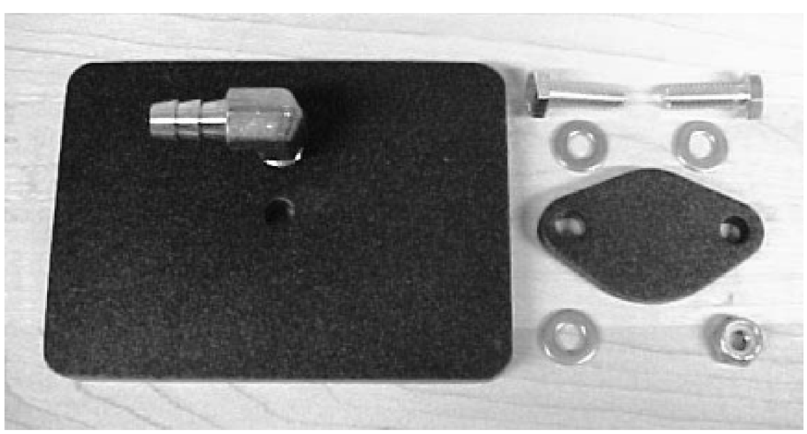
The internal baffles and central tube were then removed by chisel and hammer, carefully breaking through the spot welds. After removal, an empty can remained. A ¼ inch thick sheet of muffler fiberglass wool was carefully measured and cut to line the inside of the can diameter. A matching sheet of perforated steel was cut and placed inside of the fiberglass wool. The perforated sheet was tack welded on the seam so that it formed a rigid cylinder to tightly hold the fiberglass against the outer can walls. The end cap was welded back on and the muffler painted with high temperature "barbeque black" paint. It looked totally stock from outward appearances.



The muffler, in stock form, is shown below along with the Fiberglass wool and perforated metal adapters.

I reassembled it to the engine, eagerly anticipating the sound to be pleasingly noisier. To my amazement, the muffler was actually quieter than stock! But it did have a nice, deep, healthy sound, especially when the engine was carrying a heavy load. I had to slightly richen the high-speed needle setting on the carburetor – a positive sign indicating that airflow had been increased by this modification. Instead of the exhaust flow having a tortuous and restrictive path to the outlet, it now exits into a large volume plenum with pressure waves muted by the absorption properties of the wool. The engine now felt stronger than ever with a baritone authority to its voice.

During this time I had started a small business to make some engine components for friends who had shown interest. The billet breather cover, mentioned in an earlier article, generated several inquiries so I decided to have some produced, along with a matching fuel pump cover. Really not a performance enhancer, the covers do dress up the engine in the hot rodder's tradition. The increased breather passage cross-sectional area in the billet breather is less restrictive and this appears to keep the oil cleaner, but there's no scientific proof of this. The extended hose for breather gasses to exit keeps the exterior of the engine oil-free.

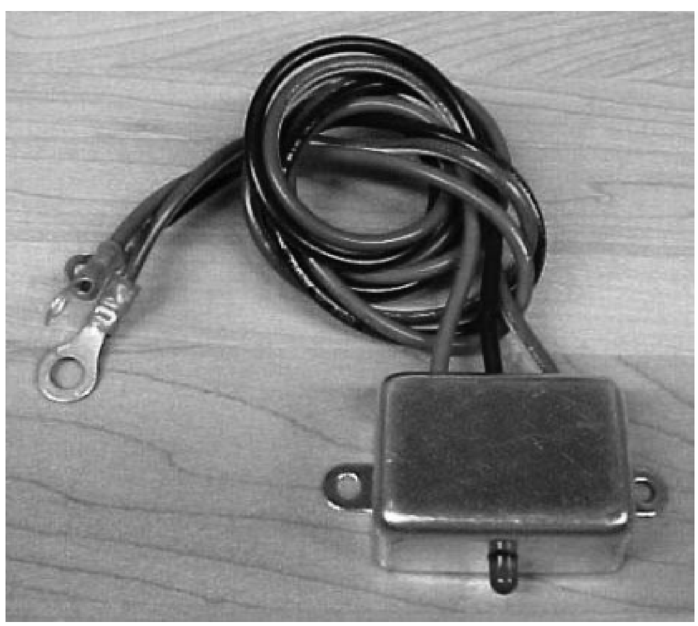


Billet Aluminum Covers

The next system improvement was that of the ignition. I'd never experienced any problems with the stock system, but knew of other users complaining about burning points and failing condensers and coils. Remembering the transistorized aftermarket systems popular in the '70's when cars still had contact breakers, a search was made to find a company still producing them. Nothing of any value was found.

Discussion ensued with a friend who is expert in electronic systems. He discovered several semiconductors available that would do the switching job much more efficiently than the older transistorized circuits and came up with a module that installs between the ignition coil and breaker points. The condenser is disconnected as it is no longer required. Current to the points is reduced from around 2.7 amps down to 100 milliamps. This 96% reduction in current enables the points to last virtually the life of the engine, as pitting and deposit formation no longer occur. The semiconductor allows faster current switching and elimination of the condenser causes no current oscillations in the circuit. This yields a higher secondary voltage discharge translating into a hotter spark at the plug. Without current oscillations, inductive tachometers can be used and operate with accuracy. The semiconductor chosen is highly over-designed for the voltage and current loads imposed, thus imparting high reliability. An LED static timing light was incorporated to allow easy and accurate ignition settings.

Several prototypes were made and I installed one on my tractor in September of 2003, along with a set of new breaker points. The system performed well during the winter with the engine starting very reliably even on the coldest days. It was decided to market these units under the name "PointSaver," as that was the strongest feature. I'm still running this unit on my engine today, eight years later, along with the same breaker points and spark plug.



The PointSaver Module

I was aware of the praise that the Bosch "Blue" ignition coil has among competition tractor pullers. These coils are epoxy filled, which is highly desirable, especially on a single-cylinder engine where vibration is severe. They seem to be totally reliable—I've never heard of one failing. I purchased a Bosch "Blue" and pressed it into service during the spring of '04. It really complimented the PointSaver with both running quality and starting being superb. I then decided to market both the module and coil through my mail order business, as they offer a significant upgrade in ignition performance, reliability, and lowered maintenance. My tractor and engine had become a research vehicle for product development—an interesting scenario.

After putting approximately 50 hours on my Kohler engine, I switched to Mobil 1, 10W-30 synthetic oil. The chrome top compression ring on a cast iron bore takes a while to break in properly, and 50 hours is considered about average. A pure synthetic lubricant in an air-cooled engine is ideal, mainly due to the higher oil temperatures these engines generate when compared to their liquid cooled counterparts. The synthetic maintains a more stable viscosity and offers higher film strengths at temperature plus superior dispersant and detergent additives.

I change oil every 25 to 30 hours, which for me, works out to one change per year. It's amazing how clean the oil looks after this amount of time – certainly not black, but a dark, amber color. It could easily go to 40 hours, but that's not recommended. The engine needs a topping off about every 10 hours but it only takes a few ounces to reach the dipstick "full" mark. My engine will receive a steady diet of Mobil 1 oil throughout its operational life.

I'm also a believer in Marvel Mystery Oil (MMO) and use it religiously in the fuel, mixed at .5 fluid ounces per gallon of gasoline. It has been conclusively proven (to me) that hard carbon buildup on the cylinder bore top land area and in the ring grooves is greatly reduced by use of this additive. I've talked with aircraft A&P mechanics who have praised MMO for how clean it keeps the internals of the air-cooled engines they service. This is convincing evidence that MMO is one additive that really works.

I've also experimented with running different fuels, from 87 octane unleaded to 100 low lead avgas. I cannot tell any difference in performance or running characteristics. The engine has never shown any tendency to spark knock, detonate, or run-on, even when operating on 87 octane gasoline. Normally, 91 octane premium unleaded is used just for a safety cushion. And if available in your area, I recommend the non-reformulated gasoline (no alcohol).

As is typical of these types of projects, there are a few things that I'd have done differently if given another chance (and it's never too late to redo). One is the exhaust valve, which on the K-301, is 1.10 outer seat diameter versus a 1.36 diameter on the K-321 and K-341 engines. The larger diameter is the same as the inlet valve size, which is common to all three engines. Simple calculations had shown that the area increase was hardly worth the machine time and effort to fit the larger valve. Sometime later, and after the engine was all together and running, I modeled the system using Virtual Engines, a powerful piece of computer software enabling highly accurate performance predictions. This program (which will subsequently be discussed) indicated a ½ horsepower increase at 4000 rpm with the larger valve. While this isn't spectacular, going with the "every little bit counts" mindset is what cumulatively makes for a strong engine.

Another modification that benefits the Kohler is rebalancing the crankshaft. While this is not a contributor to enhancing power output, it does produce a smoother running engine and greater operator comfort. Balancing a single cylinder engine is a compromise—that is, forces can be reduced in one direction at the expense of increasing them in another. Altering these rotating and reciprocating dynamic forces is accomplished by changing the mass of the crankshaft counterweights. Weighing the pertinent parts, measuring the counterweight moment on a static balancer, and then performing some calculations, I was surprised to find the K-301 RBF (Reciprocating Balance Factor) to be only 26.8%. There is a theoretical “ideal” RBF, in which the dynamic forces are equal along both the vertical and horizontal axes. This is a function of the engine L/R ratio (connecting rod length/crank throw radius) and for the engine in question, results in a balance factor of 64%. In practice it is found that a RBF of 50-55% is preferred for the “system”, that is, engine mounted in a vehicle. To accomplish the rebalance, a fabricated steel counterweight plate of appropriate thickness is attached to a machined side surface on the PTO-side crank counterweight with screws. This alters the effective counterweight moment and therefore the RBF. A modified crankshaft is shown below.

Rebalanced crankshaft

Advantages of this modification are (first and foremost) less transmitted vibration into the vehicle. The improvement is quite dramatic and very noticeable. Additionally, the reduction in the peak vertical forces result in lower loads imposed on the main bearings, and the slight force couple caused by asymmetry in the stock counterweight thickness difference is virtually eliminated. This can contribute to longer engine life.

The next installment will reveal a few more tricks to improve this classic powerplant! ☐

L. Kohler

L-7 Improving the Performance of the Kohler K-301 – Part 5

By David Kirk, Kirk Engines, Inc

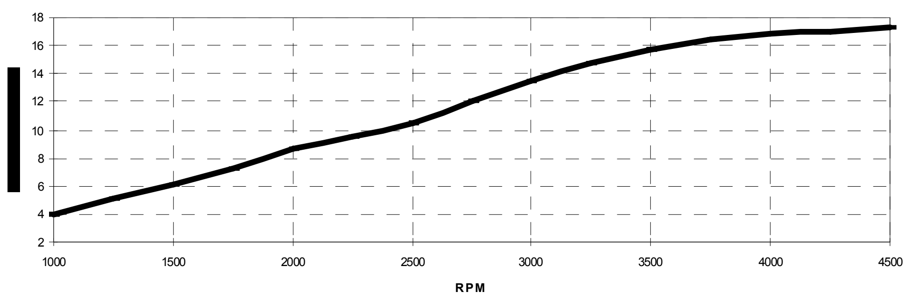
The final item on the wish list is to actually run my modified Kohler engine on a dynamometer. The dyno test is the only conclusive proof of engine performance. It's the standard tool for the engine developer to quantify the gains he's hopefully made in his endeavor.

But Dyno testing would involve removing the engine from the vehicle, something I do not want to do at this time. In the interim, I've taken a more expedient approach as to making a very exact estimate of the performance by using a computer simulation.

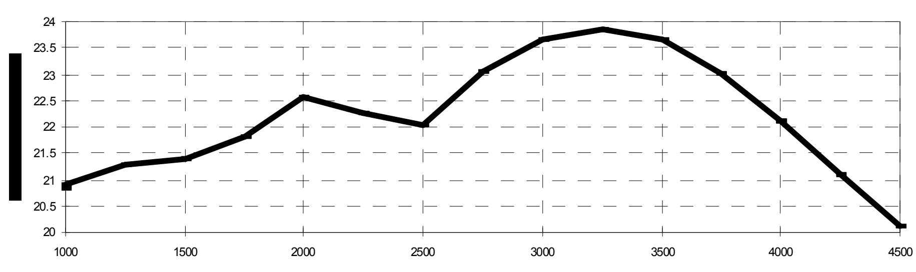
As previously mentioned, *Virtual Engines* is a powerful and sophisticated program for modeling both two and four-stroke engines and predicting all facets of performance without ever constructing a real machine. It has proven invaluable to the engine designer who doesn't have the time or resources to develop by the traditional trial and error methods. It also will predict performance of an existing engine once all the numerous inputs describing the physical geometry of the machine are entered.

Being trained in the use of this software, I modeled the hot rod Kohler as an off-hours project. With all the modifications accurately input, including those mentioned in this article, the following performance predictions were obtained and output in graphical form:

Horsepower at RPM

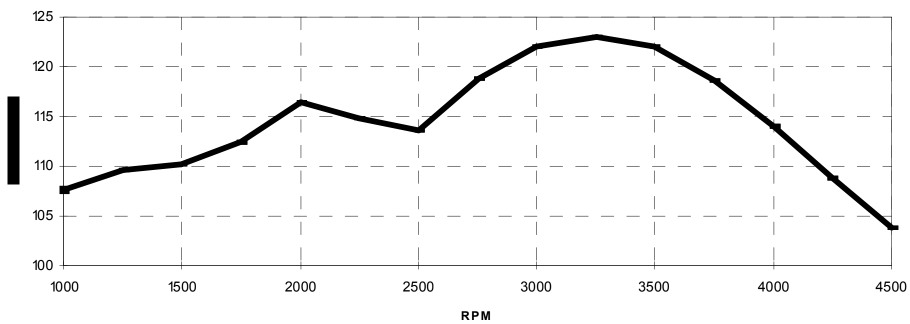


Predicted HP is 16.8 at 4,000 RPM. Note it's still climbing (slightly) at 4,500!



Predicted torque curve shows a peak of 23.8 lbf at 3,250 RPM, with a second peak of 22.5 lbf at 2,000 PRM. Note that the curve appears "lumpy" due to condensed ordinate scale but is actually quite flat.

Brake Mean Effective Pressure

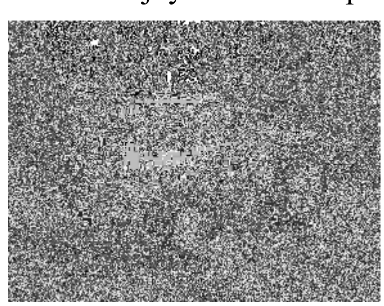


Predicted Brake Mean Effective pressure inherently corresponds to shape of torque curve. Note 114 psi at 4,000 rpm, the peak power point. 123 psi developed at 3,250 rpm, the peak torque point.

More recent optimization of this model indicates that advancing of cam timing by 6° moves both peak power and torque down by 500 rpm to place it perfectly in the operational range. This would be another item to add to the to-do list.

Virtual Engines is an incredible tool for designing and optimizing both new and existing machines. But notice how close we came to predicting peak power output in the initial study by calculating the BMEP values of an existing, similar type engine, and plugging these values into the Kohler geometry. The simple analysis yields 16.7 bhp at 4,000 rpm, where the computer model predicts 16.8 at the same speed. This is not to discredit the value of computer analysis – you can't draw a complete power curve using simple predictions! Nevertheless, simple, comparative predictions can be amazingly accurate.

My hot rodded K301 powers my 1250 Cub Cadet Quietline garden tractor, originally manufactured in 1975, and is shown in the photo below. This tractor was purchased in 1996 from the original owner's family. Over the years that I've owned it, several additions and modifications were made in addition to the hot rodded engine. It is a working tractor, used all year around. I keep it clean and serviced on a regular schedule and it has always rewarded me with excellent reliability and performance. It is completely adequate for my needs and a joy to run and operate.



My ride – a slightly customized 1250 Cub Cadet

Perhaps the main advantage for King Midgets is the 40 percent increase in power, along with improved throttle response. Remember, the Kohler K-series engine is designed for industrial applications such as tractors, generators, cement mixers, etc. The modifications proposed make the performance level and operating characteristics more comparable to an automotive engine—better top-end power with a more “sporting” personality without any detriment to the engine’s reliability or dependability in service.

This, plus the satisfaction gained in putting together an engine that performs very well, is about all I can claim.

This concludes my saga – at least for the time being. Here’s hoping this series of articles provides some technical information and stimulus to those who have considered assembling a hot rod Kohler for their King Midgets.

I’m confident that you’ll derive as much satisfaction and enjoyment from the project as I have, plus have a car that just may “blow the doors off” of your friend’s Vanguard-powered equivalent!

KOHLER K301 AQS HR ENGINE BUILD SUMMARY

Serial Number 7345447: Specification Number – 47541d:
Factory Build Date - 1976

General–Bore = 3.385 in; Stroke = 3.250 in; Displacement = 29.25 in^3
Low idle rpm = 950; High idle rpm = 3900

Block–Intake and exhaust runners ported and polished; all corners radiused
Intake port chamfer filled and matched to carburetor thermal isolator
Intake and exhaust valve pockets relieved on deck surface
Bored .010 oversize to 3.385 diameter

Head– Decked .040
Spark plug hole radiused and blended in combustion chamber
Compression ratio = 7.45:1

Camshaft–Reground “Cheater” cam
Lift* – Ex =.310 In = .320
Duration* – Ex = 280º In = .314º
Overlap = 87º Lobe center separation = 105º
Large base lifters from Wisconsin Engine Co.
*Measured seat-to-seat with lash set .014 ex, .008 in

Valves–Stellite exhaust valve, stock intake valve, both polished and lower seat edge radiused

Crankshaft–Cast surfaces ground and polished and gun bluing applied
Crankpin turned .010 undersized and polished

Piston–Style “D” Mahle brand with supplied chrome ring set

Con Rod–Kohler forged aluminum rod, P/N 45 067 18 (for K-361 engine)
Rod shank polished and oil holes chamfered

Breather–Billet aluminum breather cover with extended draft tube

Carburetor–Kohler brand with venturi machined to .875 diameter for 15% area increase

Air Filter–K&N low restriction element (p/n E-4655) in production filter housing

Muffler–Specially constructed glass pack straight through design using production outer shell
Ignition–Bosch "Blue" ignition coil triggered by PointSaver module via production breaker points. Ignition advance = 20º btdc
Lubricant–Mobil 1 brand, 10W-30 multi-viscosity synthetic, used year round

ACKNOWLEDGEMENTS

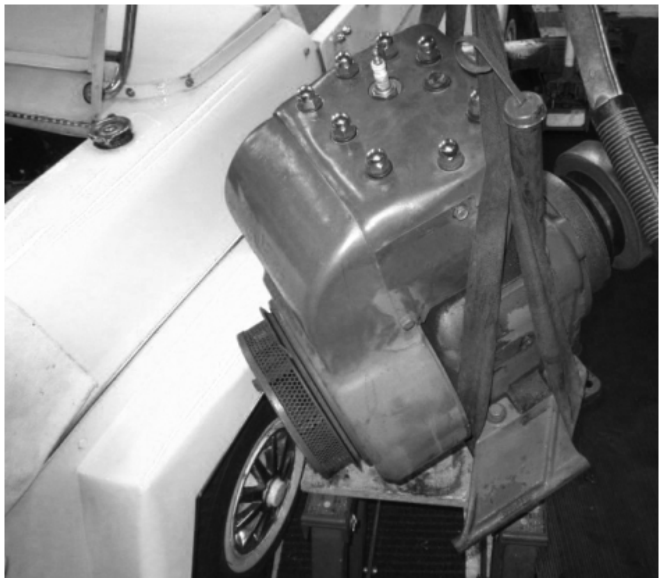
Thanks to Prof. Blair and Associates for permission to use diagrams that appear in the second article of this series.

Thanks to Optimum Power for *Virtual Engines*, unquestionably the ultimate engine modeling software.

Please visit www.kirkengines.com for information on the special components available to modify or upgrade your engine. □

L-8 A Powerhouse Kohler *By Gert Gehlhaar*

Most of you will recall the series of articles David Kirk prepared for this newsletter. How to crank your Kohler up to 16 horsepower while retaining the stock look, and making it run even smoother? How many of you have tried it? Gert Gehlhaar did, and here's his preliminary report on the results. At our King Midgets West Spring Meet in Tehachapi, California, we'll be putting Gert's car to the test in comparison with both stockers and conversions.



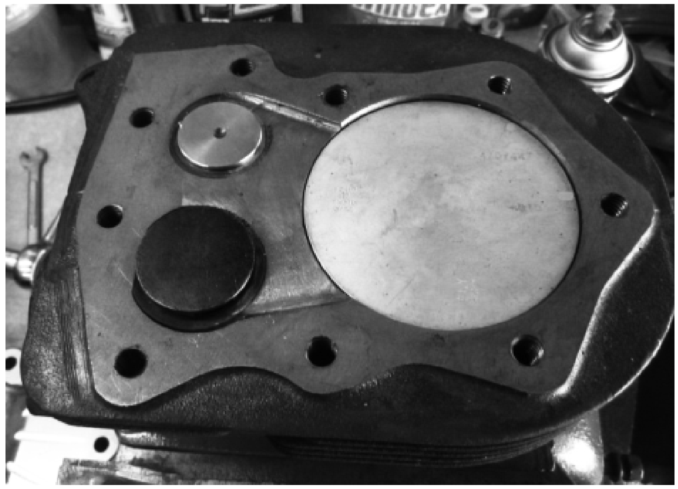
Having some free time over Christmas, I decided to pull the old Kohler and put the newly machined 16 hp Kohler engine together and install it in my 1967 King Midget.

This went along pretty easily except for the starter/generator. It weighs a lot and an overhead installation was pretty hard. I had to use my small floor jack to lift it into the area behind the engine and then wiggle it into position. That took a little over an hour. I got most of this done by Christmas Eve and then only needed to install the electrical lines, gas lines and carburetor.

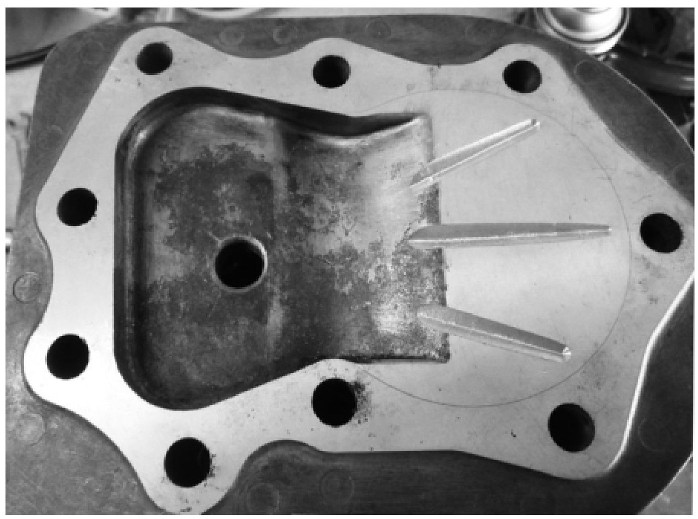
When I went out after Christmas to finish the installation, it seemed like Santa Claus had finished it for me overnight. Well, I did torque down the head again, installed the sparkplug, attached the carburetor, gas line and air-cleaner. Now for the acid test—will it start! One turn of the key and the electric fuel pump purred and the engine came to life and ran just fine. I let it warm up for a few minutes, adjusted the carburetor and then took it for a drive.

The old engine was rated at 12 hp and this new one we built is supposed to raise it to 16 hp. If that's so, just four extra horsepower sure makes a lot of difference in performance for that little car!

I installed a special rod, piston, rings and then balanced the camshaft and crankshaft. Then everything was spun balanced again before being assembled



Piston and valves installed



Head surfaced with Singh grooves milled in

The engine runs very smooth at the higher RPMs and idles very nicely at low RPM. I have now driven it for about 10 miles for the first test drive and will do some more if the weather is good tomorrow. My plan is to break it in enough to have it ready for the 3, 4 and 5 May, 2013 Tehachapi tour.

Here are some of the costs that were involved:

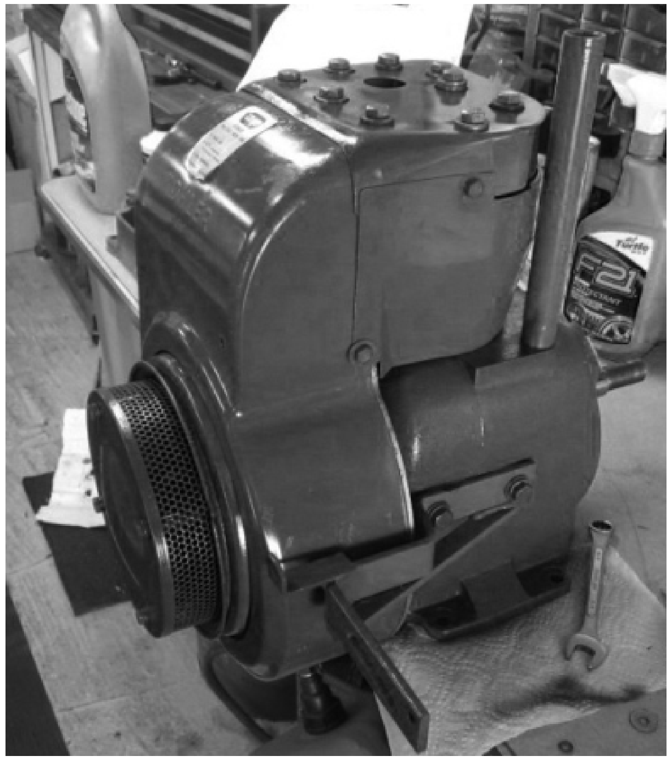
- Purchase of a spare K301 Kohler 12 hp engine; I found one for $100.
- Purchase of the special parts recommended by David Kirk such as rod, piston, rings, valves, camshaft and balancing plate for crankshaft, electronic ignition, sparkplug, and misc items; $350.

Machine work performed by Tom at Rural Machines including items such as cleaning and checking engine case, cleaning the crankshaft and polishing the journal, decking the block, machining the head and adding Singh Grooves, grind valve seats and valve guides. Balancing the crankshaft (Kirk's balancing plate was not enough) as well as the rod, piston combination and flywheel. Then he balanced all three as a unit. Assemble the engine into a complete short block. Tom's bill was $800. So the total cost of this engine upgrade from a 12 hp to a 16, 18 hp or whatever, came to about $1,250.

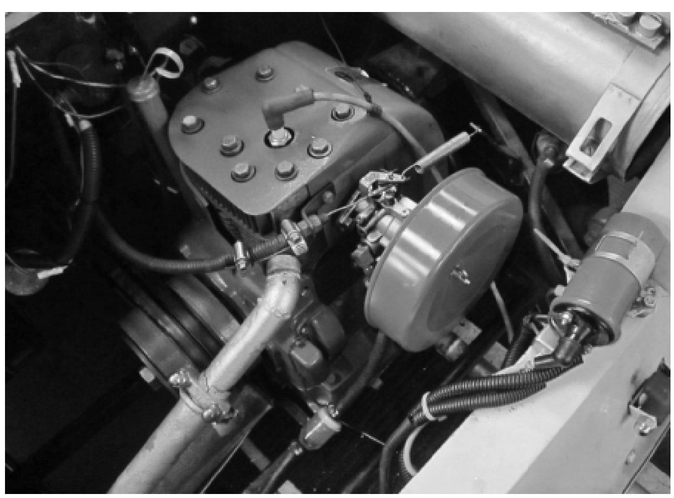
While the machine work was being done, I cleaned and painted all the metal work and assemblies. I did the final assembly myself and all went well. Upon completion of the assembly, I filled the engine with oil and cranked it over without the sparkplug or ignition connected to get some good lubrication inside the engine. Later I added the sparkplug, connected the ignition system, the electric fuel pump and carburetor. After just two rotations she fired and ran well at a slow 350 RPM idle.

Specs of the new 16 hp Kohler

- General Bore = 3.385 in
- Stroke = 3.250 in
- Displacement = 29.25 in^3
- Block Decked .010
- Intake and exhaust runners ported and polished, all corners radiused
- Intake and exhaust valve pockets relieved on deck surface
- Bored .010 oversized to 3.385 diameter
- Head Decked .040
- Singh grooves added
- Spark plug hole radiused and blended in combustion chamber
- Compression ratio = 7.55 : 1
- Camshaft Reground "Cheater" cam supplied by Madson
- Lift – Ex = .310 In = .320
- Duration – Ex = 280 deg In = .314 deg
- Overlap – 87 deg lobe center separation = 105 deg
- Large base lifters
- Valves Stellite exhaust valve, stock intake valve, both polished and;
- Lower seat edge radiused
- Crankshaft cast surfaces ground and polished and gun bluing applied
- Crankpin turned .010 undersized and polished
- Piston Style "D" Mahle brand with supplied chrome ring set
- Con Rod, Kohler forged aluminum rod for K-361 engine
- Rod shank polished and oil hole chamfered
- Breather billet aluminum breather cover with extended draft tube
- Carburetor Kohler brand with carburetor modified as follows: Venturi machined to .875 diameter
- Stock Kohler Air Filter #235166-S
- Muffler is a production outer shell with the internals removed
- Ignition Bosch "Blue" ignition coil triggered by PointSaver module via production breaker points. Ignition advance = 20 deg btdc.
- Lubrication AMSOIL 10W-40 100% synthetic oil



The next step after several test drives was to modify the Kohler carburetor with the things recommended by David Kirk. I first ported the intake to match perfectly to the carburetor and the gaskets. The venturi was measured and found to be .895 which was larger then David Kirk recommended so I left it alone. I did hand sand and polish the carburetor intake and venturi to make sure that no rough areas existed. After all this work I took the KM out for another test drive and the engine ran well with good power and very smooth, but I still felt that the low end torque was not as I would have expected.



So my final step was to research how one does the proper timing for this engine. Did not find anything in my documentation except that the point clearance was to be set at .20

and that was all it said. After a few hours of research on the internet I found a little section in a maintenance manual in Section 8.3, *Battery Ignition System Timing.*

1. Connect standard timing light by connecting the timing lead to the sparkplug wire
2. Connect one lead to the + positive side of battery
3. Connect the third lead to the engine ground
4. Start engine and run it at 1200 to 1800 RPM
5. Aim the timing light at the timing mark that is in line with the center mark on the bearing plate or blower housing

If timing is not as specified, remove breaker point cover and slightly loosen the gap adjusting screw; shift the breaker point plate until the timing mark is properly positioned, and tighten the screw.

Shut off the engine and replace the breaker point cover.

After accomplishing the very difficult task of setting the timing while the engine was running, I took it out for a 34 mile test drive and this time I tried to see how fast it would go and I had no problem pegging the speedometer at over 60 mph.

It is running very well and drops to a nice 350 RPM idle at each stop. It pulls out very nicely and accelerates smoothly and just keeps going, until I decided that was fast enough with the tachometer reading 2000 RPM. I believe my other engine was very tired and this one is very smooth and no oil consumption yet.

So now I've finished the installation and testing of the '67 KM with the rebuilt engine. Presently I have about 150 miles on the engine. Things are looking good.

I drove out to Surf Beach again and with a good head wind I was able to keep it at 50 mph. On the return trip with a tail wind I was able to peg the speedo at 60 mph which is plenty fast for me for that little car.

On the hill to my house though, it seems to bog down to 35 to 40, which is not up to what I'd expected, so I'm not satisfied with the hill-climbing torque just yet. ◻

L-9 LETTERS: Singh Grooves

BOB: DO I FEEL SOME SKEPTICISM on your part about the Singh Grooves? I most likely will never be able to prove they work, but that little engine sure does run smooth and idles very well at 300 or less RPM and very smooth at high RPM. Presently I do not believe that I am able to get all the power the engine has to the rear wheel due to slipping clutches. That problem should be solved upon the return of the rebuilt clutches next week. **Gert**

Yeah, I'm sure we'll never be able to isolate the grooves from the rest of the package. I'm not arguing with the concept, but the presentation looks like the guy is selling that "magic carburetor" that's been shut down by the auto and oil interests.

BOB: AS FOR THE GROOVES, I can see the concept. The grooves will act like a velocity stack on a carb inlet, the grooves will improve chamber explosion and create a cleaner, more efficient burn. **LEE**

ONE THING I'VE SEEN POSTED IS, if it works as well as stated in improved gas mileage and torque, why don't the automakers use it? **Gert**

GERT: REVIEWS SEEM MIXED. Seems flat head motors gain something from doing it, in improved torque and fuel mileage. Sounds like something for a Wisconsin AENL. **John White II** ☐

L-10 Fuel Pump *by Alan Conley*

Kohler cars should have the fuel pump checked. The diaphragm has usually dried out from setting for extended periods of time. The fuel pump may work, but, will not pump as much as it should, causing lower top speed and less power on hills. If the diaphragm becomes dry and brittle enough, it may crack, causing gasoline to leak into the oil. This may be detected as an oil level on the dipstick much higher than the full mark. The oil will look thin and will smell gassy. It's best not to run the engine until the fuel pump has been repaired and the oil has been changed. ☐

L-11 Kohler Fuel Pump *by Bob V.*

Speaking of Kohler, my Kohler King which has been so reliable all these years recently let me down. A new fan dropped by and wanted to take a ride and my KM refused to start! What's that all about? It started fine last winter, the last time I drove it.

A bit of work (I'm all thumbs, except on this keyboard) determined the car was not getting gas—not even to the carburetor. Aha! Fuel pump.

Those pumps have a rubberized diaphragm and mine looked really crappy. And after only 47 years!

The nearest Kohler dealer (only ten miles away) revealed that there's no repair kit and that fuel pump is no longer made, but a plastic replacement is available for $107, plus tax. Ouch.

On eBay, I bought a foreign replacement from Cirrus Outdoor Products in White House, Tennessee; for $42 including shipping. With the new pump in place, my car once more runs like a champ; 60 mph indicated—45 mph?

I suggested to Dave Kirk that he put together a rebuild kit. He notes this is a common problem and recommends an electric fuel pump. That's what Gert Gehlhaar did. His cost $38.65 including shipping from California Import Parts, Inc. Part #C13-41-2500-8 12 Volt Electric Fuel Pump, 1.5-4.0 PSI, solid state. □

L-12 LETTERS: Fuel Pump Failure

Bob: I read the piece regarding the KM fuel pump failure. I have a similar electric fuel pump low pressure gravity fed on my vintage VW. Note that the gasket even on this type can get stuck with the ethanol gasoline additive.

I found that using Sta-bil may be beneficial in this case. It was explained to me that the ethanol can soften the rubber and make things a little sticky. I also heard that the ethanol is derived from corn, which causes this problem. Another school of thought is that the gaskets are now made to prevent this from happening. I know in my case the electric fuel pump got stuck, therefore no gas to the engine. Finally got it unstuck so I always use some Sta-bil for ongoing use as well as storage. Maybe this will help? Any thought regarding? **Lenny Pearlstein**

Thanks for that comment, Lenny. The stock fuel pump on the K-301 is a mechanical one and I believe the diaphragms fail from old age, particularly if the engine sits unused for years as happens in so many cases with lost King Midgets. Ethanol can cause other problems with our old engines and your Sta-Bil suggestion seems a good one. And by the way, Dave Kirk suggests using an electric fuel pump on your K-301, and says new one's will not have the ethanol problem. □

L-13 LETTERS: Kohler Engines

Bob: I purchased your King Midget book some time ago, and as I ruminated on the KM story, several thoughts about the cars and your book kept repeating themselves. Let me explain a little.

I was always fascinated. I recall around 1966-67 as a sophomore in high school sending away for a sales brochure. I read that little booklet so much that I think I memorized it. I really wanted one for my first car, but dad was opposed. Winters in Cleveland would have been hard on the car, let alone on me! About five years later I found an early 1960's model that needed some floor work. In the process of researching power plants, I noticed that the Kohler 12 hp engine was the middle engine of a three-part engine "family"—there was a 16 hp version of the engine that shared the same basic engine architecture. Same stroke with a larger bore.

Which leads to **Question #1**. A number of people seem to have "upgraded" the KM power plant. Briggs two-cylinder engines of about 18 hp seem to be the norm. Has anyone explored replacing the Kohler 12 hp engine with the 16 hp version? If the 12 hp crank were retained, then there shouldn't have been any problem with clutches. While I've never seen one of these 16 hp engines outside of a Kohler catalog, it would seem to go a long way toward improving the stock KM's horsepower deficiency, yet still retaining a "stock" appearing power plant.

I asked Dave Kirk to jump in for this question. I'm not familiar with that engine, and don't know of anyone who has used it in a KM. I wonder why not? For you Tom, I'll make two points. First, the current Briggs Vanguard 16-24 hp engines are lighter than the stock Kohler or Wisconsin used by Midget Motors. Second, Dave Kirk is doing a series of articles for our newsletter showing how to extract 16 hp from the original K-310. That alternative has a lot of charm! Bob

Bob and Tom: Very interesting question on the larger displacement Kohler K-series engine. Actually, Kohler built four different displacement engines using virtually the same block casting (with very minor changes). The breakdown is below:

Kohler K-Series Engine Specifications				
Engine Model	K241	K301	K321	K341
Displacement, cu. in.	23.90	29.07	31.27	35.89
Rated Power @ 3600 rpm	10	12	14	16
Bore, in.	3.250	3.375	3.500	3.750
Stroke, in.	2.875	3.250	3.250	3.250
Rod Length, c to c, in.	5.560	5.300	5.300	5.300

The K341 (16 hp) the engine Tom is referring to. It has a 6.82 cubic inch advantage over the K301 (12 hp) engine which would obviously yield better performance, all things being equal. This is due to a 3.75 in cylinder bore (versus 3.375 in.). Both engines use the same stroke crankshaft and share external dimensions, weight, and appearance.

The bigger displacement is the problem; inherent in a single-cylinder engine – vibration. The 16 hp is a real shaker, due to the heavier reciprocating mass from the larger diameter piston. In a small vehicle, transmitted into the structure can be very uncomfortable to the operator, even if the engine is rubber isolated. I would be very concerned with potentially excessive vibration with the K341 “big block” installed in a King Midget.

In my opinion, the K301 was the best engine in this series, in that it produces adequate power with acceptable vibration levels. With straightforward and relatively basic modifications, it can be made to perform as well as the stock K341much smoother running characteristics. **Dave Kirk**

Now back to Tom’s questions:

Question #2. I’m 6’5,” so legroom (and hip room) are important considerations, particularly as I would want to retain second passenger capability. Your book discusses that Type 3s have a wider seat than type 2s, but there are no indications of what seat dimensions might be. I called the KM Club tech hotline requesting such info, but never received a reply. One of the things that I wished you had included in your book was a list of specifications on all three KM models. The closest I’ve been able to find is the specifications page in *Special Interest Autos* when they road tested the 1968 KM. And even there, there isn’t any mention of interior dimensions.

You may find headroom a bigger problem than legroom. The Model 2 seat is about 30 inches wide at the front (tight for two) and the Model 3 is about four inches wider. You’d be surprised the size of some folks who squeeze in! That width increase was a major design objective of the Model 3, and attaining it involved a lot of compromise in the form of additional complexity and weight. Headroom is not a huge problem if you keep the top down, but you may find your eyes about level with the top of the windshield frame. Irritating. Did you send an email to the KM website? That should draw a response.

Question/request #3. For the people that aren’t intimately familiar with the cars, some kind of timeline detailing improvements/changes to the cars would have been helpful. When did they go to 12 volts, for example? It could even serve as a kind of “buyer’s Guide” to assist the novice KM purchaser in making a more informed selection.

A section in the book on dimensions and evolving changes would have been great additions. In my defense, I’ll say that exactly when the changes took place and what was involved is a can of worms. Company records were lost and no one knows those things with precision. Still a rough timeline would have been nice. The main reason such things were left out though, is simply author’s prerogative. My prime purpose for the book was to lay out the history and challenges of Midget Motors. I asked John White to respond:

Bob and Tom: M2s and M3s from 1957-60 or 61 were 6-volt systems. They used a three brush generator with a cutout and a separate starter motor. Some M2s were also pull start, but they are rare. M2s started out with AEN Wisconsin rated at 7.5 hp, later raised to 8.25 hp through the first M3 (1957). The 1958-65 used AENL Wisconsin rated at 9.25 hp. 1965-70 used Kohler 12 hp K301. 1961-1970 the cars went to 12 volt systems using a combination starter/generator.

The first M2s had Plexiglas windshields for about the first year and a half of production,

along with optional canvas doors. Late in 1952 or early 1953 they changed to glass windshields and had optional metal doors. This lasted through 1954, when they changed to wood doors with removable canvas side curtains. The first M3, 1957 and 1958 models, used wood doors, also with removable canvas side curtains. Differences between the 1957-58 cars included the use of slightly different quarter panels and engine compartment lid. Hoods on the 1957 had only the center crease. 1958-1964 hoods had a center crease but also two recessed lines to add stiffness. The 1957 used a piece across under the hood to add stiffness. Sometime in 1964 the hood creases were reversed, having a center crease, but with the stiffening lines raised. This lasted on through end of production.
John White

Question #4. As I have a 36" inseam, has anyone lengthened the car by lengthening the passenger compartment (probably just in front of the seat)?

I've heard of but only seen photos of a Model 2 stretched to handle four passengers and another stretched about six inches. These undertakings are not for the faint of heart. Careful attention to structure would be required. The body work would be easy.

Finally #5, I really like your drawing on page 166; I've often wondered how difficult it would be to widen a KM frame and form the revised front end. **Tom Bunsey**

That drawing has caught a lot of attention, with some folks wanting to build it. I have detail drawings. It is not wider. It rides on the stock Model 3 frame, with the front fenders "ballooned" out to attain the wider hood. One can't widen the frame without also widening the tread, so changing a KM's width really calls for a whole new design. What I was illustrating there was a way to get a new look without major chassis changes.

Those comments drew this response from Tom Bunsey:

Bob: I'll grant a couple of points here, but I think that the vibration issue can be addressed.

Point #1) WEIGHT. I grant that the Wisconsin engine was heavy, being essentially all cast iron. And I'm sure that the Kohler was also (I never really looked). And I note that the Briggs V-twin engines in my lawn equipment seem to be all aluminum, but since the twins have two cylinders and are much bulkier, how much weight is actually saved? I have an Onan opposed twin in my motor home, and it's not a light engine, either. I'll also grant that the newer engines are a lot more efficient, being OHV vs. side valve. Of course, if one of the major upgrade parameters is to gain power while retaining the "stock look," then ...

Point #2 VIBRATION. I'm not so sure about this one. My old high school physics tells me that if one were to double the rpm, the vibration (due to unbalanced weight) increases by the SQUARE of the increase. Since the Wisconsin & Kohler engines were essentially low-rpm industrial engines where vibration wasn't a major issue, that was ok. But car owners, even KM car owners, don't want to feel like they are strapped into a paint mixer. Since these engines were designed for low-rpm use, I doubt that Briggs spent a lot of attention on balancing the reciprocating mass of the engine. It would seem to me that a good neutral balance job would eliminate a great deal of the vibration at its source. I believe that a great deal of care is given to balancing the Briggs engines (flathead, single-cylinder "lawnmower engines") that are used in the Junior Dragsters.

I'm not arguing that the vibration can be eliminated, but that it can be controlled. The 16 hp Kohler engine is 35.89 cubic inches, which is about 600 cc. There are single cylinder 600 cc motorcycle engines out there (Buell, or Harley-Davidson, for example, use a one-cylinder variant of a two-cylinder 1200 cc Sportster engine); these engines aren't the smoothest in the world, but they aren't that bad!

Points taken, but it is important to bear in mind your basic statement—the Wisconsin and Kohler were inherently slow-turning industrial engines. While we have no records of it, I'd not be surprised if MM experimented with the K321 and the K341. We know they built a car with a Wisconsin 16 hp twin (it still exists). That was a huge and torquey chunk of iron that has a tendency to spin the wheels inside their tires and gives new meaning to "torque steer." For the new model they were developing in the sixties, they settled on an Onan opposed twin that seems to run smoothly. The newer engines, no matter the make or cylinder count, are designed and built with greater precision and tighter tolerances. Yes, the old standbys can be hopped and smoothed, (including rebalancing) and that's what Dave Kirk is showing us in his series of articles. He takes the K301 and brings it up to the power of the K341 with relatively modest changes, while retaining its inherently smoother running characteristics. That's probably considerably easier and less costly than smoothing out the K341. Love to see it tried! John White has one. ☐