N-28 ENGINE SERVICE MANUAL

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SPECIFICATIONS AND TORQUES

SPECIFICATIONS AND TORQUES

Engine Specifications

Item	
Engine Type	Air-cooled. 2-cycle, Third Port
Displacement	1.7 cu. in. (28.5 cc)
Bore 1.31 in. (33.27 mm)	1.31 in. (33.27 mm)
Stroke 1.28 in. (32.51 mm)	1.28 in. (32.51 mm)
Average Compression	115-125 lbs. (52-57 kg)
Piston Ring(s) Side Clearance	0.004 in. max (0.101 mm)
Piston Ring Width (S/N 102084332 to 302010968)	0.060 in. (1.6 mm)
Piston Ring Width (S/N 302010969 and Greater)	0.046 in. (1.14 mm)
Piston Ring End Gap (S/N 102084332 to 302010968)	0.072 in. (1.8 mm)
Piston Ring End Gap (S/N 302010969 and Greater)	0.057 in. (1.45 mm)

Fuel and Lubrication

Item	
Lubrication	Fuel/Oil Mixture
Fuel/Oil Ratio	32:1
Approx. Fuel Tank Capacity	18 oz. (530 ml)

Ignition

Item	
Ignition Type	Electronic
Ignition Module Air Gap	0.010-0.015 in. (0.254-0.381 mm)
Spark Plug Type	Champion® RDJ7Y
Spark Plug Gap	0.018-0.023 in. (0.45 to 0.58 mm)

SPECIFICATIONS AND TORQUES (cont.)

Torque Specifications

Item	
Air Filter Cover Mounting Screws	18-22 in•lb (2.0-2.5 N•m)
Carburetor/Choke Plate Mounting Screws (Initial Torque)	13-17 in•lb (1.5-1.9 N•m)
Carburetor/Choke Plate Mounting Screws (Retorque)	23-27 in•lb (2.6-3.0 N•m)
Throttle Wire Swivel Screw (S/N 102084332 to 302010968)	9-12 in•lb (1.0-1.4 N•m)
Carburetor Spacer Screws	55-65 in•lb (6.2-7.3 N•m)
Clutch Cover Mounting Screws	35-40 in•lb (3.9-4.5 N•m)
Clutch Rotor	150-160 in•lb (16.9-18.0 N•m)
Clutch Housing/Drum Assembly Screws	35-40 in•lb (3.9-4.5 N•m)
Clutch Rotor	130-150 in•lb (14.6-16.8 N•m)
Clutch Bolts	60-80 in•lb (6.7-9.0 N•m)
Crankcase (Cylinder) Mounting Screws	50-60 in•lb (5.6-6.7 N•m)
Crankcase Cover Mounting Screws	55-65 in•lb (6.2-7.3 N•m)
Spark Plug	100-120 in•lb (11.2-13.5 N•m)
Boom Clamp Screw	70-80 in•lb (7.9-9.0 N•m)
Anti-Rotation Screw	15-20 in•lb (1.7-2.3 N•m)
Rear Engine Cover to Starter Housing Screw	50-60 in•lb (5.6-6.7 N•m)
Rear Engine Cover to Crankcase Screw	35-40 in•lb (3.9-4.5 N•m)
Engine Styling Cover	35-40 in•lb (3.9-4.5 N•m)
Boom Clamp Nut	70-80 in•lb (7.9-9.0 N•m)
Anti-Rotation Screw	15-20 in•lb (1.7-2.3 N•m)
Fuel Tank Bracket Screws	50-60 in•lb (5.6-6.7 N•m)
Ignition Module Mounting Screws	25-35 in•lb (2.8-3.9 N•m)
Muffler Exhaust Tube Screws	15-25 in•lb (1.7-2.8 N•m)
Muffler Mounting Screws	80-90 in•lb (9.0-10.1 N•m)
Starter Housing Screws	35-40 in•lb (3.9-4.5 N•m)
Starter Pulley Retainer Screw	20-30 in•lb (2.3-3.4 N•m)

SAFETY WARNINGS AND NOTES

The purpose of safety symbols is to attract your attention to possible dangers. The safety symbols and the explanations with them deserve your careful attention and understanding. The safety warnings do not by themselves eliminate any danger. The instructions or warnings they give are not substitutes for proper accident prevention measures.

WARNING: For Your Safety

Highlights instructions which failure to obey can result in personal injury.

NOTE: Advises of information which may be useful while performing maintenance or repair of the equipment. Also highlights instructions which failure to obey can result in damage to parts or equipment.

WARNING: Spring Under Tension!

The rope starter on these engines contains a flat wire spring that is under tension. Wear eye and hand protection when replacing worn or broken spring, in case it should uncoil as it is handled. Allow spring tension to be completely relieved and make sure pulley disengages from spring before removing the pulley retainer(s), pulley, and starter spring from housing.

WARNING: Electrical Shock!

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

WARNING: HOT SURFACES!

The muffler, cylinder, crankcase, trimmer cutting head, and other engine surfaces get extremely hot from operation. These surfaces remain hot for a short period of time after the engine is stopped. To prevent severe burns, allow the engine to cool completely before servicing.

WARNING: Explosive Fuel!

Gasoline may be present in the fuel tank, carburetor, fuel line, or crankcase. Gasoline is extremely flammable and its vapors can explode if ignited. Keep sparks, flames, and other sources of ignition away from the engine. Do not smoke while servicing the engine. Never use gasoline as a cleaning agent.

Store gasoline only in approved containers in well-ventilated, unoccupied buildings away from sparks, flames, or other sources of ignition. 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. Do not smoke while handling gasoline or filling the fuel tank.

WARNING: Cracked or Broken FLYWHEEL Cooling Fins Are A Hazard!

Be careful not to crack or break any flywheel cooling fins. They could fly off during operation. If cooling fins are cracked or broken, replace the flywheel.

PRODUCT IDENTIFICATION NUMBERS

When ordering parts, or in any communication involving an engine or product, always give the:

- Model Number and
- Serial Number

These numbers are located on a decal (or decals) affixed to the unit (Figure 1-1). The identification decal(s) will be located on the engine, metal boom, or plastic housing. The actual location will vary depending on the type of product.

Figure 1-1. Product Identification Decal.

OIL AND FUEL RECOMMENDATIONS

WARNING: Explosive Fuel!

Gasoline is extremely flammable and its vapors can explode if ignited. Store gasoline only in approved containers in well-ventilated, unoccupied buildings away from sparks or flames. Do not fill the 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. Do not smoke while handling gasoline. Never use gasoline as a cleaning agent.

NOTE: READ THESE INSTRUCTIONS CAREFULLY BEFORE ATTEMPTING TO START OR OPERATE THIS UNIT. Using old oil or fuel or improperly mixing the oil and fuel can cause engine damage. This type of damage will void the engine warranty.

Recommended Oil Type

Toro 2-cycle oil is recommended for use in these engines (Figure 1-2). If another brand of 2-cycle oil is used, use a high quality oil that is formulated for small 2-cycle air-cooled engines.

Figure 1-2. Recommended Oil Type.

Recommended Fuel Type

Use clean fresh, regular grade unleaded gasoline.

NOTE: Alcohol blended fuel absorbs moisture (water). As little as 1% moisture in the fuel can cause fuel and oil to separate and form acids when stored.

If these types of fuel must be used, use fresh fuel (less than 60 days old) and mix according to the instructions in this section.

Use of Blended Fuels

If you choose to use a blended fuel or its use is unavoidable, the following precautions are recommended:

1. Always use fresh fuel mixed according to the instructions in this section.

2. Use the special additive Alcohol Protector® (by Gold Eagle) or equivalent to inhibit corrosion and reduce oil/fuel separation (mix as directed).

3. Always agitate the fuel mix before fueling unit.

4. Drain the fuel tank and run engine dry before storing unit.

Problems with Blended Fuels

Some problems associated with blended fuels include:

- Vapor lock
- Poor warm restart
- Poor performance at high altitudes
- Corrosion of fuel system components

If any of these symptoms occur, switch to regular, unleaded gasoline.

Gasohol Use May Require Carburetor Adjustments

These engines are lubricated by oil mixed with fuel. Using blended fuel may alter the air/fuel ratio causing a lean mix (less fuel, more air).

If this condition is not corrected by adjusting the carburetor, engine damage due to poor lubrication can result.

Use of Fuel Additives

The use of fuel additives such as Toro Gas Stabilizer/Conditioner, STA-BIL® Gas Stabilizer, or an equivalent, will minimize the formation of fuel gum deposits. Such an additive should only be used when fuel/oil mix is prepared. Add 0.4 oz. (11 ml) per gallon of gasoline or mix per instructions on container. NEVER add fuel additives directly to the unit fuel tank.

Fuel and Oil Mixing Instructions

NOTE: For proper engine operation and maximum reliability, pay strict attention to these fuel and oil mixing instructions. Use a 32:1 fuel/oil ratio when using Toro or IDC 2-cycle oil. Using improperly mixed fuel can severely damage the engine. Never mix the gasoline and oil in the fuel tank of the unit.

Use the following procedures to ensure complete mixing:

1. Put a small amount of fresh gasoline into a clean one U.S. gallon (3.785 liter) fuel can.

2. Add 4-oz. (118 ml) of Toro 2-cycle engine oil.

3. Fill the remainder of the fuel can with gasoline.

4. Screw the fuel can cap on tightly and SHAKE THE CAN VIGOROUSLY FOR 30 SECONDS.

STARTING/STOPPING INSTRUCTIONS

To Start the Engine

1. Make sure the switch is in the “START” or “ON” position (Figure 1-3).

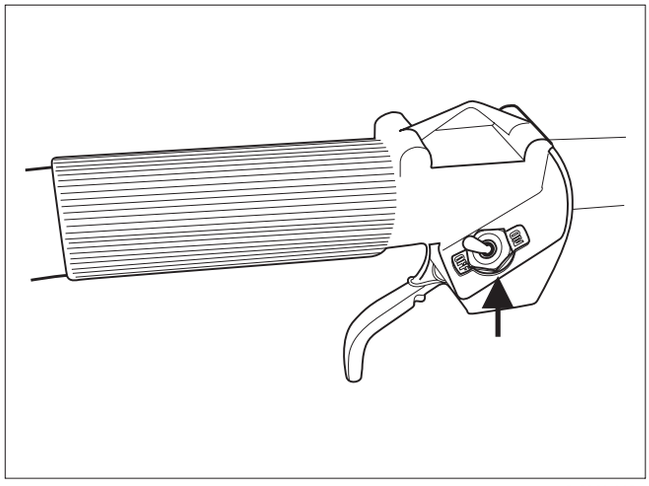

Figure 1-3. Typical Ignition Switch. 3.6069.003.

2. FULLY PRESS AND RELEASE the primer bulb 5 to 7 times (Figure 1-4).

3. Place the choke lever in the FULL “CHOKE” position (Figure 1-4).

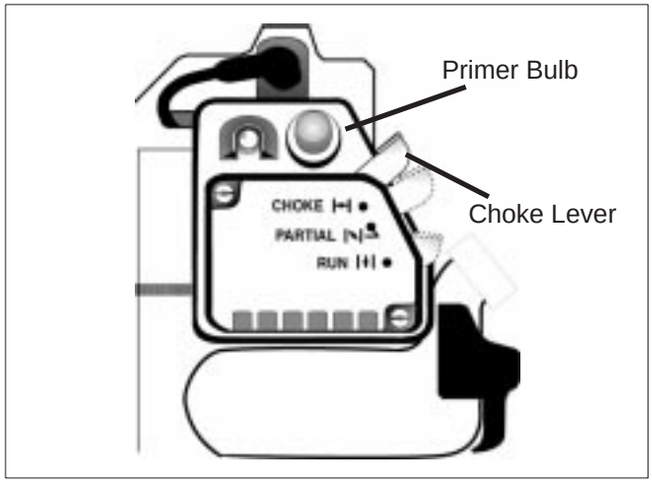

Figure 1-4. Primer Bulb and Choke Lever. 3.6069.004

4. Place the unit in the starting position with the trimmer cutting head away from yourself and others.

5. Squeeze the throttle trigger to “FULL THROTTLE” (Figure 1-5). Hold or lock the throttle in this position.

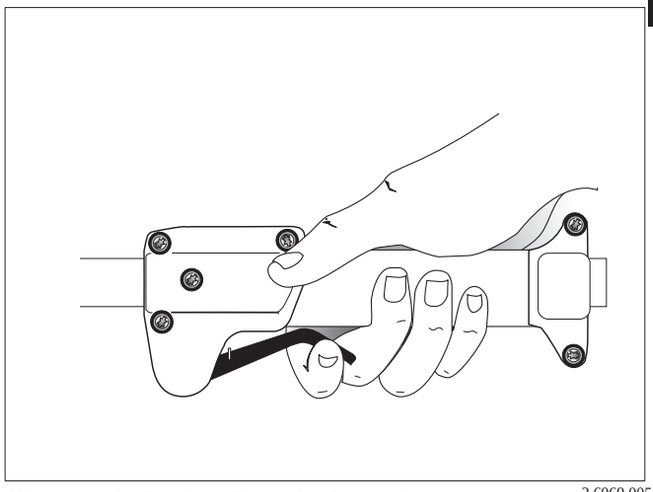

Figure 1-5. Typical Throttle Control. 3.6069.005

6. Pull the starter rope BRISKLY until you hear the engine sound like it wants to run (normally 2 to 5 pulls).

7. Place the choke lever in the “PARTIAL” choke position (Figure 1-4).

8 Pull the starter rope BRISKLY 1 to 3 pulls to start the engine.

9. If the engine does not start, repeat steps 1 through 8.

10. After the engine warms up for 5 to 10 seconds, place the choke lever in the “RUN” position.

To Stop the Engine

Place the ignition switch in the “OFF” or “STOP” position (see Figure 1-3).

SERVICE/MAINTENANCE INSTRUCTIONS

Air Filter

NOTE: CLEAN AND RE-OIL THE AIR FILTER EVERY 10 HOURS OF OPERATION. The air filter is one of the most important areas to maintain. If it is not maintained as follows, severe engine damage can result:

1 Remove the air filter from the carburetor/air filter cover assembly. Refer to Part 3 - Engine Disassembly.

2. Wash the air filter in detergent and water (Figure 1-6). Rinse the air filter thoroughly in clean water and allow it to dry.

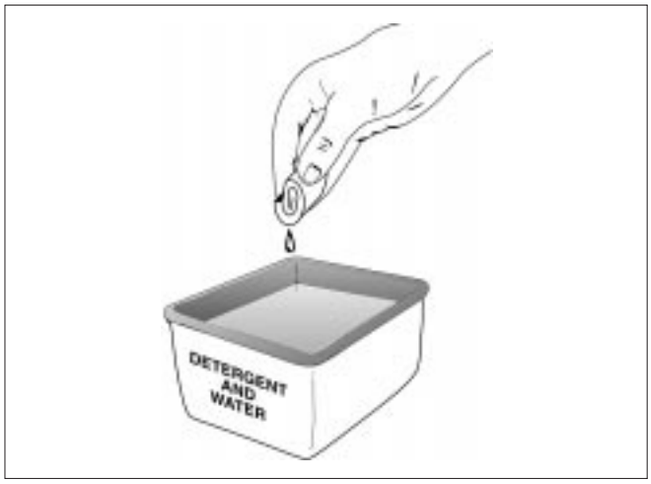

Figure 1-6. Washing Air Filter Element. 3.6069.006

3. Apply clean SAE 30 oil to the air filter (Figure 1-7).

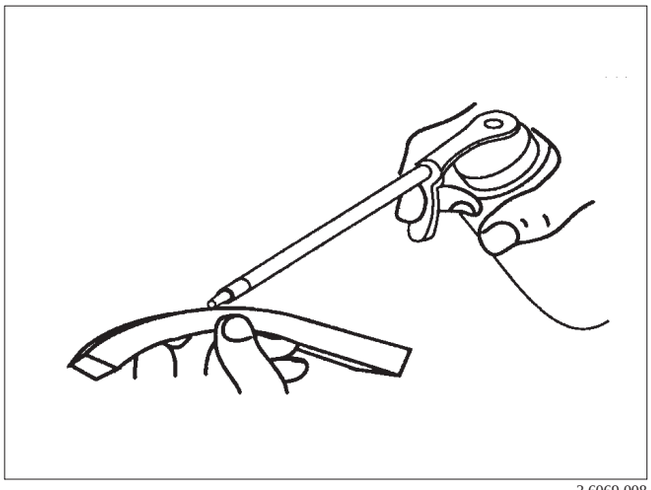

Figure 1-7. Oiling Air Filter Element. 3.6069.008

4. Squeeze the air filter to ensure that the oil is spread throughout the entire filter (Figure 1-8).

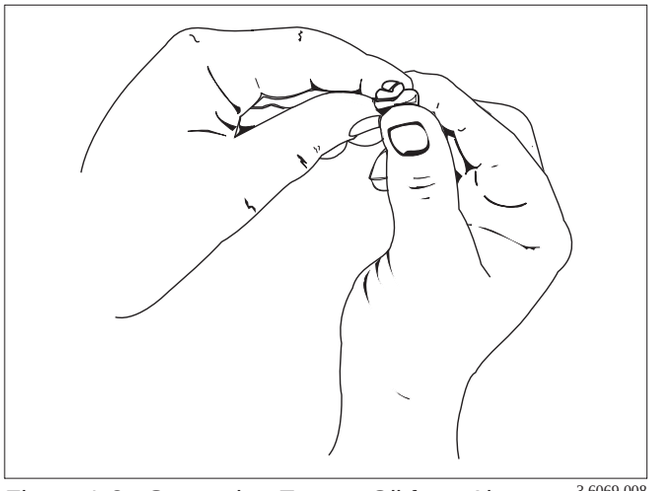

Figure 1-8. Squeezing Excess Oil from Air Filter Element. 3.6069.008

5. Reinstall the air filter in the carburetor/air filter cover assembly. Refer to Part 4 - Engine Assembly.

Spark Plug

Every 50 hours of operation remove the spark plug, check its condition, and reset the gap or replace with a new plug as necessary.

WARNING: Electrical Shock!

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

1. Before removing the spark plug, clean the area around the base of the spark plug to keep dirt and debris out of the engine.

2. Disconnect the spark plug wire and remove the spark plug from engine.

3. Inspect the spark plug for carbon buildup and clean if necessary. Replace the plug if it is badly burnt or if reuse is questionable.

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

4. Check the spark plug gap using a wire feeler gauge. Set the gap to 0.018-0.023 inch (0.45 to 0.58 mm) (Figure 1-9).

5. Reinstall the spark plug and torque to 100-120 in•lb (11.3 - 13.5 N•m).

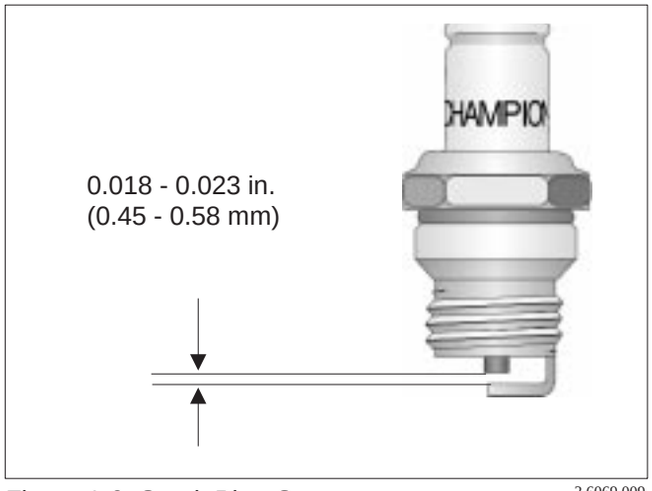

Figure 1-9. Spark Plug Gap. 3.6069.009

Carburetor Adjustment

These engines are equipped with a diaphragm-type carburetor. The carburetor has been carefully calibrated at the factory. In most cases, no further adjustment will be required.

The condition of the air filter is very important to the operation of the trimmer. A dirty air filter will restrict the air flow to the carburetor. This, in turn, upsets the fuel-air mixture in the carburetor. The resulting symptoms are often mistaken for an out-of-adjustment carburetor. Therefore, check the condition of the air filter before adjusting the carburetor. Refer to “Air Filter” Service/Maintenance Instructions.

If the following conditions are experienced, it may be necessary to adjust the carburetor:

- The engine will not idle.
- The engine hesitates or stalls on acceleration.
- The loss of engine power, which is not corrected by cleaning the air filter.
- The engine operates in an erratic or fuel-rich condition (indicated by excessive exhaust smoke from the muffler).

NOTE: Follow these carburetor adjustment procedures carefully. An incorrectly adjusted carburetor can cause severe engine damage.

Make sure the unit is fully assembled before making carburetor adjustments.

For trimmers and brushcutters, make sure the boom, cutting head, and line guard are installed and the cutting line is extended to its full cutting length.

The carburetor has three basic adjustments: idle speed adjustment, idle mixture adjustment, and high speed mixture adjustment (Figure 1-10).

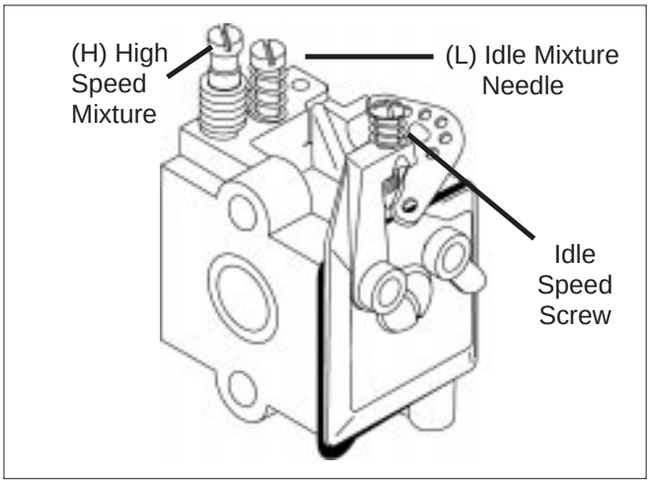

Figure 1-10. Carburetor Adjustments. 3.6069.010

1. Initial Idle Speed Setting: Turn idle speed screw counterclockwise until it does not touch the throttle lever. Now turn the screw clockwise until it just touches the throttle lever; then continue turning 2 full turns.

2. If so equipped, remove the rubber cap from the high speed mixture adjustment needle.

3. Initial High Speed Mixture and Idle Mixture Settings: Turn both the high speed mixture and idle mixture needles clockwise until they are lightly seated. Then turn the needles counterclockwise the following number of turns:

High Speed Mixture Needle :	1¼ turns
Idle Mixture Needle:	1¼ turns

   NOTE: Turn the high speed mixture and idle mixture needles finger-tight. Do not force the needles with a screw driver as this can damage the tips of the needles and the seats in the carburetor body.

4. Start engine and allow it to warm up for 3 to 5 minutes.

   NOTE: For the following steps, use a magnetic pick-up 2-cycle engine tachometer to monitor engine speed.

5. Final High Speed Mixture Setting: Squeeze the throttle trigger to the FULL (WIDE OPEN) THROTTLE position. Turn the high speed mixture needle clockwise or counterclockwise to set the high speed RPM: 6,800 to 7,200.

6. Release the throttle trigger and let the engine idle. If the engine stops, turn the idle speed screw clockwise 1/8 turn at a time until the engine idles.

7. Final Idle Mixture and Idle Speed Settings: Adjust the the idle mixture and idle speed as follows:

   a. Turn the idle mixture needle clockwise until the fastest idle RPM is reached; then turn the needle counterclockwise 1/8 turn.

   b. Squeeze the throttle trigger. If the engine falters or hesitates as it accelerates, turn the idle mixture needle counterclockwise 1/16 turn at a time until the engine accelerates rapidly.

   c. If the idle speed has changed significantly because of steps a. and b. above, readjust the idle speed screw.

      The recommended idle speed for all products is 3,000 to 3,200 RPM.

8. Make sure the air filter cover is reinstalled securely before placing the unit back into service.

Governed Carburetor Check

Some units are equipped with fuel-governed carburetors. If so equipped, and after adjusting the carburetor, check the operation of the governor on trimmers and brush cutters as follows:

1. Clip or wind the cutting line so it is inside the cutting head (not extended to its full cutting length).

2. Start the engine and run it at FULL (WIDE OPEN) THROTTLE.

   The maximum high speed RPM should not exceed 8,800 RPM.

3. If the high speed RPM exceeds 8,800 RPM, the governor assembly in the carburetor must be cleaned or replaced and the carburetor readjusted.

STORAGE INSTRUCTIONS

WARNING: Explosive Fuel!

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

Storage for 45 to 60 Days

Use the following storage procedure for equipment or fuel that will be stored for more than 45 days and less than 60 days:

Equipment - Empty the fuel tank and run the unit until the fuel system is empty. When starting the unit after storage, refill the fuel tank with freshly mixed gasoline and oil.

Fuel - Do not use fuel that has been stored for more than 60 days. Dispose the old fuel in a safe manner and use a fresh mix.

Storage for More Than 60 Days

1. Drain all fuel from the fuel tank into an approved fuel container.

2. Start the engine and run it until it stalls.

3. Allow the engine to cool. Remove the spark plug and put about 1 oz. (39 ml) of any high quality motor or 2-cycle oil into the cylinder. Pull the starter rope slowly to distribute the oil. Reinstall the spark plug.

4. Clean the unit and inspect for any loose or damaged parts. Repair or replace damaged parts and tighten loose screws, nuts, or bolts.

5. Store the unit in a dry, well ventilated area.

To Reactive Unit for Service

1. Remove the spark plug and drain the oil from the cylinder by slowly pulling the starter rope.

2. Reinstall the spark plug.

3. Refuel the unit with a fresh gasoline/oil mixture. Start engine in accordance with the Starting Instructions.

SPECIAL TOOLS

In addition to typical hand tools, the following special tools are required to properly service these engines:

- Clutch Tool, (Standard N28 Engines) P/N 147337 (Figure 1-11).
- Clutch Tool, (Professional N28 Engines) (Figure 1 -12).
- Flywheel Holder, P/N 612470 (Figure 1- 13).
- 0-250 in•lb (0-28.1 N•m) Torque Wrench (commercially available).
- Torx® Screwdriver or Bit Set (commercially available).
- Two-stroke, Magnetic Pick-up Tachometer (commercially available).
- Arbor or Hydraulic Press (commercially available).
- Bearing and Seal Pullers (commercially available).
- Hex Wrench Clutch Rotor Tool, P/N 180918.
- Flywheel Holding Tool, P/N 180918.
- 0-250 in•lb (0-28.1 N•m) Torque Wrench (commercially available).
- Torx® Screwdriver or Bit Set (commercially available).
- Two-stroke, Magnetic Pick-up Tachometer (commercially available).

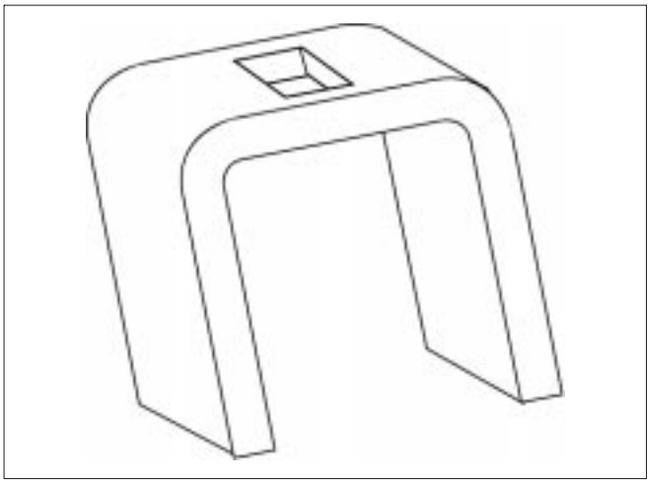

Figure 1-11. Clutch Tool P/N 147337. 3.6069.011

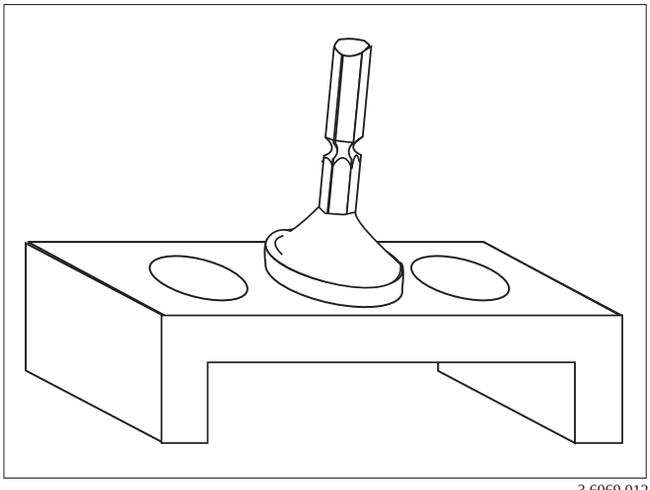

Figure 1-12. Clutch Tool for Professional N28 Engines. 3.6069.012

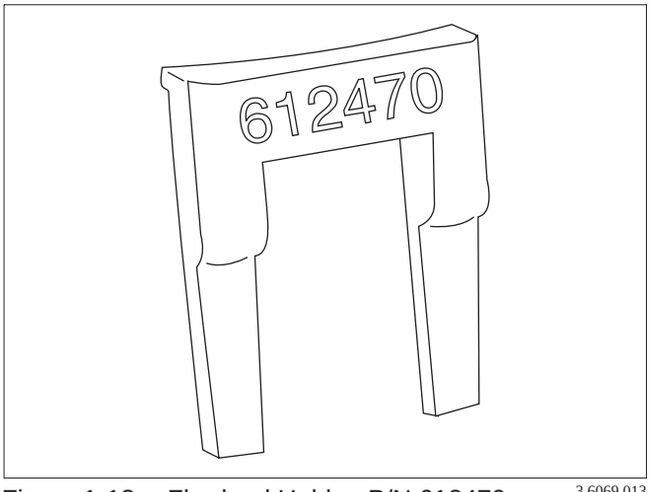

Figure 1-13. Flywheel Holder, P/N 612470. 3.6069.013

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When difficulties occur, be sure to check for simple causes which, at first, may seem too obvious to beconsidered. A starting problem, for example, could be caused by an empty fuel tank.

The following table lists some common causes of operating troubles and the possible causes and remedies.

Engine Fails to Start

Possible Cause	Remedy
Ignition switch OFF	Turn switch ON
Out of fuel or water in fuel	Drain tank and blow out fuel lines to remove water. Refuel tank with fresh fuel mixture.
Dirty or plugged air filter	Clean or replace air filter
Loose spark plug lead wire	Reconnect lead wire
Fouled, improperly gapped, or broken spark plug	Clean or replace spark plug; set gap to 0.018-0.023 inch (0.45 to 0.58 mm)
Plugged fuel tank cap vent	Clean fuel tank cap vent
Plugged or waterlogged fuel filter	Replace fuel filter
Improperly adjusted carburetor	Adjust carburetor
Plugged muffler	Clean or replace muffler
Faulty primer or primer/fuel lines improperly installed	Correctly install primer/fuel lines or replace primer
Incorrect fuel mixture	Drain tank; refill with correct fuel mixture
Plugged fuel line	Blow out fuel line
Faulty carburetor diaphragm	Replace diaphragm
Plugged fuel pump filter screen	Clean or replace filter screen
Faulty fuel pump diaphragm	Replace pump diaphragm
Plugged carburetor/fuel pump passages	Clean out passages
Incorrect air gap between flywheel and ignition	Set ignition module air gap to (0.010-0.015 in (0.254-0.381 mm)
Faulty ignition module	Replace ignition module
Low compression	Replace piston ring(s) or cylinder

Engine Starves on Acceleration

Possible Cause	Remedy
Plugged fuel filter	Replace fuel filter
Improperly adjusted carburetor	Adjust carburetor about 1/8 turn

Engine is Hard to Start

Possible Cause	Remedy
Fouled, improperly gapped, or broken spark plug	Clean or replace spark plug; set gap to 0.018-0.023 in. (0.45 to 0.58 mm)
Plugged or waterlogged fuel filter	Replace fuel filter
Improperly adjusted carburetor	Adjust carburetor
Clogged muffler	Clean or replace muffler
Faulty primer or primer/fuel lines improperly installed	Correctly install primer/fuel lines or replace primer
Incorrect air gap between flywheel and ignition module	Set ignition module air gap to 0.010-0.015 inch (0.254-0.381 mm)
Faulty ignition module	Replace ignition module
Worn or improperly adjusted carburetor jet needle	Adjust or replace needle
Faulty carburetor diaphragm	Replace carburetor diaphragm
Faulty fuel pump diaphragm	Replace fuel pump diaphragm
Low compression	Replace piston ring or cylinder

Engine Stalls

Possible Cause	Remedy
Dirty or plugged air filter	Clean or replace air filter
Fouled, improperly gapped, or broken spark plug	Clean or replace spark plug; set gap to 0.018-0.023 in. (0.45 to 0.58 mm)
Plugged fuel tank cap vent	Clean fuel tank cap vent
Incorrect fuel mixture	Drain tank; refill with correct fuel mixture
Improperly adjusted carburetor	Adjust carburetor
Plugged muffler	Clean or replace muffler
Plugged fuel line	Blow out fuel line
Faulty ignition module	Replace ignition module

Engine Fires Intermittently

Possible Cause	Remedy
Fouled, improperly gapped, or broken spark plug	Clean or replace spark plug; set gap to 0.018-0.023 in. (0.45 to 0.58 mm)
Incorrect air gap between flywheel and ignition module	Set ignition module air gap to 0.010-0.015 inch (0.254-0.381 mm)
Faulty ignition module	Replace ignition module
Incorrect fuel mixture	Drain tank; refill with correct fuel mixture

Engine Does Not Produce Maximum Power

Possible Cause	Remedy
Plugged air filter	Clean or replace filter
Incorrect fuel mixture	Drain tank; refill with correct fuel mixture
Plugged muffler	Clean or replace muffler
Plugged or waterlogged fuel filter	Replace fuel filter
Improperly adjusted carburetor	Adjust carburetor
Air leak at carburetor base gasket	Tighten carburetor fasteners or replace carburetor base gasket
Intermittent spark	Replace ignition module
Low compression	Replace piston ring or cylinder
Leaking crankcase seals	Replace crankcase seals
Scored piston and/or cylinder	Replace piston cylinder assembly
Worn piston rings or low compression	Overhaul engine

Carburetor Floods

Possible Cause	Remedy
Faulty primer or improperly installed primer/fuel lines	Correctly install primer/fuel lines or replace primer
Improperly adjusted carburetor	Adjust carburetor
Damaged carburetor	Replace carburetor
Leaking fuel inlet needle	Replace fuel inlet needle

Engine Stops After Running Briefly

Possible Cause	Remedy
Partially plugged fuel tank cap vent	Clean fuel tank cap vent
Dirty or plugged air filter	Clean or replace air filter
Water in fuel mixture	Drain tank and blow out lines
Air leak at carburetor base gasket	Tighten carburetor mounting fasteners or replace carburetor base gaskets
Dirty carburetor fuel inlet needle or passage	Replace fuel inlet needle or clean out carburetor
Faulty carburetor diaphragm	Replace diaphragm
Losing compression	Replace piston ring or gaskets or overhaul engine

Engine Will Not Idle

Possible Cause	Remedy
Improperly adjusted carburetor	Adjust carburetor
Faulty carburetor diaphragm	Replace carburetor diaphragm
Faulty carburetor inlet seat gasket	Replace carburetor inlet seat gasket
Leaking crankshaft seals	Replace crankshaft seals
Scored cylinder or low compression	Overhaul engine

Engine Backfires or Misfires

Possible Cause	Remedy
Improper or contaminated fuel mix	Drain tank; refill with fresh fuel mixture
Fouled, improperly gapped, or broken spark plug	Clean or replace spark plug; set gap to 0.018-0.023 in. (0.45 to 0.58 mm)
Shorted ignition module leads	Check for loose or bare wires or loose assembly and correct or replace ignition module.

Engine Will Not Accelerate

Possible Cause	Remedy
Carburetor improperly adjusted	Adjust carburetor
Air filter clogged	Clean or replace air filter
Spark plug fouled	Clean or replace spark plug; set gap to 0.018-0.023 in. (0.45 to 0.58 mm)
Plugged muffler	Clean or replace muffler
Carburetor diaphragm gasket leaking	Replace gasket

Engine Lacks Power or Stops During Operation

Possible Cause	Remedy
Faulty primer causing flooding	Replace primer
Dirty or plugged air filter	Clean or replace air filter
Plugged muffler	Clean or replace muffler
Scored cylinder or low compression (below 90 psi)	Overhaul engine

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Typical Disassembly Sequence

The following sequence is suggested for complete engine disassembly, inspection, and repair. This procedure can be varied to accommodate individual requirements for disassembly and repair.

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

Make sure that the cleaner is wiped off of engine parts and not allowed to air dry as some cleaners leave a residue on parts which can affect engine lubrication.

Refer to the appropriate parts manual to ensure the correct replacement parts are ordered.

1. Drain Fuel from Tank*
2. Remove Engine from Equipment
3. Remove Styling Cover
4. Remove Air Filter*
5. Remove Choke/Carburetor*
6. Remove Carburetor Spacer
7. Remove Rear Engine Cover
8. Remove Fuel Tank Bracket, Fuel Tank, and Heat Shield
9. Remove Muffler*
10. Remove Clutch
11. Remove Starter Housing
12. Remove Ignition Module
13. Remove Flywheel
14. Remove Spark Plug*, Cylinder, and Piston/ Connecting Rod
15. Remove Crankshaft; Disassemble Crankcase

* On some units, these can be removed and reinstalled without removing the engine from its normal operating installation.

NOTE: Only disassemble the engine to the extent necessary to make the desired repairs.

MAJOR COMPONENTS (cont.)

WARNING:

EXPLOSIVE FUEL

Drain Fuel From Tank

WARNING: Explosive Fuel!
Gasoline may be present in the fuel tank, carburetor, fuel lines, and crankcase. Gasoline is extremely flammable, and its vapors can explode if ignited. Keep sparks, flames, and other sources of ignition away from the engine. Do not smoke while servicing the engine. Never use gasoline as a cleaning agent.

2.0415.011

1. Drain all fuel from the fuel tank and drain into a suitable container for storing a 2-cycle fuel mixture.

2. Start the engine and allow it to run until it stalls. Allow the engine to cool.

2.6071.015

Remove Engine

Standard N28 Engines

Remove the engine from the equipment as follows:

1. If necessary, remove the air filter cover and base before the throttle cable is removed from the carburetor throttle lever.

2 For units with serial number 102084332 to 302010968 - loosen the screw securing the throttle cable in the swivel on carburetor throttle lever. Remove the throttle cable from the swivel.

MAJOR COMPONENTS (cont.)

3. For units with serial number 302010969 and greater, remove the Z-bend of throttle cable from the hole in the carburetor throttle lever.

4. Disconnect the lead wires from the ignition switch.

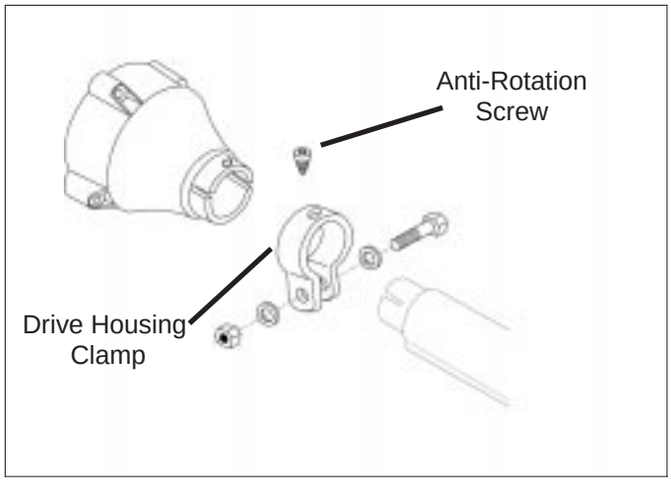
NOTE: The location of the lead wires and the removal instructions will vary from model to model.

2.6071.016

5. Remove the anti-rotation screw from the drive housing.

6. Loosen clamp nut and bolt.

7. Remove engine from the drive housing (boom).



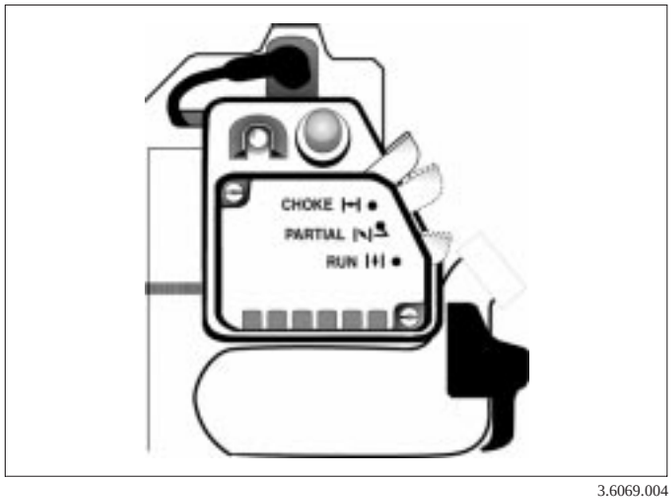
3.6071.017

Professional N28 Engines

Remove the engine from the equipment as follows:

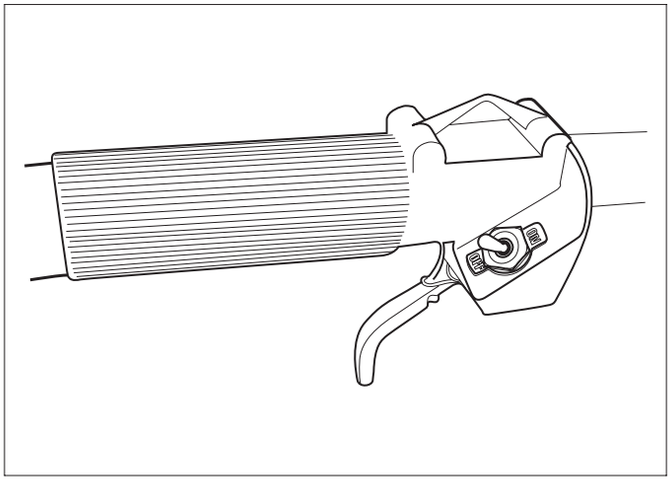
1. If necessary, remove the air filter cover and base before the throttle cable is removed from the carburetor throttle lever.

2. Remove the throttle cable from the hole in carburetor throttle lever.



3.6069.004

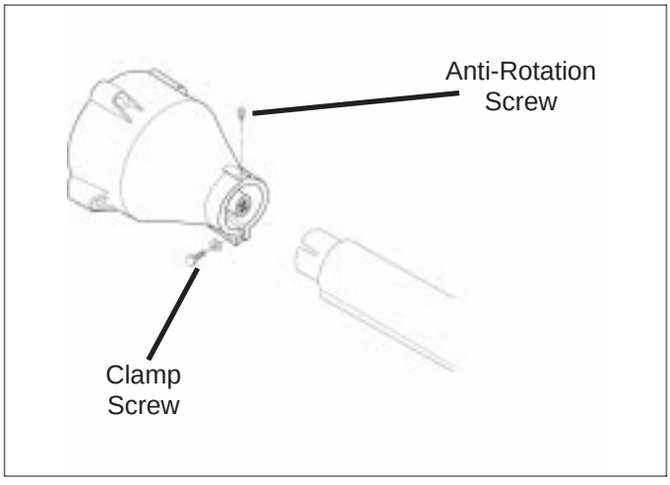
MAJOR COMPONENTS (cont.)



3.6069.003

3. Disconnect the lead wires from the ignition switch.

NOTE: The location of the lead wires and the removal instructions will vary from model to model.



3.6071.016

4. Remove the anti-rotation screw from the clutch housing/drum assembly.

5. Loosen clamp screw.

6. Remove engine from the drive housing (boom).

2.6071.018

Remove Styling Cover

Units with a professional N28 engine are equipped with an engine styling cover. To remove the styling cover:

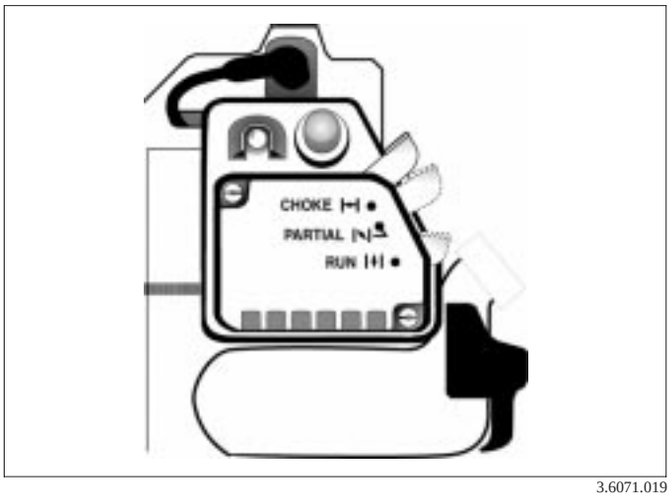
1. Remove the screws securing the styling cover. Remove the cover.

MAJOR COMPONENTS (cont.)

Remove Air Filter

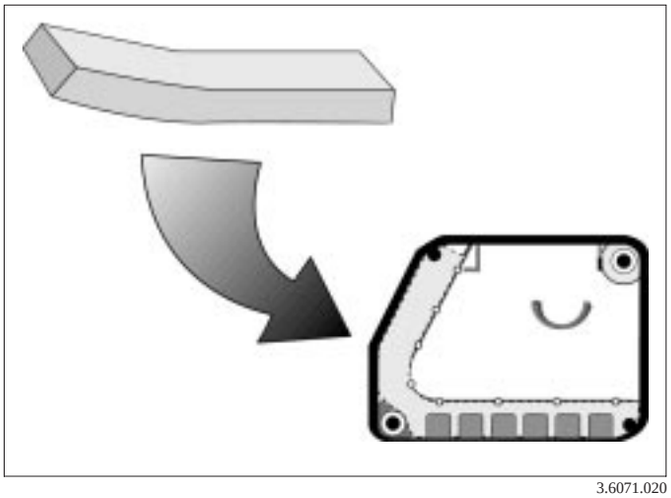
Use the following procedures to remove the air filter cover and element. Service the element as instructed in Part 1 - General Information.

1. Remove the screws securing the air filter cover. Remove the air filter cover assembly from the air filter base.



3.6071.019

2. Remove the air filter element from the air filter cover.



3.6071.020

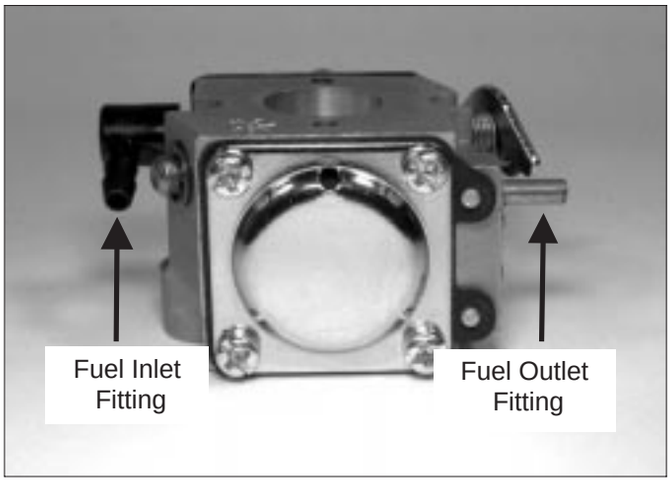
Remove Choke/Carburetor

1. Remove the screws securing the choke components, air filter base, and carburetor to the carburetor spacer.

2. Remove the flat washers, wavy washer, choke lever and choke plate, and spacers.

2.6071.021

MAJOR COMPONENTS (cont.)

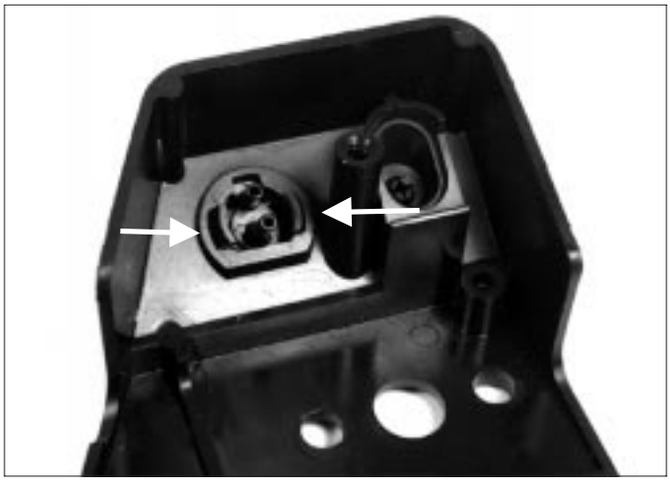


2.6071.024

3. Remove the fuel line from the carburetor fuel inlet fitting.

4. Remove the fuel line from the fuel outlet fitting on carburetor (to primer bulb).

5. Remove the carburetor and carburetor gasket.



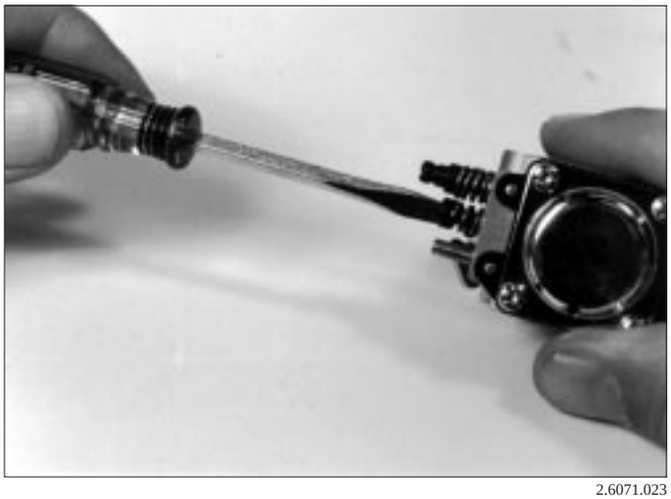
2.6071.022

Remove Primer Bulb

1. Remove the fuel lines from the fittings on primer bulb.

2. Squeeze the mounting tabs on the back of the bulb, and pull the bulb out from the front of the air filter base.

   Inspect the primer bulb for flexibility and cuts or tears. Replace the primer bulb if necessary.



2.6071.023

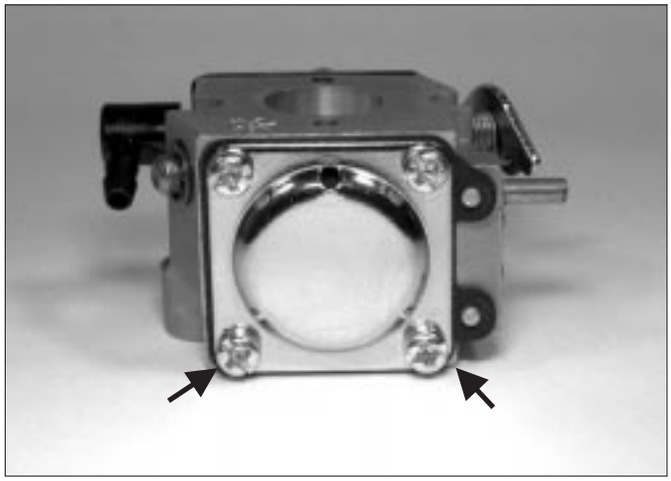
Carburetor Disassembly

Fuel Metering Side

1. Remove the high speed mixture (H) and idle mixture (L) adjusting needles and springs.

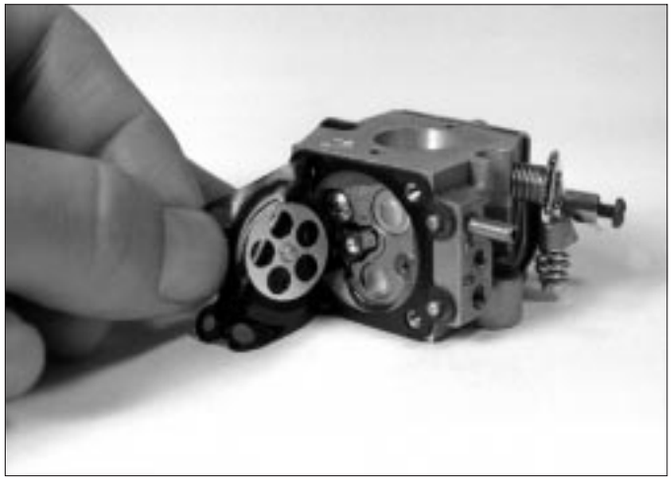
MAJOR COMPONENTS (cont.)

2. Remove the fuel metering cover screws and cover.



2.6071.024

3. Remove the fuel metering diaphragm and gasket.

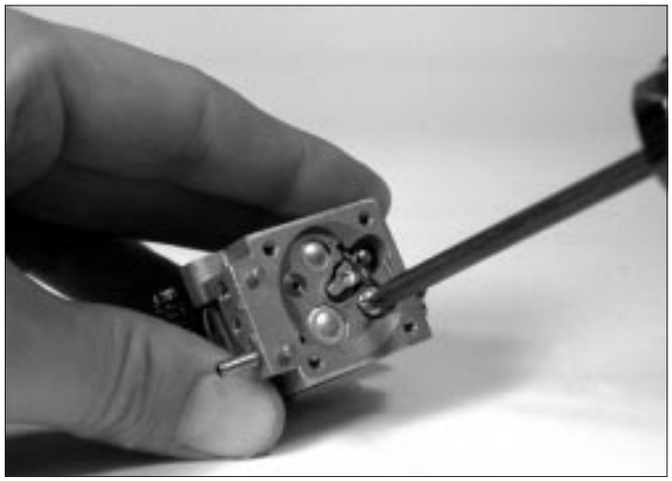


2.6071.025

4. Remove the screw securing the metering lever hinge pin in carburetor body.

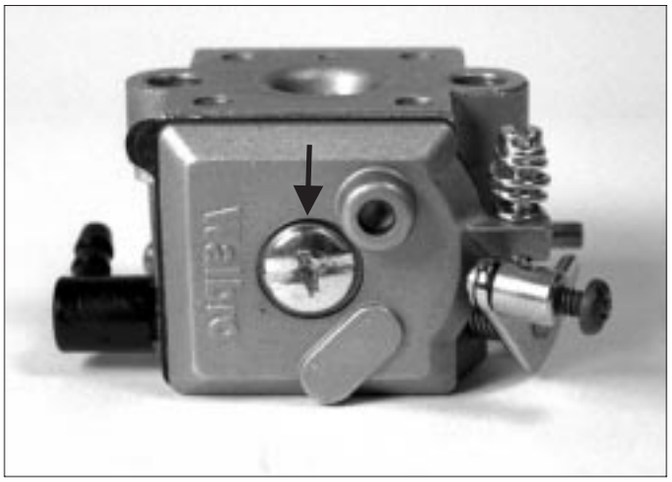
   Remove the metering lever, hinge pin, metering lever spring, and fuel inlet needle.

NOTE: These components are under spring tension. Remove them carefully to prevent loss. Make sure the spring is not stretched.



2.6071.026

MAJOR COMPONENTS (cont.)

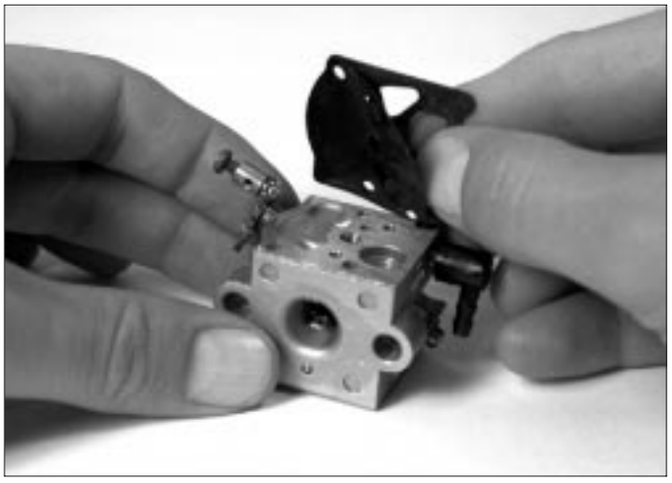


2.6047.027

Fuel pump Side

1. Remove the idle speed adjusting screw and spring from fuel pump cover.

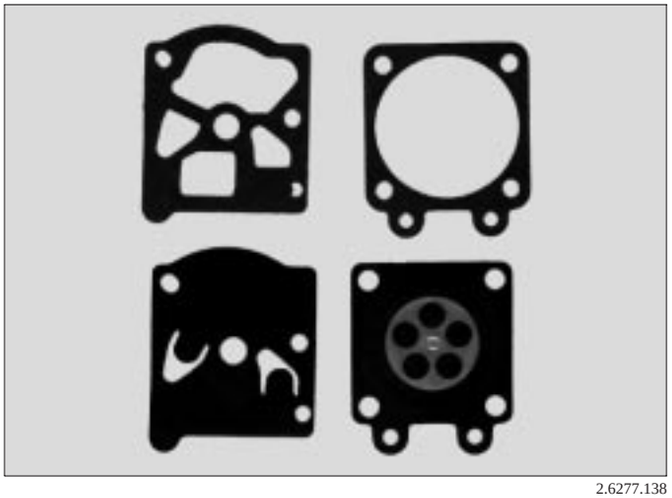
2. Remove the fuel pump cover screw and cover.



2.6071.028

3. Remove the fuel pump cover gasket and pump diaphragm.

NOTE: Further disassembly to remove the throttle plate, throttle lever, welch plugs, fuel inlet screen, etc., is not recommended.



2.6277.138

Carburetor Inspection And Cleaning

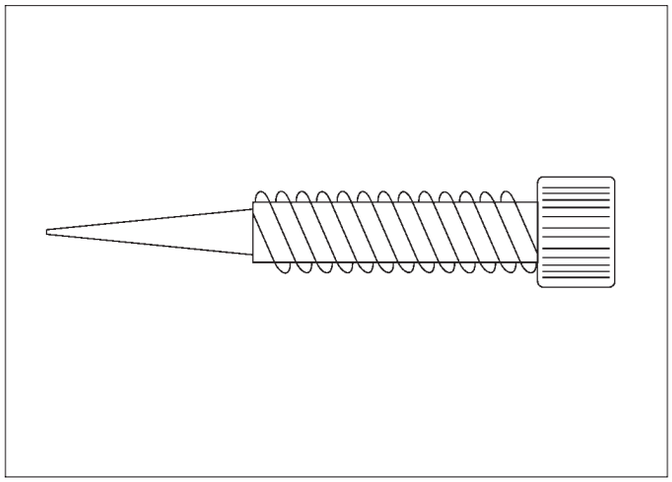
Two carburetor service kits are available: a gasket/diaphragm kit and a carburetor repair kit.

The gasket/diaphragm kit contains the fuel metering cover gasket, fuel metering diaphragm, fuel pump cover gasket, and fuel pump diaphragm.

The carburetor repair kit contains the gaskets and diaphragms included in the gasket/diaphragm kit plus the high speed mixture needle and spring, idle mixture needle and spring, fuel inlet needle and spring, fuel metering lever, metering lever hinge pin, the fuel inlet screen and welch plugs. Refer to the appropriate parts manual for service kit part numbers.

MAJOR COMPONENTS (cont.)

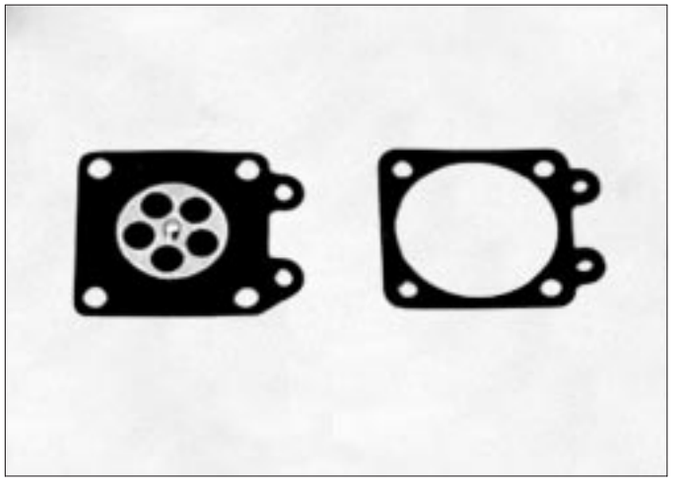
1. Inspect the tips of the high speed mixture needle, idle mixture needle, and fuel inlet needle for wear or damage. Replace the needles if necessary.



3.6179.165

2. Gaskets and diaphragms eventually deteriorate and become stiff with age and use. It is good practice to replace gaskets and diaphragms for each repair. However, if the diaphragm is soft and flexible, you do not need to replace it unless a complete carburetor rebuild is being performed.
3. Clean the metering cover, pump cover, carburetor body, and filter screen with carburetor cleaner. Blow out all passages with compressed air.

NOTE: To prevent damage to the carburetor body, do not use drill bits or wire to clean fuel ports and passages.

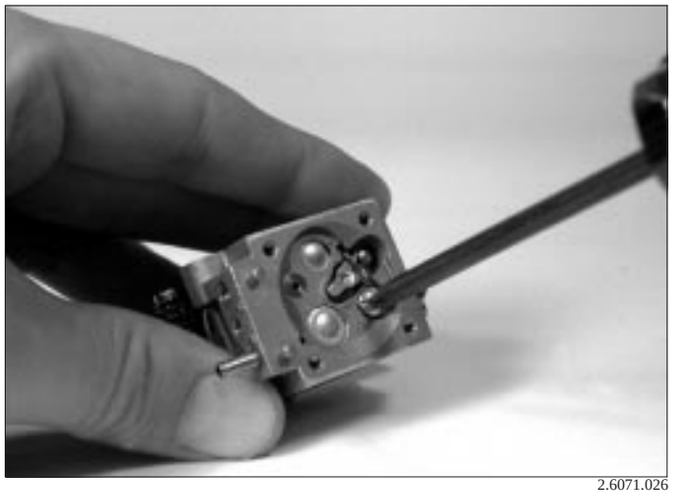


2.6060.152

Carburetor Reassembly

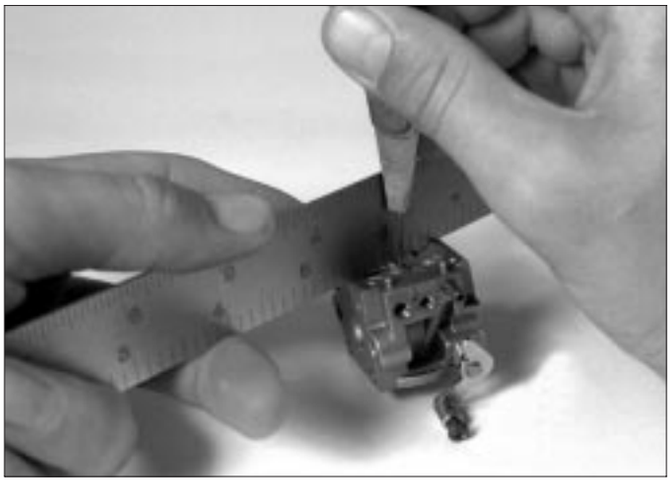
Fuel Metering Side

1. Install the fuel inlet needle, fuel metering lever spring, metering lever, and metering lever hinge pin. Secure the hinge pin in carburetor body with the hinge pin screw.



2.6071.026

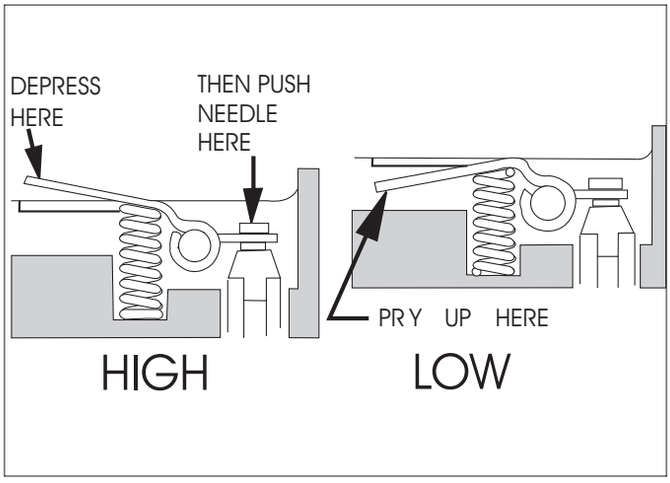
MAJOR COMPONENTS (cont.)



2.6071.029

2. Place a straight edge across the carburetor body. Use a wire feeler gauge to measure the distance between the the straight edge and the top of the fuel metering lever.

   The fuel metering lever should be 0.060-0.070 in. (1.52-1.78 mm) below the straight edge.



3.6071.031

Adjust the metering lever.

If the lever is adjusted too high, the engine will run rich. If the lever is adjusted too low, the engine will run lean. Poor acceleration and erratic operation may also be noted.

3.6071.032

3. Install the metering cover gasket (next to carburetor body) and metering diaphragm. Make sure the larger circular plate of diaphragm is towards the metering lever.

MAJOR COMPONENTS (cont.)

4. Make sure there are no wrinkles in the metering diaphragm. Install the metering cover and screws. Tighten the the screws securely.

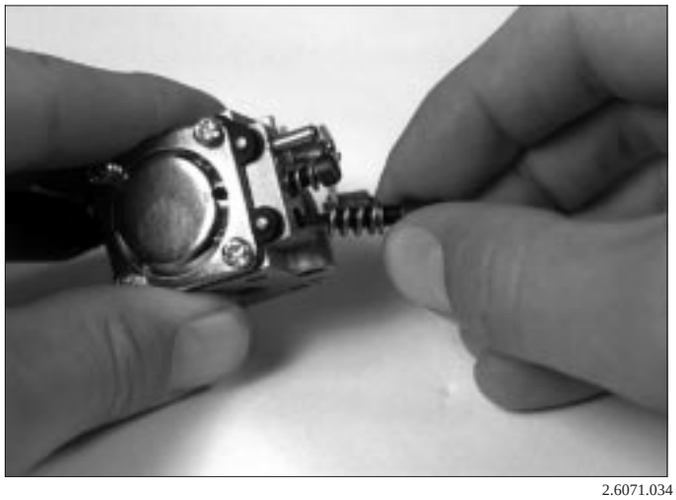
2.6071.033

5. Install the high speed mixture (H) and idle mixture (L) adjusting needles and springs.

   Turn both needles clockwise until they are lightly seated. Then turn the needles counterclockwise the following number of turns:

   High Speed Mixture Screw: 1¼ turns
   Idle Mixture Screw: 1¼ turns

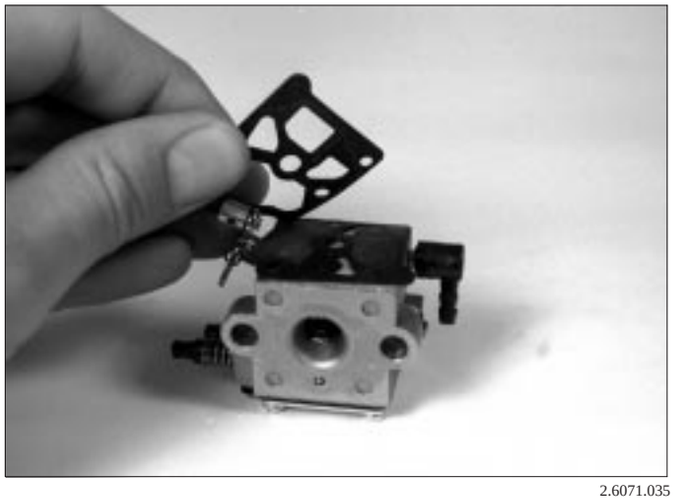
NOTE: Turn the high speed mixture and idle mixture needles finger-tight. Do not force the needles with a screwdriver as this can damage the tips of the needles and the seats in the carburetor body.



2.6071.034

Fuel Pump Side

1. Install the fuel pump diaphragm (next to carburetor body) and gasket.



2.6071.035

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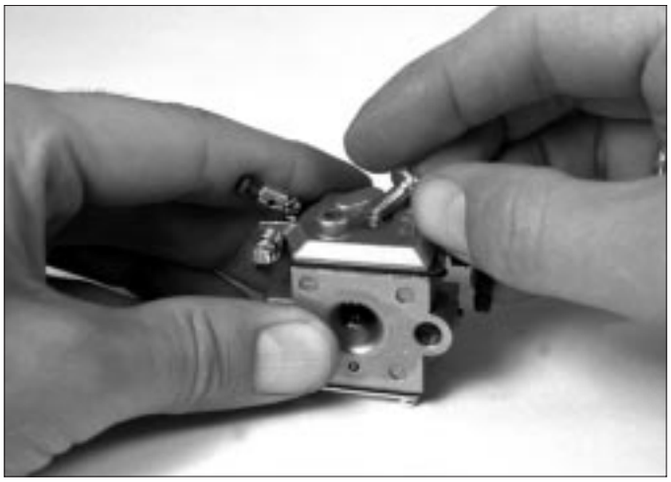
MAJOR COMPONENTS (cont.)

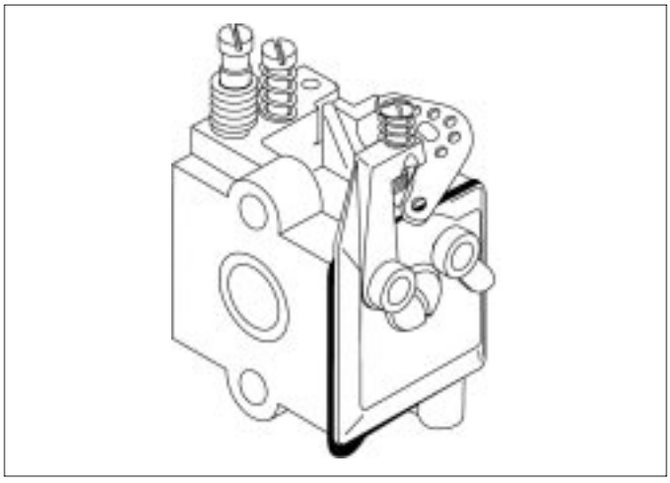


2.6071.036

2. Install the fuel pump cover and cover screw. Tighten the screw securely.

3. If necessary, install the idle speed adjusting screw and spring.

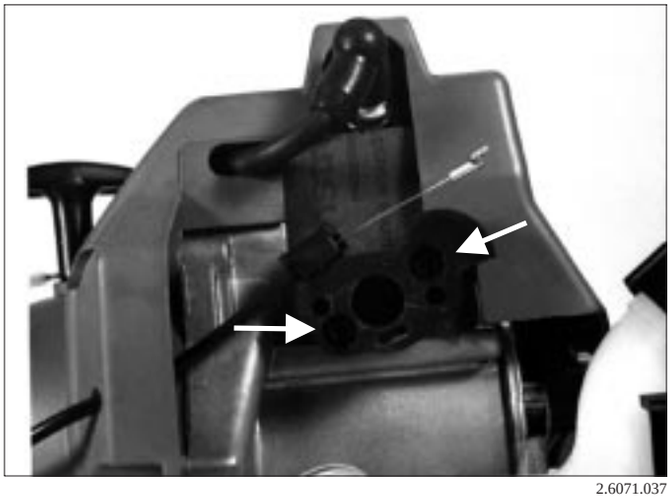
   Turn the adjusting screw clockwise until it just touches the throttle lever; then continue turning 2 full turns.



3.6069.010

Final Carburetor Adjustment

Make final adjustments to the carburetor when the unit is fully reassembled. Refer to “Carburetor Adjustment” in Part 1 - General Information.



2.6071.037

Remove Carburetor Spacer

1. Remove the two (2) screws securing the carburetor spacer to the crankcase.

2. Remove the carburetor spacer and carburetor spacer gasket.

3. If necessary, remove the two (2) hex nuts on the back of the carburetor spacer.

MAJOR COMPONENTS (cont.)

Remove Rear Engine Cover

1. Remove the two (2) screws securing the rear cover to the starter housing and crankcase.

2. Remove the rear engine cover.

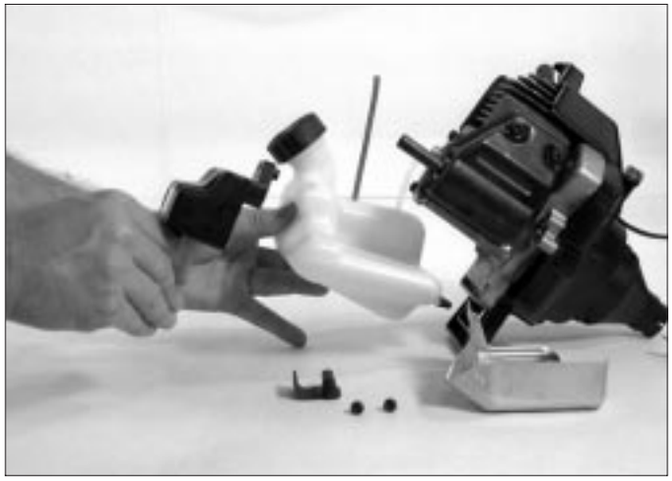
2.6071.039

Remove Fuel Tank Bracket, Fuel Tank, and Heat Shield

1. Remove the two (2) screws from the fuel tank bracket.

2. Remove the bracket, fuel tank, and heat shield.

3. Remove the rubber fuel tank mounting pads.

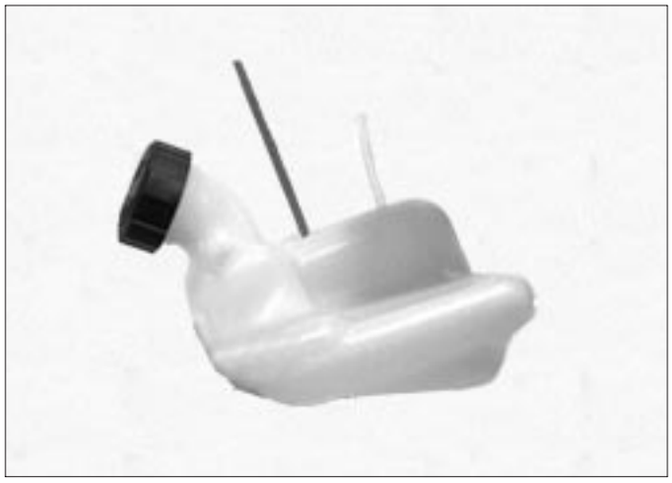


2.6071.040

Fuel Tank and Lines, Disassembly, Inspection and Reassembly

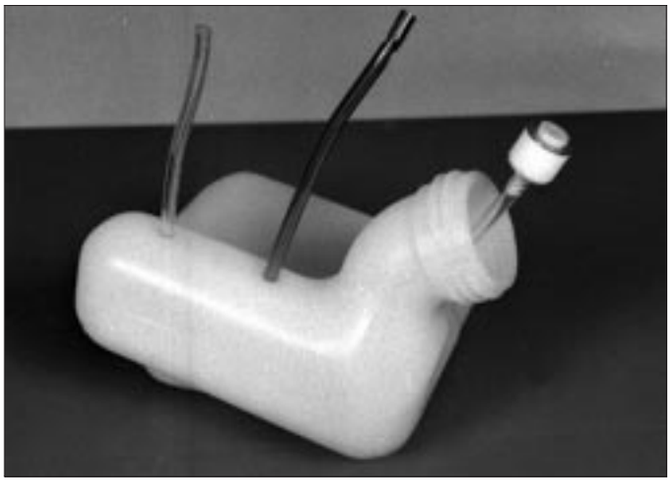
Fuel Tank and Cap

1. Inspect the fuel tank for cracks, rubbing, or chaffed spots. Replace the tank if necessary.
2. Inspect the rubber fuel tank mounting pads (on either side of the tank) for condition. Replace the mounts if necessary.
3. Inspect the fuel tank cap for cracks, damaged vent valve, or other visible signs of damage. Replace the cap if necessary.



2.6078.085

MAJOR COMPONENTS (cont.)



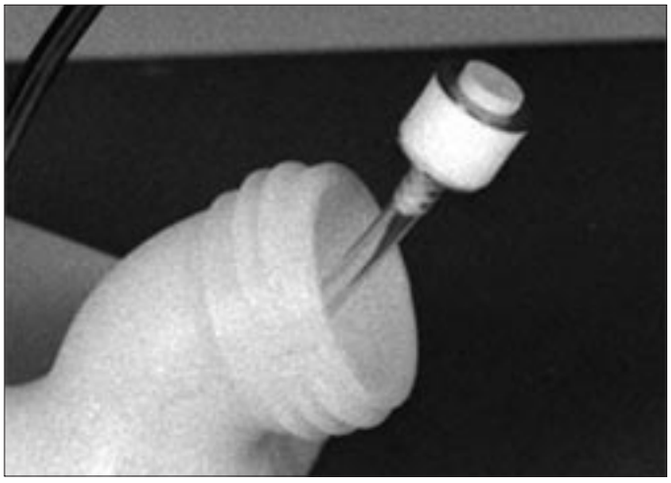
2.6071.041

Fuel Line and Filter Removal

This unit has two fuel lines to the fuel tank. The clear line provides normal fuel flow. The blue line provides a return line for excess fuel flow during the primer operation. The blue (primer) line is removed/ installed in the same manner as the fuel line except it does not have a fuel filter.

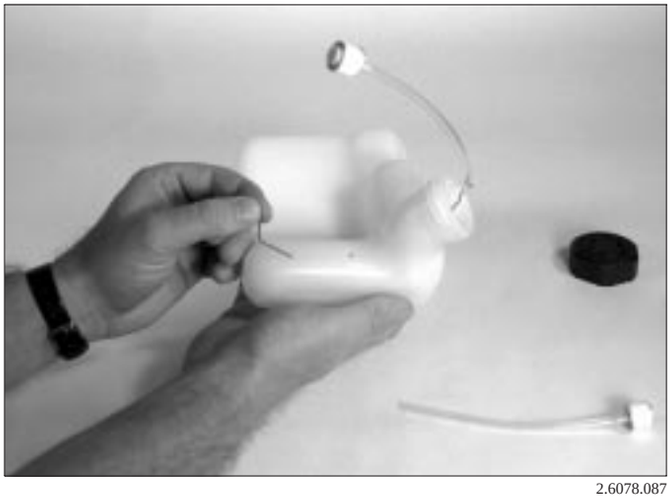
To remove the fuel lines and fuel filter:

1. Push the fuel fitting, fuel filter, and fuel line out of the fuel tank through the tank neck.



2.6078.086

2. If the fuel filter is dirty or clogged, replace it with a new fuel line assembly.



2.6078.087

Fuel Line and Filter Installation

1. Insert a piece of trimmer line through the hole in the bottom of fuel tank to the filler opening. Slide the fuel line over trimmer line.

2. Working through the filler neck, insert the fuel line with the fuel filter and fitting attached through the hole in the bottom of tank.

3. Work the fuel line from outside of tank, pulling until the filter lays on the bottom of the tank.

MAJOR COMPONENTS (cont.)

Remove Muffler

1. Remove the muffler mounting bolts.

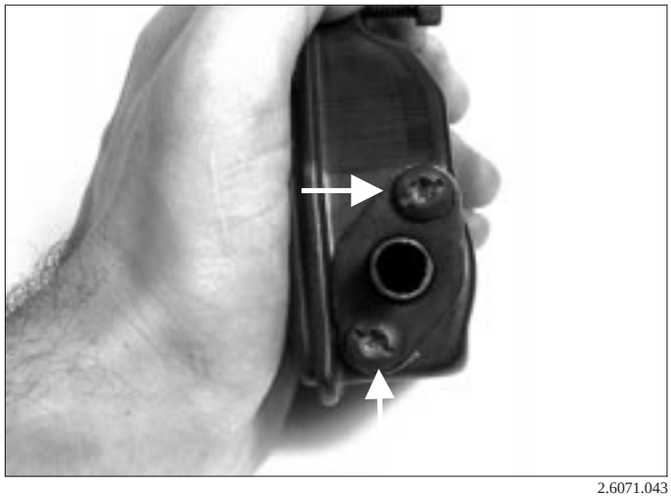
2. Remove the muffler and gasket. Discard the old gasket.

3.6071.045

Exhaust Exit Tube Removal

1. Remove the screws securing the exhaust exit tube to the muffler body.

2. Remove the exhaust exit tube and gasket.



2.6071.043

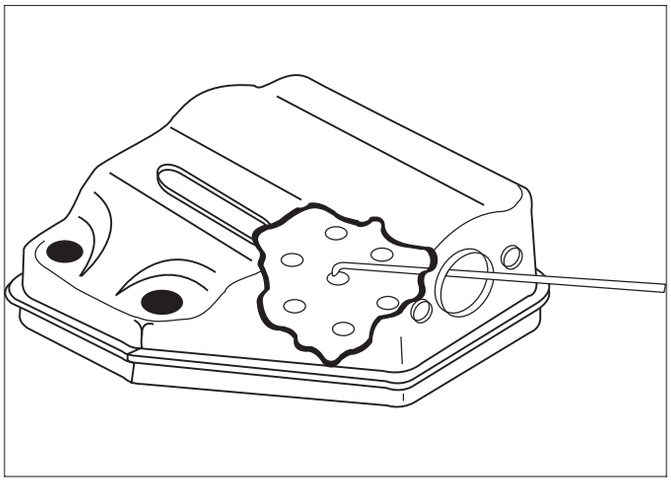
Muffler Inspection and Cleaning

The muffler should be removed periodically to inspect for excessive carbon build-up. Excessive deposits around the exhaust ports or exhaust exit holes will cause poor engine performance.

1. Check the inlet port of muffler for excessive carbon deposits. Clean as required.

2.6071.046

MAJOR COMPONENTS (cont.)



3.6071.045

2. Inspect the baffle inside muffler for carbon build-up. Clean baffle by scraping carbon as required. Use a piece of wire to clear obstructions from the small holes in baffle.

3. Inspect the muffler mounting holes for elongation. Replace the muffler if the holes are elongated.

2.6071.043

Muffler Reassembly

1. Install a new gasket and the exhaust exit tube. Secure the tube with two (2) screws.

   Torque the screws to 15-25 in•lb (1.7-2.8 N•m).

2.6071.046

Remove Clutch

Standard N28 Engines

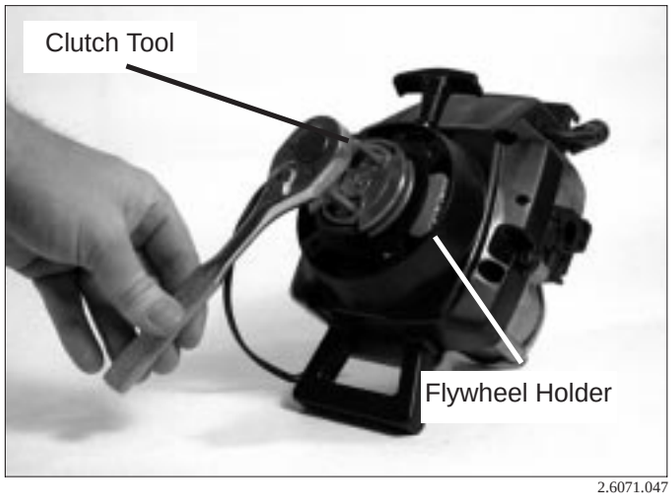
1. Remove the four (4) screws securing the clutch cover to starter housing. Remove the clutch cover.

MAJOR COMPONENTS (cont.)

2. Install flywheel holder, P/N 612470 or 180919.

3. Using clutch tool, P/N 147337 or 180918, remove the clutch rotor.

4. Remove the spacer sleeve from crankshaft.

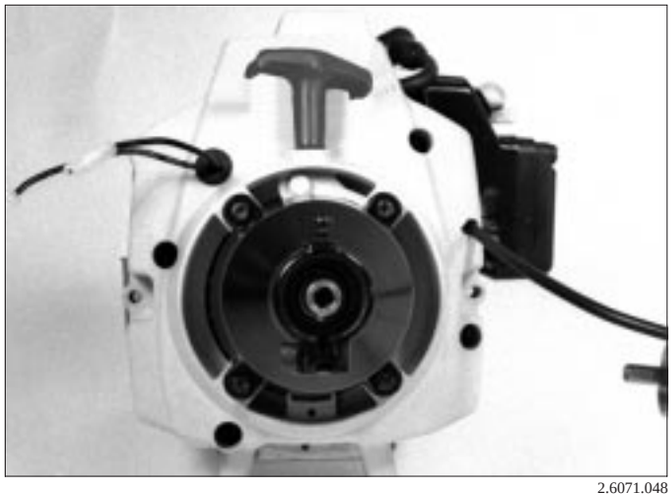


2.6071.047

Professional N28 Engines

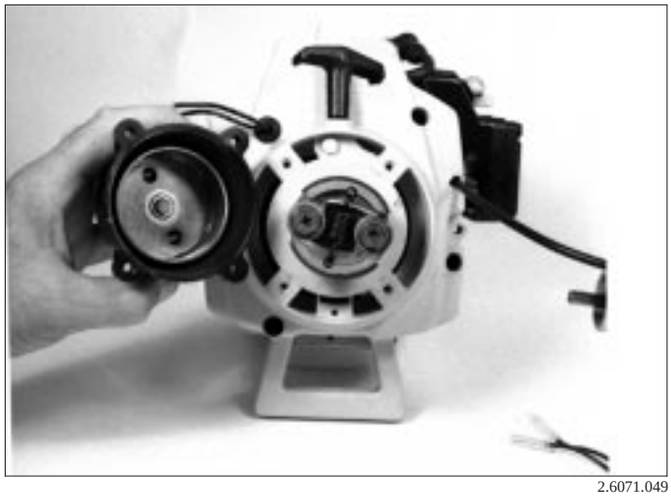
1. Remove the four (4) screws securing the clutch housing/drum assembly to starter housing. Remove the clutch housing/drum assembly.

2. Install flywheel holder, P/N 612470 or 180919.



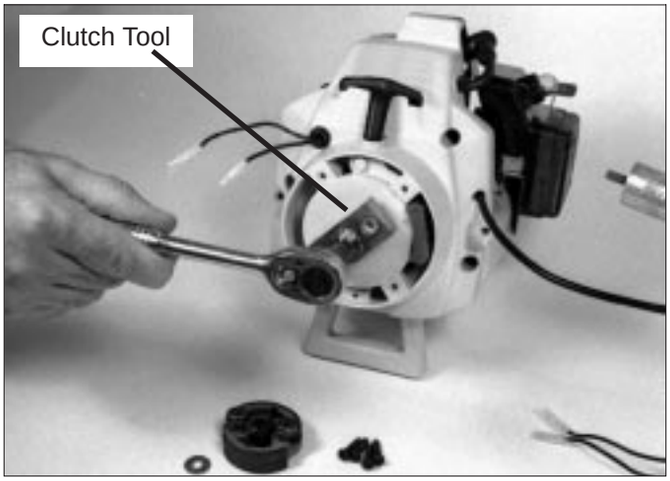
2.6071.048

3. Remove the two (2) clutch shoe bolts and washers.



2.6071.049

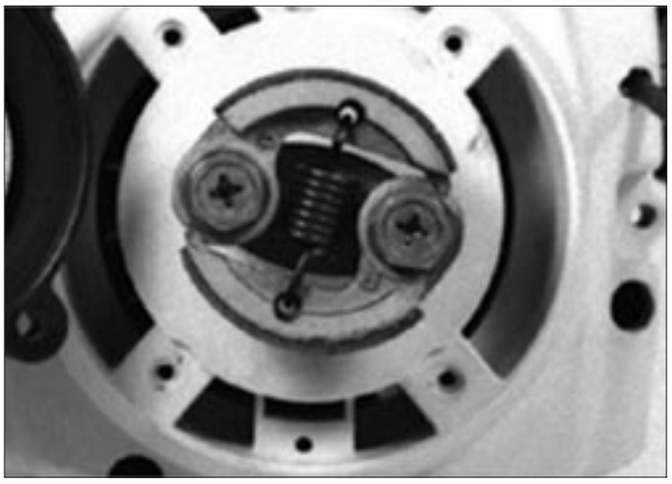
MAJOR COMPONENTS (cont.)



2.6071.050

4. Using the clutch tool for professional N28 engines, remove the clutch rotor.

5. Remove the spacer sleeve from crankshaft.



2.6078.088

Clutch Inspection

1. Check the clutch rotor, shoes, and spring for wear or damage. Replace if necessary.

2.6071.051

Remove Starter Housing

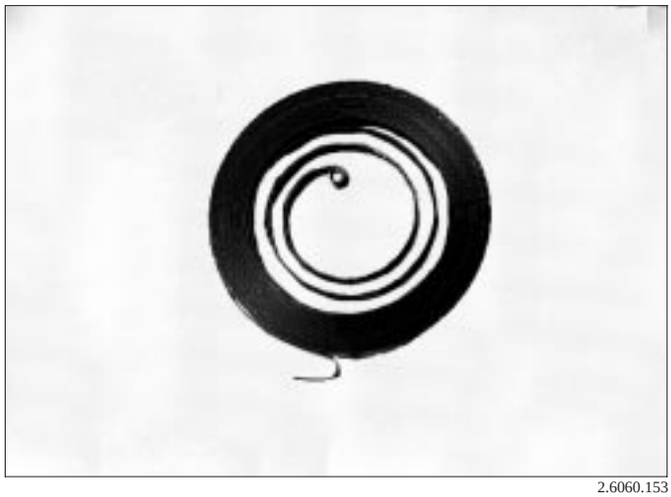
1. If necessary, disconnect the spark plug wire from spark plug and remove the spark plug.

2. Remove the screws securing the starter housing. Remove the starter housing.

MAJOR COMPONENTS (cont.)

Starter Disassembly, Repalr, and Reassembly

WARNING: Sprlng under tension!
The rope starter on these engines contains a flat wire spring that is under tension. Wear eye and hand protection when replacing worn or broken spring, in case it should uncoil as it is handled. Allow spring tension to be completely relieved and make sure pulley disengages from spring before removing the pulley retainer, pulley, and starter spring from housing.



2.6060.153

Adding Starter Spring Tension

If the rope pull handle does not fully return against the starter housing, the spring may need another turn of tension. Additional tension can be added without disassembling the starter.

To add spring tension:

1. Pull the rope out a short distance and hold the pulley from turning.

2.6071.052

2. Wind one or more extra turns of rope onto the pulley.

NOTE: If necessary, loosen the pulley retainer screw while holding the pulley down to provide clearance between the retainer and pulley. Torque the retainer screw to 20-30 in•lb (2.3-3.4 N•m) after additional rope is wound onto pulley.

2.6071.053

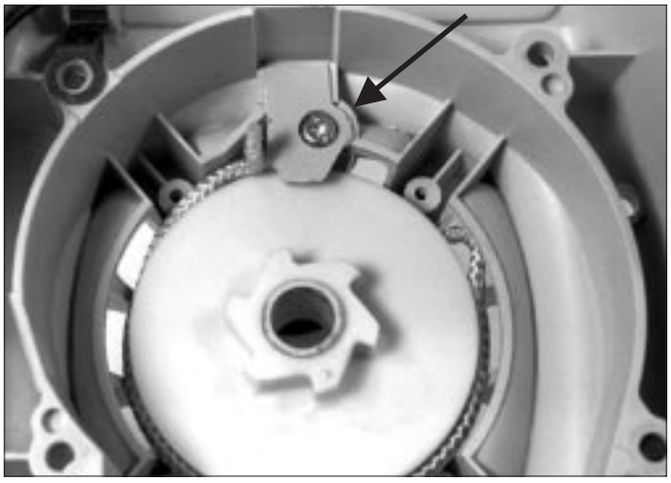
MAJOR COMPONENTS (cont.)

2.6078.089

3. Pull the rope out to its full length and let it return until the pull handle rests against the starter housing.

NOTE: Do not add any more tension than is necessary to make the pull handle return against the starter housing. Adding excessive spring tension can cause the spring to break.

If spring pressure is weak and adjustment will not enable the pull handle to return against the starter housing, replace the spring.



2.6071.053

Disassembly

1. Relieve the spring tension by removing the pull handle and allow the pulley to slowly unwind inside the starter housing. Make sure the spring tension is fully relieved before proceeding.

2. Remove screw and pulley retainer.

2.6071.054

3. Remove the starter pulley from the starter housing .

MAJOR COMPONENTS (cont.)

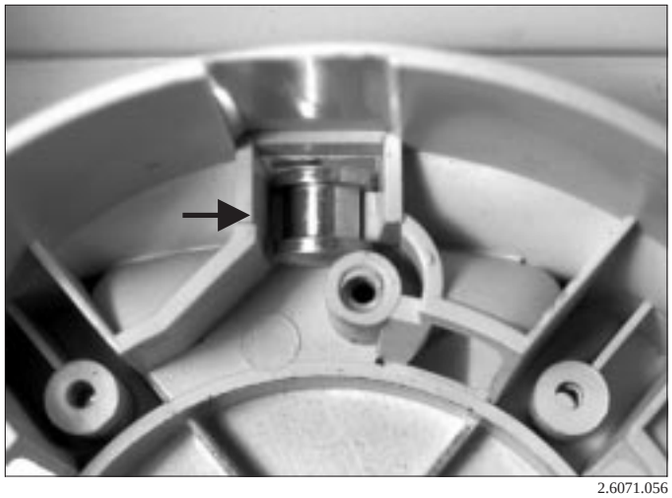
4. If necessary, carefully remove the starter spring from the starter housing using a needle-nose pliers.

NOTE: Once the starter spring is removed from the starter housing, a service replacement spring (prewound and contained in a spring retainer) should be used to reassemble the starter. Reinstallation of the old starter spring is not recommended.

2.6071.055

5. Remove the starter rope from the pulley.

6. Remove the rope guide bushing from the starter housing.



2.6071.056

Inspection and Service

1. Inspect the starter rope for wear or frays. Replace the rope if necessary.

2. Inspect the starter pulley for worn pawl engagement teeth. Also check for wear on the surface of pulley that is in contact with the starter spring.

3. Make sure old grease and dirt are cleaned from all starter components before reassembling.

2.6047.092

MAJOR COMPONENTS (cont.)

2.6071.057

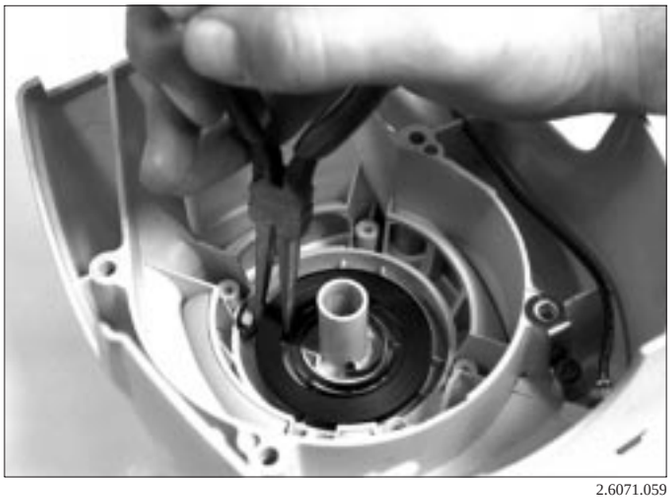
Reassembly

1. Install the starter spring into the starter housing as follows:

   a. Orient the replacement starter spring so the spring windings are clockwise (the open end of spring hook is to the left).

2.6071.058

   b. Grasp the spring near the spring hook with a needle-nose pliers and carefully remove the spring retainer.



2.6071.059

   c. Place the spring into the starter housing. Make sure the spring hook is installed over the post in the starter housing.

   d. Make sure the spring windings are laying flat against the starter housing around the entire circumference of the spring. Hold the spring in this position and carefully release the needle-nose pliers holding the spring.

MAJOR COMPONENTS (cont.)

2. Insert the rope through the hole in starter pulley. Tie a single knot in the rope approximately 0.5 in. (12.7 mm) from the end.

3. Pull the rope tight, pulling the knot into the pocket in the pulley. Using a screwdriver, or similar tool, push the end of the rope into the slot in the pulley.

2.6071.060

4. Hold the pulley with the pawl engagement teeth towards you. Wrap the rope around the pulley in the clockwise direction. Make sure all of the rope is wound onto the pulley.

5. Apply a small amount of grease (Mobilgrease® HP or equivalent) to the post in starter housing, spring, and backside of pulley.

6. Install the rope guide bushing into the starter housing.

2.6071.056

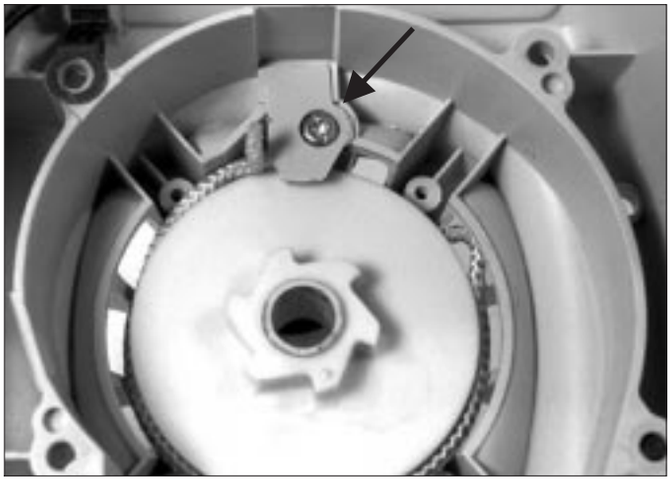
7. Install the pulley/rope assembly into the starter housing. Rotate the pulley slightly until the spring hooks onto the pulley, and the pulley drops into place.

8. Route rope through the guide bushing in the starter housing.

   Install the pull handle on the rope and secure it with a single knot.

2.6071.062

MAJOR COMPONENTS (cont.)

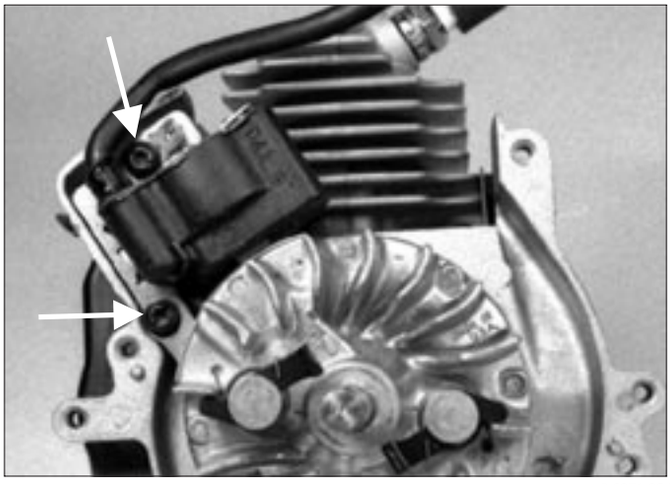


2.6071.053

9. Install the pulley retainer and screw. Torque the screws to 20-30 in•lb (2.3-3.4 N•m).

10. Pull the rope out to its full length and let it return. Check the spring tension and adjust as necessary. Refer to “Adding Starter Spring Tension” above.

ENGINE

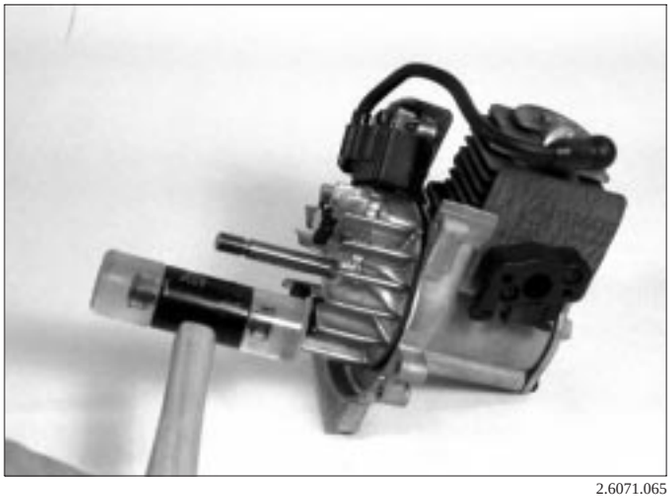


2.6071.064

Remove Ignition Module

1. Make sure the spark plug wire and the lead wires to the ignition module are disconnected.

2. Remove the screws securing the ignition module to the cylinder. Remove the ignition module.



2.6071.065

Remove Flywheel

WARNING: CRACKED OR BROKEN COOLING FINS ARE A HAZARD!

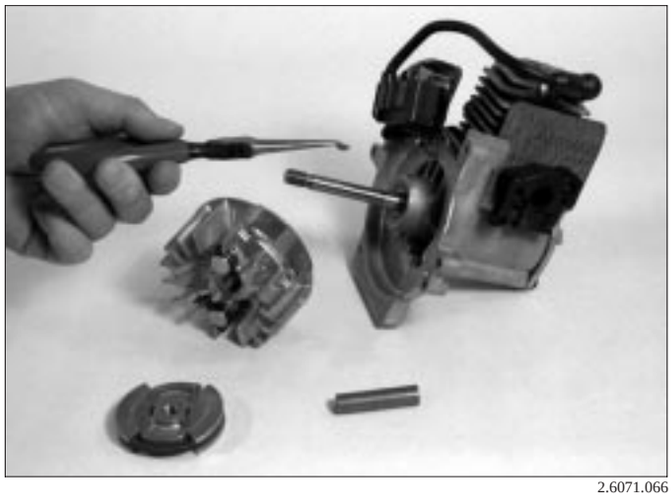
Be careful not to crack or break any cooling fins. They could fly off during operation. If cooling fins are cracked or broken, replace the flywheel.

1. Using a plastic-faced mallet, tap and pull flywheel until it breaks free from the crankshaft.

ENGINE (cont.)

2. Remove the flywheel from the crankshaft.

3. Remove the flywheel key from crankshaft.

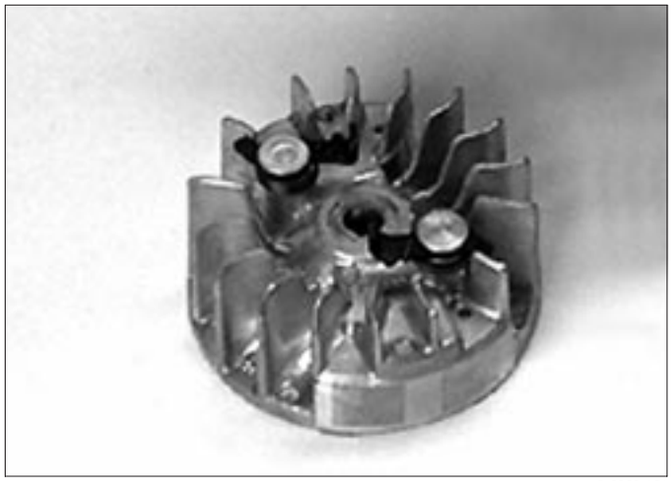


2.6071.066

Flywheel Inspection and Repair

Inspect the flywheel for the following conditions:

- Missing, broken, or cracked fins.
- Oval shaped pawl pin holes.
- Broken, damaged or missing springs, pawls, or pawl pins. Freedom of movement of pawls.
- Evidence that the Starter Pawl Repair Kit has been installed (holes in bottom of the flywheel below pawl pins).
- Other signs of fatigue, wear, or damage to the flywheel.

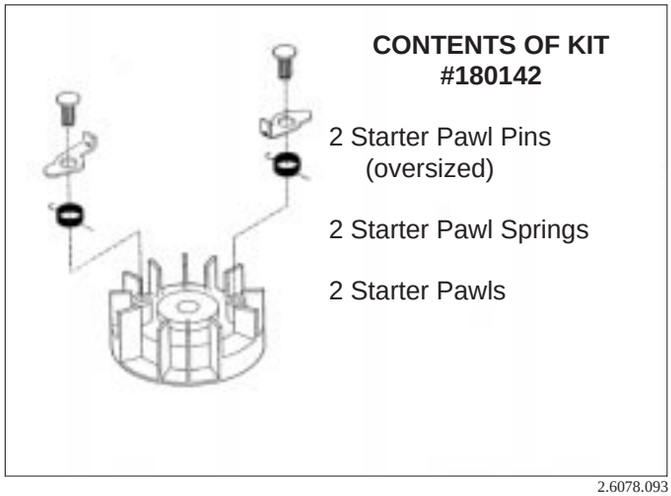


2.6060.161

Starter Pawl Repair Kit, P/N 180142, is available to repair the flywheel. This kit contains 2 pawl pins (oversized*), 2 pawl springs, and 2 pawls. To install the kit, an arbor press, 0.228 in (5.79 mm) drill and drill press are required. Installation instructions are provided in the kit.

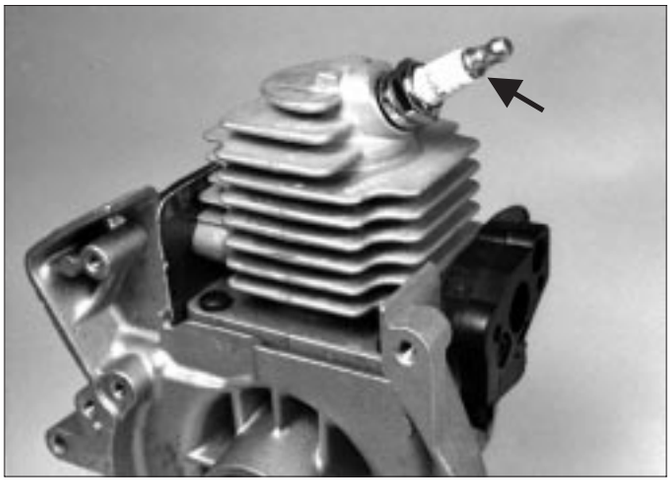
***NOTE:** The pawl pins in this kit are oversized. Once this kit is installed, the flywheel cannot be repaired a second time.

For all other damage, replace the flywheel.



2.6078.093

ENGINE (cont.)



2.6071.067

Remove Spark Plug, Cylinder, and Piston Connecting Rod Assembly

1. Remove the spark plug from cylinder.

   Service the spark plug as instructed in Part 1 - General Information.

2.6071.068

2. Remove the four (4) screws securing the crankcase cover to crankcase. Remove the crankcase cover and gasket.

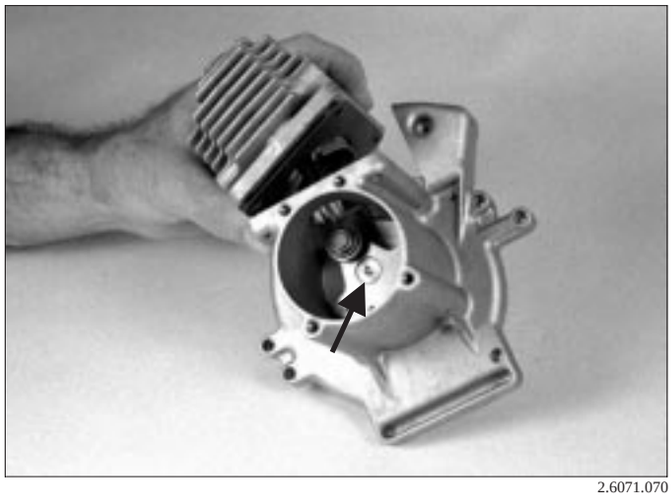
2.6071.069

3. Remove the four (4) cylinder mounting screws.

ENGINE (cont.)

4. Remove the connecting rod from crankshaft.

5. Remove the cylinder with piston/connecting rod assembly from the crankcase as a unit. Remove the cylinder gasket.



2.6071.070

6. Remove the piston/connecting rod assembly from the cylinder.

NOTE: Units with serial number 102084332 to 302010968 have one (1) piston ring. Units with serial number 302010969 and greater have two (2) piston rings.

2.6071.071

7. Remove the piston ring(s) from the piston.

NOTE: Do not disassemble the piston/connecting rod further.

2.6071.072

ENGINE (cont.)

2.6078.090

Cylinder and Piston Inspection

1. Inspect the cylinder, piston, and piston ring(s) for wear and damage. Refer to the specifications and tolerances in Part 1 - General Information. Replace the cylinder, piston, or piston ring(s) if necessary.

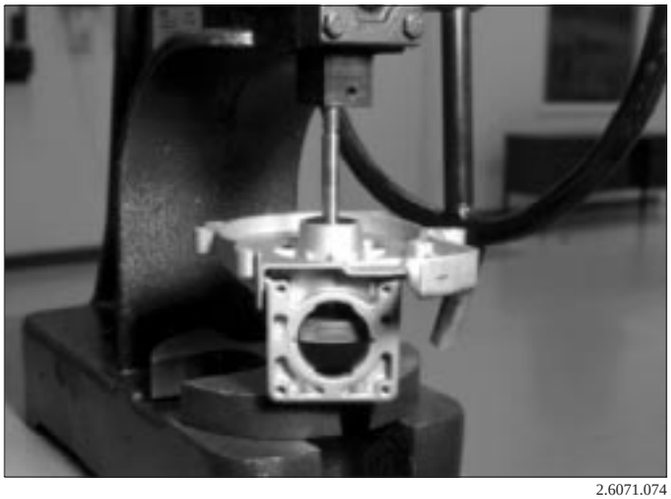
2.6071.073

2. Install the piston ring(s) into the ring groove(s) in piston, and check the side clearance of piston ring(s). The maximum side clearance is 0.004 inch (0.101 mm). Replace the ring(s) and piston if necessary.

NOTE: Units with one (1) piston ring have a piston ring width of 0.060 inch (1.6 mm) minimum.

Units with two (2) piston rings have a piston ring width of 0.047 inch (1.14 mm) minimum.

3. Inspect the ring groove(s) on piston for carbon deposits. Clean the ring groove(s) thoroughly.



2.6071.074

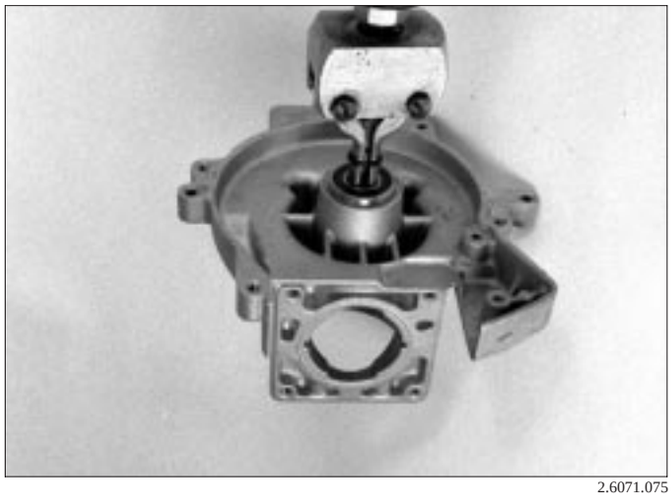
Crankshaft and Crankcase Disassembly

NOTE: Crankcase disassembly and reassembly requires the use of an arbor press and suitable drift punches and bearing supports. If these are not available, do not attempt to repair the crankcase assembly. Refer to the appropriate parts manual to order a complete crankcase/crankshaft assembly.

1. Using an arbor press, press the crankshaft and thrust washer out of the crankcase.

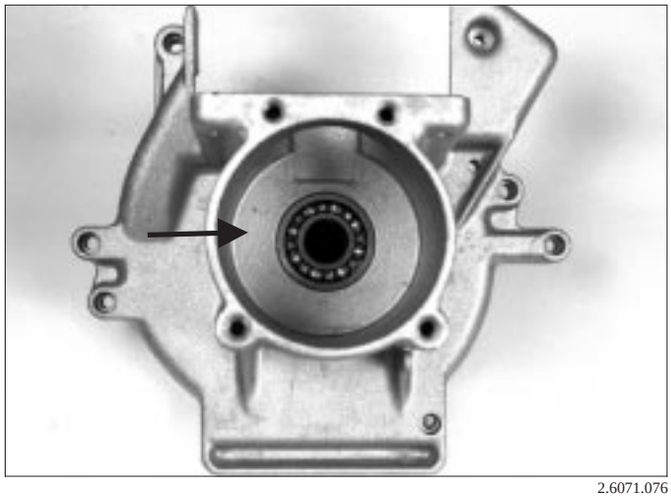
ENGINE (cont.)

2. Remove the outer (sealed) bearing from the flywheel side of the crankcase using a bearing puller.



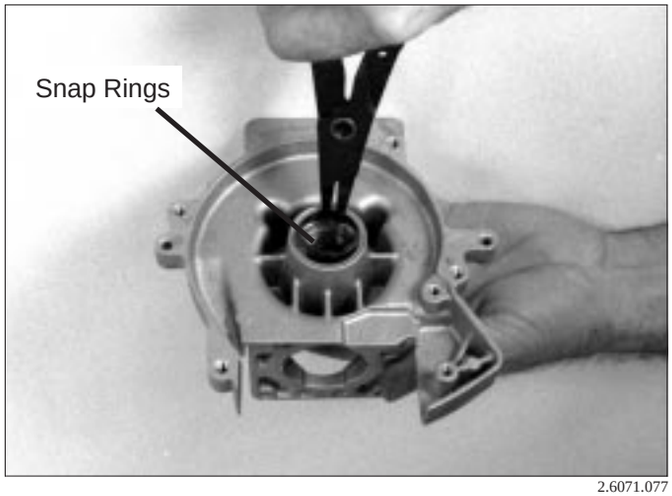
2.6071.075

3. Remove the inner (unsealed) bearing from the inside of the crankcase.



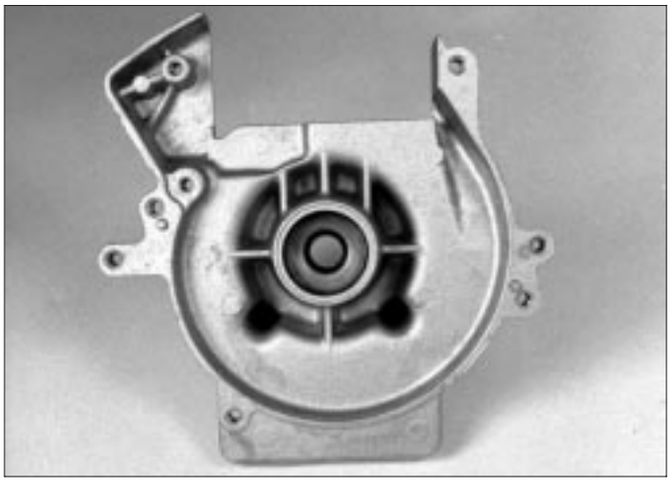
2.6071.076

4. Remove the snap rings securing the inner seal in crankcase.



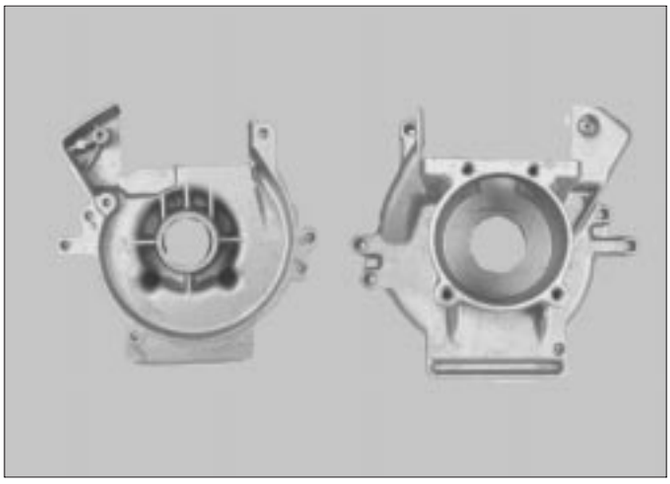
2.6071.077

ENGINE (cont.)



2.6071.078

5. Remove the inner seal from crankcase.

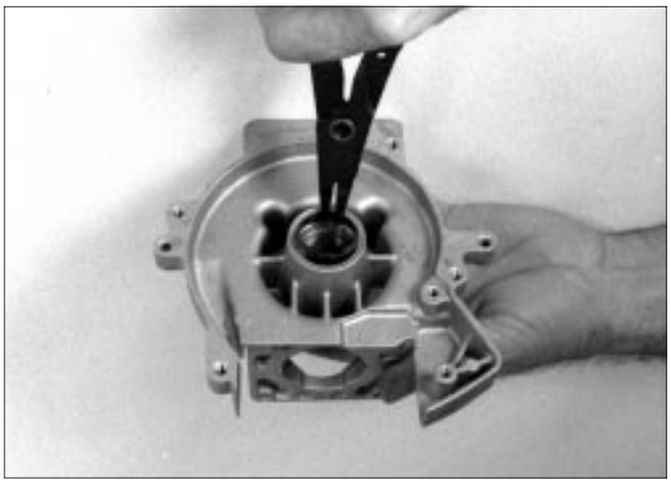


2.6071.076

Crankcase Inspection

1. Inspect the crankcase for nicks, cracks, and deformation. Replace if necessary.

2. Inspect the crankshaft for nicks, cracks, roundness, and deformation. Replace if necessary.



2.6071.077

Crankcase Reassembly

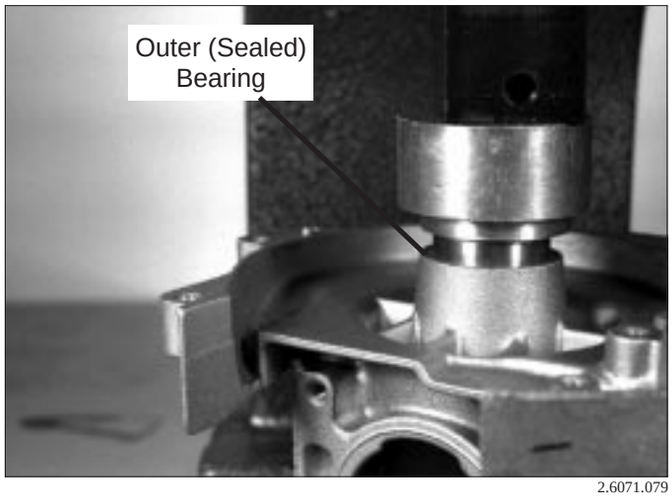
NOTE: To prevent bearing damage, make sure bearings are fully supported on both the inner and outer races during all pressing operations. Make sure the inner surface of crankcase and mating surfaces of bearings and seal are clean, dry, and free from grease and oil.

1. Install outer snap ring (nearest flywheel).

ENGINE (cont.)

2. Make sure the race of the outer (sealed) bearing is packed with grease. If necessary, apply a small amount of a high quality grade 2 lithium based (or equivalent) bearing grease to the bearing. Keep the grease off of the inner and outer bearing surfaces that mate against the crankcase and crankshaft.

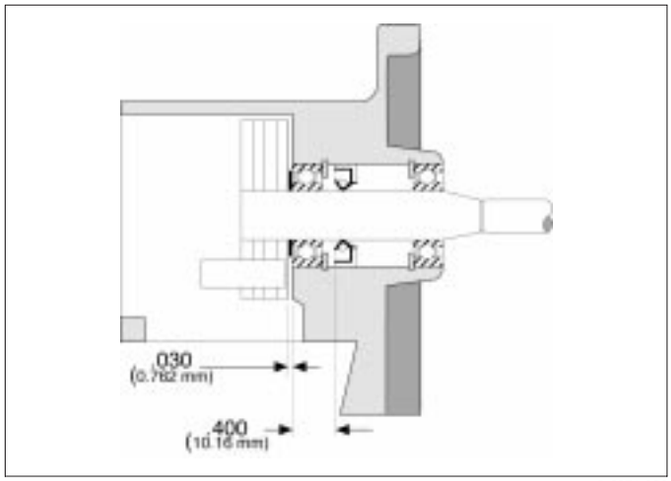
3. Press the outer (sealed) bearing into the crankcase until it is flush with the crankcase surface. Make sure the rubber seal is to the outside.



2.6071.079

4. Press the inner seal into the crankcase to a depth of 0.400 in. (10.2 mm). Make sure the lips of the inner seal face away from the outer bearing.

   Lightly lubricate the lips of the inner seal with 2-cycle engine oil.

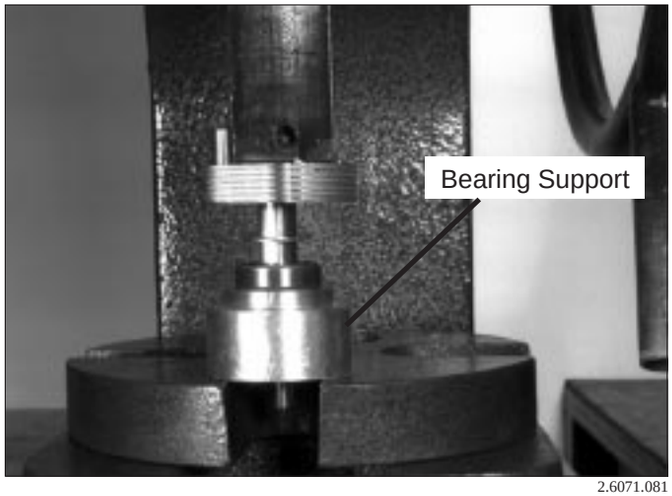


2.6071.080

5. Install the inner snap ring (nearest crank cheek).

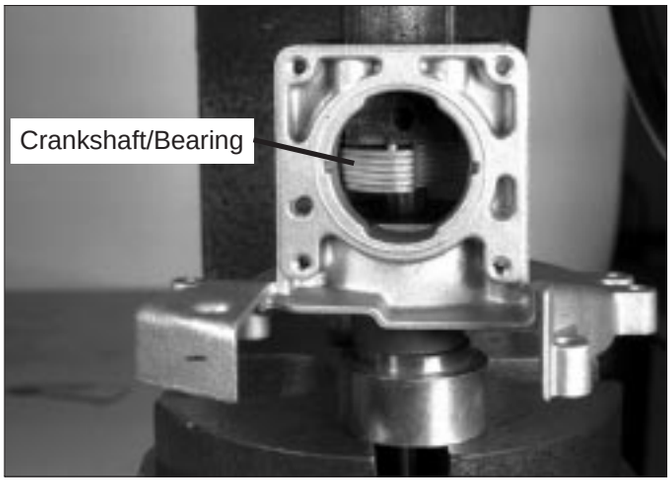
6. Install the thrust washer onto the crankshaft.

7. Press the inner (unsealed) bearing onto the crankshaft until it makes light contact with the thrust washer.



2.6071.081

ENGINE (cont.)



2.6071.082

8. Press the crankshaft/bearing assembly into the crankcase until the bearing is flush with the inner surface of the crankcase.

2.6071.083

9. Check the clearance between the inner surface of the crankcase and the crankshaft counterweight at several points.

   Recommended clearance is 0.030 in. (0.762 mm). Adjust the location of the crankshaft/bearing if necessary.

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Typical Disassembly Sequence

The following sequence is suggested for complete engine REASSEMBLY. This procedure assumes that all components are new or have been reconditioned and all component subassembly work has been completed. This procedure can be varied to accommodate individual requirements for assembly and repair.

NOTE: Make sure the engine is assembled using all specified torque values and clearances. Failure to observe specifications can cause severe engine wear or damage.

Always use new gaskets.

1. Install Piston/Connecting Rod
2. Install Cylinder to Crankcase
3. Install Spark Plug
4. Install Flew
5. Install Ignition Module
6. Install Starter Housing
7. Install Clutch
8. Install Muffler*
9. Install Carburetor Spacer*
10. Install Heat Shield, Fuel Tank, and Bracket
11. Install Rear Engine Cover
12. Install Carburetor and Choke; Connect Fuel Lines*
13. Install Air Filter*
14. Install Styling Cover
15. Install Engine
16. Prepare the Unit for Operation

* On some units, these can be removed and reinstalled without removing the engine from its normal operating installation.

ENGINE

Install Piston/Connecting Rod

For units with one (1) piston ring, use the following instructions

1. If necessary, install the piston ring onto the piston. Make sure the ring end gap is located over the anti-rotation pin in the piston ring groove.

2.6071.072

2. Lubricate the piston and piston ring with 2-cycle engine oil. Compress the piston ring and insert the piston into the cylinder.

2.6071.071

3. Position the piston ring anti-rotation pin/end gap so it faces away from the exhaust port of cylinder.

NOTE: With the exhaust port on the right and intake port on the left, the text on the piston rod should face towards you.

2.6078.095

ENGINE (cont.)

2.6078.096

For units with two (2) piston rings, use the following instructions.

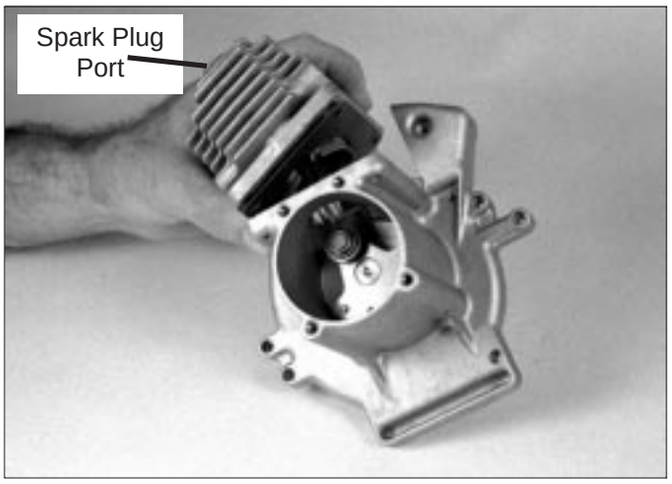
1. If necessary, install the piston rings onto the piston.

2. Make sure the ring end gaps are located over the anti-rotation in the piston ring grooves.

2.6071.071

3. Lubricate the piston and piston rings with 2-cycle engine oil. Compress the piston rings and insert the piston into the cylinder.

NOTE: With the exhaust port on the right and intake port on the left, the text on the piston rod should face towards you.



2.6071.070

Install Cylinder to Crankcase

1. Put a new cylinder gasket on the cylinder.

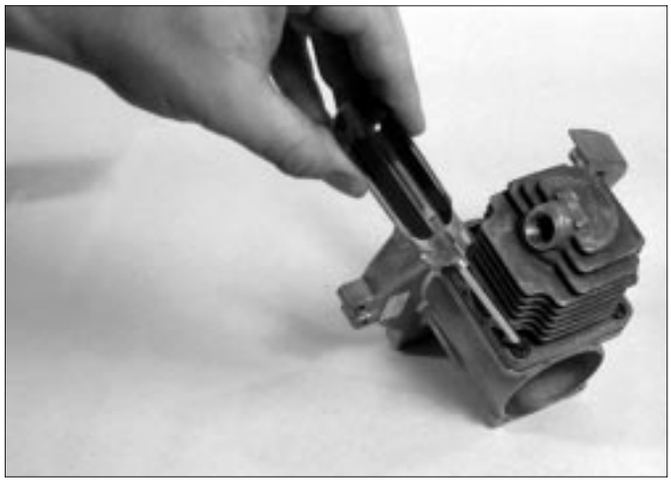
2. Position the cylinder so the spark plug port is on the left side of the cylinder.

3. Lubricate the pin on crankshaft counterweight with 2-cycle engine oil. Slip the connecting rod bearing over the pin.

ENGINE (cont.)

4. Secure the crankcase to the cylinder with four (4) screws.

   Torque the screws to 50-60 in•lb (5.6-6.8 N•m).



2.6071.069

5. Install a new crankcase cover gasket, the crankcase cover, and attaching screws.

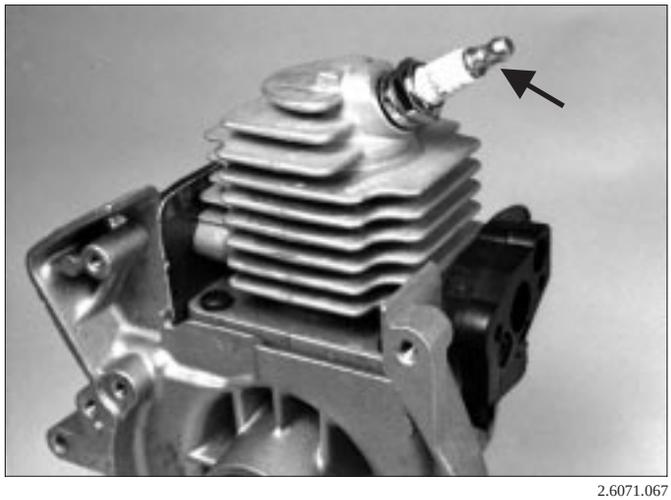
   Torque the screws to 55-65 in•lb (6.2-7.3 N•m).

2.6071.068

Install Spark Plug

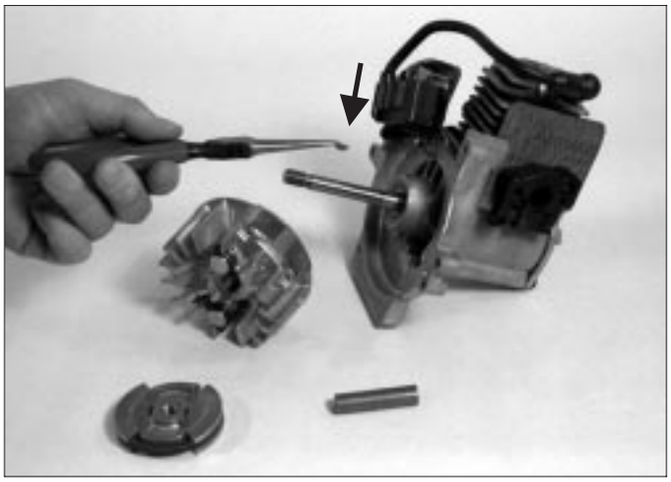
1. Make sure the spark plug gap is set to 0.018-0.023 inch (0.045 to 0.058 mm) using a wire feeler gauge.

2. Install the spark plug into cylinder and torque to 100-120 in•lb (11.2-13.5 N•m).



2.6071.067

MAJOR COMPONENTS



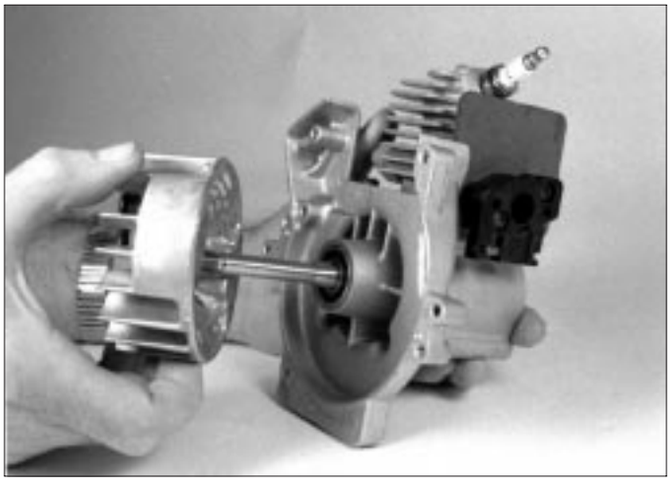
2.6071.066

Install Flywheel

WARNING: Cracked or Broken Cooling Fins Are A Hazard!

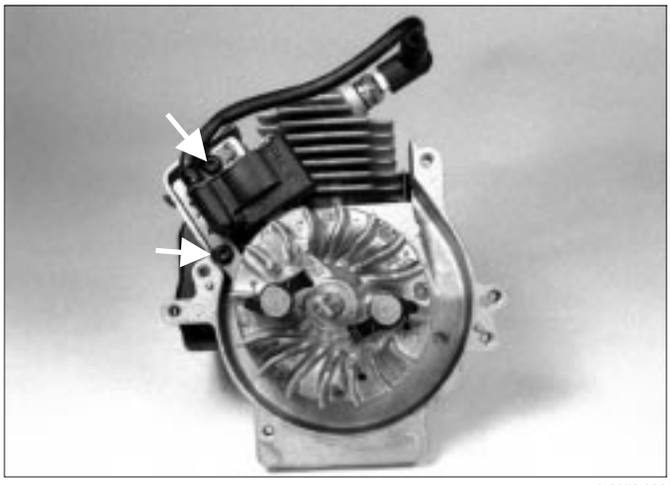
Be careful not to crank or break any cooling fins. They could fly off during operation. If cooling fins are cracked or broken, replace the flywheel.

1. Install the crankshaft key into the key way on crankshaft.



2.6078.097

2. Position the flywheel so that the key slot in the flywheel aligns with the crankshaft key. Place the flywheel onto the crankshaft.



2.6078.098

Install Ignition Module

1. Install the ignition module ground lead tab terminal and module fastening screws.

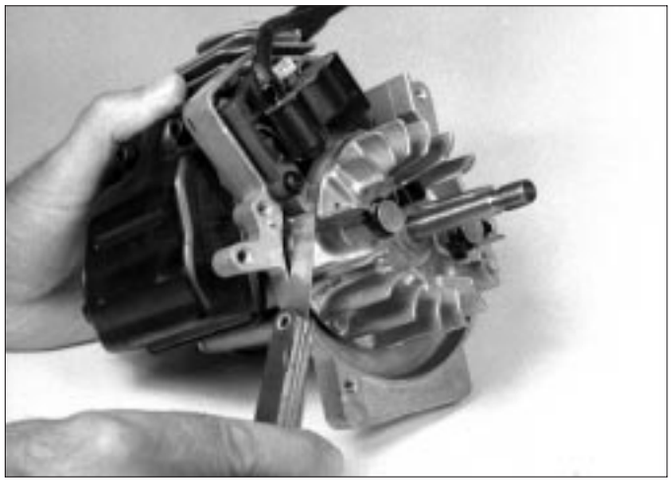
MAJOR COMPONENTS (cont.)

2. Move the ignition module away from the flywheel as far as possible. Tighten the fastening screws *slightly*.

3. Insert a 0.010-0.015 in (0.254-0.381 mm) feeler gauge or shim stock between the ignition module and flywheel magnet surfaces.

   NOTE: Brass or plastic feeler gauge or shim stock is more suitable for this application because of the magnetic forces.

4. Loosen the module fastening screws and push the ignition module tight against the feeler gauge or shim stock.



2.6078.099

Torque the screws to 28-35 in•lb (3.2-3.9 N•m). Remove the feeler gauge or shim stock.

5. Connect ignition switch lead wires as necessary.

2.6078.098

Install Starter Housing

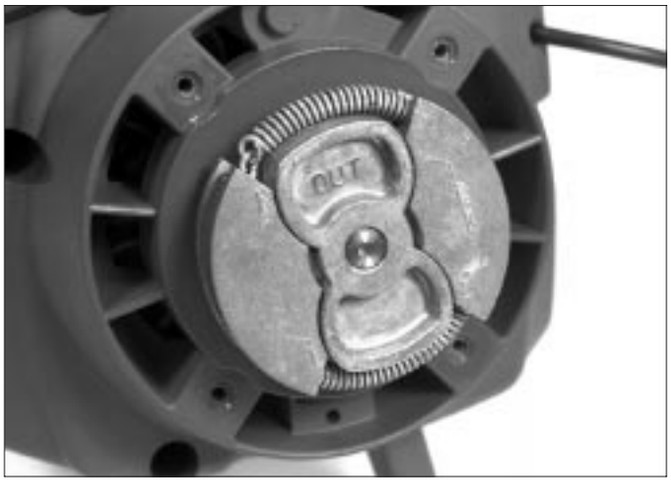
1. Install the starter housing and secure with two (2) screws.

   Torque the screws to 35-40 in•lb (3.9-4.5 N•m).

NOTE: It may be necessary to pull the starter rope slightly to enable the starter housing to drop into position.

2.6071.051

MAJOR COMPONENTS (cont.)



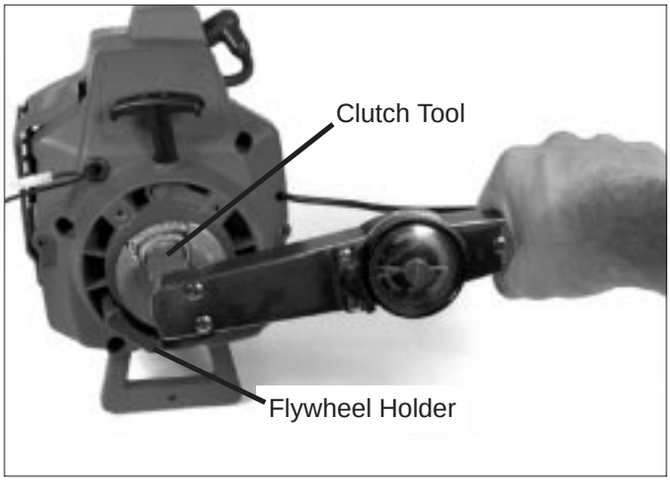
2.6078.100

Install Clutch

Standard N28 Engines

1. Install the spacer sleeve over the crankshaft.

2. Install the clutch rotor to the crankshaft. Make sure the side marked “OUT” is facing away from the starter housing.



2.6078.101

3. Install the flywheel holder, P/N 612470 or 180919.

   Using clutch tool, P/N 147337 or 180918, torque the clutch rotor to 150-160 in•lb (16.9-18 N•m).

4. Remove the flywheel holder.

2.6071.046

5. Position the raised boss inside the “snout” of the clutch cover towards the rope pull handle. Install the clutch cover/clutch drum to the starter housing and secure with four screws.

   Torque the screws to 35-40 in•lb (3.9-4.5 N•m).

MAJOR COMPONENTS (cont.)

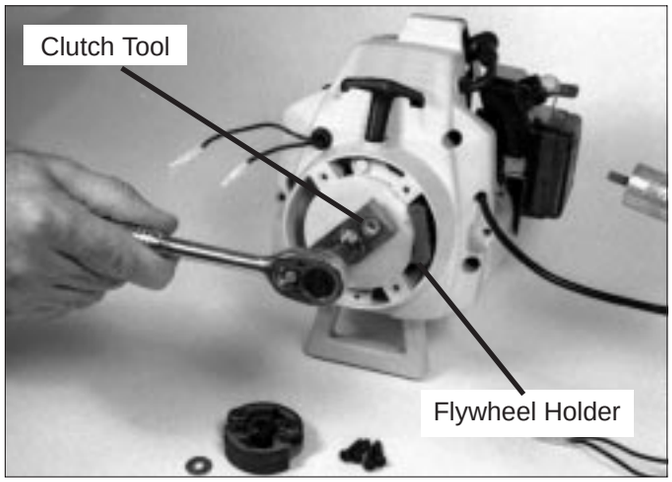
Professional N28 Engines

1. Install the spacer sleeve over the crankshaft.

2. Install the flywheel holder, P/N 612470.

3. Install the clutch rotor to crankshaft.

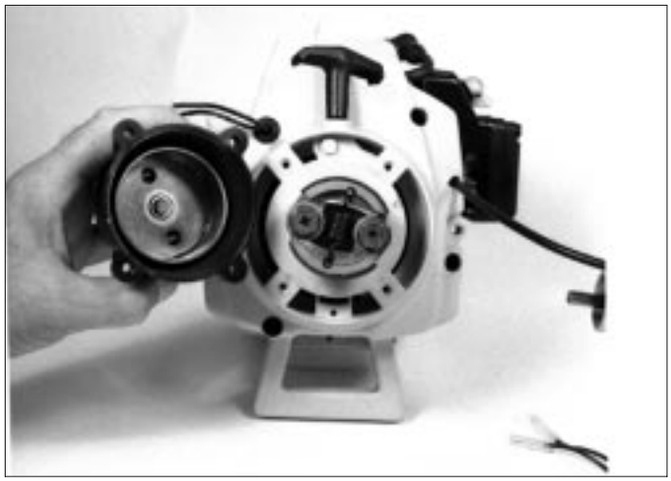
4. Using the TORO clutch tool for the professional N28 engine, torque the rotor to 130-150 in•lb (14.6-16.8 N•m).



2.6071.050

5. Install flat washer, clutch shoes, spring, and two (2) clutch shoe bolts.

   Torque the bolts to 60-80 in•lb (6.7-9 N•m).

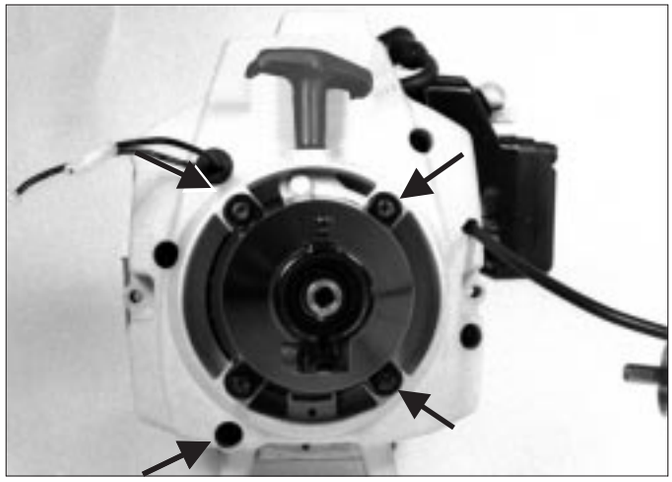


2.6078.102

6. Install the clutch housing/drum assembly and secure with four (4) screws.

   Torque the screws to 35-40 in•lb (3.9-4.5 N•m).

   NOTE: Make sure the anti-rotation screw is towards the top (rope pull handle) of the engine.



2.6071.048

MAJOR COMPONENTS (cont.)

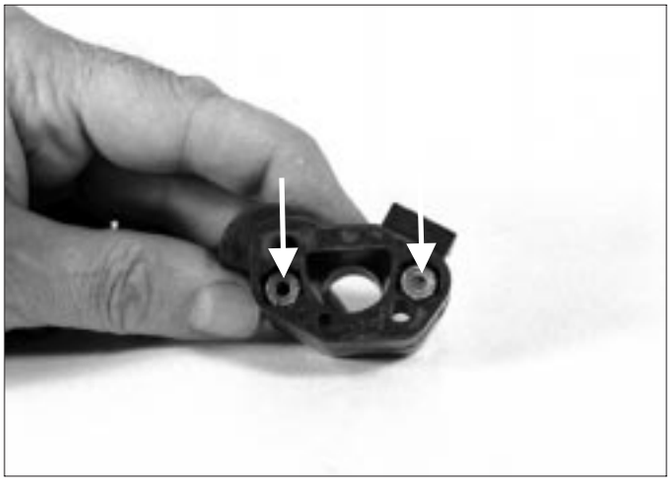
2.6078.042

Install Muffler

1. Install a new muffler gasket, muffler, and muffler mounting screws.

   Make sure the extended edge of the muffler-cylinder gasket is between the muffler body and crankcase.

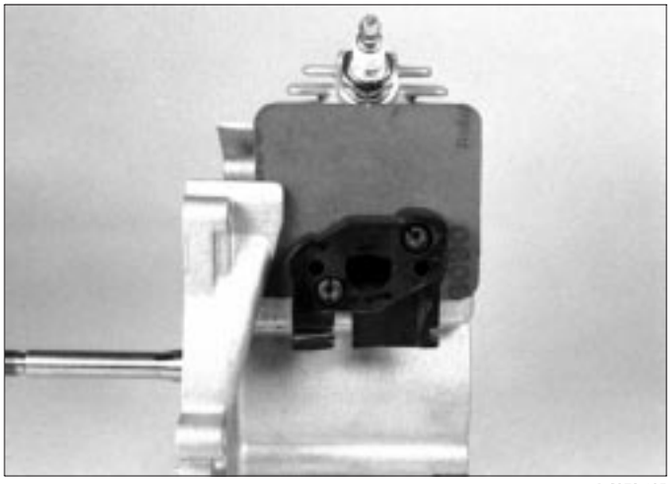
   Torque the muffler mounting screws to 80-90 in•lb (9.0-10.1 N•m).



2.6078.104

Install Carburetor Spacer

1. Insert the two (2) hex nuts into the pockets on the back of the carburetor spacer.



2.6078.105

2. Install the carburetor spacer gasket and the two attaching screws to the carburetor spacer. Install the carburetor spacer and gasket to the engine crankcase.

   Make sure the hex nuts do not fall out of the spacer during the installation of the carburetor spacer.

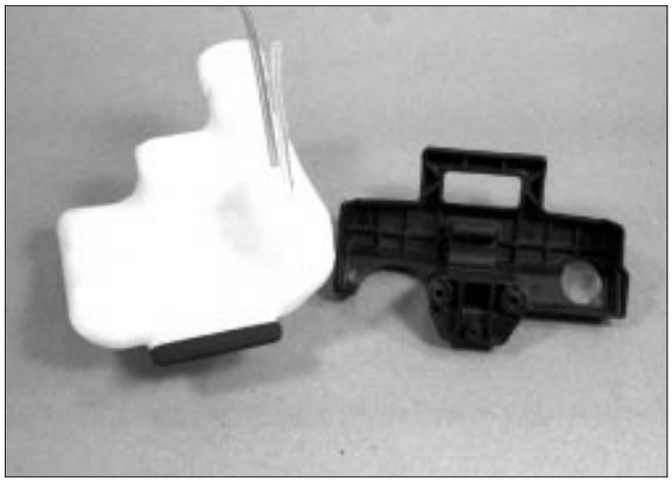
   Torque the screws to 60-65 in•lb (6.8-7.3 N•m).

MAJOR COMPONENTS (cont.)

Install Heat Shield, Fuel Tank, and Bracket

1. Install the rubber fuel tank mounting pads to the fuel tank (on front and rear of the tank).

2. Place the heat shield over the muffler and hook into the crankcase.



2.6078.106

3. Install the fuel tank, fuel tank bracket, and two (2) attaching screws.

   Torque the screws to 50-60 in•lb (5.6-6.7 N•m).

2.6078.107

Install Rear Engine Cover

1. Install rear engine cover with two (2) screws.

   Torque the upper screw (into starter housing) to 50-60 in•lb (5.6-6.7 N•m).

   Torque the lower screw (into crankcase) to 35-40 in•lb (3.9-4.5 N•m).

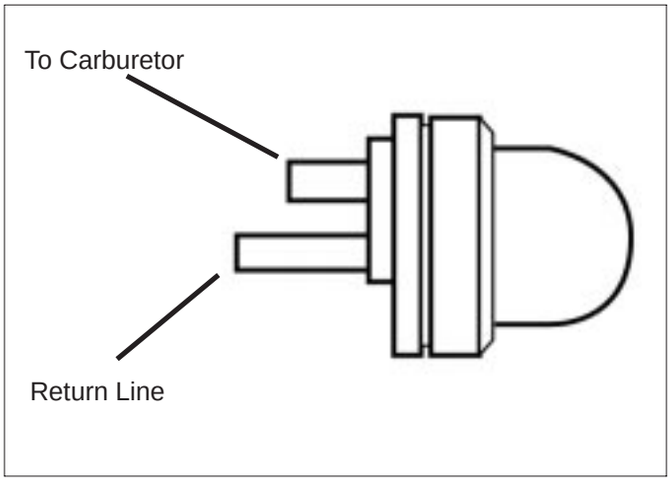
2.6071.039

MAJOR COMPONENTS (cont.)

2.6078.108

Install Primer Bulb

1. Install primer bulb into air filter base.



3.6078.110

Install Carburetor, Choke, and Connect Fuel Lines

Use the following procedures to install carburetor, fuel lines, and choke:

NOTE: This unit has two fuel lines to the fuel tank. The clear line provides normal fuel flow. The blue line provides a return line for excess fuel flow during the primer operation. The primer return line is connected to the longer fitting of the primer bulb.

1. Connect the fuel lines to the carburetor and primer bulb.

2.6078.109

2. Install the carburetor gasket, carburetor, air filter base, choke lever, wavy washers, flat washers, and carburetor mounting screws.

   Torque the screws to 23-27 in•lb (2.6-3.0 N•m).

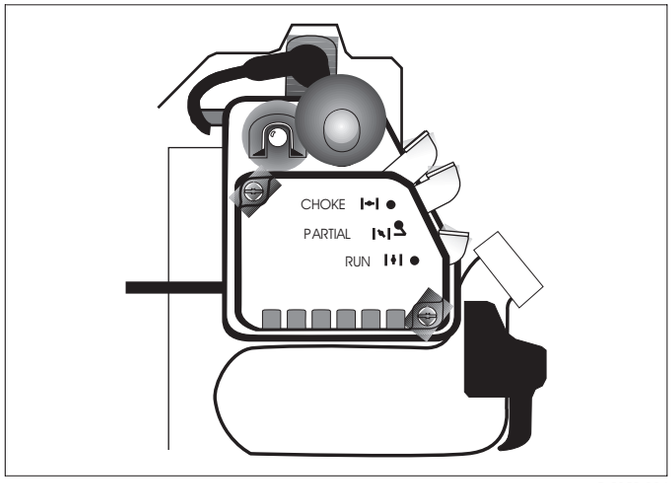
MAJOR COMPONENTS (cont.)

Install Air Filter

Make sure the air filter element is cleaned and oiled as instructed in Part 1 - General Information.

1. Install the air filter element into the air filter cover.
2. Install the air filter cover and attaching screws to air filter base.

   Torque the screws to 15-25 in•lb (1.7-2.8 N•m).



3.6069.004

Install Styling Cover

Units with professional N28 engines are equipped with an engine styling cover. To install the styling cover:

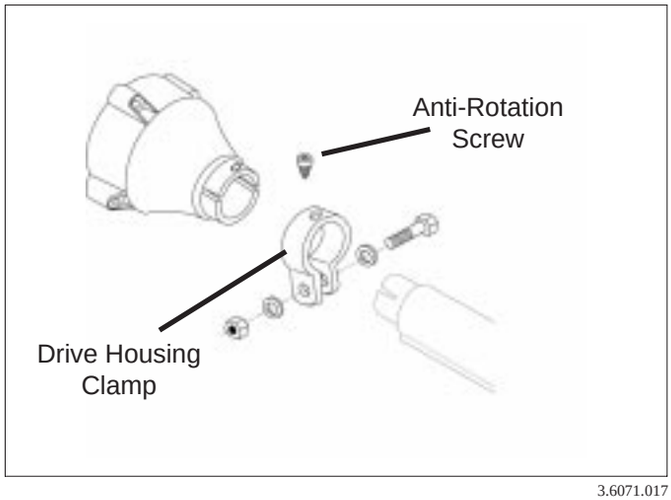
1. Install the styling cover and secure it with two screws.

2.6071.018

Install Engine

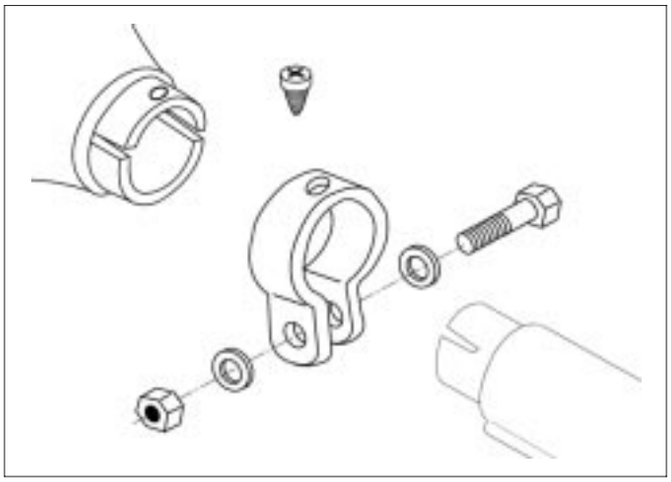
Standard N28 Engines

1. Slip the upper drive housing (boom) clamp assembly onto the clutch cover.
2. Install the engine onto the trimmer drive housing. Make sure the flex drive shaft mates with the square drive of engine. Make sure the slot in the flex drive housing aligns with the boss in the clutch cover.



3.6071.017

MAJOR COMPONENTS (cont.)

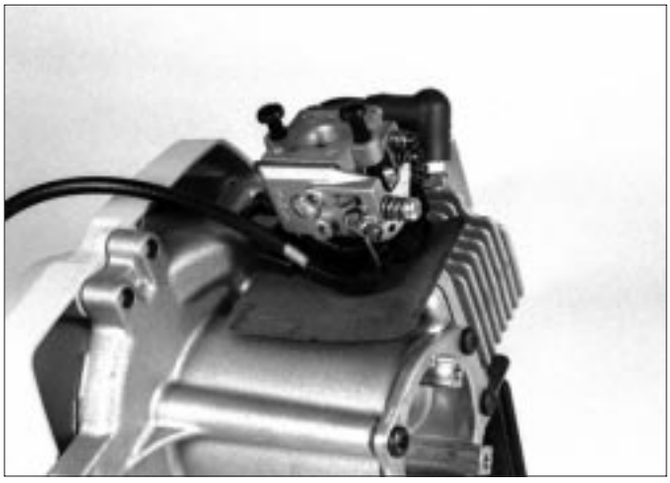


3.6078.111

3. Install the anti-rotation screw through clamp and into boom.

   Torque the anti-rotation screw to 15-20 in•lb (1.7-2.3 N•m).

   Torque the nut and bolt of clamp to 70-80 in•lb (7.9-9 N•m).



2.6071.015

4. For units with serial number 102084332 to 302010968, install the throttle control cable and insert it through the hole in the swivel on carburetor throttle lever. Torque the screw in the swivel to 9-12 in•lb (1.0-1.4 N•m).

2.6071.016

5. For units with serial number 302010968 and greater, insert the Z-bend end of the throttle control cable into the third hole from the end of the carburetor throttle lever.

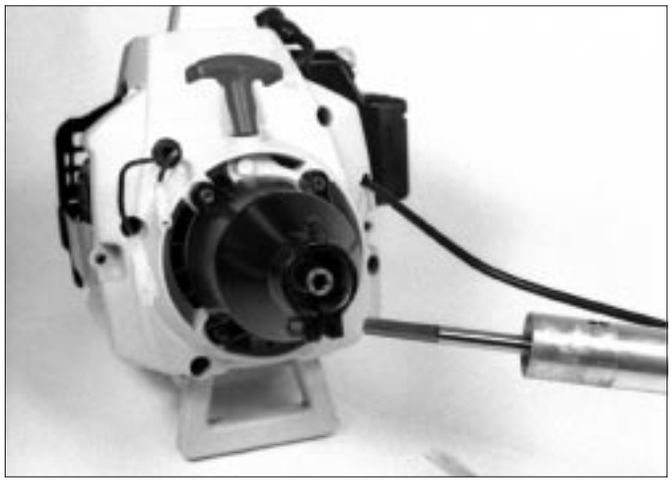
6. Adjust the throttle control cable in the lever for full range of throttle travel.

   Make sure the outer cover of the throttle cable seats in the back of the carburetor spacer.

MAJOR COMPONENTS (cont.)

Professional N 28 Engines

1. Install the engine onto the trimmer drive housing. Make sure the drive shaft mates with the square drive of the engine. Make sure the slot in the flex drive housing aligns with the boss in the clutch housing/drum assembly.

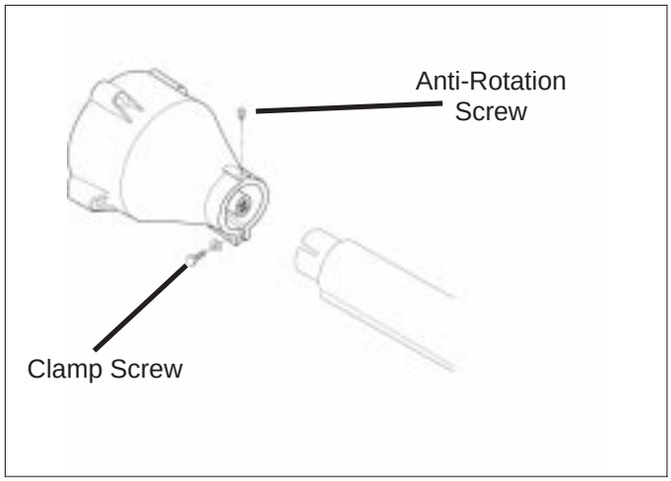


2.6078.112

2. Install the anti-rotation screw through the clutch housing/drum assembly and into the boom.

   Torque the anti-rotation screw to 15-20 in•lb (1.7-2.3 N•m).

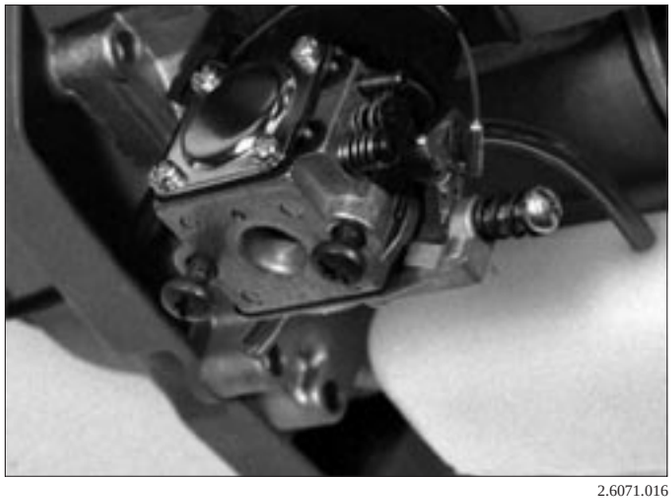
   Torque the clamp screw to 70-80 in•lb (7.0-9.0 N•m).



3.6071.016

3. Insert the Z-bend end of the throttle control cable into the third hole from the end of the carburetor throttle lever.
4. Install the throttle control cable in the swivel on carburetor throttle lever.

   Make sure the outer cover of the throttle cable seats in the back of the carburetor spacer.
5. Adjust the throttle control cable in the swivel for the full range of the throttle travel.
6. Connect lead wires to ignition switch.



2.6071.016

MAJOR COMPONENTS (cont.)

2.6071.015

Prepare The Unit For Operation

Before placing the unit back into service, be sure to do the following:

- Make Sure all fasteners are tightened securely.
- Fill the fuel tank with a fresh gasoline and 2-cycle oil mix. Refer to the “Fuel Recommendations” in Part 1 - General Information.
- Adjust the carburetor high speed mixture, idle mixture, and idle speed settings. Refer to “Carburetor Adjustment” in Part 1 - General Information.

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