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110000/120000 Professional Series™ Single Cylinder Engines



Service, Troubleshooting, and Repair Manual

FORWARD

This manual was written to assist engine technicians and service personnel with the repair and maintenance procedures for Briggs & Stratton® engines. It assumes that persons using this manual have been properly trained in and are familiar with the servicing procedures for these products, including the proper use of required tools and safety equipment and the application of appropriate safety practices. Persons untrained or unfamiliar with these procedures or products should not attempt to perform such work.

Proper maintenance and repair is important to safe, reliable operation of all engines and engine-driven systems. The troubleshooting, testing, maintenance, and repair procedures described in this manual are appropriate for the Briggs & Stratton® engines described herein. Alternative methods or procedures may pose risk to personal safety and the safety and/or reliability of the engine and are not endorsed or recommended by Briggs & Stratton.

All information, illustrations, and specifications contained in this manual were based on the data available at the time of publication. Briggs & Stratton Corporation reserves the right to change, alter, or otherwise improve the product or the product manuals at any time without prior notice.

Briggs & Stratton offers two complementary publications to enhance understanding of engine technology, maintenance, and repair. (Neither publication, however, is a substitution for a recognized training program for engine technicians.)

- For consumers, *Small Engine Care & Repair* (p/n 274041) provides a comprehensive overview of how small air-cooled engines work, basic troubleshooting, and step-by-step maintenance procedures.
- For engine technicians and consumers alike, an in-depth study of engine theory and operation can be found in the textbook *Small Engines* (p/n CE8020).

Both publications can be purchased at BRIGGSandSTRATTON.COM or through a local Authorized Briggs & Stratton Service Dealer.

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This engine repair manual includes the following engine models:

- **MODEL 110000**
- **MODEL 120000**

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SAFETY INFORMATION

1

This repair manual contains safety information that is designed to:

- Make you aware of hazards associated with engines.
- Inform you of the risk of injury associated with those hazards.
- Tell you how to avoid or reduce the risk of injury.

Signal Words in Safety Messages

The safety alert symbol is used to identify safety information about hazards that can result in personal injury.

A signal word (**DANGER**, **WARNING**, or **CAUTION**) is used with the alert symbol to indicate the likelihood and the potential severity of injury. In addition, a hazard symbol may be used to represent the type of hazard.

DANGER indicates a hazard which, if not avoided, will result in death or serious injury.

WARNING indicates a hazard which, if not avoided, could result in death or serious injury.

CAUTION indicates a hazard which, if not avoided, could result in minor or moderate injury.

NOTICE indicates a situation that could result in damage to the product.

Prior to work, read and understand the section(s) of this manual that pertain to the job. Follow all safety warnings.

- Always use fresh gasoline. Stale fuel can cause gum deposits in the carburetor and cause leakage, flow restrictions, or other problems.
- Check fuel lines and fittings frequently for cracks or leaks and replace if necessary.

WARNING

Before attempting to service this equipment, read and understand this manual and the operating instructions of the engine and the equipment it powers.

Failure to follow instructions could result in property damage, serious injury (including paralysis) or even death.

Hazard Symbols and Meanings



WARNING

Battery posts, terminals, and related accessories contain lead and lead compounds - chemicals known to the State of California to cause cancer and reproductive harm. Wash hands after handling.

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WARNING

Certain components in this product and its related accessories contain chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm. Wash hands after handling.

WARNING

Briggs & Stratton Engines are not designed for and are not to be used to power: fun-karts; go-karts; children's, recreational or sport all-terrain vehicles (ATVs); motorbikes; hovercraft; aircraft products; or vehicles used in competitive events not sanctioned by Briggs & Stratton. For information about competitive racing products, see www.briggsracing.com. For use with utiity and side-by-side ATVs, please contact Briggs & Stratton Engine Application Center, 1-866-927-3349. Improper engine application may result in serious injury or death.

WARNING

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

WARNING



Running engines produce heat. Severe burns can occur on contact.

- Allow muffler, engine cylinder fins, and radiator to cool before touching.
- Remove accumulated combustibles from muffler area and cylinder area.
- It is a violation of California Public Resource Code, Section 4442, to use or operate the engine on any forest-covered, brush-covered, or grass-covered land unless the exhaust system is equipped with a spark arrester, as defined in Section 4442, maintained in effective working order. Other States and Federal jurisdictions may have similar laws. Contact the original equipment manufacturer, retailer, or dealer to obtain spark arrester designed for the exhaust system installed on this engine.

WARNING



Fuel and its vapors are extremely flammable and explosive.



Fire or explosion can cause severe burns or death.

When adding fuel:

- Turn engine OFF and let engine cool for at least 2 minutes before removing the fuel cap.
- Fill fuel tank outdoors or in a well-ventilated area.
- Do not overfill fuel tank. To allow for expansion of the gasoline, do not fill above the bottom of the fuel tank neck.
- Keep gasoline away from sparks, open flames, pilot lights, heat and other ignition sources.
- Check fuel lines, tank, cap, and fittings frequently for cracks or leaks. Replace if necessary.
- If fuel spills, wait until it evaporates before starting engine.

When starting engine:

- Make sure spark plug, muffler, fuel cap, and air cleaner are in place.
- Do not crank engine with spark plug removed.
- If fuel spills, wait until it evaporates before starting engine.
- If engine floods, set choke (if equipped) to **OPEN/RUN** position. Place throttle (if equipped) in **FAST** and crank until engine starts.

When operating equipment:

- Do not tip engine or equipment at an angle which would cause fuel to spill.
- Do not choke carburetor to stop engine.
- Never start or run the engine with the air cleaner assembly (if equipped) or the air filter (if equipped) removed.

When changing oil:

- If you drain the oil from the top oil fill tube, the fuel tank must be empty or fuel can leak out and result in a fire or explosion.

When transporting equipment:

- Transport with fuel tank empty or with fuel shut-off valve set to OFF.

When storing gasoline or equipment with fuel in the tank:

- Store away from furnaces, stoves, water heaters, or other appliances that have a pilot light or other ignition source because they can ignite gasoline vapors.

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WARNING



Unintentional sparking can result in fire or electrical shock.
Unintentional start-up can result in entanglement, traumatic amputation, or severe lacerations.

Before performing adjustments or repairs:
- Disconnect spark plug wire and keep it away from spark plug.
- Disconnect the negative (-) battery terminal.

When testing for spark:
- Use approved spark plug tester.
- Do not check for spark with spark plug removed.

WARNING



Engines give off carbon monoxide, an odorless, colorless, poison gas.
Breathing carbon monoxide can cause nausea, fainting, or death.
- Start and run engine outdoors.
- Do not start or run engine in an enclosed area, even if doors and windows are open.

WARNING



Starting engine creates sparking.
Sparking can ignite nearby flammable gases.
Explosion and fire could result.
- If there is a natural or LP gas leak in the area, do not start engine.
- Do not use pressurized starting fluids because vapors are flammable.

WARNING



Rotating parts can contact or entangle hands, feet, hair, clothing, or accessories.
Traumatic amputation or severe lacerations can result.
- Operate equipment with guards in place.
- Keep hands and feet away from rotating parts.
- Tie up long hair and remove jewelry.
- Do not wear loose-fitting clothing, dangling drawstrings, or items that could become entangled in the equipment.

WARNING



Charging batteries produce hydrogen gas. Do not store or charge a battery near an open flame or device that utilizes a pilot light or can create a spark.

WARNING



Damaged, worn, or loose fuel components can leak fuel. Explosion or fire could result.
- All fuel components should be in good condition and properly maintained.
- Repairs should only be made with factory approved parts.
- Repair work should be done by a qualified technician.
- Flexible supply lines should be checked regularly to make sure they are in good condition.

WARNING



Rapid retraction of starter cord (kickback) will pull hand and arm toward engine faster than you can let go.
Broken bones, fractures, bruises, or sprains could result.
- When starting engine, pull the starter cord slowly until resistance is felt and then pull rapidly to avoid kickback.
- Remove all external equipment/engine loads before starting engine.
- Direct-coupled equipment components, such as but not limited to blades, impellers, pulleys, and sprockets, must be securely attached.

WARNING

Prolonged or repeated contact with used motor oil could cause injury.
- Used motor oil has been shown to cause skin cancer in certain laboratory animals.
- Thoroughly wash exposed areas with soap and water.

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Fuel and Oil Recommendations

Fuel must meet these requirements:

- Clean, fresh, unleaded gasoline.
- A minimum of 87 octane / 87 AKI (90 RON).
- Gasoline with up to 10% ethanol (gasahol) or up to 15% MTBE (methyl tertiary butyl ether) is acceptable.

NOTICE: Do not use unapproved gasoline, such as E85. Do not mix oil in gasoline or modify the engine to run on alternate fuels. This will damage the engine components and **void the engine warranty**.

To protect the fuel system from gum formation, mix a fuel stabilizer into the fuel. All fuel is not the same. If starting or performance problems occur, change fuel providers or change brands. This engine is certified to operate on gasoline. The emissions control system for this engine is EM (Engine Modifications).

High Altitude

At altitudes over 5,000 feet (1524 meters), a minimum 85 octane / 85 AKI (89 RON) gasoline is acceptable. To remain emissions compliant, high altitude adjustment is required. Operation without this adjustment will cause decreased performance, increased fuel consumption, and increased emissions.

Operation of the engine at altitudes below 2,500 feet (762 meters) with the high altitude kit is not recommended.

Fresh Start® Fuel Cap

Some engines are equipped with a Fresh Start® fuel cap. The Fresh Start fuel cap is designed to hold a cartridge (sold separately) that contains fuel stabilizer.

Oil must meet these requirements:

- Briggs & Stratton warranty certified oils are recommended for best performance.
- Other high-quality detergent oils are acceptable if classified for service SF, SG, SH, SJ or higher.
- Do not use special additives.

Outdoor temperatures determine the proper oil viscosity for the engine.

Use the chart (Figure 1-1) to select the best viscosity for the outdoor temperature range expected.

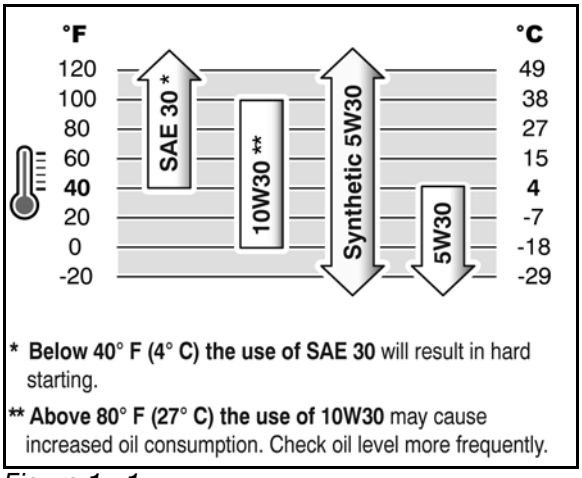


Figure 1 - 1

MAINTENANCE CHART

First 5 Hours
• Change oil
Every 8 Hours or Daily
• Check engine oil level • Clean area around muffler and controls • Clean finger guard
Every 25 Hours or Annually
• Clean air filter* • Clean pre-cleaner*
Every 50 Hours or Annually
• Change engine oil • Check muffler and spark arrester
Annually
• Replace air filter • Replace pre-cleaner • Replace spark plug • Replace fuel filter • Clean air cooling system*

* In dusty conditions or when airborne debris is present, clean more often.

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Oil Change

Change oil after the first 5 hours of operation. After that, change oil after every 50 hours of operation. Change oil more often if engine is operated in dirty or dusty conditions, under heavy loads, or in high ambient temperatures.

1. Remove oil drain plug from side or bottom of engine, if equipped, and drain oil while the engine is still warm.
2. Install drain plug.
3. Fill crankcase with correct amount of new oil. Do Not overfill.
4. Start engine and run at idle for a minute or so.
5. Shut engine off and wait for oil to settle back into the cylinder.
6. Check dipstick. If necessary, add more oil slowly to bring level to FULL mark on dipstick.
7. If engine is equipped with an oil filter, change oil filter every 50 hours of operation followng these steps:
   - Remove oil fitler and dispose of properly.
   - Before installing a new oil filter, lightly lubricate the oil filter with fresh, clean oil.
   - Install the oil filter by hand until the gasket contacts the oil fill adapter, then tighten the oil fitler 1/2 to 3/4 turn.
   - Add the appropriate amount of oil. Do Not overfill.
   - Start and run the engine for a few minutes to check for oil leaks.

Air Filter

A correctly serviced air filter protects internal engine parts from airborne dirt and dust. Poor filter maintenance will allow dirt and dust to be drawn into the engine, causing wear to the intake system and contamination of the oil. Dirt in the oil forms an abrasive mixture which wears down moving parts.

WARNING

Fuel and its vapors are extremely flammable and explosive.
Fire or explosion can cause severe burns or death.

- Never start or run the engine with the air cleaner assembly or the air filter removed.

NOTE: Do not use pressurized air or solvents to clean the filter. Pressurized air can damage the filter and solvents will dissolve the filter.

High Capacity Air Filter

1. Loosen the fastener (**A**, Figure 1-2) that holds the cover (**B**). Remove pre-cleaner (**C**) and the filter (**D**).
2. Gently tap air filter cartridge on a hard surface to loosen debris. Replace cartridge if very dirty.
3. Wash foam pre-cleaner in warm, soapy water, then rinse and allow to air dry. Do Not oil the the pre-cleaner.
4. Reassemble the air cleaner system into the base (**E**).

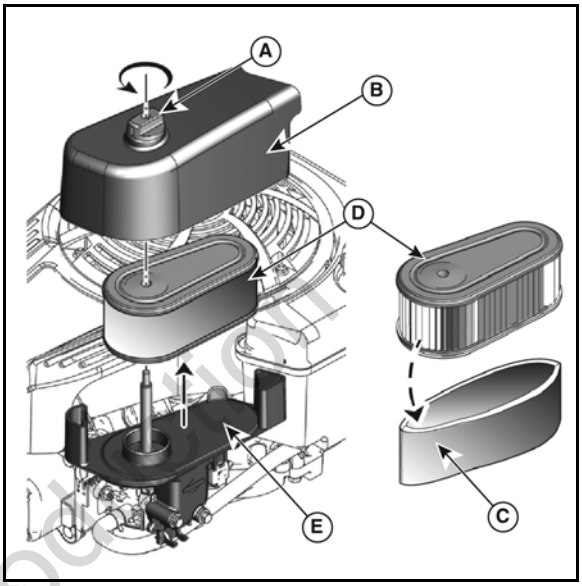


Figure 1 - 2

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Standard Air Filter

1. Move the slide lock (**A**, Figure 1-3) to the unlock position. Open the cover (**B**).
2. Remove the foam element (**C**).
3. Wash the foam element in liquid detergent and water. Squeeze dry the foam element in a clean cloth.
4. Saturate the foam element with clean engine oil. To remove the excess engine oil, squeeze the foam element in a clean cloth.
5. Install the foam element into the air filter base.
6. Close the cover and move the slide lock to the locked position.

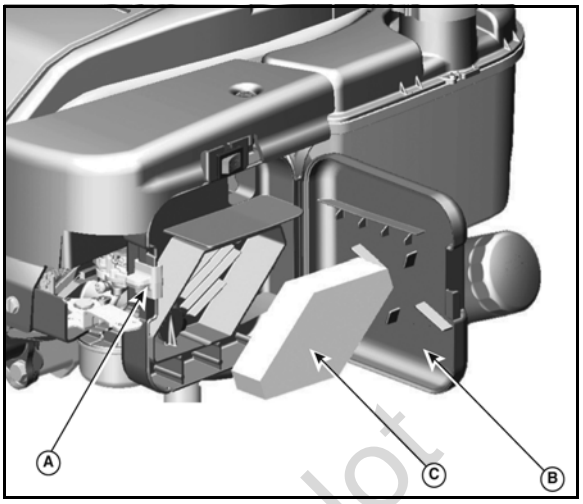


Figure 1 - 3

Spark Plug

The spark plug should be replaced every year.

NOTICE
Spark plugs have different thread lengths and heat ranges. When changing a spark plug, use only the specified replacement, otherwise engine damage could occur.

NOTE: In some areas, local law requires using resistor spark plugs to suppress radio frequency interference.

1. Disconnect spark plug wire.
2. Remove and inspect spark plug for wear and damage. Replace spark plug if electrodes are burned away, or the porcelain is cracked.
3. Using a spark plug gage, check and set the gap (**A**, Figure 1-4) per Section 12 - Engine Specifications.

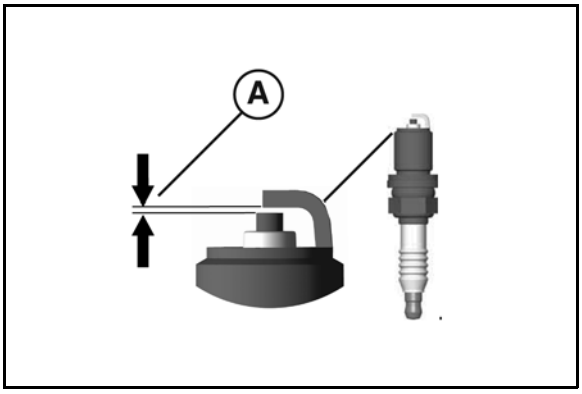


Figure 1 - 4

4. Re-install spark plug and torque to values listed in Section 12 - Engine Specifications.
5. Connect spark plug wire.

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Cooling System

WARNING

Running engines produce heat.
Severe burns can occur on contact.

- Allow muffler, engine cylinder fins, and radiator to cool before touching.
- Remove accumulated combustibles from muffler area and cylinder area.

Dirt or debris can restrict air flow and cause the engine to overheat, resulting in poor performance and reduced engine life. Continued operation with a clogged cooling system can cause severe overheating and possible engine damage. Clean these areas (**A**, Figure 1-5) yearly or more often when dust or airborne debris is present.

NOTICE: Do not use water to clean the engine. Water could contaminate the fuel system. Use a brush or dry cloth to clean the engine.

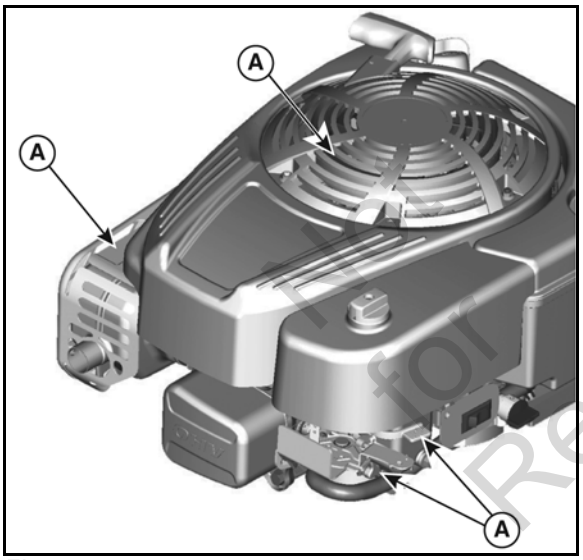


Figure 1 - 5

Charging Battery

1. Clean the battery of all dirt and corrosion.
2. Clean, then lightly grease the terminals.
3. Bring the battery to full charge using a taper charge (automatically reduces charge rate).

NOTE: Do not exceed a charge rate of 1/10 ampere for every ampere of battery rating.

Consult the battery manufacturer for maximum charge recommendations.

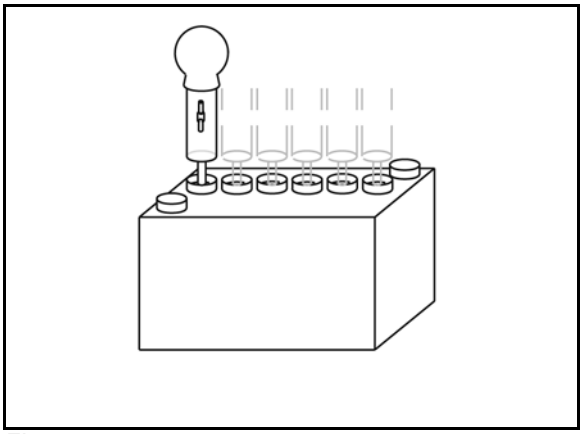


Figure 1 - 6

Combustion Chamber

Remove combustion chamber deposits every 500 hours or whenever the cylinder head is removed.

With the piston at Top Dead Center (TDC), scrape deposits from top of piston and upper bore with a plastic scraper.

Remove the loosened deposits from around the top ring land area using compressed air or a shop vacuum and a soft bristle brush.

NOTE: Use care to prevent debris from entering the push rod or oil return cavities in cylinder. Do not damage bore, top of piston, cylinder head, or gasket mounting surfaces.

It is not necessary to remove the discoloration marks on the piston, valves, and/or cylinder head. These marks are normal and will not affect engine operation.

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Throttle Cable Adjustment

The remote control wire should measure 2.125 in. (54 mm) when extended outside the casing (**A**, Figure 1-7). After installation, the travel (**B**) of the remote control wire must be at least 1.375 in. (35 mm). If the travel of the remote control wire does not reach the minimum distance, use the following procedure to adjust the cable:

1. Loosen casing clamp screw (**C**).
2. Move throttle lever to FAST position.
3. Move casing in direction of arrow (**D**) until slack is removed.
4. Tighten casing clamp screw. Torque to values listed in Section 12 - Engine Specifications.

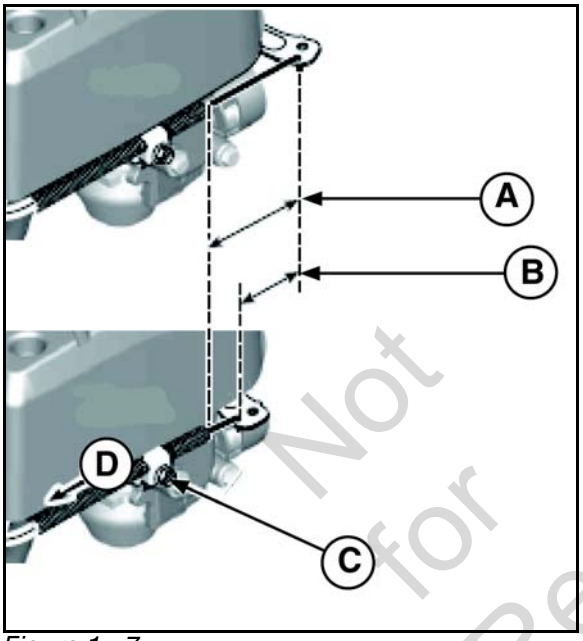


Figure 1 - 7

Governor Adjustments

A complete governor system adjustment includes a static adjustment, engine warm-up, and top no-load adjustment. Be sure to complete all steps.

Static Adjustment

1. Loosen nut (**A**, Figure 1-8) until governor lever (**B**) moves freely from governor crank (**C**).
2. Move throttle linkage (**D**) until throttle plate is wide open (**E**).

NOTE: Choke valve closes when opening the throttle plate.

3. While holding linkage, tighten governor lever nut. Torque to values listed in Section 12 - Engine Specifications.
4. Before starting engine, manually actuate throttle linkage to check for binding.

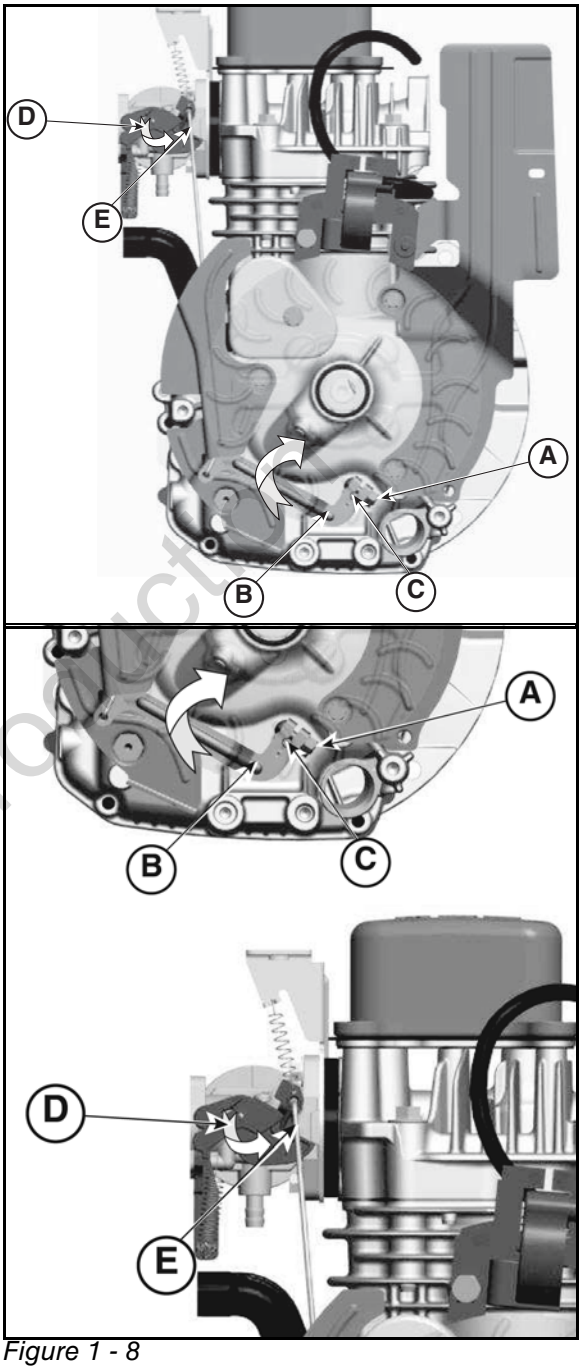


Figure 1 - 8

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Top No-Load Adjustment

1. Start engine and run at idle speed until it reaches operating temperature.
2. Place throttle lever (**F**, Figure 1-9) in FAST position.
3. Using Tachometer #19200 or #19389, and Tang Bender #19229 or #19352, bend spring tang (**G**) to obtain correct top no-load RPM.

NOTE: Correct top no-load RPM for each model-type-trim can be found in the engine replacement data on Briggs & Stratton websites.

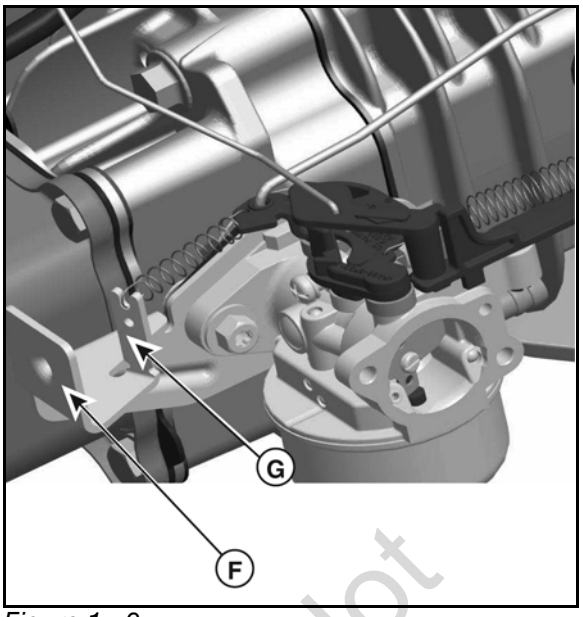


Figure 1 - 9

Adjust Valve Clearance

NOTE: Check valve clearance while the engine is cold.

1. Insert a narrow gauge such as a screwdriver, rod, or pencil into the spark plug hole until it touches the piston. Cut away view is shown.
2. Observe the movement of the gauge and turn the flywheel clockwise past top dead center on the compression stroke until the piston has moved down the bore 0.25 in. (6.4 mm).
3. Valve clearance is checked by placing a feeler gauge (**H**,Figure 1-10) between the rocker arm adjusting screw (**J**) and the valve cap (**K**).
4. Using an Allen wrench, loosen the head set screw. Turn the adjusting nut (L) in or out until the correct clearance is obtained between the valve stem cap and rocker arm.
5. Tighten the allen head set screw to lock the setting in. Recheck clearance and readjust as necessary.

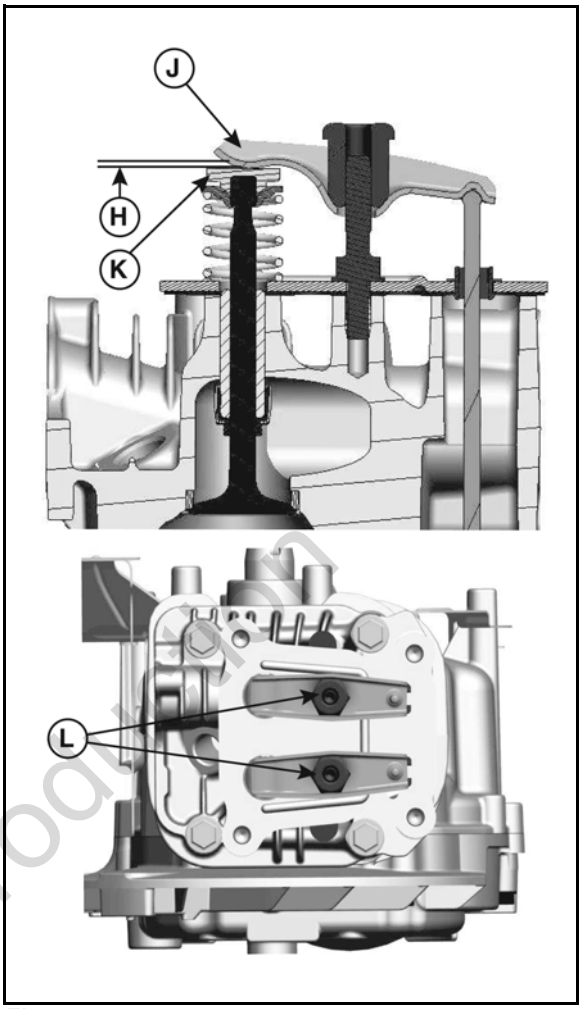


Figure 1 - 10

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Adjust ReadyStart® Choke Link

Perform this adjustment while the engine is cold.

1. Using pliers, bend adjusting loop (**M**, Figure 1-11) on choke link (**N**) until choke lever gap measures 0.000 - 0.060 in. (0.000 - 1.52 mm). When properly adjusted, the choke plate will be fully closed. Reshape wire to keep it parallel (**P**) after adjusting loop.

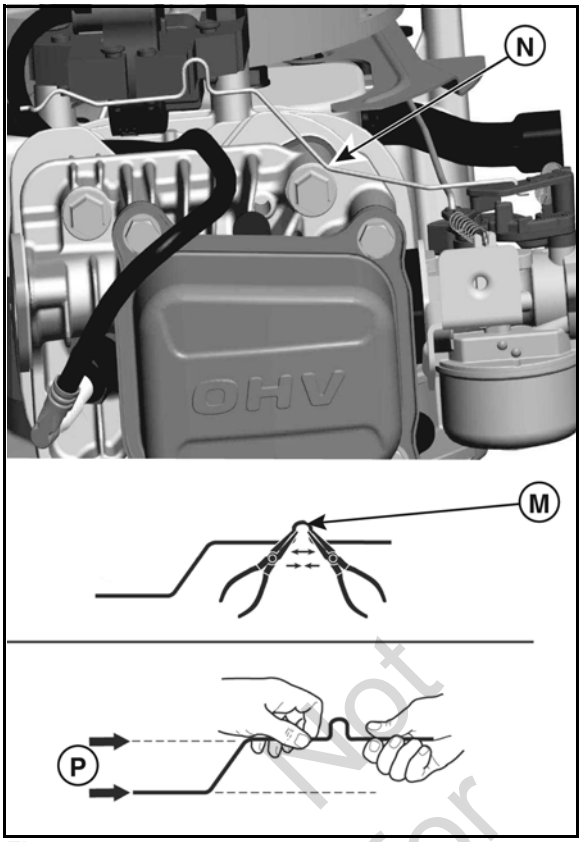


Figure 1 - 11

7. Loosen stud and allow magnet to pull armature against gauge (**G**).
8. Tighten fasteners and torque to values listed in Section 12 - Engine Specifications.
9. Rotate flywheel to remove gauge.

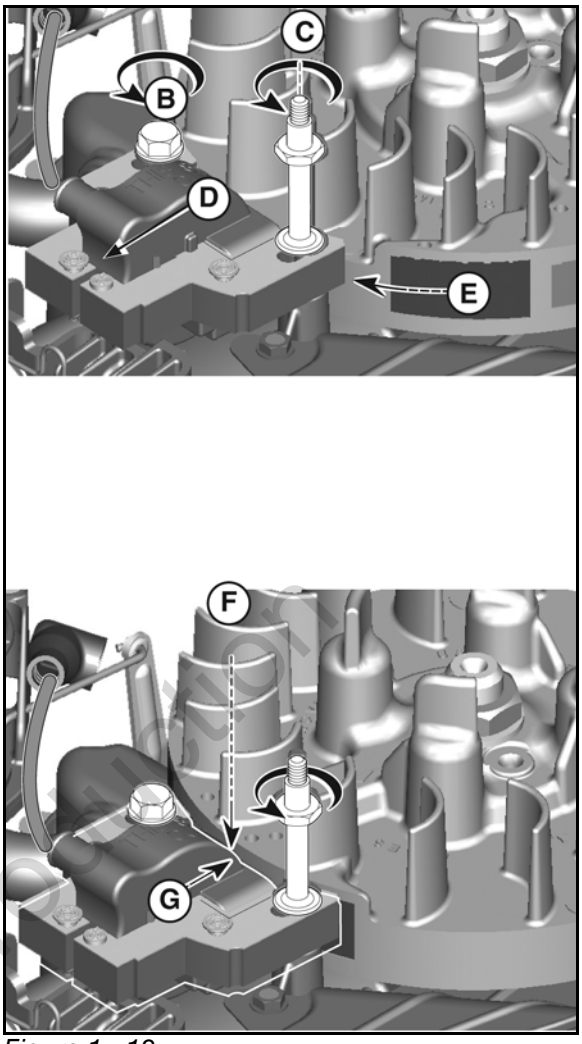


Figure 1 - 12

Adjust Armature Air Gap

1. Disconnect spark plug boot (**A**, Figure 1-12) and secure away from spark plug.
2. Loosen screw (**B**) and stud (**C**).
3. Slide armature (**D**) away from flywheel.
4. Tighten stud to secure armature.
5. Line up flywheel magnets **(E**) with armature.
6. Insert a strip of gauge material (**F**) between flywheel magnet and both legs of armature.

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Adjust Alternator Air Gap

1. Remove spark plug.
2. Loosen alternator screws (**A**, Figure 1-13). and slide alternator (**B**) away from flywheel.
3. Tighten one screw to secure alternator.
4. Line up flywheel magnet (**D**) with alternator.
5. Insert Air Gap Gauge Tool #CE5121 (**C**) between flywheel magnet and both legs of alternator.
6. Loosen screw and allow magnet to pull alternator against gauge.
7. Tighten fasteners and torque to values listed in Section 12 - Engine Specifications.
8. Rotate flywheel to remove gauge.

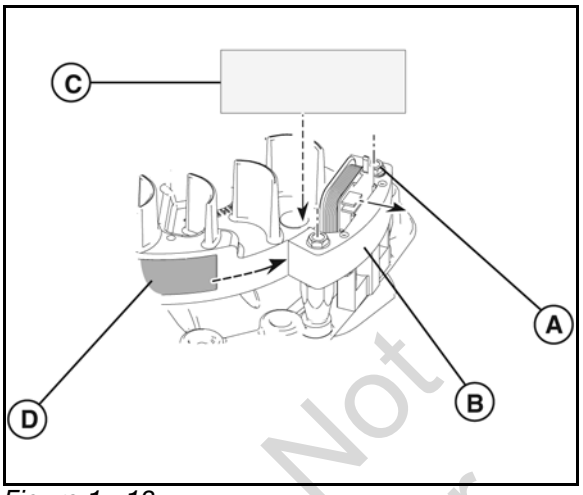


Figure 1 - 13

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Flywheel Brake

The flywheel brake is part of the safety control system required for some applications. While running at the FAST speed position, the flywheel brake MUST stop the engine within three seconds when the operator releases the equipment safety control.

Test Brake Torque

1. Disconnect spark plug wire.
2. Remove static guard/rewind assembly.
3. Unscrew and remove fuel tank.
4. Remove dipstick and oil fill tube.
5. Unscrew and remove blower housing.
6. Using a torque wrench (**A**, Figure 1-14) and socket to fit the flywheel nut, turn flywheel clockwise with brake engaged. While turning at a steady rate, torque value should be 26 lb.-in. (3 Nm) or higher.
7. If reading is low, check thickness of brake pad (**B**). Replace brake assembly if thickness is less than 0.090 in. (2.28 mm).
8. If brake pad thickness is acceptable, adjust control cable to position pad closer to flywheel when safety control is in RUN position. Repeat Step 6.
9. Replace brake assembly if correct adjustment cannot be made.

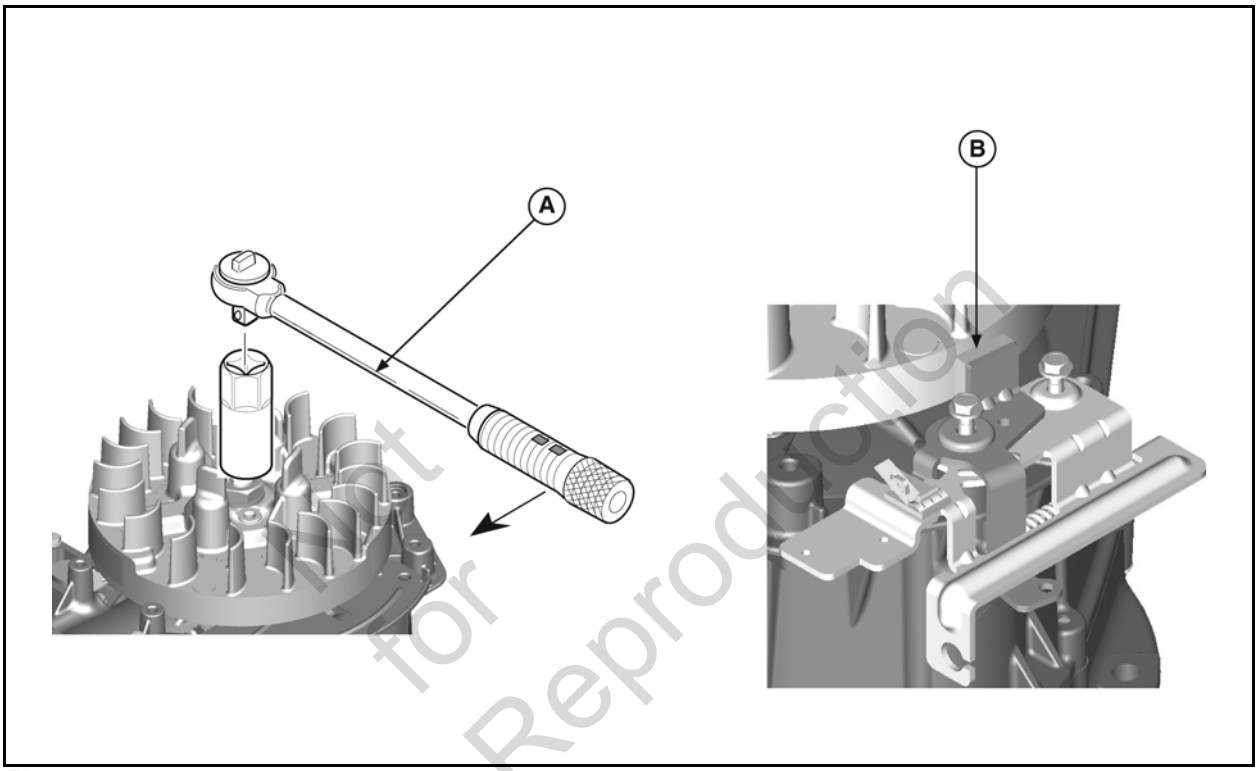


Figure 1 - 14

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Remove Flywheel Brake

1. Disconnect and remove spring from brake anchor. (Standard brake assembly (**A**). Electric start brake assembly (**B**).
2. Disconnect safety control cable from brake assembly.
3. Loosen brake screw (**C**, Figure 1-15) but do not remove.
4. Rotate bracket to relieve tension on screw (**D**) and remove, then remove screw (**C**).
5. Press stop switch tang to disconnect stop wire, then remove brake assembly.
6. Disconnect wires on interlock switch, if equipped.

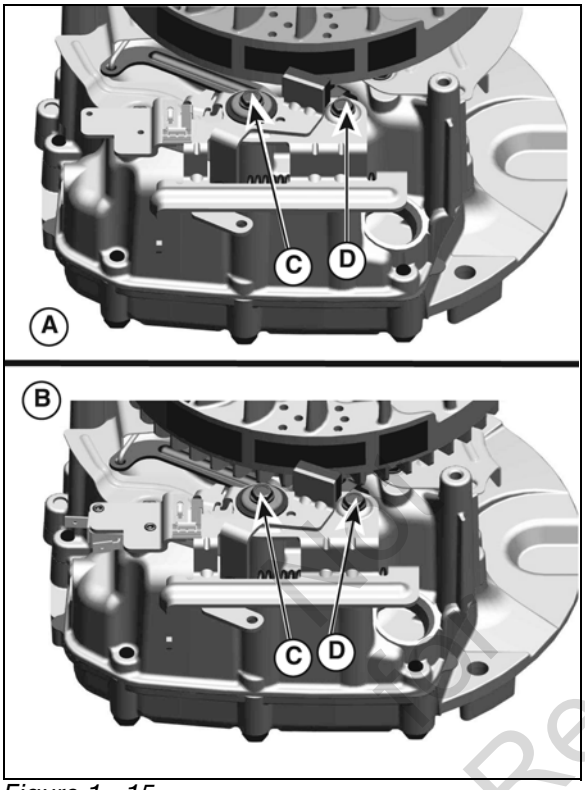


Figure 1 - 15

Install Flywheel Brake

1. Install stop switch wire and bend end of wire 90°. Install wires on interlock switch, if equipped.
2. Install brake assembly on cylinder and torque mounting screws to values listed in Section 12 - Engine Specifications.
3. When assembled, the electric start switch lever (Figure 1-16) must be outside of, and not interfere with, the flywheel guard.
4. Connect safety control cable and install brake spring.
5. Actuate brake system to ensure proper movement, then test brake torque as previously described.
6. Install blower housing, oil fill tube, dipstick, fuel tank, and static guard/rewind assembly. Torque all screws to values listed in Section 12 - Engine Specifications.

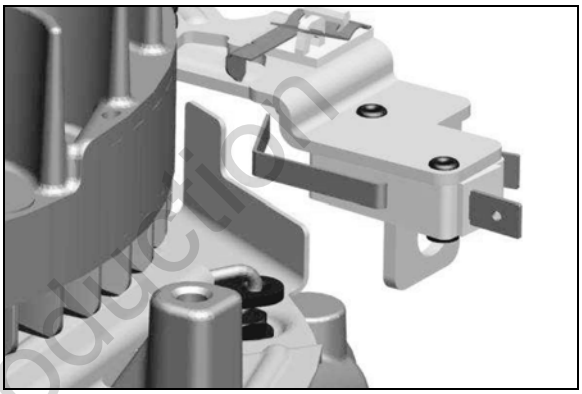


Figure 1 - 16

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SECTION 2 - TROUBLESHOOTING

SYSTEMS CHECK ---------- 18

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Most complaints concerning engine operation can be classified as one or a combination of the following:

- Will not start
- Hard starting
- Lack of power
- Runs rough
- Vibration
- Overheating
- High oil consumption

What appears to be a problem with the engine may actually be the fault of the equipment. Following is a list of some common engine symptoms and their relationship to equipment problems.

No Start - Hard Start

- Loose belt or blade
- Misadjusted controls
- Interlock system malfunction

Engine Will Not Stop

- Equipment stop switch not functioning
- Engine ground wire damaged or disconnected

Vibration

- Bent cutter blades
- Loose spindles and couplings
- Bent/broken deck or weldments
- Bent crankshaft
- Loose equipment mounting bolts
- Damaged or worn belts and pulleys
- Out of balance impeller

Power Loss

- Bind or drag in moving parts of equipment
- Grass build-up under deck
- No lubrication in equipment gear box
- Excessive belt tension

Once equipment sources are ruled out, the cause for most of these symptoms can be determined by performing a systems check in the following order:

1. Ignition
2. Carburetion
3. Compression

This check-up can usually be done in a matter of minutes and is the quickest and surest method of determining the cause of such problems.

1) Check Ignition

Engine Stopped

With spark plug installed, attach Ignition Tester #19368 to spark plug lead and ground the other end of the tester (Figure 2-1). Pull the starter rope or activate the electric starter (if equipped). If spark jumps the tester gap, you may assume the ignition system is functioning satisfactorily.

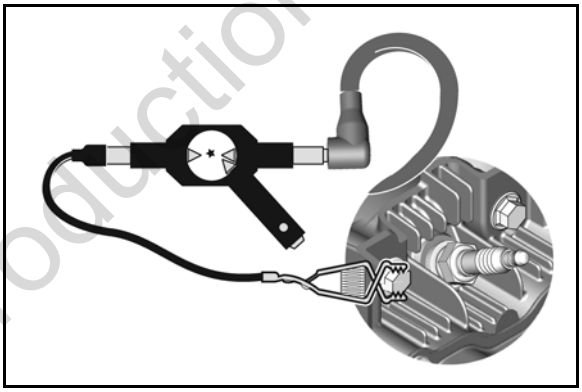


Figure 2 - 1

Engine Running

If engine runs but misses during operation, a quick check to determine whether the ignition is at fault can be made by installing Ignition Tester #19368 between the spark plug lead and spark plug (Figure 2-2). If spark is good but engine misses, install a new spark plug.

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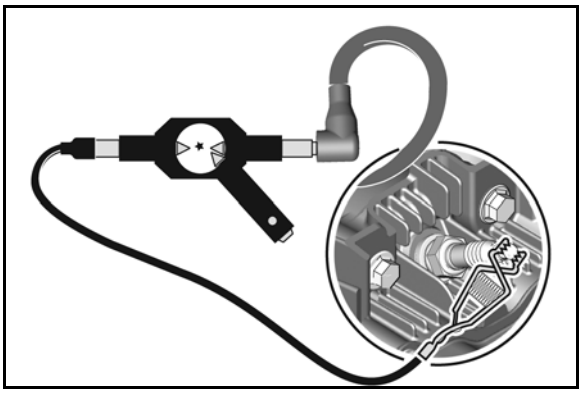


Figure 2 - 2

If spark does not occur, look for:

- Improperly operating interlock system
- Shorted equipment or engine stop switch wire
- Incorrect armature air gap
- Armature failure

2) Check Carburetion

Before making a carburetion check, be sure the fuel tank has an ample supply of fresh, clean gasoline.

Be sure the shutoff valve, if equipped, is open and fuel flows freely through the fuel line. If fuel fails to flow or is slow, check for plugged fuel cap vent, fuel line restriction or plugged fuel filter.

Be sure throttle and choke controls are properly adjusted.

If engine cranks but will not start, remove and inspect the spark plug.

If plug is wet, look for:

- Over choking
- Excessively rich fuel mixture
- Water in fuel
- Float needle valve stuck open
- Plugged air cleaner
- Fouled spark plug

If plug is dry, look for:

- Leaking carburetor or intake manifold gaskets
- Gummy or dirty carburetor, fuel filter, fuel lines or fuel tank
- Float needle valve stuck closed
- Inoperative fuel pump (if equipped)
- Inoperative fuel shut-off solenoid (if equipped)

A simple check to determine if the fuel is getting to the combustion chamber through the carburetor is to remove the spark plug and pour a small quantity of gasoline through the spark plug hole. Replace the plug. If the engine fires a few times and then stops, look for the same conditions as for a dry plug.

3) Check Compression

Use Leakdown Tester #19545 to check the sealing capabilities of the compression components.

Follow the instructions provided with the tester to perform the leakdown test.

NOTE: Any air leaks at the connections or fittings of the tester will affect the accuracy of the test.

Listen for air leaking from the cylinder head gasket, carburetor, exhaust system, and the crankcase breather tube.

- Air flowing between the cylinder and cylinder head indicates that the cylinder head gasket is leaking.
- Air flowing from the carburetor indicates air is leaking past the intake valve and seat.
- Air flowing from the exhaust system indicates air is leaking past the exhaust valve and seat.
- Air flowing from the crankcase breather tube or high oil fill dipstick tube indicates air is leaking past the piston rings.

Possible Causes for Poor Compression:

- Loose cylinder head bolts
- Blown head gasket
- Burned valves, valve seats and/or loose valve seats
- Insufficient tappet clearance
- Warped cylinder head
- Warped valve stems
- Worn bore and/or rings
- Broken connecting rod

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Equipment Used for Testing

Digital Multimeter

A digital multimeter is recommended for all electrical testing of Briggs & Stratton® engines. The meter can be used to read volts, ohms, amperes, and to test diodes.

Digital Multimeter #19602 is available from your Briggs & Stratton source of supply. Follow the unit's operator manual for complete operating instructions.

DC Shunt

The Fluke® meter will withstand DC input of 10-20 amps for up to 30 seconds.

The UNI-T® meter will withstand DC input of 10 amps for up to 10 seconds.

When checking DC output on 10 and 16 amp regulated systems, the DC Shunt #19468 (Figure 2-3) is required to avoid blowing a fuse in either of the meters.

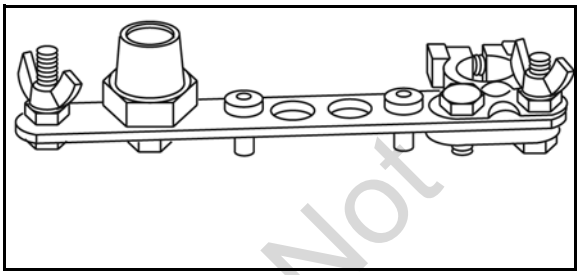


Figure 2 - 3

Tachometer

Tachometers #19200 (**A**) or #19389 (**B**, Figure 2-4) are available from your Briggs & Stratton source of supply.

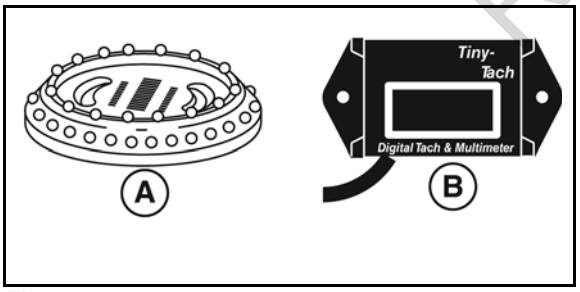


Figure 2 - 4

Starter Motor Test Fixture

A starter motor test fixture may be made from 1/4" (6 mm) steel stock (Figure 2-5).

1. Drill two 3/8" (10 mm) holes for starter mounting bracket (**B**).
2. Using same spacing, drill an additional 3/8" (10 mm) hole (**A**) for alternate starter mounting position.
3. Using a #7 bit, drill two holes for mounting Tachometer #19200. Tap the holes for 1/4-20 NC screws (**C**).

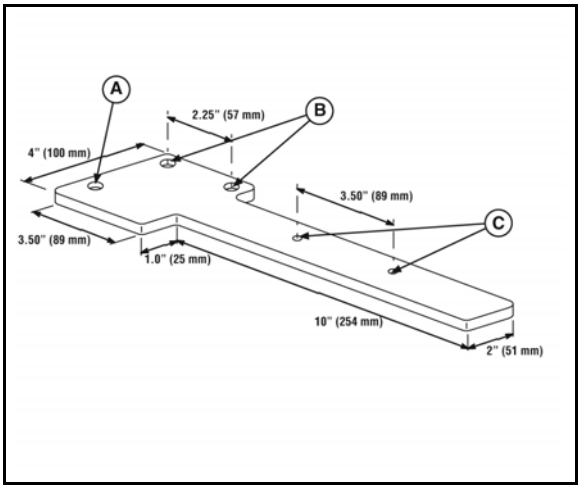


Figure 2 - 5

Other Equipment

A growler or armature tester (checks armature for continuity, shorts, and opens) is available from an Automobile Diagnostic Service supplier.

Also, a known good 12 Volt battery is required when testing starting systems or alternators.

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Alternator Testing

When testing alternators, perform the tests in the following sequence:

1. Test alternator output.
2. Test diode(s) or regulator-rectifier (if equipped).

The 0.5 Amp, DC alternator (Figure 2-6) is designed to operate as an integral part of the engine and is separate from the starting and ignition system. It is intended to provide DC charging current for a 12 Volt battery.

- Unregulated
- 0.5 Amp DC for charging battery
- One black lead (**A**) from stator
- White connector (**B**) output lead

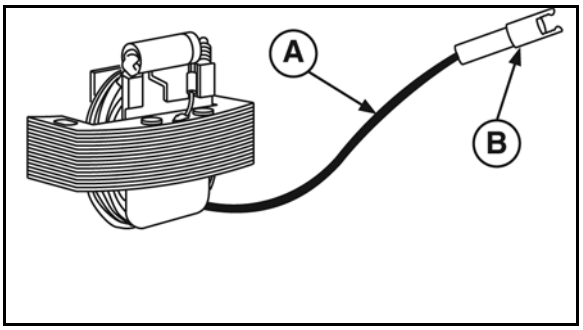


Figure 2 - 6

1. Disconnect charging lead to battery at white connector.
2. Insert RED test lead into 10 Amps receptacle in meter.
3. Insert BLACK test lead into COM receptacle in meter.
4. Rotate selector to DC Amps position.
5. Attach RED test clip to output lead (**A**, Figure 2-7).
6. Attach BLACK test clip to charging lead (**B**).

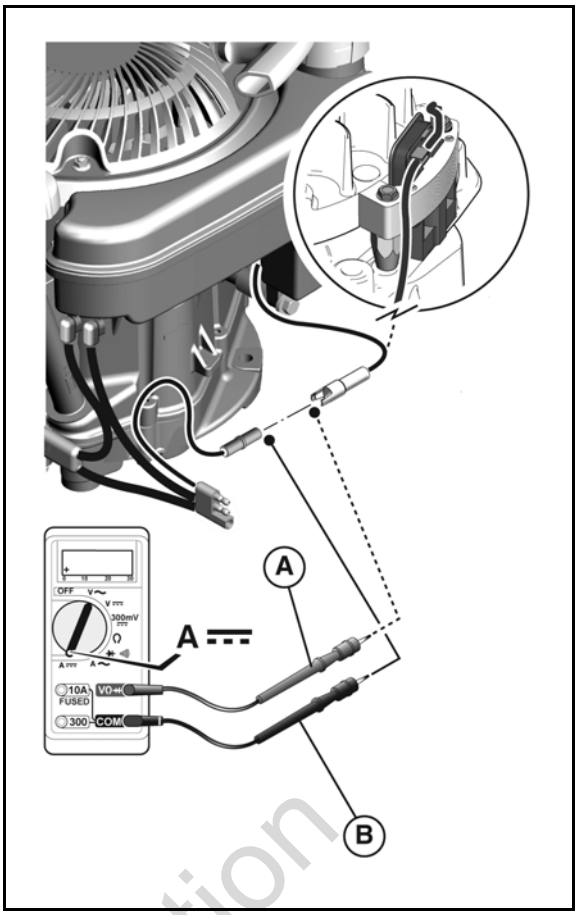


Figure 2 - 7

7. Install tachometer, then start and run engine at 2800 RPM. Meter should display no less than 0.5 Amp DC.
8. If low or no output, check alternator air gap. Adjust to value listed in Section 12 - Engine Specifications.
9. If alternator air gap is within specification and there is still low or no output, replace alternator.

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Starter Motor Testing

Before assuming an electric starter requires service, check the engine for freedom of rotation by removing the spark plug and turning the crankshaft over by hand. Any belt, clutch, or other parasitic load will affect the starter cranking performance, so ensure their effects are minimized.

The following list is given to aid in diagnosing problems for the 12 Volt starting system.

1. Engine Cranks Slowly
   - Parasitic load affecting performance
   - Discharged, defective, or incorrect battery
   - Faulty electrical connection (battery circuit)
   - Dirty or worn starter motor commutator, bearing, weak magnets, etc.
   - Wrong engine oil viscosity for ambient temperatures
   - Defective starter clutch
   - Flywheel brake misadjusted
   - Battery leads too long or wire diameter too small
2. Engine Will Not Crank
   - Improperly operating interlock system
   - Discharged battery
   - Loose or corroded electrical connections
   - Open circuit in starter motor switch
   - Open circuit in starter motor
   - Brushes sticking
   - Inoperative starter solenoid
   - Blown fuse in equipment wiring harness
3. Starter Motor Spins But Does Not Crank Engine
   - Sticking pinion gear
   - Damaged pinion or ring gear
   - Starter motor clutch slipping
   - Incorrect rotation due to reversed motor polarity

Check Starter Motor Drive and Clutch

When the starter switch is activated, the pinion gear should rise, engage the flywheel ring gear, and crank the engine. The pinion gear must rotate counterclockwise, as viewed from the gear. If the starter motor drive does not react properly, check the helix and pinion gear for free operation. If the pinion gear sticks, clean the helix and gear with a mild solvent and compressed air. If the pinion continues to stick, replace the entire starter drive assembly.

NOTE: Do not oil the pinion gear or clutch helix.

The starter motor clutch is designed to prevent damage from shock loads such as engine backfire. If the clutch slips while cranking, replace the entire starter drive assembly.

Test Starter Motor

1. Clamp starter motor test fixture in vise (Figure 2-8).
2. Remove starter motor from engine and mount to fixture.

NOTICE: Do not clamp the motor housing in a vise or strike with a hammer. Starter motors contain ceramic magnets that can be damaged if the motor housing is hit, deformed, or dented.

3. Set meter to DC Amps position.
4. Connect the optional starter switch (**A**, Figure 2-8), starter motor, battery (**F**), black lead (**C**), red lead (**D**), shunt (**E**), and tachometer (**B**).

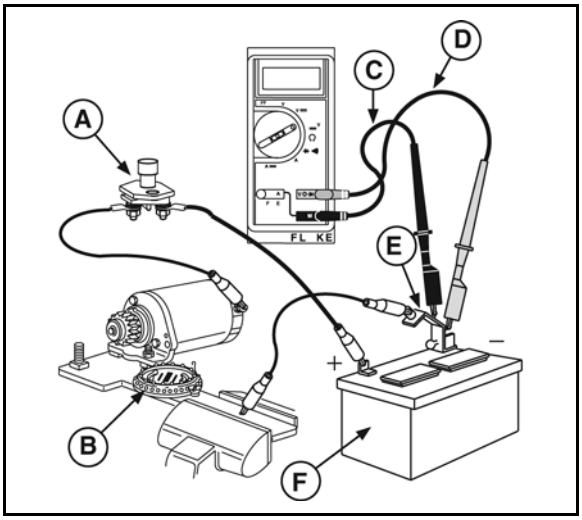


Figure 2 - 8

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5. Activate starter motor and note readings of meter and tachometer.Take reading after meter stabilizes (approximately 2-3 seconds).

With a fully-charged battery, the starter motor should deliver 6500 RPM (minimum) and 35 Amps (maximum). If the starter motor does not meet these specifications, it must be replaced.

Battery Testing

A 12 Volt, lead acid, wet cell battery is required to operate the starter motor. This type is available as a wet charge or dry charge battery.

The wet charged maintenance-free battery is filled with electrolyte and sealed at the time production. The level of electrolyte cannot be checked.

The dry charge battery requires electrolyte to be added at the time the battery is placed in service. Before activating a dry charge battery, read and follow the manufacturer's recommended procedure.

⚠ WARNING





Storage batteries give off explosive hydrogen gas during recharging.
Slightest spark will ignite hydrogen and cause explosion.
Battery electrolyte fluid contains acid and is extremely caustic.
Contact with battery contents will cause severe chemical burns.
A battery presents a risk of electrical shock and high short circuit current.

- DO NOT dispose of a battery in a fire.
- DO NOT allow any open flame, spark, heat, or lit cigarette during and for several minutes after charging a battery.
- DO NOT open or mutilate the battery.
- Wear protective goggles, rubber apron, and rubber gloves.
- Remove watches, rings, or other metal objects.
- Use tools with insulated handles.

Check Battery and Cable Sizes

The following battery size recommendations are based on the minimum temperature expected and the correct weight of oil being used.

- 30 Amp. Hr. +20ºF (-6ºC) or higher
- 40 Amp. Hr. -5ºF (-20ºC) or higher
- 50 Amp. Hr. -15ºF (-26ºC) or higher

The following cable sizes are based on the total distance from the battery positive (**+**) post to the starter switch and/or solenoid, plus the ground return to the battery negative (**-**) post.

- #6 AWG - 4 ft. (1.2m) or less
- #5 AWG - 5 ft. (1.5m) or less
- #4 AWG - 6 ft. (1.8m) or less

⚠ WARNING

Battery posts, terminals, and related accessories contain lead and lead compounds - chemicals known to the State of California to cause cancer and reproductive harm. Wash hands after handling.

Check Battery Installation

1. Ensure the battery is in a holder with a flat base. Tighten holder down evenly until snug. DO NOT over tighten.
2. Clean, then lightly grease the terminals.
3. Connect positive (**+**) cable to positive battery post FIRST, to prevent sparks from accidental grounding. Tighten connector securely.
4. Connect negative (**-**) cable to negative battery post. Tighten connector securely.

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SECTION 3 - EXHAUST SYSTEM

EXHAUST SYSTEM - - - - - - - - - - 26

REMOVE GUARD AND MUFFLER - - - - - - - - - - 27

INSPECT EXHAUST SYSTEM - - - - - - - - - - 27

INSTALL GUARD AND MUFFLER - - - - - - - - - - 27

3

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EXHAUST SYSTEM

Some engines may be equipped with an exhaust system (muffler, bracket, and hardware) supplied by the equipment manufacturer. Contact the equipment manufacturer for muffler service information.

The exhaust system covered in this section is supplied by Briggs & Stratton.

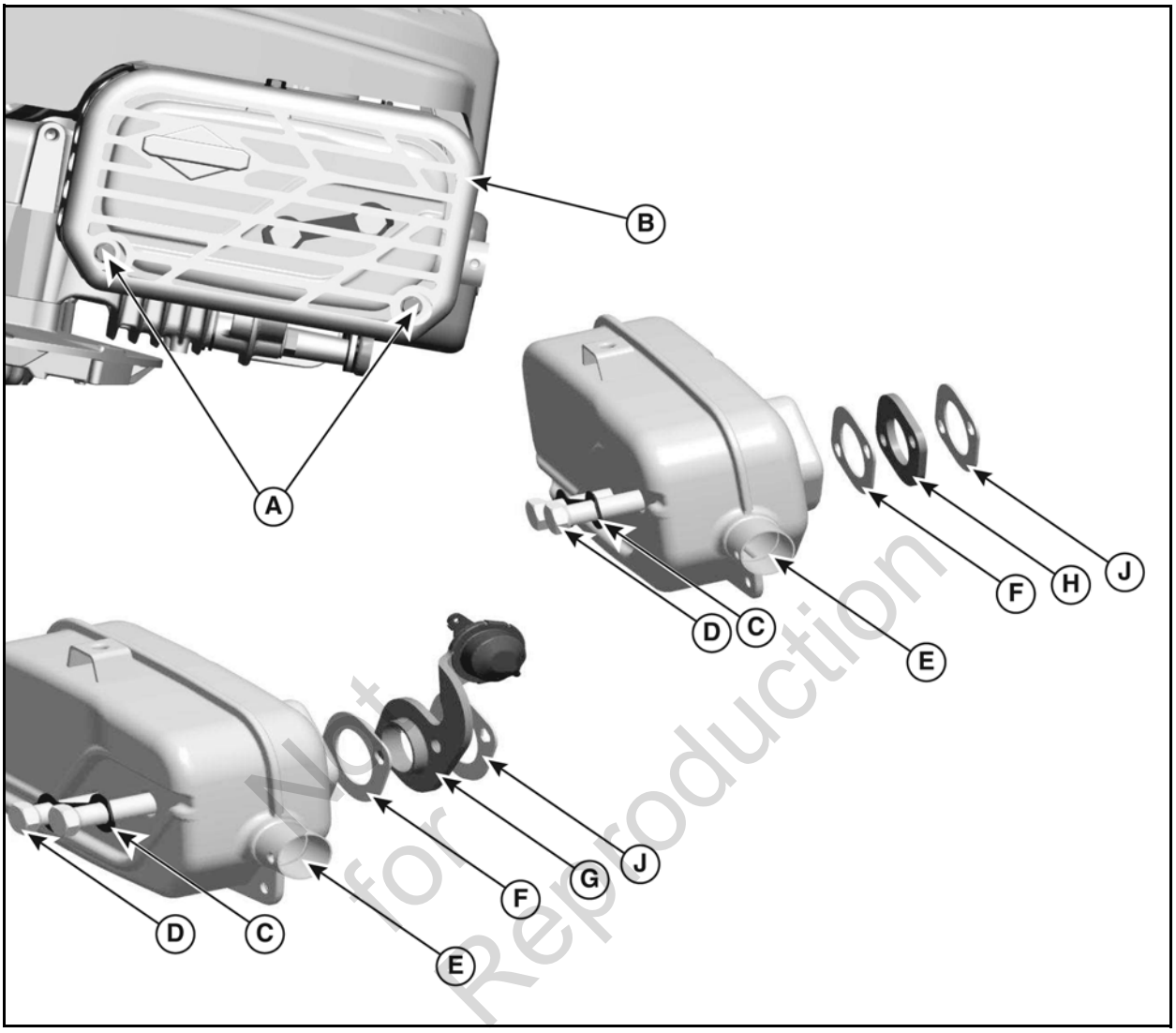


Figure 3 - 1

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Remove Guard and Muffler

1. Remove screws (**A**, Figure 3-1) holding muffler guard (**B**) (if equipped). Remove guard and set aside.
2. Bend back tabs on screw lock (**C**) and remove screws (**D**), muffler (**E**), and gasket (**F**). Discard gasket.
3. Remove thermostat (**G**)(if equipped), spacer (**H**)(if equipped), and gasket (**J**). Discard gasket.

Inspect Exhaust System

All exhaust system components must be inspected whenever the exhaust system is disassembled. Check the muffler mounting bracket and/or muffler adapters for cracked welds or breakage. Check the muffler for split seams, loose internal parts, or cracked welds. Replace any damaged parts with new original equipment parts. **Never reinstall broken or damaged components.**

Install Muffler and Guard

1. Insert screws with new screw lock into muffler and place new exhaust gasket on end of screws.
2. Lightly coat screw threads with Valve Guide Lubricant #93963.
3. Position new gasket and thermostat or spacer on cylinder head, then install muffler assembly.
4. If muffler guard is not used, install muffler assembly to flywheel guard. Torque to values listed in Section 12 - Engine Specifications.
5. Tighten screws to values listed in Section 12 - Engine Specifications, then bend the screw lock tabs up against the head of the mounting screws.
6. Install muffler guard (if equipped) with screws. Torque to values listed in Section 12 - Engine Specifications.

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SECTION 4 - FUEL SYSTEM AND CARBURETION

FUEL TANK -30

CARBURETOR -32

4

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FUEL TANK

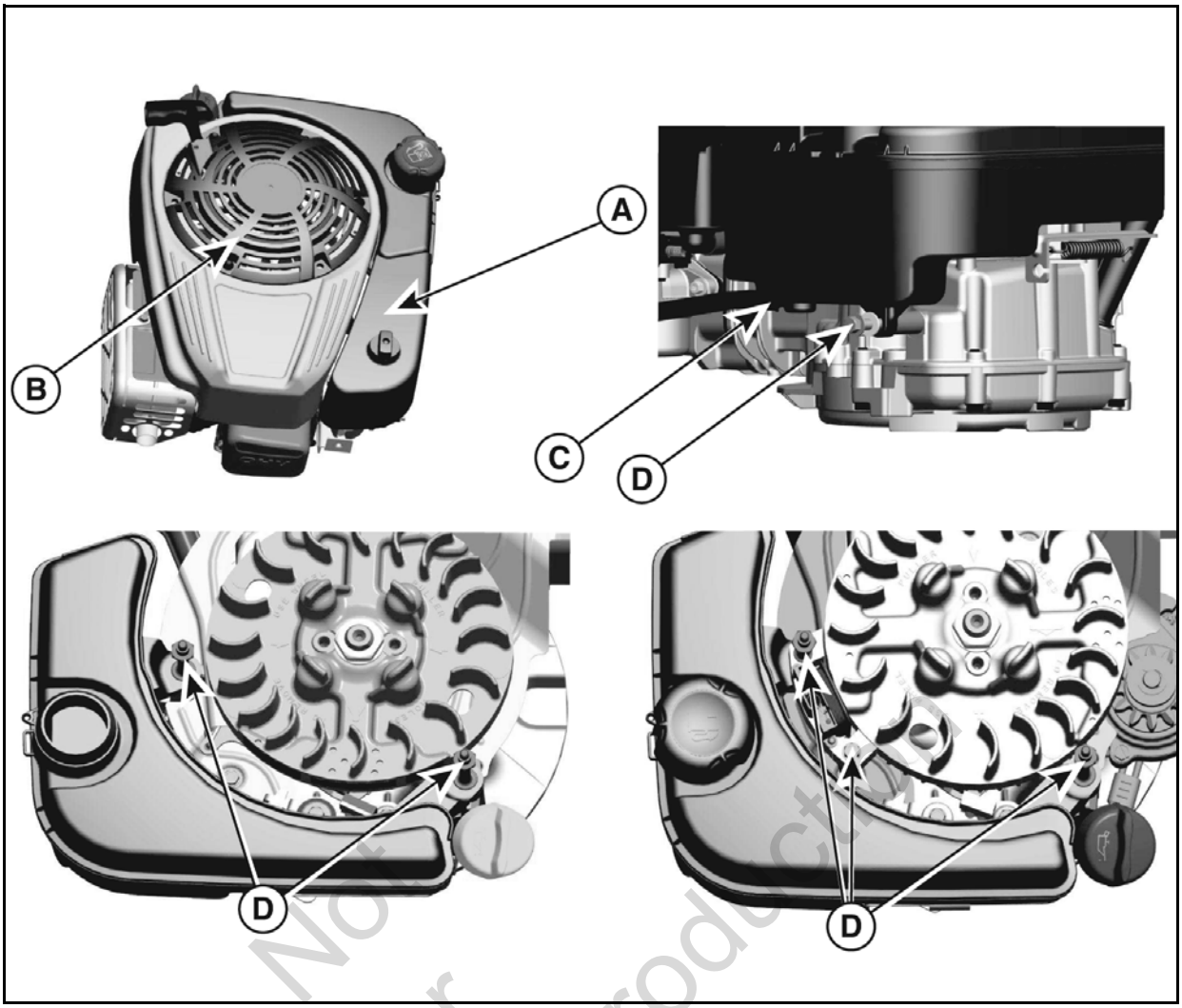


Figure 4 - 1

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WARNING



Gasoline and its vapors are extremely flammable and explosive.
Fire or explosion can cause severe burns or death.

When adding fuel:
- Turn engine OFF and let engine cool for at least 2 minutes before removing the fuel cap.
- Fill fuel tank outdoors or in a well-ventilated area.
- Do not overfill fuel tank. To allow for expansion of the gasoline, do not fill above the bottom of the fuel tank neck.
- Keep gasoline away from sparks, open flames, pilot lights, heat and other ignition sources.
- Check fuel lines, tank, cap, and fittings frequently for cracks or leaks. Replace if necessary.
- If fuel spills, wait until it evaporates before starting engine.

When starting engine:
- Make sure spark plug, muffler, fuel cap, and air cleaner are in place.
- Do not crank engine with spark plug removed.
- If fuel spills, wait until it evaporates before starting engine.
- If engine floods, set choke (if equipped) to **OPEN/RUN** position. Place throttle (if equipped) in **FAST** and crank until engine starts.

When operating equipment:
- Do not tip engine or equipment at an angle which would cause fuel to spill.
- Do not choke carburetor to stop engine.
- Never start or run the engine with the air cleaner assembly (if equipped) or the air filter (if equipped) removed.

When changing oil:
- If you drain the oil from the top oil fill tube, the fuel tank must be empty or fuel can leak out and result in a fire or explosion.

When transporting equipment:
- Transport with fuel tank empty or with fuel shut-off valve set to OFF.

When storing gasoline or equipment with fuel in the tank:
- Store away from furnaces, stoves, water heaters, or other appliances that have a pilot light or other ignition source because they can ignite gasoline vapors.

Removal

1. Drain the fuel into an appropriate container.
2. Remove air cleaner cover (**A**, Figure 4-1) and gas cap.
3. Remove screws and the static guard/ rewind assembly (**B**).
4. Remove the trim cover and blower housing assembly (**C**).
5. Release clamp and pull hose off the tank fitting (**D**). Remove screws, washers, and spacers at top and bottom of tank then lift tank off engine.

Inspection

1. Clean gummy or dirty fuel tanks with Briggs & Stratton Carburetor Cleaner #100041 or #100042, or equivalent.
2. Inspect fuel tank for:
   - Corrosion
   - Leaks
   - Broken mounting brackets
3. Check fuel cap and filler neck for:
   - Proper seals
   - Vents

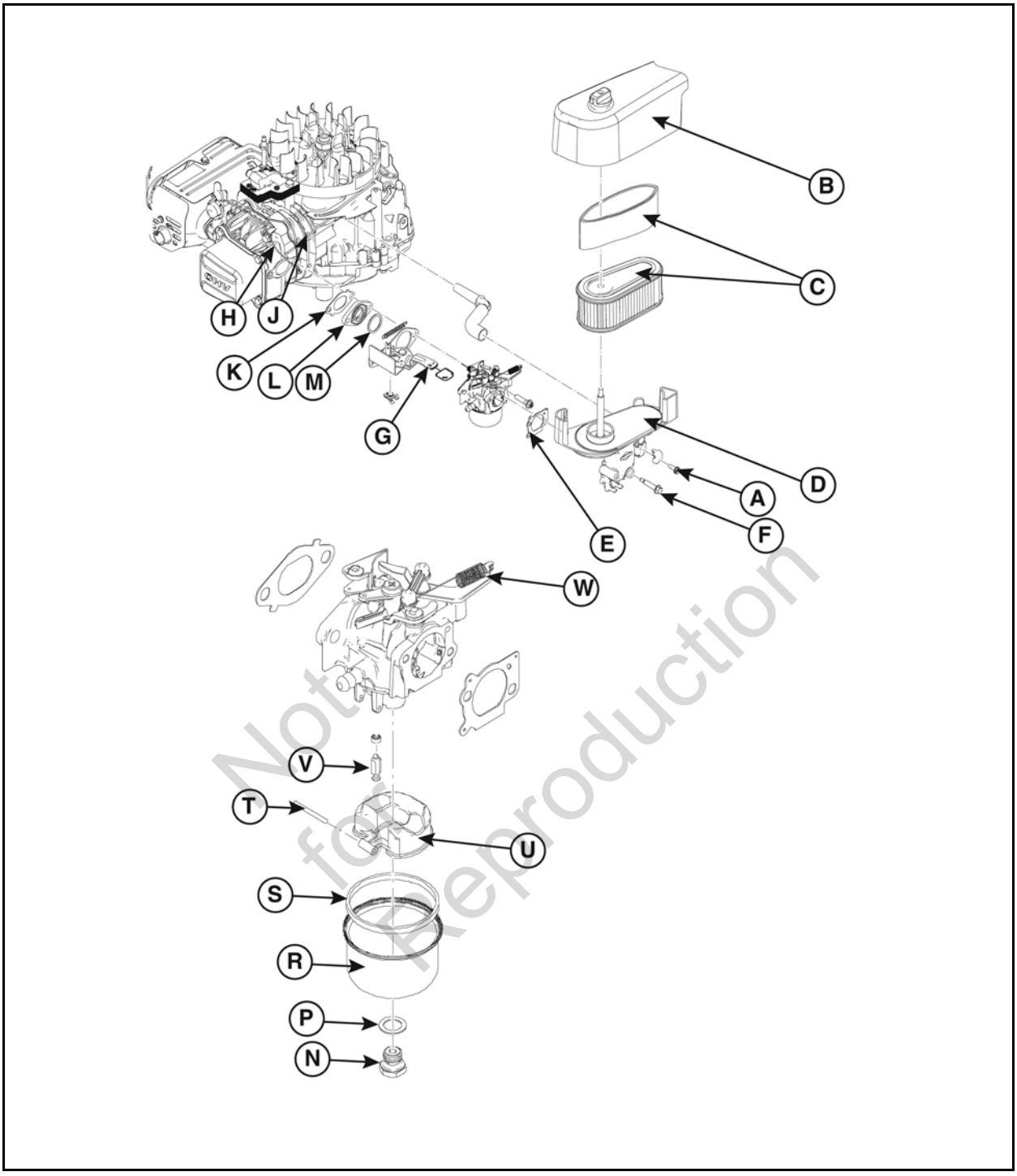
Clean or replace parts as required.

Installation

1. Install fuel hose to tank fitting and secure with hose clamp. Position tank on engine and install screws, washers, and spacers at top and bottom of tank. Torque screws to values in Section 12 - Engine Specifications.
2. Install trim cover and blower housing assembly.
3. Install static guard/rewind assembly. Torque screws to values listed in Section 12 - Engine Specifications.
4. Install gas cap and air cleaner cover.
5. Partially fill tank with fuel and check for leaks. Repair as necessary.

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CARBURETOR



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Figure 4 - 2

This engine is equipped with either a ReadyStart® Carburetor or a choke system.

The ReadyStart® utilizes a thermostatically controlled choke system, requiring no primer or manual choke. The linkages and carburetor body have no serviceable components.

Remove Carburetor

> **⚠ WARNING**
>
> Before servicing the carburetor or other fuel system components, drain all fuel from the tank and turn OFF the fuel valve (if equipped).
>
> Do not attempt to stop the fuel flow by plugging the fuel hose.

1. Remove casing clamp (**A**, Figure 4-2) and disconnect throttle cable (if equipped) from throttle lever.
2. Remove air cleaner cover (**B**), filters (**C**), base screws, base (**D**), and gasket (**E**). Discard the gasket.
3. Release clamp and disconnect fuel hose from carburetor.
4. Remove two carburetor mounting screws (**F**).
5. Carefully remove carburetor from control bracket (**G**). Rotate the carburetor to disconnect the choke link (**H**), and governor link (**J**).
6. Remove gasket (**K**), spacer (**L**), and o-ring (**M**) between control bracket and carburetor. Discard gasket and o-ring.

Disassemble Carburetor

1. Remove the fixed main jet (bowl nut, **N**) and fiber washer (**P**), then remove the fuel bowl (**R**) and the bowl gasket (**S**) from the carburetor body. Discard the fiber washer and the gasket.
2. Remove the float hinge pin (**T**), float (**U**), and inlet needle (**V**). Discard the hinge pin, and inlet needle.
3. If damaged, remove the choke return spring (**W**) and discard. Note orientation of spring before removal.

NOTE: Do not disassemble the carburetor body or choke and throttle levers.

Inspect and Clean Carburetor

1. Inspect openings in the carburetor body for evidence of wear or damage. If found, replace the entire carburetor assembly.
2. Inspect the choke shaft, choke valve, throttle shaft, and throttle valve for evidence of wear or damage. If found, replace the entire carburetor assembly.
3. Using Carb/Choke Cleaner #100041 or #100042, clean inside and outside surfaces of carburetor, then follow with compressed air to dry.

NOTE: Do not soak the carburetor in carb/choke cleaner or it will be damaged.

4. If any passages remain plugged after cleaning, replace the entire carburetor assembly.

Assemble Carburetor

Consult the Illustrated Parts List to obtain the appropriate carburetor overhaul kit before reassembling the carburetor.

NOTE: Install new gaskets and o-rings whenever carburetor is removed for service.

1. Install new choke return spring, if removed previously.
2. Install new hinge pin, float, and new inlet needle.
3. Install new bowl gasket with the fuel bowl. Install new fiber washer and the fixed main jet. Torque to values listed in Section 12 - Engine Specifications.
4. Attach governor link and choke link to carburetor.
5. Place spacer with new gasket and o-ring on control bracket.
6. Position carburetor on spacer and install screws. Torque to value listed in Section 12 - Engine Specifications.

NOTE: Use new screws or apply thread locking compound to original screws to prevent loosening from vibration.

7. Connect fuel hose to carburetor and secure with clamp.
8. Using new gasket, install air cleaner components to carburetor. Torque screws to values listed in Section 12 - Engine Specifications.
9. Connect throttle cable (if equipped) to throttle lever and secure with casing clamp. Torque screw to value listed in Section 12 - Engine Specifications.

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SECTION 5 - GOVERNOR SYSTEM

GOVERNOR SYSTEM - - - 36

LINKAGE AND SPRING ORIENTATION - - - 37

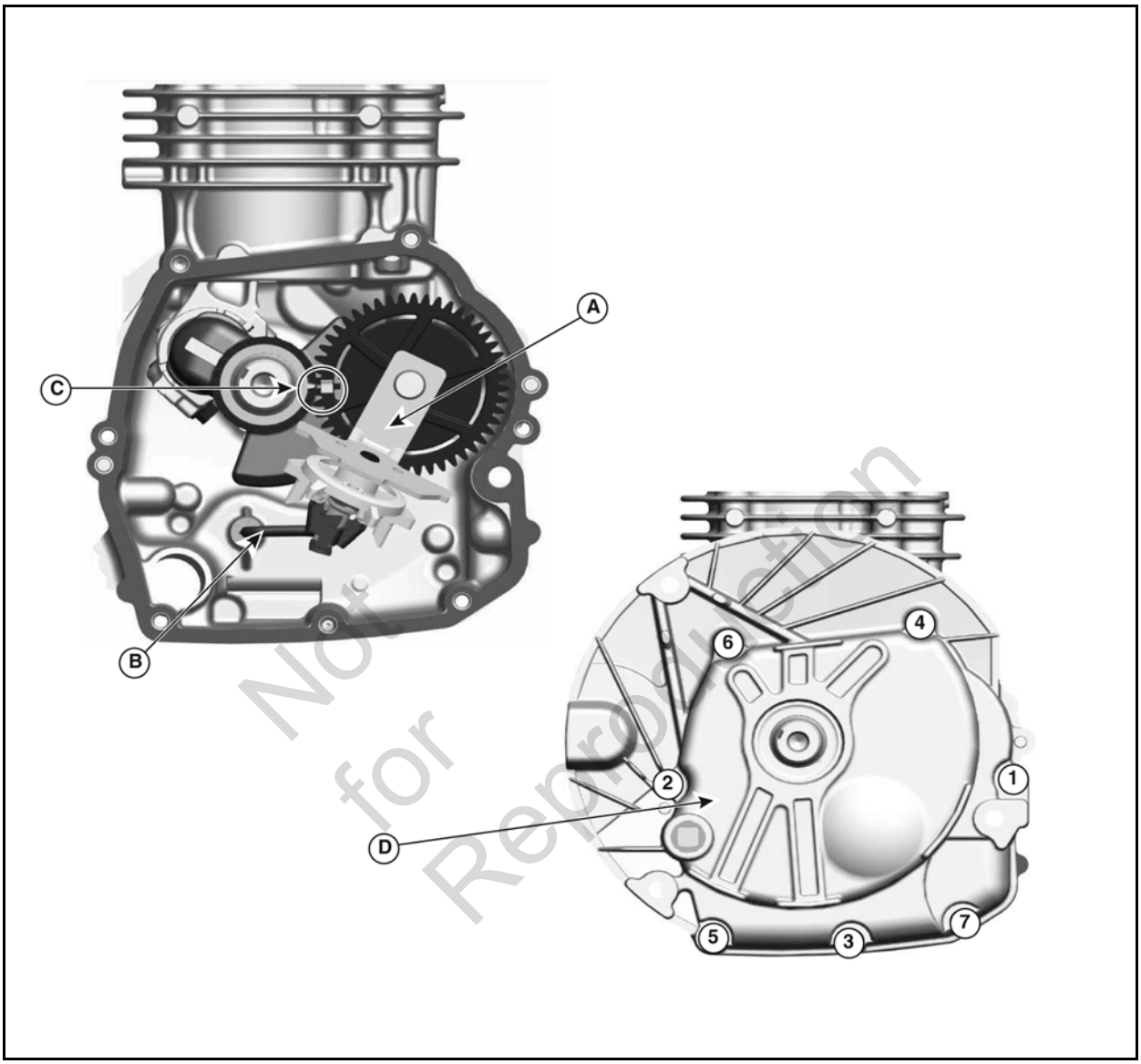
TOP NO-LOAD RPM - - - 37

GOVERNOR SERVICE - - - 37

5

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GOVERNOR SYSTEM



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Figure 5 - 1

Linkage and Spring Orientation

Be sure to note orientation of linkages and springs before removing.

Top No-Load RPM

Briggs & Stratton supplies engines with an adjustable top no-load RPM, which the equipment manufacturers set to their own specifications. Do not exceed these limitations.

NOTE: Correct top-no-load RPM for each model-type-trim can be found in the engine replacement data on Briggs & Stratton websites.

Top no-load RPM should be checked with a tachometer when the engine is operating on a completely assembled unit. The equipment should be operated under no-load when making this check.

If a governor spring must be replaced, consult the appropriate Illustrated Parts List for the correct part number. After the spring is installed, check the top no-load RPM with an accurate tachometer, as noted above, and adjust as required. (See Section 1 - Safety, Maintenance and Adjustments).

Governor Service

The mechanical governor is part of the oil slinger assembly (**A**, Figure 5-1) attached to the sump. The governor crank (**B**) is mounted in the cylinder assembly.

Disassemble

1. Drain oil from engine into an appropriate container.
2. Remove burrs and clean the crankshaft PTO, the carefully remove sump from engine and discard the gasket.
3. Loosen the governor lever nut and slide the lever off the governor crank and disconnect from the governor link. Set aside.
4. Remove push nut or clip and washer from governor crank. Remove burrs and clean the governor crank, then remove crank from inside of cylinder.

NOTE: Inspect governor gear for worn weight pins and chipped or missing gear teeth before removing.

Inspect Governor Parts

1. Check oil slinger assembly for chipped or damaged teeth, or damage on paddles. If damage to the oil slinger is found, replace the entire sump.
2. Check governor crank for wear or damage. Replace if necessary.
3. Inspect cam gear for worn or damaged teeth and evidence of wear on cam lobe. Replace if necessary.

Assemble Governor

1. Install governor crank from inside cylinder. Slide washer on crank and install new push nut or clip.
2. Install governor gear on spindle in sump. Using thumbs, press firmly until gear clicks into place.
3. Align dot on timing gear with notch in cam gear and place cam gear on boss in cylinder (**C**, Figure 5-1).
4. Slide governor lever on crank and finger-tighten bolt and nut until crank turns with slight resistance.
5. Rotate crank so that paddle will be aligned with cup on governor gear when sump is installed.
6. Install new sump gasket of same thickness as originally removed from cylinder.
7. Place seal protector in oil seal and slide sump over crankshaft until it seats.
8. Install sump screws in order shown (**D**). Torque screws to values listed in Section 12 - Engine Specifications. The sump bolt in the number 4 position utilizes a sealant patch.
9. Rotate crankshaft by hand to check for binding then adjust governor system per Section 1.

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Install Governor Spring

The governor spring is assembled to the control lever tab and the lower hole of the carburetor throttle lever.

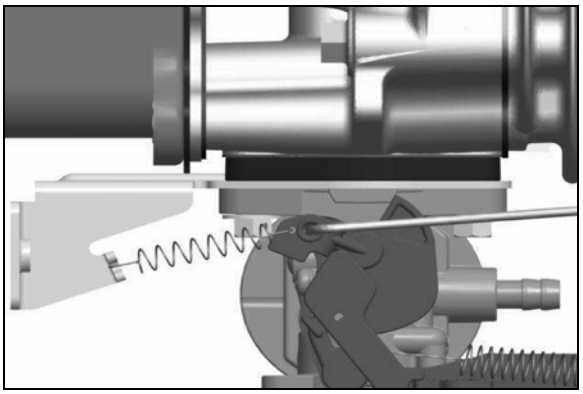


Figure 5 - 2

Spring ends must be orientated as shown in below:

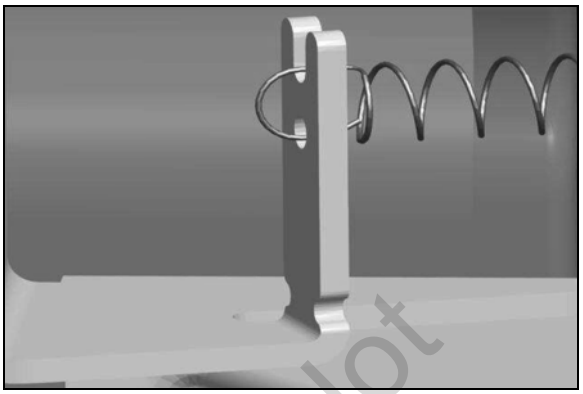


Figure 5 - 3

NOTE: Governor spring must pull carburetor to wide open position when adjusting governor crank and tightening governor lever.

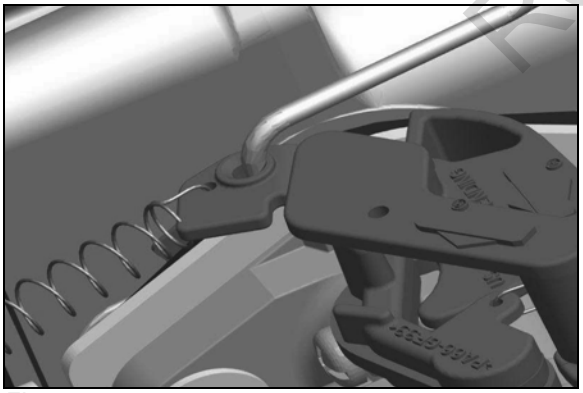


Figure 5 - 4

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SECTION 6 - CYLINDER HEAD AND VALVES

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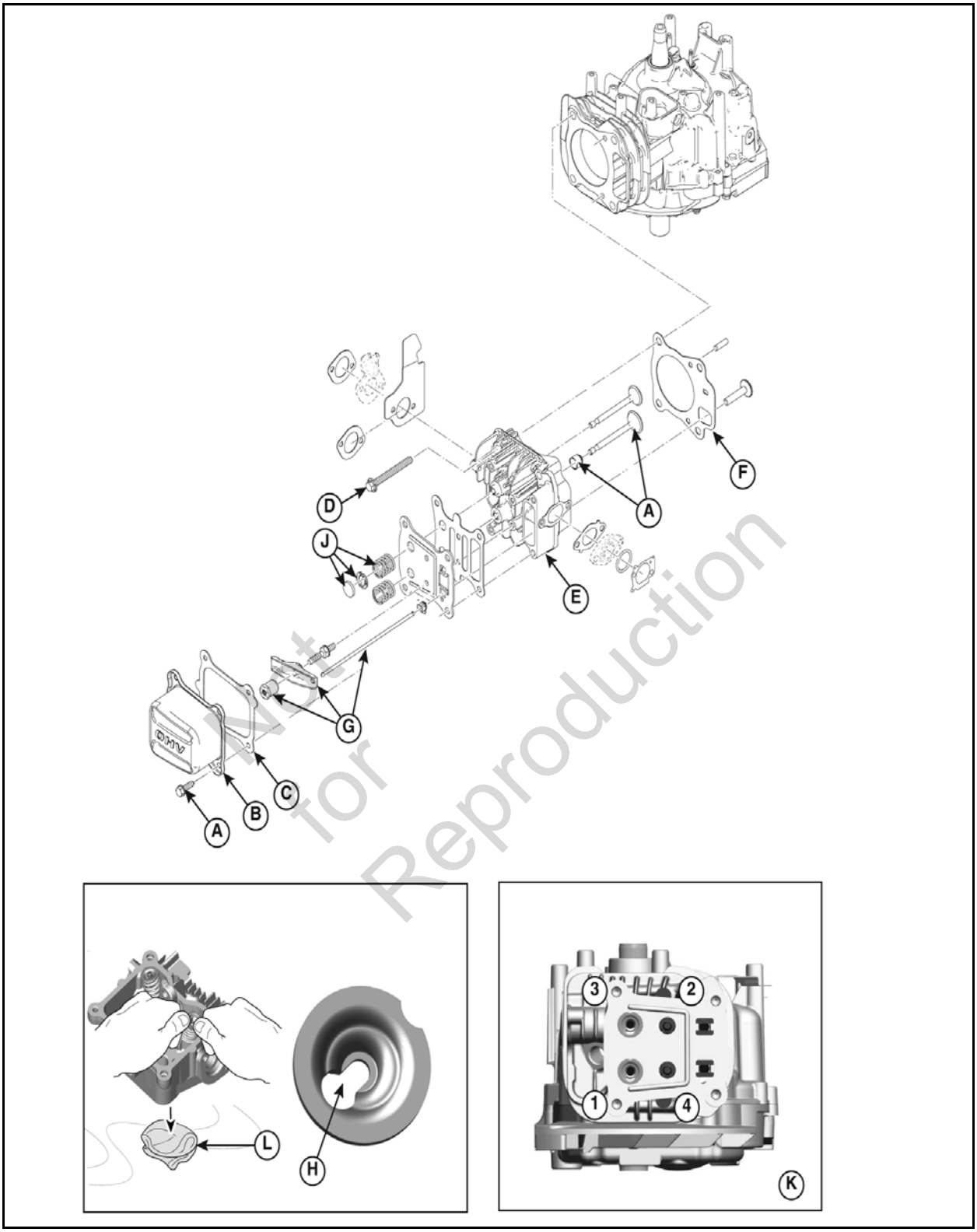
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CYLINDER HEAD AND VALVES



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Figure 6 - 1

Before the cylinder head can be removed, other external parts must be removed, such as the air cleaner, fuel tank, oil fill tube, blower housing, muffler, carburetor, control bracket assembly, and intake manifold.

Remove Cylinder Head

1. Remove spark plug.
2. Remove four screws (**A**, Figure 6-1) from valve cover then remove cover (**B**) and gasket (**C**). Discard gasket.
3. Remove cylinder head screws (**D**), then remove head (**E**) and gasket (**F**) from cylinder. Discard gasket.

Disassemble

1. Remove the set screws, rocker arms, and push rods (**G**).
2. Place a clean shop rag (**L**) under the cylinder head to hold valves in place while compressing spring.
3. Using thumb pressure, compress valve spring retainer until larger hole (**H**) of retainer fits over valve stem.
4. Remove retainer, spring, valve, and valve seal (**J**).
5. Repeat for other valve.
6. Using a plastic scraping tool, carefully clean all traces of head gasket from the head and cylinder mating surfaces.

Inspection

1. Visually inspect cylinder head for cracks, excessive heat discoloration, warping, and burned or damaged valve seats. Replace head, if any of these problems are found.
2. Inspect valves for wear or damage. Replace if necessary.
3. Oil the intake valve stem then insert valve into head.
4. Using Valve Lapping Tool #19258 and Lapping Compound #94150, lap valve and seat together to assure a good sealing surface. Remove valve, then repeat procedure for the exhaust valve.
5. Thoroughly clean both valves and valve seats of all lapping compound residue.

Assemble

1. Lightly coat valve stems with Valve Guide Lubricant #93963, then insert valves into cylinder head. Do not get lubricant on valve face, valve seat, or exposed end of valve stem.
2. Oil inside diameter of new stem seal and install on intake valve stem. Slide seal down against the cylinder head.
3. Support valve side of cylinder head on clean shop rags. Place valve springs and valve spring retainers over valve stems. Using thumbs, press against each retainer until it securely locks into groove in valve stem.

Install Cylinder Head

1. Using new head gasket, install cylinder head on cylinder and start screws by hand.
2. Step-torque screws in sequence shown (**K**) to values listed in Section 12 - Engine Specifications.
3. Install push rods, rocker arm, and set screws.
4. Rotate crankshaft at least twice to ensure proper movement of the levers and valves.
5. Adjust valve clearance per Section 1, then install a new valve cover gasket and the valve cover. Torque screws to values listed in Section 12 - Engine Specifications.

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SECTION 7 - STARTERS

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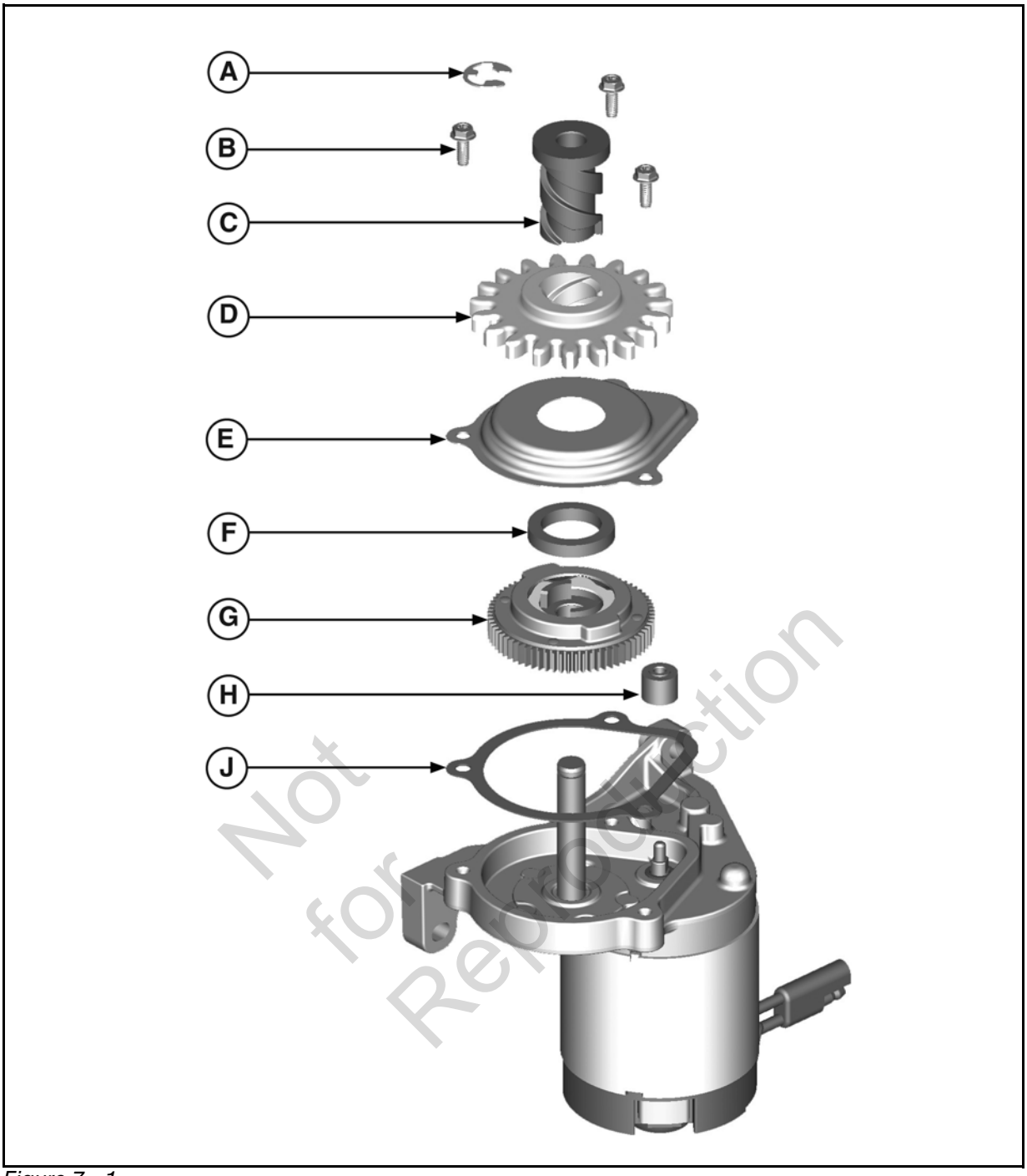
REWIND STARTER ----------46

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ELECTRIC STARTER



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Figure 7 - 1

Ring Gear
The ring gear on this engine is made of steel and is heat shrunk to the flywheel. It is not repairable. If the ring gear is damaged, replace the flywheel assembly.

Check Starter Drive Operation
When the starter switch is activated, the starter gear should engage the flywheel ring gear and crank the engine. The starter gear should not bind on the helix. If necessary, use a mild solvent to clean the starter gear and helix. Dry with compressed air.

NOTE: Do not oil the starter gear or helix.

If the starter gear still binds on the helix, replace the entire starter drive assembly using the following procedures.

Disassemble Starter Drive
1. Disconnect wire harness and remove screws and starter motor from cylinder.
2. Carefully pry off and discard e-ring (**A**, Figure 7-1).
3. Remove helix (**C**) from starter gear (**D**) by rotating helix back and forth while pulling.
4. Remove three screws (**B**) that secure the cover (**E**) to the starter drive assembly.
5. Remove and discard felt washer (**F**). Disassemble the drive gear (**G**), pinion gear (**H**), and gasket (**J**). Do not discard the gasket or washer.

NOTE: The felt washer and gasket are not serviceable parts.

Inspect Starter Parts
1. Inspect drive gear and pinion gear for worn or broken teeth. Replace if necessary.
2. Inspect starter gear and helix for wear or scoring from dirt. Replace if necessary.

Assemble Starter Drive
1. Install gasket, pinion gear and drive gear to the starter motor. Apply liberal amount of grease to gear teeth.
2. Install felt washer.
3. Install cover and screws and torque to values listed in Section 12 - Engine Specifications.
4. Insert helix into starter gear and install through cover and into drive gear.
5. Install new e-ring.
6. Position starter on cylinder and install screws. Torque to values listed in Section 12 - Engine Specifications. Connect wire harness.

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REWIND STARTER

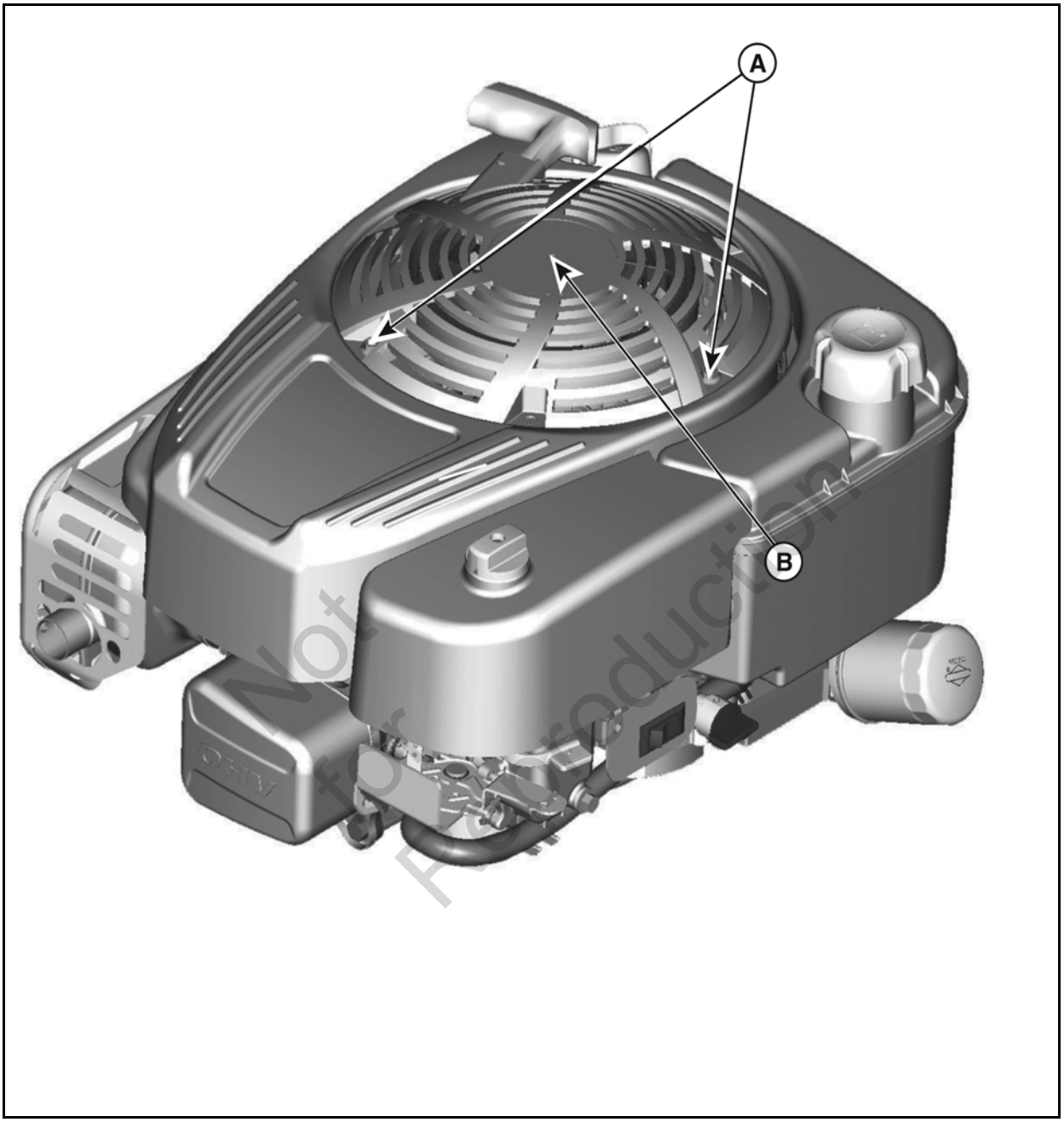


Figure 7 - 2

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7

The rewind starter mechanism installed on this engine is non-serviceable. The rope and handle are the only serviceable parts.

Inspect Rewind Starter Parts

1. Remove flange nuts (**A**, Figure 7-2) and lift static guard/rewind assembly (**B**) off blower housing.
2. Inspect the starter assembly for wear or burrs at the rope eyelet, the center pivot post, and the anchor tab. If damage is found, replace the static guard/rewind assembly.
3. Inspect the rope for broken or frayed areas. Replace rope, if necessary.

Replace Rope

NOTE: Consult the Illustrated Parts List or Section 12 - Engine Specifications for the correct diameter and length of rope.

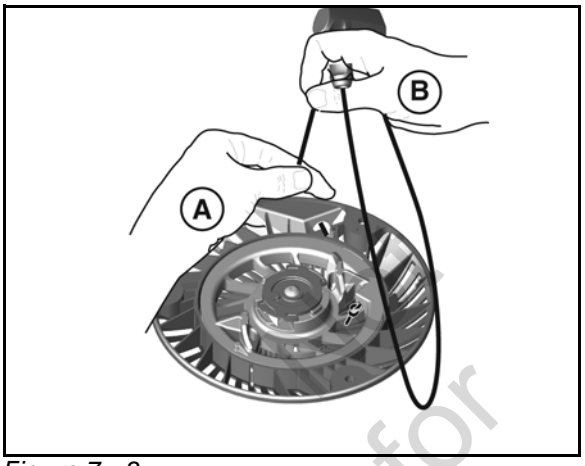


Figure 7 - 3

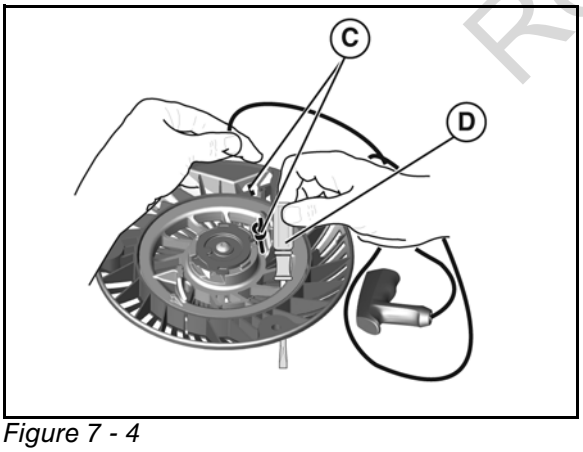


Figure 7 - 4

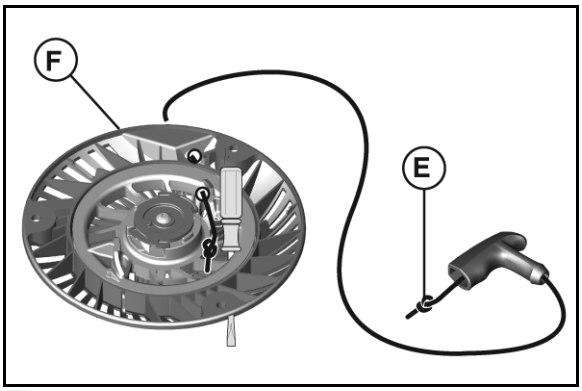


Figure 7 - 5

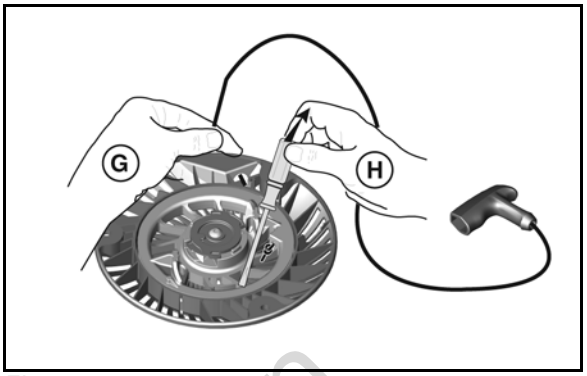


Figure 7 - 6

1. Hold rewind assembly firmly (**A**, Figure 7-3) and pull out rope (**B**) until pulley stops.

NOTE: Spring tension in pulley will increase as rope is pulled out.

2. Line up holes (**C**, Figure 7-4) of rewind pulley and rope eyelet and secure pulley assembly with small screwdriver (**D**).
3. Cut through middle of rope then remove pieces from pulley and handle.
4. Insert one end of new rope into handle and tie a knot (**E**, Figure 7-5) to secure it.
5. Insert other end of rope through eyelet and hole in pulley (**F**). Tie a knot to secure the rope, then fit knot into recess in pulley.
6. Hold rope firmly (**G**, Figure 7-6) while removing screwdriver (**H**) then slowly allow rope to rewind itself on pulley.
7. Place static guard/rewind assembly on blower housing and install fasteners. Torque to value listed in Section 12 - Engine Specifications.

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SECTION 8 - LUBRICATION

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LUBRICATION SYSTEM

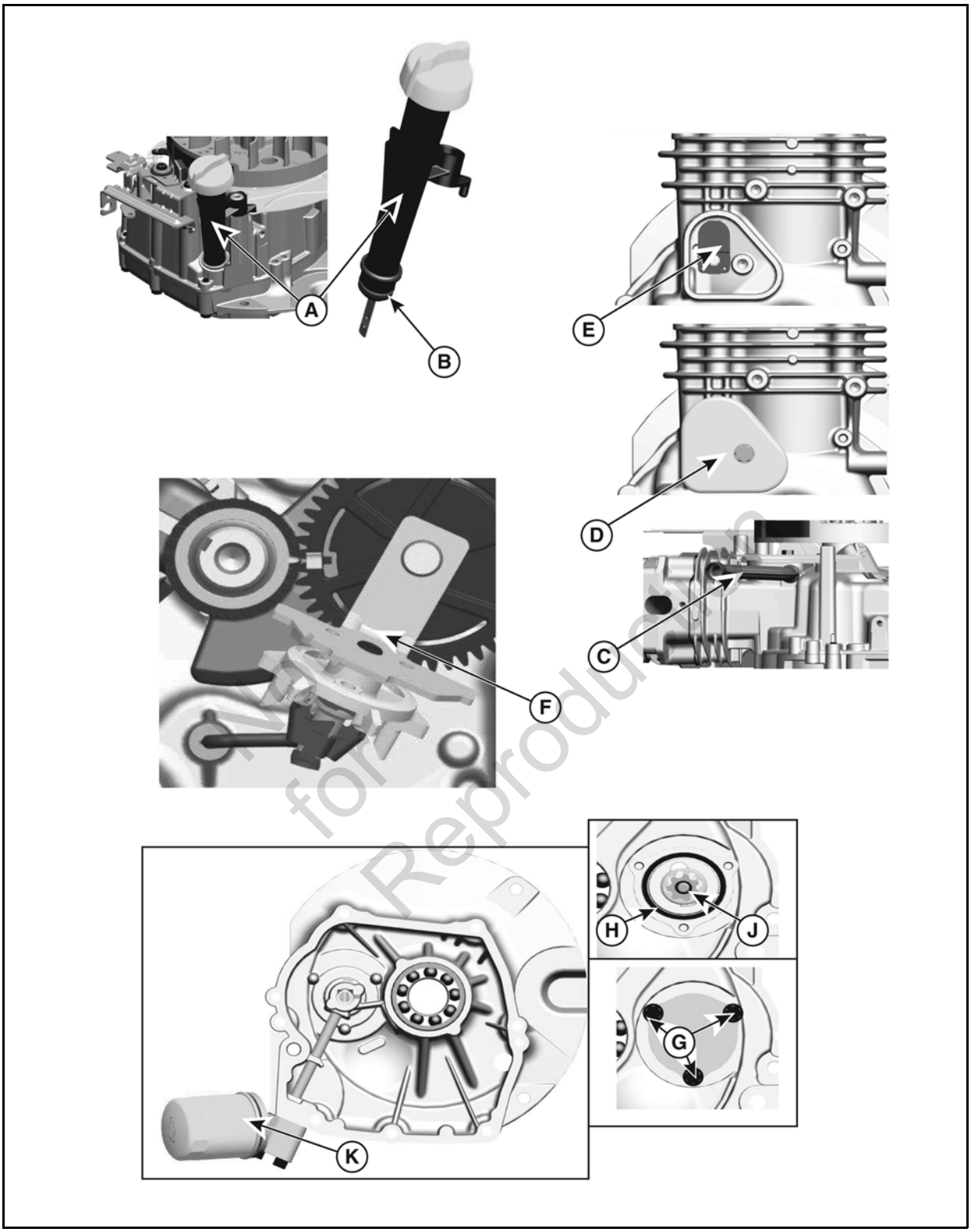


Figure 8 - 1

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Oil Fill Tube and Dipstick

This engine uses a plastic extended oil fill tube (**A**, Figure 8-1) and a quarter-turn dipstick with o-ring (**B**). An o-ring seals the tube in the sump and a retaining bracket and screw secure it to the engine.

The oil fill tube and dipstick must be replaced as a set.

Breather

Briggs & Stratton engines utilize a breather valve system to control and maintain crankcase vacuum. The breather valve installed on this engine is a reed which closes on the piston up stroke and opens on the piston down stroke.

Remove Breather

1. Remove breather tube (**C**) from air cleaner base.
2. Remove two screws (**D**), breather cover, and gasket. Discard gasket.

Check Breather

1. Remove and check breather reed (**E**). If the reed is worn or bent it cannot function properly and must be replaced.
2. Inspect the oil-drain back hole in the breather cavity. Insert a fine wire to ensure the opening is not plugged.

Install Breather

1. Install reed with the metal tab facing away from the crankshaft. Torque screw to value listed in Section 12 - Engine Specifications.
2. Using new gasket, install breather cover and torque screws to values listed in Section 12 - Engine Specifications.
3. Securely install breather tube in breather cover.

Oil Slinger Lubrication

The governor gear/oil slinger (**F**) is used on vertical shaft engines. It is mounted to the sump and driven by the cam gear.

Inspect Assembly

1. Visually inspect governor gear/oil slinger assembly for wear, broken teeth, broken slinger paddles, or burrs.
2. Ensure governor gear and slinger rotate freely. Check for worn weight pins, worn cup, or sticking weights.
3. The governor gear can be replaced, but if there is damage to the oil slinger, the entire sump must be replaced as an assembly.

Pressure Lube Sump

On some models of the engine, there is a pressure lube oil filter system. In this system, the pump draws oil from the sump and pumps it through the oil filter and back to the sump PTO bearings.

Remove Oil Pump

The oil pump can be removed without removing the sump from the engine.

1. Remove the three screws (**G**) that attach the pump cover to the sump. Remove and discard the o-ring (**H**).
2. Carefully remove the inner and outer rotors (**J**).

Inspect Oil Pump

1. Inspect surfaces of outer and inner rotors, pump, housing, cover and shaft for wear and scoring.
2. Inspect pump housing and passages for debris. Clean as required.
3. Replace worn or damaged parts.

Install Oil Pump

1. Lubricate the outer rotor and install in pump cavity. Do not use force to install.
2. Lubricate the inner rotor and install in pump cavity.
3. Turn rotors to engage pump in cam or governor gear.
4. Place o-ring in groove, in the pump cover.
5. Place pump cover on sump and torque screws to values listed in Section 12 - Specifications.

Oil Filter Service

Perform oil filter (**K**) service by following the procedures found in Section 1 - Service, Maintenance, and Adjustments.

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SECTION 9 - CYLINDER AND SUMP

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INSPECT SUMP ---------- 56

MAIN BEARINGS ---------- 56

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CYLINDER AND SUMP

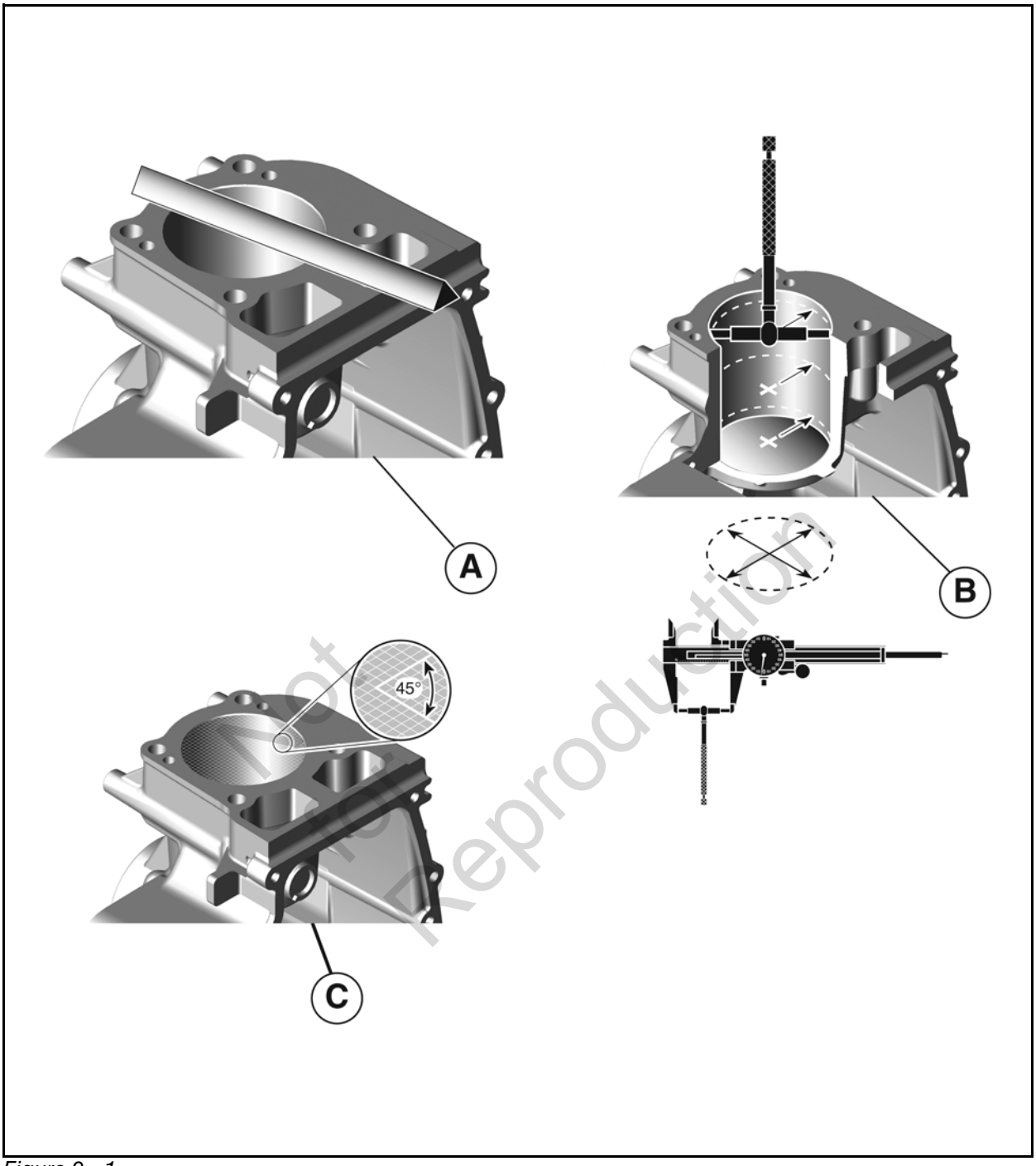


Figure 9 - 1

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Inspect Cylinder

1. Remove oil seal and discard. Using a plastic scraper, remove all traces of head gasket and sump gasket material.
   - Visually check cylinder for cracks, stripped threads, and bore damage. Bore damage, if not severe, may be corrected by reconditioning or resizing.
   - If cracks are found, replace the cylinder.
   - Stripped threads can sometimes be repaired using a helicoil, but if multiple holes have thread damage, replace the cylinder.
2. Using a straight edge, check across cylinder head mounting surface for distortion (**A**, Figure 9-1). If mounting surface is distorted more than 0.004” (0.1 mm), the cylinder must be replaced.
   - Using Telescoping Gauge #19610 and Dial Caliper #19199, measure the diameter of the bore. If necessary, recondition or resize the bore as described below.
   - Take two measurements (90° apart) at the top, center, and bottom of the piston ring travel (**B**).
   - Compare measurements to the standard cylinder bore size provided in Section 12 - Engine Specifications.

Reconditioning Bore

If cylinder bore is within specification and shows no signs of scoring or other damage, it can be reconditioned using a rigid hone with finishing stones to restore the proper crosshatch angle. The correct crosshatch of approximately 45° (**C**) ensures proper lubrication and piston ring break-in.

NOTE: IT IS MOST IMPORTANT THAT THE ENTIRE CYLINDER BE THOROUGHLY CLEANED AFTER HONING.

Resizing Bore

If the cylinder bore is worn more than 0.003” (0.08 mm) oversize, or is 0.0015” (.04 mm) out of round, it must be resized.

Always resize to exactly 0.020” (.51 mm) larger than standard bore size. Done accurately, the service oversize rings and pistons will fit perfectly with proper clearances.

Use the stones and lubrication recommended by the hone manufacturer to produce the proper sizing and finish.

NOTE: IT IS MOST IMPORTANT THAT THE ENTIRE CYLINDER BE THOROUGHLY CLEANED AFTER HONING.

Cleaning Cylinder

1. Wash the cylinder thoroughly with kerosene or other commercial solvent.
2. Wash cylinder again using a stiff brush with soap and hot water.
3. Rinse cylinder thoroughly with hot running water.
4. Repeat washing and rinsing until all traces of honing grit are gone.

NOTE: Honing grit is highly abrasive and will cause rapid wear to all of the internal components of the engine.

When cylinder has been thoroughly cleaned, use a clean white rag to wipe the cylinder bore. If honing grit is still present, it will appear as a grey residue on the rag. Re-wash and rinse entire cylinder, then check again. When there is no trace of honing grit on the rag, the cylinder is properly cleaned. Oil the cylinder bore to protect the surface.

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Inspect Sump

1. Remove oil seal and discard.
2. Visually inspect sump for cracks, stripped threads, and wear in bearing surfaces. If damage is found, replace the sump.

Cleaning Sump

1. Wash the sump thoroughly with kerosene or other commercial solvent.
2. Wash sump again using a stiff brush with soap and hot water.
3. Rinse sump thoroughly with hot running water.
4. Repeat washing and rinsing until all traces of oil sludge are gone.

Main Bearings

Plain Bearings

Plain (or machined) bearings are not repairable. If a plain bearing is scored or worn beyond reject size, the cylinder or cover/sump must be replaced.

DP™ Bearings

DP™ bearings are not repairable. If a DP™ bearing is scored or worn beyond its reject size, the cylinder or cover/sump must be replaced.

NOTE: Standard and reject sizes for the main bearings are listed in Section 12 - Engine Specifications.

Oil Seals

PTO Oil Seal

Press in new oil seal to a depth of 0.175 - 0.225 in. (4 - 6 mm) (Figure 9-2).

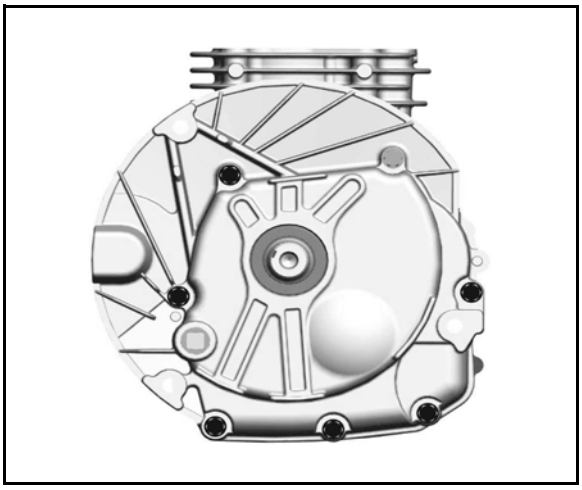


Figure 9 - 2

Mag Oil Seal

Press in new oil seal to a depth of 0.175 - 0.225 in. (4 - 6 mm) (Figure 9-3). The oil seal should be flush with the cylinder.

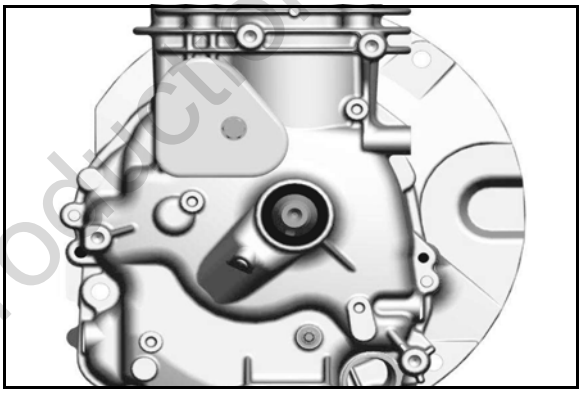


Figure 9 - 3

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SECTION 10 - CRANKSHAFT

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INSTALL CRANKSHAFT ---------- 59

INSTALL SUMP ---------- 59

CHECK AND ADJUST CRANKSHAFT END PLAY ---------- 59

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CRANKSHAFT

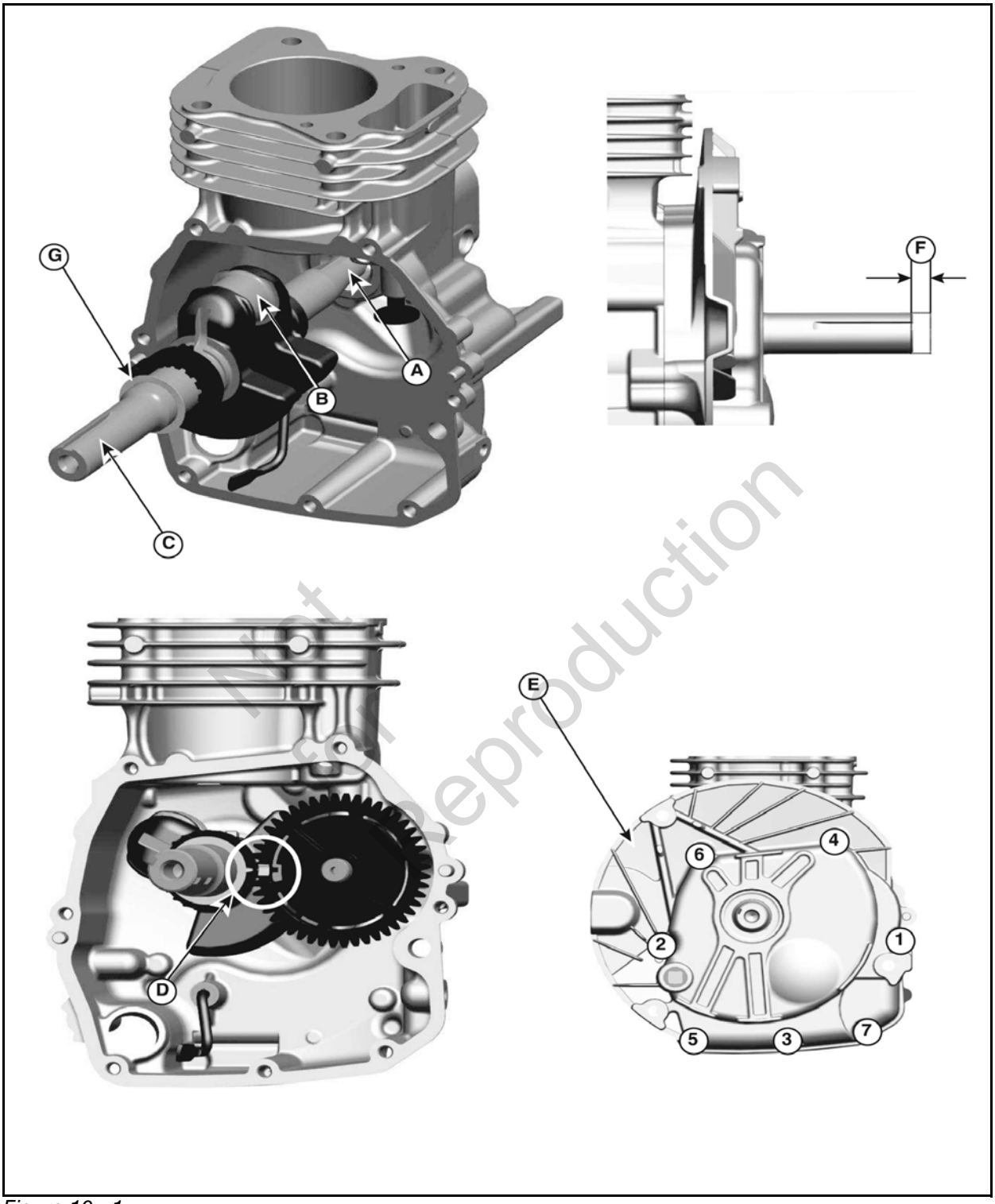


Figure 10 - 1

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Remove Crankshaft

1. Drain oil from engine and all fuel from fuel tank into appropriate container.
2. Remove external components including flywheel assembly.
3. Remove burrs and clean crankshaft PTO, then remove sump.
4. Carefully tip engine with PTO-end facing up.
5. Rotate crankshaft to place piston at top dead center.
6. Remove connecting rod cap, then rotate and slide out crankshaft.

Inspect Crankshaft

1. Inspect crankshaft for scoring on mag journal (**A**, Figure 10-1), crankpin journal (**B**), and PTO journal (**C**). Replace crankshaft if scoring is found.
2. If crankshaft is bent, replace it. DO NOT attempt to straighten crankshafts.
3. Using a dial caliper or micrometer, measure the journal diameters. Compare results to values listed in Section 12 - Engine Specifications. If wear meets or exceeds the reject dimensions, replace the crankshaft.
4. Inspect timing gear for any evidence of wear, distortion, or damage. Replace gear if any damage is found.

Install Crankshaft

1. Lubricate the magneto bearing/oil seal with engine oil.
2. Support both ends of the crankshaft, and carefully install into the cylinder.
3. Rotate crankshaft until crankpin journal fits into connecting rod.
4. Lubricate the crankpin journal with engine oil, then assemble connecting rod to crankshaft and torque cap screws to values listed in Section 12 - Engine Specifications.

NOTE: The screw closer to the piston must be tightened first.

5. Install the timing gear to the crankshaft.
6. Align timing marks on timing gear and cam gear (**D**), then install cam gear on boss in cylinder.

Install Sump

1. Protect oil seal when installing sump.
2. Place new gasket on cylinder.
3. Install sump on cylinder, making sure spindle in sump fits into cam gear, and all gears mesh. Do not force sump.
4. Install screws and tighten in sequence shown (**E**). Torque screws to values listed in Section 12 - Engine Specifications.

Check and Adjust Crankshaft End Play

When the sump is installed with a standard gasket, end play should match the value listed in Section 12 - Engine Specifications.

If end play (**F**) is less than specified, remove sump and install an additional gasket. Do not use more than two gaskets.

If end play is more than specified, remove sump and install a shim per the Illustrated Parts List.

Install shim on PTO-end of crankshaft (**G**), between timing gear and sump.

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SECTION 11 - PISTONS, RINGS, AND CONNECTING RODS

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PISTONS, RINGS, AND CONNECTING RODS

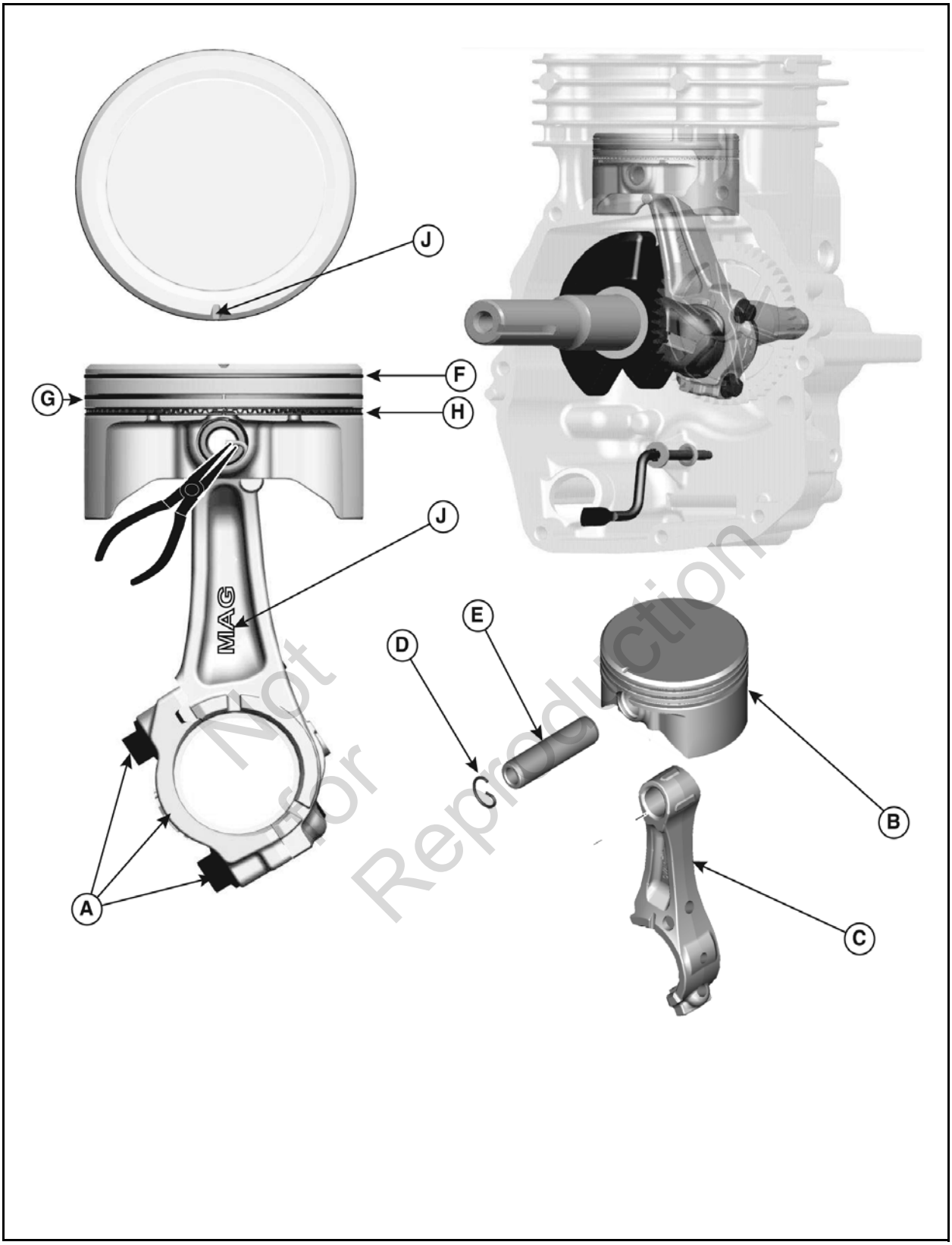


Figure 11 - 1

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Remove Piston and Connecting Rod

1. Carefully remove any carbon or ridge at top of cylinder bore to prevent ring breakage.
2. Remove rod bolts and connecting rod cap (**A**, Figure 11-1).
3. Push piston (**B**) and connecting rod (**C**) out through top of bore.

Disassemble

1. Using pliers, rotate piston pin clip (**D**) until one end is exposed in notch in pin bore, then remove clip.
2. Slide out piston pin (**E**) and remove connecting rod from piston.
3. Using Piston Ring Expander #19340, remove the compression ring (**F**) and the wiper ring (**G**).

NOTE: Identify the top side of each ring before removal.

4. The oil control rings (**H**) consist of two thin steel rails and a spring expander. These must be removed by hand as follows:
   - Grasp one end of the upper steel rail and wind the rail from the oil ring groove into the center ring groove. Repeat into top ring groove and then off the piston.
   - Remove the spring expander then remove the lower steel rail.

Inspect

Check Piston and Pin

1. Inspect piston for scoring, galling, or other damage. Replace piston if necessary.
2. Using a dial caliper or plug gauge, measure the pin bore diameter in the piston. Compare with reject dimensions listed in Section 12 - Engine Specifications. If pin bore meets or exceeds reject dimension, replace the piston.
3. Measure outside diameter of pin and compare to the reject dimensions listed in Section 12 - Engine Specifications. If pin meets or exceeds the reject dimension, replace the pin.
4. Clean any carbon from the top ring groove in piston. Place NEW ring in groove and, using a feeler gauge, measure the clearance between ring and ring land (Figure 11-2).
5. Repeat procedure for wiper ring groove and oil control ring groove.
6. Compare with reject dimensions listed in Section 12 - Engine Specifications. If clearance meets or exceeds the reject dimensions, replace the piston.

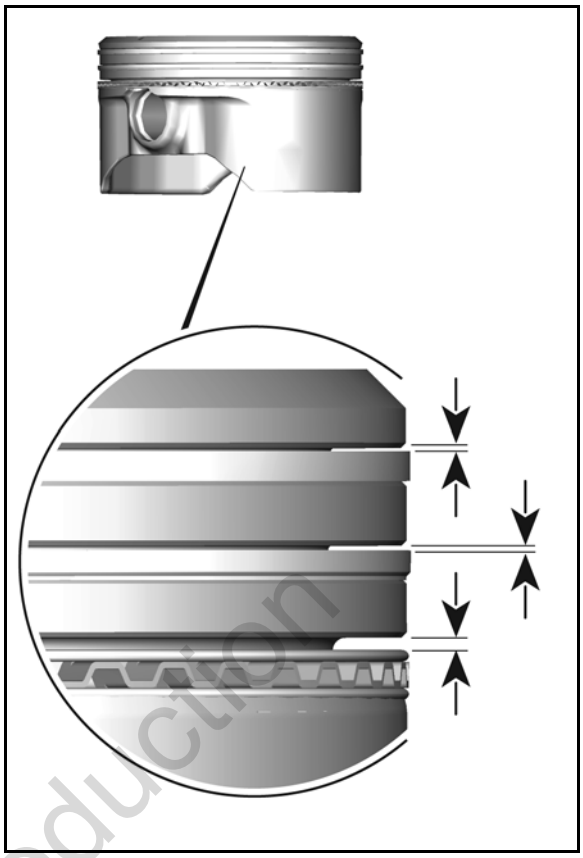


Figure 11 - 2

Check Connecting Rod

If either the crankpin bearing or the piston pin bearing is scored or discolored, the rod must be replaced.

1. Reinstall rod cap and bolts on rod. Tighten bolts until snug.
2. Using a dial caliper or plug gauge, measure the two bearing diameters. Compare with reject dimensions listed in Section 12 - Engine Specifications. If either bearing meets or exceeds its reject dimension, the rod must be replaced.
3. Remove rod bolts and rod cap. Set aside.

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Check Ring End Gap

It is recommended that the entire ring set be replaced when servicing the piston and/or cylinder bore. However, the original rings can be re-used if they are not damaged and are checked as follows:

1. Clean all carbon from the rings and the cylinder bore.
2. Insert one of the original rings approximately one inch down the cylinder bore.
3. Measure the ring end gap with a feeler gauge (Figure 11-3).
4. Repeat the procedure for each ring in the set.
5. Compare with reject dimensions listed in Section 12 - Engine Specifications. If gap of any of the rings meets or exceeds the reject dimensions, all rings should be replaced as a set.

Assemble

1. Install a pin retainer clip into one groove in the pin bore.
2. Oil the piston pin bore, connecting rod pin bearing, and the pin. Insert rod into piston, then slip pin through piston and rod until it seats against the retainer.

NOTE: The notch or arrow on the piston and "MAG" on the rod must face the same direction (**J**, Figure 11-1).

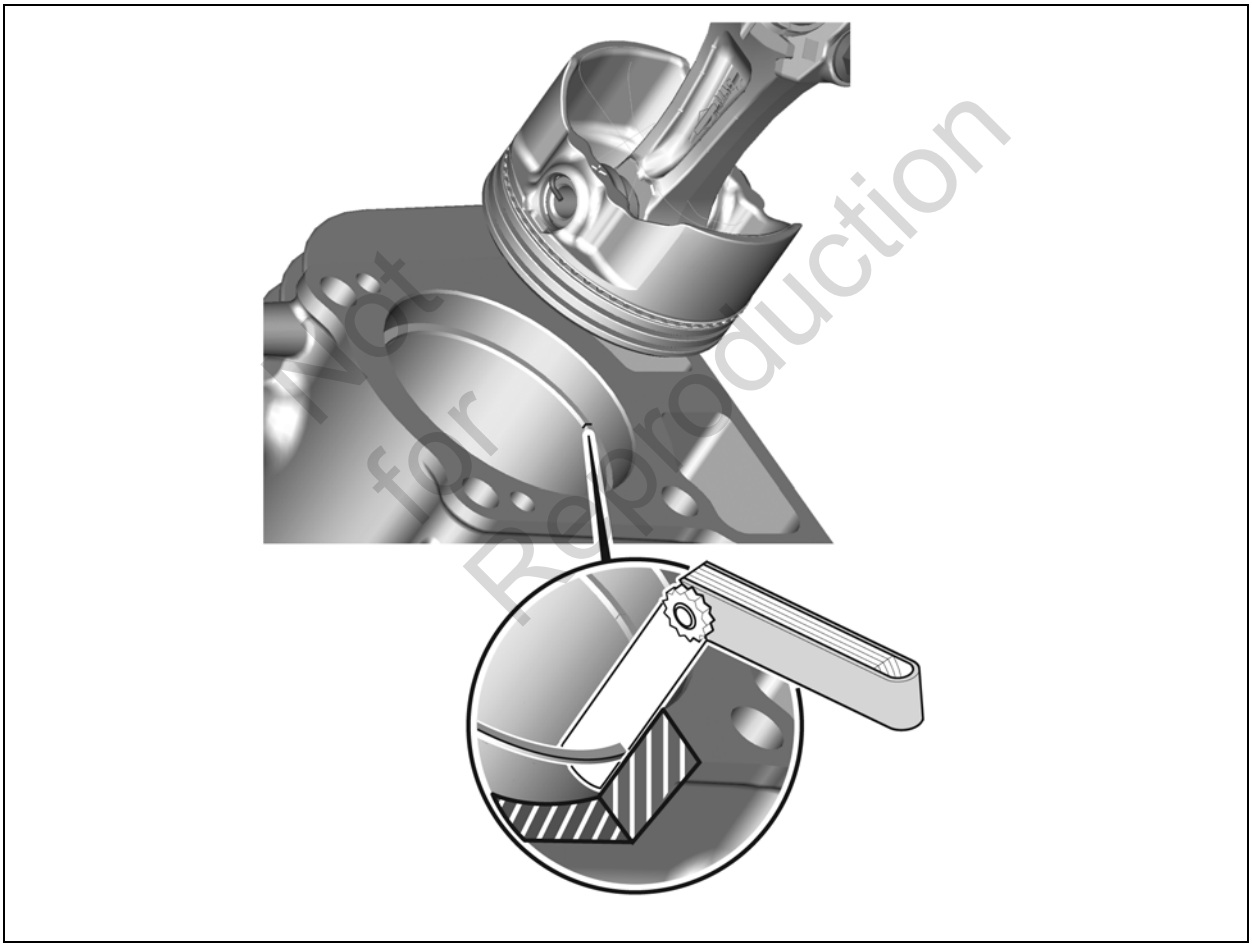


Figure 11 - 3

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3. Install a pin retainer clip into groove on open side of piston pin bore. Ensure both retainers are firmly seated in the grooves.
4. Install the oil ring by hand as follows:
   - Grasp one end of lower steel rail and wind it over the top ring groove, then over the center ring groove, and finally into the oil ring groove.
   - Install the spring expander on top of the lower rail, then install the upper steel rail.
5. Using Piston Ring Expander #19340, install the wiper ring, then the compression ring.

NOTE: If installing the original rings, ensure the top sides are facing the top of the piston. If installing a new ring set, follow the instructions provided with the set.

Install Piston and Connecting Rod

1. Thoroughly clean and oil cylinder bore and crankpin journal of crankshaft.
2. Rotate crankshaft until crankpin journal is at bottom of stroke.
3. Using Ring Compressor Tool #19070 or #19230, install piston with notch or arrow toward flywheel side of engine, taking care not to damage crankpin journal or connecting rod bearing.
4. Fit connecting rod bearing on crankpin journal, then install rod cap with match marks aligned. Cap should snap into position when assembled correctly.
5. Install rod screws. Tighten screw closer to the piston first, and the screw farther from the piston second. Torque screws to values listed in Section 12 - Engine Specifications.

NOTE: Failure to use a torque wrench can result in loose rods causing breakage, or over-tightened rods causing scoring.

6. Rotate crankshaft two revolutions to ensure crankpin and rod do not bind, then move connecting rod sideways to ensure there is clearance on crankpin. If binding occurs, remove and reinstall the rod cap.

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11

SECTION 12 - ENGINE SPECIFICATIONS

MODEL 110000 -68

MODEL 120000 -70

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12

ENGINE SPECIFICATIONS

MODEL 110000

ENGINE SPECIFICATIONS	
Armature Air Gap	.010 - .014 in. (.25 - .36 mm)
Crankshaft End Play	.002 - .038 in. (.05 - .97 mm)
Spark Plug Gap	.020 in. (.51 mm)
Valve Clearance – Intake	.004 - .008 in. (.10 - .20 mm)
Valve Clearance – Exhaust	.004 - .008 in. (.10 - .20 mm)
FASTENER TORQUE SPECIFICATIONS	**TORQUE**
Air Cleaner Base to Carburetor	45 lb-in. (5 Nm)
Air Cleaner Cover	10 lb-in. (1 Nm)
Alternator	40 - 85 lb-in. (5 - 10 Nm)
Armature to Cylinder	85 lb-in. (10 Nm)
Brake Assemblies	50 lb-in. (6 Nm)
Breather Cover	55 lb-in. (6 Nm)
Breather Reed	45 lb-in. (5 Nm)
Carburetor to Cylinder Head	85 lb-in. (10 Nm)
Casing Clamp	15 lb-in. (2 Nm)
Connecting Rod Cap to Connecting Rod	95 lb-in. (11 Nm)
Cylinder Head to Cylinder Block	210 lb-in. (24 Nm)
Electric Starter to Cylinder	85 lb-in. (10 Nm)
Flywheel Guards	65 lb-in. (5 Nm)
Flywheel Nut	60 lb-ft. (81 Nm)
Fuel Tank to Cylinder	85 lb-in. (10 Nm)
Fuel Tank Spacer Bolt	85 lb-in. (10 Nm)
Governor Lever Nut	30 lb-in. (3 Nm)
Muffler Bolts	85 lb-in. (10 Nm)
Muffler Guard	25 lb-in. (2 Nm)
Oil Drain Plug	145 lb-in. (16 Nm)
Oil Filter	75 lb-in. (9 Nm)
Oil Filter Adapter	85 lb-in. (10 Nm)
Oil Pump Cover	30 lb-in (3 Nm)
Rewind Nuts	30 lb-in (3 Nm)
Rocker Arm Studs	50 lb-in. (6 Nm)
Rocker Ball Set Screws	40 lb-in. (5 Nm)
Spark Plug	180 lb-in. (20 Nm)
Stop Switch Bracket	15 lb-in. (2 Nm)
Sump to Cylinder Block	110 lb-in. (12 Nm)
Valve Cover	40 lb-in. (5 Nm)

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	Standard Dimensions		Reject Dimensions	
	SAE	**Metric**	**SAE**	**Metric**
CYLINDER				
Mag Bearing	.876 in.	22.25 mm	.878 in.	22.30 mm
Mag Oil Seal Depth	Flush	Flush	N/A	N/A
Bore Diameter	2.583 in.	65.61mm	N/A	N/A
Bore out-of-round	N/A	N/A	.0015 in.	.04 mm
Cam Bearing	.501 in.	12.73 mm	.502 in.	12.75 mm
CYLINDER HEAD				
Intake Valve Seat Angle	46°	46°	N/A	N/A
Intake Valve Stem	.247 in.	6.29 mm	.245 in.	6.22 mm
Intake Valve Guide	.249 in.	6.32 mm	.251 in.	6.38 mm
Exhaust Valve Seat Angle	46°	46°	N/A	N/A
Exhaust Valve Stem	.247 in.	6.29 mm	.245 in.	6.22 mm
Exhaust Valve Guide	.249 in.	6.32 mm	.251 in.	6.38 mm
CRANKCASE COVER/SUMP				
PTO Bearing	1.065 in	27.05 mm	1.067 in.	27.10 mm
PTO Oil Seal Depth	.200 in.	.508 mm	5.075 in.	128.91 mm
Cam Bearing	.501 in.	12.73 mm	.502 in.	12.75 mm
CRANKSHAFT				
Crankpin Journal	1.098 in.	27.89 mm	1.096 in.	27.84 mm
Mag Journal	.875 in.	22.23 mm	.873 in.	22.17 mm
PTO Journal	1.062 in.	26.97 mm	1.060 in.	26.92 mm
CAM SHAFT				
Mag Side Journal	.500 in.	12.70 mm	.499 in.	12.67 mm
PTO Side Journal	.500 in.	12.70 mm	.499 in.	12.67 mm
CONNECTING ROD				
Crankpin Bearing	1.100 in.	27.95 mm	1.101 in.	27.97 mm
Piston Pin Bearing	.491 in.	12.47 mm	.493 in.	12.52 mm
PISTON				
Pin Diameter	.490 in.	12.45 mm	.489 in.	12.42 mm
Pin Bore	.491 in.	12.47 mm	.492 in.	12.50mm
PISTON RINGS				
Ring End Gap - Top	.005 - .015 in.	.13 - .38 mm	.025 in.	.64 mm
Ring End Gap - Middle	.025 - .035 in.	.64 - .88 mm	.045 in.	1.14 mm
Ring End Gap - Oil	.010 - .030 in.	.05 - .08 mm	.045 in.	1.14 mm
Rng Land Clearance - Top	.002 in.	.05 mm	.005 in.	.13 mm
Ring Land Clearance - Middle	.002 in.	.05 mm	.005 in.	.13 mm
Ring Land Clearance - Oil	.004 in.	.10 mm	.007 in.	.18 mm

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MODEL 120000

ENGINE SPECIFICATIONS	
Armature Air Gap	.010 - .014 in. (.25 - .36 mm)
Crankshaft End Play	.002 - .038 in. (.05 - .97 mm)
Spark Plug Gap	.020 in. (.51 mm)
Valve Clearance – Intake	.004 - .008 in. (.10 - .20 mm)
Valve Clearance – Exhaust	.004 - .008 in. (.10 - .20 mm)
FASTENER TORQUE SPECIFICATIONS	**TORQUE**
Air Cleaner Base to Carburetor	45 lb-in. (5 Nm)
Air Cleaner Cover	10 lb-in. (1 Nm)
Alternator	40 - 85 lb-in. (5 - 10 Nm)
Armature to Cylinder	85 lb-in. (10 Nm)
Brake Assemblies	50 lb-in. (6 Nm)
Breather Cover	55 lb-in. (6 Nm)
Breather Reed	45 lb-in. (5 Nm)
Carburetor to Cylinder Head	85 lb-in. (10 Nm)
Casing Clamp	15 lb-in. (2 Nm)
Connecting Rod Cap to Connecting Rod	95 lb-in. (11 Nm)
Cylinder Head to Cylinder Block	210 lb-in. (24 Nm)
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Mag Bearing	.876 in.	22.25 mm	.878 in.	22.30 mm
Mag Oil Seal Depth	Flush	Flush	N/A	N/A
Bore Diameter	2.688 in.	68.28 mm	N/A	N/A
Bore out-of-round	N/A	N/A	.0015 in.	.04 mm
Cam Bearing	.501 in.	12.73 mm	.502 in.	12.75 mm
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Intake Valve Seat Angle	46°	46°	N/A	N/A
Intake Valve Stem	.247 in.	6.29 mm	.245 in.	6.22 mm
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Ring Land Clearance - Middle	.002 in.	.05 mm	.005 in.	.13 mm
Ring Land Clearance - Oil	.004 in.	.10 mm	.007 in.	.18 mm

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