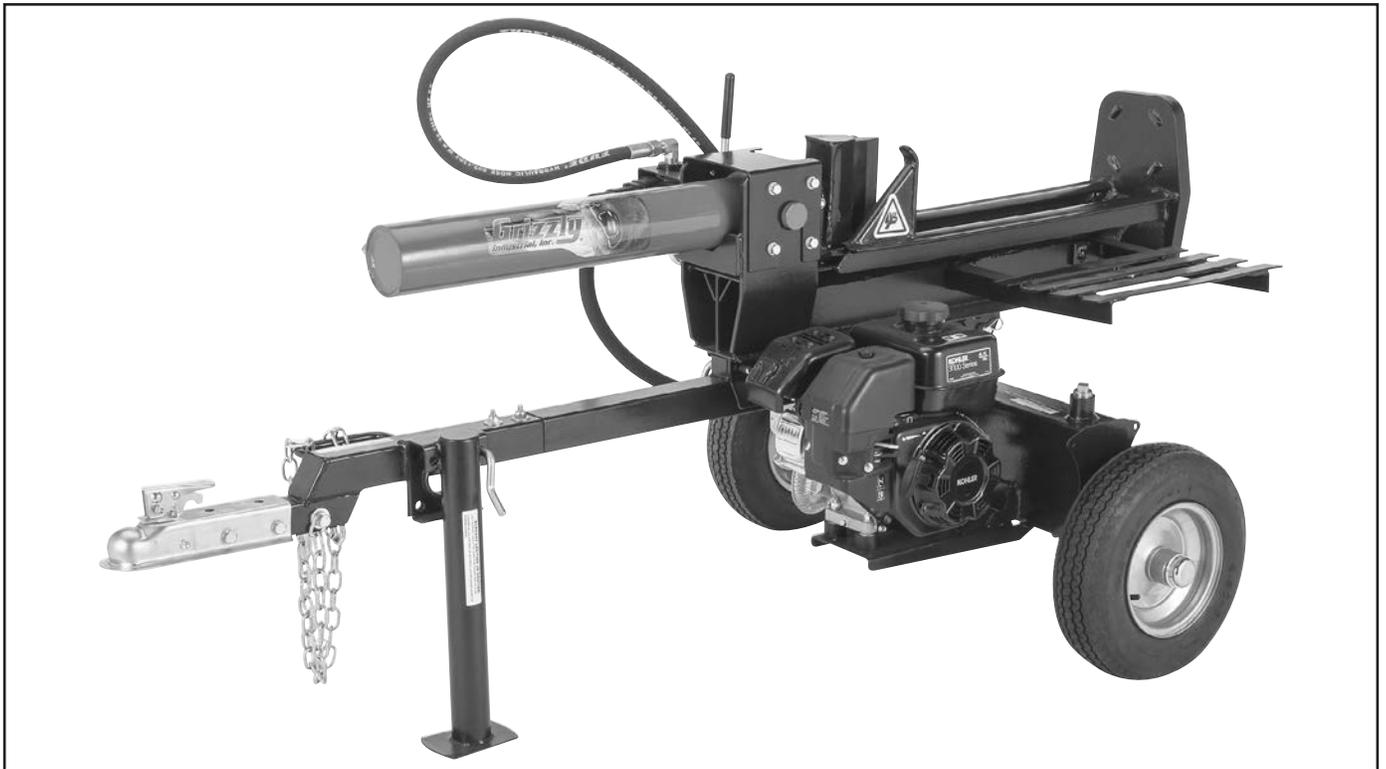


Grizzly **Industrial, Inc.**®

MODEL T27710 **22-TON LOG SPLITTER** **w/KOHLER ENGINE** **OWNER'S MANUAL**

(For models manufactured since 04/16)



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**WARNING: NO PORTION OF THIS MANUAL MAY BE REPRODUCED IN ANY SHAPE
OR FORM WITHOUT THE WRITTEN APPROVAL OF GRIZZLY INDUSTRIAL, INC.**

#BLWK18211 PRINTED IN CHINA

V1.06.16

 **WARNING!**

This manual provides critical safety instructions on the proper setup, operation, maintenance, and service of this machine/tool. Save this document, refer to it often, and use it to instruct other operators.

Failure to read, understand and follow the instructions in this manual may result in fire or serious personal injury—including amputation, electrocution, or death.

The owner of this machine/tool is solely responsible for its safe use. This responsibility includes but is not limited to proper installation in a safe environment, personnel training and usage authorization, proper inspection and maintenance, manual availability and comprehension, application of safety devices, cutting/sanding/grinding tool integrity, and the usage of personal protective equipment.

The manufacturer will not be held liable for injury or property damage from negligence, improper training, machine modifications or misuse.

 **WARNING!**

Some dust created by power sanding, sawing, grinding, drilling, and other construction activities contains chemicals known to the State of California to cause cancer, birth defects or other reproductive harm. Some examples of these chemicals are:

- **Lead from lead-based paints.**
- **Crystalline silica from bricks, cement and other masonry products.**
- **Arsenic and chromium from chemically-treated lumber.**

Your risk from these exposures varies, depending on how often you do this type of work. To reduce your exposure to these chemicals: Work in a well ventilated area, and work with approved safety equipment, such as those dust masks that are specially designed to filter out microscopic particles.

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INTRODUCTION

Contact Info

We stand behind our machines! If you have questions or need help, contact us with the information below. Before contacting, make sure you get the **serial number** and **manufacture date** from the machine ID label. This will help us help you faster.

Grizzly Technical Support
1815 W. Battlefield
Springfield, MO 65807
Phone: (570) 546-9663
Email: techsupport@grizzly.com

We want your feedback on this manual. What did you like about it? Where could it be improved? Please take a few minutes to give us feedback.

Grizzly Documentation Manager
P.O. Box 2069
Bellingham, WA 98227-2069
Email: manuals@grizzly.com

Manual Accuracy

We are proud to provide a high-quality owner's manual with your new machine!

We made every effort to be exact with the instructions, specifications, drawings, and photographs in this manual. Sometimes we make mistakes, but our policy of continuous improvement also means that **sometimes the machine you receive is slightly different than shown in the manual.**

If you find this to be the case, and the difference between the manual and machine leaves you confused or unsure about something, check our website for an updated version. We post current manuals and manual updates for free on our website at **www.grizzly.com**.

Alternatively, you can call our Technical Support for help. Before calling, make sure you write down the **Manufacture Date** and **Serial Number** from the machine ID label (see below). This information is required for us to provide proper tech support, and it helps us determine if updated documentation is available for your machine.

| | | | |
|--|--|-----------------------------|--|
|  | | MODEL GXXXX MACHINE NAME | |
| SPECIFICATIONS | | ▲ WARNING! | |
| Motor: | To reduce risk of serious injury when using this machine: | | |
| Specification: | Read manual before operation. | | |
| Specification: | Wear safety glasses and respirator. | | |
| Specification: | Ensure safety glasses/respirator are properly adjusted/setup and | | |
| Specification: | power is connected to grounded circuit before starting. | | |
| Weight: | 4. Make sure the motor has stopped and disconnect power before adjustments, maintenance, or service. | | |
| | 5. DO NOT expose to rain or dampness. | | |
| | 6. DO NOT modify this machine in any way. | | |
| | 7. | | |
| | 8. | | |
| | 9. Do not use while intoxicated or under the influence of drugs or alcohol. | | |
| | 10. Maintain machine carefully to prevent accidents. | | |
| Manufactured for Grizzly in Taiwan | | | |

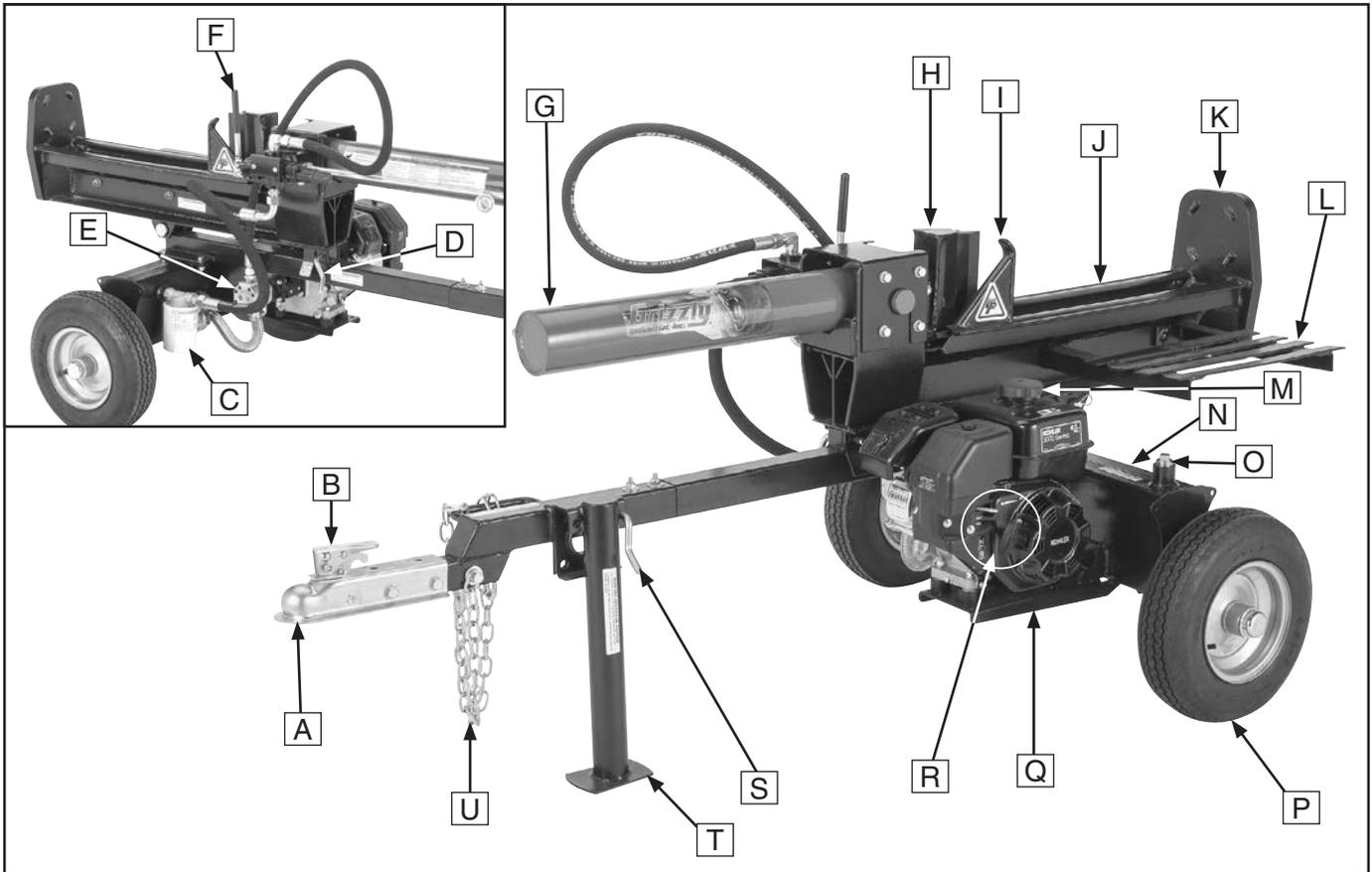
Manufacture Date

Serial Number

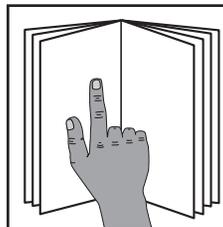


Identification

Become familiar with the names and locations of the controls and features shown below to better understand the instructions in this manual.



- | | |
|---|--|
| <ul style="list-style-type: none"> A. 2" Tow Bar Coupler B. Coupler Lock Lever C. Hydraulic Tank Filter D. Beam Lock Pin E. Hydraulic Pump F. Control Lever G. Hydraulic Cylinder Assembly H. Splitting Wedge I. Dislodger J. Beam K. Foot Plate | <ul style="list-style-type: none"> L. Log Table M. Gas Cap N. Hydraulic Tank O. Vented Cap with Dipstick P. Tubeless Tire Q. Kohler Gasoline Engine R. Engine Controls (refer to Page 5 for details) S. Support Leg Lock Pin T. Support Leg U. Safety Chain |
|---|--|



!WARNING

To reduce your risk of serious injury, read this entire manual **BEFORE** using machine.



Controls & Components



Refer to **Figures 1–4** and the following descriptions to become familiar with the basic controls and components of this machine. Understanding these items and how they work will help you understand the rest of the manual and stay safe when operating this machine.

Log Splitter Controls

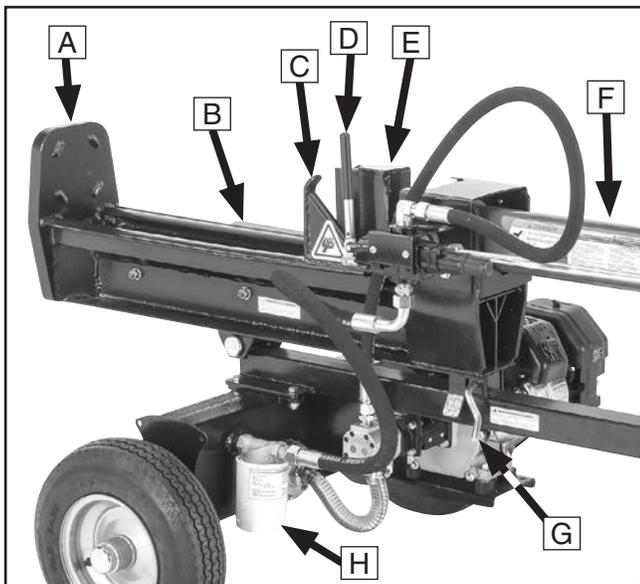


Figure 1. Log splitter controls.

- A. Foot Plate:** Supports log being split.
- B. Beam:** Stabilizes length of log being split.
- C. Dislodger:** Removes log from splitting wedge after splitting operation is complete.
- D. Control Lever:** When placed in forward position (toward foot plate), splitting wedge moves into log and splits it in half. When placed in full REVERSE, the splitting wedge retracts, the lever automatically moves to NEUTRAL, and wedge stops moving.

- E. Splitting Wedge:** 7" high-carbon steel wedge delivers 22 tons of ram force to split logs in half.
- F. Hydraulic Cylinder:** 4" x 23" cylinder supplies 3600 PSI of force using 23 $\frac{1}{8}$ " stroke to operate splitting wedge.
- G. Beam Lock Pin:** Secures beam horizontally for jobsite towing or horizontal operation.
- H. Hydraulic Tank Filter:** Removes contaminants from hydraulic fluid flowing back to hydraulic tank.

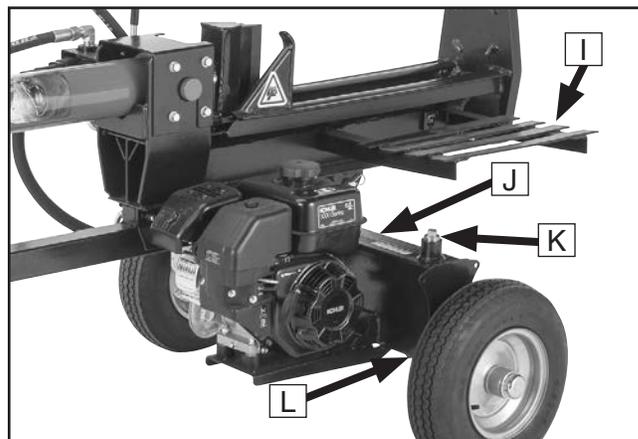


Figure 2. Hydraulic tank components.

- I. Log Table:** Temporarily supports logs before they are loaded onto beam for splitting.
- J. Hydraulic Tank:** Holds 3 $\frac{1}{2}$ gallons of AW-32, ASLE H-150, universal hydraulic fluid, or ISO 32 equivalent hydraulic fluid for log splitter operations.
- K. Vented Cap:** Vents hot gases and fluid from hydraulic tank. Features dipstick for checking tank fluid level.
- L. Hydraulic Tank Drain Plug:** Remove to drain hydraulic tank fluid.



Kohler Engine Controls & Components

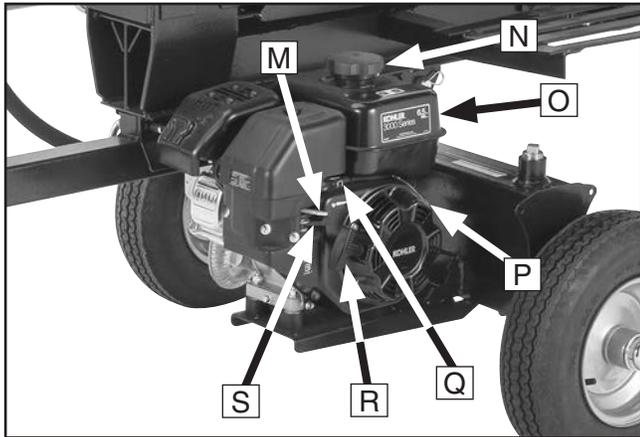


Figure 3. Kohler engine controls and components.

- M. Choke Lever:** Controls choke valve and air-to-fuel ratio in engine. Move lever left to ON (I) position when starting engine when it is cold. Move lever right to OFF position (O) after engine starts. Use this position if starting engine when it is already warm.
- N. Gas Cap:** Remove to fill fuel tank.
- O. Fuel Tank:** Fill with clean, fresh gasoline. Refer to Kohler engine manual to select required fuel type. Avoid overfilling.
- P. ON/OFF Switch:** Turn to ON position (I) before starting engine. Turn to OFF position (O) to shut engine **OFF**.
- Q. Throttle Control Lever:** Regulates amount of air entering engine, thereby controlling its speed. Move halfway between SLOW (turtle) and FAST (rabbit) when starting engine. Adjust lever as needed for operation.
- R. Starter Rope:** Pull several times to start engine and allow fuel to flow into engine. Slowly retract to engine once it starts.
- S. Fuel Shutoff Lever:** Controls flow of fuel from tank to carburetor. Turn to ON position before engine startup. Turn to OFF position (O) when shutting down engine, or before towing to avoid flooding engine.

Towing Controls

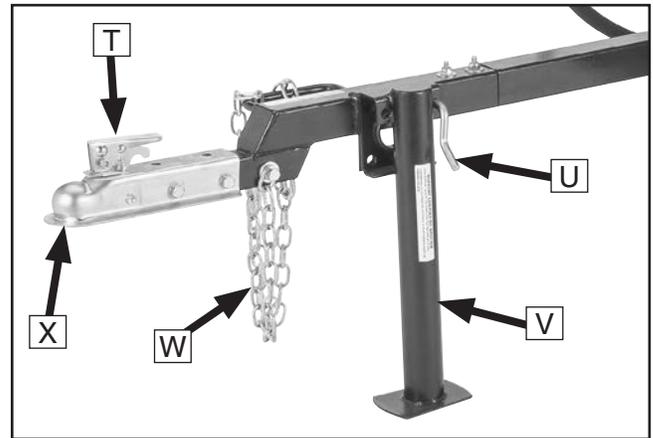


Figure 4. Towing controls and components.

- T. Coupler Lock Lever:** Push down to lock coupler onto vehicle tow ball; lift up to release coupler from vehicle tow ball. Features a hole for inserting a pin or padlock.
- U. Support Leg Lock Pin:** When engaged, secures support leg in up or down position. When disengaged, allows support leg to pivot.
- V. Support Leg:** Supports weight of log splitter and provides stability during splitting operations. Leg can be lowered for operation or raised for towing.
- W. Safety Chains:** Ensure log splitter remains attached to towing vehicle if coupler accidentally separates from towing hitch ball while towing.
- X. 2" Tow Bar Coupler:** Connects log splitter to 2" trailer hitch ball for towing.





MACHINE DATA SHEET

© Grizzly Industrial, Inc. • Customer Service: (800) 523-4777 • Tech Support: (570) 546-9663

MODEL T27710 22-TON LOG SPLITTER WITH KOHLER ENGINE

Product Dimensions:

Weight 388 lbs.
Width (side-to-side) x Depth (front-to-back) x Height 42-1/2 x 84 x 41 in.
Footprint (Length x Width) 85 x 44 in.

Shipping Dimensions:

Type Wood Crate
Content Machine
Weight 441 lbs.
Length x Width x Height 45 x 34 x 22 in.
Must Ship Upright Yes

Engine Information:

Manufacturer Kohler
Horsepower 6.5 HP
Bore 68 mm (2.7 in.)
Stroke 54 mm (2.1 in.)
Displacement 196 CC
Oil Capacity 0.63 qt.

Hydraulic Information:

Hydraulic Cylinder Size (Diameter x Length) 4 x 23 in.
Automatic Cylinder Return Yes
Maximum Pump Pressure 3600 PSI
Pump Rating 11 GPM, 2-Stage
Hydraulic Tank Capacity 3-1/2 gal.
Hydraulic Oil Type AW-32, ASLE H-150, Universal Hydraulic Oil, or ISO 32 equivalent
Filter Type Replaceable, Spin-Off
Cycle Time 13 Seconds

Main Specifications:

Operation Information

Ram Force 22 Tons
Max. Length of Log 25-5/8 in.
Max. Stroke Length 23-1/8 in.
Automatic Cylinder Return Yes
Vertical & Horizontal Operation Yes

Construction Information

Splitter Wedge Carbon Steel
Splitter Wedge Height 7 in.
Axle Carbon Steel
Hoses Wire Braid



Chassis:

Type Carbon Steel
Tow Ball Receiver 2 in. Ball Coupler
Wheels Steel, Integral Hub
Tires Tubeless 16 in. x 4.80-8
Tire Max. Load 590 lbs.
Tire Rating (Max. Speed) 45 MPH
Wheel Bearing Type Tapered Roller
Jackstand Included Yes

Other Specifications:

Country of Origin China
Warranty 1 Year
Serial Number Location ID Label
ISO 9001 Factory Yes
Certified by a Nationally Recognized Testing Laboratory No
Assembly Time 30 Minutes

Features:

Automatic Cylinder Return
25-5/8 in. Log Capacity
22-Ton Splitter Ram Force
2" Tow Ball Coupler
45 MPH Tow Rating
Carbon Steel Splitter Wedge
Carbon Steel Frame



SECTION 1: SAFETY

For Your Own Safety, Read Instruction Manual Before Operating This Machine

The purpose of safety symbols is to attract your attention to possible hazardous conditions. This manual uses a series of symbols and signal words intended to convey the level of importance of the safety messages. The progression of symbols is described below. Remember that safety messages by themselves do not eliminate danger and are not a substitute for proper accident prevention measures. Always use common sense and good judgment.

 **DANGER** Indicates an imminently hazardous situation which, if not avoided, **WILL** result in death or serious injury.

 **WARNING** Indicates a potentially hazardous situation which, if not avoided, **COULD** result in death or serious injury.

 **CAUTION** Indicates a potentially hazardous situation which, if not avoided, **MAY** result in minor or moderate injury. It may also be used to alert against unsafe practices.

NOTICE This symbol is used to alert the user to useful information about proper operation of the machine.

Safety Instructions for Machinery

WARNING

OWNER'S MANUAL. Read and understand this owner's manual **BEFORE** using machine.

TRAINED OPERATORS ONLY. Untrained operators have a higher risk of being hurt or killed. Only allow trained/supervised people to use this machine. When machine is not being used, disconnect power, remove switch keys, or lock-out machine to prevent unauthorized use—especially around children. Make workshop kid proof!

DANGEROUS ENVIRONMENTS. Do not use machinery in areas that are wet, cluttered, or have poor lighting. Operating machinery in these areas greatly increases the risk of accidents and injury.

MENTAL ALERTNESS REQUIRED. Full mental alertness is required for safe operation of machinery. Never operate under the influence of drugs or alcohol, when tired, or when distracted.

ELECTRICAL EQUIPMENT INJURY RISKS. You can be shocked, burned, or killed by touching live electrical components or improperly grounded machinery. To reduce this risk, only allow qualified service personnel to do electrical installation or repair work, and always disconnect power before accessing or exposing electrical equipment.

DISCONNECT POWER FIRST. Always disconnect machine from power supply **BEFORE** making adjustments, changing tooling, or servicing machine. This prevents an injury risk from unintended startup or contact with live electrical components.

EYE PROTECTION. Always wear ANSI-approved safety glasses or a face shield when operating or observing machinery to reduce the risk of eye injury or blindness from flying particles. Everyday eyeglasses are **NOT** approved safety glasses.



WARNING

WEARING PROPER APPAREL. Do not wear clothing, apparel or jewelry that can become entangled in moving parts. Always tie back or cover long hair. Wear non-slip footwear to reduce risk of slipping and losing control or accidentally contacting cutting tool or moving parts.

HAZARDOUS DUST. Dust created by machinery operations may cause cancer, birth defects, or long-term respiratory damage. Be aware of dust hazards associated with each workpiece material. Always wear a NIOSH-approved respirator to reduce your risk.

HEARING PROTECTION. Always wear hearing protection when operating or observing loud machinery. Extended exposure to this noise without hearing protection can cause permanent hearing loss.

REMOVE ADJUSTING TOOLS. Tools left on machinery can become dangerous projectiles upon startup. Never leave chuck keys, wrenches, or any other tools on machine. Always verify removal before starting!

USE CORRECT TOOL FOR THE JOB. Only use this tool for its intended purpose—do not force it or an attachment to do a job for which it was not designed. Never make unapproved modifications—modifying tool or using it differently than intended may result in malfunction or mechanical failure that can lead to personal injury or death!

AWKWARD POSITIONS. Keep proper footing and balance at all times when operating machine. Do not overreach! Avoid awkward hand positions that make workpiece control difficult or increase the risk of accidental injury.

CHILDREN & BYSTANDERS. Keep children and bystanders at a safe distance from the work area. Stop using machine if they become a distraction.

GUARDS & COVERS. Guards and covers reduce accidental contact with moving parts or flying debris. Make sure they are properly installed, undamaged, and working correctly BEFORE operating machine.

FORCING MACHINERY. Do not force machine. It will do the job safer and better at the rate for which it was designed.

NEVER STAND ON MACHINE. Serious injury may occur if machine is tipped or if the cutting tool is unintentionally contacted.

STABLE MACHINE. Unexpected movement during operation greatly increases risk of injury or loss of control. Before starting, verify machine is stable and mobile base (if used) is locked.

USE RECOMMENDED ACCESSORIES. Consult this owner's manual or the manufacturer for recommended accessories. Using improper accessories will increase the risk of serious injury.

UNATTENDED OPERATION. To reduce the risk of accidental injury, turn machine **OFF** and ensure all moving parts completely stop before walking away. Never leave machine running while unattended.

MAINTAIN WITH CARE. Follow all maintenance instructions and lubrication schedules to keep machine in good working condition. A machine that is improperly maintained could malfunction, leading to serious personal injury or death.

DAMAGED PARTS. Regularly inspect machine for damaged, loose, or mis-adjusted parts—or any condition that could affect safe operation. Immediately repair/replace BEFORE operating machine. For your own safety, DO NOT operate machine with damaged parts!

MAINTAIN POWER CORDS. When disconnecting cord-connected machines from power, grab and pull the plug—NOT the cord. Pulling the cord may damage the wires inside. Do not handle cord/plug with wet hands. Avoid cord damage by keeping it away from heated surfaces, high traffic areas, harsh chemicals, and wet/damp locations.

EXPERIENCING DIFFICULTIES. If at any time you experience difficulties performing the intended operation, stop using the machine! Contact our Technical Support at (570) 546-9663.



Additional Safety for Log Splitters

WARNING

Serious injury or death can occur from getting hands or fingers crushed by logs or amputated by splitting wedge. Severe burns can be caused by touching hot parts during operation. Death can result from getting accidentally injected by hydraulic fluid or inhaling carbon monoxide. Workpieces can be ejected by splitter and strike operator or bystanders. To minimize risk of injury, anyone operating this machine MUST completely heed hazards and warnings below.

HOT ENGINE. Motor and other parts of machine get hot during operation. Allow to cool before placing hands near motor, hydraulic cylinder, or hydraulic lines, adding fuel, or performing any service or maintenance.

SUPPORTING LOGS BY HAND. Never use any part of your body to guide or steady a log when ram is moving. Failure to follow this instruction can result in crushing or amputation injuries.

ADEQUATE VENTILATION. The log splitter engine produces carbon monoxide, which is a poisonous gas. Make sure work area is adequately ventilated. Never operate this machine indoors or in any type of enclosed area.

FLUID INJECTION. Fluid pressures developed from this machine are up to 3000 PSI, which are high enough to penetrate your skin and enter your bloodstream. Hydraulic fluid injected into your bloodstream is a medical emergency. If not treated immediately, this blood poisoning could result in an aggressive infection, amputation, or death. Keep body parts away from any high-pressure hydraulic leak.

CORRECT USAGE. Never split wood across grain or use log splitter to split concrete blocks, rocks, or to bend metal.

PROTECTING CHILDREN. Keep children away from log splitter at all times! It is not a toy. Never allow any child to climb or ride on log splitter.

FUEL SPILLS. Fuel exposed to hot engine components may ignite. Thoroughly clean all fuel spills before starting engine.

TROUBLESHOOTING. If you suspect a hydraulic leak, DO NOT use your hand or fingers to locate it. Instead, keep your skin at least 12" away from potential leaking areas and move a strip of cardboard to where leak may exist and watch to see if hydraulic oil is sprayed onto cardboard. Some high-pressure streams can be almost invisible to the naked eye.

HYDRAULIC PRESSURE RELIEF VALVE. Adjusting pressure limit screw may lead to hydraulic explosion and seriously injure operator and bystanders. The pressure relief valve is factory set and should not be adjusted unless by professional hydraulic technician.

TOWING. This log splitter is not designed to be towed on logging roads, forest service roads, public roads, or highways. This machine is designed for job site towing only where speed will not exceed maximum speed listed in **Data Sheet**.

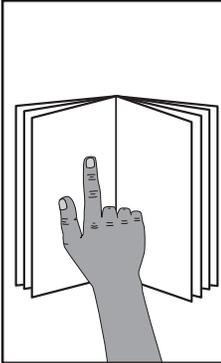
WORKPIECE SELECTION. Logs with extensive knotting may be difficult or impossible to split. Making repeated attempts to split an unsuitable log will increase wear on the pressure relief valve, hydraulic lines, and increase risk of operator injury.

CORRECT USAGE. Never attempt to split more than one log at a time. Doing so may cause logs to fly off splitter with great force, resulting in serious injury or death.

MACHINE LOCATION. Never leave splitter running unattended, always block wheels to prevent rolling, and store unit in locked location.

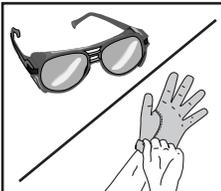


SECTION 2: SETUP



!WARNING

This machine presents serious injury hazards to untrained users. Read through this entire manual to become familiar with the controls and operations before starting the machine!



!WARNING

Wear safety glasses and gloves during entire setup process!



!WARNING

HEAVY LIFT!

Straining or crushing injury may occur from improperly lifting machine or some of its parts. To reduce this risk, get help from other people and use a forklift (or other lifting equipment) rated for weight of this machine.

Needed for Setup

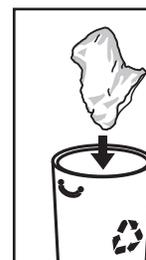
The following items are needed, but not included, for the setup/assembly of this machine.

| Description | Qty |
|---|--------------------------|
| • Safety Glasses (for each person)..... | 1 |
| • Gloves (for each person)..... | 1 |
| • Another Person | 1 |
| • Adjustable Wrench | 1 |
| • Flat Head Screwdriver..... | 1 |
| • Multi-Purpose Grease | As Needed |
| • Open-End Wrenches/Sockets 13mm | 2 |
| • Open-End Wrenches/Sockets 17mm | 2 |
| • Open-End Wrenches/Sockets 19mm | 2 |
| • Phillips Head Screwdriver..... | 1 |
| • Pliers..... | 1 |
| • Rubber Hammer..... | 1 |
| • Hydraulic Fluid AW-32/ISO 32 | 3.5 Gallons |
| • Engine Oil..... | See Kohler Engine Manual |
| • Gasoline | As Needed |

Unpacking

This machine was carefully packaged for safe transport. When unpacking, separate all enclosed items from packaging materials and inspect them for shipping damage. ***If items are damaged, please call us immediately at (570) 546-9663.***

IMPORTANT: Save all packaging materials until you are completely satisfied with the machine and have resolved any issues between Grizzly or the shipping agent. ***You MUST have the original packaging to file a freight claim. It is also extremely helpful if you need to return your machine later.***



!WARNING

SUFFOCATION HAZARD!

Keep children and pets away from plastic bags or packing materials shipped with this machine. Discard immediately.



Inventory

The following is a list of items shipped with your machine. Before beginning setup, lay these items out and inventory them.

If any non-proprietary parts are missing (e.g. a nut or a washer), we will gladly replace them; or for the sake of expediency, replacements can be obtained at your local hardware store.

NOTICE

If you cannot find an item on this list, carefully check around/inside the machine and packaging materials. Often, these items get lost in packaging materials while unpacking or they are pre-installed at the factory.

| Box Inventory (Figures 5–6) | Qty |
|---|-----|
| A. Wheel Assemblies..... | 2 |
| B. Support Leg and Coupler Assembly | 1 |
| C. Rear Frame Tube | 1 |
| D. Hydraulic Cylinder Assembly..... | 1 |
| E. Log Splitter Assembly | 1 |
| F. Hydraulic Tank Assembly | 1 |
| G. Kohler Engine 3000, 6.5HP, 196CC..... | 1 |
| H. Suction Hose..... | 1 |

| Hardware Bag Contents (Figure 7) | Qty |
|---|-----|
| I. Axle Caps (Wheel) | 2 |
| J. Flat Washers 20mm (Wheel)..... | 2 |
| K. Cotter Pins 4 x 36 (Wheel)..... | 2 |
| L. Slotted Hex Nuts M20-2.5 (Wheel) | 2 |
| M. Hex Bolts M10-1.5 x 70 (Frame Tube)..... | 2 |
| N. Flat Washers 10mm (Frame Tube)..... | 2 |
| O. Lock Nuts M10-1.5 (Frame Tube) | 2 |
| P. Hex Bolts M12-1.75 x 35 (Frame/Tank) | 4 |
| Q. Flat Washers 12mm (Frame/Tank) | 4 |
| R. Lock Nuts M12-1.75 (Frame/Tank)..... | 4 |

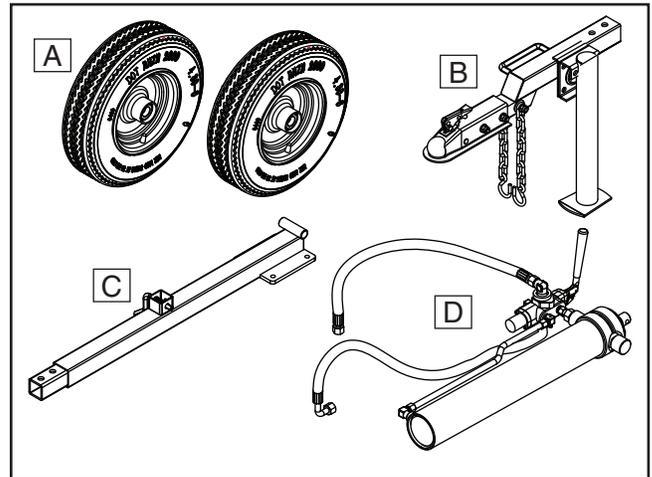


Figure 5. Box inventory 1.

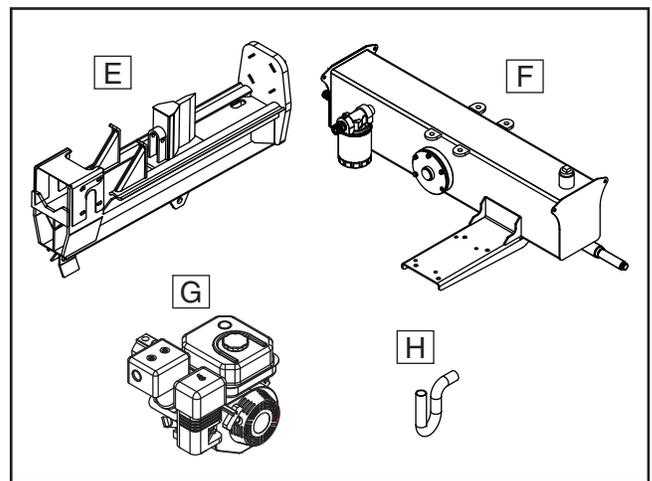


Figure 6. Box inventory 2.

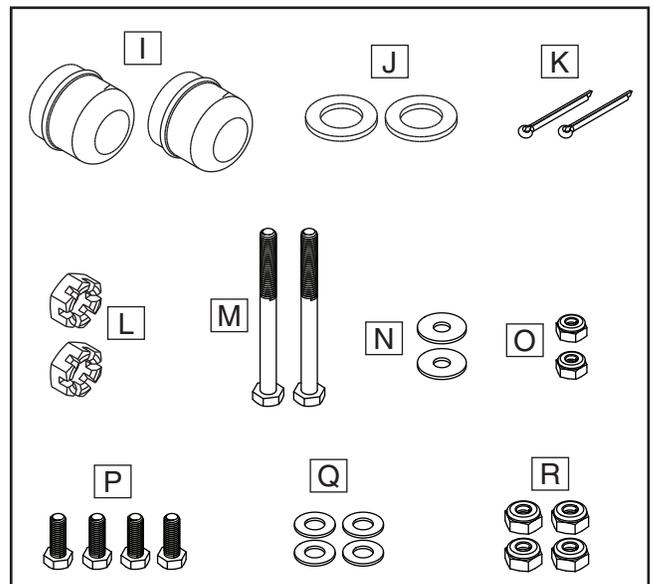


Figure 7. Hardware inventory.



Addl. Hardware Bag Contents (Figure 8) Qty

- S.** Clevis Pin 21 x 126mm (Cylinder/Beam).... 1
- T.** Hairpin Cotter Pin 1³/₄" x 2¹/₂"
(Cylinder/Beam)..... 1
- U.** Fender Washers 10mm (Engine)..... 4
- V.** Rubber Spacers (Engine)..... 4
- W.** Hex Bolts M8-1.25 x 65 (Engine)..... 4
- X.** Fender Washers 8mm (Engine) 4
- Y.** Lock Washers 8mm (Engine) 4
- Z.** Lock Nuts M8-1.25 (Engine) 4
- AA.** Hose Clamps (Suction Hose) 2
- AB.** O-Ring 11.2 x 2.4mm (High Press. Hose).. 1
- AC.** O-Ring 17 x 2.5mm (Hydraulic Filter)..... 1

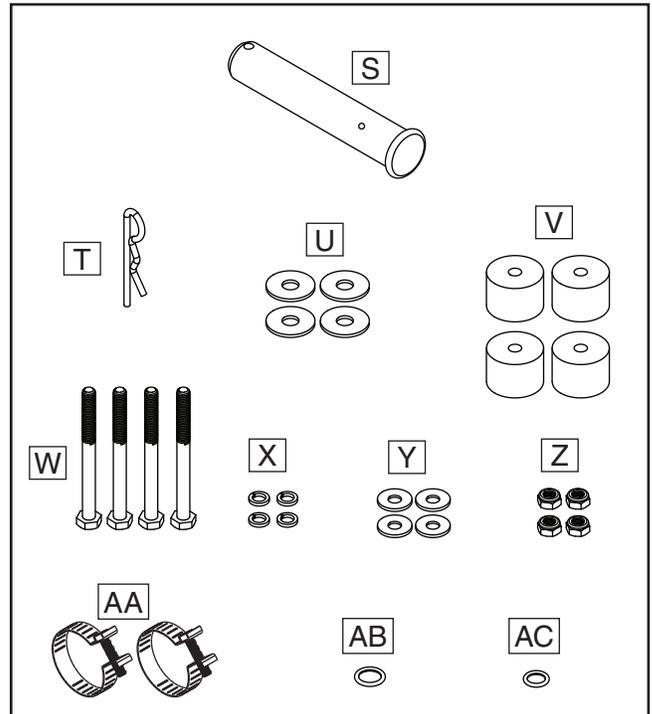


Figure 8. Additional hardware inventory.



Site Considerations

Physical Environment

The physical environment where the machine is operated is important for safe operation and longevity of components. For best results, operate this machine in a dry environment that is free from excessive moisture, hazardous chemicals, airborne abrasives, or extreme conditions. Extreme conditions for this type of machinery are generally those where the ambient temperature range is outside 41°–104°F; the relative humidity range is outside 20–95% (non-condensing); or the environment is subject to vibration, shocks, or bumps.

Space Allocation

Consider the largest size of workpiece that will be processed through this machine and provide enough space around the machine for adequate operator material handling or the installation of auxiliary equipment. With permanent installations, leave enough space around the machine to open or remove doors/covers as required by the maintenance and service described in this manual. **See below for required space allocation.**

Weight Load

Refer to the **Machine Data Sheet** for the weight of your machine. Make sure that the surface upon which the machine is placed will bear the weight of the machine, additional equipment that may be installed on the machine, and the heaviest workpiece that will be used. Additionally, consider the weight of the operator and any dynamic loading that may occur when operating the machine.

Lighting

Lighting around the machine must be adequate enough that operations can be performed safely. Shadows, glare, or strobe effects that may distract or impede the operator must be eliminated.

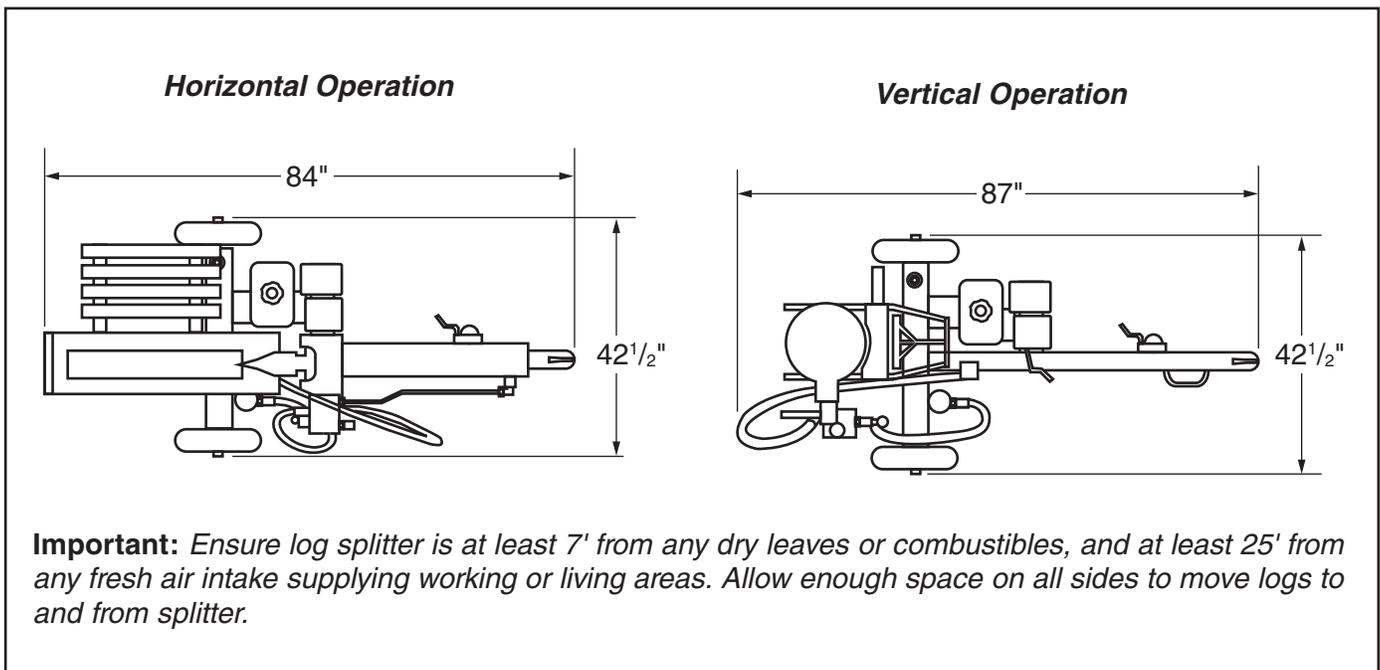


Figure 9. Working clearances.



Assembly

The machine must be fully assembled before it can be operated. Before beginning the assembly process, refer to **Needed for Setup** and gather all listed items. To make sure the assembly process goes smoothly, clean all parts that have any heavy-duty rust preventative applied by the factory (if applicable).

To assemble log splitter:

1. Wipe dab of multi-purpose grease onto spindle and wheel bearing (see **Figure 10**), and with valve stem facing outward, slide wheel onto axle until it stops.
2. Place 20mm flat washer with M20-2.5 slotted hex nut onto axle, then place 4 x 36mm cotter pin through hole in spindle end (see **Figure 10**).
3. Bend both cotter pin tangs so wheel is held onto axle, and tap axle cap (see **Figure 10**) onto wheel.

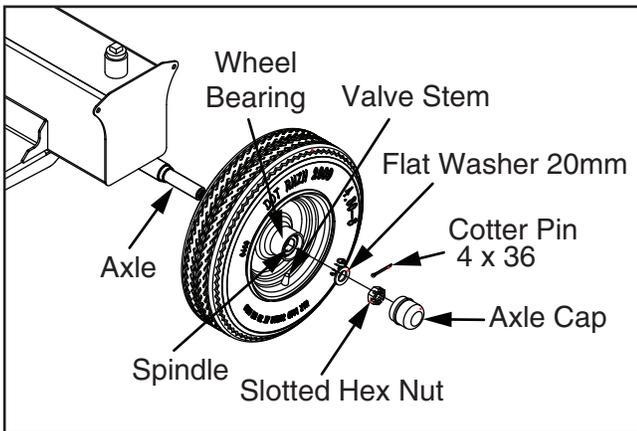


Figure 10. Installing wheel onto axle.

4. Repeat **Steps 1–3** to install the other wheel.

5. Pull lock pin out and pivot support leg until pin locks leg in down position (see **Figure 11**).

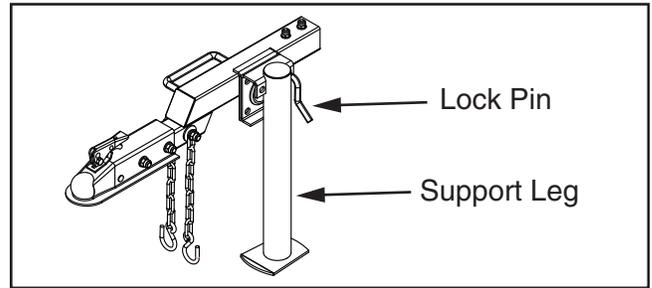


Figure 11. Support leg locked in down position.

6. Attach front frame tube with support leg to rear frame tube with (2) M10-1.5 x 70 hex bolts, (2) 10mm flat washers, and (2) M10-1.5 lock nuts (see **Figure 12**).

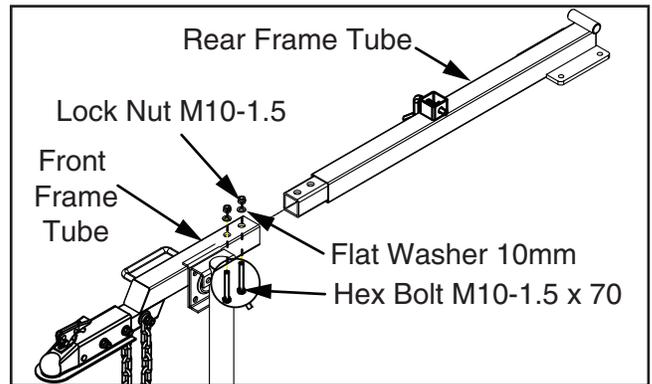


Figure 12. Installing front frame tube onto rear frame tube.

7. Place frame tube onto hydraulic tank and attach it with (4) M12-1.75 x 35 hex bolts, (4) 12mm flat washers, and (4) M12-1.75 lock nuts, as shown in **Figure 13**.

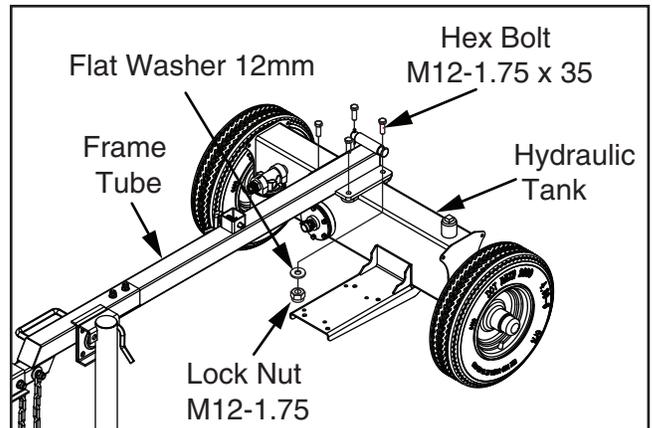


Figure 13. Installing frame tube onto tank.



8. Remove cylinder cover, then attach hydraulic cylinder to splitting wedge with pre-installed (1) M12-1.75 x 65 hex bolt and (1) M12-1.75 lock nut (see **Figure 14**).

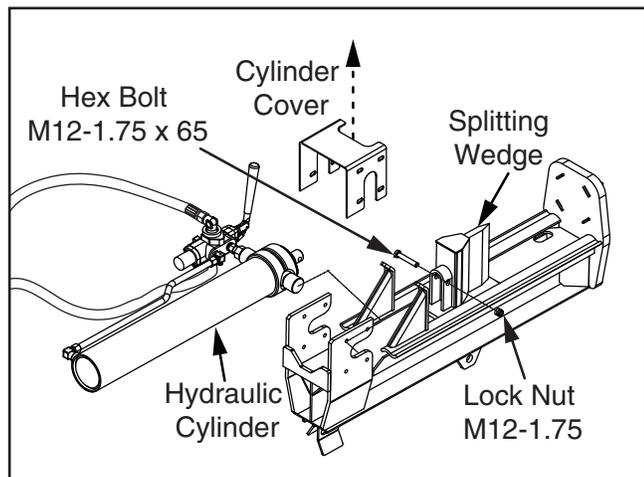


Figure 14. Attaching hydraulic cylinder to splitting wedge.

9. Re-install cylinder cover with (8) M10-1.5 x 20 hex bolts, (8) 10mm lock washers, and (8) 10mm flat washers that were removed in **Step 8** (see **Figure 15**).

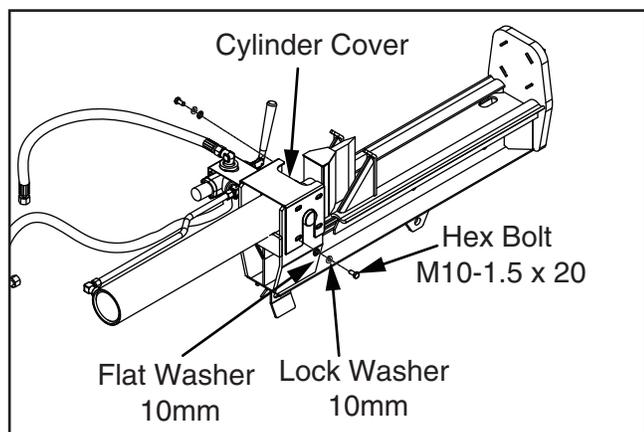


Figure 15. Hydraulic cylinder cover re-installed.

10. With help of assistant, lift hydraulic cylinder and beam onto frame tube. Secure with (1) 21 x 126mm clevis pin and (1) 1³/₄" x 2¹/₂" hairpin cotter pin (see **Figure 16**).

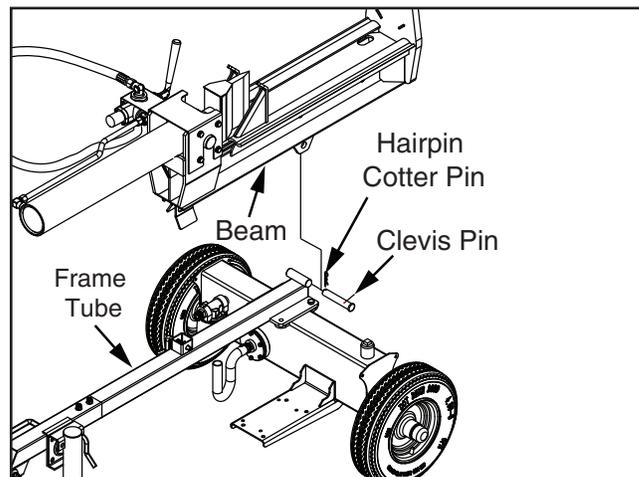


Figure 16. Attaching hydraulic cylinder and beam to frame tube.

11. Remove any paint chips or foreign material from engine mounting pad, then place (4) rubber spacers—each with a 10mm fender washer—over holes on engine mounting pad (see **Figure 17**).

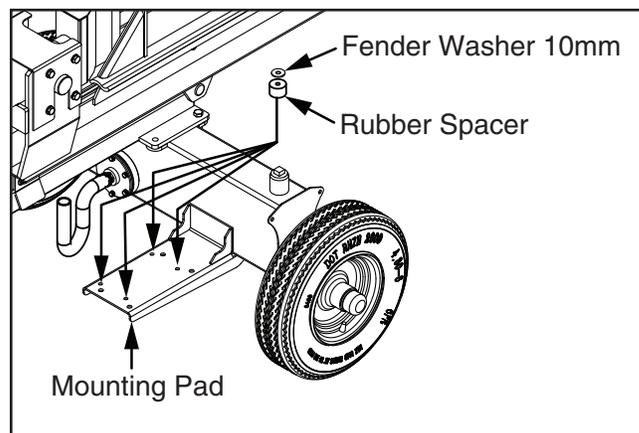


Figure 17. Installing rubber spacers and flat washers onto motor mounting pad.



- Attach engine to mounting pad with (4) M8-1.25 x 65 hex bolts, (4) 8mm fender washers, (4) 8mm lock washers, and (4) M8-1.25 lock nuts (see **Figures 18–19**). Tighten fasteners evenly, in alternating pattern, to reduce risk of cracking mounting flange. **DO NOT** overtighten!

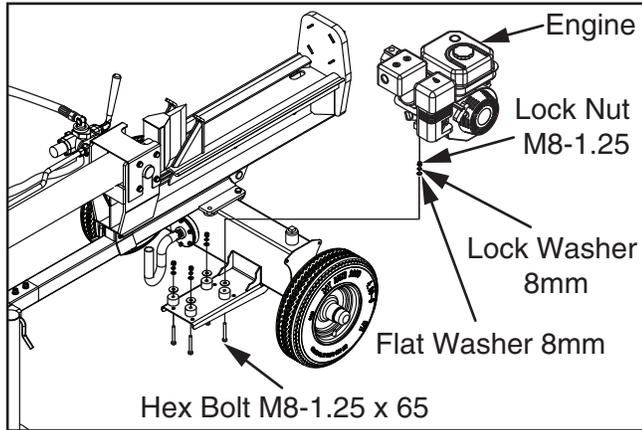


Figure 18. Installing rubber spacers and flat washers onto engine mounting pad.

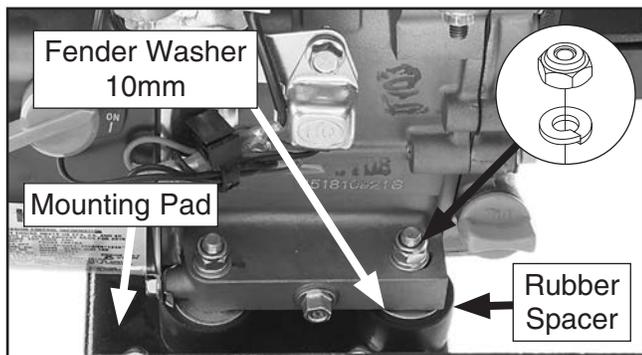


Figure 19. Engine fastener detail.

- Attach suction hose to hydraulic pump suction port and hydraulic tank with hose clamps (see **Figure 20**).

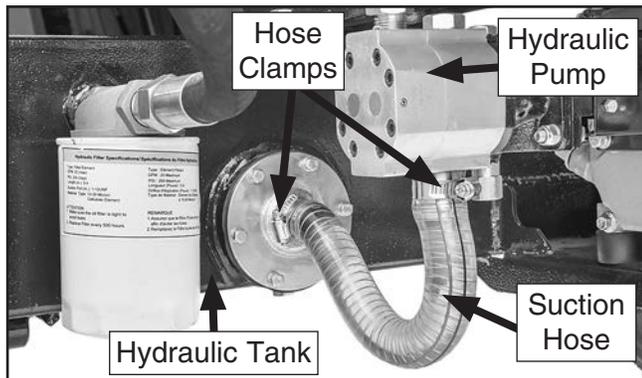


Figure 20. Suction hose attached to hydraulic pump and hydraulic tank.

- Remove plastic cap from pump pressure port and add a couple of tablespoons of hydraulic fluid into pressure port (see **Figure 21**).

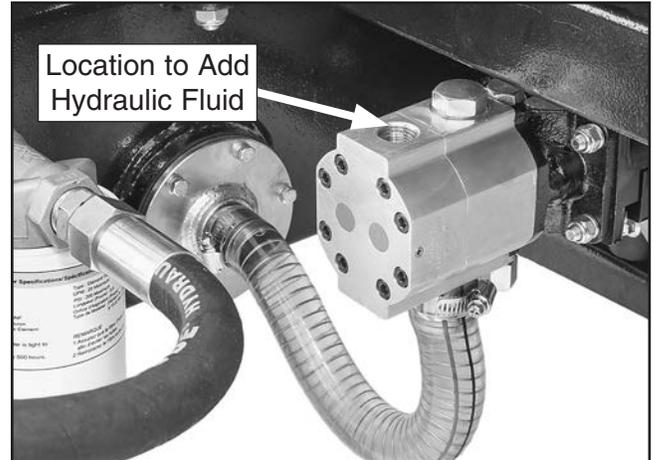


Figure 21. Pump pressure port.

- Unthread plastic plug from high pressure hose (see **Figure 22**).
- Install high pressure hose onto pump pressure fitting (see **Figure 22**) with (1) 11.2 x 2.4 O-ring.

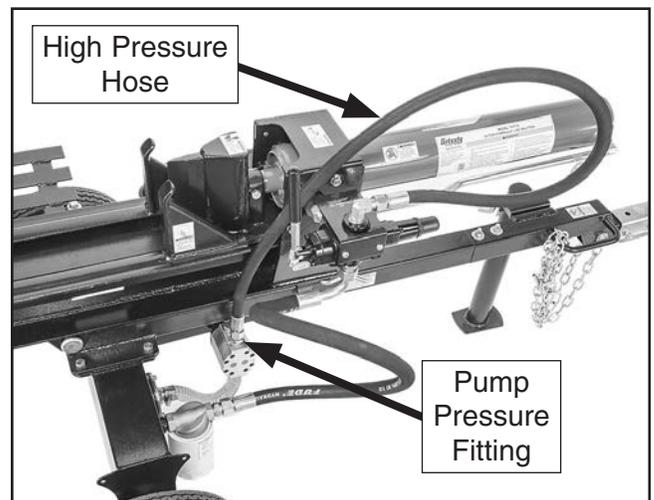


Figure 22. High pressure hose and control lever.



17. Remove plastic cap from hydraulic filter fitting (see **Figure 23**), and lubricate and install (1) 17 x 2.5mm O-ring on end of fitting.
18. Unthread plastic plug from low pressure return hose (see **Figure 23**).
19. Install low pressure return hose onto tank hydraulic filter fitting (see **Figure 23**), making sure O-ring stays in place.

Note: Tighten hydraulic hose connector to 18-20 inch/pounds.

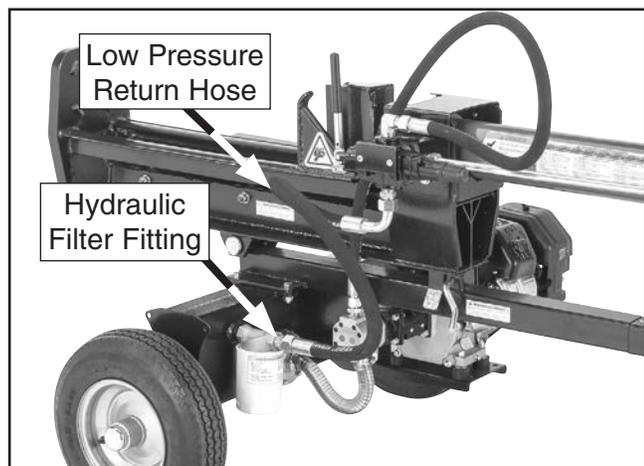


Figure 23. Low pressure hose and oil filter fitting.

20. Make sure log splitter is on level surface, and fill hydraulic tank with hydraulic fluid. Refer to **Checking/Adding Hydraulic Fluid on Page 29** for specific details.

IMPORTANT: Hydraulic tank is shipped from factory without hydraulic fluid. It must be filled before operation!

21. Refer to Kohler engine manual to select required engine oil type, locate fill plug (see **Figure 24**), and fill engine with required oil.
22. Refer to Kohler engine manual to select required fuel type, locate gas cap (see **Figure 24**), and fill engine with required fuel.

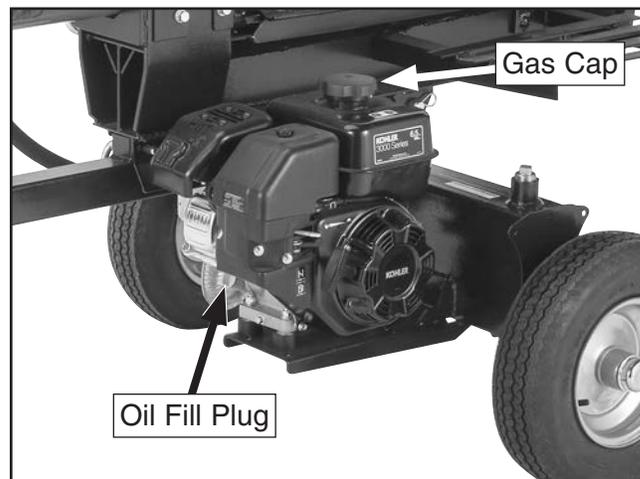


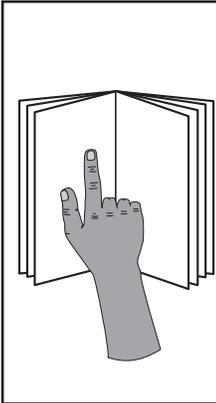
Figure 24. Engine gas cap and oil fill plug locations.

NOTICE

Damage caused by running log splitter without hydraulic fluid or engine oil will not be covered under warranty.



Test Run/Break-In



!WARNING

This machine presents serious injury hazards to untrained users. Read through this entire manual and Kohler engine manual to become familiar with controls and operations before starting engine and using log splitter!



!WARNING **HYDRAULIC INJECTION HAZARD**

Hydraulic fluid leaks can be under sufficient pressure to penetrate your skin and enter your bloodstream. If fluid is injected into any part of your body, it is a medical emergency and may, if not treated immediately, result in severe infection, permanent disability, or even death.

IMPORTANT: Do not leave area during test run, in case there is a problem or a leak.

To test run and break-in log splitter:

1. Read and understand Kohler engine manual that accompanied this log splitter and follow all safety precautions. Read and understand entire Grizzly manual and follow all safety precautions.
2. Make sure hydraulic tank and engine have been filled to required fluid and fuel levels. Hydraulic tank and engine are not filled at factory for shipping purposes. DO NOT operate log splitter without filling hydraulic tank and engine!

3. Move fuel shutoff lever to ON (I) position, as shown in **Figure 25**.

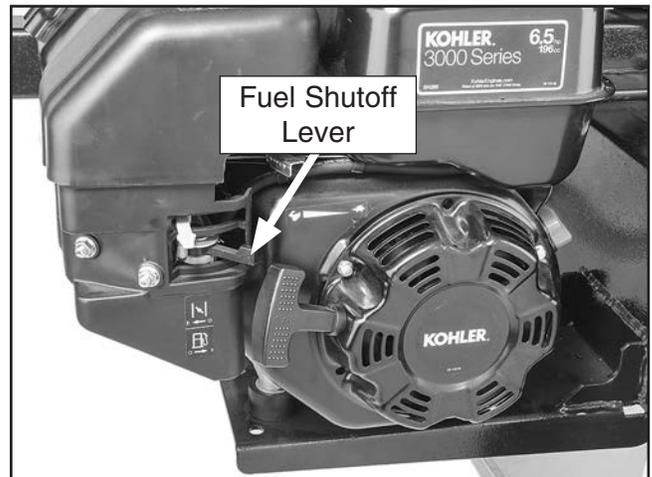


Figure 25. Fuel shutoff lever in ON position.

4. Turn engine ON/OFF switch to ON (I) position, as shown in **Figure 26**.

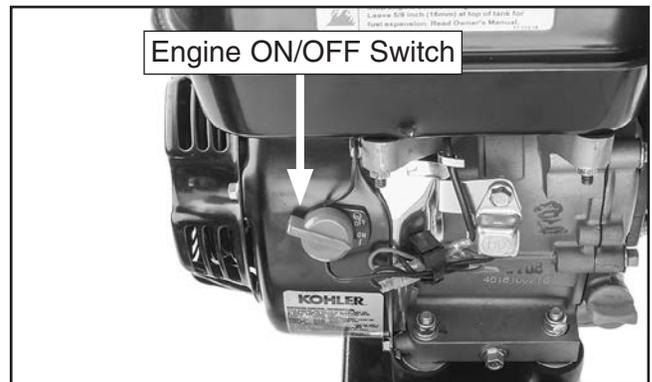


Figure 26. Engine ON/OFF switch in ON position.

5. Move throttle control lever halfway between SLOW (turtle) and FAST (rabbit), and move choke lever to ON (I) position (see **Figure 27**).

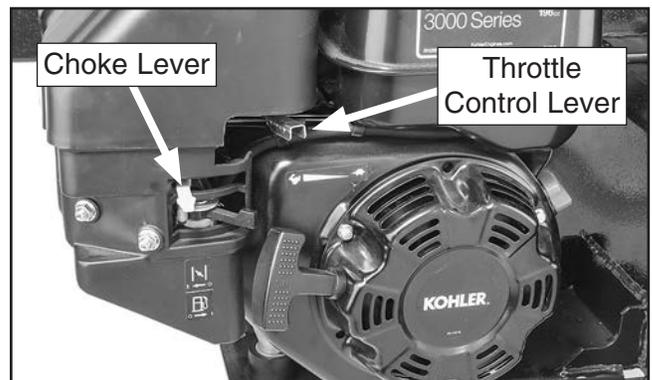


Figure 27. Fuel shutoff lever and throttle lever adjusted to starting positions.



- Pull starter handle (see **Figure 28**) slowly until resistance is felt. Retract handle, then pull handle quickly with smooth, steady motion until engine starts.

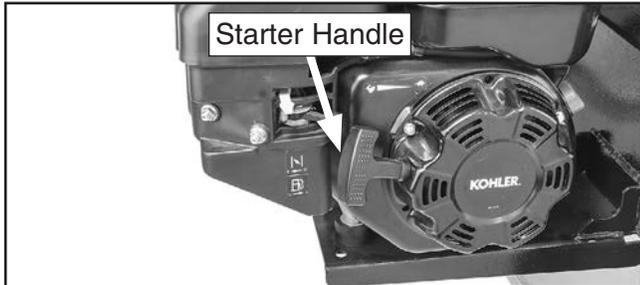


Figure 28. Starter handle location.

- After several seconds, move choke lever slowly to OFF (O) position.
- Let engine run at 75% throttle for one hour.
- Move control lever (see **Figure 29**) to cycle log splitter ram back and forth periodically during break-in process to bleed hydraulic system and check for fluid leaks. Do not operate at full load until after engine break-in has been completed.

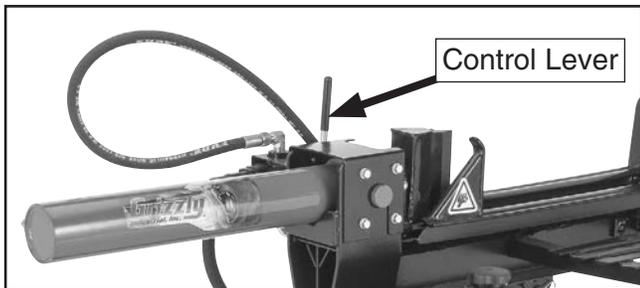


Figure 29. Control lever location.

- To turn engine **OFF**, move throttle control lever to SLOW (turtle), move ON/OFF switch to OFF (O), and move fuel shutoff switch to OFF (O), as shown in **Figures 30–31**.

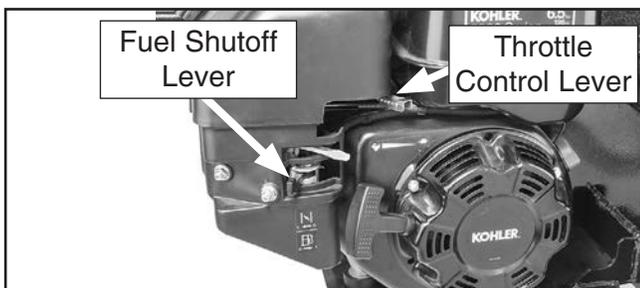


Figure 30. Engine controls in OFF position.

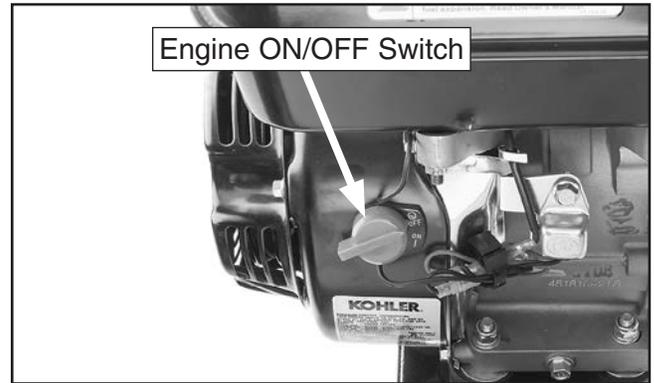


Figure 31. ON/OFF switch in OFF position.

- After first 5 to 10 hours of initial operation, change engine oil (refer to Kohler engine manual for details).

If any problem or leak is found, do the following before you troubleshoot or correct problem:

- Shut engine down immediately and let it cool for at least 15 minutes to prevent burn injuries.
- DISCONNECT SPARK PLUG WIRE (see **Figure 32**) from spark plug to prevent possibility of accidental start-up.

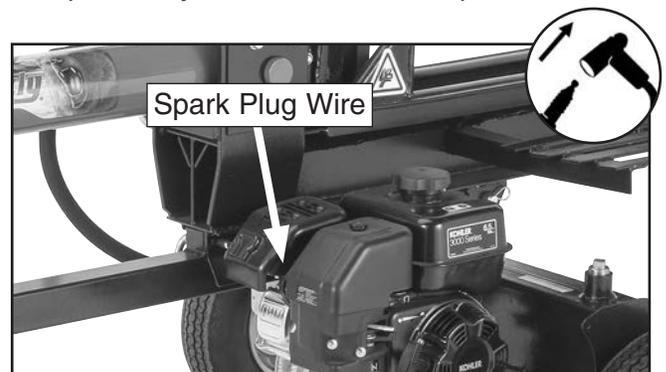


Figure 32. Location of spark plug.

IMPORTANT: *If fluid leak is suspected or seen, DO NOT touch area to find the leak. Move control lever completely to forward and backward positions to relieve any hydraulic pressure and prevent possibility of hydraulic fluid injection injury during repair.*

- Refer to **Troubleshooting** on **Page 33** for solutions, or call Technical Support at (570) 546-9663.

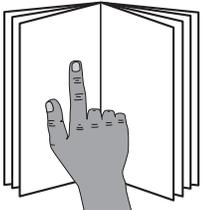


SECTION 3: OPERATIONS

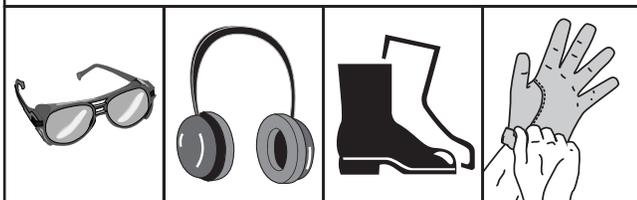
Operation Overview

The purpose of this overview is to provide the novice machine operator with a basic understanding of how the machine is used during operation, so the machine controls/components discussed later in this manual are easier to understand.

Due to the generic nature of this overview, it is **not** intended to be an instructional guide. To learn more about specific operations, read this entire manual and seek additional training from experienced machine operators, and do additional research outside of this manual by reading "how-to" books, trade magazines, or websites.

| | |
|--|--|
|  | !WARNING To reduce your risk of serious injury, read this entire manual BEFORE using machine. |
|--|--|

| | |
|--|--|
| !WARNING Bodily injury could result from using this machine. Always wear safety glasses, hearing protection, leather work boots, and heavy-duty leather work gloves when operating this machine. | |
|--|--|



| | |
|---|---|
|  | !WARNING NEVER run engine indoors such as in a garage, barn, carport, or storage shed, even if it is ventilated. Engine exhaust is poisonous and can kill animals and you without warning. |
|---|---|

To complete a typical operation, the operator does the following:

1. Places log splitter on flat, stable work surface, and blocks wheels.
2. Makes sure support leg is secured in down position.
3. Checks that engine and hydraulic tank are filled with proper amount of fluid.
4. Sets up log splitter for horizontal or vertical operation. If operating in horizontal position, ensures beam is secured with beam lock pin; if operating in vertical position, ensures foot plate sits on flat, stable ground.
5. Puts on safety glasses, hearing protection, leather work boots, and leather work gloves.
6. Turns engine **ON**.
7. Places log lengthwise on beam and flat against foot plate.
8. Moves control lever to forward position to drive wedge through log, then moves lever to reverse position to retract wedge. After wedge retracts, lever automatically resets to neutral position.
9. Repeats **Steps 4–8** as needed for remaining logs, then turns engine **OFF**.

| |
|--|
| NOTICE If you are not experienced with this type of machine, WE STRONGLY RECOMMEND that you seek additional training outside of this manual. Read books/magazines or get formal training before beginning any projects. Regardless of the content in this section, Grizzly Industrial will not be held liable for accidents caused by lack of training. |
|--|



Job Site Considerations

Work Location

Only use this log splitter outdoors, and never leave the area while the engine is running. **NEVER** run the engine indoors such as in a garage, barn, carport, or storage shed, even if it is ventilated. Engine exhaust is poisonous and can kill people and animals without warning.

Always use the splitter on a flat, stable work surface, and block the log splitter wheels so it cannot roll forward or backward.

Position the log splitter in a well lit, flat area at least seven feet away from any dry leaves or combustibles, and at least 25 feet from any fresh air intake supplying working or living areas.

Working Clearances

Allow enough room on all sides to move logs to and from the splitter.

Keep your work zone clear of lumber to avoid tripping hazards while using the machine.

Transporting

!WARNING

Log splitter is **NOT** designed to be towed on logging roads, forest service roads, public roads, or highways. It is designed for towing only where maximum speed will not exceed 45 MPH. Log splitter must be transported between job sites on trailer capable of carrying 1000 lbs.

To tow splitter:

1. Lower log splitter cylinder and beam to horizontal position, and lock with beam lock pin (see **Figure 33**).

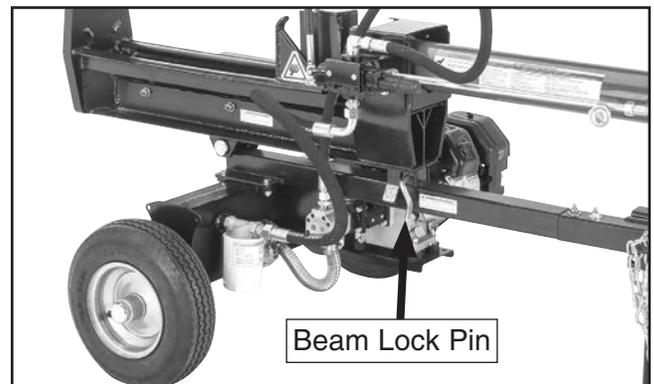


Figure 33. Beam lock pin location.

2. Raise and lock support leg in up position with support-leg lock pin (see **Figure 34**).
3. Raise coupler lock lever (see **Figure 34**) to unlatch it, and place coupler onto tow ball.

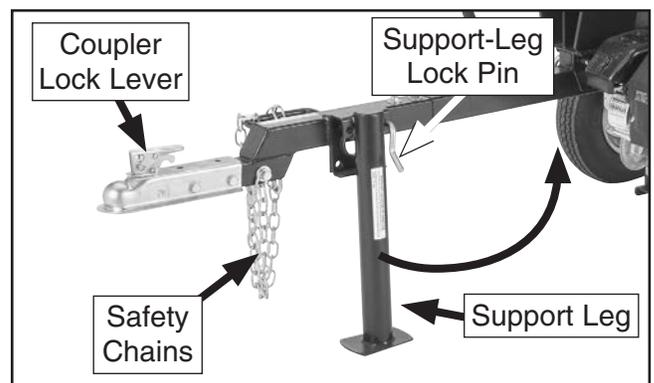


Figure 34. Raising support leg to towing position.



4. Make sure tow ball is fully seated inside coupler.
5. Push down on coupler lock lever until it pulls the lock tongue up against underside of tow ball and locks tow ball and coupler together.
6. Secure safety chains (see **Figure 34**) to tow vehicle and double-check all your connections.
7. Close fuel shutoff valve (see **Figure 35**) on engine carburetor to prevent fuel leakage.
8. Make sure engine gas cap (see **Figure 35**) is secure and there are no tools or logs still on log splitter. Never allow any riders or cargo on log splitter while towing.

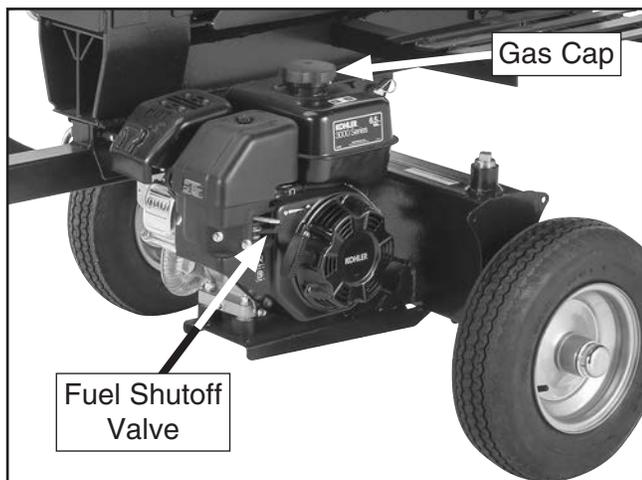


Figure 35. Fuel shutoff valve and gas cap location.

9. Tow log splitter responsibly! Do not tow it while engine is operating, and take precautions to make sure machine will not tip over during towing, causing a fuel leak and possible fire.

Control Lever

When the engine is running and the control lever is in the neutral position (see **Figure 36**), the hydraulic pump delivers hydraulic fluid at 11 GPM through the control valve and back into the hydraulic tank.

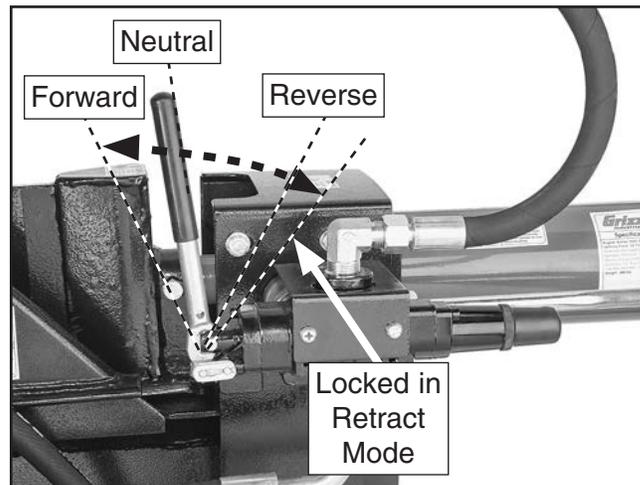


Figure 36. Control lever positions.

When you move the control lever to the *forward* position, the control valve diverts hydraulic fluid up to 3600 PSI to one side of the splitter piston, moving the splitting wedge into the log and splitting the log in half. The maximum distance of the wedge stroke is 23 $\frac{1}{8}$ ".

When you move the control lever to the full *reverse* position, the lever locks in retract mode, and the control valve diverts the hydraulic fluid to the other side of the splitter piston. As a result, both of your hands are free to load the next log for splitting.

When the ram fully retracts, the control lever automatically moves back to neutral, and the log splitter is ready to split another log.



Splitting Logs

This log splitter is ONLY designed to split wood with the direction of the grain. DO NOT attempt to split or crush wood against the grain, or split brick, concrete blocks, or rock. If you do, you will damage the machine, void the warranty, and possibly severely injure or kill bystanders or yourself.

The log splitter can be operated in either the horizontal or vertical position, as shown in **Figure 37**. The horizontal position is generally for lighter, easy-to-lift logs; the vertical position is generally for splitting heavier logs that are difficult to lift onto the log splitter.

To operate log splitter:

1. Read and understand this entire manual and Kohler engine manual.
2. Verify your job site location meets at least the minimum requirements for safety and use. Refer to **Job Site Considerations** on **Page 22** for details.
3. Lower support leg and secure it in place with support leg lock pin.

!WARNING

Do NOT touch hydraulic cylinder or hydraulic tube during or immediately after operation. These components get extremely hot. Allow them to cool before repositioning ram and beam during following step.

4. Move beam and cylinder assembly to either horizontal or vertical position (see **Figure 37**).

Horizontal Operation: Beam lock pin automatically locks log splitter into position. Pull up on beam to ensure splitter is locked. Operator stands on side near control lever.

Vertical Operation: Pull beam lock pin out and rotate beam and cylinder up until foot plate sits squarely on level ground. Operator stands in front of splitter on side by control lever.

5. Closely inspect all components and hydraulic lines for any evidence of damage, wear, or unsafe conditions. Correct before proceeding any further.

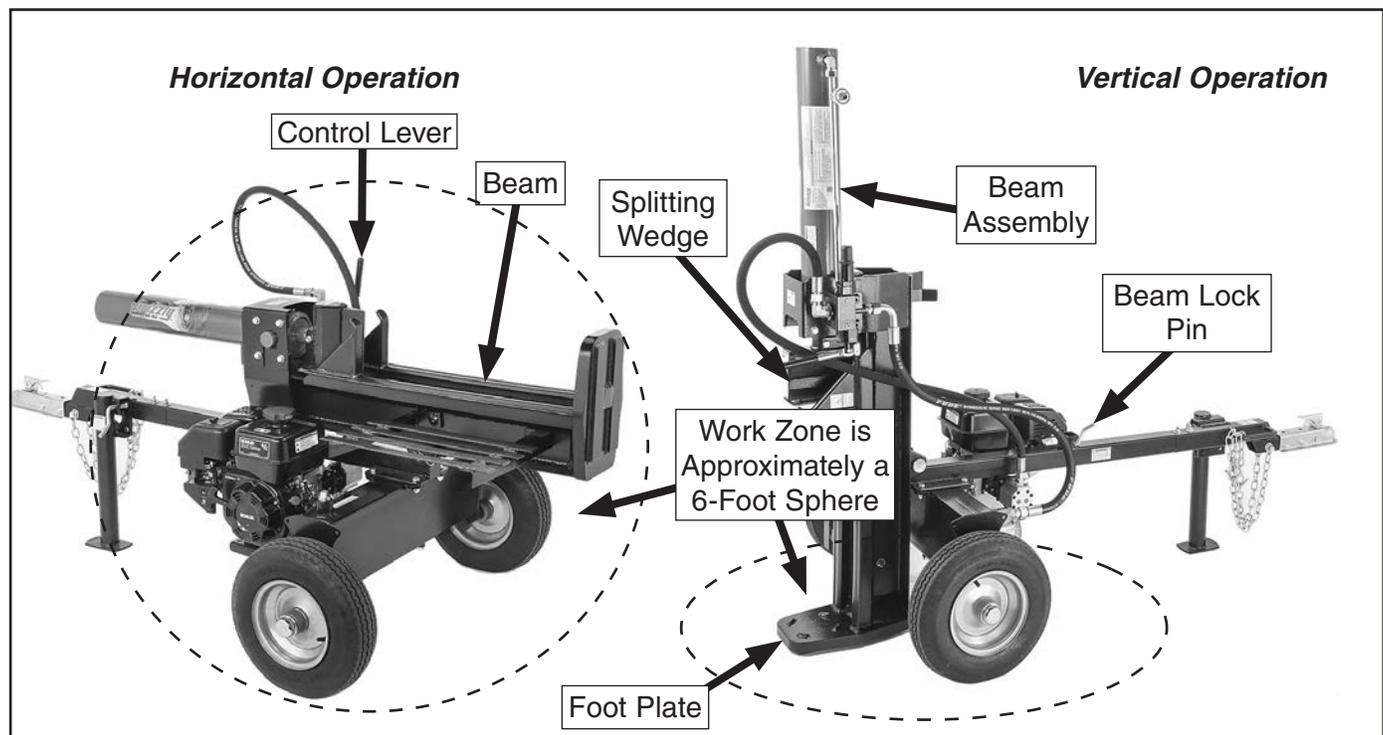


Figure 37. Horizontal and vertical log splitter operating positions.



6. Put on safety glasses, hearing protection, and thick leather gloves.
7. Start engine and place log lengthwise on beam and flat against foot plate, as shown in **Figure 38**.

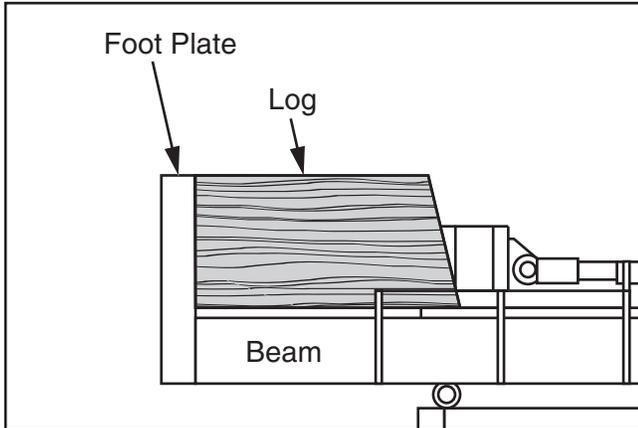


Figure 38. Best placement of log against beam and foot plate (horizontal operation shown).

8. Make sure bystanders are out of work zone and that zone is clear of split logs. The work zone is an approximate 6-foot sphere that extends around log splitter, as shown in **Figure 37**.
9. While keeping hands clear of splitting wedge, use control lever to split log, retract wedge, and remove split log from work zone.

Removing Stuck Logs

!WARNING

Never use your hands to remove a log stuck on wedge, as it could crush hands and fingers during accidental startup. Always use log dislodger to remove log. If log is still stuck, turn log splitter **OFF** and use sledge hammer and crow bar to remove stuck log.

This log splitter features a dislodger for helping eject partially split logs or logs that get stuck on the wedge. To eject a stuck log, move the control lever to reverse until the split log contacts the dislodger brackets shown in **Figure 39** and slips off the wedge.

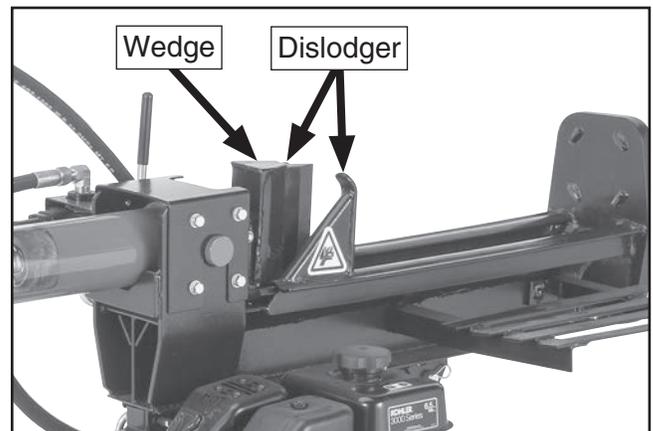


Figure 39. Dislodger location.

If the log remains stuck on the wedge, turn the log splitter **OFF** and use a sledge hammer and crowbar to remove the log.



SECTION 4: ACCESSORIES

! WARNING

Installing unapproved accessories may cause machine to malfunction, resulting in serious personal injury or machine damage. To reduce this risk, only install accessories recommended for this machine by Grizzly.

NOTICE

Refer to our website or latest catalog for additional recommended accessories.

H4978—Deluxe Earmuffs - 27dB

H4979—Twin Cup Hearing Protector - 29dB

T20446—Classic Earplugs, 200-pair - 31dB

Protect yourself comfortably with a pair of cushioned earmuffs. Especially important if you or employees operate for hours at a time.



Figure 40. Hearing protection.

T21273—Golden Cowhide Gloves

T21272—Golden Pigskin Gloves

T20692—Deluxe Soft Goatskin Gloves

Grizzly offers a wide selection of synthetic and leather gloves for all-day comfort in a variety of working conditions.



Figure 41. Assortment of gloves.

Basic Eye Protection

T20451—“Kirova” Clear Safety Glasses

T20452—“Kirova” Anti-Reflective S. Glasses

H7194—Bifocal Safety Glasses 1.5

H7195—Bifocal Safety Glasses 2.0

H7196—Bifocal Safety Glasses 2.5



Figure 42. Assortment of basic eye protection.

order online at www.grizzly.com or call 1-800-523-4777



T10028—Pair of Wheel Chocks

Prevent accidental shifting of your vehicle with a pair of these stackable, high impact plastic Wheel Chocks. Just place each chock against the tires and you know your vehicle isn't going anywhere. Great for campers and utility trailers as well as preventing vehicles from shifting during jacking.



Figure 43. T10028 Pair of Wheel Chocks.

T10278—Chainsaw Filing Guide

Get the most out of your chainsaw with a properly filed saw chain. This Chainsaw Filing Guide is easy to use—requires no chain removal from the saw. No guesswork involved—angle settings, depths and file heights are dial set. Designed to handle all saw chains. Accepts all chainsaw file sizes (not included). Great for fast, on-site sharpening!

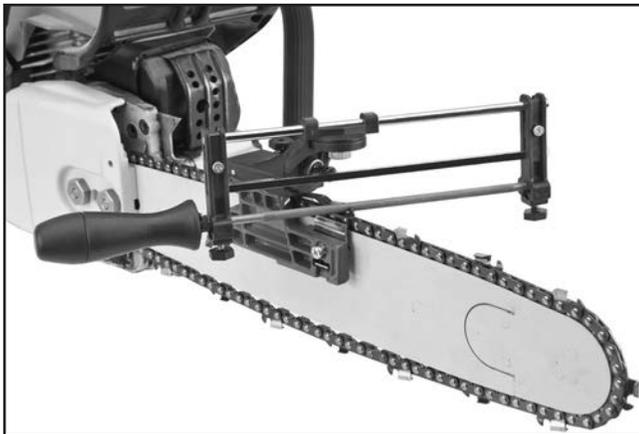


Figure 44. T10278 Chainsaw Filing Guide.

T27709—17-Cubic-Foot Steel Dump Cart

This ruggedly constructed cart is perfect for hauling logs. Features tilting dump bed with removable rear panel for easy loading and unloading, and a maximum capacity of 500 lbs. Dimensions: 59"L x 30½"W x 23½"H.



Figure 45. T27709 Dump Cart.

H7824—2" Stainless Ball Hitch

This ball hitch has a 5,000-pound capacity and includes nuts and lock washer. 2" hitch ball, 1" x 2¼" shank.



Figure 46. H7824 2" Stainless Ball Hitch.

order online at www.grizzly.com or call 1-800-523-4777



SECTION 5: MAINTENANCE



Schedule

For optimum performance from your machine, follow this maintenance schedule and refer to any specific instructions given in this section.

Daily Check:

- Hydraulic fluid and engine oil levels are full.
- Tires have recommended air pressure.
- Cracks, leaks, kinks, and abrasions do not exist in hydraulic hoses, fuel lines, or fittings.
- Engine air filter is clean.
- Loose fasteners, hose clamps, bent components.
- Safety features and guards are working and in place.

Every 25 Hours of Use:

- Clean hydraulic tank vented cap (see **Page 29**) with solvent, let air dry, re-install.

Every 100 Hours of Use:

- Change hydraulic tank fluid, clean inner filter.

Every 500 Hours of Use:

- Change hydraulic tank filter (see **Page 30**).

Every 6 Months

- Relubricate wheel bushings (**on this page**).

As Needed:

- Inspect for burnt-smelling or tan-colored, water-contaminated hydraulic fluid. If contaminated, replace tank vented cap, clean tank filter/strainer, flush system, and replace fluid.
- Refer to the Kohler engine manual for general engine maintenance schedules.

Cleaning

For optimum performance from your log splitter, clean it with a brush after every use and wipe it down occasionally with a rag.

Lubrication

| Items Needed | Qty |
|-----------------------------------|-----------|
| Flat Head Screwdriver #2..... | 1 |
| Pliers..... | 1 |
| Rubber Mallet..... | 1 |
| Multi-Purpose Bearing Grease..... | As Needed |

The wheel bearings will require lubrication with multi-purpose bearing grease about every six months.

To lubricate wheel bearings:

1. Remove wheel axle cap, cotter pin, flat washer, and slotted hex nut shown in **Figure 47**.
2. Remove and clean inner and outer tapered roller bearings (see **Figure 47**), re-pack these with multi-purpose grease, and re-install.

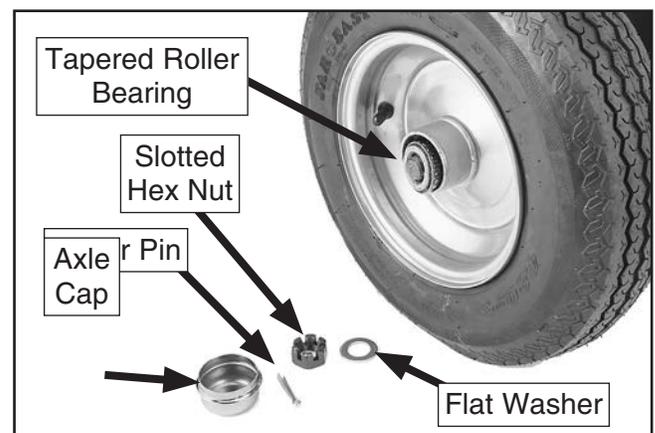


Figure 47. Components removed from wheel to access and grease outer wheel bearing.

3. In reverse order, re-install wheel with components removed in **Step 1**.



Checking/Adding Hydraulic Fluid

⚠ WARNING

Do not remove hydraulic vented cap while engine is running or just after it is shut **OFF**. You could be severely burned by hot vented cap or hot hydraulic fluid escaping from tank. Allow log splitter to cool sufficiently before removing vented cap.

| Items Needed | Qty |
|---|-------------|
| Adjustable Wrench | 1 |
| Clean Rag | As Needed |
| Drain Pan 5-Gallon..... | 1 |
| Hydraulic Fluid AW-32, ASLE H-150, ISO 32 or Universal Hydraulic Fluid | 3.5 Gallons |
| Flashlight | 1 |

Checking Hydraulic Fluid Level

1. DISCONNECT SPARK PLUG WIRE!
2. Position log splitter on level ground, lower support leg, and lock in place. Ensure engine is cold.
3. Remove vented cap (see **Figure 48**) and wipe dipstick with clean rag.

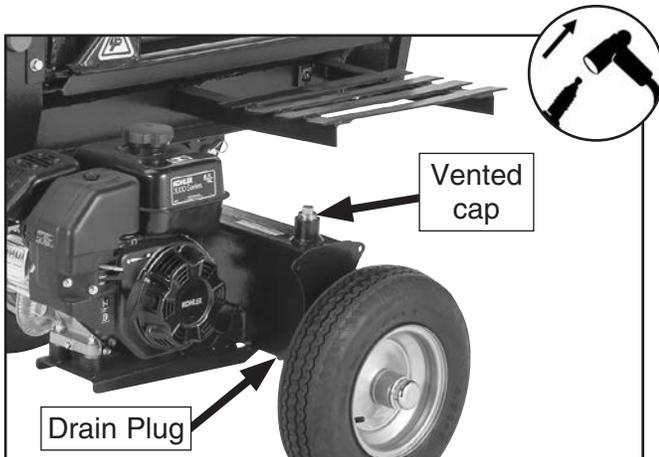


Figure 48. Vented cap location.

4. Re-install vented cap, remove it, then check oil level on dipstick.
 - If fluid level is near *middle* of dipstick (see **Figure 49**), no fluid needs to be added.

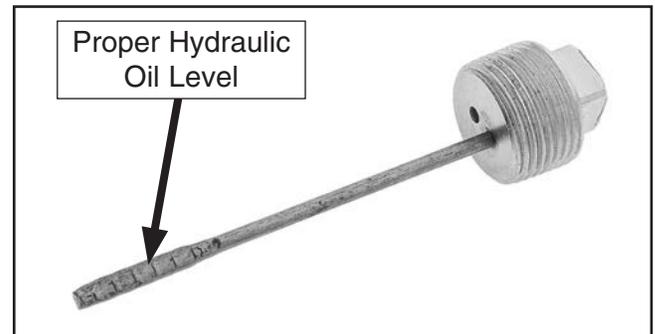


Figure 49. Location of correct hydraulic fluid level on dipstick.

- If fluid level is *below* middle of dipstick, add hydraulic fluid as required to bring it to correct level. Refer to **Adding Hydraulic Fluid** below.
- If fluid level is *above* middle of dipstick, place drain pan under drain plug (see **Figure 48**), and carefully remove plug from bottom of hydraulic tank. Allow fluid to drain to bring it to correct level. Re-install drain plug when finished.

5. Re-install vented cap.
6. Start engine. Use control lever to extend and retract wedge several times to remove air from hydraulic lines.
7. Turn engine **OFF** and repeat **Step 1**.
8. Repeat **Steps 3–4** and continue adding hydraulic fluid until level is correct.

Adding Hydraulic Fluid

1. DISCONNECT SPARK PLUG WIRE!
2. Remove vented cap (see **Figure 48**) and fill hydraulic tank with 3.5 gallons of hydraulic fluid or amount needed to fill tank to middle of dipstick.
3. Check hydraulic fluid level (follow steps from **Checking Hydraulic Fluid Level**) then re-install vented cap.



Changing Hydraulic Fluid

The hydraulic fluid should be inspected and replaced on a regular basis. Replace the fluid after every 100 hours of operation, if it smells burnt, or if it is contaminated by water.

Water contamination can build up over time and can be identified as a tan discoloration in the fluid.

| | |
|---|--|
|  | <p>CAUTION Wear safety goggles when servicing hydraulic system to avoid getting hydraulic fluid in your eyes.</p> |
|---|--|

Tools Needed

Qty

| | |
|--|-------------------|
| Drain Pan 5-Gallon..... | 1 |
| Disposable Shop Rags..... | As Needed |
| Goggles | 1 Pair Per Person |
| Gloves | 1 Per Person |
| Hydraulic Fluid AW-32, ASLE H-150, ISO 32 or Universal Hydraulic Fluid | 3.5 Gallons |
| Mineral Spirits..... | As Need |
| Open-End Wrench 10mm..... | 1 |

To change hydraulic fluid:

1. DISCONNECT SPARK PLUG WIRE!
2. Block log splitter wheels to prevent them from rolling.
3. Place a 5-gallon drain pan under suction filter cover, as shown in **Figure 50**.

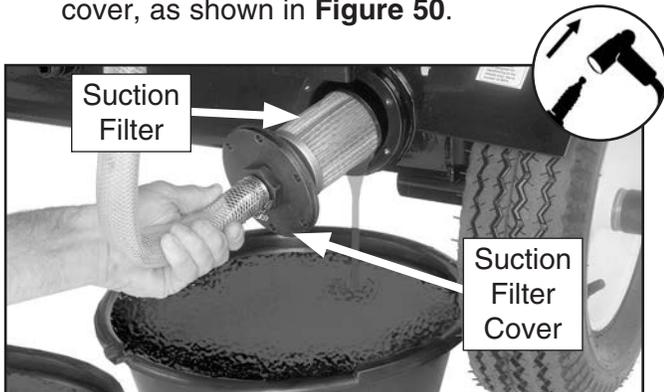


Figure 50. Example photo of draining hydraulic fluid.

4. Loosen filter cover hex bolts and carefully dislodge cover slightly so hydraulic fluid spills into drain pan (see **Figure 50**). Be careful to avoid dropping rubber gasket into drain pan.
5. When tank is empty, remove bolts all the way, then remove suction filter.
6. Remove tank vented cap.
7. Clean tank vent with mineral spirits and let air dry.
8. Clean suction filter screen with mineral spirits and blow dry with compressed air.
9. Inspect suction filter screen and tank vent for any holes, and replace if any damage exists.
10. Reach into tank and wipe out as much residual fluid and contaminants as possible. We highly recommend tank be cleaned out with a pressure washer or steam cleaner and fully dried with compressed air for best results.
11. Re-install suction filter, rubber gasket, and hose.
12. Fill tank with 3.5 gallons of hydraulic fluid and re-install tank vented cap.
13. Check hydraulic fluid level (refer to **Page 29**).

IMPORTANT: Be sure to dispose of old hydraulic fluid according to federal, state, and fluid manufacturer's requirements.



Changing Hydraulic Tank Filter

The hydraulic tank filter shown in **Figure 51** needs to be replaced every 500 operating hours, but for convenience it should be done when you change the hydraulic fluid (follow **Steps 1–13** from **Changing Hydraulic Fluid** on **Page 30**).

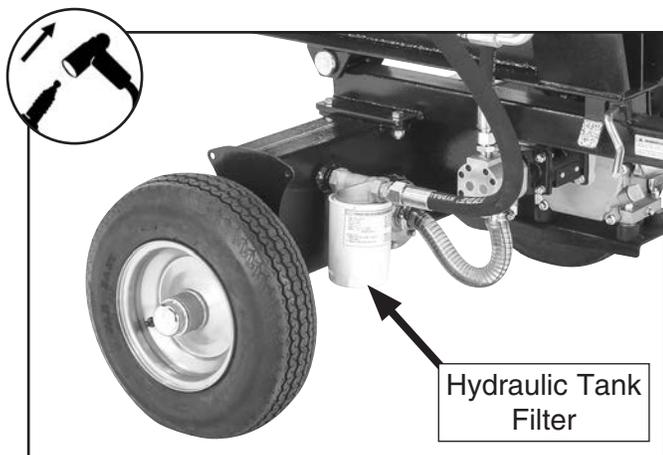


Figure 51. Location of hydraulic tank filter.

The hydraulic tank filter can be purchased from most local hardware stores, or replacement part #PT27710040 can be purchased by contacting the Grizzly Order Desk at (800) 523-4777.

To change the filter, DISCONNECT SPARK PLUG WIRE!, drain the hydraulic tank, remove the old filter, and install the new one. Be sure to follow any additional instructions the replacement filter manufacturer provides.

IMPORTANT: *Be sure to dispose of old hydraulic fluid according to federal, state, and fluid manufacturer's requirements.*

Storage

If the log splitter will not be used for longer than two months, we recommend storing it. Be sure to store the log splitter in a clean, dry, well-ventilated area that is away from ignition sources and inaccessible to children.

Preparing Log Splitter for Storage

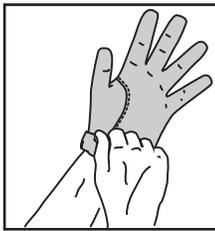
1. Wait for engine to cool, and clean log splitter thoroughly with a clean, dry cloth. Do not use water to clean log splitter, as it could damage bearings or the engine.
2. Use lightly oiled rag to wipe down all metal components to prevent rust.
3. Follow Kohler engine manual instructions for preparing engine for storage.

Bringing Log Splitter Out of Storage

1. Follow Kohler engine manual instructions for storage in reverse.
2. Drain fuel from tank and use clean, fresh, unleaded gasoline that meets Kohler's specifications, especially if fuel has been sitting for longer than fuel stabilizer manufacturer's recommendation.
3. Perform **Test Run/Break In** procedure on **Page 19** before putting log splitter back into service.



Sharpening Splitting Wedge



!WARNING

To reduce risk of serious cuts, always wear leather gloves when sharpening splitting wedge.

During the life of your log splitter, you will need to sharpen the splitting wedge periodically. When sharpening the wedge, keep in mind that if you try to keep the wedge sharpened to a razor point (like an axe blade), you will greatly reduce the life of the wedge by always sharpening it. However, if you allow the point to become very dull or bullnosed, your log splitter will have to overwork to split logs, which will decrease the lifespan of the splitter. The optimum point is somewhere between. Refer to **Figure 52** for a general idea.

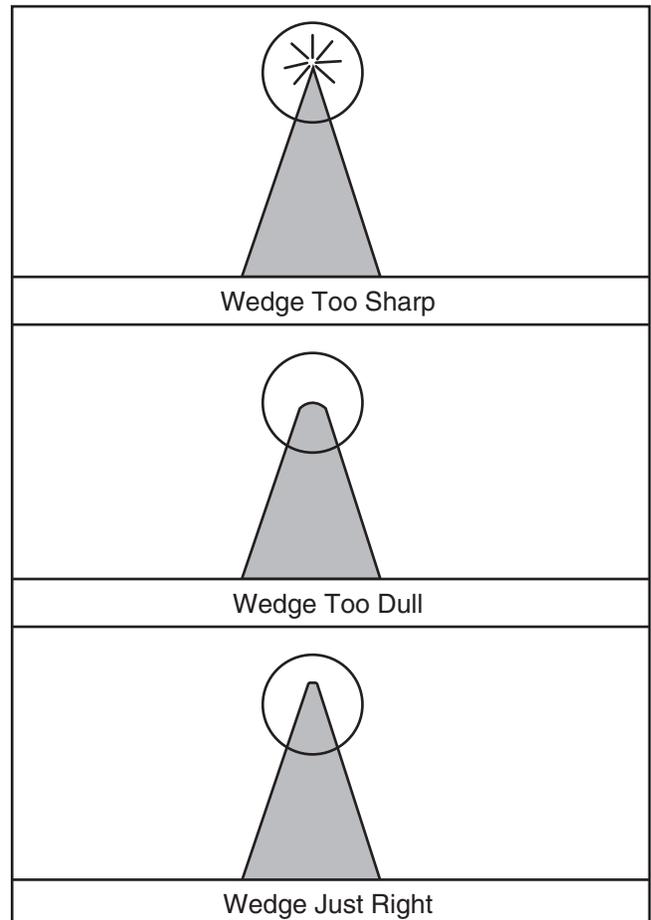


Figure 52. Good and bad wedge points.



SECTION 6: SERVICE

Review the troubleshooting and procedures in this section if a problem develops with your machine. If you need replacement parts or additional help with a procedure, call our Technical Support. **Note:** *Please gather the serial number and manufacture date of your machine before calling.*

Troubleshooting



Operation

| Symptom | Possible Cause | Possible Solution |
|--|--|--|
| Splitting wedge moves forward and backward too slowly, or does not move in either direction. | <ol style="list-style-type: none"> Hydraulic tank empty or low. Tank suction filter clogged. Air in hydraulic system. Control lever linkage at fault. Pump or pump relief valve at fault. Hydraulic control valve at fault. Damaged ram piston seals. | <ol style="list-style-type: none"> Fill tank to required level (Page 29). Clean suction filter (Page 30). Service hydraulic system. Bleed air out of system by moving wedge back/forth several times until it moves smoothly. Replace/repair bent or worn linkage to provide full range of travel. Replace pump and flush/service hydraulic system (Page 30). Replace valve and flush/service hydraulic system (Page 30). Replace ram assembly and flush/service hydraulic system (Page 30). |
| Splitting wedge moves forward too slowly or not at all, but retracts correctly. | <ol style="list-style-type: none"> Control lever linkage at fault. Splitting wedge dull; log unsuitable for splitting. Hydraulic fluid too low or contaminated. Hydraulic control valve at fault. Damaged ram piston seals. | <ol style="list-style-type: none"> Replace/repair bent or worn linkage to provide full range of travel. Sharpen wedge; avoid splitting logs with twisted grain, numerous knots, or high moisture content. Replace/fill tank to required fluid level (Page 29). Replace valve and flush/service hydraulic system (Page 30). Replace ram assembly and flush/service hydraulic system (Page 30). |
| Splitting wedge retracts too slowly or not at all, but moves forward correctly. | <ol style="list-style-type: none"> Control lever linkage at fault. Hydraulic control valve at fault. Damaged ram piston seals. | <ol style="list-style-type: none"> Replace/repair bent or worn linkage to provide full range of travel. Replace control valve. Replace ram assembly and flush/service hydraulic system (Page 30). |
| Splitter will not split wood or splits it too slowly. | <ol style="list-style-type: none"> Splitting wedge dull. Engine oil level too low or contaminated. Hydraulic tank filter clogged. Splitting wood against grain. Air in hydraulic system. | <ol style="list-style-type: none"> Sharpen wedge (Page 32). Add/replace engine oil. Replace hydraulic tank filter (Page 31). Split wood with grain instead of against grain. Bleed air out of hydraulic system. |
| Hydraulic tank fluid burnt or has tan discoloration. | <ol style="list-style-type: none"> Hydraulic fluid old or contaminated with water. | <ol style="list-style-type: none"> Replace hydraulic fluid (Page 30). |

Note: *Refer to the Kohler engine manual for engine-related troubleshooting.*



SECTION 7: HYDRAULIC SYSTEM

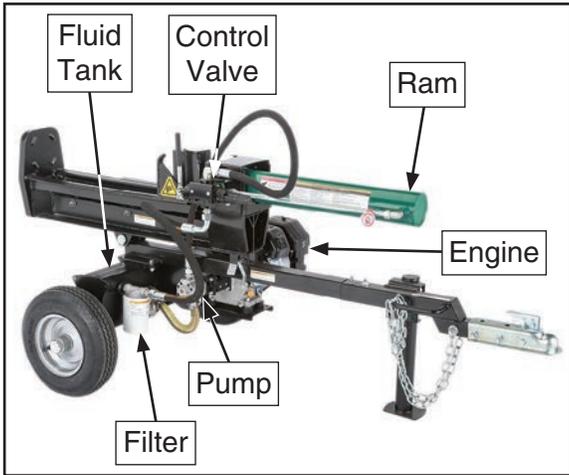
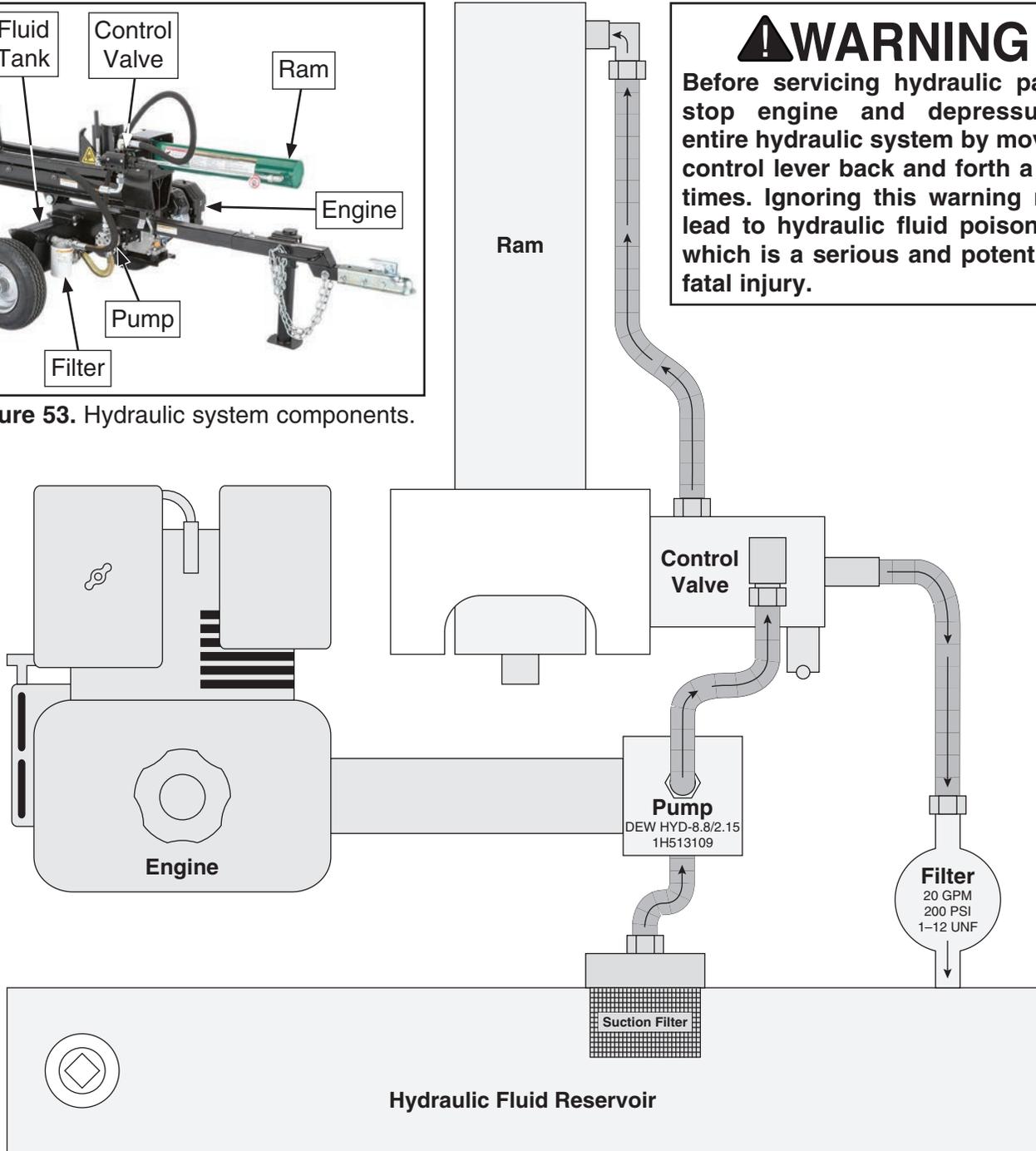


Figure 53. Hydraulic system components.

⚠ WARNING
 Before servicing hydraulic parts, stop engine and depressurize entire hydraulic system by moving control lever back and forth a few times. Ignoring this warning may lead to hydraulic fluid poisoning, which is a serious and potentially fatal injury.



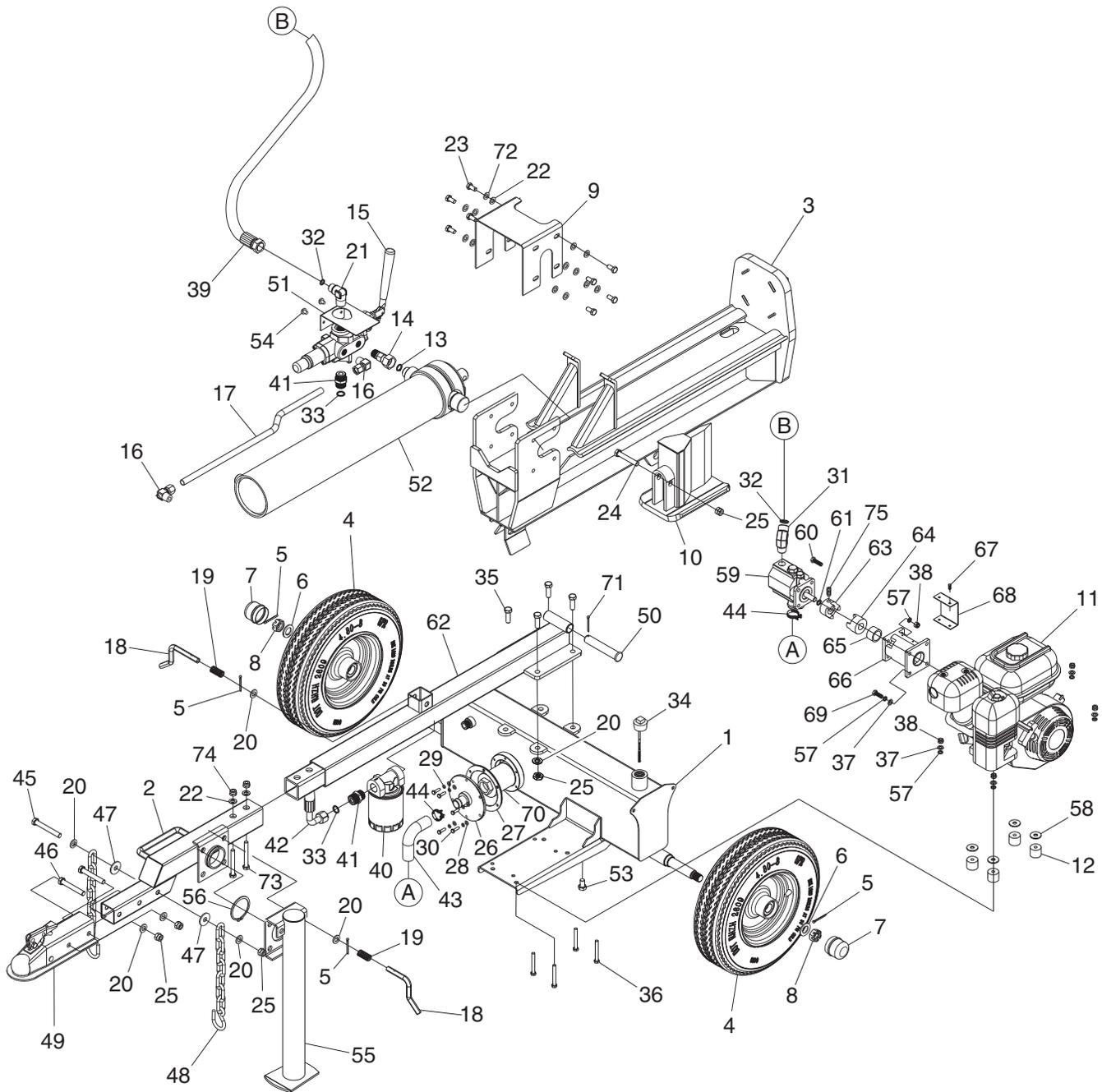
NOTICE
 This diagram is only provided as a reference to help you identify hydraulic system components. Seek assistance from a professional hydraulic technician whenever servicing or repairing the hydraulic system.



SECTION 8: PARTS

We do our best to stock replacement parts when possible, but we cannot guarantee that all parts shown are available for purchase. Call (800) 523-4777 or visit www.grizzly.com/parts to check for availability.

Main



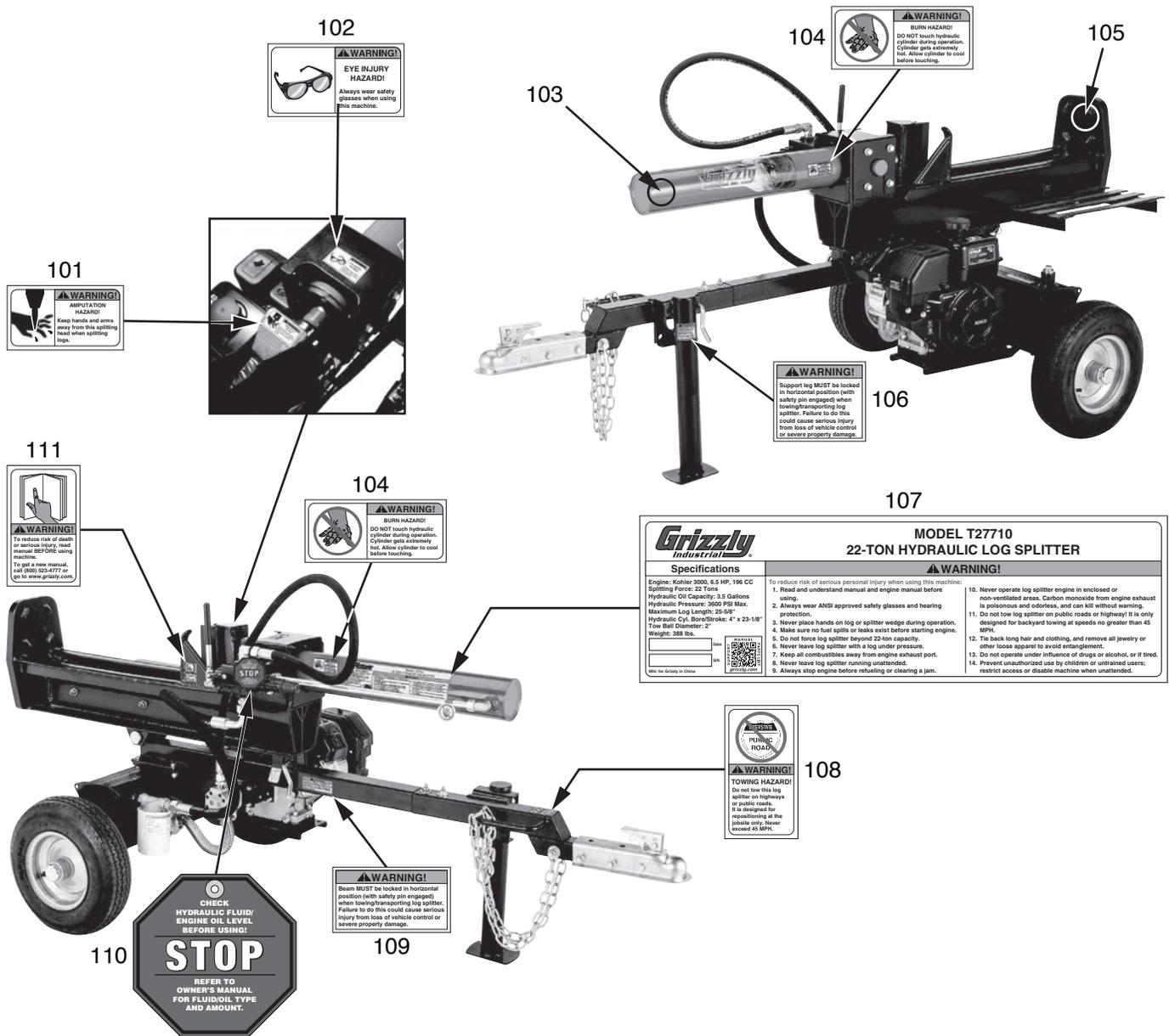
Main Parts List

| REF | PART # | DESCRIPTION |
|-----|------------|-----------------------------------|
| 1 | PT27710001 | HYDRAULIC FLUID TANK |
| 2 | PT27710002 | TONGUE SECTION (FRONT) |
| 3 | PT27710003 | BEAM |
| 4 | PT27710004 | WHEEL W/TIRE 8 X 3.75, 4.80-8 |
| 5 | PT27710005 | COTTER PIN 4 X 36 STANDARD |
| 6 | PT27710006 | FLAT WASHER 20MM |
| 7 | PT27710007 | AXLE CAP |
| 8 | PT27710008 | HEX NUT THIN SLOTTED M20-2.5 |
| 9 | PT27710009 | CYLINDER COVER |
| 10 | PT27710010 | WEDGE SLIDE |
| 11 | PT27710011 | ENGINE KOHLER 3000 6.5HP 196CC |
| 12 | PT27710012 | RUBBER SHOCK ABSORBER |
| 13 | PT27710013 | O-RING 16 X 2.5 |
| 14 | PT27710014 | CONNECTOR-MF M22-1.75, M28-1.25 |
| 15 | PT27710015 | CONTROL VALVE ASSEMBLY |
| 16 | PT27710016 | ELBOW-MM 90DEG M22-1.75, M22-1.75 |
| 17 | PT27710017 | HYDRAULIC TUBE 16 OD X 560 L (SS) |
| 18 | PT27710018 | SAFETY PIN |
| 19 | PT27710019 | COMPRESSION SPRING 1.5 X 18 X 60 |
| 20 | PT27710020 | FLAT WASHER 12MM |
| 21 | PT27710021 | ELBOW-MM 90DEG M22-1.75, M26-1.75 |
| 22 | PT27710022 | FLAT WASHER 10MM |
| 23 | PT27710023 | HEX BOLT M10-1.5 X 20 |
| 24 | PT27710024 | HEX BOLT M12-1.75 X 65 |
| 25 | PT27710025 | LOCK NUT M12-1.75 |
| 26 | PT27710026 | FILTER MOUNT PLATE |
| 27 | PT27710027 | GASKET (RUBBER) |
| 28 | PT27710028 | FLAT WASHER 6MM |
| 29 | PT27710029 | LOCK WASHER 6MM |
| 30 | PT27710030 | HEX BOLT M6-1 X 20 |
| 31 | PT27710031 | PUMP CONNECTOR M26-1.75 |
| 32 | PT27710032 | O-RING 11.2 X 2.4 |
| 33 | PT27710033 | O-RING 17 X 2.5 |
| 34 | PT27710034 | VENTED CAP 1-1/4 NPT |
| 35 | PT27710035 | HEX BOLT M12-1.75 X 35 |
| 36 | PT27710036 | HEX BOLT M8-1.25 X 65 |
| 37 | PT27710037 | FLAT WASHER 8MM |
| 38 | PT27710038 | LOCK NUT M8-1.25 |

| REF | PART # | DESCRIPTION |
|-----|------------|---|
| 39 | PT27710039 | HYDRAULIC HOSE 602-1302 62"L |
| 40 | PT27710040 | FILTER 20GPM 200PSI 5.4" 1-12UNF 10-30M |
| 41 | PT27710041 | CONNECTOR-MM M26-1.75, M26-1.75 |
| 42 | PT27710042 | HYDRAULIC HOSE 602-1302 48"L |
| 43 | PT27710043 | HYDRAULIC HOSE 1-3/8" X 18" (CLEAR) |
| 44 | PT27710044 | HOSE CLAMP 1-1/2" |
| 45 | PT27710045 | HEX BOLT M12-1.75 X 90 |
| 46 | PT27710046 | HEX BOLT M12-1.75 X 80 |
| 47 | PT27710047 | FENDER WASHER 12MM |
| 48 | PT27710048 | SAFETY CHAIN W/HOOK 28-LINK |
| 49 | PT27710049 | BALL RECEIVER 2" |
| 50 | PT27710050 | CLEVIS PIN 21 X 126 |
| 51 | PT27710051 | CONTROL VALVE COVER |
| 52 | PT27710052 | HYDRAULIC CYLINDER ASSEMBLY |
| 53 | PT27710053 | DRAIN PLUG 3/8 NPT |
| 54 | PT27710054 | PHLP HD SCR M8-1.25 X 10 |
| 55 | PT27710055 | SUPPORT LEG |
| 56 | PT27710056 | EXT RETAINING RING 62MM |
| 57 | PT27710057 | LOCK WASHER 8MM |
| 58 | PT27710058 | FENDER WASHER 8MM |
| 59 | PT27710059 | PUMP DELI CBNA-8.8/2.1J |
| 60 | PT27710060 | HEX BOLT M8-1.25 X 30 |
| 61 | PT27710061 | EXT RETAINING RING 11MM |
| 62 | PT27710062 | TONGUE SECTION (REAR) |
| 63 | PT27710063 | PUMP COUPLER |
| 64 | PT27710064 | ENGINE COUPLER |
| 65 | PT27710065 | ENGINE COUPLER BUSHING |
| 66 | PT27710066 | PUMP MOUNTING BLOCK |
| 67 | PT27710067 | HEX BOLT M5-.8 X 10 |
| 68 | PT27710068 | COUPLER COVER |
| 69 | PT27710069 | HEX BOLT M8-1.25 X 25 |
| 70 | PT27710070 | INNER FILTER |
| 71 | PT27710071 | COTTER PIN 1-3/4-1-7/8 X 2-1/2 HAIRPIN |
| 72 | PT27710072 | LOCK WASHER 10MM |
| 73 | PT27710073 | HEX BOLT M10-1.5 X 70 |
| 74 | PT27710074 | LOCK NUT M10-1.5 |
| 75 | PT27710075 | SET SCREW M6-1 X 10 |



Labels



| REF | PART # | DESCRIPTION |
|-----|------------|-------------------------------|
| 101 | PT27710101 | AMPUTATION HAZARD LABEL |
| 102 | PT27710102 | EYE INJURY HAZARD LABEL |
| 103 | PT27710103 | TOUCH-UP PAINT, GRIZZLY GREEN |
| 104 | PT27710104 | BURN HAZARD LABEL |
| 105 | PT27710105 | TOUCH-UP PAINT, GLOSSY BLACK |
| 106 | PT27710106 | SUPPORT LEG WARNING LABEL |

| REF | PART # | DESCRIPTION |
|-----|------------|-------------------------------|
| 107 | PT27710107 | MACHINE ID LABEL |
| 108 | PT27710108 | TOWING HAZARD LABEL |
| 109 | PT27710109 | BEAM SAFETY PIN WARNING LABEL |
| 110 | PT27710110 | STOP CHECK FLUID/OIL TAG |
| 111 | PT27710111 | READ MANUAL LABEL |

! WARNING

Safety labels help reduce the risk of serious injury caused by machine hazards. If any label comes off or becomes unreadable, the owner of this machine **MUST** replace it in the original location before resuming operations. For replacements, contact (800) 523-4777 or www.grizzly.com.







WARRANTY CARD

Name _____
 Street _____
 City _____ State _____ Zip _____
 Phone # _____ Email _____
 Model # _____ Order # _____ Serial # _____

The following information is given on a voluntary basis. It will be used for marketing purposes to help us develop better products and services. **Of course, all information is strictly confidential.**

1. How did you learn about us?

| | | |
|--|----------------------------------|---------------------------------------|
| <input type="checkbox"/> Advertisement | <input type="checkbox"/> Friend | <input type="checkbox"/> Catalog |
| <input type="checkbox"/> Card Deck | <input type="checkbox"/> Website | <input type="checkbox"/> Other: _____ |

2. Which of the following magazines do you subscribe to?

| | | |
|---|--|---|
| <input type="checkbox"/> Cabinetmaker & FDM | <input type="checkbox"/> Popular Science | <input type="checkbox"/> Wooden Boat |
| <input type="checkbox"/> Family Handyman | <input type="checkbox"/> Popular Woodworking | <input type="checkbox"/> Woodshop News |
| <input type="checkbox"/> Hand Loader | <input type="checkbox"/> Precision Shooter | <input type="checkbox"/> Woodsmith |
| <input type="checkbox"/> Handy | <input type="checkbox"/> Projects in Metal | <input type="checkbox"/> Woodwork |
| <input type="checkbox"/> Home Shop Machinist | <input type="checkbox"/> RC Modeler | <input type="checkbox"/> Woodworker West |
| <input type="checkbox"/> Journal of Light Cont. | <input type="checkbox"/> Rifle | <input type="checkbox"/> Woodworker's Journal |
| <input type="checkbox"/> Live Steam | <input type="checkbox"/> Shop Notes | <input type="checkbox"/> Other: _____ |
| <input type="checkbox"/> Model Airplane News | <input type="checkbox"/> Shotgun News | |
| <input type="checkbox"/> Old House Journal | <input type="checkbox"/> Today's Homeowner | |
| <input type="checkbox"/> Popular Mechanics | <input type="checkbox"/> Wood | |

3. What is your annual household income?

| | | |
|--|--|--|
| <input type="checkbox"/> \$20,000-\$29,000 | <input type="checkbox"/> \$30,000-\$39,000 | <input type="checkbox"/> \$40,000-\$49,000 |
| <input type="checkbox"/> \$50,000-\$59,000 | <input type="checkbox"/> \$60,000-\$69,000 | <input type="checkbox"/> \$70,000+ |

4. What is your age group?

| | | |
|--------------------------------|--------------------------------|--------------------------------|
| <input type="checkbox"/> 20-29 | <input type="checkbox"/> 30-39 | <input type="checkbox"/> 40-49 |
| <input type="checkbox"/> 50-59 | <input type="checkbox"/> 60-69 | <input type="checkbox"/> 70+ |

5. How long have you been a woodworker/metalworker?

| | | | |
|------------------------------------|------------------------------------|-------------------------------------|------------------------------------|
| <input type="checkbox"/> 0-2 Years | <input type="checkbox"/> 2-8 Years | <input type="checkbox"/> 8-20 Years | <input type="checkbox"/> 20+ Years |
|------------------------------------|------------------------------------|-------------------------------------|------------------------------------|

6. How many of your machines or tools are Grizzly?

| | | | |
|------------------------------|------------------------------|------------------------------|------------------------------|
| <input type="checkbox"/> 0-2 | <input type="checkbox"/> 3-5 | <input type="checkbox"/> 6-9 | <input type="checkbox"/> 10+ |
|------------------------------|------------------------------|------------------------------|------------------------------|

7. Do you think your machine represents a good value? Yes No

8. Would you recommend Grizzly Industrial to a friend? Yes No

9. Would you allow us to use your name as a reference for Grizzly customers in your area?
Note: We never use names more than 3 times. Yes No

10. Comments: _____

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WARRANTY & RETURNS

Grizzly Industrial, Inc. warrants every product it sells for a period of **1 year** to the original purchaser from the date of purchase. This warranty does not apply to defects due directly or indirectly to misuse, abuse, negligence, accidents, repairs or alterations or lack of maintenance. This is Grizzly's sole written warranty and any and all warranties that may be implied by law, including any merchantability or fitness, for any particular purpose, are hereby limited to the duration of this written warranty. We do not warrant or represent that the merchandise complies with the provisions of any law or acts unless the manufacturer so warrants. In no event shall Grizzly's liability under this warranty exceed the purchase price paid for the product and any legal actions brought against Grizzly shall be tried in the State of Washington, County of Whatcom.

We shall in no event be liable for death, injuries to persons or property or for incidental, contingent, special, or consequential damages arising from the use of our products.

To take advantage of this warranty, contact us by mail or phone and give us all the details. We will then issue you a "Return Number," which must be clearly posted on the outside as well as the inside of the carton. We will not accept any item back without this number. Proof of purchase must accompany the merchandise.

The manufacturers reserve the right to change specifications at any time because they constantly strive to achieve better quality equipment. We make every effort to ensure that our products meet high quality and durability standards and we hope you never need to use this warranty.

Please feel free to write or call us if you have any questions about the machine or the manual.

Thank you again for your business and continued support. We hope to serve you again soon.

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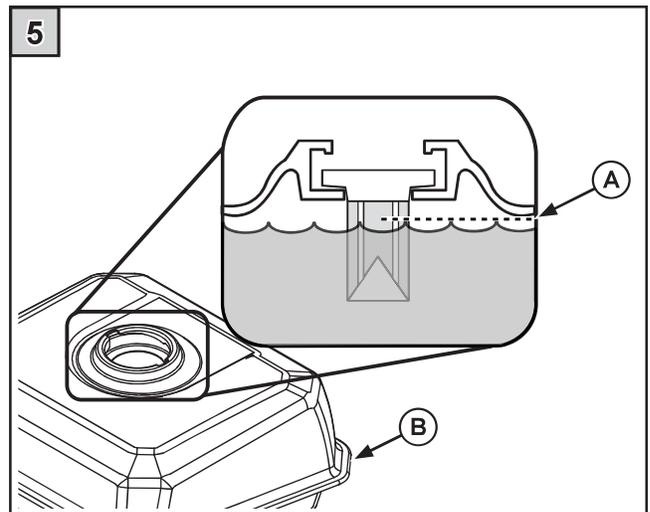
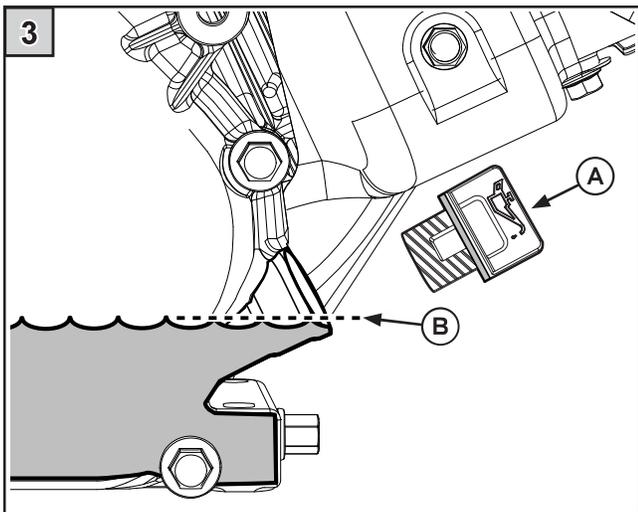
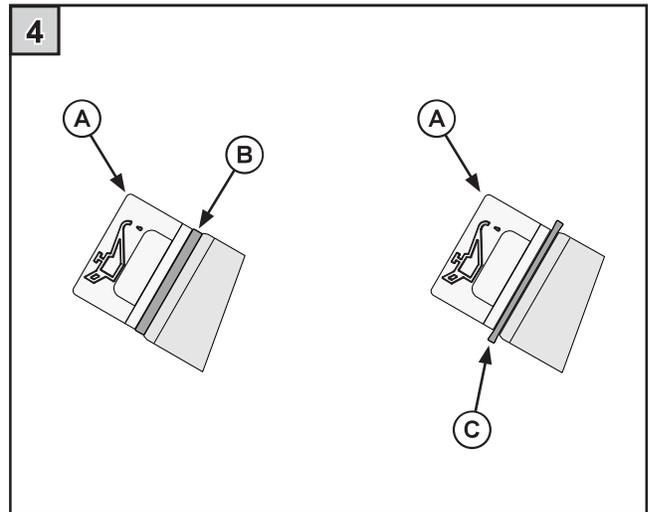
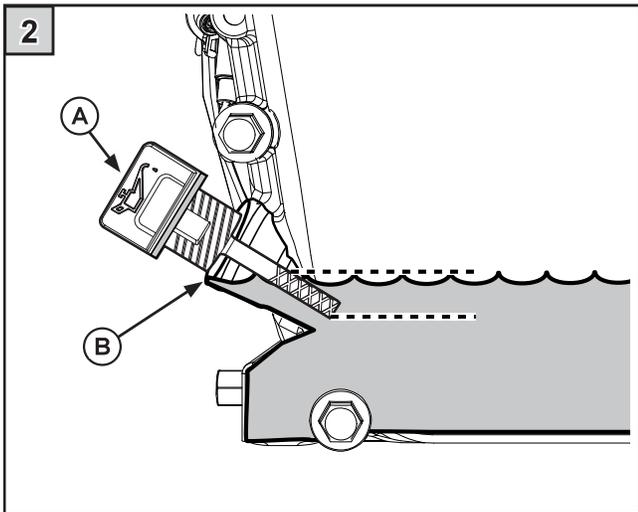
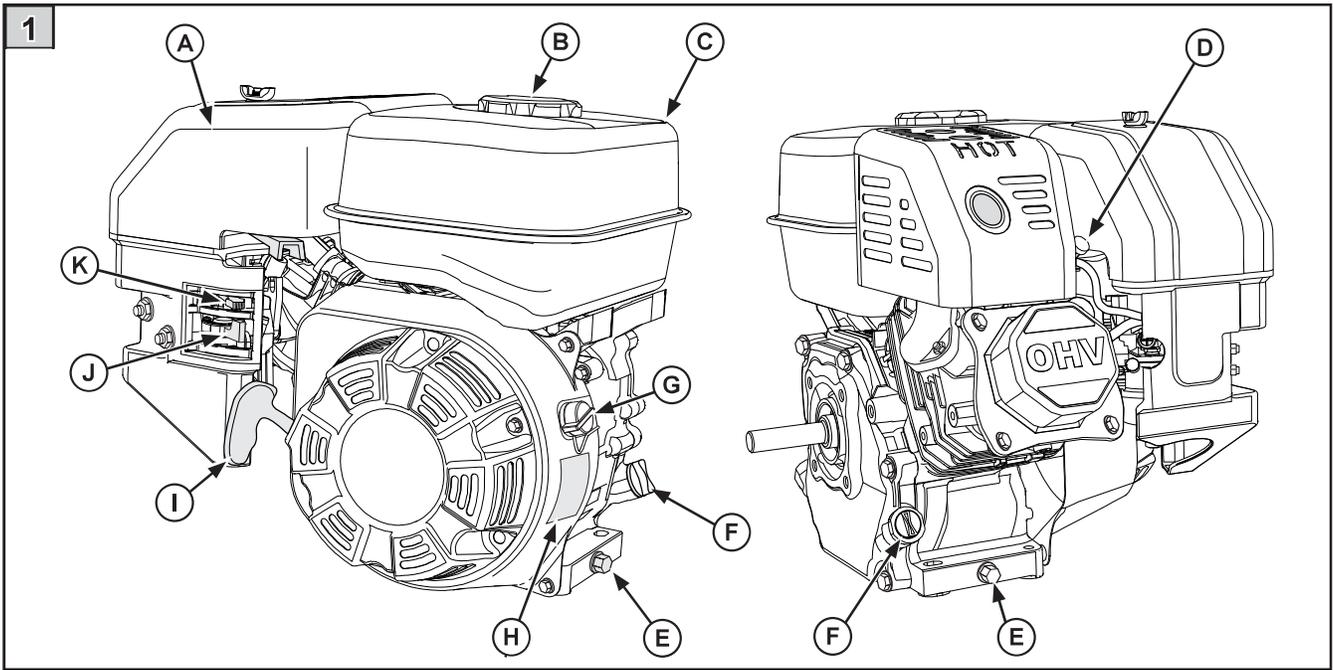
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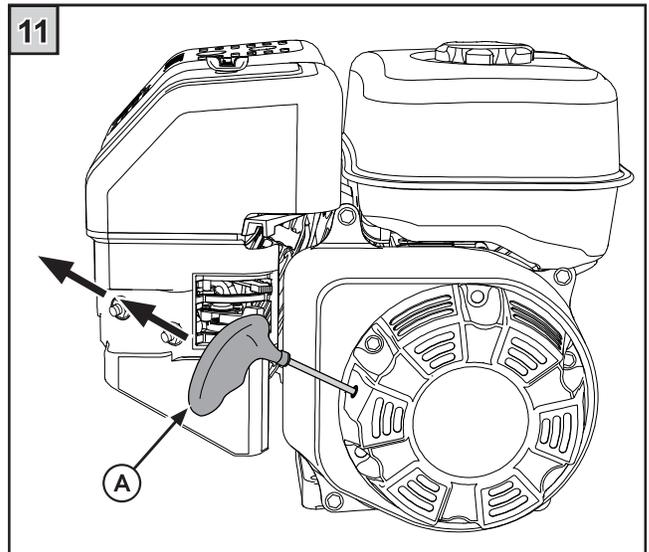
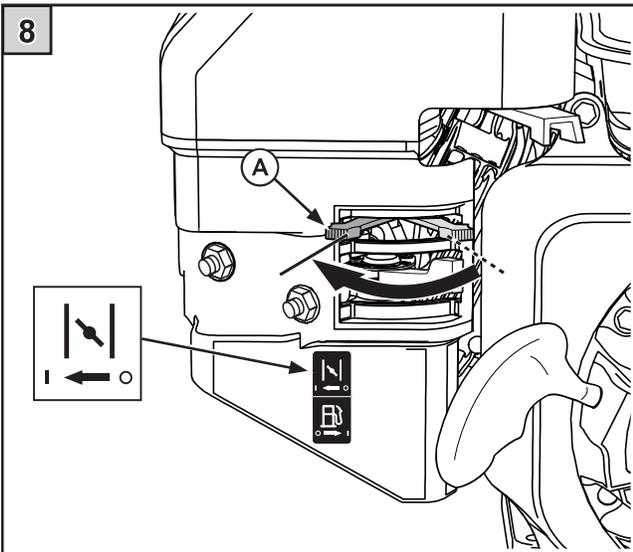
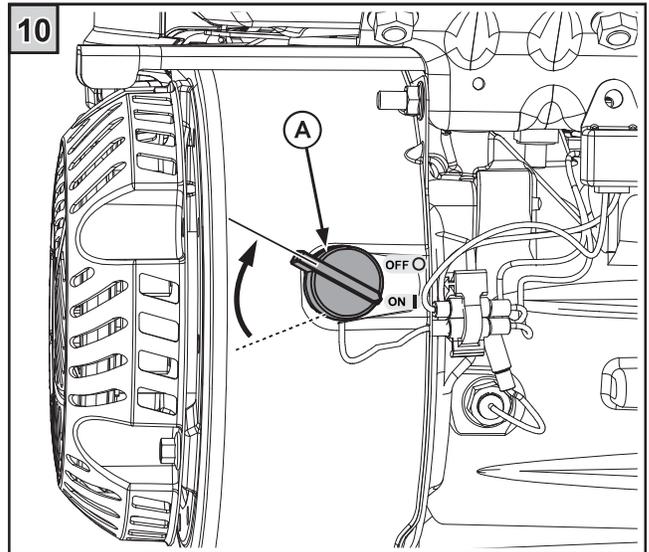
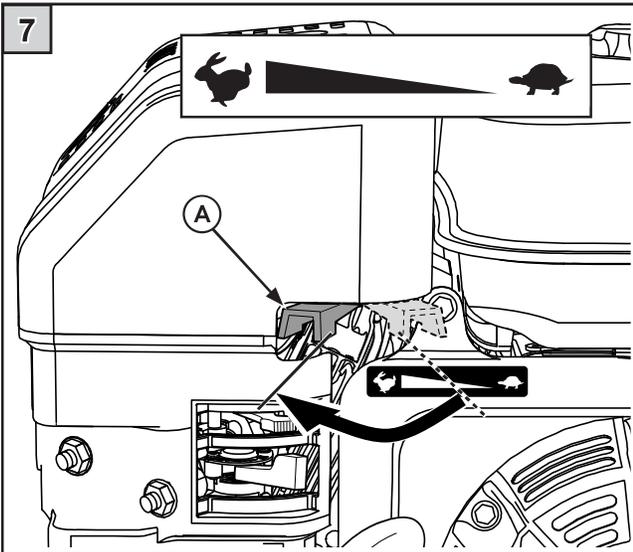
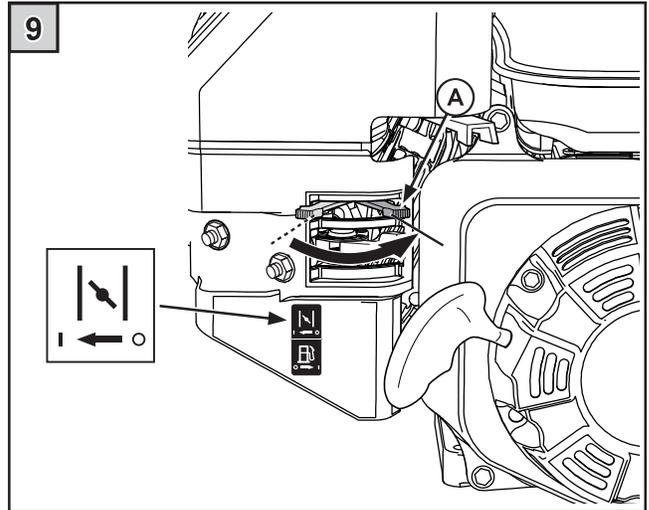
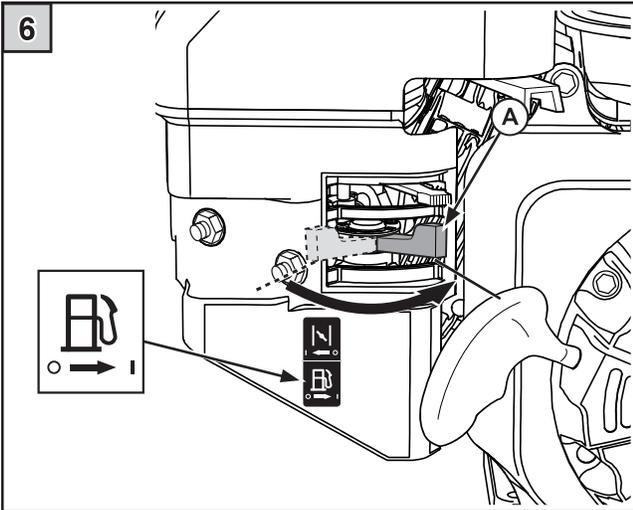
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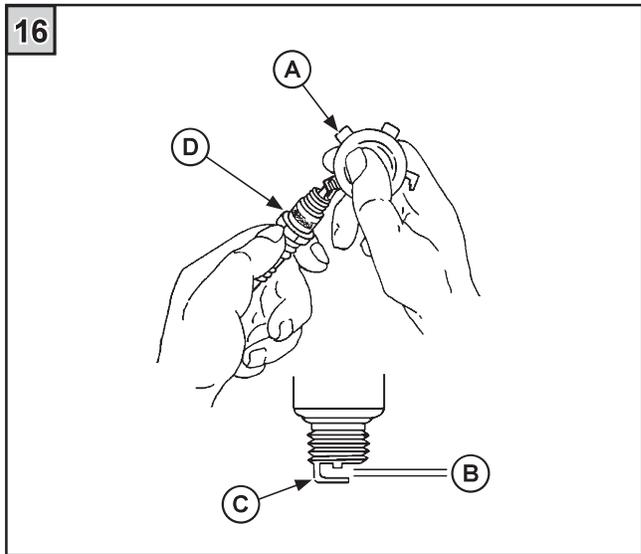
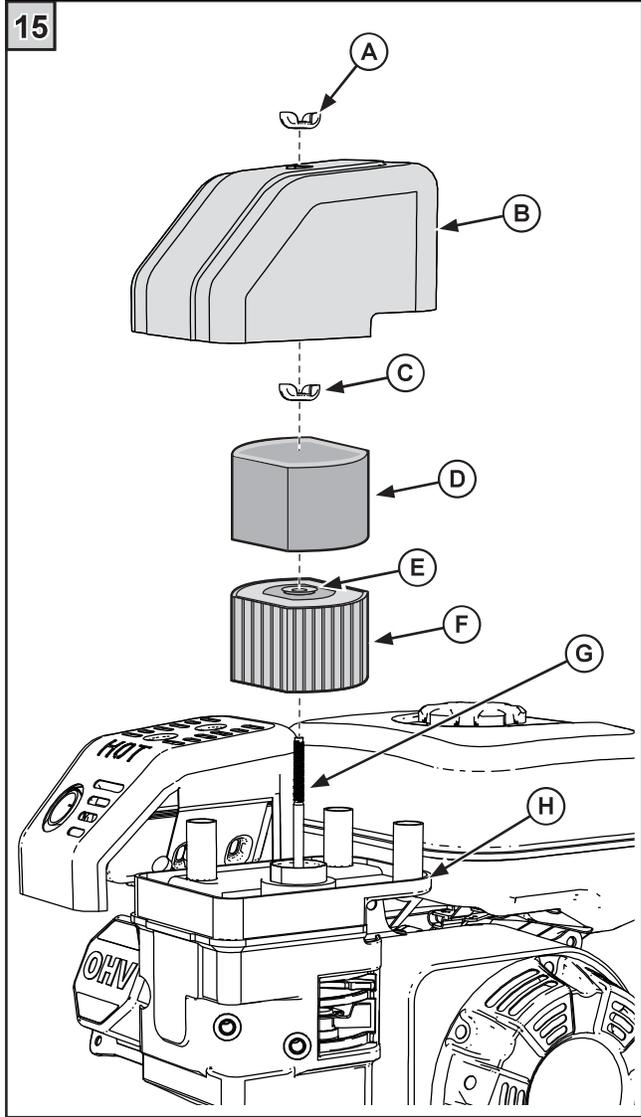
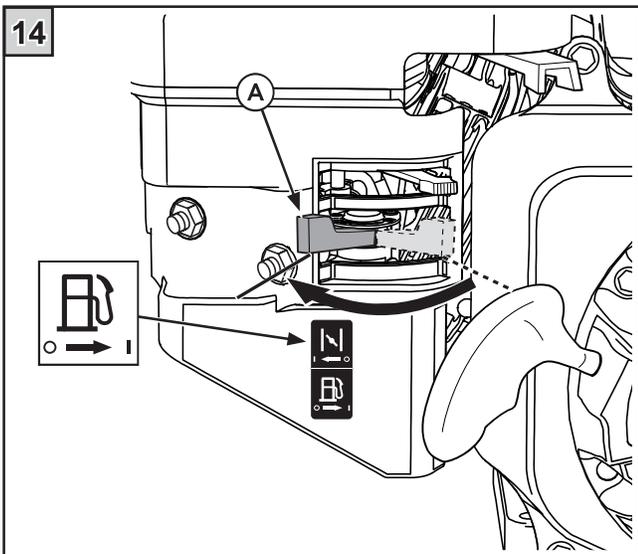
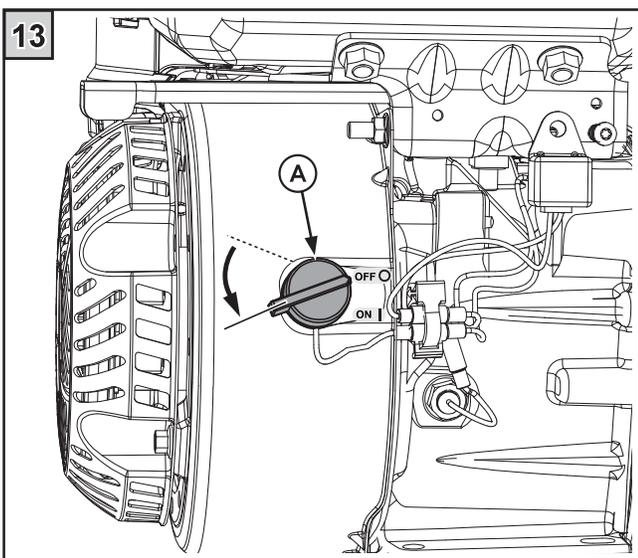
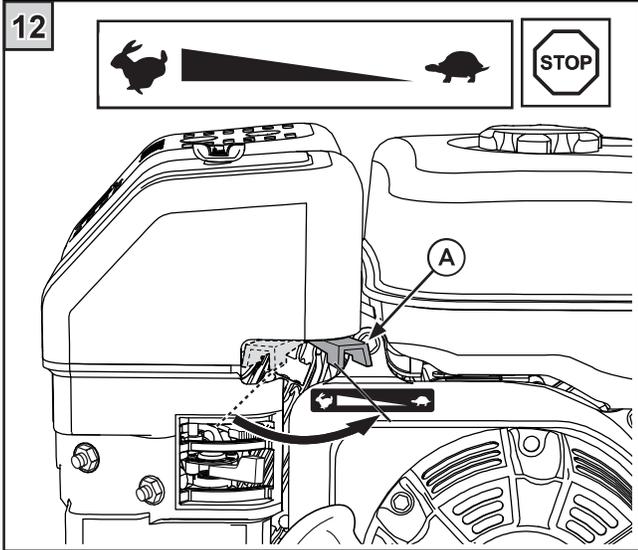
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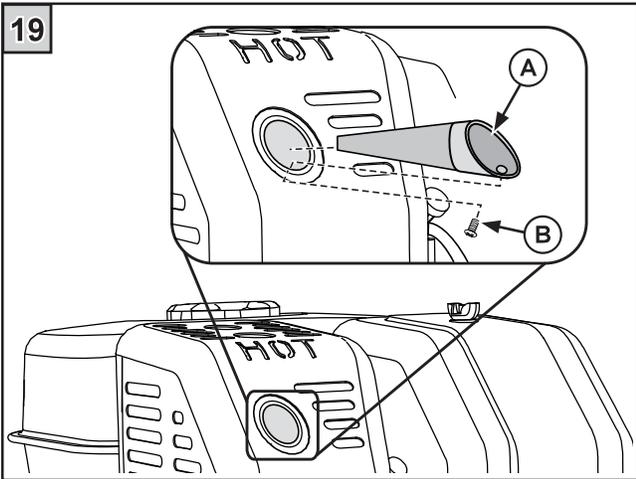
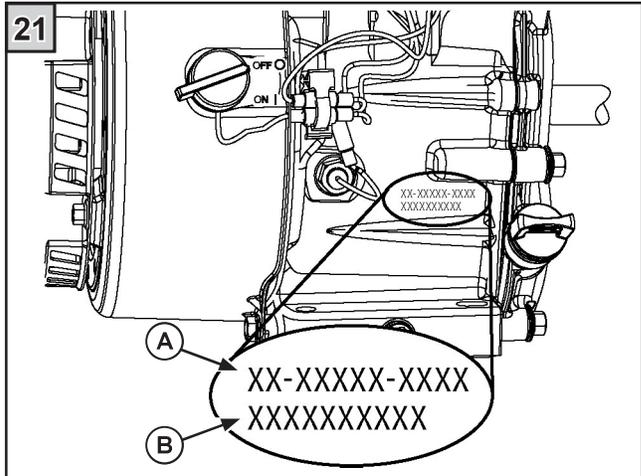
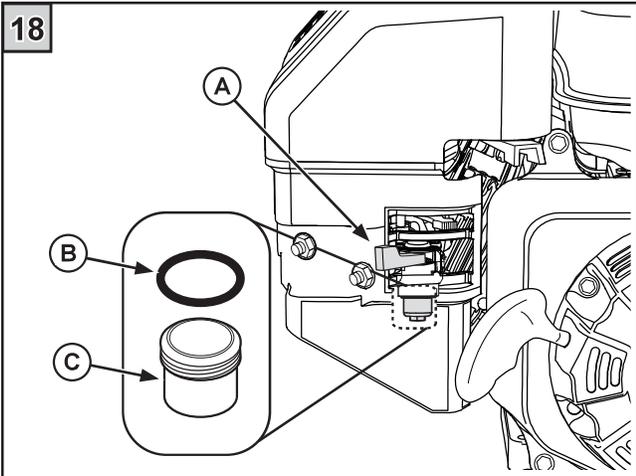
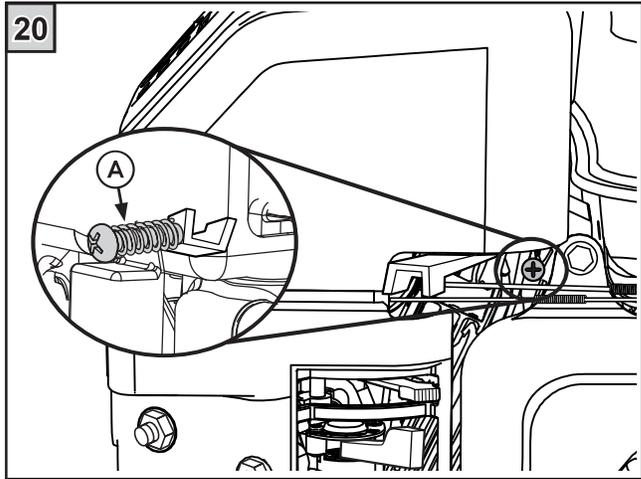
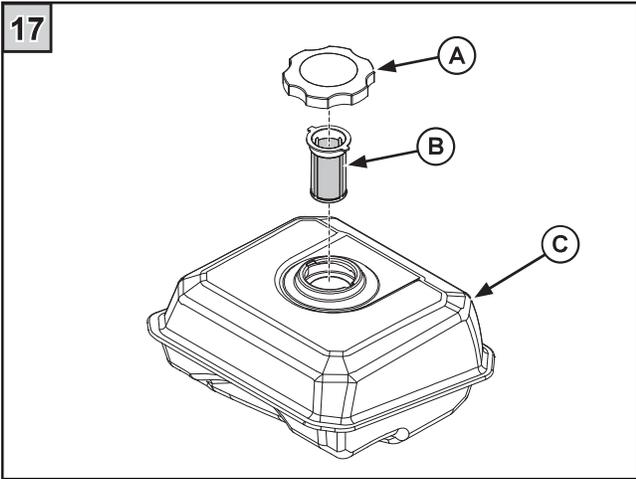
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KOHLER[®]
ENGINES









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KOHLER
IMPORTANT ENGINE INFORMATION
 THIS ENGINE MEETS U.S., EPA PHASE II, EC STAGE II (SN-3) AND CA 2008 AND LATER EXH EMISSION REGS FOR SI SORE

FAMILY: TYPE APP
 DISPL. (CC): SPEC. NO.
 SERIAL NO.: BUILD DATE

EMISSION COMPLIANCE PERIOD:
 EPA: CERTIFIED ON: CARB:
 REFER TO OWNER'S MANUAL FOR HP RATING, SAFETY, MAINTENANCE AND ADJUSTMENTS.

1406462344 koehler@koehler.com
 KOHLER CO., KOHLER, WISCONSIN, USA
 CRAFTED IN CHINA

IMPORTANT ENGINE INFORMATION THIS ENGINE MEETS U.S., EPA PHASE II, EC STAGE II (SN-3) AND CA 2008 AND LATER EXH EMISSION REGS FOR SI SORE EVP CODE: CO DUM:

FUEL: TYPE: DISP: SPEC: C 11236

EF: COMPLIANCE PERIOD: THIS APPLIES TO OWNERS MANUAL FOR MAINTENANCE AND ADJUSTMENTS
 KOHLER CO., KOHLER, WISCONSIN, USA
 CRAFTED IN CHINA

KOHLER

Symbols Associated with This Product

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| | | | | | | | |
|--|-------|--|-------------|--|-------|--|------|
| | Alert | | Read Manual | | Start | | Stop |
| | On | | Off | | Slow | | Fast |
| | Oil | | Choke | | Fuel | | |

Safety Precautions

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

WARNING

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

CAUTION

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

NOTE

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

For Your Safety!

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

| | |
|--|--|
|  |  WARNING |
| <p>Explosive Fuel can cause fires and severe burns. Do not fill the fuel tank while the engine is hot or running.</p> | |

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 |
| <p>Carbon Monoxide can cause severe nausea, fainting or death. Avoid inhaling exhaust fumes, and never run the engine in a closed building or confined area.</p> | |

Lethal Exhaust Gases!

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

| | |
|--|--|
|  |  WARNING |
| <p>Accidental Starts can cause severe injury or death. Disconnect and ground spark plug lead(s) before servicing.</p> | |

Accidental Starts!

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

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

Rotating Parts!

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

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

Hot Parts!

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

| | |
|--|--|
|  |  CAUTION |
| <p>Electrical Shock can cause injury. Do not touch wires while engine is running.</p> | |

Electrical Shock!

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

Congratulations on your purchase of a Kohler Engine. Every part, every component, every system on a Kohler engine is guided by our exclusive Performance Engineering philosophy:

- To operate on the leading edge of innovation
- To push the boundaries of cleaner, more efficient engines
- To manufacture the highest performing, most reliable engines on the market

You can rest assured that your Kohler Engine will provide maximum power and reliability in all operating conditions. Also, Kohler engines are backed by a worldwide network of over 10,000 distributors and dealers. For more information on Kohler Engines or to find a Kohler Service Center, visit KohlerEngines.com.

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

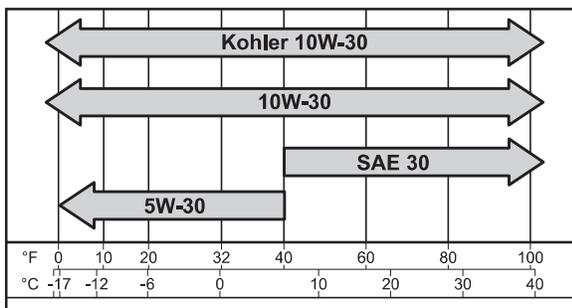
Oil Recommendations

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

Oil Type

Use high-quality oil that ranks at or above the American Petroleum Institute's (API) SJ service class. Select the oil's viscosity based on air temperature at the time of operation, as shown in the viscosity grades table.

Recommended SAE Viscosity Grades



Use service class SJ rated oil or higher. Do not extend the oil change intervals longer than recommended, as this can cause engine damage and may void the warranty. An API symbol on the oil container identifies the service class and SAE viscosity grade.

Fuel Recommendations

| | |
|---|---|
|  | WARNING Explosive Fuel can cause fires and severe burns. Do not fill the fuel tank while the engine is hot or running. |
|---|---|

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 Fuel Recommendations

See Figure 1

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.

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

Do not add oil to the gasoline.

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

Fuel Type

For best results use only clean, fresh, unleaded gasoline with an 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 and reduces harmful exhaust emissions. Leaded gasoline is not recommended.

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, including E20 and E85, should not be used. Failures resulting from use of these fuels will not be warranted.

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.

Fuel Line

These engines use Low Permeation SAE 30 R7 rated fuel lines, certified to meet emission requirements. Standard fuel lines may not be used. Order replacement hose through a Kohler Service Center.

Operating Instructions

Also read the operating instructions of equipment this engine powers.

EN

Check Oil Level

See Figures , , , and 

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 cool so the oil has had time to drain into the sump.
2. Clean the area around and beneath the dipstick or the oil fill plug (F) before removing it. This will help keep dirt, debris, and other foreign matter out of the engine. See Figure 1.

NOTE: The engine may be equipped with two dipsticks or an oil fill plug and a dipstick. These can be placed in either hole.

3. **Checking oil level with a dipstick (A):** Unscrew and remove the dipstick; wipe off oil. Reinsert the dipstick into the oil fill tube and rest the dipstick on the oil fill neck (B). Turn it counterclockwise until the oil fill cap drops down to the lowest point of the thread leads. **Do not** thread the dipstick cap onto the tube. See Figure 2.

Checking oil level with an oil fill plug: Unscrew and remove the oil fill plug (A). The level should be up to, but not over, the point of overflowing the filler neck (B). See Figure 3.

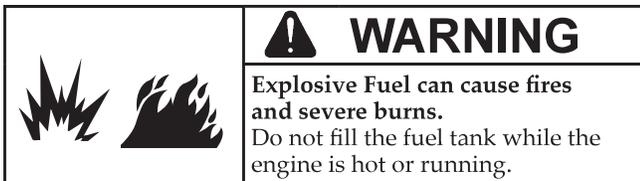
4. If the level is low, add oil of the proper type and to the correct level. (Refer to **Oil Type**.) Always check the level before adding more oil.
5. Reinstall the dipstick/oil fill plug (A) and gasket (B), and tighten securely. See Figure 4.

NOTE: Over tightening the dipstick/oil fill plug (A) will distort the gasket (C) and may cause oil weeping. See Figure 4.

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 above the correct level.

Add Fuel

See Figures , and 



1. Make sure the engine is **OFF**, level, and is cool.
2. Clean the area around the fuel cap (B). See Figure 1.
3. Remove the fuel cap. Fill to the base of the filler neck (A). Do not overfill the fuel tank (B). Leave room for the fuel to expand. See Figure 5.

4. Reinstall the fuel cap (B) and tighten securely. See Figure 1.

Check Cooling Areas

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

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

Check Air Cleaner

See Figure 

This engine is equipped with either a replaceable, high-density paper air cleaner element. In addition, an optional foam precleaner may also be included.

Check the air cleaner (A) for a buildup of dirt and debris daily or before starting the engine. Keep the area in and around the air cleaner clean. Also check for loose or damaged components. Replace all worn 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.

Pre-Start Checklist

1. Check oil level; if low, add oil. Do not overfill. (Refer to **Check Oil Level**.)

NOTE: Engines are shipped without oil. Do not start engine with low or no oil. This will cause damage to the engine and will not be covered under warranty.

2. Check fuel level; if low, add fuel. Do not overfill.
3. Check cooling areas, air intake areas, and external surfaces of engine. Make sure they are clean and unobstructed.
4. Check that the air cleaner components and all shrouds, equipment covers, and guards are in place and securely fastened.
5. 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 that could keep the engine from starting.

Cold Weather Starting Hints

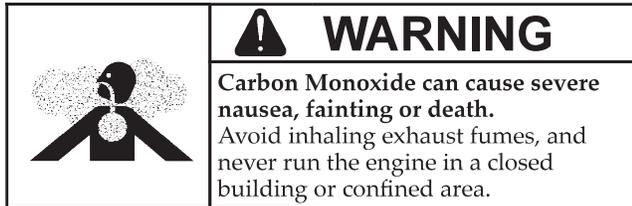
1. Be sure to use the proper oil for the temperature expected. (Refer to **Oil Recommendations**.)
2. Declutch all possible external loads.
3. Use fresh winter grade fuel.

NOTE: Winter grade gasoline has higher volatility to improve starting. Do not use gasoline left over from summer.

4. **Electric Start Models:** Be sure the battery is in good condition. A warm battery has much more starting capacity than a cold battery.

Starting

See Figures **6**, **7**, **8**, **9**, **10**, and **11**



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.

1. Turn the fuel shut-off valve (A) to the **ON** position. See Figure 6.
2. For a **Cold Engine** – Place the throttle control (A) midway between the **SLOW** and **FAST** positions. See Figure 7. Place the choke control (A) into the **ON** position. See Figure 8.

For a **Warm Engine (Normal Operating Temperatures)** – Place the throttle control (A) midway between the **SLOW** and **FAST** positions. A warm engine usually does not require the choke on. See Figure 7.

NOTE: The choke position for starting may vary depending upon temperature and other factors. Once engine is running and warm, turn choke to **OFF** position (A). See Figure 9.

3. Start the engine as follows:

For **Retractable Start Engine** – Turn engine On/Off switch (A) to the **ON** position. See Figure 10.

SLOWLY pull the starter handle (A) until just past compression – **STOP!** Return starter handle, and pull firmly with a smooth, steady motion to start. Pull the handle straight out to avoid excessive rope wear from the starter rope guide. See Figure 11.

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

4. Gradually return the choke control to the **OFF** position (A) after the engine starts and warms up. See Figure 9.

The engine/equipment may be operated during the warm-up period, but it may be necessary to leave the choke partially on until the engine warms up.

Stopping

See Figures **12**, **13**, and **14**

1. If possible, remove the load.
2. Move the throttle control (A) to the **SLOW** or **LOW** idle position. Allow the engine to run at idle for 30–60 seconds. See Figure 12.
3. Turn On/Off switch or key switch (A) to the **OFF** position. Move throttle to the **STOP** position if equipped. See Figure 13.
4. Close the fuel shut-off valve (A). See Figure 14.

Operating

Angle of Operation

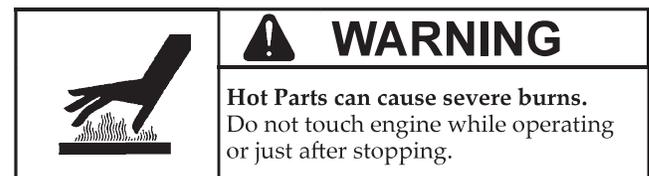
Continuous operation at angles up to 25° with 1/2-full fuel tank. Before operation check oil level to ensure crankcase oil level is correct. (Refer to **Check Oil Level.**)

Intermittent operation, up to one minute at angles up to 30° with 1/2-full fuel tank. Check oil level to ensure crankcase oil level is correct. (Refer to **Check Oil Level.**)

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 25° in any direction, because engine damage could result from insufficient lubrication.

Cooling



EN

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.

NOTE: If debris builds up on the recoil starter screen or other cooling 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. (Refer to **Clean Air Intake/Cooling Areas.**)

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

Before each season of operation, clean the cooling fins and external surfaces as necessary. Reinstall the blower housing and other cooling shrouds.

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. The maximum allowable high-idle speed for these engines is 3850 ± 100 RPM, no load.

Carburetor

The carburetor is designed to deliver the correct fuel-to-air mixture to the engine under all operating conditions. It has been calibrated at the factory and is not adjustable.

NOTE: To ensure correct engine operation at altitudes above 1525 meters (5000 ft.), it may be necessary to have a Kohler Engine Service Center install a high-altitude jet kit. If a high-altitude kit has been installed, the

engine must be reconverted to the original jet size before it is operated at lower altitudes, or overheating and engine damage may result.

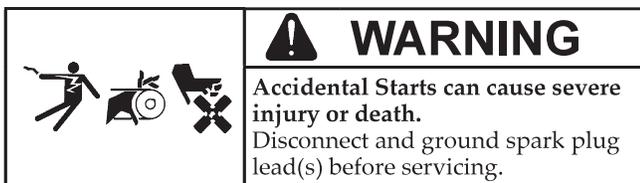
If engine troubles appear to be fuel-system related, check the following areas before seeking service from a Kohler Engine Service Center.

- Ensure the fuel tank is filled with clean, fresh gasoline.
- Ensure the air cleaner and precleaner are clean and securely fastened.
- Ensure that the fuel tank cap vent is not blocked and that it is operating properly.
- Ensure the in-line fuel filter, if equipped, is clean and unobstructed. Replace if necessary.

If after checking these items the engine is still hard to start, runs roughly, or stalls at low-idle speed, it may be necessary to have the carburetor serviced by a Kohler Engine Service Center.

Maintenance Instructions

Maintenance, repair, or replacement of the emission control devices and systems, which are being done at the customer's expense, may be performed by any non-road engine repair establishment or individual. Warranty repairs must be performed by a Kohler Engine Service Center.



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

Maintenance Schedule

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

| Frequency | Maintenance Required |
|--|--|
| Daily or Before Starting Engine | Check oil level. |
| | Fill fuel tank. |
| | Check air intake and cooling areas; clean as necessary. ¹ |
| | Check fuel screen. |
| | Check air cleaner element and precleaner (if equipped). |
| Yearly or Every 50 Hours | Check spark arrestor (if equipped); clean as necessary. ¹ |
| Yearly or Every 100 Hours | Clean or replace precleaner (if equipped). ¹ |
| | Replace air cleaner element. |
| | Change oil (after first 5 hours, then yearly or 100 hours.) |
| | Clean cooling areas. |
| | Clean spark arrestor (if equipped). |
| | Clean or replace spark plug, and set gap. |
| | Clean fuel valve cup. |
| | Replace fuel filter (if equipped). |
| Check and adjust valve clearance when engine is cold. ² | |
| Every 200 Hours or as Necessary | Service starter motor drive (if equipped). ² |
| | Have combustion chamber decarbonized. ² |
| Every 200 Hours or as Necessary | Replace fuel line. |

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

² These procedures should be performed by a Kohler Engine Service Center.

Oil Disposal

Protect and respect the environment. Dispose of oil at your local recycling center or municipal collection location in accordance with local ordinances.

Change Oil

See Figures [1](#), [2](#), [3](#), and [4](#)

For a new engine, change oil after the first **5 hours** of operation. Thereafter, change oil after every **100 hours** of operation.

For an overhauled engine, use Kohler 10W-30 service class SJ or higher oil for the first **5 hours** of operation. Change the oil after this initial run-in period. Refill with service class SJ or higher oil as specified in **Oil Type**.

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, debris, etc., out of the engine, clean the area around the dipstick/oil fill plug (F) before removing it. See Figure 1.
2. Remove the oil drain plug (E) and the dipstick/oil fill plug (F). Allow ample time for complete drainage. See Figure 1.
3. Reinstall the drain plug (E) and tighten to **17.6 N·m (13 ft. lb.)**. See Figure 1.
4. Fill the crankcase with new oil of the proper type, up to the point of overflowing the filler neck. (Refer to **Oil Type**). Always check the level before adding more oil.
5. Reinstall the dipstick/oil fill plug (A) and gasket (B), and tighten securely. See Figures 2 and 3.

NOTE: Over-tightening the dipstick/oil fill plug (A) will distort the gasket (C) and may cause oil weeping. See Figure 4.

Oil Sentry™

Some engines are equipped with an optional Oil Sentry™ switch. This switch is designed to prevent the engine from being started in a low-oil or no-oil condition. The Oil Sentry™ may not shut down a running engine before damage occurs. In some applications this switch may activate a warning signal.

NOTE: Check the oil level **BEFORE EACH USE** and maintain to the correct level. This includes engines equipped with Oil Sentry™.

Service Precleaner and Air Cleaner Element

See Figure [15](#)

These engines are equipped with a replaceable, high-density paper air cleaner element (F). Some engines are also equipped with a pre-oiled, foam precleaner (D), which surrounds the paper element.

Check the air cleaner daily or before starting the engine. Check for a 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 (If Equipped)

See Figure [15](#)

Wash or replace the precleaner every **50 hours** of operation (more often under extremely dusty or dirty conditions).

1. Remove the top wing nut (A) and air cleaner cover (B).
2. Remove the wing nut (C) (some models) and special washer (E).
3. Remove the precleaner (D) from the paper element (F).
4. Wash the precleaner (D) 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. Do not oil precleaner.
5. Reinstall the precleaner (D) over the paper element (F).
6. Slide the precleaner (D) and paper element (F) onto the air cleaner stud (G). Secure with special washer (E) and wing nut (C) (some models).
7. Reinstall the air cleaner cover (B) and secure with wing nut (A).

Service Air Cleaner Element

See Figure [15](#)

Yearly or 100 hours (which ever comes first) of operation (more often under extremely dusty or dirty conditions), replace the paper element.

1. Remove the top wing nut (A) and air cleaner cover (B). Remove the wing nut (C) (some models) and special washer (E).
2. Separate the precleaner (D) from the element (F) and service as outlined in **Service Precleaner**.

NOTE: Do not wash the paper element (F) 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 (H). Make sure it is secured and not bent or damaged. Check the air cleaner cover/housing (B) for damage or improper fit. Replace all bent or damaged air cleaner components.

4. Slide the precleaner (D) and paper element (F) onto the air cleaner stud (G). Secure with special washer (E) and wing nut (C) (some models).
5. Reinstall the air cleaner cover (B) and secure with wing nut (A).

Ignition

This engine is equipped with a dependable maintenance-free ignition system. Other than periodically checking/replacing the spark plug, no adjustments are necessary or possible with this system.

In the event starting problems should occur that are not corrected by replacing the spark plug, see your Kohler Engine Service Center.

NOTE: Some engines may be equipped with components that comply with RFI regulations.

Spark Plug

See Figures **1** and **16**

Yearly or every **100 hours** of operation, remove the spark plug, check its condition, and reset the gap or replace with a new plug as necessary. The original spark plug is a Champion® RC12YC; the Kohler equivalent is **Kohler Part No. 12 132 02-S** or for RFI **Kohler Part No. 25 132 14-S**. Equivalent alternate brand plugs can also be used.

1. Before removing the spark plug (D), clean the area around the base of the plug to keep dirt and debris out of the engine. See Figure 1.
2. Remove the plug (D) and check its condition. Replace the plug if worn or if reuse is questionable. See Figure 16.
3. Check the gap (B) using a feeler gauge (A). See Figure 16.

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.

4. Adjust the gap (B) by carefully bending the ground electrode (C). Gap spark plug to **0.76 mm (0.030 in.)**. See Figure 16.
5. Reinstall the spark plug into the cylinder head. Torque the plug to **20 N·m (14 ft. lb.)**.

Fuel Filter (If Equipped)

| | |
|---|--|
|  | WARNING |
| | Explosive Fuel can cause fires and severe burns. Do not fill the fuel tank while the engine is hot or running. |

Replace with a Kohler fuel filter yearly or every **50 hours** of operation. Removing the air filter cover will allow easy access to the fuel filter for servicing.

Fuel Tank Screen

See Figure **17**

A serviceable fuel tank screen is located under the fuel tank cap, in the filler neck.

| | |
|--|--|
|  | WARNING |
| | Explosive Fuel can cause fires and severe burns. Do not fill the fuel tank while the engine is hot or running. |

Daily, or as required, clean screen of any accumulation as follows:

1. Remove the fuel tank cap (A) and screen (B).
2. Clean the screen (B) with solvent. Replace if damaged.
3. Wipe the screen (B) and insert it into the filler neck (C).
4. Tighten the tank cap (A) securely.

Fuel Valve

See Figure **18**

Engines are equipped with a fuel valve and integral screen filter located at the inlet of the carburetor. It controls and filters fuel flow from the tank to the carburetor.

Every **100 hours** of operation clean fuel valve cup of any accumulated debris. If the screen becomes clogged or damaged, replace it.

| | |
|--|--|
|  | WARNING |
| | Explosive Fuel can cause fires and severe burns. Do not fill the fuel tank while the engine is hot or running. |

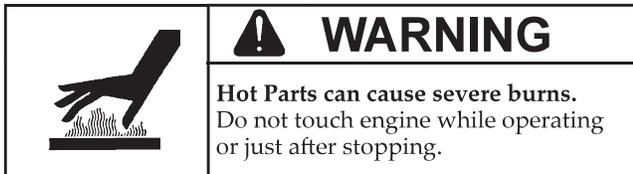
1. Stop the engine.
2. Turn the fuel valve lever (A) to the **OFF** position.
3. Remove the fuel valve cup (C).
4. Clean the fuel valve cup (C) with solvent and wipe it off.
5. Check the O-ring (B). Replace if damaged.
6. Place the O-ring (B) on the fuel valve cup (C). Rotate the fuel valve cup until it is finger tight. Turn with a wrench 1/2 to 3/4 full turn.
7. Turn the fuel valve (A) to the **ON** position and check for leaks. If fuel valve cup leaks repeat steps 5 and 6.
8. Tighten the tank cap securely.

Spark Arrestor

See Figure **19**

Engines are equipped with a spark arrestor for operational and environmental safety.

Every **100 hours** of operation, remove and clean or replace the spark arrestor following the instructions below.



1. Remove the securing hardware (B) and the spark arrestor (A).
2. Clean the carbon deposits out of the screen using a wire brush.
3. Check the spark arrestor (A). Replace if damaged.
4. Reinstall the spark arrestor (A), securing with the hardware (B) previously removed.

Clean Air Intake/Cooling Areas

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

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

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

Carburetor Troubleshooting and Adjustments

See Figure **20**

NOTE: Carburetor adjustments should be made only after the engine is at operating temperature.

The carburetor is designed to deliver the correct fuel-to-air mixture to the engine under all operating conditions. The idle mixture is set at the factory and normally does not require adjustment.

If the engine is hard to start, runs roughly, or stalls at low idle speed, it may be necessary to adjust or service the carburetor. Engine must not exceed **3850 ± 100 RPM** if the high speed screw (A) is adjusted.

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 that the fuel tank cap vent is not blocked and that it is operating properly.
- Make sure the fuel shut-off valve is fully open.
- Make sure fuel shut-off valve strainer and in-line fuel filter (if used) are clean and unobstructed. Clean or replace as necessary.
- Make sure fuel is reaching the carburetor. This includes checking the fuel lines and components for restrictions or problems. Replace as necessary.
- Make sure On/Off switch is functioning properly.
- Make sure the air cleaner element is clean and all air cleaner components are fastened securely.

If, after checking the items listed above, the engine is hard to start, runs roughly, or stalls at low-idle speed, it may be necessary to adjust or service the carburetor.

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Troubleshooting

When problems occur, first check for simple reasons for a problem: for example, an empty fuel tank or the fuel shut-off valve is turned off. Additional troubleshooting tips can be found in the troubleshooting table.

NOTE: Do not attempt to service or replace major engine components, or any items that require special timing or adjustment procedures. This work should be performed by a Kohler Engine Service Center.

| Problem | Possible Cause | | | | | | | | |
|-----------------------|----------------|------------------------|---------------|-------------------|---------------------|---------------------|-------------------|-------------------|-------------------|
| | No Fuel | Fuel Valve Closed/ Off | Improper Fuel | Dirt In Fuel Line | Dirty Debris 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 | | | | | | | ● | ● | ● |
| Smokes | | | ● | | | ● | | | ● |

Storage

See Figures **1** and **6**

If the engine will be out of service for two months or more, follow these storage procedures:

1. Clean the exterior surfaces of the engine.
2. Change the oil while the engine is still warm from operation. (Refer to **Change Oil**.)
3. The engine must be run until the fuel tank is completely emptied, or the gasoline must be treated with a stabilizer to prevent deterioration. If a stabilizer is used, follow the manufacturer's instructions. Fill the tank with fresh gasoline and run the engine for 2–3 minutes to ensure stabilized fuel has entered the carburetor.
To empty the system, run the engine until the tank and system are empty.
4. Before transporting the engine, ensure the fuel valve (A) is in the **OFF** position to prevent fuel spillage. See Figure 6.
5. Remove the spark plug (D). Add one tablespoon of engine oil into the spark plug hole. Reinstall the plug, but do not connect the plug lead. Turn the crank to rotate the engine two to three revolutions. See Figure 1.

6. Remove the spark plug (D). 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 the thumb is greatest). Reinstall the spark plug, but do not connect the spark plug lead. See Figure 1.
7. Store the engine on a level surface in a clean, dry place. Never store the unit where there is an open flame, spark, or pilot light such as on a water heater or other appliances.

Transport

1. Turn the fuel valve to the **OFF** position.
2. Tighten the fuel cap.
3. Read and follow the transport guidelines provided by equipment manufacturer.

Repairs

Repair information is available in Kohler Engine service manuals, which are available at KohlerEngines.com, or at Kohler Engine Service Centers. Major repairs generally require the services of a trained mechanic and the use of specialized tools and equipment. Kohler Engine Service Centers have the facilities, training, and genuine Kohler replacement parts necessary to perform these services.

For the nearest sales and service location, visit our Web site at KohlerEngines.com, or in the U.S. and Canada call 1-800-544-2444.

Parts Ordering

The engine model, specification, and serial numbers are required when ordering replacement parts from your Kohler Engine Service Center. These numbers are found on the identification plate, which is affixed to the engine shrouding. Include letter suffixes if there are any. (Refer to **Engine Identification Numbers**.)

Always insist on genuine Kohler replacement parts, as they adhere to strict standards for fit, reliability, and performance. Visit KohlerEngines.com or your Kohler Engine Service Center.

Engine Identification Numbers

See Figures **1** and **22**

Engine identification numbers will appear on one of several variations of labels affixed to the engine (Figure 22). See Figure 1 for Engine Identification Label location (H).

When ordering parts, or in any communication concerning this engine, always give the model name, specification number, and serial number — including any letter suffixes.

Record all engine ID numbers for future reference.

Serial Number and Spec Number

See Figures **21** and **22**

The spec number (A) and serial number (B) is etched into the engine block, directly below the fuel tank. When ordering parts, or in any communication, always provide model, specification number (A), and serial number (B). Record these numbers for future reference. See Figure 21.

Additional engine identification numbers can be found on the engine ID labels. See Figure 22.

Emission Compliance

See Figure **22**

The Emission Compliance Period referred to on the Emission Control or Air Index label indicates the number of operating hours for which the engine has been shown to meet Federal and CARB emission requirements. The following table provides the Engine Compliance Period (in hours) associated with the category descriptor found on the certification label.

| Emission Compliance Period | |
|----------------------------|------------|
| EPA | Category C |
| Below 225 cc | 125 hours |

Refer to certification label for engine displacement. Exhaust Emission Control System for model SH265 is EM for U.S. EPA and Europe.

| Engine Specifications* | |
|---|----------------------------|
| Model | SH265 |
| Bore | 68 mm (2.7 in.) |
| Stroke | 54 mm (2.1 in.) |
| Displacement | 196 cc (12 cu. in.) |
| Gross Power @ 3600 RPM** | 4.9 kW (6.5 HP) |
| Net Power @ 3600 RPM** | 4.1 kW (5.5 HP) |
| Net Peak Torque @ 2800 RPM | 11.5 N·m (8.5 ft. lb.) |
| Compression Ratio | 8.5:1 |
| Weight (Recoil Start) | 16 kg (35.3 lb.) |
| Oil Capacity | .60 L (.63 qt.) |
| Fuel Capacity | 3.6 L (3.8 qt.) |
| Exhaust Emission Control System | EM for U.S. EPA and Europe |
| *Kohler Co. reserves the right to change product specifications, designs, and equipment without notice and without incurring obligation. | |
| **Horsepower ratings exceed Society of Automotive Engineers Small Engine Test Code J1940. Actual engine horsepower is lower and affected by, but not limited to, accessories (air cleaner, exhaust, charging, cooling, fuel pump, etc.), application, engine speed, and ambient operating conditions (temperature, humidity, and altitude). | |

EN

COURAGE® ENGINE LIMITED WARRANTY

Kohler Co. warrants to the original retail consumer that each new COURAGE® engine sold by Kohler Co. will be free from manufacturing defects in materials or workmanship in normal residential homeowner service for a period of two (2) years from date of purchase, provided it is operated and maintained in accordance with Kohler Co.'s instructions and manuals. If used commercially the COURAGE® engine is covered by a 90-day¹ limited warranty.

The warranty period begins on the date of purchase by the original retail consumer or commercial end user. "Residential homeowner service" means residential use by a retail consumer. "Commercial use" means all other uses, including use for commercial, or rental purposes. Once in commercial use, the engine will thereafter be considered a commercial use engine for the purposes of this warranty.

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 parts as inspection shall disclose to have been defective.

EXCLUSIONS:

Mufflers on engines used commercially (non-residential) are warranted for 90 days from date of purchase. 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.

Kohler Co. AND/OR THE SELLER 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 repair or replacement of defective parts.

IMPLIED OR STATUTORY WARRANTIES, INCLUDING WARRANTIES 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 any one authorized to make any on 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. To locate the nearest facility, visit our Web site, www.KohlerEngines.com, consult your local telephone directory or telephone 1-800-544-2444.

ENGINE DIVISION, KOHLER CO., KOHLER, WISCONSIN 53044

¹ With the exception of countries governed by the European Union (EU), where a one (1) year warranty is required for commercial/professional use.

KOHLER CO. FEDERAL AND CALIFORNIA EMISSION CONTROL SYSTEMS LIMITED WARRANTY SMALL OFF-ROAD ENGINES

The U.S. Environmental Protection Agency (EPA), the California Air Resources Board (CARB), and Kohler Co. are pleased to explain the Federal and California Emission Control Systems Warranty on your small off-road equipment engine. In California beginning in 2006, "emissions" means both exhaust and evaporative emissions. For California, engines produced in 2006 and later must be designed, built and equipped to meet the state's stringent anti-smog standards. In other states, 1997 and later model year engines must be designed, built and equipped, to meet the U.S. EPA regulations for small non-road engines. The engine must be free from defects in materials and workmanship which cause it to fail to conform with U.S. EPA standards for the first two years of engine use from the date of sale to the ultimate purchaser. Kohler Co. must warrant the emission control system on the engine for the period of time listed above, provided there has been no abuse, neglect or improper maintenance.

The emission control system may include parts such as the carburetor or fuel injection system, the ignition system, and catalytic converter. Also included are the hoses, belts and connectors and other emission related assemblies.

Where a warrantable condition exists, Kohler Co. will repair the engine at no cost, including diagnosis (if the diagnostic work is performed at an authorized dealer), parts and labor.

MANUFACTURER'S WARRANTY COVERAGE

Engines produced in 2006 or later are warranted for two years in California. In other states, 1997 and later model year engines are warranted for two years. If any emission related part on the engine is defective, the part will be repaired or replaced by Kohler Co. free of charge.

Continued on the next page.

OWNER'S WARRANTY RESPONSIBILITIES

- (a) The engine owner is responsible for the performance of the required maintenance listed in the owner's manual. Kohler Co. recommends that you retain all receipts covering maintenance on the engine, but Kohler Co. cannot deny warranty solely for the lack of receipts or for your failure to assure that all scheduled maintenance was performed.
- (b) Be aware, however, that Kohler Co. may deny warranty coverage if the engine or a part has failed due to abuse, neglect, improper maintenance or unapproved modifications.
- (c) For warranty repairs, the engine must be presented to a Kohler Co. service center as soon as a problem exists. Call 1-800-544-2444 or access our web site at: www.KohlerEngines.com, for the names of the nearest service centers. The warranty repairs should be completed in a reasonable amount of time, not to exceed 30 days.

If you have any questions regarding warranty rights and responsibilities, you should contact Kohler Co. at 1-920-457-4441 and ask for an engine service representative.

COVERAGE

Kohler Co. warrants to the ultimate purchaser and each subsequent purchaser that the engine will be designed, built and equipped, at the time of sale, to meet all applicable regulations. Kohler Co. also warrants to the initial purchaser and each subsequent purchaser, that the engine is free from defects in materials and workmanship which cause the engine to fail to conform with applicable regulations for a period of two years.

Engines produced in 2006 or later are warranted for two years in California. For 1997 and later model years, EPA requires manufacturers to warrant engines for two years in all other states. These warranty periods will begin on the date the engine is purchased by the initial purchaser. If any emission related part on the engine is defective, the part will be replaced by Kohler Co. at no cost to the owner. Kohler Co. is liable for damages to other engine components caused by the failure of a warranted part still under warranty.

Kohler Co. shall remedy warranty defects at any authorized Kohler Co. engine dealer or warranty station. Warranty repair work done at an authorized dealer or warranty station shall be free of charge to the owner if such work determines that a warranted part is defective.

Listed below are the parts covered by the Federal and California Emission Control Systems Warranty. Some parts listed below may require scheduled maintenance and are warranted up to the first scheduled replacement point for that part. The warranted parts include the following if they were present in the engine purchased:

- Oxygen sensor (if equipped)
- Intake manifold (if equipped)
- Exhaust manifold (if equipped)
- Catalytic muffler (if equipped)
- Thermal reactor muffler (if equipped)
- Spark advance module (if equipped)
- Air filter, fuel filter, and spark plugs (only to first scheduled replacement point)
- Crankcase breather
- Ignition module(s) with high tension lead
- Gaseous fuel regulator (if equipped)
- Electronic control unit (if equipped)
- Carburetor or fuel injection system (if equipped)
- Fuel lines, fuel line fittings and clamps (if equipped)
- Fuel metering valve (if equipped)
- Air injection system (if equipped)
 - Air pump or pulse valve assembly (if equipped)
 - Control/distribution valve (if equipped)
 - Distribution manifold (if equipped)
 - Air hoses (if equipped)
 - Vacuum lines (if equipped)
- Evaporative system (if equipped)
 - Canister (if equipped)
 - Canister filter (if equipped)
 - Vapor hose (if equipped)
 - Orifice connector (if equipped)
 - Fuel tank (if equipped)
 - Fuel cap (if equipped)
 - Primer bulb canister (if equipped)

LIMITATIONS

This Emission Control System Warranty shall not cover any of the following:

- (a) Repair or replacement required because of misuse or neglect, improper maintenance, improper repairs, or replacements not conforming to Kohler Co. specifications that adversely affect performance and/or durability and alterations or modifications not recommended or approved in writing by Kohler Co.,
- (b) Replacement of parts and other services and adjustments necessary for required maintenance at and after the first scheduled replacement point,
- (c) Consequential damages such as loss of time, inconvenience, loss of use of the engine or equipment, etc.,
- (d) Diagnosis and inspection fees that do not result in eligible warranty service being performed, and
- (e) Any add-on or modified part, or malfunction of authorized parts due to the use of add-on or modified parts.

MAINTENANCE AND REPAIR REQUIREMENTS

The owner is responsible for the proper use and maintenance of the engine. Kohler Co. recommends that all receipts and records covering the performance of regular maintenance be retained in case questions arise. If the engine is resold during the warranty period, the maintenance records should be transferred to each subsequent owner. Kohler Co. reserves the right to deny warranty coverage if the engine has not been properly maintained; however, Kohler Co. may not deny warranty repairs solely because of the lack of repair maintenance or failure to keep maintenance records.

Normal maintenance, replacement or repair of emission control devices and systems may be performed by any repair establishment or individual; however, **warranty repairs must be performed by a Kohler Authorized Service Center**. Any replacement part or service that is equivalent in performance and durability may be used in non-warranty maintenance or repairs, and shall not reduce the warranty obligations of the engine manufacturer.

KOHLER® ENGINES

FOR SALES AND SERVICE INFORMATION
IN U.S. AND CANADA, CALL **1-800-544-2444**

KohlerEngines.com

ENGINE DIVISION, KOHLER CO., KOHLER, WISCONSIN 53044

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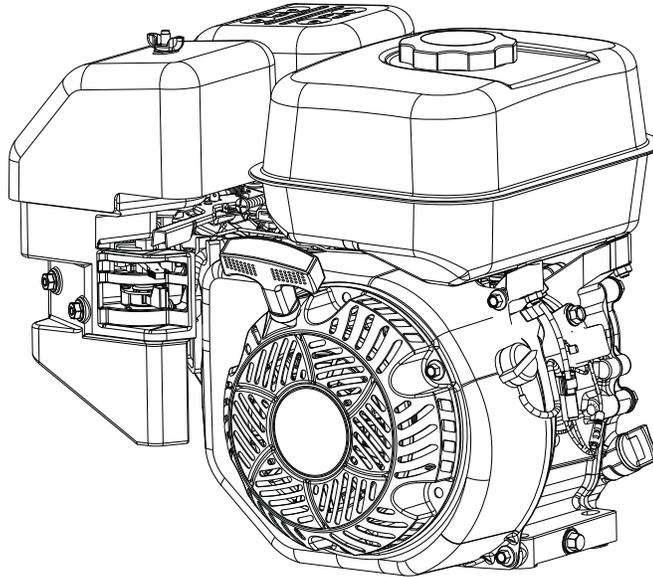
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KOHLER® 3000 Series

KOHLER® Courage

SH265

Service Manual



IMPORTANT: Read all safety precautions and instructions carefully before operating equipment. Refer to operating instruction of equipment that this engine powers.

Ensure engine is stopped and level before performing any maintenance or service.

| | |
|----|------------------------------------|
| 2 | Safety |
| 3 | Maintenance |
| 5 | Specifications |
| 12 | Tools and Aids |
| 15 | Troubleshooting |
| 19 | Air Cleaner/Intake |
| 20 | Fuel System |
| 24 | Governor System |
| 25 | Lubrication System |
| 26 | Electrical System |
| 30 | Starter System |
| 33 | Disassembly/Inspection and Service |
| 43 | Reassembly |

Safety

SAFETY PRECAUTIONS

⚠ WARNING: A hazard that could result in death, serious injury, or substantial property damage.

⚠ CAUTION: A hazard that could result in minor personal injury or property damage.

NOTE: is used to notify people of important installation, operation, or maintenance information.

| | |
|---|---|
|  | ⚠ WARNING |
| | Explosive Fuel can cause fires and severe burns. Do not fill fuel tank while engine is hot or running. |
| 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. Spilled fuel could ignite if it comes in contact with hot parts or sparks from ignition. Never use gasoline as a cleaning agent. | |

| | |
|--|--|
|  | ⚠ WARNING |
| | Rotating Parts can cause severe injury. Stay away while engine is in operation. |
| Keep hands, feet, hair, and clothing away from all moving parts to prevent injury. Never operate engine with covers, shrouds, or guards removed. | |

| | |
|---|--|
|  | ⚠ WARNING |
| | Carbon Monoxide can cause severe nausea, fainting or death. Avoid inhaling exhaust fumes. |
| Engine exhaust gases contain poisonous carbon monoxide. Carbon monoxide is odorless, colorless, and can cause death if inhaled. | |

| | |
|--|---|
|  | ⚠ WARNING |
| | Accidental Starts can cause severe injury or death. Disconnect and ground spark plug lead(s) before servicing. |
| Before working on engine or equipment, disable engine as follows: 1) Disconnect spark plug lead(s). 2) Disconnect negative (-) battery cable from battery. | |

| | |
|---|--|
|  | ⚠ WARNING |
| | Hot Parts can cause severe burns. Do not touch engine while operating or just after stopping. |
| Never operate engine with heat shields or guards removed. | |

| | |
|---|--|
|  | ⚠ WARNING |
| | Cleaning Solvents can cause severe injury or death. Use only in well ventilated areas away from ignition sources. |
| Carburetor cleaners and solvents are extremely flammable. Follow cleaner manufacturer's warnings and instructions on its proper and safe use. Never use gasoline as a cleaning agent. | |

| | |
|---|---|
|  | ⚠ CAUTION |
| | Electrical Shock can cause injury. Do not touch wires while engine is running. |

| | |
|---|---|
|  | ⚠ CAUTION |
| | Damaging Crankshaft and Flywheel can cause personal injury. |
| Using improper procedures can lead to broken fragments. Broken fragments could be thrown from engine. Always observe and use precautions and procedures when installing flywheel. | |

| | |
|---|---|
|  | ⚠ WARNING |
| | Uncoiling Spring can cause severe injury. Wear safety goggles or face protection when servicing retractable starter. |
| Retractable starters contain a powerful, recoil spring that is under tension. Always wear safety goggles when servicing retractable starters and carefully follow instructions in Retractable Starter for relieving spring tension. | |

MAINTENANCE INSTRUCTIONS

| | | |
|---|---|--|
|  | ⚠ WARNING | Before working on engine or equipment, disable engine as follows: 1) Disconnect spark plug lead(s). 2) Disconnect negative (-) battery cable from battery. |
| | Accidental Starts can cause severe injury or death. Disconnect and ground spark plug lead(s) before servicing. | |

Normal maintenance, replacement or repair of emission control devices and systems may be performed by any repair establishment or individual; however, warranty repairs must be performed by a Kohler authorized dealer.

MAINTENANCE SCHEDULE

After first 5 Hours

| | |
|---|--------------------|
| <ul style="list-style-type: none"> Change oil. | Lubrication System |
|---|--------------------|

Every 50 Hours or Annually

| | |
|--|--------------------|
| <ul style="list-style-type: none"> Service/replace dual-element precleaner. | Air Cleaner/Intake |
|--|--------------------|

Every 100 Hours or Annually¹

| | |
|---|--------------------|
| <ul style="list-style-type: none"> Clean low-profile air cleaner element. | Air Cleaner/Intake |
| <ul style="list-style-type: none"> Replace dual-element air cleaner element. | Air Cleaner/Intake |
| <ul style="list-style-type: none"> Change oil. | Lubrication System |
| <ul style="list-style-type: none"> Clean cooling areas. | Air Cleaner/Intake |
| <ul style="list-style-type: none"> Clean spark arrestor (if equipped). | |
| <ul style="list-style-type: none"> Replace fuel filter (if equipped). | |

Every 100 Hours²

| | |
|---|------------|
| <ul style="list-style-type: none"> Check and adjust valve clearance when engine is cold. | Reassembly |
| <ul style="list-style-type: none"> Have combustion chamber decarbonized. | |

Every 125 Hours or Annually¹

| | |
|---|-------------------|
| <ul style="list-style-type: none"> Replace spark plug and set gap. | Electrical System |
|---|-------------------|

Every 200 Hours²

| | |
|--|-------------|
| <ul style="list-style-type: none"> Replace fuel line. | Fuel System |
|--|-------------|

Every 300 Hours

| | |
|--|--------------------|
| <ul style="list-style-type: none"> Replace low-profile air cleaner element. | Air Cleaner/Intake |
|--|--------------------|

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

² Have a Kohler authorized dealer perform this service.

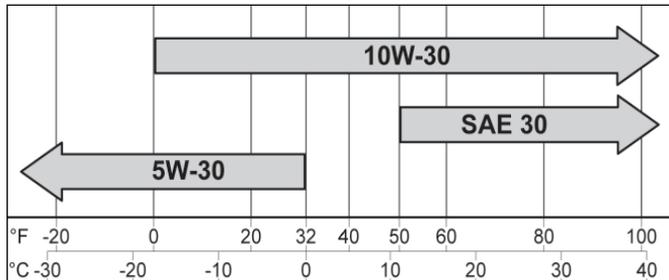
REPAIRS/SERVICE PARTS

Kohler genuine service parts can be purchased from Kohler authorized dealers. To find a local Kohler authorized dealer visit KohlerEngines.com or call 1-800-544-2444 (U.S. and Canada).

Maintenance

OIL RECOMMENDATIONS

We recommend use of Kohler oils for best performance. Other high-quality detergent oils (including synthetic) of API (American Petroleum Institute) service class SJ or higher are acceptable. Select viscosity based on air temperature at time of operation as shown in table below.



FUEL RECOMMENDATIONS

| | |
|---|---|
|  | ⚠ WARNING |
| | Explosive Fuel can cause fires and severe burns. Do not fill fuel tank while engine is hot or running. |
| 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. Spilled fuel could ignite if it comes in contact with hot parts or sparks from ignition. Never use gasoline as a cleaning agent. | |

NOTE: E15, E20 and E85 are NOT approved and should NOT be used; effects of old, stale or contaminated fuel are not warrantable.

Fuel must meet these requirements:

- Clean, fresh, unleaded gasoline.
- Octane rating of 87 (R+M)/2 or higher.
- Research Octane Number (RON) 90 octane minimum.
- Gasoline up to 10% ethyl alcohol, 90% unleaded is acceptable.
- Methyl Tertiary Butyl Ether (MTBE) and unleaded gasoline blend (max 15% MTBE by volume) are approved.
- Do not add oil to gasoline.
- Do not overfill fuel tank.
- Do not use gasoline older than 30 days.

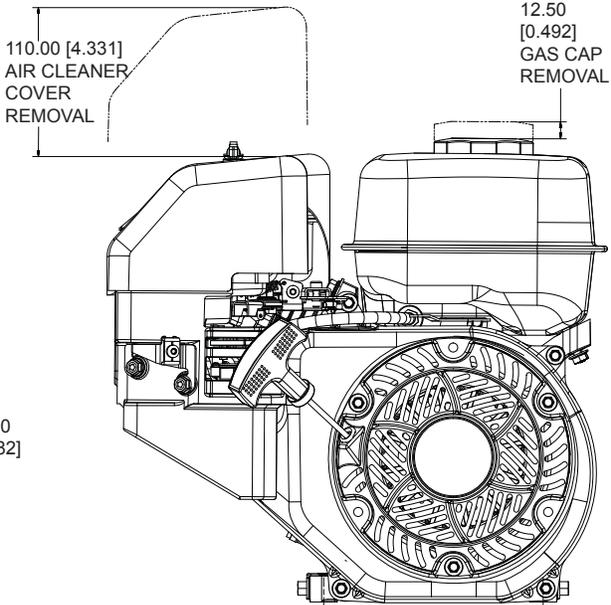
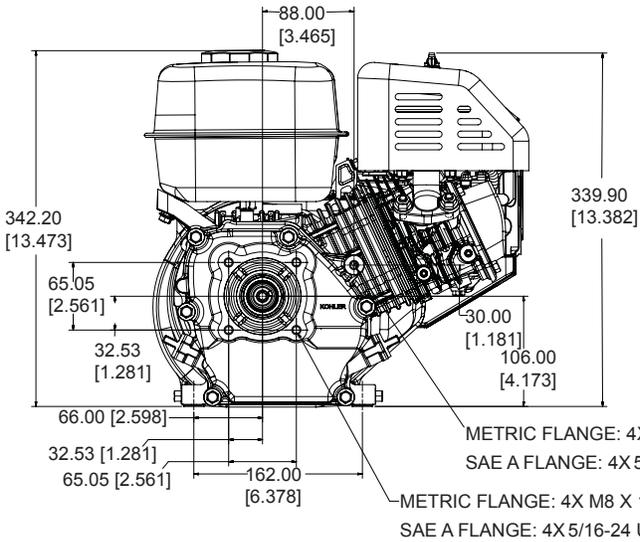
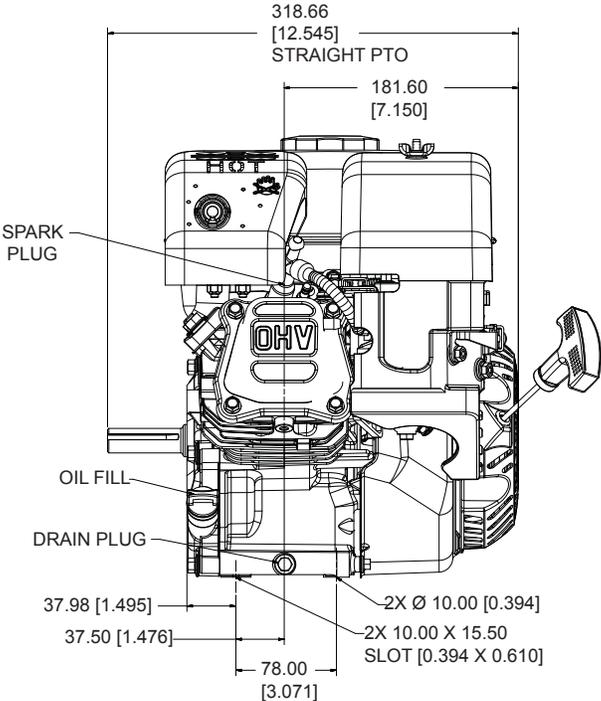
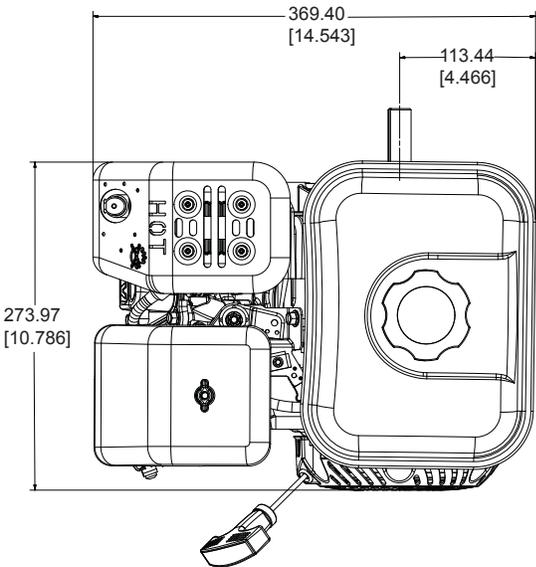
STORAGE

If engine will be out of service for 2 months or more follow procedure below.

1. Add Kohler PRO Series fuel treatment or equivalent to fuel tank. Run engine 2-3 minutes to get stabilized fuel into fuel system (failures due to untreated fuel are not warrantable).
2. Change oil while engine is still warm from operation. Remove spark plug(s) and pour about 1 oz. of engine oil into cylinder(s). Replace spark plug(s) and crank engine slowly to distribute oil.
3. Disconnect negative (-) battery cable.
4. Store engine in a clean, dry place.

Engine Dimensions

Dimensions in millimeters.
Inch equivalents shown in [].

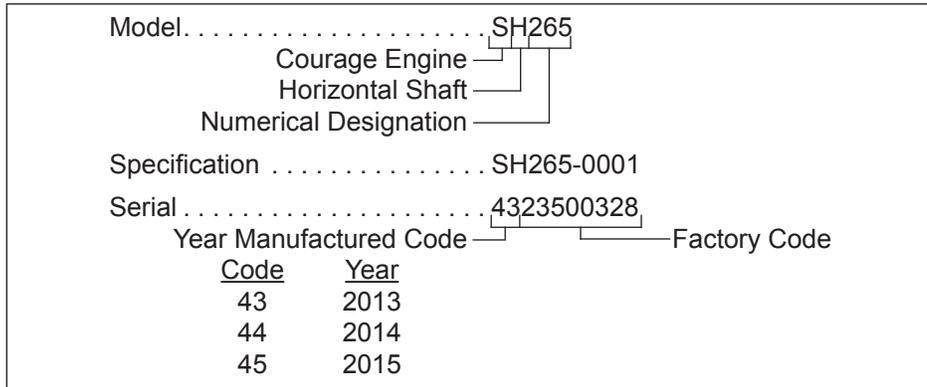


METRIC FLANGE: 4X M8 X 1.25-6H ∇ THRU
SAE A FLANGE: 4X 5/16-24 UNF-2B ∇ THRU
METRIC FLANGE: 4X M8 X 1.25-6H ∇ 15.00 [0.591]
SAE A FLANGE: 4X 5/16-24 UNF-2B ∇ 15.00 [0.591]

Specifications

ENGINE IDENTIFICATION NUMBERS

Kohler engine identification numbers (model, specification and serial) should be referenced for efficient repair, ordering correct parts, and engine replacement.



GENERAL SPECIFICATIONS^{3,6}

SH265

| | |
|--|-----------------------|
| Bore | 68 mm (2.7 in.) |
| Stroke | 54 mm (2.1 in.) |
| Displacement | 196 cc (12.0 cu. in.) |
| Oil Capacity (refill) | 0.6 L (0.63 U.S. qt.) |
| Maximum Angle of Operation (@ full oil level) ⁴ | 25° |

TORQUE SPECIFICATIONS^{3,5}

SH265

Air Cleaner

| | |
|---------------------------------------|----------------------|
| Mounting Screw (into intake manifold) | 8 N·m (70.8 in. lb.) |
|---------------------------------------|----------------------|

Blower Housing and Sheet Metal

| | |
|-------------------|-----------------------|
| M6 Shoulder Screw | 10 N·m (88.5 in. lb.) |
| M6 Nut | 8 N·m (70.8 in. lb.) |

Carburetor

| | |
|------------------|-----------------------|
| Stud | 10 N·m (88.5 in. lb.) |
| Primary Nut | 8 N·m (70.8 in. lb.) |
| Secondary Nut | 10 N·m (88.5 in. lb.) |
| Intake Cover Nut | 4 N·m (35.4 in. lb.) |

Connecting Rod

| | |
|-------------------------------------|----------------------|
| Cap Fastener (torque in increments) | 12 N·m (106 in. lb.) |
|-------------------------------------|----------------------|

Crankcase

| | |
|---------------------|----------------------|
| Oil Drain Plug | 18 N·m (13 ft. lb.) |
| Closure Plate Screw | 24 N·m (212 in. lb.) |

Cylinder Head

| | |
|-----------------------------------|--|
| Fastener (torque in 2 increments) | first to 12 N·m (106 in. lb.) finally to 24 N·m (212 in. lb.) |
|-----------------------------------|--|

³ Values are in Metric units. Values in parentheses are English equivalents.

⁴ Exceeding maximum angle of operation may cause engine damage from insufficient lubrication.

⁵ Lubricate threads with engine oil prior to assembly.

⁶ Any and all horsepower (hp) references by Kohler are Certified Power Ratings and per SAE J1940 & J1995 hp standards. Details on Certified Power Ratings can be found at KohlerEngines.com.

TORQUE SPECIFICATIONS^{3,5}

SH265

Flywheel

| | |
|---------------|----------------------|
| Retaining Nut | 74 N·m (655 in. lb.) |
|---------------|----------------------|

Fuel Tank

| | |
|----------------|------------------------|
| Mounting Nut | 24 N·m (212 in. lb.) |
| Mounting Screw | 24 N·m (212 in. lb.) |
| Inlet Fitting | 1.5 N·m (13.3 in. lb.) |

Governor

| | |
|----------------------------|---------------------------|
| Arm Nut | 10 N·m (88.5 in. lb.) |
| Throttle Control Lever Nut | 4.5-6 N·m (40-53 in. lb.) |

Ignition

| | |
|--------------------------|-----------------------|
| Spark Plug | 27 N·m (20 ft. lb.) |
| Module Fastener | 8 N·m (70.8 in. lb.) |
| Module Screw | 10 N·m (88.5 in. lb.) |
| Oil Sentry™ Module Screw | 8 N·m (70.8 in. lb.) |

Muffler

| | |
|-------------------------|----------------------|
| M8 Exhaust Screw | 24 N·m (212 in. lb.) |
| M6 Muffler Shield Screw | 8 N·m (70.8 in. lb.) |
| M4 Muffler Shield Screw | 2 N·m (17.7 in. lb.) |
| M5 Spark Arrestor Screw | 3.5 N·m (31 in. lb.) |

Retractable Starter

| | |
|-------------|------------------------|
| Cover Screw | 5.4 N·m (47.8 in. lb.) |
| Screw | 10 N·m (88.5 in. lb.) |

Rocker Arm

| | |
|---------------|------------------------|
| Stud | 13.6 N·m (120 in. lb.) |
| Pivot Jam Nut | 10 N·m (88.5 in. lb.) |

Valve Cover

| | |
|----------|----------------------|
| Fastener | 8 N·m (70.8 in. lb.) |
|----------|----------------------|

³ Values are in Metric units. Values in parentheses are English equivalents.

⁵ Lubricate threads with engine oil prior to assembly.

Specifications

CLEARANCE SPECIFICATIONS³

SH265

Camshaft

| | |
|-------------------------------------|--|
| End Play | 0.025/0.602 mm (0.0010/0.0237 in.) |
| Running Clearance | 0.016/0.052 mm (0.0006/0.0020 in.) |
| Bore I.D. New Max. Wear Limit | 14.000/14.018 mm (0.5512/0.5519 in.) 14.048 mm (0.5531 in.) |

Connecting Rod

| | |
|--|--|
| Crankpin End I.D. @ 21°C (70°F) New Max. Wear Limit | 30.021/30.026 mm (1.1819/1.1821 in.) 30.08 mm (1.184 in.) |
| Connecting Rod-to-Crankpin Running Clearance New Max. Wear Limit | 0.041/0.051 mm (0.002/0.002 in.) 0.12 mm (0.005 in.) |
| Connecting Rod-to-Crankpin Side Clearance New Max. Wear Limit | 0.58/0.60 mm (0.023/0.024 in.) 1.10 mm (0.043 in.) |
| Connecting Rod-to-Piston Pin Running Clearance | 0.01/0.027 mm (0.0004/0.0011 in.) |
| Piston Pin End I.D. @ 21°C (70°F) New Max. Wear Limit | 18.010/18.015 mm (0.709/0.709 in.) 18.08 mm (0.712 in.) |

Crankcase

| | |
|--|---|
| Governor Cross Shaft Bore I.D. New Max. Wear Limit | 6.000/6.018 mm (0.2362/0.2369 in.) 6.037 mm (0.2377 in.) |
|--|---|

Crankshaft

| | |
|--|--|
| End Play (free) | 0.025/0.703 mm (0.0010/0.028 in.) |
| Ball Bearing | 0.003/0.25 mm (0.0001/0.0010 in.) |
| Bore (in crankcase) New, without Main Bearing | 51.961/51.991 mm (2.0457/2.0469 in.) |
| Bore (in closure plate) New, without Main Bearing | 51.961/51.991 mm (2.0457/2.0469 in.) |
| Flywheel End Main Bearing Journal O.D. O.D.-New O.D.-Max. Wear Limit Max. Taper Max. Out-of-Round | 24.975/24.989 mm (0.9833/0.9838 in.) 24.95 mm (0.9823 in.) 0.025 mm (0.0010 in.) 0.025 mm (0.0010 in.) |
| Closure Plate End Main Bearing Journal O.D. O.D.-New O.D.-Max. Wear Limit Max. Taper Max. Out-of-Round | 24.975/24.989 mm (0.9833/0.9838 in.) 24.95 mm (0.9823 in.) 0.025 mm (0.0010 in.) 0.025 mm (0.0010 in.) |
| Connecting Rod Journal O.D. O.D.-New O.D.-Max. Wear Limit Max. Taper Max. Out-of-Round Width | 29.975/29.985 mm (1.1801/1.1805 in.) 29.920 mm (1.1779 in.) 0.025 mm (0.0010 in.) 0.025 mm (0.0010 in.) 25.02/25.08 mm (0.9850/0.9874 in.) |
| Runout (either end) | 0.025 mm (0.0010 in.) |
| Main Bearing I.D. (Crankcase/Closure Plate) New (installed) | 24.994/25.000 mm (0.9840/0.9842 in.) |

³ Values are in Metric units. Values in parentheses are English equivalents.

⁵ Lubricate threads with engine oil prior to assembly.

CLEARANCE SPECIFICATIONS³

SH265

Cylinder Bore

| | |
|--|---|
| Bore I.D. New Max. Wear Limit Max. Out-of-Round Max. Taper | 70.027/70.035 mm (2.757/2.757 in.) 70.200 mm (2.764 in.) 12.7 microns (0.0005 in.) 12.7 microns (0.0005 in.) |
|--|---|

Cylinder Head

| | |
|----------------------|---------------------|
| Max. Out-of-Flatness | 0.1 mm (0.0039 in.) |
|----------------------|---------------------|

Governor

| | |
|--|---|
| Governor Cross Shaft-to-Crankcase Running Clearance | 0.013/0.075 mm (0.0005/0.0029 in.) |
| Governor Cross Shaft O.D. New Max. Wear Limit | 5.95/5.98 mm (0.2342/0.2354 in.) 5.85 mm (0.2303 in.) |
| Governor Gear Shaft-to-Governor Gear Running Clearance | 0.09/0.19 mm (0.0035/0.0074 in.) |
| Governor Gear Shaft O.D. New Max. Wear Limit | 6.028/6.043 mm (0.2373/0.2379 in.) 6.018 mm (0.2369 in.) |

Ignition

| | |
|----------------|-----------------------|
| Spark Plug Gap | 0.76 mm (0.030 in.) |
| Module Air Gap | 0.254 mm (0.0100 in.) |

Piston, Piston Rings, and Piston Pin

| | |
|--|---|
| Piston-to-Piston Pin Running Clearance | 0.009/0.016 mm (0.0003/0.0006 in.) |
| Piston Pin Bore I.D. New Max. Wear Limit | 18.004/18.005 mm (0.7088/0.7089 in.) 18.05 mm (0.7106 in.) |
| Piston Pin O.D. New Max. Wear Limit | 17.992/17.995 mm (0.7083/0.7084 in.) 17.95 mm (0.7067 in.) |
| Top and Center Compression Ring Side Clearance New Bore Used Bore (max.) | 0.04 mm (0.002 in.) 0.15 mm (0.006 in.) |
| Top and Center Compression Ring End Gap New Bore Used Bore (max.) | 0.325 mm/0.4 (0.013/0.016 in.) 1.00 mm (0.039 in.) |
| Top and Center Compression Ring Width New Bore Used Bore (max.) | 1.5/1.51 mm (0.059/0.059 in.) 1.37 mm (0.054 in.) |
| Oil Control Ring-to-Groove Side Clearance | 0.06/0.18 mm (0.0023/0.0071 in.) |
| Piston Thrust Face O.D. ⁷ New Max. Wear Limit | 67.975/67.985 mm (2.6762/2.6766 in.) 67.85 mm (2.6712 in.) |
| Piston Thrust Face-to-Cylinder Bore Running Clearance New | 0.057/0.075 mm (0.0022/0.0029 in.) |

³ Values are in Metric units. Values in parentheses are English equivalents.

⁷ Measure 15 mm (0.5905 in.) above bottom of piston skirt at right angles to piston pin.

Specifications

CLEARANCE SPECIFICATIONS³

SH265

Valves and Valve Lifters

| | |
|--|--|
| Intake Valve Stem-to-Valve Guide Running Clearance | 0.020/0.044 mm (0.008/0.0017 in.) |
| Exhaust Valve Stem-to-Valve Guide Running Clearance | 0.030/0.054 mm (0.0011/0.0021 in.) |
| Intake Valve Stem O.D. New Max. Wear Limit | 5.480 mm (0.2157 in.) 5.32 mm (0.2094 in.) |
| Exhaust Valve Stem O.D. New Max. Wear Limit | 5.47 mm (0.2153 in.) 5.305 mm (0.2088 in.) |
| Intake Valve Stem to Guide New Max. Wear Limit | 0.024/0.039 mm (0.001/0.002 in.) 0.10 mm (0.0004 in.) |
| Exhaust Valve Stem to Guide New Max. Wear Limit | 0.098/0.112 mm (0.0038/0.0044 in.) 0.12 mm (0.0005 in.) |
| Valve Guide Reamer Size Standard Intake Standard Exhaust | 5.506 mm (0.2168 in.) 5.506 mm (0.2168 in.) |
| Valve Seat Width | 0.800/2.00 mm (0.0315/0.787 in.) |
| Nominal Valve Face Angle | 30°, 45°, 60° |

³Values are in Metric units. Values in parentheses are English equivalents.

GENERAL TORQUE VALUES

| English Fastener Torque Recommendations for Standard Applications | | | | |
|---|---|---|---|--------------------------------------|
| Bolts, Screws, Nuts and Fasteners Assembled Into Cast Iron or Steel | | | | Grade 2 or 5 Fasteners Into Aluminum |
| Size |  Grade 2 |  Grade 5 |  Grade 8 | |
| Tightening Torque: N·m (in. lb.) ± 20% | | | | |
| 8-32 | 2.3 (20) | 2.8 (25) | — | 2.3 (20) |
| 10-24 | 3.6 (32) | 4.5 (40) | — | 3.6 (32) |
| 10-32 | 3.6 (32) | 4.5 (40) | — | — |
| 1/4-20 | 7.9 (70) | 13.0 (115) | 18.7 (165) | 7.9 (70) |
| 1/4-28 | 9.6 (85) | 15.8 (140) | 22.6 (200) | — |
| 5/16-18 | 17.0 (150) | 28.3 (250) | 39.6 (350) | 17.0 (150) |
| 5/16-24 | 18.7 (165) | 30.5 (270) | — | — |
| 3/8-16 | 29.4 (260) | — | — | — |
| 3/8-24 | 33.9 (300) | — | — | — |

| Tightening Torque: N·m (ft. lb.) ± 20% | | | | |
|--|-------------|-------------|-------------|---|
| 5/16-24 | — | — | 40.7 (30) | — |
| 3/8-16 | — | 47.5 (35) | 67.8 (50) | — |
| 3/8-24 | — | 54.2 (40) | 81.4 (60) | — |
| 7/16-14 | 47.5 (35) | 74.6 (55) | 108.5 (80) | — |
| 7/16-20 | 61.0 (45) | 101.7 (75) | 142.5 (105) | — |
| 1/2-13 | 67.8 (50) | 108.5 (80) | 155.9 (115) | — |
| 1/2-20 | 94.9 (70) | 142.4 (105) | 223.7 (165) | — |
| 9/16-12 | 101.7 (75) | 169.5 (125) | 237.3 (175) | — |
| 9/16-18 | 135.6 (100) | 223.7 (165) | 311.9 (230) | — |
| 5/8-11 | 149.5 (110) | 244.1 (180) | 352.6 (260) | — |
| 5/8-18 | 189.8 (140) | 311.9 (230) | 447.5 (330) | — |
| 3/4-10 | 199.3 (147) | 332.2 (245) | 474.6 (350) | — |
| 3/4-16 | 271.2 (200) | 440.7 (325) | 637.3 (470) | — |

| Metric Fastener Torque Recommendations for Standard Applications | | | | | | |
|--|---|---|---|--|---|-------------------------------------|
| Size | Property Class | | | | | Noncritical Fasteners Into Aluminum |
| |  |  |  |  |  | |
| Tightening Torque: N·m (in. lb.) ± 10% | | | | | | |
| M4 | 1.2 (11) | 1.7 (15) | 2.9 (26) | 4.1 (36) | 5.0 (44) | 2.0 (18) |
| M5 | 2.5 (22) | 3.2 (28) | 5.8 (51) | 8.1 (72) | 9.7 (86) | 4.0 (35) |
| M6 | 4.3 (38) | 5.7 (50) | 9.9 (88) | 14.0 (124) | 16.5 (146) | 6.8 (60) |
| M8 | 10.5 (93) | 13.6 (120) | 24.4 (216) | 33.9 (300) | 40.7 (360) | 17.0 (150) |
| Tightening Torque: N·m (ft. lb.) ± 10% | | | | | | |
| M10 | 21.7 (16) | 27.1 (20) | 47.5 (35) | 66.4 (49) | 81.4 (60) | 33.9 (25) |
| M12 | 36.6 (27) | 47.5 (35) | 82.7 (61) | 116.6 (86) | 139.7 (103) | 61.0 (45) |
| M14 | 58.3 (43) | 76.4 (56) | 131.5 (97) | 184.4 (136) | 219.7 (162) | 94.9 (70) |

| Torque Conversions | |
|-----------------------|-----------------------|
| N·m = in. lb. x 0.113 | in. lb. = N·m x 8.85 |
| N·m = ft. lb. x 1.356 | ft. lb. = N·m x 0.737 |

Tools and Aids

Certain quality tools are designed to help you perform specific disassembly, repair, and reassembly procedures. By using these tools, you can properly service engines easier, faster, and safer! In addition, you'll increase your service capabilities and customer satisfaction by decreasing engine downtime.

Here is a list of tools and their source.

SEPARATE TOOL SUPPLIERS

Kohler Tools
Contact your local Kohler source of supply.

SE Tools
415 Howard St.
Lapeer, MI 48446
Phone 810-664-2981
Toll Free 800-664-2981
Fax 810-664-8181

Design Technology Inc.
768 Burr Oak Drive
Westmont, IL 60559
Phone 630-920-1300
Fax 630-920-0011

TOOLS

| Description | Source/Part No. |
|--|--|
| Alcohol Content Tester For testing alcohol content (%) in reformulated/oxygenated fuels. | Kohler 25 455 11-S |
| Camshaft Endplay Plate For checking camshaft endplay. | SE Tools KLR-82405 |
| Camshaft Seal Protector (Aegis) For protecting seal during camshaft installation. | SE Tools KLR-82417 |
| Cylinder Leakdown Tester For checking combustion retention and if cylinder, piston, rings, or valves are worn. Individual component available: Adapter 12 mm x 14 mm (Required for leakdown test on XT-6 engines) | Kohler 25 761 05-S Design Technology Inc. DTI-731-03 |
| Dealer Tool Kit (Domestic) Complete kit of Kohler required tools. Components of 25 761 39-S Ignition System Tester Cylinder Leakdown Tester Oil Pressure Test Kit Rectifier-Regulator Tester (120 V AC/60Hz) | Kohler 25 761 39-S Kohler 25 455 01-S Kohler 25 761 05-S Kohler 25 761 06-S Kohler 25 761 20-S |
| Dealer Tool Kit (International) Complete kit of Kohler required tools. Components of 25 761 42-S Ignition System Tester Cylinder Leakdown Tester Oil Pressure Test Kit Rectifier-Regulator Tester (240 V AC/50Hz) | Kohler 25 761 42-S Kohler 25 455 01-S Kohler 25 761 05-S Kohler 25 761 06-S Kohler 25 761 41-S |
| Digital Vacuum/Pressure Tester For checking crankcase vacuum. Individual component available: Rubber Adapter Plug | Design Technology Inc. DTI-721-01 Design Technology Inc. DTI-721-10 |
| Electronic Fuel Injection (EFI) Diagnostic Software For Laptop or Desktop PC. | Kohler 25 761 23-S |
| EFI Service Kit For troubleshooting and setting up an EFI engine. Components of 24 761 01-S Fuel Pressure Tester Noid Light 90° Adapter Code Plug, Red Wire Code Plug, Blue Wire Shrader Valve Adapter Hose Wire Probe Set (2 pieces regular wire with clip; 1 piece fused wire) Hose Removal Tool, Dual Size/End (also sold as individual Kohler tool) | Kohler 24 761 01-S Design Technology Inc. DTI-019 DTI-021 DTI-023 DTI-027 DTI-029 DTI-037 DTI-031 DTI-033 |
| Flywheel Puller For properly removing flywheel from engine. | SE Tools KLR-82408 |

TOOLS

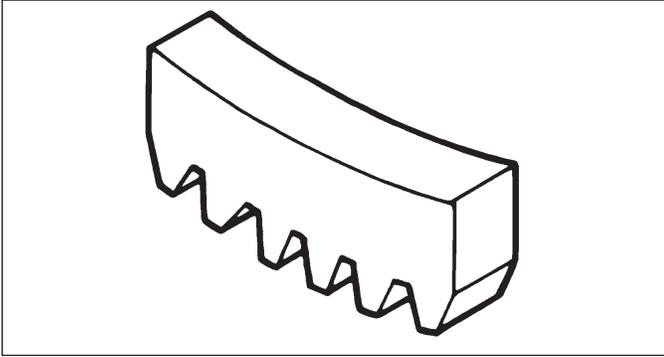
| Description | Source/Part No. |
|--|--|
| Hose Removal Tool, Dual Size/End (also available in EFI Service Kit) Used to properly remove fuel hose from engine components. | Kohler 25 455 20-S |
| Hydraulic Valve Lifter Tool For removing and installing hydraulic lifters. | Kohler 25 761 38-S |
| Ignition System Tester For testing output on all systems, including CD. | Kohler 25 455 01-S |
| Inductive Tachometer (Digital) For checking operating speed (RPM) of an engine. | Design Technology Inc. DTI-110 |
| Offset Wrench (K and M Series) For removing and reinstalling cylinder barrel retaining nuts. | Kohler 52 455 04-S |
| Oil Pressure Test Kit For testing/verifying oil pressure on pressure lubricated engines. | Kohler 25 761 06-S |
| Rectifier-Regulator Tester (120 volt current) Rectifier-Regulator Tester (240 volt current) For testing rectifier-regulators. Components of 25 761 20-S and 25 761 41-S CS-PRO Regulator Test Harness Special Regulator Test Harness with Diode | Kohler 25 761 20-S Kohler 25 761 41-S Design Technology Inc. DTI-031R DTI-033R |
| Spark Advance Module (SAM) Tester For testing SAM (ASAM and DSAM) on engines with SMART-SPARK™. | Kohler 25 761 40-S |
| Starter Servicing Kit (All Starters) For removing and reinstalling drive retaining rings and brushes. Individual component available: Starter Brush Holding Tool (Solenoid Shift) | SE Tools KLR-82411 SE Tools KLR-82416 |
| Triad/OHC Timing Tool Set For holding cam gears and crankshaft in timed position while installing timing belt. | Kohler 28 761 01-S |
| Valve Guide Reamer (K and M Series) For properly sizing valve guides after installation. | Design Technology Inc. DTI-K828 |
| Valve Guide Reamer O.S. (Command Series) For reaming worn valve guides to accept replacement oversize valves. Can be used in low-speed drill press or with handle below for hand reaming. | Kohler 25 455 12-S |
| Reamer Handle For hand reaming using Kohler 25 455 12-S reamer. | Design Technology Inc. DTI-K830 |

AIDS

| Description | Source/Part No. |
|---|---|
| Camshaft Lubricant (Valspar ZZ613) | Kohler 25 357 14-S |
| Dielectric Grease (GE/Novaguard G661) | Kohler 25 357 11-S |
| Dielectric Grease | Loctite® 51360 |
| Kohler Electric Starter Drive Lubricant (Inertia Drive) | Kohler 52 357 01-S |
| Kohler Electric Starter Drive Lubricant (Solenoid Shift) | Kohler 52 357 02-S |
| RTV Silicone Sealant Loctite® 5900® Heavy Body in 4 oz. aerosol dispenser. Only oxime-based, oil resistant RTV sealants, such as those listed, are approved for use. Permatex® the Right Stuff® 1 Minute Gasket™ or Loctite® Nos. 5900® or 5910® are recommended for best sealing characteristics. | Kohler 25 597 07-S Loctite® 5910® Loctite® Ultra Black 598™ Loctite® Ultra Blue 587™ Loctite® Ultra Copper 5920™ Permatex® the Right Stuff® 1 Minute Gasket™ |
| Spline Drive Lubricant | Kohler 25 357 12-S |

Tools and Aids

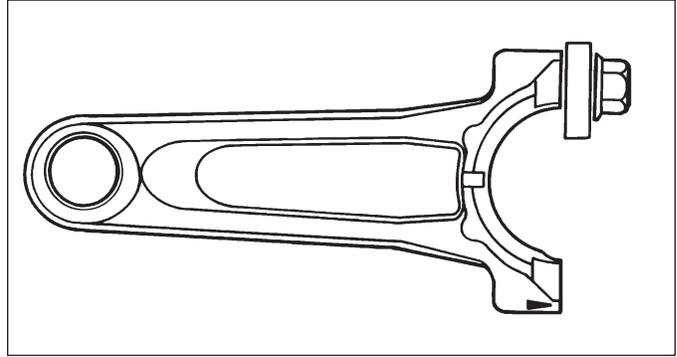
FLYWHEEL HOLDING TOOL



A flywheel holding tool can be made out of an old junk flywheel ring gear and used in place of a strap wrench.

1. Using an abrasive cut-off wheel, cut out a six tooth segment of ring gear as shown.
2. Grind off any burrs or sharp edges.
3. Invert segment and place it between ignition bosses on crankcase so tool teeth engage flywheel ring gear teeth. Bosses will lock tool and flywheel in position for loosening, tightening, or removing with a puller.

ROCKER ARM/CRANKSHAFT TOOL



A spanner wrench to lift rocker arms or turn crankshaft may be made out of an old junk connecting rod.

1. Find a used connecting rod from a 10 HP or larger engine. Remove and discard rod cap.
2. Remove studs of a Posi-Lock rod or grind off aligning steps of a Command rod, so joint surface is flat.
3. Find a 1 in. long capscrew with correct thread size to match threads in connecting rod.
4. Use a flat washer with correct I.D. to slip on capscrew and approximately 1 in. O.D. Assemble capscrew and washer to joint surface of rod.

TROUBLESHOOTING GUIDE

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

Some general common causes of engine troubles are listed below and vary by engine specification. Use these to locate causing factors.

Engine Cranks But Will Not Start

- Battery connected backwards.
- Blown fuse.
- Carburetor solenoid malfunction.
- Choke not closing.
- Clogged fuel line or fuel filter.
- Diode in wiring harness failed in open circuit mode.
- DSAI or DSAM malfunction.
- Empty fuel tank.
- Faulty electronic control unit.
- Faulty ignition coil(s).
- Faulty spark plug(s).
- Fuel pump malfunction-vacuum hose clogged or leaking.
- Fuel shut-off valve closed.
- Ignition module(s) faulty or improperly gapped.
- Insufficient voltage to electronic control unit.
- Interlock switch is engaged or faulty.
- Key switch or kill switch in OFF position.
- Low oil level.
- Quality of fuel (dirt, water, stale, mixture).
- SMART-SPARK™ malfunction.
- Spark plug lead(s) disconnected.

Engine Starts But Does Not Keep Running

- Faulty carburetor.
- Faulty cylinder head gasket.
- Faulty or misadjusted choke or throttle controls.
- Fuel pump malfunction-vacuum hose clogged or leaking.
- Intake system leak.
- Loose wires or connections that intermittently ground ignition kill circuit.
- Quality of fuel (dirt, water, stale, mixture).
- Restricted fuel tank cap vent.

Engine Starts Hard

- Clogged fuel line or fuel filter.
- Engine overheated.
- Faulty ACR mechanism.
- Faulty or misadjusted choke or throttle controls.
- Faulty spark plug(s).
- Flywheel key sheared.
- Fuel pump malfunction-vacuum hose clogged or leaking.
- Interlock switch is engaged or faulty.
- Loose wires or connections that intermittently ground ignition kill circuit.
- Low compression.
- Quality of fuel (dirt, water, stale, mixture).
- Weak spark.

Engine Will Not Crank

- Battery is discharged.
- Faulty electric starter or solenoid.
- Faulty key switch or ignition switch.
- Interlock switch is engaged or faulty.
- Loose wires or connections that intermittently ground ignition kill circuit.
- Pawls not engaging in drive cup.
- Seized internal engine components.

Engine Runs But Misses

- Carburetor adjusted incorrectly.
- Engine overheated.
- Faulty spark plug(s).
- Ignition module(s) faulty or improperly gapped.
- Incorrect crankshaft position sensor air gap.
- Interlock switch is engaged or faulty.
- Loose wires or connections that intermittently ground ignition kill circuit.
- Quality of fuel (dirt, water, stale, mixture).
- Spark plug lead(s) disconnected.
- Spark plug lead boot loose on plug.
- Spark plug lead loose.

Engine Will Not Idle

- Engine overheated.
- Faulty spark plug(s).
- Idle fuel adjusting needle(s) improperly set.
- Idle speed adjusting screw improperly set.
- Inadequate fuel supply.
- Low compression.
- Quality of fuel (dirt, water, stale, mixture).
- Restricted fuel tank cap vent.

Engine Overheats

- Cooling fan broken.
- Excessive engine load.
- Fan belt failed/off.
- Faulty carburetor.
- High crankcase oil level.
- Lean fuel mixture.
- Low cooling system fluid level.
- Low crankcase oil level.
- Radiator, and/or cooling system components clogged, restricted, or leaking.
- Water pump belt failed/broken.
- Water pump malfunction.

Engine Knocks

- Excessive engine load.
- Hydraulic lifter malfunction.
- Incorrect oil viscosity/type.
- Internal wear or damage.
- Low crankcase oil level.
- Quality of fuel (dirt, water, stale, mixture).

Troubleshooting

Engine Loses Power

- Dirty air cleaner element.
- Engine overheated.
- Excessive engine load.
- Restricted exhaust.
- Faulty spark plug(s).
- High crankcase oil level.
- Incorrect governor setting.
- Low battery.
- Low compression.
- Low crankcase oil level.
- Quality of fuel (dirt, water, stale, mixture).

Engine Uses Excessive Amount of Oil

- Loose or improperly torqued fasteners.
- Blown head gasket/overheated.
- Breather reed broken.
- Clogged, broken, or inoperative crankcase breather.
- Crankcase overfilled.
- Incorrect oil viscosity/type.
- Worn cylinder bore.
- Worn or broken piston rings.
- Worn valve stems/valve guides.

Oil Leaks from Oil Seals, Gaskets

- Breather reed broken.
- Clogged, broken, or inoperative crankcase breather.
- Loose or improperly torqued fasteners.
- Piston blow by, or leaky valves.
- Restricted exhaust.

EXTERNAL ENGINE INSPECTION

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

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

- Check for buildup of dirt and debris on crankcase, cooling fins, grass screen, and other external surfaces. Dirt or debris on these areas can cause overheating.
- Check for obvious fuel and oil leaks, and damaged components. Excessive oil leakage can indicate a clogged or inoperative breather, worn or damaged seals or gaskets, or loose fasteners.
- Check air cleaner cover and base for damage or indications of improper fit and seal.
- Check air cleaner element. Look for holes, tears, cracked or damaged sealing surfaces, or other damage that could allow unfiltered air into engine. A dirty or clogged element could indicate insufficient or improper maintenance.
- Check carburetor throat for dirt. Dirt in throat is further indication that air cleaner was not functioning properly.
- Check if oil level is within operating range on dipstick. If it is above, sniff for gasoline odor.
- Check condition of oil. Drain oil into a container; it should flow freely. Check for metal chips and other foreign particles.

Sludge is a natural by-product of combustion; a small accumulation is normal. Excessive sludge formation could indicate over rich fuel settings, weak ignition, overextended oil change interval or wrong weight or type of oil was used.

CLEANING ENGINE

| | |
|---|--|
|  | ⚠ WARNING |
| | Cleaning Solvents can cause severe injury or death. Use only in well ventilated areas away from ignition sources. |
| Carburetor cleaners and solvents are extremely flammable. Follow cleaner manufacturer's warnings and instructions on its proper and safe use. Never use gasoline as a cleaning agent. | |

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

Make sure all traces of cleaner are removed before engine is reassembled and placed into operation. Even small amounts of these cleaners can quickly break down lubricating properties of engine oil.

CRANKCASE VACUUM TEST

| | |
|---|--|
|  | ⚠ WARNING |
| | Carbon Monoxide can cause severe nausea, fainting or death. Avoid inhaling exhaust fumes. |
| Engine exhaust gases contain poisonous carbon monoxide. Carbon monoxide is odorless, colorless, and can cause death if inhaled. | |

| | |
|--|--|
|  | ⚠ WARNING |
| | Rotating Parts can cause severe injury. Stay away while engine is in operation. |
| Keep hands, feet, hair, and clothing away from all moving parts to prevent injury. Never operate engine with covers, shrouds, or guards removed. | |

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

Crankcase vacuum is best measured with either a water manometer or a vacuum gauge. Complete instructions are provided in kits.

To test crankcase vacuum with manometer:

1. Insert rubber stopper into oil fill hole. Be sure pinch clamp is installed on hose and use tapered adapters to connect hose between stopper and one manometer tube. Leave other tube open to atmosphere. Check that water level in manometer is at 0 line. Make sure pinch clamp is closed.
2. Start engine and run no-load high speed.
3. Open clamp and note water level in tube.
Level in engine side should be a minimum of 10.2 cm (4 in.) above level in open side.
If level in engine side is less than specified (low/no vacuum), or level in engine side is lower than level in open side (pressure), check for conditions in table below.
4. Close pinch clamp before stopping engine.

To test crankcase vacuum with vacuum/pressure gauge:

1. Remove dipstick or oil fill plug/cap.
2. Install adapter into oil fill//dipstick tube opening, upside down over end of a small diameter dipstick tube, or directly into engine if a tube is not used. Insert barbed gauge fitting into hole in stopper.
3. Run engine and observe gauge reading.
Analog tester—needle movement to left of 0 is a vacuum, and movement to right indicates a pressure.
Digital tester—depress test button on top of tester.
Crankcase vacuum should be a minimum of 10.2 cm (4 in.) of water. If reading is below specification, or if pressure is present, check table below for possible causes and conclusions.

| Condition | Conclusion |
|---|--|
| Crankcase breather clogged or inoperative. | NOTE: If breather is integral part of valve cover and cannot be serviced separately, replace valve cover and recheck pressure. Disassemble breather, clean parts thoroughly, check sealing surfaces for flatness, reassemble, and recheck pressure. |
| Seals and/or gaskets leaking. Loose or improperly torque fasteners. | Replace all worn or damaged seals and gaskets. Make sure all fasteners are tightened securely. Use appropriate torque valves and sequences when necessary. |
| Piston blow by or leaky valves (confirm by inspecting components). | Recondition piston, rings, cylinder bore, valves and valves guides. |
| Restricted exhaust. | Check exhaust screen/spark arrestor (if equipped). Clean or replace as needed. Repair or replace any other damaged/restricted muffler or exhaust system parts. |

Troubleshooting

COMPRESSION TEST

For Command Twins:

A compression test is best performed on a warm engine. Clean any dirt or debris away from base of spark plug(s) before removing them. Be sure choke is off, and throttle is wide open during test. Compression should be at least 160 psi and should not vary more than 15% between cylinders.

All other models:

These engines are equipped with an automatic compression release (ACR) mechanism. It is difficult to obtain an accurate compression reading because of ACR mechanism. As an alternative, use cylinder leakdown test described below.

CYLINDER LEAKDOWN TEST

A cylinder leakdown test can be a valuable alternative to a compression test. By pressurizing combustion chamber from an external air source you can determine if valves or rings are leaking, and how badly.

Cylinder leakdown tester is a relatively simple, inexpensive leakdown tester for small engines. This tester includes a quick-connect for attaching adapter hose and a holding tool.

1. Run engine for 3-5 minutes to warm it up.
2. Remove spark plug(s) and air filter from engine.
3. Rotate crankshaft until piston (of cylinder being tested) is at top dead center (TDC) of compression stroke. Hold engine in this position while testing. Holding tool supplied with tester can be used if PTO end of crankshaft is accessible. Lock holding tool onto crankshaft. Install a 3/8 in. breaker bar into hole/slot of holding tool, so it is perpendicular to both holding tool and crankshaft PTO.

If flywheel end is more accessible, use a breaker bar and socket on flywheel nut/screw to hold it in position. An assistant may be needed to hold breaker bar during testing. If engine is mounted in a piece of equipment, it may be possible to hold it by clamping or wedging a driven component. Just be certain that engine cannot rotate off of TDC in either direction.

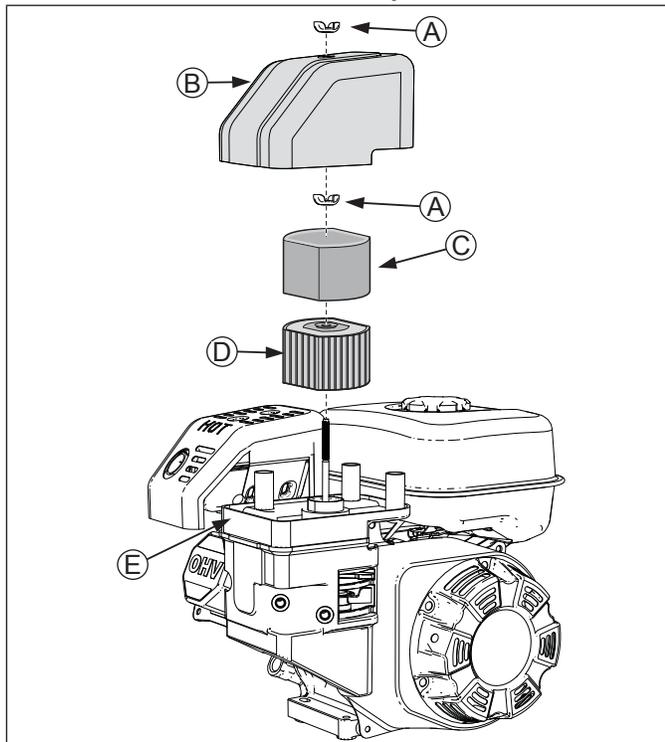
4. Install adapter into spark plug hole, but do not attach it to tester at this time.
5. Turn regulator knob completely counterclockwise.
6. Connect an air source of at least 50 psi to tester.
7. Turn regulator knob clockwise (increase direction) until gauge needle is in yellow set area at low end of scale.
8. Connect tester quick-connect to adapter hose. While firmly holding engine at TDC, gradually open tester valve. Note gauge reading and listen for escaping air at combustion air intake, exhaust outlet, and crankcase breather.

| Condition | Conclusion |
|--|---|
| Air escaping from crankcase breather. | Ring or cylinder worn. |
| Air escaping from exhaust system. | Defective exhaust valve/improper seating. |
| Air escaping from intake. | Defective intake valve/improper seating. |
| Gauge reading in low (green) zone. | Piston rings and cylinder in good condition. |
| Gauge reading in moderate (yellow) zone. | Engine is still usable, but there is some wear present. Customer should start planning for overhaul or replacement. |
| Gauge reading in high (red) zone. | Rings and/or cylinder have considerable wear. Engine should be reconditioned or replaced. |

AIR CLEANER

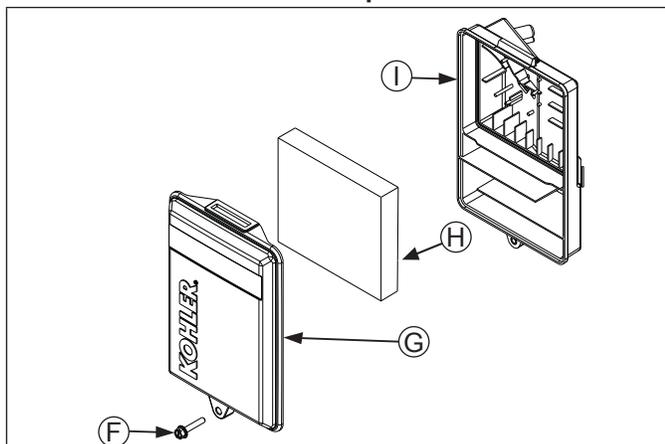
These systems are CARB/EPA certified and components should not be altered or modified in any way.

Dual-Element Air Cleaner Components



| | | | |
|----------|------------------|----------|-------------------|
| A | Wing Nut | B | Air Cleaner Cover |
| C | Precleaner | D | Paper Element |
| E | Air Cleaner Base | | |

Low-Profile Air Cleaner Components



| | | | |
|----------|-------------------|----------|--------------|
| F | Air Cleaner Base | G | Foam Element |
| H | Air Cleaner Cover | I | Screw |

NOTE: Operating engine with loose or damaged air cleaner components could cause premature wear and failure. Replace all bent or damaged components.

NOTE: Paper element cannot be blown out with compressed air.

Dual-Element

Remove wing nut and air cleaner cover.

Precleaner

1. Remove precleaner from paper element.
2. Replace or wash precleaner in warm water with detergent. Rinse and allow to air dry.
3. Reinstall precleaner over paper element.

Paper Element

1. Remove wing nut (if equipped) and paper element with precleaner.
2. Separate precleaner from element; service precleaner and replace element.
3. Reinstall precleaner over paper element; secure with wing nut (if equipped).

Reinstall air cleaner cover and secure with wing nut.

Low-Profile

1. Remove screw and air cleaner cover.
2. Remove foam element from base.
3. Wash foam element in warm water with detergent. Rinse and allow to air dry.
4. Lightly oil foam element with new engine oil; squeeze out excess oil.
5. Reinstall foam element into base.
6. Reinstall cover and secure with screw.

BREATHER TUBE

Make sure both ends of breather tube are properly connected.

AIR COOLING

| | |
|--|--|
| | WARNING |
| | <p>Hot Parts can cause severe burns. Do not touch engine while operating or just after stopping.</p> |
| <p>Never operate engine with heat shields or guards removed.</p> | |

Proper cooling is essential. To prevent over heating, clean screens, cooling fins, and other external surfaces of engine. Avoid spraying water at wiring harness or any electrical components. Refer to Maintenance Schedule.

Fuel System

Typical carbureted fuel system and related components include:

- Fuel tank.
- Fuel lines.
- In-line fuel filter.
- Fuel tank filter.
- Carburetor.
- Fuel strainer screen in carburetor.

Fuel tank outlet is located above carburetor inlet, allowing gravity to feed fuel through in-line filter and fuel line to carburetor.

Fuel then enters carburetor through a fuel shut-off valve and a fine screen/sediment bowl, and then to carburetor float bowl. Fuel is drawn into carburetor body and is mixed with air. This fuel-air mixture is then burned in engine combustion chamber.

FUEL RECOMMENDATIONS

Refer to Maintenance.

FUEL LINE

Low permeation fuel line must be installed on carbureted Kohler Co. engines to maintain EPA and CARB regulatory compliance.

FUEL FILTER

Fuel Tank Filter

A serviceable fuel tank filter is located under fuel tank cap, in filler neck.

Daily or as required clean filter of any accumulation as follows:

1. Remove fuel tank cap and filter.
2. Clean filter with solvent, replace if damaged.
3. Wipe filter and insert it.
4. Tighten fuel tank cap securely.

FUEL SYSTEM TESTS

When engine starts hard or turns over but will not start, fuel system might be causing problems. Test fuel system by performing following test.

1. Check for fuel in combustion chamber.
 - a. Disconnect and ground spark plug lead.
 - b. Close choke on carburetor.
 - c. Crank engine several times.
 - d. Remove spark plug and check for fuel at tip.
2. Check for fuel flow from tank to carburetor.
 - a. Remove fuel line from inlet fitting of carburetor.
 - b. Use an approved fuel container to catch fuel, and hold line below bottom of tank to observe fuel flow.
3. Check operation of fuel shut-off valve.
 - a. Remove fuel sediment bowl under inlet fitting of carburetor.
 - b. Turn fuel shut-off valve ON and OFF and observe operation.

Fuel Shut-Off

| | |
|---|---|
|  | ⚠ WARNING |
| | Explosive Fuel can cause fires and severe burns. Do not fill fuel tank while engine is hot or running. |
| 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. Spilled fuel could ignite if it comes in contact with hot parts or sparks from ignition. Never use gasoline as a cleaning agent. | |

Engines are equipped with a fuel shut-off located at carburetor. It controls fuel flow from tank to carburetor.

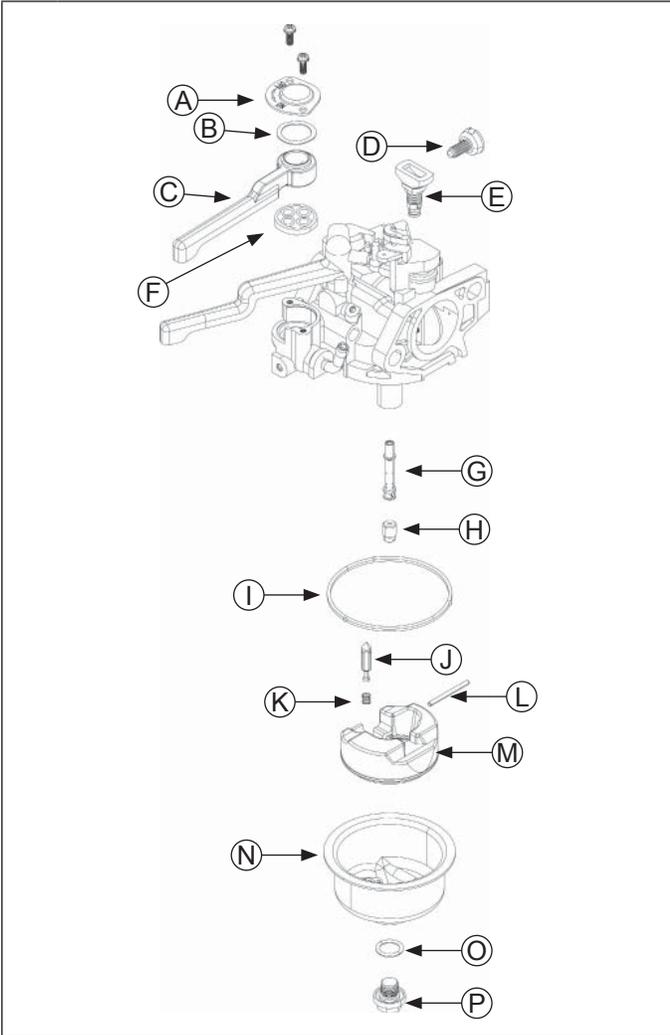
1. Stop engine.
2. Turn fuel shut-off lever to OFF position.
3. Remove fuel shut-off cup.
4. Clean fuel shut-off cup with solvent and wipe dry.
5. Inspect for worn or damaged O-ring; replace as necessary.
6. Place O-ring on fuel shut-off cup. Install fuel shut-off cup and O-ring; rotate until finger tight. Turn with a wrench 1/2 to 3/4 full turn.
7. Turn fuel shut-off lever to ON position and check for leaks. If fuel shut-off cup leaks, repeat steps 5 and 6.
8. Tighten fuel tank cap securely.

| Condition | Conclusion |
|-------------------------------|--|
| Fuel at tip of spark plug. | Fuel is reaching combustion chamber. |
| No fuel at tip of spark plug. | Check fuel flow from fuel tank (step 2). |
| Fuel flows from fuel line. | Check operation of fuel shut-off valve (step 3). |
| No fuel flow from fuel line. | Check fuel tank vent, in-line filter threaded into tank, and fuel line. Correct any observed problem and reconnect line. |
| Fuel flows from valve. | Check for dirt and water in sediment bowl and screen. Clean bowl and screen as needed. Check for faulty carburetor, refer to Carburetor. |
| No fuel flows from valve. | Check for a restriction in fuel shut-off valve or inlet elbow. |

CARBURETOR

| | | |
|---|---|---|
|  |  WARNING | 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. Spilled fuel could ignite if it comes in contact with hot parts or sparks from ignition. Never use gasoline as a cleaning agent. |
| | Explosive Fuel can cause fires and severe burns. Do not fill fuel tank while engine is hot or running. | |

Typical One-Barrel Carburetor Components



| | | | |
|----------|-----------------------------|----------|--------------------------------|
| A | Fuel Shut-Off | B | Wave Washer |
| C | Fuel Shut-Off Valve | D | Low Idle Speed Adjusting Screw |
| E | Idle Jet | F | Fuel Shut-Off Gasket |
| G | Main Nozzle Tube | H | Main Jet |
| I | Bowl Gasket | J | Fuel Inlet Needle |
| K | Spring | L | Hinge Pin |
| M | Float | N | Fuel Bowl |
| O | Bowl Retaining Screw Gasket | P | Bowl Retaining Screw |

These engines are equipped with a fixed main jet carburetor. Carburetor is designed to deliver correct fuel-to-air mixture to engine under all operating conditions. Idle mixture is set at factory and cannot be adjusted.

Troubleshooting Checklist

- When engine starts hard, runs rough, or stalls at low idle speed, check these areas before adjusting or disassembling carburetor.
1. Make sure fuel tank is filled with clean, fresh gasoline.
 2. Make sure fuel tank cap vent is not blocked and is operating properly.
 3. Make sure fuel is reaching carburetor. This includes checking fuel shut-off valve, fuel tank filter screen, in-line fuel filter, fuel lines and fuel pump for restrictions or faulty components as necessary.
 4. Make sure air cleaner base and carburetor are securely fastened to engine using gaskets in good condition.
 5. Make sure air cleaner element (including pre-cleaner if equipped) is clean and all air cleaner components are fastened securely.
 6. Make sure ignition system, governor system, exhaust system, and throttle and choke controls are operating properly.

Fuel System

Troubleshooting-Carburetor Related Causes

| Condition | Possible Cause | Conclusion |
|--|---|---|
| Engine starts hard, runs rough, or stalls at idle speed. | Low idle fuel mixture (some models)/ speed improperly adjusted. | Adjust idle speed screw or clean carburetor. |
| Engine runs rich (indicated by black, sooty exhaust smoke, misfiring, loss of speed and power, governor hunting, or excessive throttle opening). | Clogged air cleaner. | Clean or replace air cleaner. |
| | Choke partially closed during operation. | Check choke lever/linkage to ensure choke is operating properly. |
| | Dirt under fuel inlet needle. | Remove needle; clean needle and seat and blow with compressed air. |
| | Bowl vent or air bleeds plugged. | Clean vent, ports, and air bleeds. Blow out all passages with compressed air. |
| | Leaky, cracked, or damaged float. | Submerge float to check for leaks. |
| Engine runs lean (indicated by misfiring, loss of speed and power, governor hunting, or excessive throttle opening). | Intake air leak. | Check if carburetor is loose or one of intake gaskets is leaking. |
| | Idle holes plugged; dirt in fuel delivery channels. | Clean main fuel jet and all passages; blow out with compressed air. |
| Fuel leaks from carburetor. | Float damaged. | Submerge float to check for leaks. Replace float. |
| | Dirt under fuel inlet needle. | Remove needle; clean needle and seat and blow with compressed air. |
| | Bowl vents plugged. | Blow out with compressed air. |
| | Carburetor bowl gasket leaks. | Replace gasket. |

Carburetor Circuits

Float

Fuel level in bowl is maintained by float and fuel inlet needle. Buoyant force of float stops fuel flow when engine is at rest. When fuel is being consumed, float will drop and fuel pressure will push inlet needle away from seat, allowing more fuel to enter bowl. When demand ceases, buoyant force of float will again overcome fuel pressure, rising to predetermined setting and stop flow.

Slow and Mid-Range

At low speeds engine operates only on slow circuit. As a metered amount of air is drawn through slow air bleed jets, fuel is drawn through main jet and further metered through slow jet. Air and fuel are mixed in body of slow jet and exit to idle progression (transfer port) chamber. From idle progression chamber, air fuel mixture is metered through idle port passage. At low idle air/fuel mixture is controlled by setting of idle fuel adjusting screws. This mixture is then mixed with main body of air and delivered to engine. As throttle plate opening increases, greater amounts of air/fuel mixture are drawn in through fixed and metered idle progression holes. As throttle plate opens further, vacuum signal becomes great enough at venturi so main circuit begins to work.

Main (high-speed)

At high speeds/loads engine operates on main circuit. As a metered amount of air is drawn through air jet, fuel is drawn through main jet. Air and fuel are mixed in main nozzles then enters main body of airflow where further mixing of fuel and air occurs. This mixture is then delivered to combustion chamber. Carburetor has a fixed main circuit; no adjustment is possible.

Carburetor Adjustments

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

Carburetor is designed to deliver correct fuel-to-air mixture to engine under all operating conditions. Main fuel jet is calibrated at factory and is not adjustable. Idle fuel adjusting needles are also set at factory and are not adjustable.

Low Idle Speed (RPM) Adjustment

NOTE: Actual low idle speed depends on application. Refer to equipment manufacturer's recommendations. Low idle speed for basic engines is 1800 RPM.

1. Place throttle control into idle or slow position. Turn low idle speed adjusting screw in or out to obtain allow idle speed of 1800 RPM (\pm 75 RPM).

Carburetor Servicing

| | |
|---|--|
|    | ⚠ WARNING |
| | <p>Accidental Starts can cause severe injury or death.</p> <p>Disconnect and ground spark plug lead(s) before servicing.</p> |
| <p>Before working on engine or equipment, disable engine as follows: 1) Disconnect spark plug lead(s). 2) Disconnect negative (-) battery cable from battery.</p> | |

NOTE: Main and slow jets are fixed and size specific and can be removed if required. Fixed jets for high altitudes are available.

- Inspect carburetor body for cracks, holes, and other wear or damage.
 - Inspect float for cracks, holes, and missing or damaged float tabs. Check float hinge and shaft for wear or damage.
 - Inspect fuel inlet needle and seat for wear or damage.
1. Perform removal procedures for appropriate air cleaner and carburetor outlined in Disassembly.
 2. Clean exterior surfaces of dirt or foreign material before disassembling carburetor. Remove bowl retaining screws, and carefully separate fuel bowl from carburetor. Do not damage fuel bowl O-rings. Transfer any remaining fuel into an approved container. Save all parts. Fuel can also be drained prior to bowl removal by loosening/removing bowl drain screw.
 3. Remove float pin and inlet needle. Seat for inlet needle is not serviceable and should not be removed.
 4. Clean carburetor bowl and inlet seat areas as required.
 5. Carefully remove main jet from carburetor. After main jet is removed, main nozzles can be removed through bottom of main towers. Note orientation/direction of nozzles. End with 2 raised shoulders should be out/down adjacent to main jets.
 6. Save parts for cleaning and reuse unless a jet kit is also being installed. Clean slow jets using compressed air or carburetor cleaner, do not use wire.

NOTE: There are 2 O-rings on body of idle jet.

Carburetor is now disassembled for appropriate cleaning and installation of parts in overhaul kit. See instructions provided with repair kits for more detailed information.

High Altitude Operation

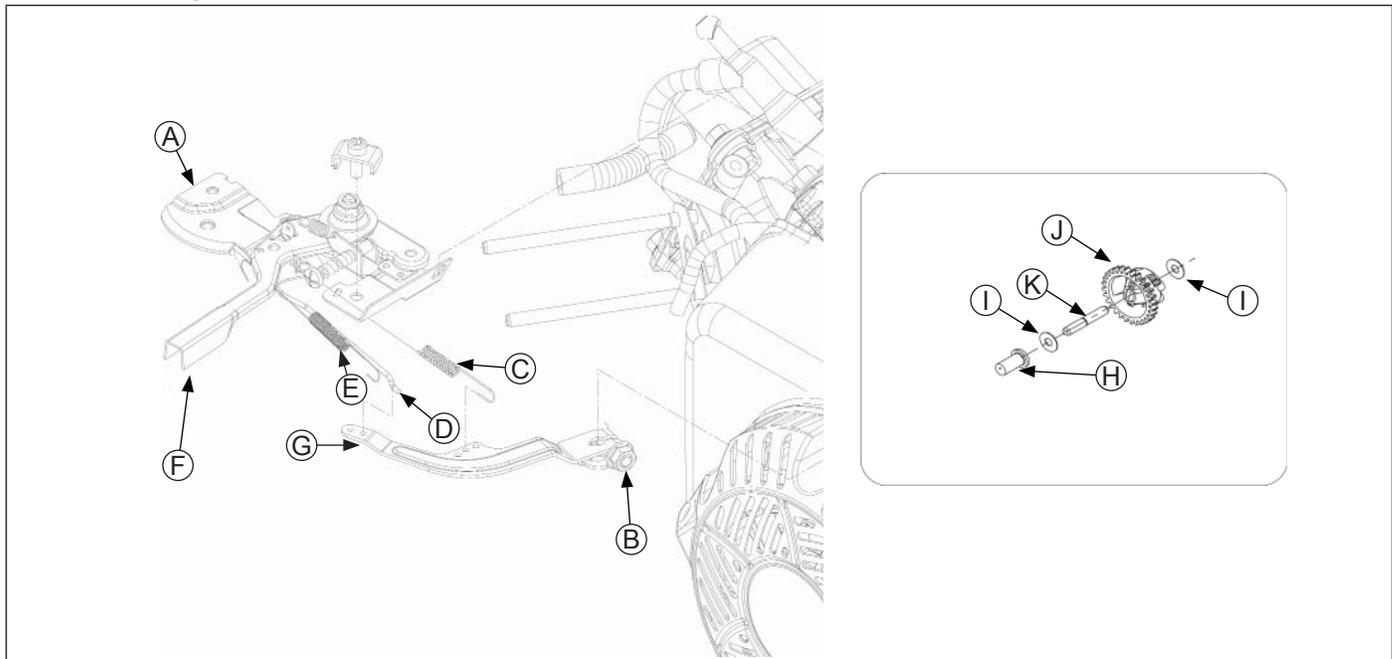
Engines may require a high altitude carburetor kit to ensure correct engine operation at altitudes above 1219 meters (4000 ft.). To obtain high altitude kit information or to find a Kohler authorized dealer visit KohlerEngines.com or call 1-800-544-2444 (U.S. and Canada).

This engine should be operated in its original configuration below 1219 meters (4000 ft.) as damage may occur if high altitude carburetor kit is installed and operated below 1219 meters (4000 ft.).

Governor System

GOVERNOR

Governor Components



| | | | | | | | |
|----------|------------------|----------|------------------------|----------|---------------------|----------|---------------|
| A | Control Assembly | B | Nut | C | Governor Spring | D | Throttle Link |
| E | Dampening Spring | F | Throttle Control Lever | G | Governor Lever | H | Cup |
| I | Washer | J | Governor Gear | K | Governor Gear Shaft | | |

Governed speed setting is determined by position of throttle control. It can be variable or constant, depending on engine application.

Governor is designed to hold engine speed constant under changing load conditions. Most engines are equipped with a centrifugal flyweight mechanical governor. Governor gear/flyweight mechanism of mechanical governor is mounted inside crankcase and is driven off gear on crankshaft.

This governor design works as follows:

- Centrifugal force acting on rotating governor gear assembly causes flyweights to move outward as speed increases. Governor spring tension moves them inward as speed decreases.
- As flyweights move outward, they cause regulating pin to move outward.
- Regulating pin contacts tab on cross shaft causing shaft to rotate.
- One end of cross shaft protrudes through crankcase. Rotating action of cross shaft is transmitted to throttle lever of carburetor through external throttle linkage.
- When engine is at rest, and throttle is in fast position, tension of governor spring holds throttle plate open. When engine is operating, governor gear assembly is rotating. Force applied by regulating pin against cross shaft tends to close throttle plate. Governor spring tension and force applied by regulating pin balance each other during operation, to maintain engine speed.

- When load is applied and engine speed and governor gear speed decreases, governor spring tension moves governor arm to open throttle plate wider. This allows more fuel into engine, increasing engine speed. As speed reaches governed setting, governor spring tension and force applied by regulating pin will again offset each other to hold a steady engine speed.

Governor Adjustments

Initial Adjustment Procedure

NOTE: Make sure carburetor is mounted and secured in place when adjustment is being made/checked.

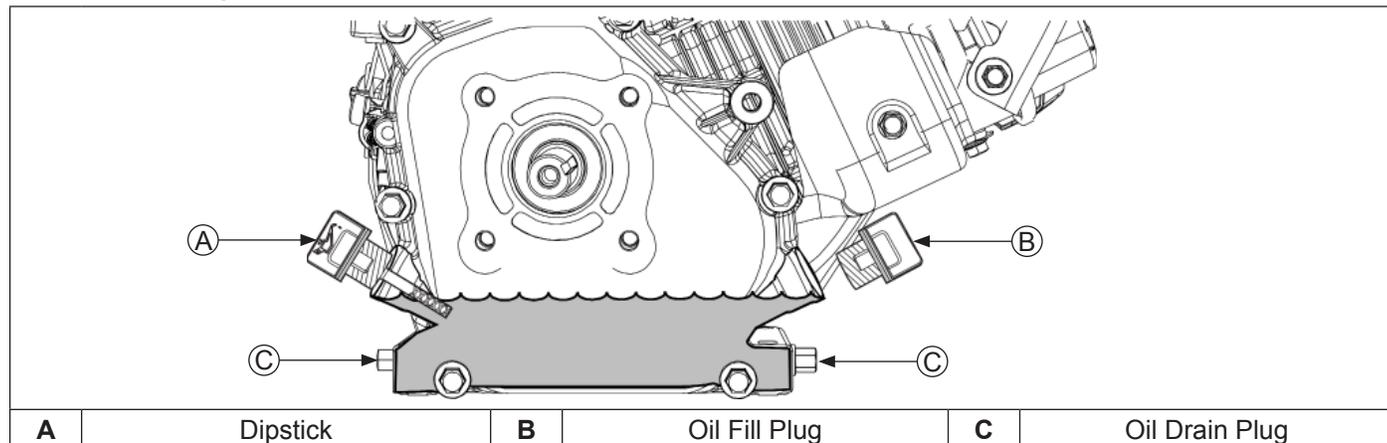
Make this initial adjustment whenever governor lever is loosened or removed from cross shaft. To ensure proper setting, make sure throttle linkage is connected to governor lever and to carburetor throttle lever.

Adjust as follows:

1. Close fuel shut-off valve.
2. Remove air cleaner outer cover. Then either reposition fuel tank to access governor shaft and lever joint, or disconnect fuel line and remove tank from engine.
3. Loosen governor lever mounting nut.
4. Move governor lever clockwise until it stops.
5. Rotate governor shaft clockwise until it stops.
6. Hold both in this position and torque governor lever nut to 10 N·m (88.5 in. lb.).

These engines use a splash lubrication system, supplying necessary lubrication to crankshaft, camshaft, connecting rod and valve train components.

Lubrication Components



OIL RECOMMENDATIONS

Refer to Maintenance.

CHECK OIL LEVEL

NOTE: To prevent extensive engine wear or damage, never run engine with oil level below or above operating range indicator on dipstick.

Ensure engine is cool. Clean oil fill/dipstick areas of any debris.

1. Remove dipstick; wipe oil off.
2. Reinsert dipstick into tube; rest on oil fill neck; turn counterclockwise until cap drops down to lowest point of thread leads; do not thread cap onto tube.
 - a. Remove dipstick; check oil level. Level should be at top of indicator on dipstick.
 - or
 - b. Remove oil fill plug. Level should be up to point of overflowing filler neck.
3. If oil is low, add oil up to point of overflowing filler neck.
4. Reinstall dipstick or oil fill plug and tighten securely.

CHANGE OIL

Change oil while engine is warm.

1. Clean area around oil fill plug/dipstick and drain plug.
2. Remove drain plug and oil fill plug/dipstick. Drain oil completely.
3. Reinstall drain plug. Torque 18 N·m (13 ft. lb.).
4. Fill crankcase with new oil, up to point of overflowing filler neck.
5. Reinstall oil fill plug/dipstick and tighten securely.
6. Dispose of used oil in accordance with local ordinances.

OIL SENTRY™ (if equipped)

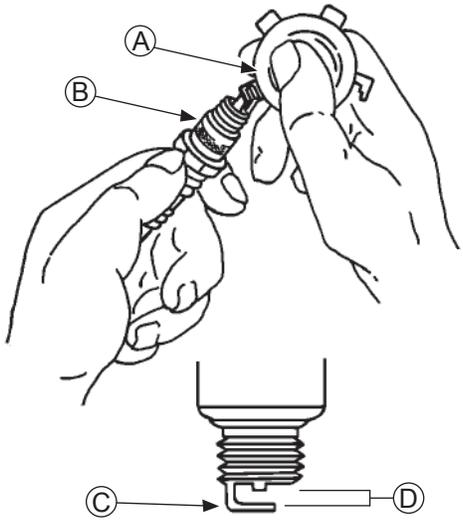
This switch is designed to prevent engine from starting in a low oil or no oil condition. Oil Sentry™ may not shut down a running engine before damage occurs. In some applications this switch may activate a warning signal. Read your equipment manuals for more information. For testing procedures refer to Electronic Ignition Systems and Oil Sentry™ Tests.

Electrical System

SPARK PLUGS

| | |
|---|---|
|  | ⚠ CAUTION |
| | Electrical Shock can cause injury. Do not touch wires while engine is running. |

Spark Plug Component and Details



| | | | |
|----------|------------------|----------|------------|
| A | Wire Gauge | B | Spark Plug |
| C | Ground Electrode | D | Gap |

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

Engine misfire or starting problems are often caused by a spark plug that has improper gap or is in poor condition.

Engine is equipped with following spark plugs:

| | |
|-------------|--------------------|
| Gap | 0.76 mm (0.03 in.) |
| Thread Size | 14 mm |
| Reach | 19.1 mm (3/4 in.) |
| Hex Size | 15.9 mm (5/8 in.) |

Refer to Maintenance for Repairs/Service Parts.

Service

Clean out spark plug recess. Remove plug and replace.

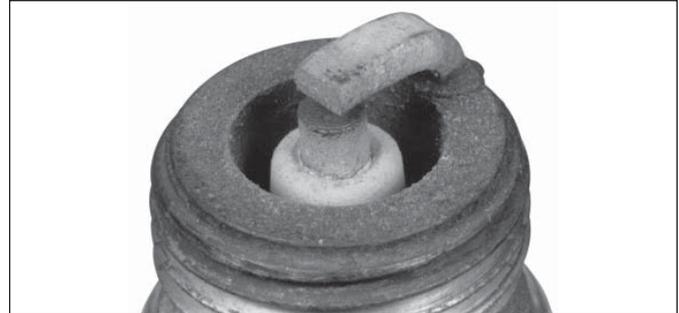
1. Check gap using wire feeler gauge. Adjust gap to 0.76 mm (0.03 in.).
2. Install plug into cylinder head.
3. Torque plug to 27 N·m (20 ft. lb.).

Inspection

Inspect each spark plug as it is removed from cylinder head. Deposits on tip are an indication of general condition of piston rings, valves, and carburetor.

Normal and fouled plugs are shown in following photos:

Normal



Plug taken from an engine operating under normal conditions will have light tan or gray colored deposits. If center electrode is not worn, plug can be set to proper gap and reused.

Worn



On a worn plug, center electrode will be rounded and gap will be greater than specified gap. Replace a worn spark plug immediately.

Wet Fouled



A wet plug is caused by excess fuel or oil in combustion chamber. Excess fuel could be caused by a restricted air cleaner, a carburetor problem, or operating engine with too much choke. Oil in combustion chamber is usually caused by a restricted air cleaner, a breather problem, worn piston rings, or valve guides.

Carbon Fouled



Soft, sooty, black deposits indicate incomplete combustion caused by a restricted air cleaner, over rich carburetion, weak ignition, or poor compression.

Overheated



Chalky, white deposits indicate very high combustion temperatures. This condition is usually accompanied by excessive gap erosion. Lean carburetor settings, an intake air leak, or incorrect spark timing are normal causes for high combustion temperatures.

BATTERY

A 12 volt battery (not furnished) with a minimum current rating of 230 cold cranking amps/18 amp hours should be sufficient for cranking most electric start engine models. Actual cold cranking requirement depends on engine size, application and starting temperatures. Cranking requirements increase as temperatures decrease and battery capacity shrinks. Refer to equipment's operating instructions for specific battery requirements.

If battery charge is insufficient to turn over engine, recharge battery.

Battery Maintenance

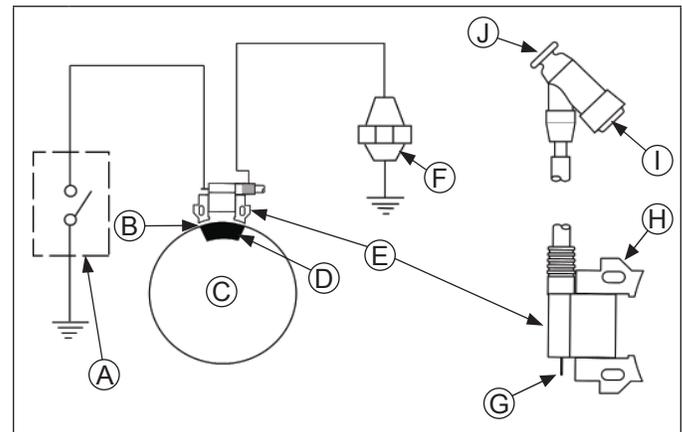
Regular maintenance is necessary to prolong battery life.

Battery Test

To test battery, follow manufacturer's instructions.

ELECTRONIC IGNITION SYSTEM

Inductive Discharge Ignition System Components



| | | | |
|----------|--|----------|------------------------------|
| A | Kill Switch/Off Position of Key Switch | B | Air Gap 0.254 mm (0.010 in.) |
| C | Flywheel | D | Magnet |
| E | Ignition Module | F | Spark Plug |
| G | Kill Terminal | H | Lamination |
| I | Spark Plug Terminal | J | Spark Plug Boot |

These engines are equipped with a dependable magneto breakerless ignition. In such a system, electrical energy is generated by cutting of magnetic flux lines generated from ignition magnet on engine flywheel via prescribed air gap as it passes ignition module. This energy is transferred through ignition module laminations and is then converted in module electronics and stored in module primary coil, as a current. Stored energy is transferred at correct moment by triggering a semiconductor switch inside module. Electrical break by switch initiates energy transfer by causing collapse of magnetic field at coil primary. This includes a voltage at coil primary that is amplified via transformer action at coil secondary. Amplitude of voltage at coil secondary is sufficient to jump gap at spark plug, igniting fuel air mixture in gap and initiating combustion. Note that by design, these modules only will provide proper function if mounted in correct orientation.

This ignition system is designed to be trouble free for life of engine. Other than periodically checking/replacing spark plugs, no maintenance or timing adjustments are necessary or possible. Mechanical systems do occasionally fail or break down. Refer to Troubleshooting to determine root of a reported problem.

Reported ignition problems are most often due to poor connections. Before beginning test procedure, check all external wiring. Be certain all ignition-related wires are connected, including spark plug leads. Be certain all terminal connections fit snugly. Make sure ignition switch is in run position.

Electrical System

Electronic Ignition Systems and Oil Sentry™ Tests

1. Disconnect cap from spark plug and attach it to terminal end of spark tester. Attach tester spring clip to a good ground, not to spark plug. Turn ignition/key switch ON and crank engine while observing firing tip of tester.

| Condition | Conclusion |
|----------------------|---|
| Tester is firing. | Ignition system is good. Install a new spark plug and try to start engine. If it still will not start, check other possible causes (fuel, compression, etc.). |
| Tester doesn't fire. | Go to step 2. |

2. Trace yellow lead wire from Oil Sentry™ control module to Oil Sentry™ float switch. Disconnect bullet connector where it joins lead from Oil Sentry™ float switch (yellow lead wire). Repeat spark test.

| Condition | Conclusion |
|-----------------------|---|
| Spark is now present. | Control module or float switch is faulty. Test control module (step 3) and float switch (step 4). |
| Still no spark. | Test ignition module (step 5). |

3. Connect a jumper lead from yellow lead terminal to a bare spot on crankcase (ground). Turn ignition switch ON, crank engine, and observe red LED indicator lamp.

| Condition | Conclusion |
|---|--|
| Indicator lamp was not flashing. | Trace black lead from ignition switch. Separate bullet connector where switch lead joins double red harness lead. Crank engine, again observing red LED indicator lamp. |
| Indicator lamp flashes during cranking. | Control module is functioning, proceed to step 5. If lamp was not flashing initially but did flash in step 3, control module is good, but ignition switch is probably faulty. Test float switch (step 4) and ignition switch (step 6). |

4. Set an ohmmeter to Rx1 scale and zero meter. Connect one ohmmeter lead to Oil Sentry™ float switch lead (yellow with green sleeve) and touch other lead to a bare spot on crankcase (ground). Drain oil from crankcase and repeat test.

With oil at proper level, no continuity should have been indicated. After oil was drained, continuity should have been indicated.

| Condition | Conclusion |
|--------------------------|---|
| No continuity indicated. | Remove closure plate from engine and remove float switch for further testing (steps 4a and 4b). |

- a. If continuity was indicated with and without oil above, check if insulation has been scraped off float switch lead.

| Condition | Conclusion |
|--------------------|--|
| Lead wire is bare. | Allow it to short, repair with electrical tape, or replace float switch. |

- b. With float switch removed, connect one ohmmeter lead to float switch lead terminal and connect other lead to mounting bracket. Test resistance with switch in normal position and inverted. Repeat test 2 or 3 times in each direction.

| Condition | Conclusion |
|---|---------------------|
| Switch continuity should be as indicated. | If not, replace it. |

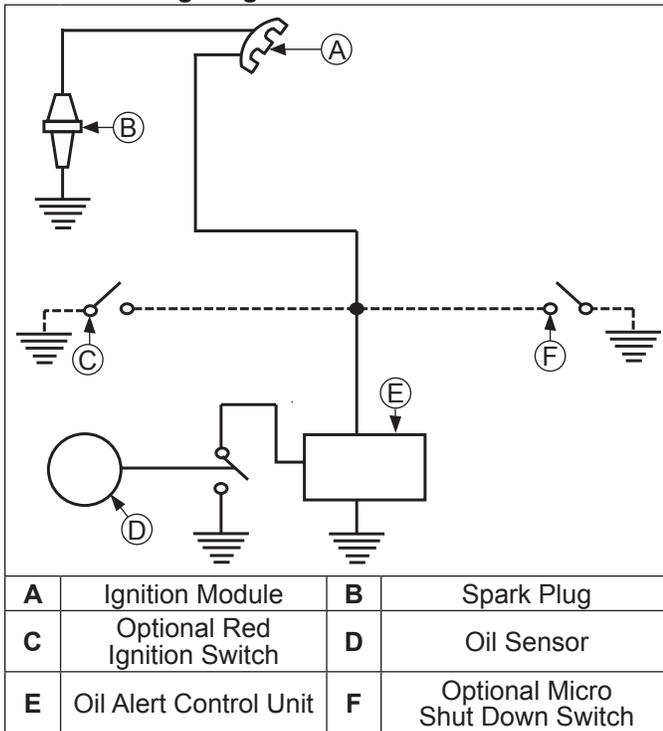
5. Set an ohmmeter to Rx1K or Rx10K scale and zero. Connect one ohmmeter lead to kill lead (black/white) terminal and connect other lead into spark plug cap.
 - a. Remove cap from spark plug lead and test resistance of cap alone.
 - b. If resistances are other than specified, remove blower housing and remove ignition module. With kill lead and spark plug cap removed, test resistance from small spade terminal to core of spark plug lead wire. If resistance is not in this range, replace module.

| Resistance Chart | |
|--|------------------|
| Ignition Module | 13.5-18.0 K ohms |
| Cap | 4-6 K ohms |
| Spade Terminal to Spark Plug Lead Wire | 9.5-12.9 K ohms |

6. Set an ohmmeter to Rx1 scale and zero meter. Test ignition/key switch as follows.
 - a. Trace two black leads from on/off switch and separate them from any connections. Connect ohmmeter leads to switch leads, and check for continuity in both switch positions.

| Condition | Conclusion |
|--|---------------------------------------|
| Continuity should be indicated when and only when switch is in OFF position. | Replace switch for any other results. |

General Wiring Diagram



Starter System

NOTE: Do not crank engine continuously for more than 10 seconds. Allow a 60 second cool down period between starting attempts. Failure to follow these guidelines can burn out starter motor.

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

NOTE: If starter does not crank engine, shut off starter immediately. Check condition of inline fuse and do not make further attempts to start engine until condition is corrected.

NOTE: Do not drop starter or strike starter housing. Doing so can damage starter.

Engines in this series use inertia drive electric starters or retractable starters. Inertia drive electric starters are not serviceable.

Troubleshooting-Starting Difficulties

| Condition | Possible Cause | Conclusion |
|-------------------------------------|----------------------------|---|
| Starter does not energize. | Battery | Check specific gravity of battery. If low, recharge or replace battery as necessary. |
| | Wiring | Check fuse condition. Clean corroded connections and tighten loose connections. Replace wires in poor condition and with frayed or broken insulation. |
| | Starter Switch or Solenoid | Check switch or relay operation. If starter cranks normally, replace faulty components. |
| Starter energizes but turns slowly. | Battery | Check specific gravity of battery. If low, recharge or replace battery as necessary. |
| | Wiring | Check for corroded connections, poor ground connection. |
| | Transmission or Engine | Make sure clutch or transmission is disengaged or placed in neutral. This is especially important on equipment with hydrostatic drive. Transmission must be exactly in neutral to prevent resistance which could keep engine from starting. Check for seized engine components such as bearings, connecting rod, and piston. |

Electric Starting System Tests

1. Test battery on unit.
 - a. Connect a DC voltmeter across battery terminals and read battery voltage (key switch OFF).
 - b. Turn key switch to start position and read battery voltage again. Turn switch OFF.

| Condition | Conclusion |
|--|--|
| Voltage less than 12 volts. | Charge battery. |
| Battery voltage should not fall below 9 volts during cranking. | If it does, battery may be faulty or there may be a short in starting circuit. Have battery load tested. If battery passes load test, check circuitry. |

2. Remove electric starter cover panel and check fuse inside plastic holder. Fuse outside holder is a spare.

| Condition | Conclusion |
|----------------|--|
| Fuse is blown. | Check for a wiring problem (bare wire, short circuit). Correct problem and replace fuse. Try to start engine. If it still won't start, go to step 3. |

3. Disconnect blue relay lead. Be sure transmission is in neutral and PTO is OFF. Connect one end of a jumper lead to positive terminal of battery. Connect other end to terminal of relay.

| Condition | Conclusion |
|--|--|
| Relay engages and starter begins to crank. | Key switch is faulty, or there is a wiring problem to/from key switch. Check wiring and test key switch circuits with an ohmmeter. |

4. Use a known, good, fully-charged battery and jumper cables to test starter motor. Be sure transmission is in neutral and PTO is OFF.

Remove heavy lead from post terminal on starter. Connect one end of positive jumper cable to post terminal and connect other end to positive terminal of battery.

Connect one end of negative jumper cable to negative terminal of battery. Touch other end of negative jumper cable to a bare surface on crankcase or to starter housing.

| Condition | Conclusion |
|--|--|
| Relay engages and starter begins to crank. | Key switch is faulty, or there is a wiring problem to/from key switch. Check wiring and test key switch circuits with an ohmmeter. |

5. Disconnect leads from starter relay and remove it from starter for testing.
- a. Set an ohmmeter on Rx1 scale and zero meter. Connect one ohmmeter lead to terminal of blue lead from relay. Connect other ohmmeter lead to relay mounting bracket.

| Condition | Conclusion |
|--|---------------------------------------|
| Meter reading less than 3.4 ohms, or an open circuit is indicated (infinity ohms). | Relay is faulty and must be replaced. |

- b. With ohmmeter still on Rx1 scale, connect leads to two large post terminals. Meter should indicate an open circuit (infinity ohms, no continuity).
- c. Leave ohmmeter leads connected to large terminals. Connect a jumper lead from positive terminal of battery to terminal of blue relay lead. Connect another jumper lead from negative terminal of battery to relay mounting bracket.

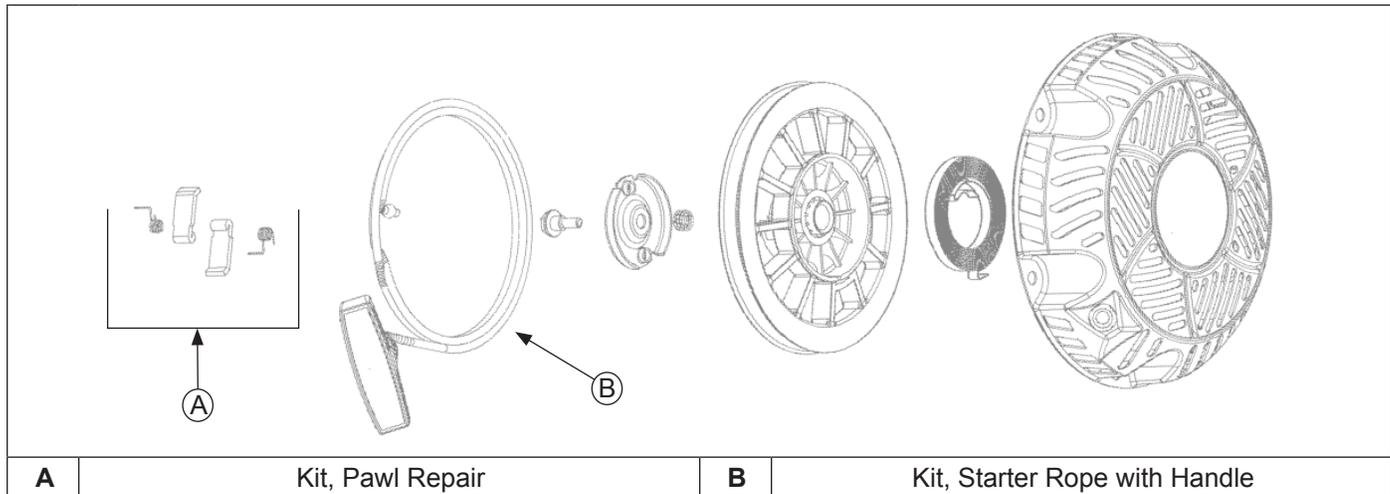
| Condition | Conclusion |
|---|--|
| When circuit is completed, applying 12 volts to energizing coil, an audible click should be heard as relay engages, and ohmmeter should then indicate continuity between large terminals. | Results are other than indicated, replace relay. |

Starter System

RETRACTABLE STARTERS

| | | |
|--|--|---|
|  | WARNING | Retractable starters contain a powerful, recoil spring that is under tension. Always wear safety goggles when servicing retractable starters and carefully follow instructions in Retractable Starter for relieving spring tension. |
| | Uncoiling Spring can cause severe injury. Wear safety goggles or face protection when servicing retractable starter. | |

Retractable Starter Components



Remove Starter

1. Remove screws securing starter to blower housing.
2. Remove starter assembly.

Rope Replacement

NOTE: Do not allow pulley/spring to unwind. Enlist aid of a helper if necessary.

Rope can be replaced without complete starter disassembly.

1. Remove starter assembly from engine.
2. Pull rope out approximately 12 in. and tie a temporary (slip) knot in it to keep it from retracting into starter.
3. Pull knot end out of handle, untie knot, and slide handle off.
4. Hold pulley firmly and untie slipknot. Allow pulley to rotate slowly as spring tension is released.
5. When all spring tension on starter pulley is released, remove rope from pulley.
6. Tie a double left-hand knot in one end of new rope.
7. Rotate pulley counterclockwise to pre-tension spring (approximately 4 full turns of pulley).
8. Continue rotating pulley counterclockwise until rope hole in pulley is aligned with rope guide bushing of starter housing.
9. Insert unknotted end of new rope through rope hole in starter pulley and rope guide bushing of housing.
10. Tie a slipknot approximately 12 in. from free end of rope. Hold pulley firmly and allow it to rotate slowly until slipknot reaches guide bushing of housing.

11. Insert starter rope through starter handle and tie a double, left-hand knot at end of starter rope. Insert knot into hole in handle.
12. Untie slip knot and pull on starter handle until starter rope is fully extended. Slowly retract starter rope into starter assembly. If recoil spring is properly tensioned, starter rope will retract fully and starter handle will stop against starter housing.

Pawls (dogs) Replacement

1. Install a clamp to hold pulley in starter housing and prevent it from rotating.
2. Unscrew center screw and lift off drive plate.
3. Note positions of pawls and pawl springs before removing. Remove parts from pulley.
4. Install pawl springs and pawls into pawl slots of pulley. All parts must be dry.
5. Position drive plate over pawls, aligning actuating slots in place with raised sections on each drive pawl. Torque center screw to 5-6 N·m (44-54 in. lb.).
6. Remove clamp and pull starter rope out part way to check operation of pawls.

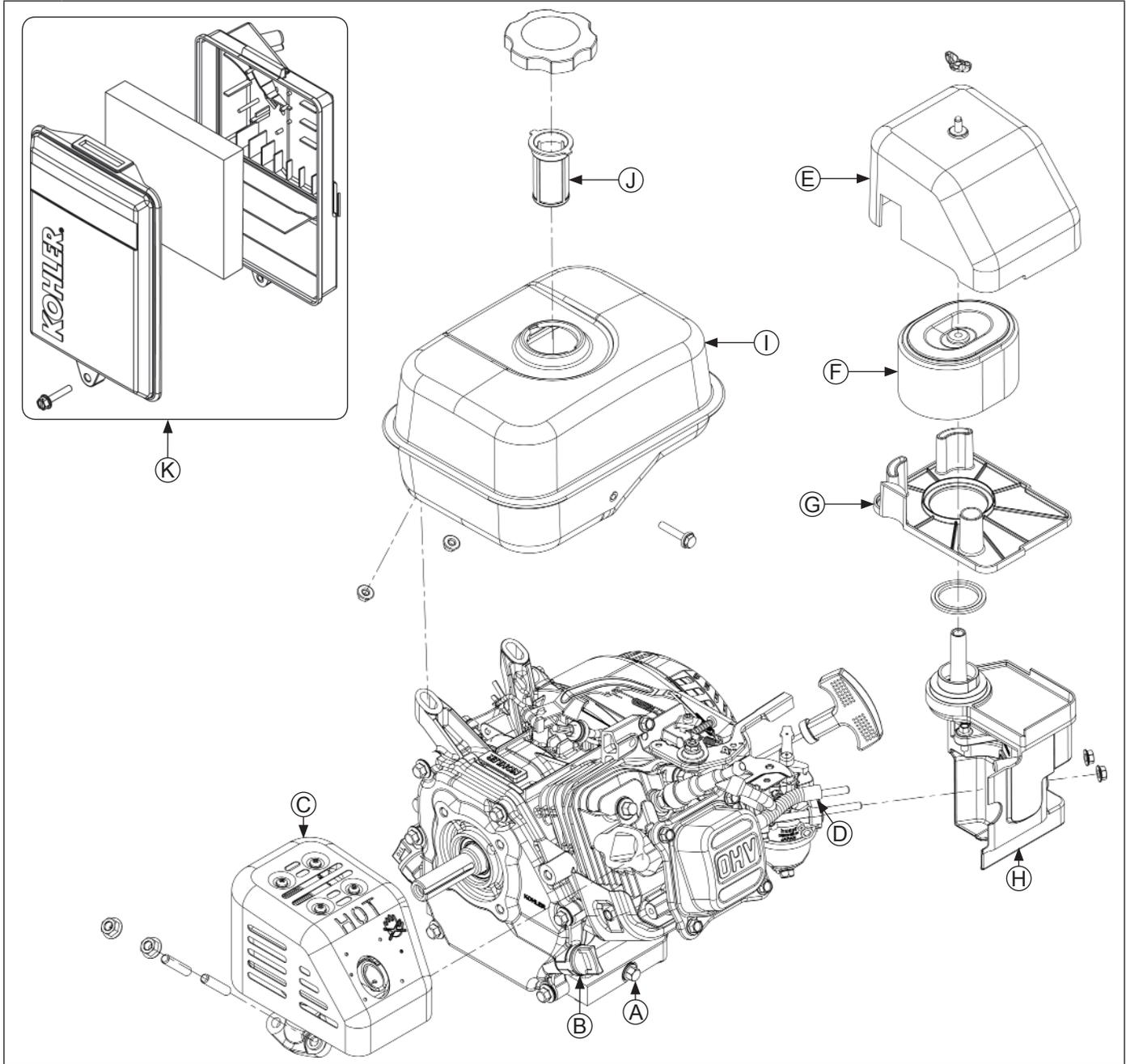
Install Starter

1. Install retractable starter onto blower housing leaving screws slightly loose.
2. Pull starter handle out until pawls engage in drive cup. Hold handle in this position and tighten screws securely.

Disassembly/Inspection and Service

| | | |
|--|---|--|
| | ⚠ WARNING | Before working on engine or equipment, disable engine as follows: 1) Disconnect spark plug lead(s). 2) Disconnect negative (-) battery cable from battery. |
| | Accidental Starts can cause severe injury or death. Disconnect and ground spark plug lead(s) before servicing. | |

External Engine Components



| | | | | | | | |
|----------|-------------------|----------|--------------------|----------|-------------------------|----------|------------------|
| A | Oil Drain Plug | B | Oil Fill Plug | C | Muffler Assembly | D | Breather Hose |
| E | Air Cleaner Cover | F | Element/Precleaner | G | Air Cleaner Base | H | Carburetor Cover |
| I | Fuel Tank | J | Fuel Tank Filter | K | Low-Profile Air Cleaner | | |

Disassembly/Inspection and Service

Clean all parts thoroughly as engine is disassembled. Only clean parts can be accurately inspected and gauged for wear or damage. There are many commercially available cleaners that will quickly remove grease, oil, and grime from engine parts. When such a cleaner is used, follow manufacturer's instructions and safety precautions carefully.

Make sure all traces of cleaner are removed before engine is reassembled and placed into operation. Even small amounts of these cleaners can quickly break down lubricating properties of engine oil.

Disconnect Spark Plug Lead

NOTE: Pull on boot only, to prevent damage to spark plug lead.

1. Disconnect spark plug lead from spark plug.
2. Push fuel shut-off lever left to close fuel valve.

Drain Oil From Crankcase

1. Remove 1 oil drain plug and 1 oil fill plug.
2. Allow ample time for oil to drain from crankcase.

Remove Muffler and Heat Shield Assembly

1. Remove nuts, lock washers, and flat washers.

2. Remove muffler assembly from exhaust outlet.
3. Remove exhaust gasket from exhaust outlet.

Remove Air Cleaner Assembly

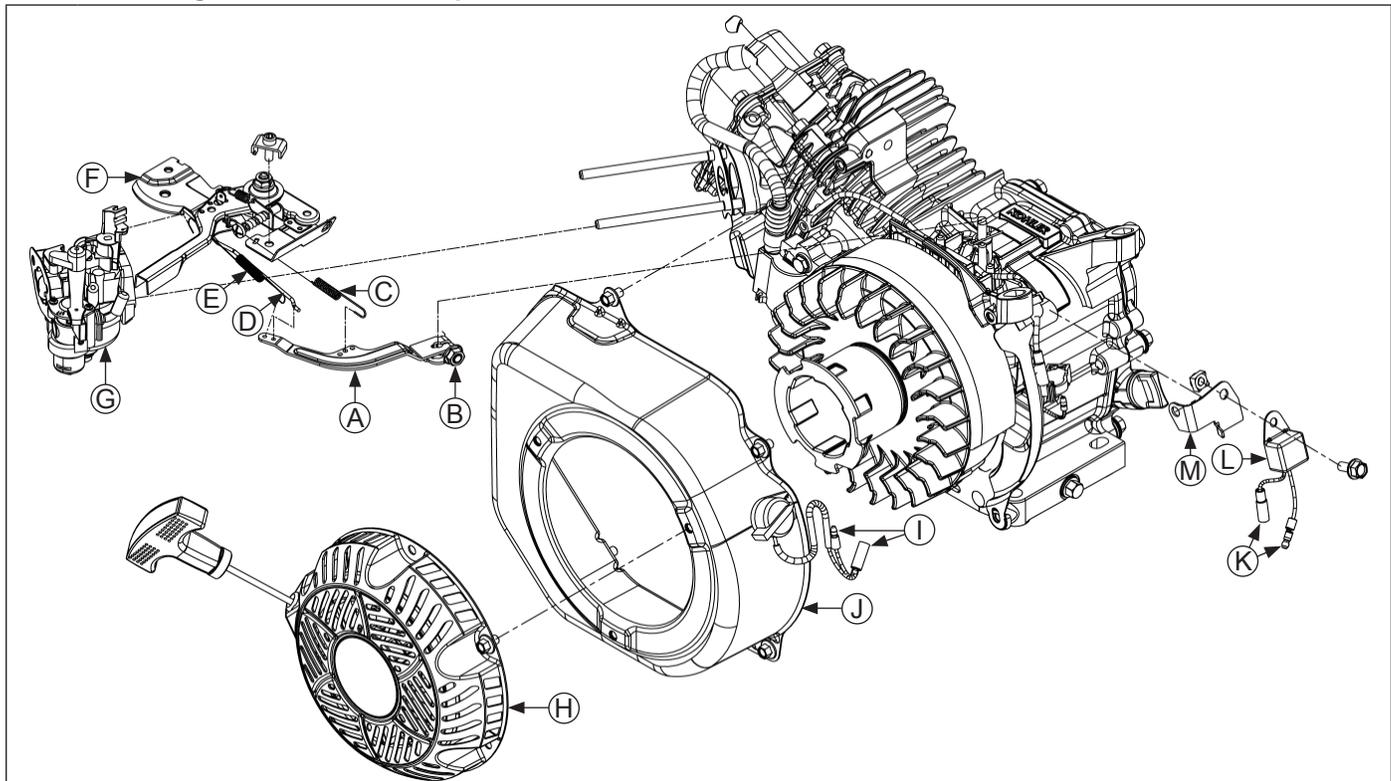
Remove air cleaner base from engine as follows:

1. Remove screws securing base of air cleaner assembly to engine.
2. Disconnect breather hose and remove base of air cleaner assembly.
3. Remove nuts and carburetor cover.
4. Loosely install nuts on studs (to temporarily hold carburetor on engine).

Remove Fuel Tank

1. Ensure fuel tank is empty.
2. Loosen clamp and disconnect fuel line from inlet of shut-off valve.
3. Remove nuts.
4. Remove screw and fuel tank while guiding fuel hose through engine bracket.

Blower Housing/Control Panel Components



| | | | | | | | |
|----------|--|----------|------------------|----------|---|----------|---------------------|
| A | Governor Lever | B | Nut | C | Governor Spring | D | Throttle Link |
| E | Dampening Spring | F | Control Assembly | G | Carburetor | H | Retractable Starter |
| I | On/Off Wiring Harness Bullet Connector | J | Blower Housing | K | Oil Sentry™ Wiring Harness Bullet Connector | L | Oil Sentry™ Module |
| M | Oil Sentry™ Bracket | | | | | | |

Remove External Throttle, Governor and Choke Linkage

1. Mark hole in which governor spring is attached and loosen nut securing governor lever arm to governor shaft. Lift off governor lever and remove carburetor throttle link, dampening spring, and governor spring from governor lever.
2. Remove nut securing throttle control lever. Unhook spring and remove throttle control lever.
3. Remove screws and throttle plate.

Remove Carburetor

| | |
|---|---|
|  | WARNING |
| | Explosive Fuel can cause fires and severe burns. Do not fill fuel tank while engine is hot or running. |

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. Spilled fuel could ignite if it comes in contact with hot parts or sparks from ignition. Never use gasoline as a cleaning agent.

Remove air cleaner gasket and slide carburetor off mounting studs while disconnecting throttle linkage and dampening spring. Remove carburetor to insulator gasket, insulator, and insulator to cylinder head gasket.

Remove Retractable Starter

Remove screws securing retractable starter assembly to blower housing.

Remove Electric Starter (if equipped)

Remove screws securing electric starter to blower housing.

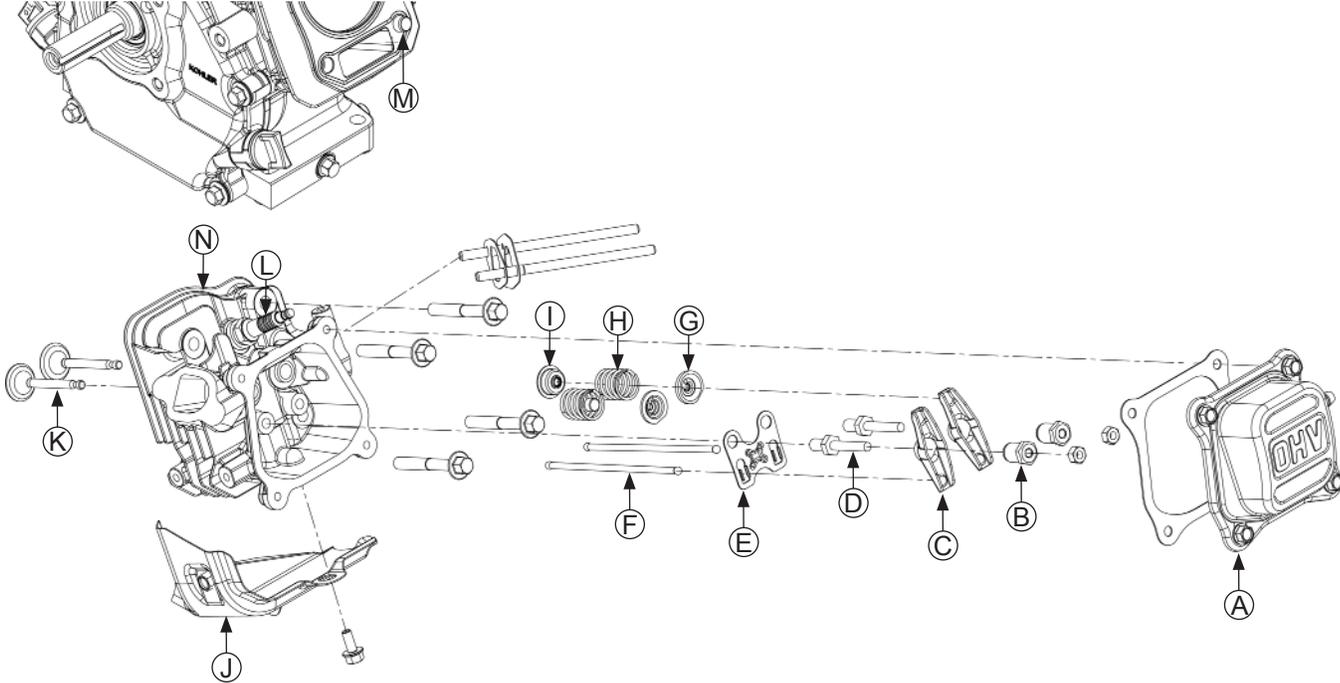
Remove Blower Housing

1. Remove screws securing blower housing.
2. Release wiring harness bundle clamp and disconnect ON/OFF wiring harness bullet connectors.
3. Remove blower housing.

Remove Oil Sentry™ Module

Disconnect wiring harness bullet connector between Oil Sentry™ switch and module. Remove screw securing module to bracket.

Cylinder Head Components



| | | | | | | | |
|----------|------------------------|----------|-----------------|----------|--------------|----------|-----------------|
| A | Valve Cover | B | Adjusting Nut | C | Rocker Arm | D | Rocker Arm Stud |
| E | Push Rod Guide | F | Push Rod | G | Valve Keeper | H | Valve Spring |
| I | Intake Valve Stem Seal | J | Cylinder Shroud | K | Valve | L | Spark Plug |
| M | Dowel Pins | N | Cylinder Head | | | | |

Disassembly/Inspection and Service

Remove Valve Cover/Breather, Rocker Arms, Push Rods and Cylinder Head Assembly

NOTE: Mark location of push rods and any other part removed that will be reused.

Valve Cover with Gasket

1. Remove screws and remove valve cover and gasket from engine. Breather assembly is inside valve cover.
2. Remove screws securing cylinder shroud and remove cylinder shroud.
3. Loosen and remove rocker arm lock nuts and adjuster nuts. Remove rocker arms and push rods.
4. Remove spark plug.
5. Remove screws securing cylinder head.
6. Remove cylinder head, dowel pins, and cylinder head gasket.

Valve Cover with RTV Sealant

NOTE: Valve cover is sealed to cylinder head using RTV silicone sealant. When removing valve cover, use care not to damage gasket surfaces of cover and cylinder head. To break RTV seal, hold block of wood against 1 flat surface of valve cover. Strike wood firmly with mallet. If seal doesn't break loose after 1 or 2 attempts, repeat procedure on other side.

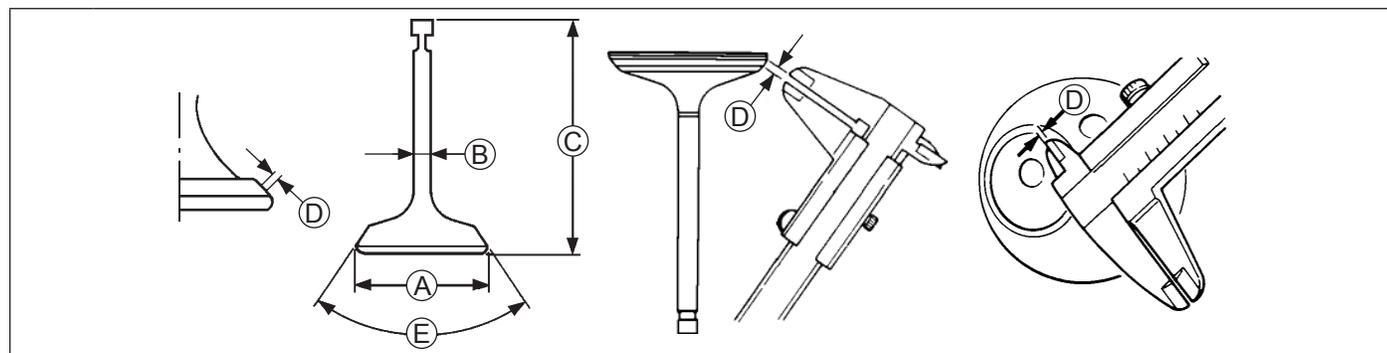
1. Remove screws and remove valve cover from engine. Breather assembly is inside valve cover.
2. Using a brass wire brush and gasket remover or similar solvent, clean old RTV from surface of cylinder head and valve cover.
3. Remove screws securing cylinder shroud and remove cylinder shroud.
4. Loosen and remove rocker arm lock nuts and adjuster nuts. Remove rocker arms and push rods.
5. Remove spark plug.
6. Remove screws securing cylinder head.
7. Remove cylinder head, dowel pins, and cylinder head gasket.

Remove Valves

NOTE: Mark location of any part removed that will be reused.

1. Supporting head of valve from below, depress valve keeper and valve spring until keeper can be released from valve stem. Remove valve spring and valve from head. Repeat this procedure for remaining valve.
2. Remove and replace intake valve stem seal whenever cylinder head is serviced or disassembled.

Valve Details



| Item | Dimension | Intake | Exhaust |
|-----------------------|---|---|--|
| A | Head Diameter—Specification | 25 mm + 0.1 mm (0.9842 in. + 0.0039 in.) | 24 mm + 0.1 mm (0.9449 in. + 0.0039 in.) |
| | Head Diameter—Maximum | 25.1 mm (0.9881 in.) | 24.1 mm (0.9488 in.) |
| | Head Diameter—Service Limit | 24.9 mm (0.9803 in.) | 23.9 mm (0.9409 in.) |
| B | Stem Diameter—Specification | 5.5 mm (0.217 in.) | 5.438 mm (0.214 in.) |
| | Stem Diameter—Maximum | 5.491 mm (0.216 in.) | 5.430 mm (0.214 in.) |
| | Stem Diameter—Service Limit | 5.340 mm (0.210 in.) | 5.280 mm (0.208 in.) |
| C | Valve Length—Specification | 64 mm + 0.15 mm (2.5197in. + 0.0059 in.) | 62 mm + 0.15 mm (2.4409 in. + 0.0059 in.) |
| | Valve Length—Maximum | 64.15 mm (2.5256 in.) | 62.15 mm (2.4468 in.) |
| | Valve Length—Service Limit | 64.15 mm (2.5256 in.) | 62.15 mm (2.4468 in.) |
| D | Face/Seat Width—Maximum | 2.0 mm (0.079 in.) | 2.0 mm (0.079 in.) |
| E | Face/Seat Angle | 90°-90.5°/89.5°-90° | 90-90.5°/89.5°-90° |
| | Stem to Guide—Specification | 0.024 mm (0.0009 in.) | 0.098 mm (0.0038 in.) |
| | Stem to Guide—Maximum | 0.039 mm (0.0015 in.) | 0.112 mm (0.0044 in.) |
| | Stem to Guide—Service Limit | 0.10 mm (0.0039 in.) | 0.12 mm (0.0047 in.) |
| | Stem to Guide Running Clearance—Specification | 0.020 mm (0.0008 in.) | 0.030 mm (0.0008 in.) |
| | Stem to Guide Running Clearance—Maximum | 0.044 mm (0.0017 in.) | 0.054 mm (0.0021 in.) |
| | Stem to Guide Running Clearance—Service Limit | 0.10 mm (0.0039 in.) | 0.12 mm (0.0047 in.) |
| | Valve Guide – Specification | 5.5 mm (0.2165 in.) | 5.5 mm (0.2165 in.) |
| Valve Guide – Maximum | 5.512 mm (0.2170 in.) | 5.512 mm (0.2170 in.) | |

Disassembly/Inspection and Service

Inspection and Service

After cleaning, check flatness of cylinder head and corresponding top surface of crankcase, using a surface plate or piece of glass and feeler gauge. Maximum allowable out of flatness is 0.1 mm (0.0039 in.).

Carefully inspect valve mechanism parts. Inspect valve springs and related hardware for excessive wear or distortion. Check valves and valve seats for evidence of deep pitting, cracks, or distortion. Check running clearance between valve stems and guides.

Hard starting, or loss of power accompanied by high fuel consumption may be symptoms of faulty valves. Although these symptoms could also be attributed to worn rings, remove and check valves first. After removal, clean valve heads, faces, and stems with a power wire brush.

Then, carefully inspect each valve for defects such as warped head, excessive corrosion, or worn stem end. Replace valves found to be in bad condition.

Valve Guides

If a valve guide is worn beyond specifications, it will not guide valve in a straight line. This may result in burned valve faces or seats, loss of compression, and excessive oil consumption.

To check valve guide-to-valve stem clearance, thoroughly clean valve guide and, using a split-ball gauge, measure inside diameter of guide. Then, using an outside micrometer, measure diameter of valve stem at several points on stem where it moves in valve guide. Use largest stem diameter to calculate clearance by subtracting stem diameter from guide diameter. If intake or exhaust clearance exceeds specifications in Valve Specification table, determine whether valve stem or guide is responsible for excessive clearance.

If guides are within limits but valve stems are worn beyond limits, install new valves.

Valve Seat Inserts

Hardened steel alloy intake and exhaust valve seat inserts are press-fitted into cylinder head. Inserts are not replaceable but can be reconditioned if not too badly pitted or distorted. If cracked or badly warped, cylinder head should be replaced.

Recondition valve seat inserts following instructions provided with valve seat cutter being used. Cutting proper valve face angle, as specified in Clearance Specifications table and proper valve seat angle (89.5°-90°) will achieve desired 0° (1° full cut) interference angle where maximum pressure occurs on outside diameters of valve face and seat.

Lapping Valves

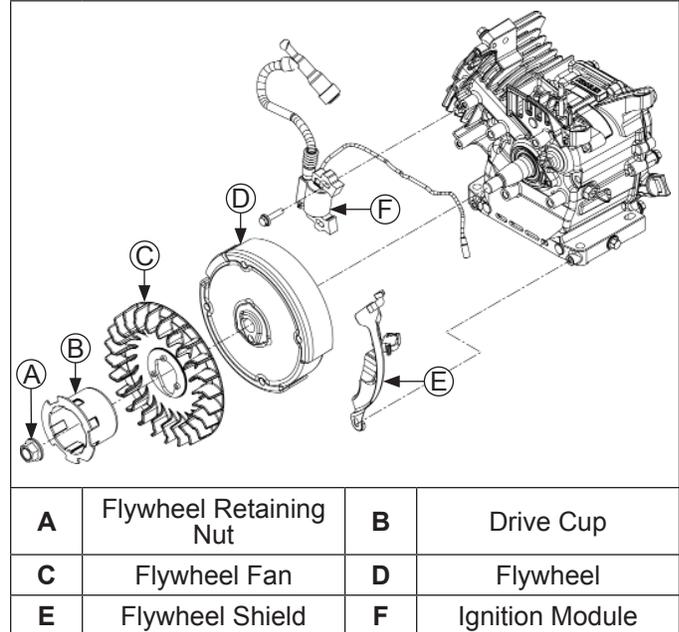
Reground or new valves must be lapped in, to provide proper fit. Use a hand valve grinder with a suction cup for final lapping. Lightly coat valve face with a fine grade of grinding compound, then rotate valve on seat with grinder. Continue grinding until a smooth surface is obtained on seat and on valve face. Thoroughly clean cylinder head in hot, soapy water to remove all traces of grinding compound. After drying cylinder head, apply a light coating of SAE 10 oil to prevent rusting.

Intake Valve Stem Seal

Some engines use a valve stem seal on intake valve.

Always use a new seal when valves are removed from cylinder head. Seals should also be replaced if deteriorated or damaged in any way. Never reuse an old seal.

Flywheel/Ignition Components



Remove Ignition Module

Remove screws securing ignition module to crankcase. Remove module.

Remove Flywheel

NOTE: Whenever possible, an impact wrench should be used to loosen flywheel retaining nut. A flywheel strap wrench may be used to hold flywheel when loosening or tightening flywheel retaining nut.

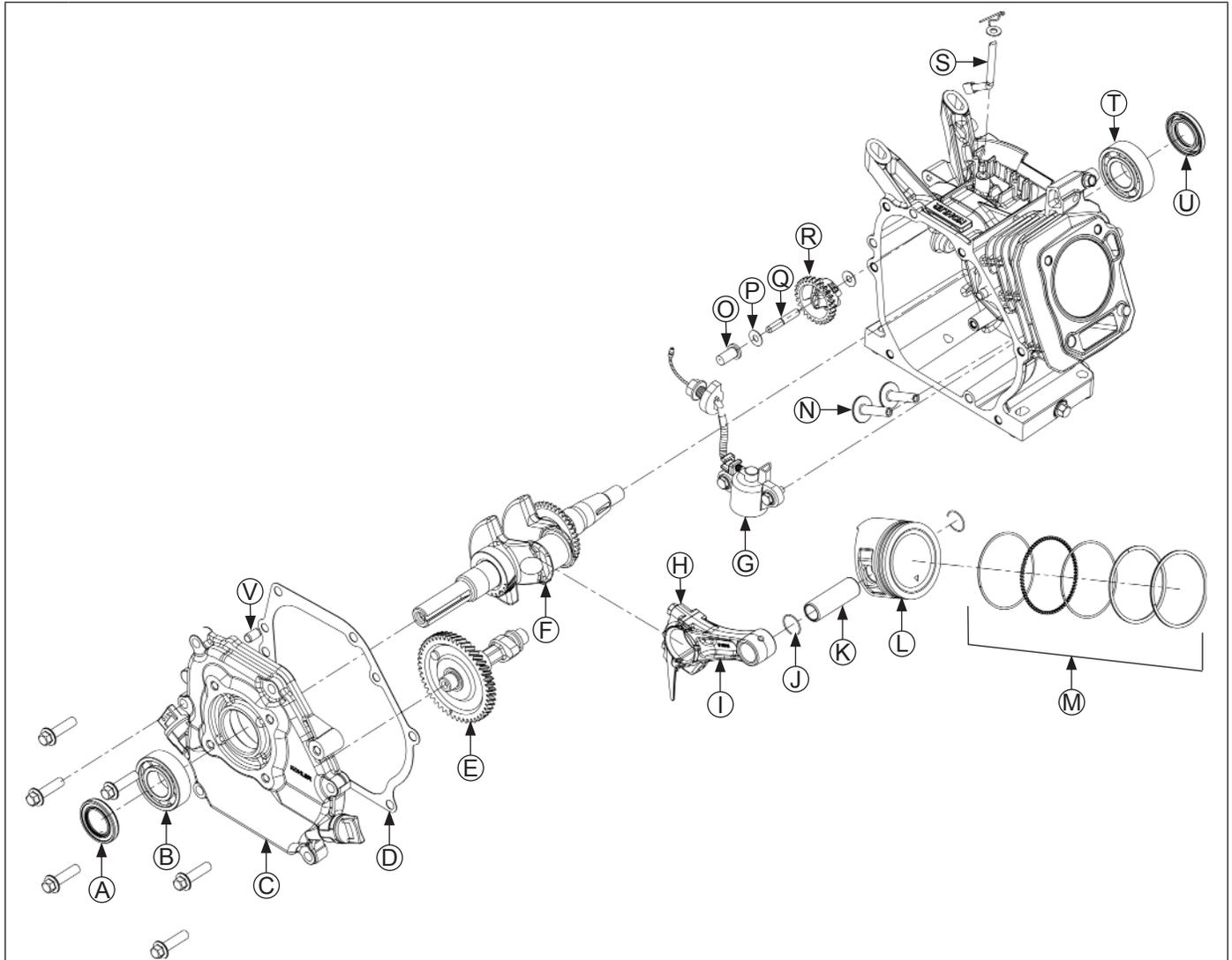
NOTE: Always use a puller to remove flywheel from crankshaft. Do not strike flywheel or crankshaft as these parts could become cracked or damaged.

1. Remove flywheel retaining nut.
2. Remove drive cup and fan from flywheel.
3. Remove screw and shield on right side of flywheel (required for use of puller in next step).
4. Remove flywheel from crankshaft using a suitable puller.
5. Remove flywheel key from crankshaft keyway.

Inspection

Inspect flywheel for cracks and flywheel keyway for damage. Replace flywheel if it is cracked. Replace flywheel, crankshaft, and key if flywheel key is sheared or keyway is damaged.

Crankcase Components



| | | | | | | | |
|----------|------------------------|----------|-----------------------|----------|--------------------------|----------|-------------------|
| A | Closure Plate Oil Seal | B | Closure Plate Bearing | C | Closure Plate | D | Gasket |
| E | Camshaft | F | Crankshaft | G | Oil Sentry™ Float Switch | H | End Cap |
| I | Connecting Rod | J | Piston Pin Retainer | K | Piston Pin | L | Piston |
| M | Piston Ring Set | N | Tappet | O | Governor Cup | P | Governor Washer |
| Q | Governor Shaft | R | Governor Gear | S | Governor Cross Shaft | T | Crankcase Bearing |
| U | Crankcase Oil Seal | V | Dowel Pin | | | | |

Remove Closure Plate

NOTE: Do not pry on gasket surface of crankcase or closure plate, as this can cause damage and leakage.

1. Remove screws securing closure plate to crankcase.
2. Remove closure plate, gasket, and dowel pins (if required) from crankcase.

Inspection

Inspect oil seal in closure plate and remove it if it is worn or damaged. New oil seal can be installed after closure plate is assembled to crankcase. See Reassembly for oil seal installation instructions.

Inspect main bearing surface for wear or damage (refer to Specifications). Replace closure plate if required.

Disassembly/Inspection and Service

Remove Camshaft and Valve Tappets

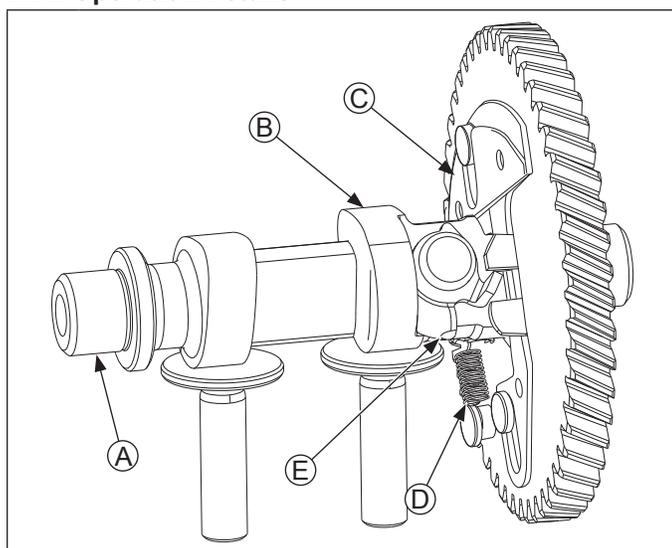
1. Remove camshaft by pulling it straight out of crankcase.
2. Remove valve tappets by pulling straight out of crankcase. Mark their positions.

Inspection and Service

Inspect gear teeth of camshaft. If teeth are badly worn or chipped, or if some are missing, replacement of camshaft will be necessary. If unusual wear or damage is evident on either camshaft lobes or mating tappets camshaft and both tappets must be replaced. Check condition and operation of Automatic Compression Release (ACR) mechanism.

Automatic Compression Release (ACR)

ACR Operation Details



| | | | |
|----------|----------------------|----------|------------------|
| A | Camshaft | B | Exhaust Cam Lobe |
| C | Decompression Weight | D | Return Spring |
| E | Arm | | |

These engines are equipped with an ACR mechanism. ACR lowers compression at cranking speeds to make starting easier.

Operation

ACR mechanism consists of a decompression weight and arm mounted to camshaft, and activated by a return spring. When engine is rotating at low cranking speeds (1000 RPM or less), decompression weight holds arm so it protrudes above heel of exhaust lobe. This holds exhaust valve off its seat during first part of compression stroke.

After engine speed increases above approximately 1000 RPM, centrifugal force causes decompression weight to move outward, causing arm to retract. When in this position, arm has no effect on exhaust valve and engine operates at FULL compression and power.

Benefits

As a result of reduced compression at cranking speeds, several important benefits are obtained:

1. Manual (retractable) starting is much easier. Without ACR, manual starting would be virtually impossible.
2. Electric start models can use a smaller starter and battery that are more practical for application.
3. ACR eliminates need for a spark retard/advance mechanism. A spark retard/advance mechanism would be required on engines without ACR to prevent kickback that would occur during starting. ACR eliminates this kickback, making manual starting safer.
4. Choke control setting is less critical with ACR. If flooding occurs, excess fuel is blown out opened exhaust valve and does not hamper starting.
5. Engines with ACR start much faster in cold weather than engines without ACR.
6. Engines with ACR can be started with spark plugs that are worn or fouled. Engines without ACR are more difficult to start with those same spark plugs.

Remove Piston, Connecting Rod, and Crankshaft

NOTE: If a carbon ridge is present at top of cylinder bore, use a ridge reamer to remove it before attempting to remove piston.

1. Remove screws securing end cap to connecting rod. Remove end cap. While guiding connecting rod, slide piston and connecting rod from cylinder bore.
2. Remove crankshaft from crankcase.

Connecting Rod Inspection and Service

Check bearing area (big end) for excessive wear, score marks, running and side clearances. Replace connecting rod and end cap if scored or excessively worn.

Service replacement connecting rods are available in STD size.

Pistons and Rings Inspection

Scuffing and scoring of pistons and cylinder walls occurs when internal engine temperatures approach welding point of piston. Temperatures high enough to do this are created by friction, which is usually attributed to improper lubrication and/or overheating of engine.

Normally, very little wear takes place in piston boss or piston pin area. If original piston and connecting rod can be reused after new rings are installed, original pin can also be reused but new piston pin retainers are required. Piston pin is included as part of piston assembly; if pin boss in piston or pin itself is worn or damaged, a new piston assembly is required.

Ring failure is usually indicated by excessive oil consumption and blue exhaust smoke. When rings fail, oil is allowed to enter combustion chamber where it is burned along with fuel. High oil consumption can also occur when piston ring end gap is incorrect, because ring cannot properly conform to cylinder wall under this condition. Oil control is also lost when ring gaps are not staggered during installation.

When cylinder temperatures get too high, lacquer and varnish collect on pistons, causing rings to stick, which results in rapid wear. A worn ring usually takes on a shiny or bright appearance.

Scratches on rings and pistons are caused by abrasive material such as carbon, dirt, or pieces of hard metal.

Disassembly/Inspection and Service

Detonation damage occurs when a portion of fuel charge ignites spontaneously from heat and pressure shortly after ignition. This creates 2 flame fronts, which meet and explode to create extreme hammering pressures on a specific area of piston. Detonation generally occurs from using low octane fuels.

Preignition or ignition of fuel charge before timed spark can cause damage similar to detonation. Preignition damage is often more severe than detonation damage. Preignition is caused by a hot spot in combustion chamber such as glowing carbon deposits, blocked cooling fins, an improperly seated valve, or wrong spark plug.

Replacement pistons are available in STD bore size. Replacement pistons include new piston ring sets and new piston pins.

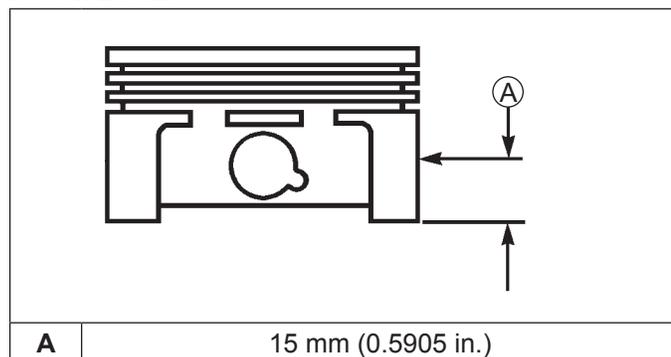
Replacement ring sets are also available separately for STD pistons. Always use new piston rings when installing pistons. Never use old rings.

Some important points to remember when servicing piston rings:

1. Cylinder bore must be deglazed before service ring sets are used.
2. If cylinder bore does not need reboring and if old piston is within wear limits and free of score or scuff marks, old piston may be reused.
3. Remove old rings and clean up grooves. Never reuse old rings.
4. Before installing new rings on piston, place top 2 rings, each in turn, in its running area in cylinder bore and check end gap. Compare ring gap to Clearance Specifications.
5. After installing new compression (top and middle) rings on piston, check piston-to-ring side clearance. Compare clearance to Clearance Specifications. If side clearance is greater than specified, a new piston must be used.

Measuring Piston-to-Bore Clearance

Piston Detail



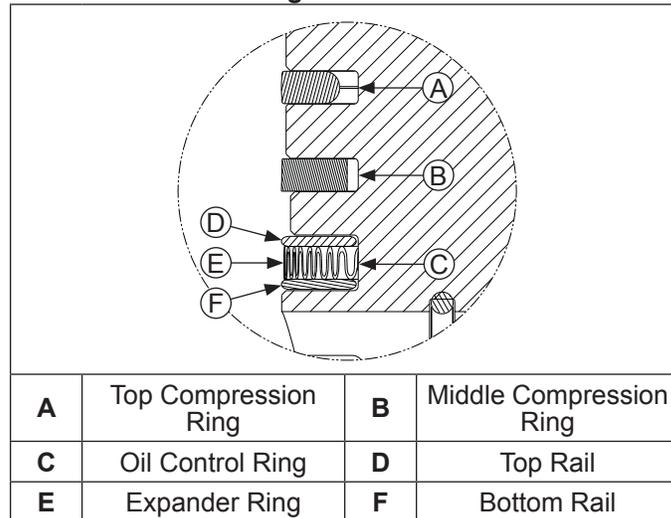
NOTE: Do not use a feeler gauge to measure piston-to-bore clearance, it will yield inaccurate measurements. Always use a micrometer.

Before installing piston into cylinder bore, it is necessary that clearance be accurately checked. This step is often overlooked, and if clearances are not within specifications, engine failure will usually result.

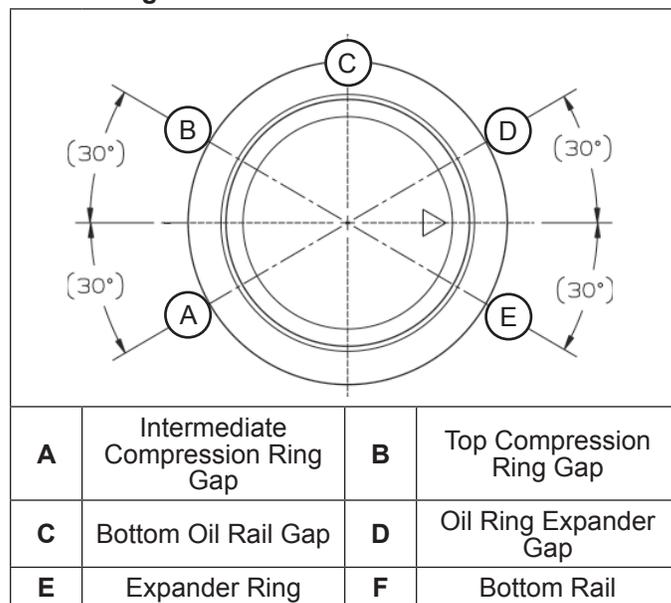
Use following procedure to accurately measure piston-to-bore clearance:

1. Use a micrometer and measure diameter of piston 15 mm (0.5905 in.) above bottom of piston skirt and perpendicular to piston pin.
2. Use an inside micrometer, telescoping gauge, or bore gauge and measure cylinder bore. Take measurement approximately 7.0 mm (0.2756 in.) below top of bore and perpendicular to piston pin.
3. Piston-to-bore clearance is difference between bore diameter and piston diameter (step 2 minus step 1).

Install New Piston Rings



Piston Ring Orientation



NOTE: Rings must be installed correctly. Install oil control ring assembly (bottom groove) first, middle compression ring (center groove) second, and top compression ring (top groove) last. Oil control ring assembly is a three-piece design, and consists of a top rail, expander ring, and bottom rail.

To install new piston rings, proceed as follows:

Use a piston ring expander to install rings.

Disassembly/Inspection and Service

1. Oil control ring assembly (bottom groove): Install expander first then bottom rail and top rail last. Make sure ends of expander are not overlapped. Adjust ring gaps.
2. Middle compression ring (center groove): Install middle compression ring using a piston ring expander tool. Make sure identification mark is up or colored dye stripe (if contained) is left of end gap. Adjust ring gaps.
3. Top compression ring (top groove): Install top compression ring using a piston ring expander tool. Make sure identification mark is up or colored dye stripe (if contained) is left of end gap. Adjust ring gaps.

Crankshaft Inspection and Service

Inspect gear teeth of crankshaft and ACR gear. If any teeth are badly worn or chipped, or if some are missing, replacement of crankshaft will be necessary.

Inspect crankshaft bearing surfaces for scoring, grooving, etc. Measure running clearance between crankshaft journals and their respective bearing bores. Use an inside micrometer or telescoping gauge to measure inside diameter of both bearing bores in vertical and horizontal planes. Use an outside micrometer to measure outside diameter of crankshaft main bearing journals. Subtract journal diameters from their respective bore diameters to get running clearances. Check results against values in specification tables. If running clearances are within specification, and there is no evidence of scoring, grooving, etc., no further reconditioning is necessary. If bearing surfaces are worn or damaged, crankcase and/or closure plate will need to be replaced.

Inspect crankshaft keyway. If worn or chipped, replacement of crankshaft will be necessary.

Inspect crankpin for score marks or metallic pickup. Slight score marks can be cleaned with crocus cloth soaked in oil. If wear limits in Specifications are exceeded, it will be necessary to replace crankshaft.

Remove Oil Sentry™ System

1. Remove nut securing Oil Sentry™ lead wire grommet assembly to crankcase.
2. Pull grommet assembly from crankcase on inside.
3. Remove screws securing Oil Sentry™ float switch to crankcase. Remove Oil Sentry™ float switch.

Remove Governor Assembly

NOTE: Mark location of all parts as governor assembly is removed.

1. Remove hitch pin from governor cross shaft.
2. Remove governor cross shaft from inside crankcase.
3. Remove cup and washer from governor gear.
4. Using a suitable drift, drive governor gear shaft from crankcase.

Inspection

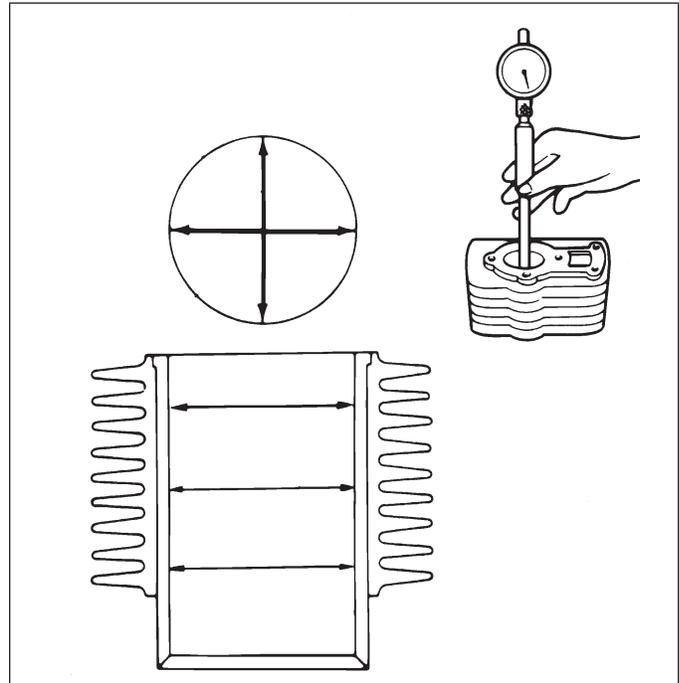
Inspect governor gear teeth. Replace gear if it is worn, chipped, or if any teeth are missing. Inspect governor weights. They should move freely in governor gear.

Remove Crankcase and Closure Plate Seals and Bearings

1. Remove oil seal from crankcase.
2. Using a suitable press, drive crankshaft bearing from crankcase.
3. Remove oil seal from closure plate.
4. Using a suitable press, drive crankshaft bearing from closure plate.

Crankcase

Cylinder Bore Details



Inspection and Service

Check all gasket surfaces to make sure they are free of gasket fragments. Gasket surfaces must also be free of deep scratches or nicks.

Check cylinder bore for scoring. In severe cases, unburned fuel can cause scuffing and scoring of cylinder wall. It washes necessary lubricating oils off piston and cylinder wall. As raw fuel seeps down cylinder wall, piston rings make metal-to-metal contact with wall. Scoring of cylinder wall can also be caused by localized hot spots resulting from blocked cooling fins or from inadequate or contaminated lubrication.

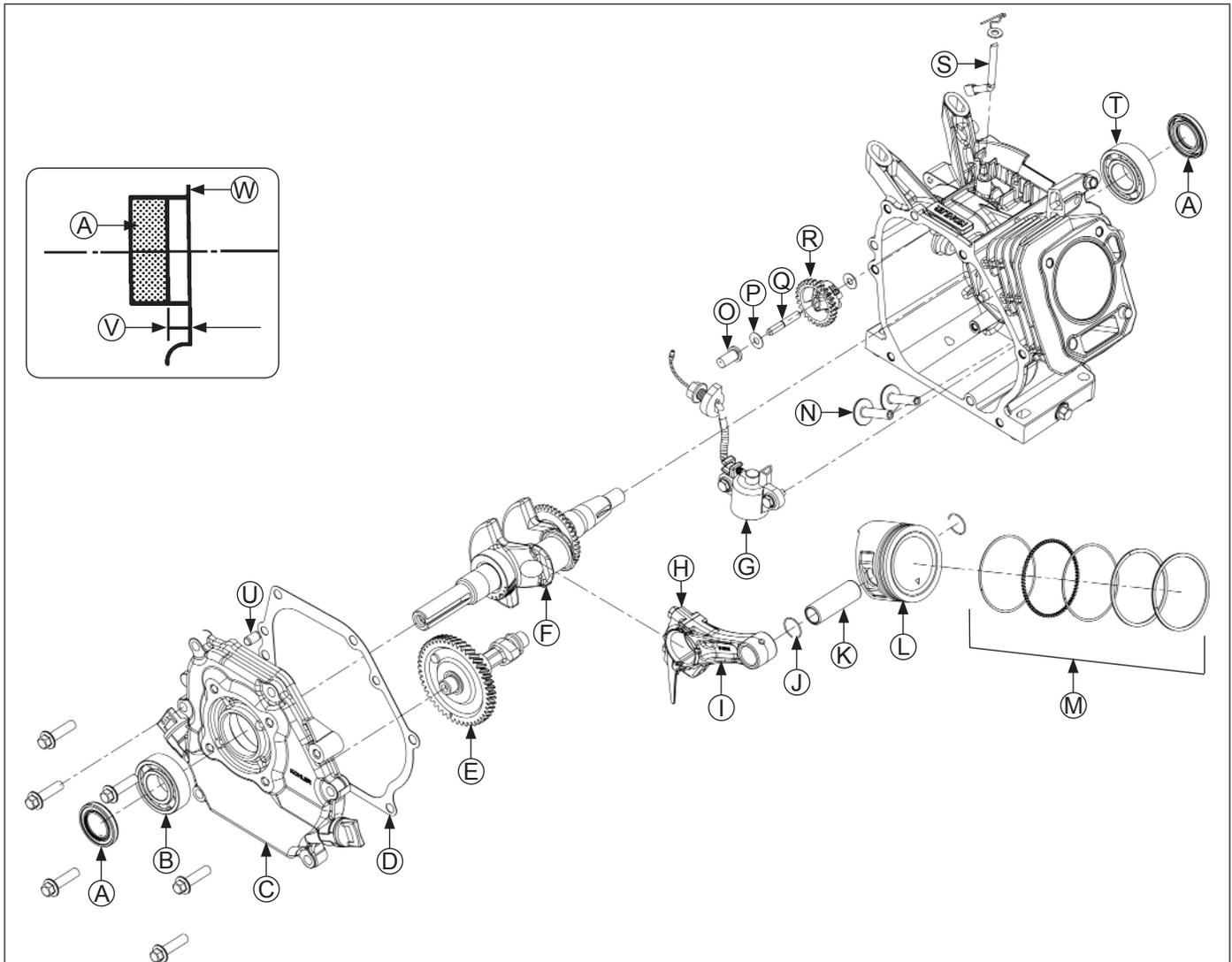
If cylinder bore is badly scored, excessively worn, tapered, or out-of-round, replacement is necessary. Use an inside micrometer to determine amount of wear.

Breather Design

Breather system is designed to control amount of oil in head area and still maintain necessary vacuum in crankcase.

When pistons moves downward, crankcase gases are pushed past reed through mesh filter into intake system. Upward travel of pistons closes reed and creates a low vacuum in lower crankcase. Any oil separated out through filter drains back into crankcase.

Crankcase Components



| | | | | | | | |
|----------|-----------------|----------|-----------------------|----------|--------------------------|----------|-------------------|
| A | Oil Seal | B | Closure Plate Bearing | C | Closure Plate | D | Gasket |
| E | Camshaft | F | Crankshaft | G | Oil Sentry™ Float Switch | H | End Cap |
| I | Connecting Rod | J | Piston Pin Retainer | K | Piston Pin | L | Piston |
| M | Piston Ring Set | N | Tappet | O | Governor Cup | P | Governor Washer |
| Q | Governor Shaft | R | Governor Gear | S | Governor Cross Shaft | T | Crankcase Bearing |
| U | Dowel Pin | V | Oil Seal Depth | W | Outer Surface | | |

NOTE: Make sure engine is assembled using all specified torque values, tightening sequences, and clearances. Failure to observe specifications could cause severe engine wear or damage. Always use new gaskets.

Install Crankcase Bearings and Oil Seals

NOTE: Oil bearings liberally with engine oil when installing.

NOTE: In steps 3 and 4, position oil seals with manufacturer's identification marks visible and facing you.

1. Make sure there are no nicks, burrs, or damage in bores for bearings. Crankcase and closure plate must be clean.
2. Use an arbor press to make sure bearings are installed straight into their respective bore, until fully seated.
3. Using an appropriate seal driver, install oil seal into closure plate to a depth of 5.5 mm (0.217 in.) from outer surface.
4. Using an appropriate seal driver, install oil seal into crankcase to a depth of 0.0-1.0 mm (0.0-0.039 in.) from outer surface.

Reassembly

5. Apply a light coating of lithium grease to seal lips after installing.

Install Governor Assembly

1. Install governor shaft through gear and add thrust washer to shaft.
2. Install governor gear assembly into crankcase using a press, or a drift with light taps, until tip of shaft is 78.862 mm (3.105 in.) below machined gasket surface of crankcase.
3. Install thrust washer and cup on governor gear shaft.
4. Install thrust washer onto governor cross shaft and slide shaft up through inside of crankcase.
5. Install second flat washer onto shaft. Position shaft so flat index end of shaft faces left (9 o'clock position). Insert hitch pin so end of pin comes in contact with raised boss on housing, limiting inward movement of shaft.

Install Oil Sentry™ System

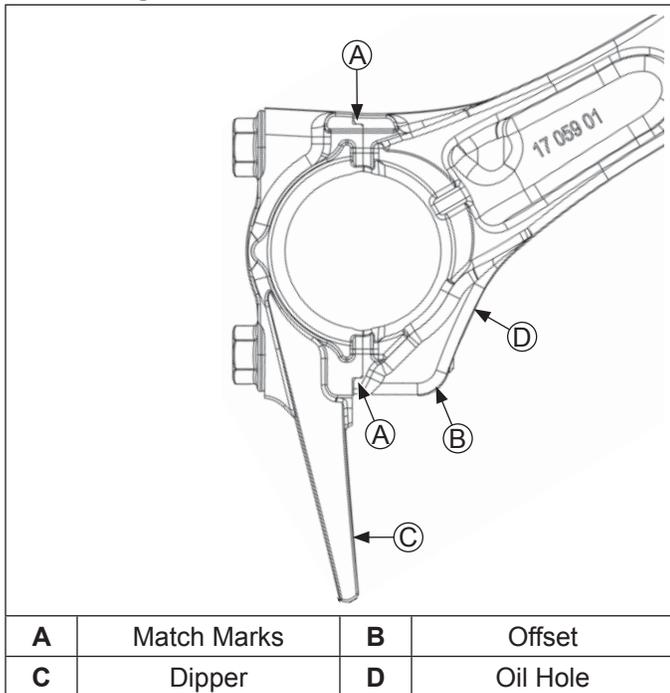
1. Mount Oil Sentry™ float into crankcase using screws.
2. Route wire lead grommet assembly through crankcase housing.
3. Install nut onto grommet assembly external stud and tighten securely.

Install Crankshaft

Carefully slide flywheel end of crankshaft through main bearing and seal.

Install Connecting Rod with Piston and Rings

Connecting Rod Details



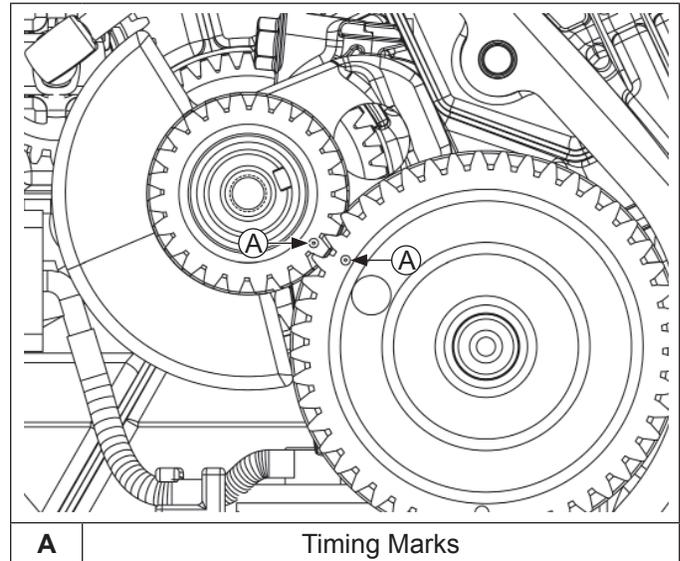
NOTE: If piston and/or connecting rod has been changed or removed, be sure piston index mark and end cap dipper orientation are correct before installation.

NOTE: Install oil control ring assembly first, middle compression ring second, and top compression ring last. Oil control ring assembly is a three-piece design, and consists of a top rail, expander ring, and bottom rail.

1. Install piston with index mark on piston to connecting rod with dipper of end cap down.
2. Install connecting rod with offset down and oil hole in 4 o'clock position shown. Match marks should align as shown.
3. Install and stagger piston rings in grooves.
4. Lubricate cylinder bore, piston, piston pin, and piston rings with engine oil. Compress rings using a piston ring compressor.
5. Lubricate crankshaft journal and connecting rod bearing surfaces with engine oil.
6. Be sure index mark on piston is facing down toward base of engine. Use a hammer handle or rounded wood dowel and gently tap piston into cylinder. Be careful oil ring rails do not spring free between bottom of ring compressor and top of cylinder.
7. Install connecting rod end cap to connecting rod so dipper is down and match marks are aligned.
8. Torque connecting rod screws in increments to 12 N·m (106 in. lb.).

Install Valve Tappets and Camshaft

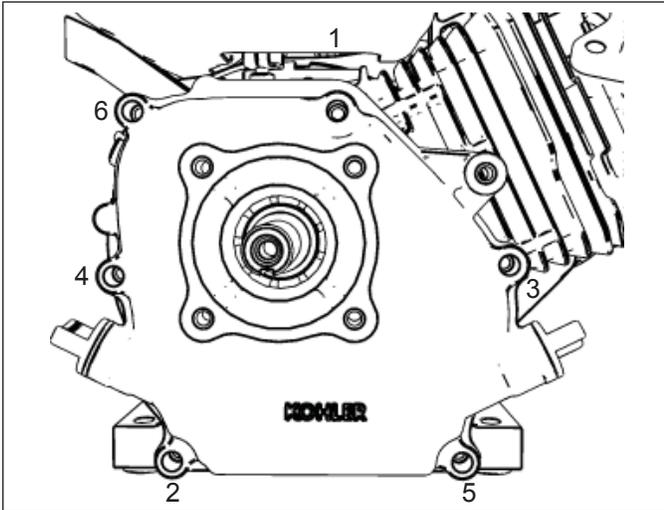
Crankshaft and Camshaft Timing Marks



1. Identify valve tappets as to their proper locations. Lubricate face and stem of each tappet with engine oil. Install each into its respective bore.
2. Lubricate camshaft bearing surfaces and cam lobes as well as camshaft bore in crankcase with engine oil.
3. Rotate crankshaft to TDC so timing mark (dimple) on crankgear (smaller gear) is in 4 o'clock position. Install camshaft into crankcase, aligning timing marks on gears.

Install Closure Plate

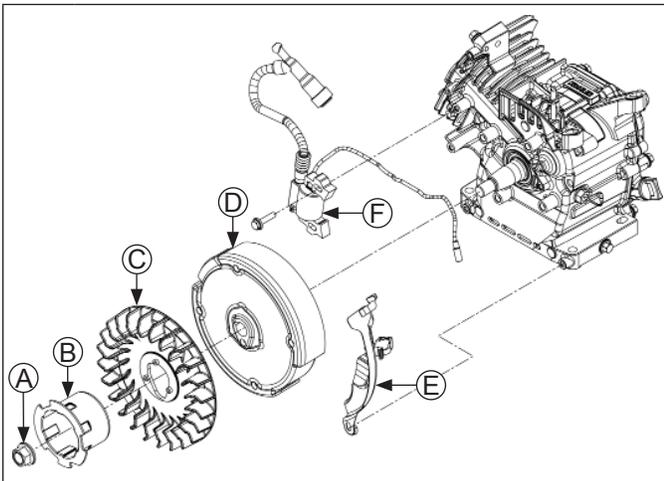
Torque Sequence



NOTE: Make sure governor lever is against cup on governor gear assembly.

1. Check to be sure sealing surfaces of crankcase and closure plate are clean and free of nicks or burrs.
2. Install dowel pins and install a new closure plate gasket (dry) onto dowel pins.
3. Install closure plate to crankcase. Carefully seat ends of camshaft and balance shaft into their mating bearings. Rotate crankshaft slightly to help engage governor gear teeth.
4. Install screws securing closure plate to crankcase. Torque screws in sequence shown to 24 N·m (212 in. lb.).

Flywheel/Ignition Components



| | | | |
|----------|------------------------|----------|-----------------|
| A | Flywheel Retaining Nut | B | Drive Cup |
| C | Flywheel Fan | D | Flywheel |
| E | Flywheel Shield | F | Ignition Module |

Install Flywheel



CAUTION

Damaging Crankshaft and Flywheel can cause personal injury.

Using improper procedures can lead to broken fragments. Broken fragments could be thrown from engine. Always observe and use precautions and procedures when installing flywheel.

NOTE: Before installing flywheel make sure crankshaft taper and flywheel hub bore are clean, dry, and completely free of lubricants. Presence of lubricants can cause flywheel to be overstressed and damaged when nut is torqued to specification.

NOTE: Make sure flywheel key is installed properly in keyway. Flywheel can become cracked or damaged if key is not installed properly.

1. Install woodruff key into keyway of crankshaft. Be sure that key is properly seated and parallel with taper of shaft.
2. Install flywheel onto crankshaft, being careful not to shift position of woodruff key.
3. Install flywheel shield and secure with screw.
4. Install fan bosses into matching holes in flywheel.
5. Position drive cup on flywheel, engaging boss on its base with corresponding hole on flywheel. Hold in position and install nut. Finger tighten to keep cup indexed.
6. Use a flywheel strap wrench and torque wrench to tighten flywheel nut. Torque nut to 74 N·m (655 in. lb.).

Install Ignition Module

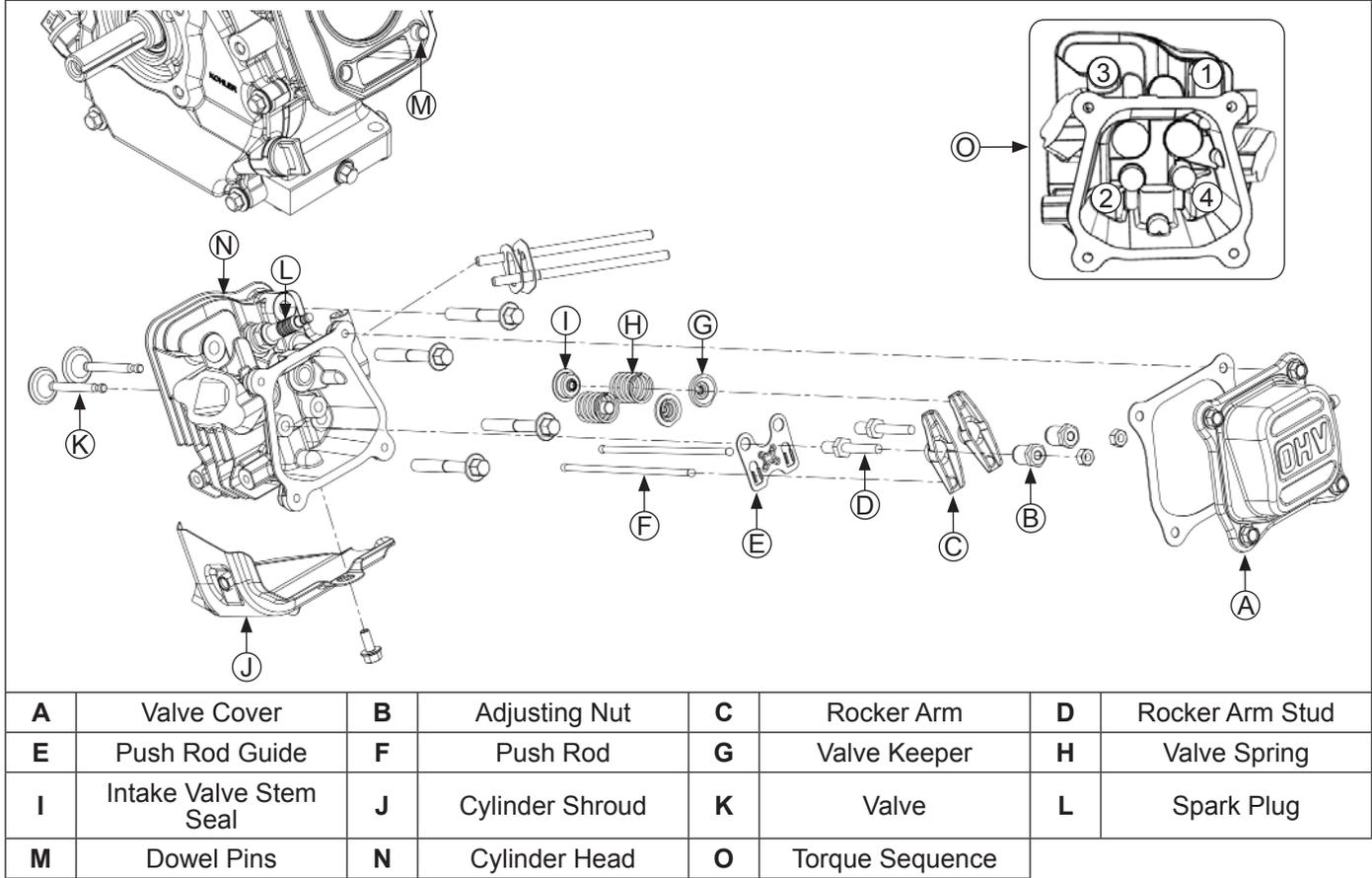
NOTE: Ensure ignition module is correctly oriented.

1. Turn flywheel so magnet is away from location where ignition module will be installed.
2. Install ignition module loosely to bosses with screws. Move module as far away from flywheel as possible, then tighten screws just enough to hold it in position.
3. Rotate flywheel in a clockwise direction until magnet is under 1 leg of ignition module.
4. Insert a 0.254 mm (0.010 in.) flat feeler gauge between leg of module and magnet. Loosen nearest screw, allowing magnet to draw module against feeler gauge. Push against module to hold leg tight against feeler gauge while tightening screw.
5. Rotate flywheel until magnet is under other leg of module. Loosen nearest screw, allowing magnet to draw module against feeler gauge. Push against module to hold leg tight against feeler gauge while tightening screw.
6. Torque both module screws to 8 N·m (70.8 in. lb.).
7. Rotate flywheel back and forth, checking to make sure magnet does not strike module.

Reassembly

8. Connect kill wire to ignition module bottom blade terminal and route wire lead across top of crankcase.

Cylinder Head Components



Assemble Cylinder Head

NOTE: Engine utilizes a valve stem seal on intake valve. Always use a new seal when valves are installed in cylinder head. Never reuse an old seal.

1. Install valves into their respective positions.
2. Install a new valve seal on stem of intake valve.
3. Install valve springs and retainers into their respective locations in cylinder head. Using hand pressure, compress each valve spring and slide each retainer onto valve stem to lock in place.

Install Cylinder Head

1. Check to make sure there are no nicks or burrs on sealing surfaces of cylinder head or crankcase.
2. Rotate crankshaft to position piston at TDC on compression stroke.
3. Install dowel pins into recesses around lower cylinder head bolt holes and install a new cylinder head gasket.
4. Install cylinder head and start screws. Tighten screws initially to a torque of 12 N·m (106 in. lb.) in several increments using sequence shown. Tighten to a final torque of 24 N·m (212 in. lb.).

Install Push Rods and Rocker Arms

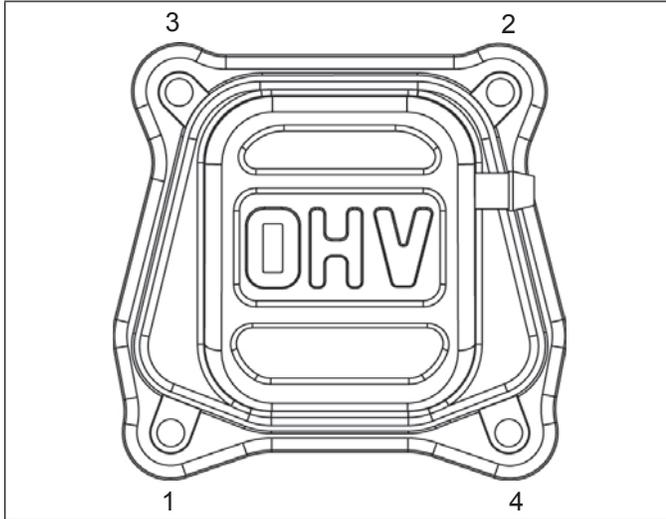
NOTE: Push rods should always be installed in original location.

1. Install push rod guide plate, aligning holes for rocker arm studs. Install rocker arm studs and torque to 13.6 N·m (120 in. lb.).
2. Dip ends of push rods in engine oil and install them in their respective locations, seating each into tappet socket.
3. Assemble rocker arms, adjusters, and locknuts onto rocker arm studs and push rods.
4. Adjust valve tappet clearance as follows:
 - a. Be sure piston is still at top of compression stroke.
 - b. Insert a flat feeler gauge between rocker arm and valve stem. Recommended valve to rocker arm clearance for intake is 0.1 mm (0.0040 in.) and 0.15 mm (0.0060 in.) for exhaust.
 - c. Adjust clearance as required by loosening locknut and tightening adjuster.
Turn clockwise to decrease clearance.
Turn counterclockwise to increase clearance.

- d. Hold adjuster from turning and tighten locknut. Torque locknut to 10 N·m (88.5 in. lb.).
- e. Recheck that clearance is correct.
5. Set gap of new spark plug to 0.76 mm (0.030 in.).
6. Install spark plug in cylinder head and torque to 27 N·m (20 ft. lb.).

Install Valve Cover

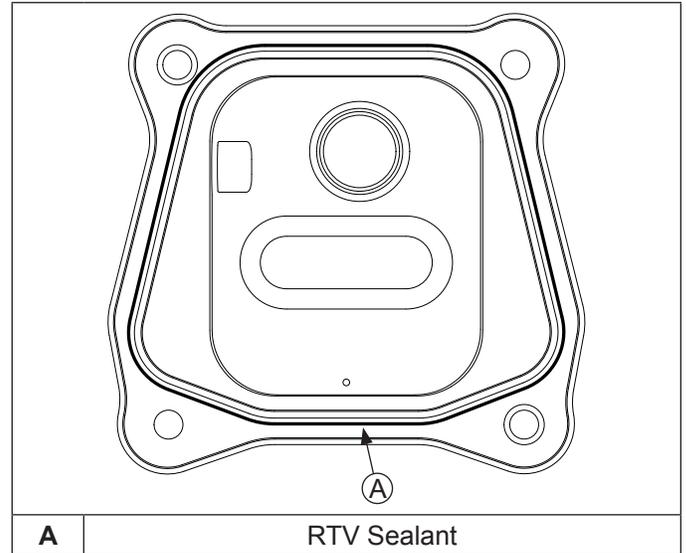
Valve Cover Torque Sequence



Valve Cover with Gasket

1. Make sure sealing surfaces of valve cover and cylinder head are clean, and free of any nicks or burrs.
2. Install a new valve cover gasket, followed by valve cover on head with screws and torque to 8.0 N·m (71 in. lb.) using sequence shown.

Valve Cover with RTV



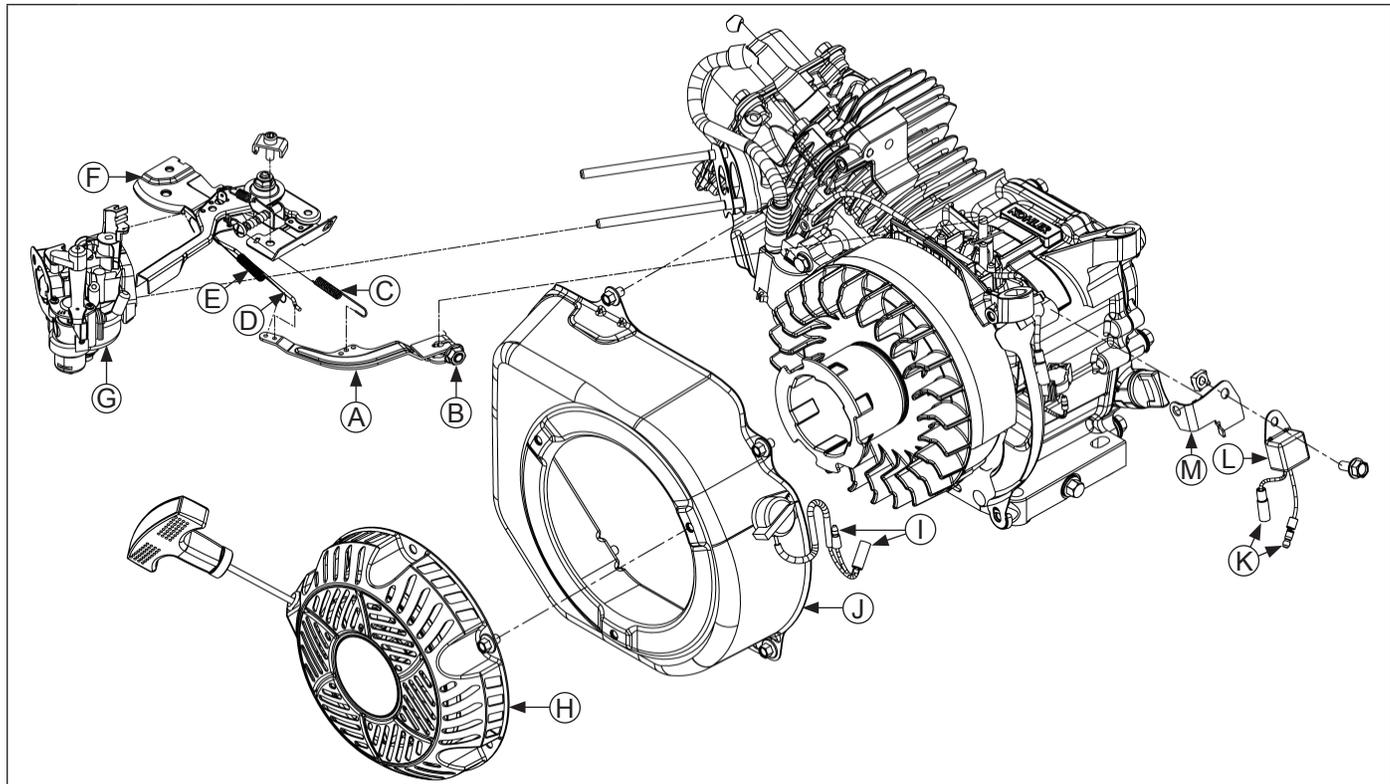
NOTE: Always use fresh sealant. Using outdated sealant can result in leakage. Refer to Tools and Aids for important information on sealant dispenser.

NOTE: To ensure proper adhesion of sealant to both surfaces, perform step 3 immediately (5 minutes maximum) after application of RTV.

1. Prepare sealing surface of cylinder head and valve cover.
2. Apply a 1.5 mm (1/16 in.) bead of sealant to valve cover as shown.
3. Position cover on cylinder head and start mounting screws.
4. Torque screws to 8.0 N·m (71 in. lb.) using sequence shown.

Reassembly

Blower Housing/Control Panel Components



| | | | | | | | |
|----------|--|----------|------------------|----------|---|----------|---------------------|
| A | Governor Lever | B | Nut | C | Governor Spring | D | Throttle Link |
| E | Dampening Spring | F | Control Assembly | G | Carburetor | H | Retractable Starter |
| I | On/Off Wiring Harness Bullet Connector | J | Blower Housing | K | Oil Sentry™ Wiring Harness Bullet Connector | L | Oil Sentry™ Module |
| M | Oil Sentry™ Bracket | | | | | | |

Install Throttle Plate

Install throttle plate with screws.

Install Engine Air Shroud

Install cylinder shroud. Torque screws to 8 N·m (70.8 in. lb.).

Install Carburetor

1. Install a new insulator to cylinder head gasket onto carburetor studs, followed by insulator, carburetor to insulator gasket, carburetor, and air cleaner gasket.
2. Connect throttle link and dampening spring into their respective holes on throttle lever.

Install Blower Housing

1. Position spark plug lead in molded clip in carburetor insulator.
2. Install blower housing on crankcase with screws. Torque screws to 10 N·m (88.5 in. lb.).

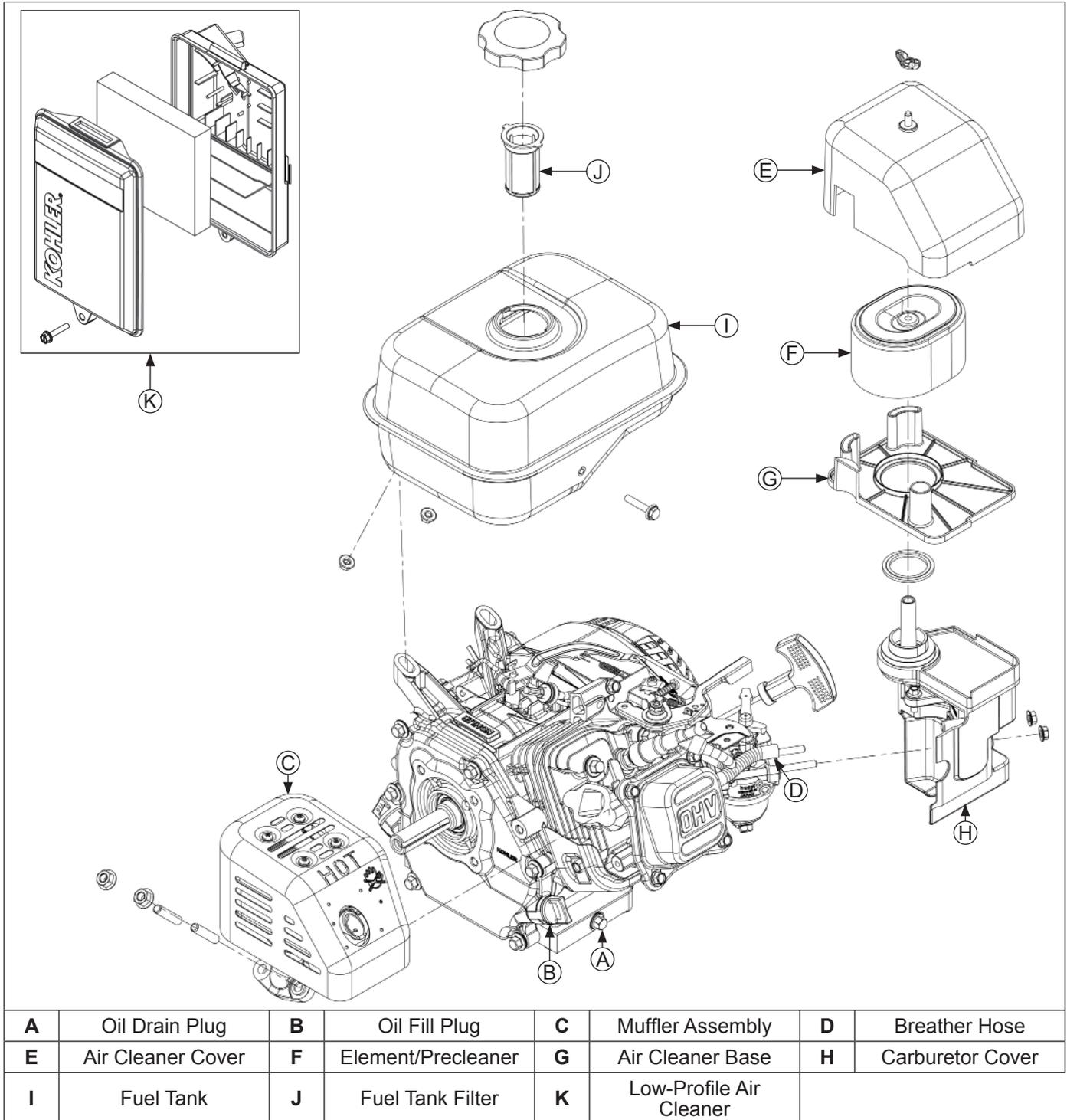
Install Electric Starter and Control Panel (if equipped)

1. Align and mount electric starter onto crankcase. Install and torque screws to 24 N·m (212 in. lb.).
2. Connect electrical leads for Oil Sentry™, ignition module, key switch, relay, and starter.
3. Mount control panel to crankcase and secure with screws. Ensure ground wires are placed between screw and bracket. Torque screws to 24 N·m (212 in. lb.).

Install Retractable Starter

1. Install retractable starter on blower housing using screws. Finger tighten screws only.
2. Pull rope handle to engage pawls and center starter to drive cup. Hold in this position and torque screws to 5.4 N·m (47.8 in. lb.).

External Engine Components

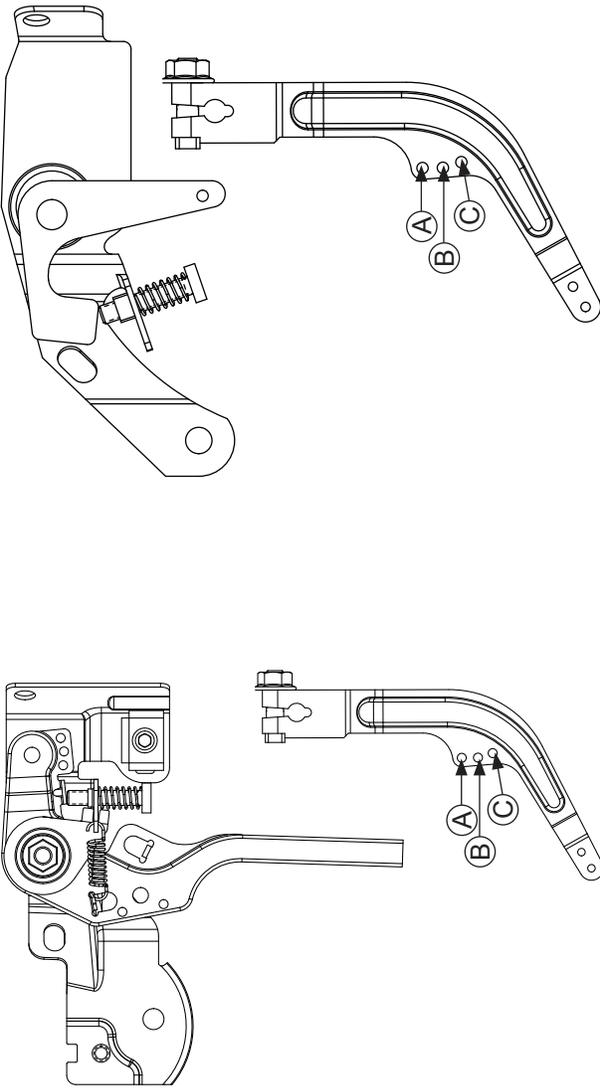


Reassembly

Install Throttle Lever, Governor Lever, Throttle Link, Dampening Spring, and Governor Spring

1. Install nylon washer and wave spring to throttle plate.
2. Connect spring to throttle lever and throttle plate. Install throttle lever to throttle plate. Install tabbed washer (with tab engaged in slot) and secure with nut.
3. Torque nut to 5.4 N·m (47.8 in. lb.).
4. Install governor lever onto shaft.
5. Connect dampening spring and throttle link to governor lever. Connect governor spring to governor lever and to throttle lever.
6. Move governor lever clockwise until it stops. Rotate governor shaft clockwise until it stops. Hold both in this position and torque governor lever nut to 10 N·m (88.5 in. lb.).

SH265 Governor Lever Hole Position/RPM Chart



| Engine Speed RPM | Droop | | | | | | | | | | | | | |
|------------------|--------------|------|--------------|------|--------------|------|--------------|------|--------------|------|--------------|-------|--------------|------|
| | 5-8% | | 5-10% | | 8-13% | | 8-14% | | 9-15% | | 14-18% | | 11-18% | |
| | Spring Color | Hole | Spring Color | Hole |
| 3750-3950 | | | | | | | | | | None | B | | | |
| 3100-3300 | | | | | | | Gold | C | | | | | | |
| 3500-3700 | | | Green | A | | | | | | | | | | |
| 3750-3950 | | | | | | | | | | | | Green | B | |
| 3601-3800 | | | Black | B | | | | | | | | | | |
| 3001-3200 | Black | B | | | | | | | | | | | | |
| 3800-4000 | | | | | | | | | | | | | | |
| 3801-4000 | | | | | Black | B | | | | | Purple | A | | |
| 3601-3800 | | | | | Black | B | | | | | | | | |
| 3401-3600 | | | | | Gold | C | | | | | | | | |
| 3201-3400 | | | | | Gold | C | | | | | | | | |
| 3001-3200 | | | | | Gold | B | | | | | | | | |
| 2800-3000 | | | | | Gold | A | | | | | | | | |

Reassembly

Install Oil Sentry™ Module

1. Install Oil Sentry™ module and secure with screw.
2. Connect electrical leads for Oil Sentry™ module.

Install Fuel Tank

1. Route fuel line across top of engine toward carburetor while positioning fuel tank on mounting brackets.
2. Secure with screw on inner mounting bracket.
3. Install nuts on fuel tank studs.
4. Torque fuel tank screw and nuts to 24 N·m (212 in. lb.).
5. Position fuel line in clip at carburetor and connect fuel line to shut-off valve on carburetor. Secure clamp.

Install Carburetor Cover

Install outer air cleaner cover onto studs and secure with nuts.

Install Muffler and Heat Shield Assembly

1. Install a new exhaust gasket with muffler and heat shield assembly. Secure muffler and heat shield assembly with nuts.
2. Torque nuts to 8 N·m (70.8 in. lb.).

Install Air Cleaner Base, Element, and Cover

Dual-Element

1. Install air cleaner base and secure with screws.
2. Install paper element with precleaner onto air cleaner stud and secure with washer and wing nut (if equipped).
3. Install air cleaner cover and secure with wing nut.

Low-Profile

1. Install air cleaner base and secure with screws.
2. Install foam element (lightly oiled) into base.
3. Install cover and secure with screw.

Prepare Engine for Operation

Engine is now reassembled. Before starting or operating engine be sure to do following:

1. Make sure all hardware is properly torqued.
2. Make sure oil drain plugs, oil fill plugs, and Oil Sentry™ wire lead bullet connectors are tightened securely.
3. Fill crankcase with correct oil. Refer to Maintenance and Lubrication System for oil recommendations and procedures.

Testing Engine

NOTE: Do not adjust maximum no-load high-idle engine speed beyond 3950 RPM maximum.

It is recommended engine be operated on a test stand or bench prior to installation on a piece of equipment.

1. Set engine up on a test stand. Check gas and oil levels. Start engine and run for 5-10 minutes between idle and midrange. Adjust low-speed idle screw so low idle speed is set to 1800 RPM (± 150) or application specifications.
2. Adjust high-speed stop screw as necessary to 3850 ± 100 RPM (typical RPM).



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