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Commercial Power Repair Manuals:**

- 272147 - Vanguard Single Cylinder OHV Air-Cooled Engines
- 272144 - Vanguard Twin Cylinder OHV Air-Cooled Engines
- 275429 - Vanguard Twin Cylinder OHV Liquid-Cooled Engines
- MS-0750 - Vanguard 3-Cylinder OHV Liquid-Cooled Gasoline Engines
- MS-1055 - Vanguard 3-Cylinder OHV Liquid-Cooled Diesel Engines



COMMERCIAL POWER

Briggs & Stratton



COMMERCIAL POWER

**Vanguard™ Single Cylinder  
OHV Air-Cooled Engines**



Quality Starts With A  
Master Service Technician



Equipment & Engine  
Training Council



Part No. 272147-1/07

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VANGUARD™ SINGLE CYLINDER OHV AIR-COOLED ENGINES





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## **FORWARD**

This guide has been written and published by Briggs & Stratton Corporation to aid our dealers' mechanics and company service personnel when servicing the products described herein.

It is assumed that these personnel are familiar with the servicing procedures for these products, or like or similar products, manufactured by Briggs & Stratton Corporation. It is also assumed that they have been trained in the recommended servicing procedures for these products, which includes the use of mechanics hand tools and any special tools that might be required.

Proper service and repair is important to the safe, economical and reliable operation of all engines and engine driven systems. The troubleshooting, testing, service and repair procedures described in this guide are effective methods of performing such operations.

We could not possibly know of and advise the service trade of all conceivable procedures or methods by which a service might be performed, nor of every possible hazards and/or results of each procedure or method. We have not undertaken any such wide evaluation. Therefore, anyone who uses a procedure or method not described by the manufacturer must first satisfy himself that neither his safety, nor the safety of the product, will be endangered by the service or operating procedure selected.

All information, illustrations, and specifications contained in this guide are based on the latest production information available at the time of publication. However, Briggs & Stratton Corporation reserves the right to change, alter, or otherwise improve the product at any time without prior notice.

Some components or assemblies of the product described in this guide may not be considered repairable. Disassembly, repair and reassembly of such components may not be included in this guide.

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## SECTION 1 - SAFETY, MAINTENANCE AND ADJUSTMENTS

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## ENGINE SAFETY

### In The Interest Of Safety


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.

**WARNING**  



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

Failure to **FOLLOW** instructions could result in **DEATH, SERIOUS INJURY** (including paralysis) or property damage.

**WARNING**

**Briggs & Stratton does not approve or authorize the use of these engines on 3-wheel All Terrain Vehicles (ATV's), motorbikes, fun/recreational vehicles for use in competitive events. Use of these engines in such applications could result in property damage, serious injury (including paralysis), or even death.**

### The Safety Alert Symbol

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, **might result in minor or moderate injury**.



**CAUTION:** When this signal word is used without the alert symbol, it indicates a situation that could result in damage to the engine.



- Prior to work, read and understand the section(s) of this manual that pertain to the job. Follow all safety warnings.
- Wear suitable eye protection.
- When servicing engines or equipment, prevent accidental starting by removing the spark plug wire from the spark plug(s).
- Disconnect negative battery terminal if the application is equipped with an electric starting system.
- Periodically clean engine. Keep governor parts free of dirt, grass and other debris which can affect engine speed and cooling.
- Always use fresh gasoline. Stale fuel can cause gum deposits in the carburetor and cause leakage, flow restrictions or other failures.
- Check fuel lines and fittings frequently for cracks or leaks and replace if necessary.



HAZARD SYMBOLS AND MEANINGS		
		
Explosion	Fire	Shock
		
Goggles	Chemical Burns	Explosive Pressure
		
Kick Back	Hot Surface	Entanglement
		
Toxic Fumes	Read	Disconnect Spark Plug



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

 <b>WARNING</b>
 
<b>Gasoline and its vapors are extremely flammable and explosive.</b> <b>Fire or explosion can cause severe burns or death.</b>
<b>When adding fuel:</b> <ul style="list-style-type: none"> <li>• Turn engine <b>OFF</b> and let engine cool at least 2 minutes before filling or refilling.</li> <li>• Fill fuel tank outdoors or in a well-ventilated area.</li> <li>• Do not overfill fuel tank. Fill tank to approximately 1-1/2 inches below top of neck to allow for fuel expansion.</li> <li>• Keep gasoline away from sparks, open flames, pilot lights, heat and other ignition sources.</li> <li>• Check fuel lines, tank, cap and fittings frequently for cracks or leaks and replace if necessary.</li> </ul>
<b>When starting engine:</b> <ul style="list-style-type: none"> <li>• Make sure spark plug, muffler, fuel cap and air cleaner are in place.</li> <li>• Do not crank engine with spark plug removed.</li> <li>• If fuel spills, wait until it evaporates before starting engine.</li> <li>• If engine floods, set choke to <b>OPEN/RUN</b> position. Place throttle in <b>FAST</b> and crank until engine starts.</li> </ul>
<b>When operating equipment:</b> <ul style="list-style-type: none"> <li>• Do not tip engine or equipment at an angle which would cause fuel to spill.</li> <li>• Do not choke carburetor to stop engine.</li> </ul>
<b>When transporting equipment:</b> <ul style="list-style-type: none"> <li>• Transport with fuel tank empty or with fuel shut-off valve set to OFF.</li> </ul>
<b>When storing gasoline or equipment with fuel in tank:</b> <ul style="list-style-type: none"> <li>• 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.</li> </ul>

 <b>DANGER</b>

<p>Running engines produce heat. Temperature of muffler and surrounding areas can exceed 150°F (65°C). Severe burns can occur on contact.</p>
<ul style="list-style-type: none"> <li>• Allow muffler, engine cylinder fins and radiator to cool before touching.</li> <li>• Remove accumulated combustibles from muffler area and cylinder area.</li> <li>• Install and maintain in working order a spark arrestor before using equipment on forest-covered, brush-covered unimproved land. The state of California requires this (Section 4442 of the Public Resources Code). Other states may have similar laws. Federal laws apply on federal land.</li> </ul>

 <b>WARNING</b>

<p>Unintentional sparking can result in fire or electric shock. Unintentional start-up can result in entanglement, traumatic amputation or severe lacerations.</p>
<p><b>Before performing adjustments or repairs:</b></p> <ul style="list-style-type: none"> <li>• Disconnect spark plug wire and keep it away from spark plug.</li> <li>• Disconnect negative (-) battery terminal.</li> </ul> <p><b>When testing for spark:</b></p> <ul style="list-style-type: none"> <li>• Use approved spark plug tester.</li> <li>• Do not check for spark with spark plug removed.</li> </ul>

 <b>DANGER</b>

<p>Engines give off carbon monoxide, an odorless, colorless, poison gas. Breathing carbon monoxide can cause nausea, fainting or death.</p> <ul style="list-style-type: none"> <li>• Start and run engine outdoors.</li> <li>• Do not start or run engine in an enclosed area, even if doors and windows are open.</li> </ul>

 <b>DANGER</b>

<p>Starting engine creates sparking. Sparking can ignite nearby flammable gases. Explosion and fire could result.</p> <ul style="list-style-type: none"> <li>• If there is a natural or LP gas leakage in the area, do not start engine.</li> <li>• Do not use pressurized starting fluids because vapors are flammable.</li> </ul>

 <b>DANGER</b>

<p>Rotating parts can contact or entangle hands, feet, hair, clothing or accessories. Traumatic amputation or severe lacerations can result.</p> <ul style="list-style-type: none"> <li>• Operate equipment with guards in place.</li> <li>• Keep hands and feet away from rotating parts.</li> <li>• Tie up long hair and remove jewelry.</li> <li>• Do not wear loose-fitting clothing, dangling drawstrings or items that could become entangled in the equipment.</li> </ul>





### WARNING



Charging batteries produces hydrogen gas. Do not store or charge a battery near an open flame or devices that utilize a pilot light or can create a spark.



### WARNING



Kerosene and its vapors are extremely flammable and should be handled with the same precautions as gasoline.



### DANGER



**Broken bones, fractures, bruises or sprains could result.**

- 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



**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.

## BRIGGS & STRATTON NUMERICAL IDENTIFICATION SYSTEM

This chart explains the unique Briggs & Stratton numerical designation system. It is possible to determine most of the important mechanical features of the engine by merely knowing the model number. Here is how it works.

- A** The first one or two digits indicate the approximate cubic inch displacement.
- B** The first digit after the displacement indicates the basic design series, relating to cylinder construction, ignition and general configuration, etc.
- C** The second digit after the displacement indicates crankshaft orientation.
- D** The third digit after the displacement indicates the type of bearings and whether or not the engine is equipped with reduction gearing or auxiliary drive.
- E** The last digit indicates the type of starter.

### BRIGGS & STRATTON MODEL NUMBERING SYSTEM

<b>A</b> Cubic Inch Displacement	<b>B</b> First Digit After Displacement Basic Design Series	<b>C</b> Second Digit After Displacement Crankshaft Orientation	<b>D</b> Third Digit After Displacement PTO, Bearing, Reduction Gearing, Auxiliary Drive, Lubrication	<b>E</b> Fourth Digit After Displacement Type Of Starter
2	0	0 to 4 - Horizontal Shaft	0 - Plain Bearing/Tilt, No-Flange Mount.	0 - No Starter
5	1	5 to 8 - Vertical Shaft	1 - Plain Bearing, Flange Mounting	1 - Rope Starter
6	2	A to G - Horizontal Shaft	2 - Roller Bearing, Flange Mounting, Splash Lube	2 - Rewind Starter
8	3	H to Z - Vertical Shaft	3 - Ball Bearing, Flange Mounting, Splash Lube	3 - Electric Starter Only 110 or 220V Gear Drive
9	4		4 - Ball Bearing, Flange Mounting, Pressure Lube	4 - Electric Starter 110 or 220V Gear Drive with Alternator
10	5		5 - Plain Bearing, Gear Reduction (6 to 1) CW Rotation, Flange Mounting	5 - Electric Starter Only 12 or 24V Gear Drive
12	6		6 - Ball Bearing, Gear Reduction (2 to 1) CW Rotation	6 - Alternator Only
13	7		7 - Plain Bearing, Pressure Lube	7 - Electric Starter 12 or 24V Gear Drive with Alternator
14	8		8 - Plain Bearing, Auxiliary Drive (PTO), Perpendicular to Crank	8 - Vertical Pull Starter or Side Pull Starter
16	9		9 - Plain Bearing, Auxiliary Drive, Parallel to Crank	9 - Mechanical Starter
18	A to Z		A - Plain Bearing, Pressure Lube, No Oil Filter	A - Electric Starter 12 or 24V Gear Drive with Alternator and Inverter
20				
21				
22				
23				
24				
25				
26				
28				
29				
30				
31				
32				
35				
36				
40				
45				
46				
52				
54				
56				
61				

EXAMPLE - To identify Model #33447:

<b>33</b> 33 Cubic Inch	<b>3</b> Design Series 3	<b>4</b> Horizontal Shaft	<b>4</b> Ball Bearing, Flange Mounting, Pressure Lube	<b>7</b> Electric Starter 12 or 24V Gear Drive with Alternator
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**TYPE 1234-01** The type number identifies the engine mechanical parts, color, details, governed speed and OEM.

**CODE 01061201** The code is the manufacturing date and is read as follows:

<b>YEAR</b>	<b>MONTH</b>	<b>DAY</b>	<b>Assembly Line And Manufacturing Plant</b>
01	06	12	

# ENGINE MAINTENANCE

## Fuel and Oil Recommendations

### Fuel

Fuel must meet these requirements:

- Use clean, fresh unleaded gasoline.
- A minimum of 87 octane / 87 AKI (91 RON). For high altitude use, see “High Altitude” below.
- Gasoline with up to 10% ethanol (gasohol) or up to 15% MTBE (Methyl Tertiary Butyl Ether) is acceptable.

**CAUTION:** Do not use unapproved gasoline such as E85. Do not mix 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 gasoline see “Storage” below. All fuel is not the same.

**If starting or performance problems occur:**

- Change fuel providers or change brands.

### High Altitude

At altitudes over 5000 feet (1524 meters), a minimum of 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.

At altitudes below 2500 feet (762 meters), high altitude adjustment is **not** recommended.

### Storage

Fuel can become stale when stored over 30 days. Stale fuel causes acid and gum deposits to form in the fuel system and/or on essential carburetor parts. To keep fuel fresh, use Briggs & Stratton FRESH START™ (#5041) fuel stabilizer, available as a liquid additive or a drip concentrate cartridge.

There is no need to drain gasoline from the engine before storage if fuel stabilizer is added according to instructions. Run the engine for two

minutes to circulate the stabilizer throughout the system. The engine and fuel can then be stored for up to 24 months.

If gasoline has not been treated with a fuel stabilizer prior to storage, it must be drained from the engine into an approved container. Run the engine until it stops from lack of fuel. The use of a fuel stabilizer in the storage container is recommended to maintain freshness.

**CAUTION:** Some fuel, called “oxygenated” or “reformulated” gasoline, is gasoline blended with alcohol or ether. Excessive amounts of these blends can damage the fuel system or cause performance problems. If any undesirable operating symptoms occur, use gasoline with a lower percentage of alcohol or ether.

### Oil

Oil has four purposes:

- It cools
- It cleans
- It seals
- It lubricates

During normal operation, small particles of metal from the cylinder walls, pistons, bearings as well as normal combustion deposits will gradually contaminate the oil. Dust particles from the air also contaminate the oil. This forms an abrasive mixture that can cause wear to the internal parts of the engine if the oil is not changed regularly. Fresh oil also assists in cooling. Old oil gradually becomes thick and loses its cooling ability as well as its lubricating qualities.

Use a high quality detergent oil classified “For Service SF, SG, SH, SJ” or higher. Use synthetic oil such as Briggs & Stratton (#100074) or equivalent. If synthetic oil is not available, Briggs & Stratton non-synthetic 30 weight oil (#100005 or #100028) is an acceptable substitute. Do not use special additives with recommended oils.

Do not mix oil with gasoline.

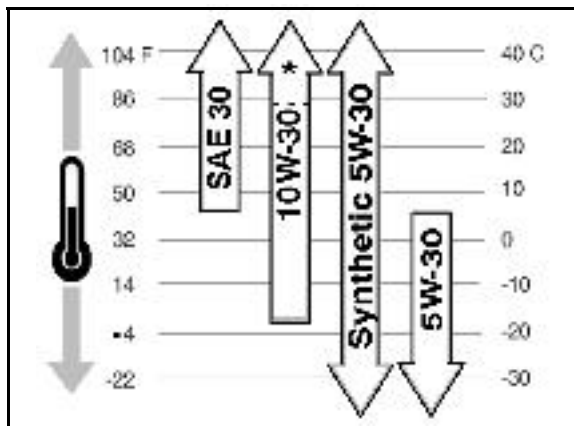


Fig. 1

**CAUTION:** The use of non-synthetic multi-viscosity oils (5W-30, 10W-30, etc.) in temperatures above 40°F (4°C) will result in higher than normal oil consumption. When using a multi-viscosity oil, check oil level more frequently. SAE 30 oil, if used below 40°F (4°C), will result in hard starting and possible engine bore damage due to inadequate lubrication.

**NOTE:** The use of synthetic oils does not alter the oil change intervals.

## Changing Oil

Change oil and filter (if equipped) after the first 5-8 hours. Thereafter, change oil every 100 hours of operation.

Change oil more often if engine is operated in dirty or dusty conditions or if engine is operated under heavy loads and/or in high ambient air temperatures.

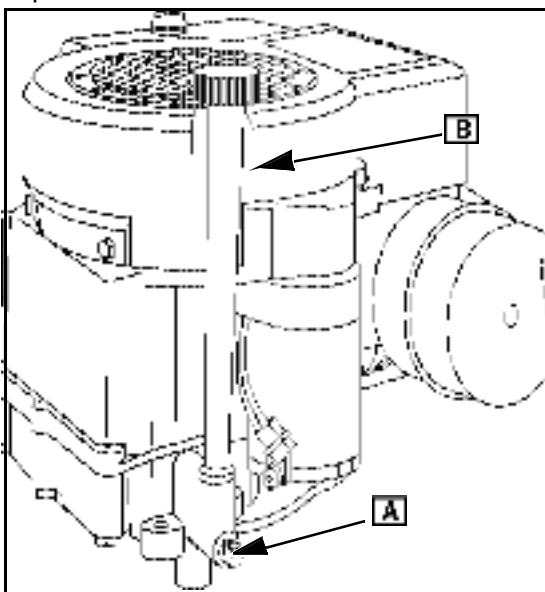


Fig. 2

1. Park equipment so engine is level.
2. Remove oil drain plug ([A] Fig. 2).
  - Drain oil while engine is still warm.
3. Install drain plug. Torque to value listed.

### SEE SECTION 14- ENGINE SPECIFICATIONS.

4. Remove oil filter ([C] Fig. 3), if equipped.
  - Clean surface of filter mounting adaptor ([D] Fig. 3).
  - Apply light coat of clean engine oil to new filter gasket.

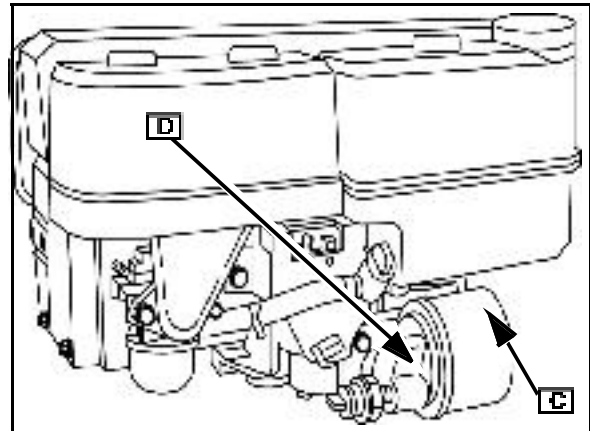


Fig. 3

5. Screw filter on by hand until gasket contacts oil filter mounting adaptor. Then tighten an additional  $\frac{1}{2}$  to  $\frac{3}{4}$  turn.
6. Clean area around oil fill cap and tube ([B] Fig. 2).
7. Fill with the correct amount of new oil.

### SEE SECTION 14- ENGINE SPECIFICATIONS.

Start engine and run at idle for a minute or so.

8. Shut engine off and wait for oil to settle back into the cylinder.
9. Check dipstick. If necessary, add more oil slowly to bring oil level to **FULL** mark ([A] Fig. 4) on dipstick.

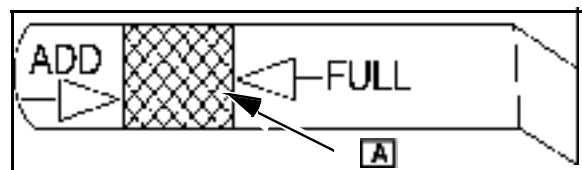


Fig. 4

**CAUTION:** Do not overfill. Overfilling can cause seals to fail or overheating due to oil foaming.

10. Replace oil fill cap and dipstick.
11. Start and run engine. Check for oil leaks.

## MAINTENANCE SCHEDULE


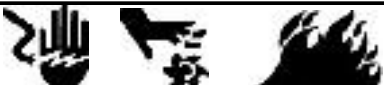
1

Periodic Maintenance Actions	8 Hrs.	25 Hrs.	50 Hrs.	100 Hrs.	250 Hrs.
Check Oil Level	X				
Change Oil	X*			X**	
Change Oil Filter				X**	
Change Gear Reduction Oil				X	
Replace Air Filter Pre-Cleaner		X***			
Replace Air Filter Cartridge w/o Pre-Cleaner		X***			
Replace Air Filter Cartridge w/ Pre-Cleaner				X***	
Inspect/Replace Spark Arrestor			X		
Replace Spark Plug				X	
Replace In-Line Fuel Filter				X	
Check/Adjust Valve Clearance					X
Clean Controls / Rewind / Screen / Muffler	X				

\* Initial Break-In

\*\* Change oil every 50 hours when operating under heavy load or high ambient temperatures.

\*\*\* Clean or replace more often under dusty conditions or when airborne debris is present.

 <b>WARNING</b>

<p>Unintentional sparking can result in fire or electric shock.            Unintentional start-up can result in entanglement, traumatic amputation or severe lacerations.</p>
<p><b>Before performing adjustments or repairs:</b></p> <ul style="list-style-type: none"> <li>• Disconnect spark plug(s).</li> <li>• Disconnect negative (-) battery cable.</li> <li>• Use only the correct tools.</li> </ul>



## Air Cleaner Service

**CAUTION:** Never operate an engine with the air cleaner assembly or air cleaner cartridge removed.

A correctly serviced air cleaner protects internal engine parts from airborne dirt and dust particles. If air cleaner instructions are not followed, particles that should be collected in the air cleaner will pass into the engine. These particles are abrasive and will cause the piston rings and cylinder bore to wear more quickly. As the rings and bore wear, the particles enter the cylinder and contaminate the oil. This forms an abrasive mixture that will erode and damage internal engine components.

Prevent dirt and dust from entering the engine through improper sealing.

- Replace worn or damaged air cleaner gaskets and seals.
- Replace air cleaner mounting brackets if bent or damaged.

## Cleaning and Replacing Air Filters

Refer to Figures 5-10 that show the air cleaner for your engine.

1. Loosen screws or knobs (A) holding air cleaner cover in place and remove cover (B).
2. Carefully clean debris from the base and cover, then remove air filter element retaining nut (C) (if equipped).
3. Lift off filter element (D) with the pre-cleaner (E) (if so equipped).
4. Wash pre-cleaner in warm soapy water.
5. Rinse and dry thoroughly.
6. Saturate pre-cleaner in fresh clean engine oil and squeeze out excess. (Do not oil pre-cleaners labeled DO NOT OIL.) Replace pre-cleaner if no longer serviceable.
7. Gently tap filter element on a solid surface to dislodge debris. Replace filter element if very dirty or damaged.
8. Reinstall pre-cleaner, element, retaining nut(s), cover and screws.

## Remove Air Cleaner Assembly

1. Follow steps 1 through 3 listed previously.
2. Remove screws and nuts holding air cleaner base (F) to carburetor and/or control bracket.
3. Pull air cleaner base away from carburetor.
4. Disconnect breather tube (G) from air cleaner base or rocker cover.

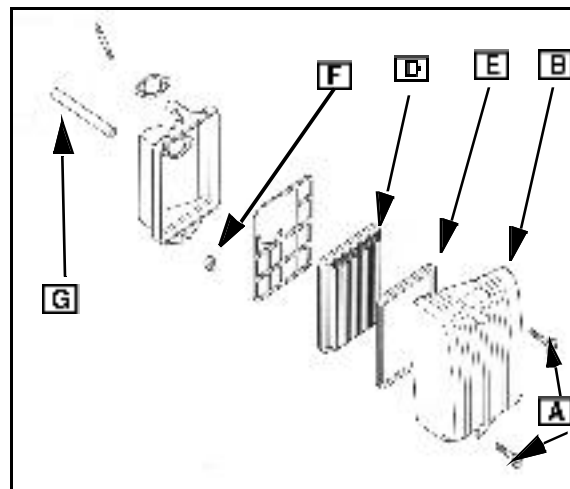


Fig. 5

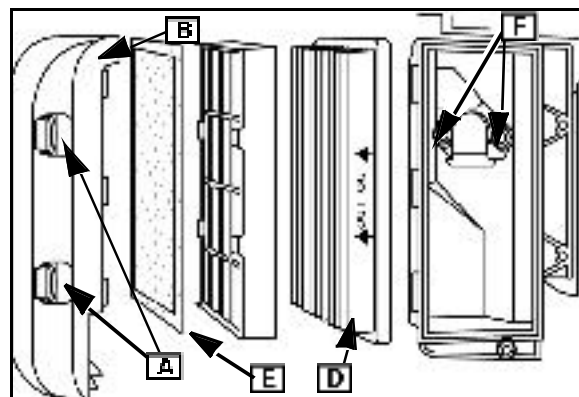


Fig. 6

**CAUTION:** Do not use pressurized air or solvents to clean filter elements. Pressurized air can damage elements and solvents might dissolve filter mesh.

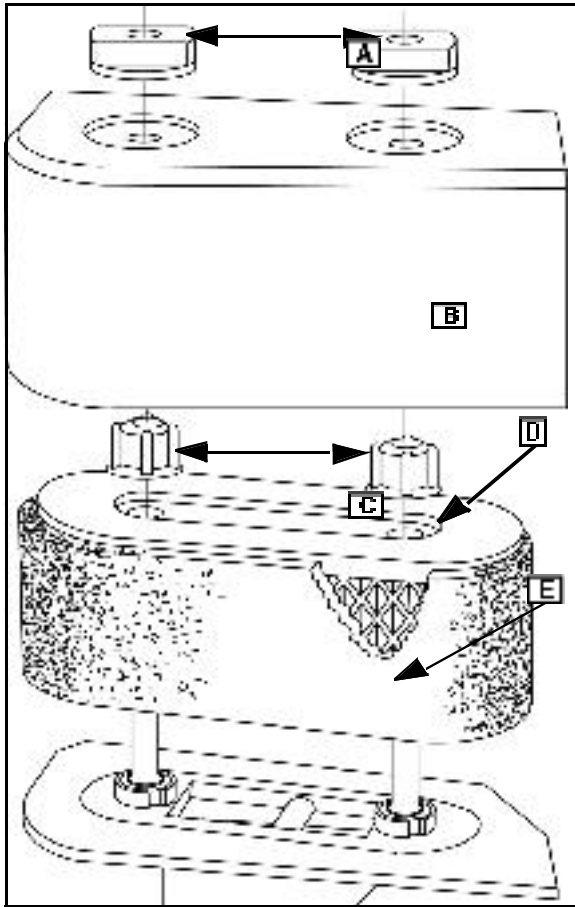


Fig. 7

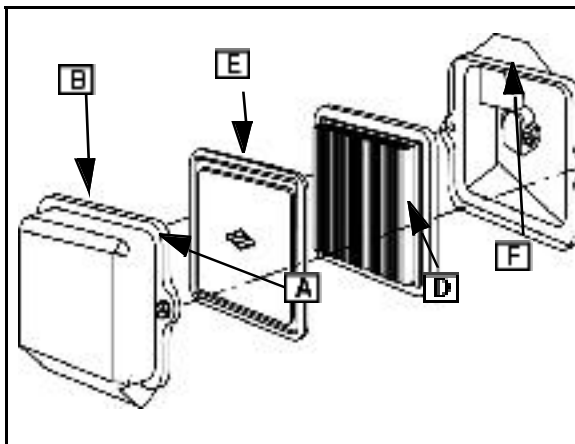


Fig. 8

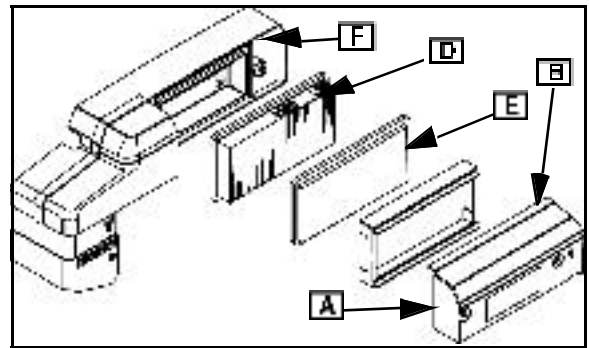


Fig. 9

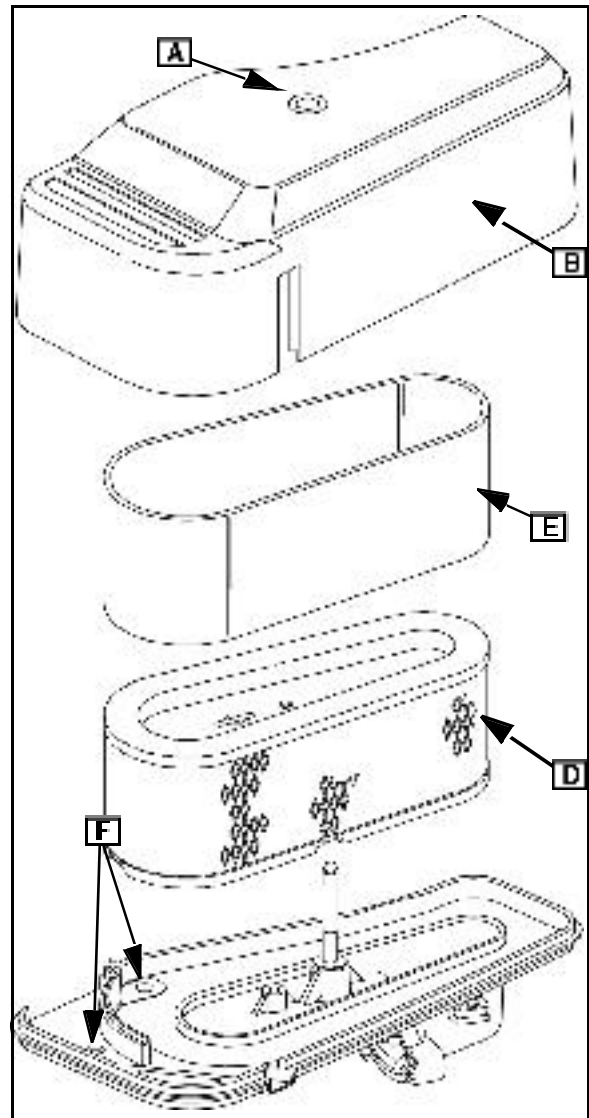


Fig. 10

### Install Air Cleaner Assembly

1. Connect breather tube to back side of air cleaner base.
2. Position base (with new gasket) on carburetor.

**NOTE:** Use new screws with sealant band or place non-hardening sealant on mounting screws.

3. Start screws into carburetor and tighten securely.
4. Install air cleaner element and/or pre-cleaner.

### In-Line Fuel Filter Service

Replace in-line fuel filter every year or 100 hours of operation, whichever occurs first. Replace the filter if dirt or water are present. Refer to the correct illustrated parts list (IPL) that applies to your engine for the correct filter.

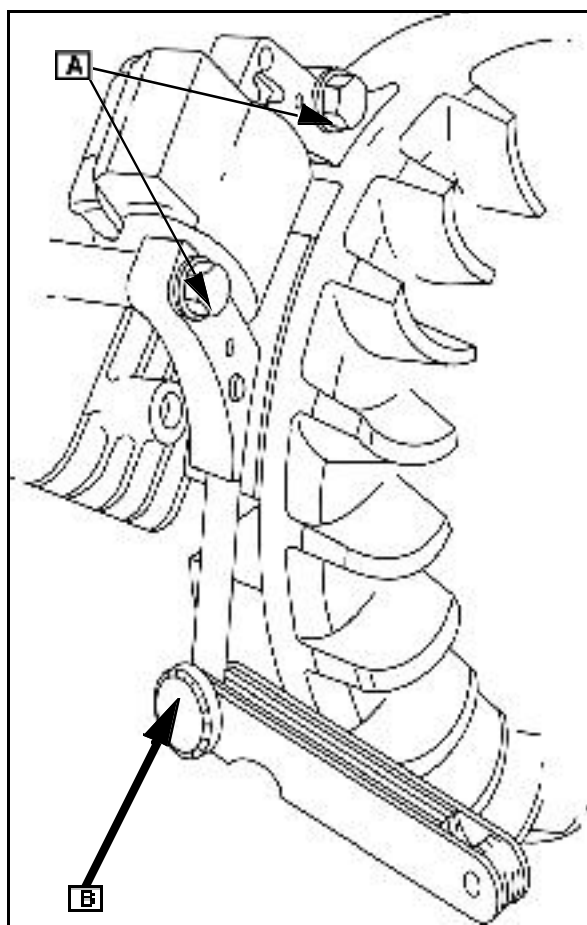


Fig. 11

## ENGINE ADJUSTMENTS

### Armature Air Gap Adjustments

1. Rotate flywheel until magnets are away from armature.
2. Loosen both armature mounting screws (**A**) and pull armature away from flywheel.
3. Snug one screw.
4. Insert the proper thickness gauge (**B** Fig. 11) between armature and flywheel.

### SEE SECTION 14- ENGINE SPECIFICATIONS.

5. Turn flywheel. Loosen screws and allow the magnets to pull armature against thickness gauge (**B** Fig. 11).
6. Tighten screws to listed values. See on page 255.

### Carburetor Idle-Mixture Adjustments

#### Initial Mixture Adjustment

Refer to the figure that shows your engine.

1. Turn the idle mixture screw (**A** Fig. 12) in until you feel it *just* make contact with the seat.
2. Back the idle mixture screw out 1-1/4 turns.
3. Start the engine and let run at half throttle for 5 minutes to bring it up to operating temperature.

#### Adjusting Idle Mixture RPM

Refer to the figure that shows your engine.

**NOTE:** Parts removed for clarity.

1. Move throttle to **SLOW**.
2. While holding the speed control lever (**B**) against the idle speed screw, adjust the idle speed screw (**C**) to obtain **1750 RPM**, except as noted for the following models:
  - Model 104700: **1500 RPM**
  - Models 161400, 260700, 261700: **1200 RPM**
  - Models 085400, 086400, 115400, 117400, 118400, 185400: **1300 RPM**
3. Turn idle mixture screw (**A**) clockwise (CW) until the engine just begins to slow.
4. Turn idle mixture screw counterclockwise (CCW) until the engine just begins to slow.

5. Turn idle mixture screw back to midpoint and release the speed control lever.
6. Install limiter cap (if equipped) using knockout pin (#19135).

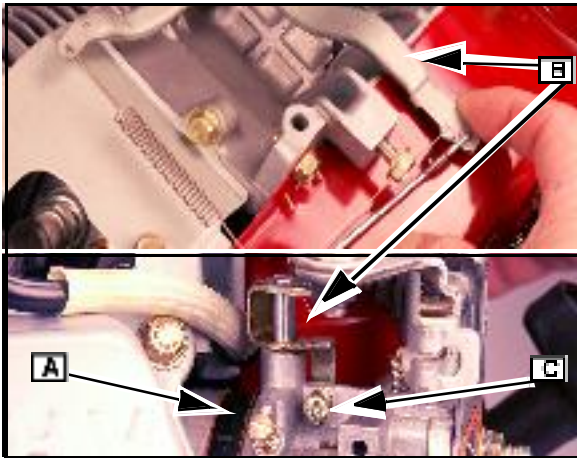


Fig. 12

**NOTE: (138400)** Does not have an idle adjustment screw.

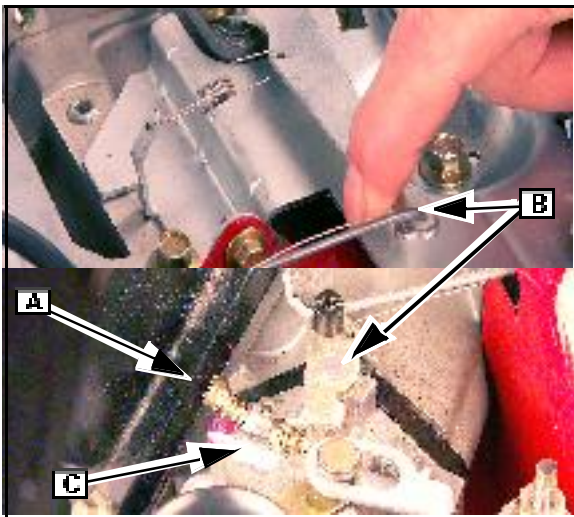


Fig. 13

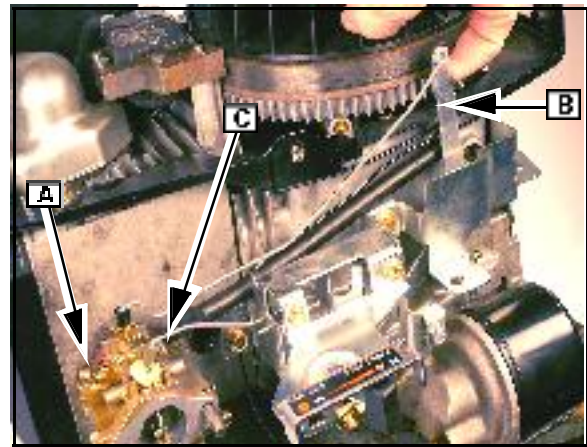


Fig. 14

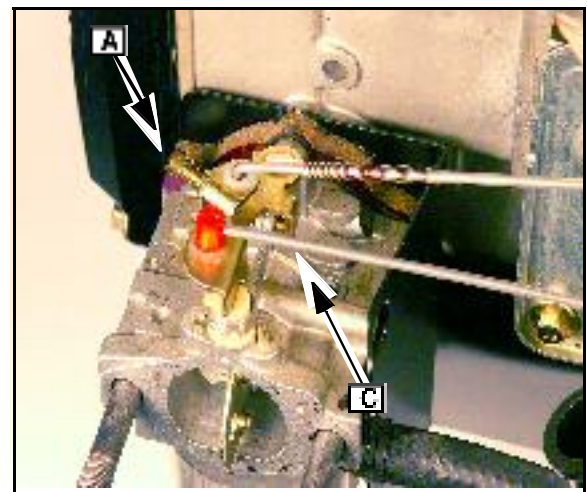


Fig. 15

7. Move speed control from **SLOW** to **FAST**.

**If the engine does not accelerate smoothly:**

- Adjust idle mixture screw 1/8 turn CCW.

8. Check idle RPM and readjust to specifications, if required.

## Control Adjustments

### Throttle Control

(050000, 085400, 086400, 115400, 117400, 118400, 138400, 185400, 235400, 245400, 28Q700)

The throttle controls on these units are interconnected with the governor linkage system.

**SEE SECTION 6- GOVERNOR SYSTEMS.**

### Throttle Control

(161400, 104700, 260700, 261700)

Refer to Figures 16 and 17 that show your engine.

1. Loosen casing clamp screw (A).
2. Move throttle to **FAST**.
3. Move casing in direction of arrow (B) until casing stops.
4. Tighten casing clamp screw.

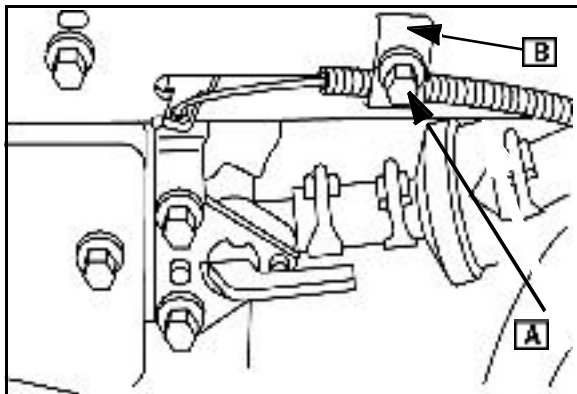


Fig. 16

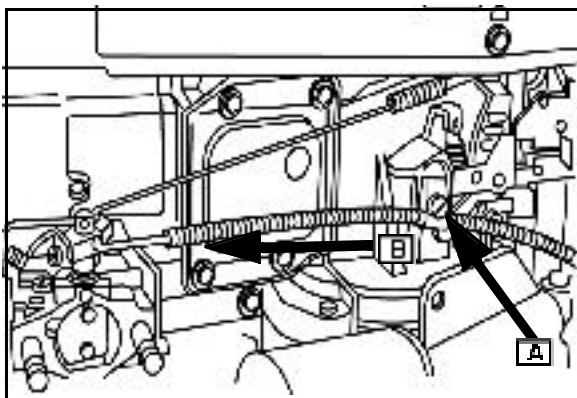


Fig. 17

### Choke Control

(050000, 085400, 086400, 115400, 117400,  
118400, 138400, 185400, 235400, 245400)

The choke on these models has a separate manual control.

Ensure that the choke valve is completely open or closed when the control is moved through its range of motion.

### Choke-A-Matic®

(104700, 161400, 260700, 261700,  
28Q700)

Choke control cables are often provided by the original equipment manufacturer. Please refer to the information provided by the OEM when this general description is not sufficient to adjust the choke control.

1. Loosen choke control casing clamp screw on engine control panel or governor control bracket.
2. Move choke control lever or knob to **CHOKE**.
3. Move choke control casing in the direction that completely closes the choke valve.
4. Tighten the casing clamp screw.

### Choke-A-Matic® Adjustments (161400)

Refer to the figure that shows your engine.

1. Move throttle control to **FAST**. The end of the choke link should contact the end of the choke lever slot. To adjust, expand or contract loop (A) in the choke link.
2. Move equipment control lever to **CHOKE**. The choke plate must be closed. Readjust as required.

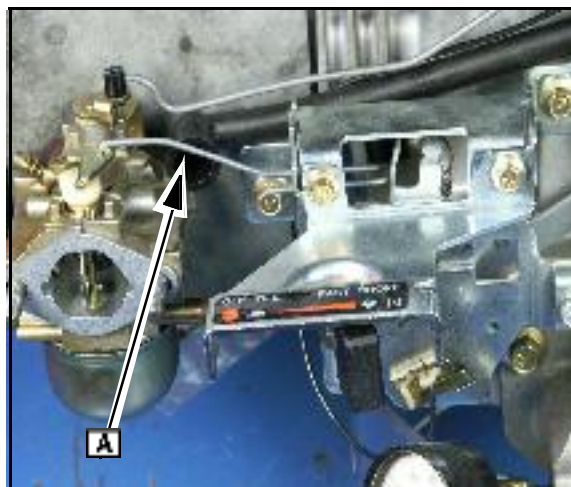


Fig. 18



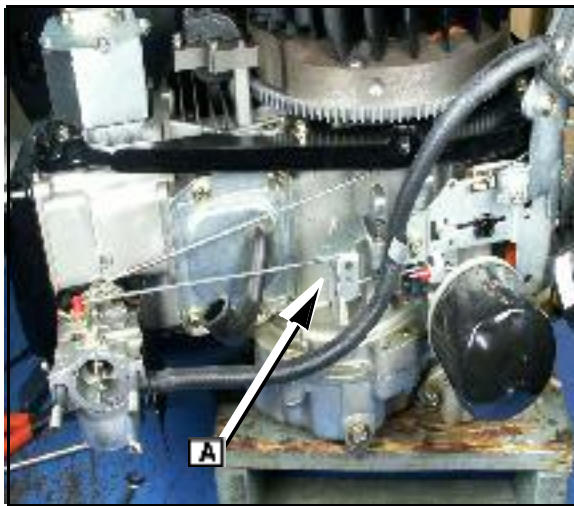


Fig. 19

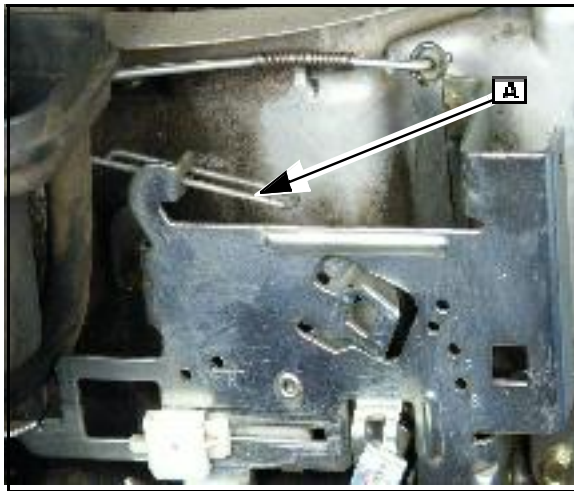


Fig. 20

## Cooling System Maintenance

**CAUTION:** Keep engine parts clean to reduce the risk of overheating and ignition of accumulated debris.

Do not use water to clean engine. Water could contaminate fuel system and short out electrical systems. Low pressure (5-10 psi.) compressed air may be used.

Grass particles, chaff, or dirt can clog the air cooling system, especially after prolonged service in very dusty conditions or when cutting dry grass. Continued operation with a clogged cooling system can cause severe overheating and possible engine damage.

Clean the static screen ([A] Fig. 21)

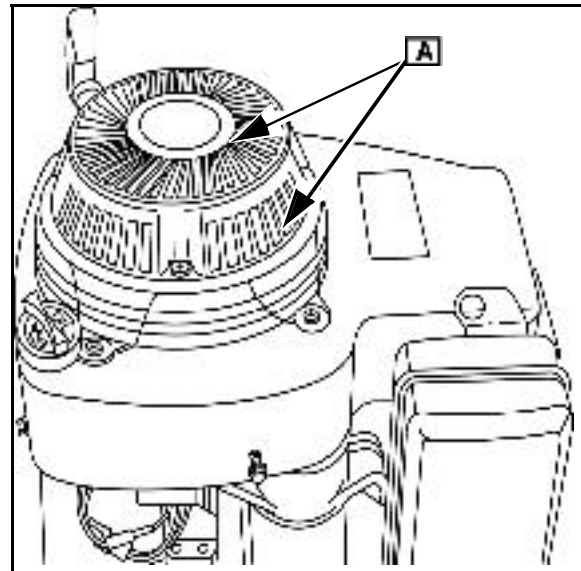


Fig. 21

Clean the ducting ([B]) and cylinder fins ([C] Fig. 22), yearly or every **100 hours** of operation. Clean more often when dust or airborne debris is present.

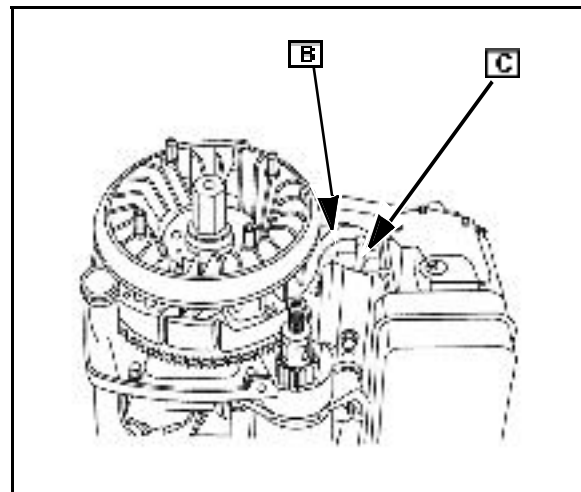



Fig. 22

## Flywheel Brake Adjustments (104700)

The flywheel brake system is part of a safety control mechanism required by some equipment applications. When the operator releases an equipment control (bail) with the engine running at the **FAST** selection, the flywheel brake must stop the engine within 3 seconds.

 <b>WARNING</b> 
<b>Unintentional sparking can result in fire or electric shock. Unintentional start-up can result in entanglement, traumatic amputation or severe lacerations.</b>
<b>Before performing adjustments or repairs:</b> <ul style="list-style-type: none"><li>• Disconnect spark plug(s).</li><li>• Disconnect negative (-) battery cable.</li><li>• Use only the correct tools.</li></ul>

Using torque wrench #19393 and a socket to fit the flywheel nut, turn the flywheel clockwise (CW) with the brake engaged. Turning at a steady rate, the torque reading should be the listed value. **SEE SECTION 14- ENGINE SPECIFICATIONS.**

### If the reading is low:

- Check the thickness of the brake pad.
- Replace brake lever and pad if the brake pad thickness is less than **0.090 in. (2.29mm)**.

### If the pad is within specification:



- Adjust the control cable casing anchor to position the pad closer to the flywheel when the safety control is in **RUN**.

### If correct adjustment cannot be made:

- Replace the brake assembly.

## Governor Adjustments

**CAUTION:** Complete the governor static adjustment before starting or running engine. Incorrect adjustment could result in engine over-speeding causing engine damage.

 <b>DANGER</b>

<b>Engines give off carbon monoxide, an odorless, colorless, poison gas. Breathing carbon monoxide can cause nausea, fainting or death.</b>
<ul style="list-style-type: none"><li>• Start and run engine outdoors.</li><li>• Do not start or run engine in an enclosed area, even if doors and windows are open.</li></ul>

**NOTE: (161432-0080-01, 161430-0199-01, 185430-0099-01, 185430-0140-01, 185430-0299-01)** These engine models are equipped with governors supplied by equipment manufacturers. Consult with the OEM for service procedures on these model/types.

A complete governor system adjustment includes the following:

1. A static governor adjustment.
2. Engine warm-up.
3. Idle and/or governed idle adjustment.
4. Top no-load RPM adjustment.

Install all linkages and springs before performing static governor adjustments. Refer to the illustration that matches the governor system on your engine.

**NOTE: (050000, 085400, 086400, 115400, 117400, 118400, 138400, 185400, 235400, 245400)** These models have left hand threads on the governor lever nut.

### Static Governor Adjustment

**(050000, 085400, 086400, 115400, 117400, 118400, 138400, 185400, 235400, 245400)**

1. Loosen lock nut **(A)** holding governor lever **(B)** to governor crank **(C)** Fig. 23).
2. Rotate throttle plate linkage from **IDLE** to **WOT** (Wide Open Throttle). Note direction of rotation of the governor lever **(B)** attached to the throttle linkage **(D)** Fig.23).
3. Place and hold the throttle plate linkage in **FAST** position.

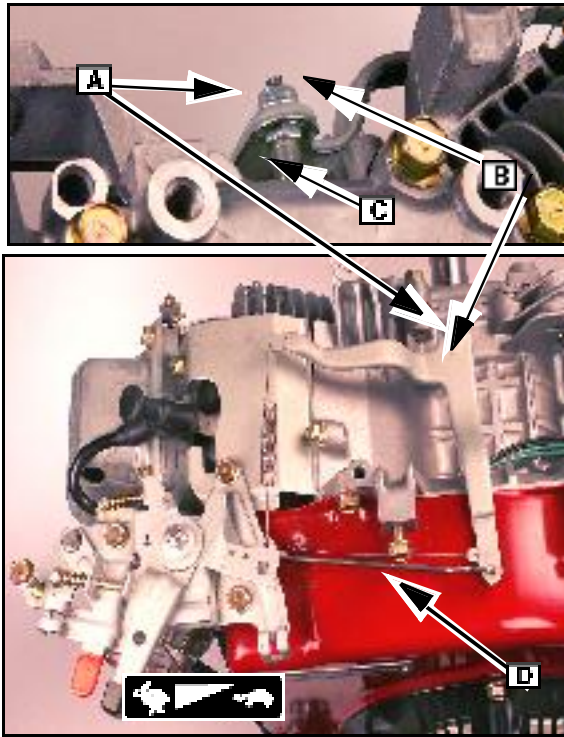


Fig. 23

4. Rotate the governor shaft in direction noted in previous step, until it stops.
5. While holding governor crank, torque the governor lever nut (left hand thread)(Fig.2.)

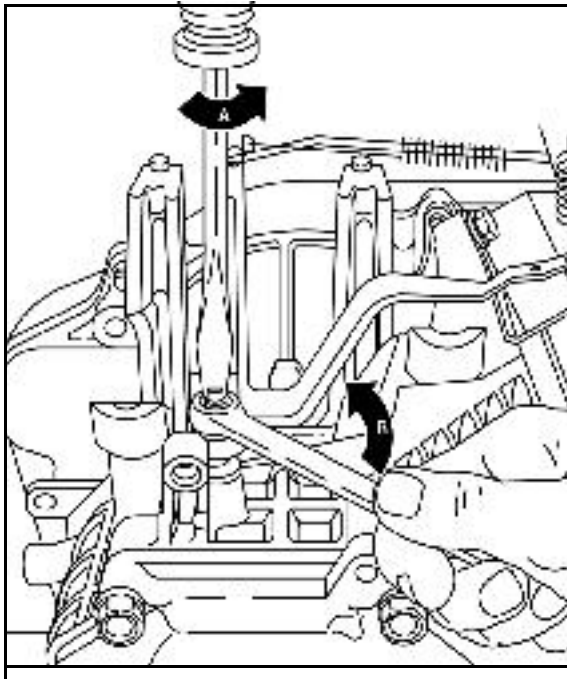


Fig. 24

### Static Governor Adjustment (161400, 104700, 260700, 261700, 28Q700)

1. Loosen nut holding governor lever ([A] Fig. 25) to governor crank.
2. Rotate throttle linkage from idle to wide open throttle. Note the direction of rotation of the governor arm attached to the throttle linkage.
3. Place and hold the throttle in high speed position.
4. While holding the throttle plate, rotate the governor shaft ([B] Fig. 25) until it stops in the direction noted in step 2.
5. While holding the governor shaft, torque the governor lever nut to listed value.

**SEE SECTION 14- ENGINE SPECIFICATIONS.**

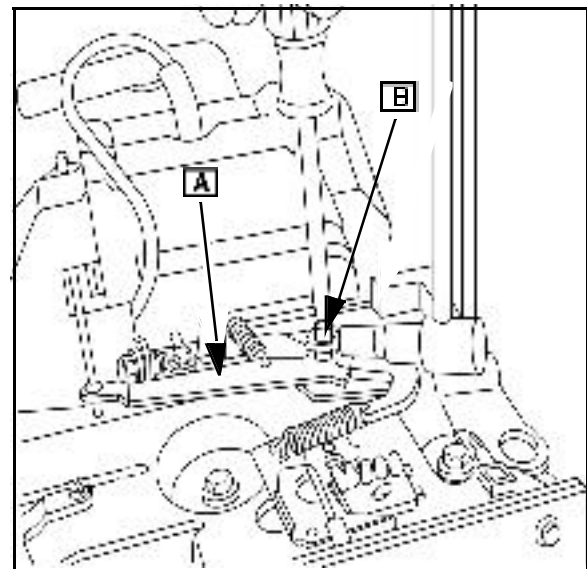


Fig. 25

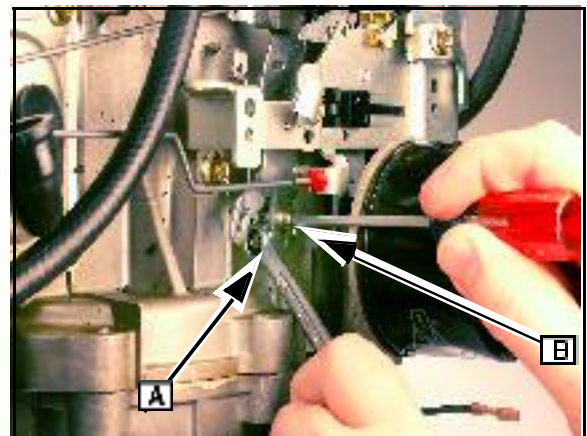


Fig. 26



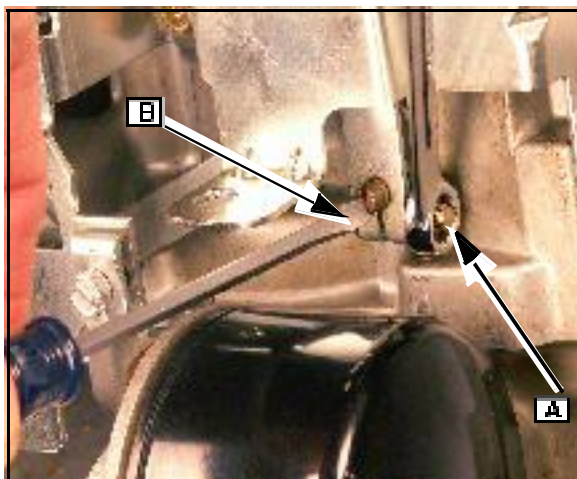


Fig. 27

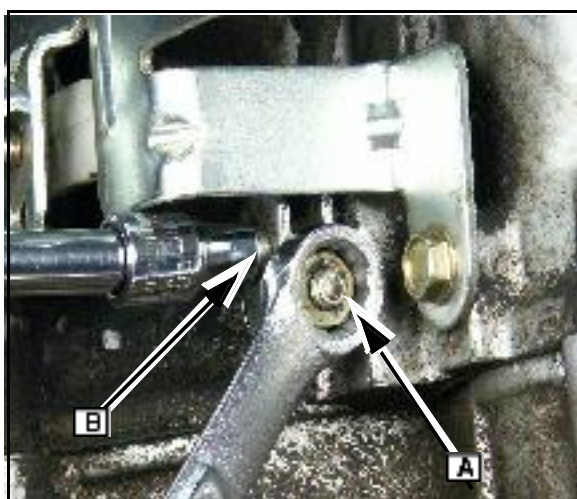


Fig. 28

### Governed Idle Speed Adjustments (085400, 086400, 115400, 117400, 138400, 185400, 235400, 245400)

Recommended tools:

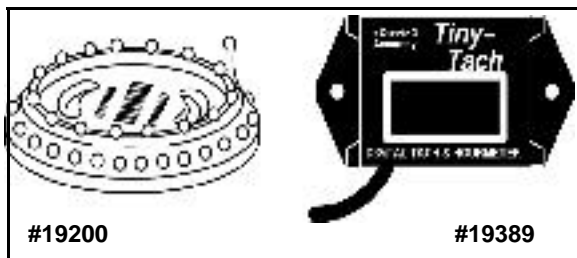


Fig. 29

1. Start and run engine at 1/2 throttle for 5 minutes to bring engine to operating temperature.
2. Move throttle to **SLOW**.

3. With the carburetor idle speed screw (A), adjust RPM to 1200 RPM.
4. With governed idle screw ([B] Fig. 30), adjust RPM to 1400 RPM.

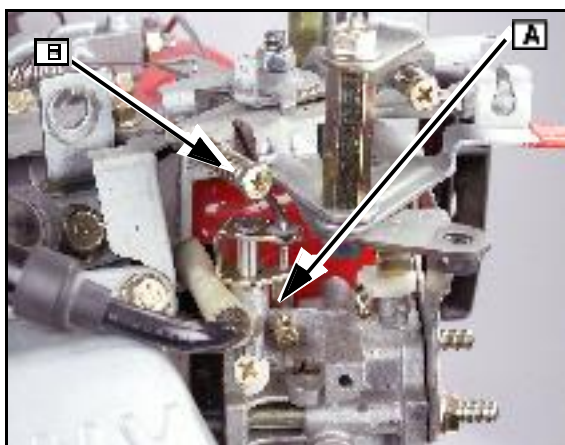
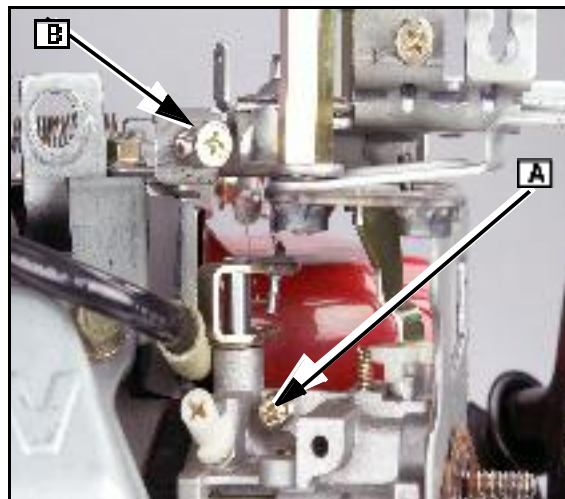


Fig. 30

**NOTE: (050000, 118400, 28Q700)** Do not have a Governed Idle Speed adjustment.

## Governed Idle RPM Adjustments (161400, 260700, 261700)

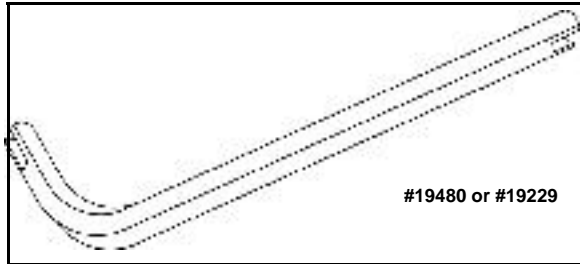


Fig. 31

Install all linkages and springs and be sure that all carburetor adjustments have been made before performing any of the running governor adjustments. To find the correct top no load RPM by model-type number, log into [thepowerportal.com/repower](http://thepowerportal.com/repower).

**NOTE: (104700)** Does not have a governed idle adjustment.

Early production versions of 260700 and 261700 had governor levers with three spring anchoring slots. Position spring in middle slot.



Fig. 32

Refer to figure that shows your model.

1. Start and run engine at 1/2 throttle for 5 minutes to bring engine to operating temperature.
2. Move throttle to **SLOW**.
3. Align holes in the governor control lever gear (A) and governor control plate (B) Fig. 33 through Fig. 35) Insert 0.125 in. (3.2 mm) diameter rod (C).
4. Using tang bender tool (D), bend governed idle speed tang to obtain **1400 RPM**.

5. Remove rod ([C] Fig. 33 through Fig. 35).

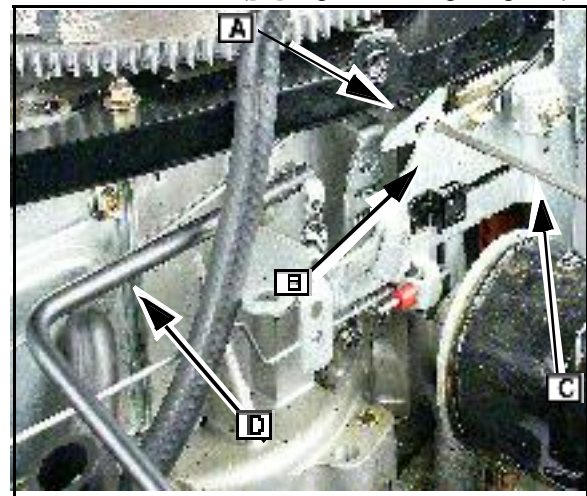


Fig. 33

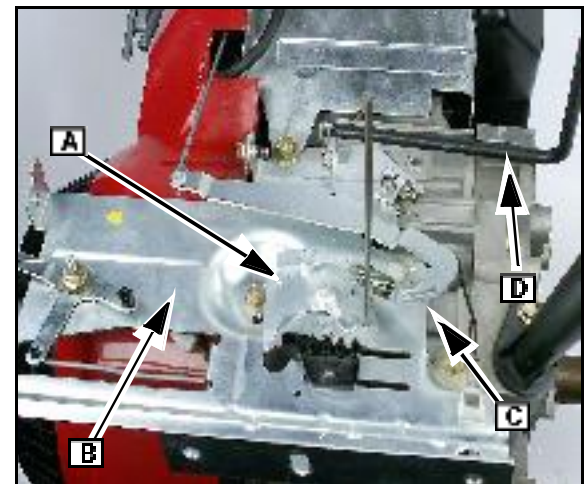


Fig. 34

## Governed Idle RPM, Fixed Speed Adjustable (161400 - No Generators)

1. Start and run engine at 1/2 throttle for 5 minutes to bring engine to operating temperature.
2. Turn speed regulator nut (A) counterclockwise (CCW) to align idle speed holes (B) in governor control lever gear with governor control plate.
3. Insert 0.125 in. (3.2 mm) diameter rod ([C] Fig. 35).



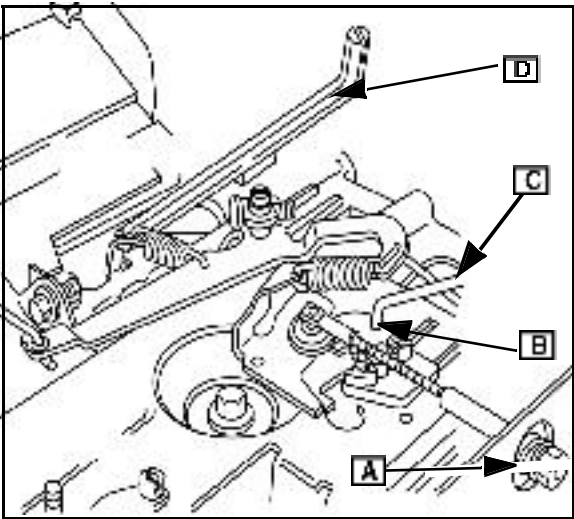


Fig. 35

4. Using tang bender tool ([D] Fig. 35), bend governed idle spring tab to obtain **1400 RPM**.
5. Remove rod.

**Top No Load RPM Adjustments**  
(050000, 085400, 086400, 115400, 117400, 118400, 138400, 185400, 235400, 245400)

1. Start and run engine at 1/2 throttle for 5 minutes to bring engine to operating temperature.
2. Move throttle to **FAST**.
3. Adjust top no load limiting screw ([A] Fig. 36) to obtain proper no load RPM.

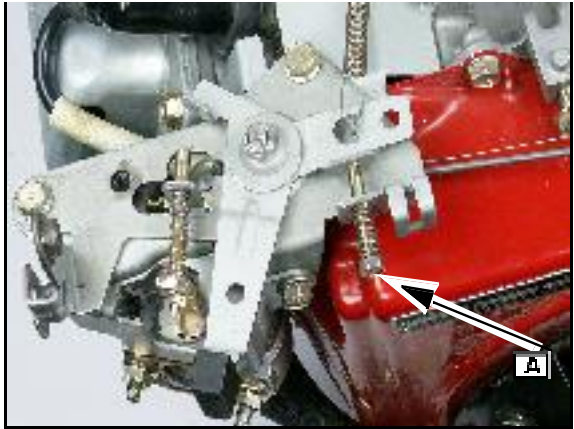


Fig. 36

**Top No Load RPM Adjustments**  
(104700, 161400, 260700, 261700, 28Q700)

- Refer to the figure that shows your model.

- Some units may have remote throttles furnished by the OEM.

1. Move throttle to **FAST**.
2. Align holes in the governor control lever gear (A) and governor control plate ([B] Fig. 37 or Fig. 38).
3. Insert 0.125 in. (3.2 mm) diameter rod ([C] Fig. 37 or Fig. 38).

**NOTE: (104700)** Alignment holes on early production models were **0.062 in. (3.2 mm)**.

4. Using tang bender tool (D), bend spring tab (or turn adjustment screw) to obtain proper top no load RPM.

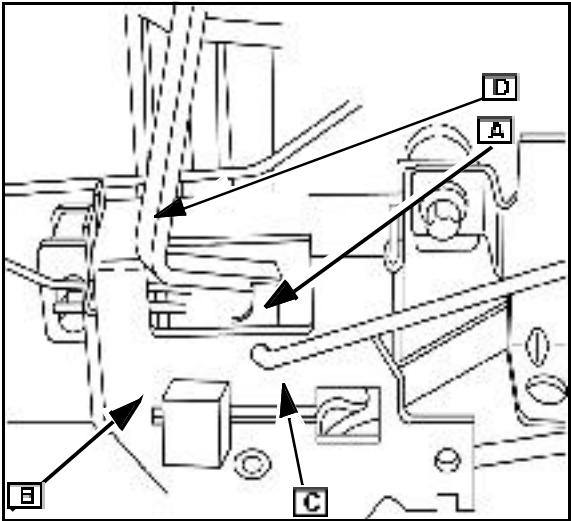


Fig. 37

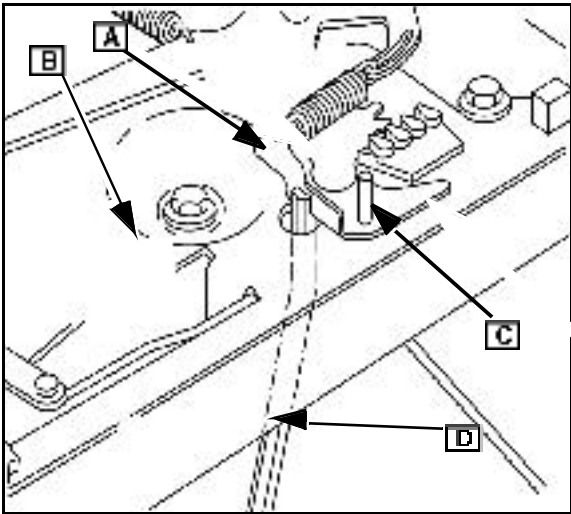


Fig. 38

5. Remove rod.

## Top No Load RPM, Fixed Speed Adjustable (161400 - No Generators)

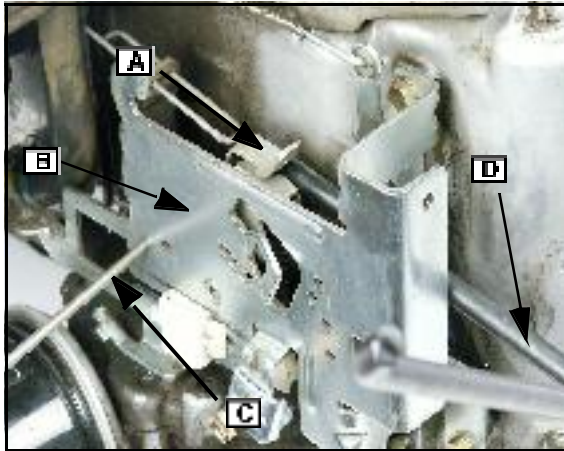


Fig. 39

1. Turn speed regulator nut (**A**) clockwise (CW) to align top no load holes in governor control lever gear and governor control plate.
2. Insert 0.125 in. (3.2 mm) diameter rod (**B**) Fig. 40).

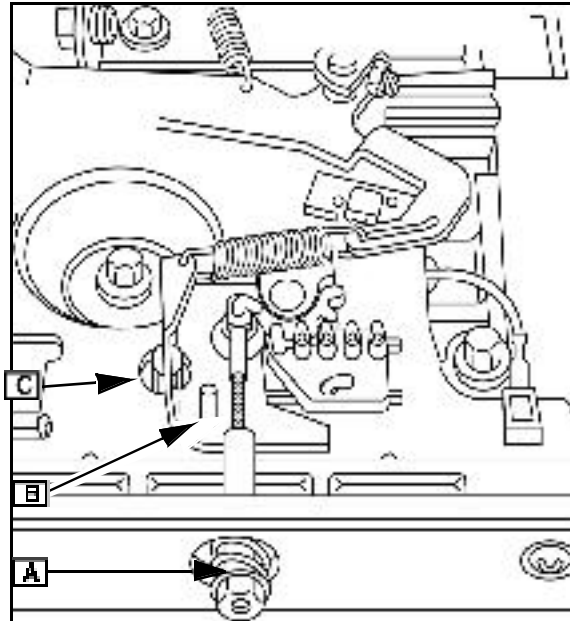


Fig. 40

3. Using tang bender tool (**C**) Fig. 40), bend governor spring tang to obtain proper top no load RPM.
4. Remove rod.

## Top No Load RPM, Fixed Speed Adjustable (161400 - Generators)

1. Turn the speed regulator nut (**A**) Fig. 41) until the desired top no load speed is achieved.

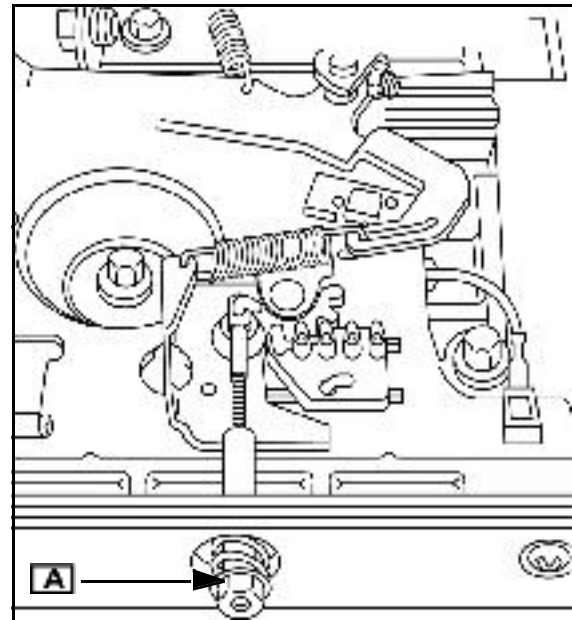


Fig. 41

## Pre-Load RPM, Fixed Speed Adjustable (161400 - Generators)

1. Push in and up on speed regulator nut to disengage from notch in control panel.
2. Start and run engine at 1/2 throttle for 5 minutes to bring to operating temperature.



Fig. 42

3. Push the governor control all the way to the end of its travel and hold it there.
4. While holding the governor control, (Fixed Speed Regulator rod removed for

clarity) use the tang bender ([A] Fig. 42) to obtain proper pre-load speed.

5. use the tang bender ([A] Fig. 42) to obtain proper pre-load speed.
6. As soon as pre-load RPM is set, move throttle to **IDLE**.
7. Stop engine.
8. Engage speed regulator nut back into notch in the control panel.

#### Top No Load RPM:

- 3150 RPM (50 cycles)
- 3750 RPM (60 cycles)

#### Pre Load RPM:

- 4000 RPM (50 cycles)
- 4300 RPM (60 cycles)

## Electro-Magnetic Idle Down Adjustments

**NOTE:** Governed idle speed and top no-load speed must be properly set before adjusting the electro-magnetic idle down.

### Electro-Magnetic Idle Down (161400)

1. Loosen both adjusting nuts ([A] and [B] Fig. 43). Then, unscrew nut (A) until flush with end of bolt.
2. Start and run engine at 1/2 throttle for 5 minutes to bring engine up to operating temperature.
3. With the engine running, apply 12VDC to connector ([C] Fig. 43). Extended governor lever ([D] Fig. 43) will be pulled against head of idle bolt.

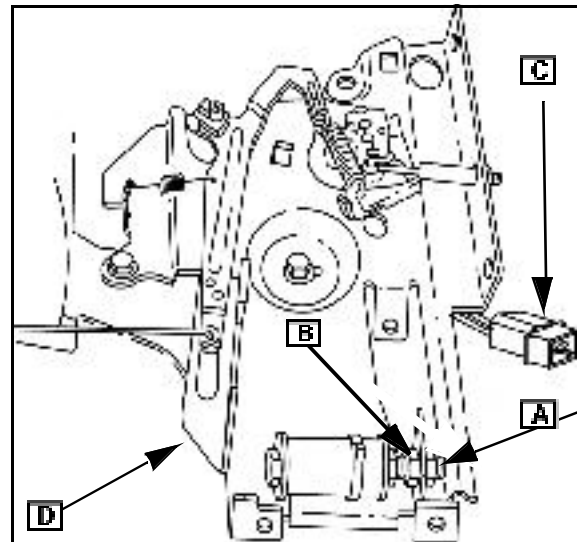


Fig. 43

4. Adjust nut (A) to obtain **2300 RPM**. Remove 12VDC from connector.
5. Hold nut (A) and idle down control in position. Tighten nut ([B] Fig. 43.)
6. Reapply 12VDC to connector to check electro-magnetic action and engine RPM. Readjust as necessary.

### Electro-Magnetic Idle Down (115400, 117400, 118400, 185400, 235400, 245400, 246400)

1. Loosen both adjusting nuts ([A] and [B] Fig. 44). Then, unscrew nut (A) until flush with end of bolt.
2. Start and run engine at 1/2 throttle for 5 minutes to bring engine up to operating temperature.

3. With the engine running, apply 12VDC to white connector with the blue wires ([C] Fig. 44). Extended governor will be pulled against head of idle down bolt. ([C] Fig. 44).

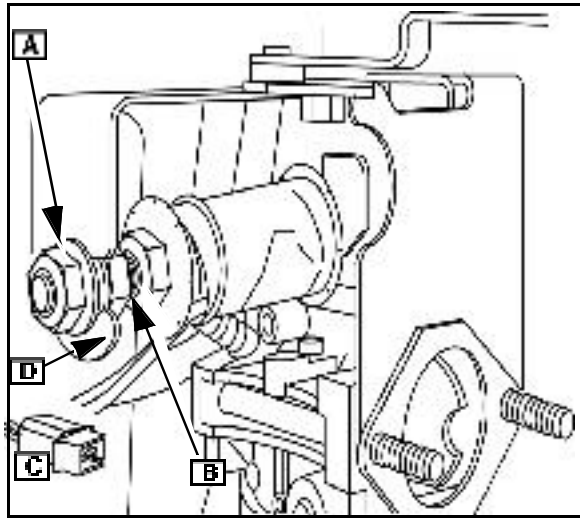


Fig. 44

4. Adjust nut ([A] Fig. 44) to obtain **2100-2500 RPM**.

Use the lowest RPM in this range that the electro-magnet will hold reliably. Remove 12VDC from connector.

5. Hold nut and idle down control in this position and tighten nut ([B] Fig. 44) to listed value.

**SEE SECTION 14- ENGINE SPECIFICATIONS.**

6. Re-apply 12VDC to connector to check electro-magnetic action and engine RPM. Re-adjust, if necessary.

## Spark Plug Maintenance

### Replace Spark Plug

Replace spark plug every year. Replace spark plugs if electrodes are burned away, or the porcelain is cracked.

**NOTE:** Local laws may require the use of a resistor spark plug to suppress ignition signals. If an engine was originally equipped with a resistor spark plug, replace it with the same type of spark plug.

Do not blast-clean spark plugs. Spark plugs should be cleaned by scraping or hand wire brushing and washing in a commercial solvent.

Use a wire gauge ([A] Fig. 45) to set the spark plug gap.

Set spark plug gap at listed value.

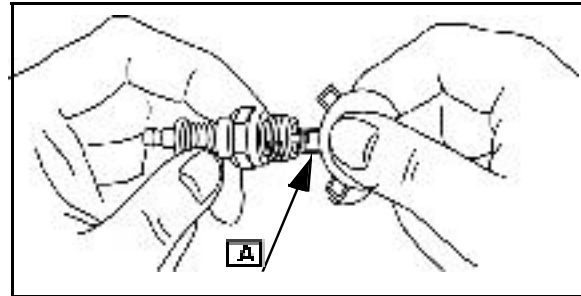


Fig. 45

Torque spark plugs to listed value.

**SEE SECTION 14- ENGINE SPECIFICATIONS.**

## Valve Clearance Adjustments

### Adjust Valve Clearance

Valve clearances should always be adjusted on a cold engine.

1. Remove the valve cover.
2. Rotate the crankshaft in the normal direction until you get to TDC (Top Dead Center) of the compression stroke.
3. Insert a narrow indicator (screwdriver or small rod) into the spark plug hole against the piston to indicate piston movement.
4. While watching the indicator, rotate crankshaft clockwise (CW) past TDC until piston is 0.25 in. (6mm) down from TDC. This is to prevent the compression release (if equipped) from affecting adjustments.
5. Loosen the jamb nut on the rocker arm.

For correct clearance dimensions see page 255.

6. Insert the proper feeler gauge. While moving it back and forth, carefully tighten the adjustment screw until a slight amount of resistance is felt on the feeler gauge.



7. Tighten the jamb nut without moving the adjustment screw Fig. 46, 47, 49, 49.



Fig. 46

8. Rotate the crankshaft through a few revolutions and recheck the clearance.



Fig. 47



Fig. 48



Fig. 49

### Combustion Chamber Deposits

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



#### WARNING



**Wear eye protection when using compressed air to clean parts.**

With the piston at Top Dead Center (TDC), remove combustion chamber deposits from top of piston with a plastic scraper or a scotch pad.

**CAUTION:** Use care to prevent debris from entering push rod or oil return cavities in cylinder. Do not damage cylinder, top of piston, cylinder head and cylinder head gasket 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.

Remove the loose deposits from around the top ring land area using compressed air and a soft bristle brush.





## SECTION 2 - TROUBLESHOOTING

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## GENERAL INFORMATION

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

1. Will not start
2. Hard starting
3. Lack of power
4. Runs rough
5. Vibration
6. Overheating
7. High oil consumption

An important consideration to remember is that what appears to be a problem with the engine may actually be the fault of the equipment. Since many types of equipment are powered by Briggs & Stratton engines, it is impossible to list all the conditions that may exist. Following, is a list of some common engine problems and their relationship to equipment applications.

### No Start - Hard Start

1. Loose belt or blade
  - Can cause a kickback effect.
2. Cranking under load
  - Parasitic loads may prevent starting.
3. Mis-adjusted controls
  - Improper linkage and cable adjustments may prevent starting.
4. Interlock system failure
  - Non-functioning safety switches, pressure sensing modules, float switches or interconnecting wires can prevent engine cranking or ignition spark.

### Engine will not stop

1. Equipment stop switch not functioning.
2. Engine ground wire damaged or disconnected.

### Vibration

1. Bent cutter blades
2. Loose spindles and couplings
3. Bent/broken deck or weldments
4. Bent crankshaft
5. Loose equipment mounting bolts
6. Damaged or worn belts and pulleys
7. Out of balance impeller

### Power Loss

1. Bind or drag in equipment
2. Grass build-up under deck
3. No lubrication in equipment gear box
4. Excessive belt tension

## SYSTEMATIC ENGINE CHECKS

A systematic check of the engine can be performed in minutes, and is an accurate method of determining the source of the problem. The basic procedure is the same for all engines. Variations, by model, will be shown under the subject heading. If the engine will not start, and the cause is not apparent, perform a systematic check in the following order:

1. Ignition System
2. Carburetion
3. Compression

	<b>WARNING</b>
	
<b>Flywheel kickback can occur if the flywheel key is sheared. Bodily injury may occur.</b>	

Briggs & Stratton OHV engines use MAGNETRON® ignition and flywheel magnets.

**NOTE:** Some engines are wired with ignition components supplied by the original equipment manufacturer (OEM). Contact the OEM for service information and adjustment procedures.

## IGNITION SYSTEM

### Spark Test

**WARNING**



**Prevent accidental starting. Remove the spark plug wire from the spark plug. Ground the wire after removal. Failure to do so can cause personal injury.**

Test Magnatron armature on the engine. Before replacing the armature, be sure that the problem is not in the wiring or switches.

**NOTE:** Engines with Magnatron ignition will show spark at the tester even if the flywheel key is sheared.

Connect the spark plug wire (A) to the long terminal of Ignition Tester #19368 (B) Fig. 1). Ground the tester to the engine with the alligator clip.

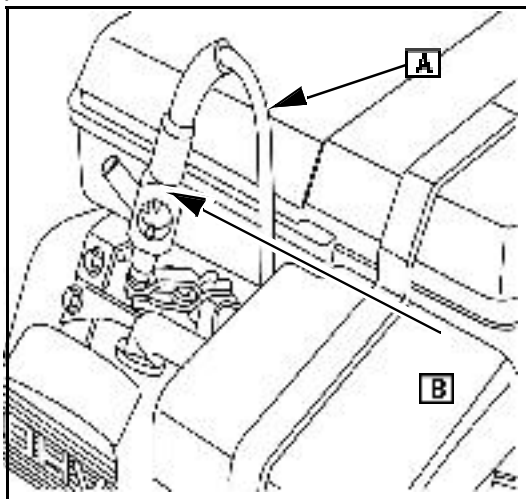


Fig. 1

**WARNING**



**Do not check for spark with spark plug removed.**

Operate starter and be sure the RPM is 350 or more. Observe tester gap in window of tester.

#### If spark jumps tester gap:

- Ignition is good.

#### If spark does not jump tester gap:

- Check the ignition coil.

### Spark Miss Test

1. To determine if an engine miss is ignition related, use Ignition Tester #19368, in series with spark plug lead and spark plug.

2. Start and run engine.

#### If spark consistently jumps the tester gap but the miss continues:

- The problem is downstream from the tester.

1. Check the spark plug.
2. Check compression.
3. Check fuel system and/or carburetion.

#### If spark in tester gap is erratic:

- Check ignition coil and associated wiring.

## CARBURETION

Before checking the carburetion, be sure the fuel tank has an ample supply of fresh, clean gasoline. Be sure that the shutoff valve (if equipped) is open and fuel flows freely through the fuel line. Make sure the choke closes completely. If engine will not start, remove and inspect the spark plug as follows:

#### Wet plug symptoms:

- Overchoking
- Excessively rich fuel mixture
- Water in fuel
- Float needle valve stuck open
- Plugged air cleaner

### Dry plug symptoms:

- Leaking carburetor mounting gaskets
- Gummy or dirty carburetor, fuel line or tank
- Float needle valve stuck shut
- Inoperative fuel pump
- Inoperative anti-afterfire solenoid

To determine if fuel is getting to the combustion chamber through the carburetor, remove the spark plug and pour a small quantity of gasoline through the spark plug hole. Replace the spark plug.

### If the engine fires a few times and then stops:

- Focus your attention on dry plug symptoms.

### If the engine does not fire:

- Replace the spark plug.

## COMPRESSION

Check the sealing capability of compression components by using cylinder leakdown tester **Tool# 19545**. The leakdown test will identify which components may be at fault.

A regulated amount of compressed air is used to pressurize the combustion chamber with the piston at Top Dead Center (TDC) on the compression stroke. By listening for air leaks, it is possible to isolate a specific component or components causing a problem. An engine in good condition will display a reading in the green area on the outlet gauge with a minimum of audible leakage. A reading in the yellow or red area along with high audible leakage noise, indicates a problem with the compression components.

A small amount of air leakage is normal in all engines, including new engines, providing that the outlet gauge remains in the green area.

However, if a single component is displaying more audible leakage, look to that component for a potential problem.

For example:


Frequently, a slight air leak at the head gasket may not register on the gauge. Obviously the head gasket would require replacement, as any leak at the head gasket would have an adverse affect on engine performance.

## Compression Test

1. Run engine for 5 minutes allowing engine to reach operating temperature.

**NOTE:** If engine is cold or cannot be started, air flow may be higher (gauge readings lower) because compression components are not at normal operating temperatures.

2. Remove spark plugs from engine. Disconnect air cleaner tube and cylinder breather tube at carburetor intake elbow.
3. Rotate crankshaft in direction of operation until piston for cylinder being tested is at top dead center of the compression stroke.

**WARNING**

**Injury may occur if the crankshaft is allowed to rotate or the engine is not securely fastened to a stand or the application. The air pressure can create a substantial rotational force if the crankshaft is not locked with the piston at top dead center.**

4. Assemble the clamping tool (comes in kit #19545) to the crankshaft. Tighten screws (**A**) securely to prevent the crankshaft from turning.
5. Insert drive end of a 3/8" breaker bar into slot of clamp. Hold the breaker bar to prevent the crankshaft from turning or install a bolt through the slot of the tool (**B**) Fig. 2) into an open hole in the bolt circle of the cylinder cover.

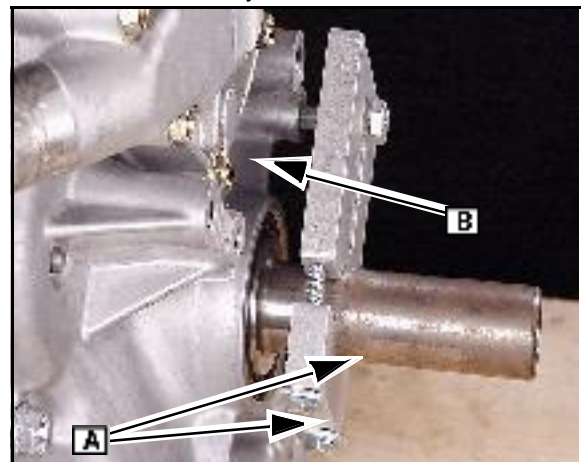


Fig. 2



**NOTE:** The crankshaft must be held with the piston at top dead center to seal the combustion chamber and eliminate any chance of rotation. If the engine is installed in an application, the equipment can often lock the crankshaft from moving.

6. Pull out the regulator adjustment knob (A) and turn knob counterclockwise as far as it will go. Make sure air outlet valve (B) Fig. 3) is closed.

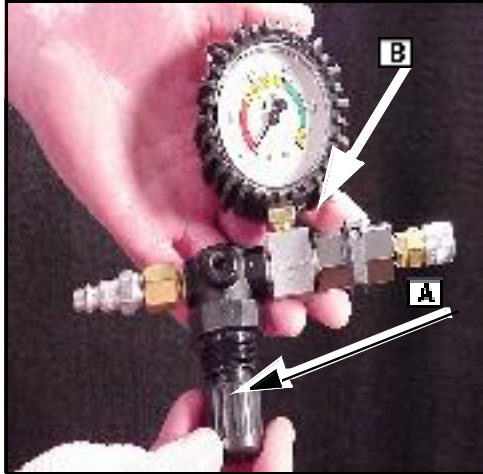


Fig. 3

7. Connect the tester to a compressed air source (minimum air pressure of 70 psi).
8. Install the outlet hose into the spark plug hole of the cylinder being tested. Be sure O-ring is seated to prevent air leak at spark plug hole. Connect other end to tester.
9. Turn regulator adjustment knob clockwise until the tester's needle is on the set point. Push knob in to lock. Slowly open air outlet valve and note position of needle on gauge, Fig. 4.

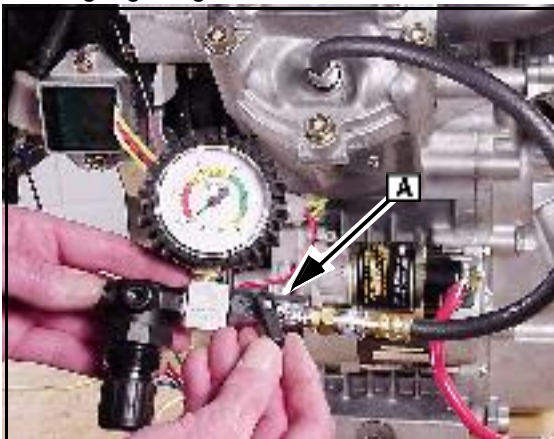


Fig. 4

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

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

**NOTE:** If a high flow of air is leaking from the exhaust and carburetor, make sure the piston is at TDC on the compression stroke.

- 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 cylinder breather tube or high oil fill dipstick tube indicates air is leaking past the piston rings.

#### COMPRESSION TEST RESULTS

Reading is Green but a small amount of air is leaking from head gasket.	Replace head gasket, and re-test.
Reading is Green with minimum air leakage.	Look for problems not compression related.
Reading is Yellow/Red or Red, and all the air is leaking from one component.	Look for a possible problem with that component.
Reading is Red, and air is leaking from several components.	Check that piston is at TDC on the compression stroke. If reading does not change, look for problems beginning with the component that appeared to leak the most air. Re-test after repair.

11. When test is complete, close air valve.  
Then, pull out knob and turn counterclockwise as far as it will go to release pressure in combustion chamber.
12. Disconnect outlet hose from tester before removing from spark plug hole.

#### 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 rods

## ELECTRICAL TEST EQUIPMENT

### Digital Multimeters & Settings

A digital multimeter is required to perform electrical tests. Briggs & Stratton offers multimeter (#19581) from your dealer source of supply. The multimeter you use must withstand DC input of **10 - 20 amps** for up to **30 seconds** and **should be** equipped with two fuses to prevent damage to the meter if the input limits are exceeded. Refer to the operators manual that applies to your meter for the procedure to check the fuses and general operation.

The digital multimeter is used for numerous tests which include the following:

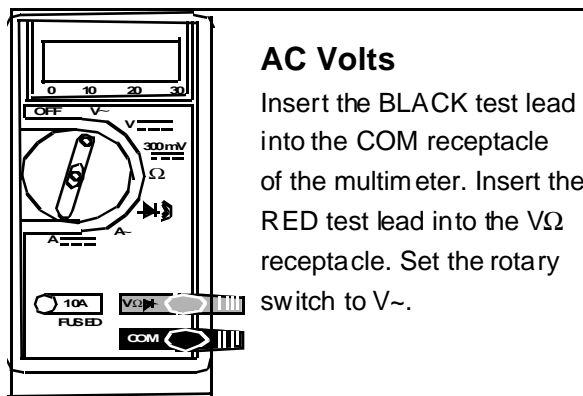
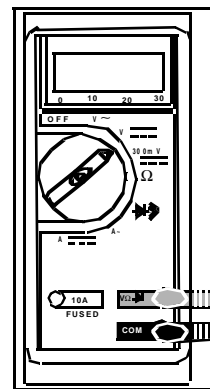


Fig. 5

#### AC Volts

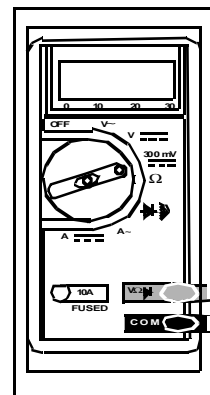
Insert the BLACK test lead into the COM receptacle of the multimeter. Insert the RED test lead into the VΩ receptacle. Set the rotary switch to V~.



#### DC Volts

Insert the BLACK test lead into the COM receptacle of the multimeter. Insert the RED test lead into the VΩ receptacle. Set the rotary switch to V==.

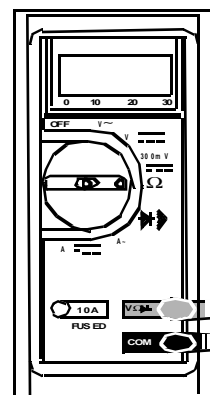
Fig. 6



#### DC Amps over 10 Amps

Use with DC Shunt. Insert the BLACK test lead into the COM receptacle of the multimeter. Insert the RED test lead into the VΩ receptacle. Set the rotary switch to 300mV.

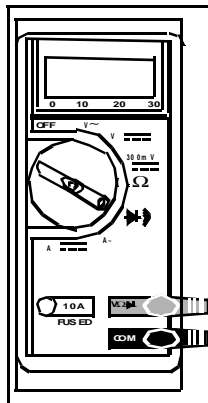
Fig. 7



#### Ohms or Continuity

Insert the BLACK test lead into the COM receptacle of the multimeter. Insert the RED test lead into the VΩ receptacle. Set the rotary switch to Ω.

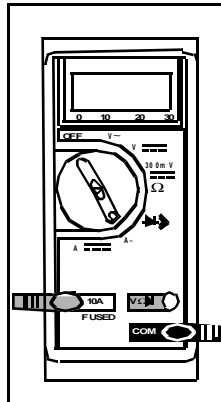
Fig. 8



### Diode Test

Insert the BLACK test lead into the COM receptacle of the multimeter. Insert the RED test lead into the **VΩ** receptacle. Set the rotary switch to **+**)). This setting also signals continuity with a continuous tone.

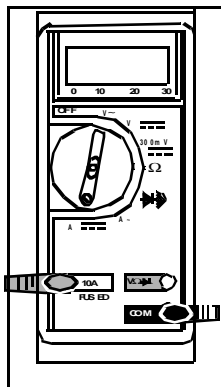
Fig. 9



### AC Amps

Insert the BLACK test lead into the COM receptacle of the multimeter. Insert the RED test lead into the **10A** receptacle. Set the rotary switch to **A~**.

Fig. 10



### DC Amps under 10 Amp

Insert the BLACK test lead into the COM receptacle of the multimeter. Insert the RED test lead into the **10A** receptacle. Set the rotary switch to **A===**.

Fig. 11

### DC Shunt

When checking DC output on systems over 10 Amps, use a digital multimeter with the DC Shunt ([#19468] Fig.12) to avoid blowing a fuse in the multimeter.

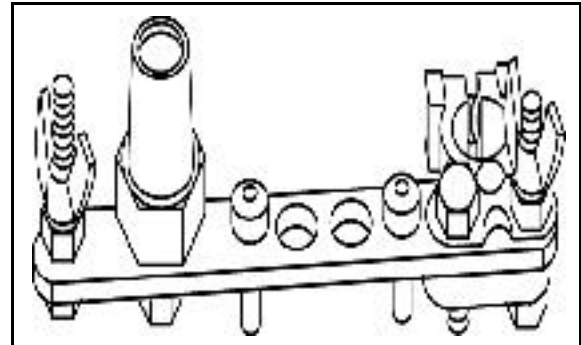


Fig. 12

### Tachometers

Tachometers are available from your Briggs & Stratton source of supply. Order Tachometer #19200 (A) or Digital Tachometer & Hourmeter #19389 ([B] Fig. 13).

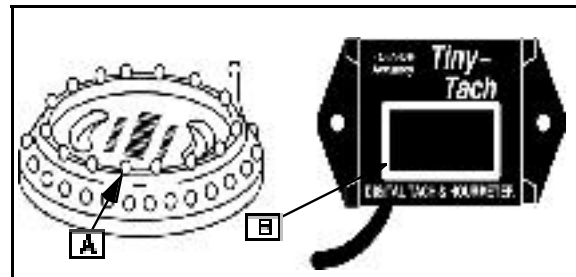


Fig. 13

## ALTERNATOR OUTPUT TESTS

### DC Only Alternator

The DC alternator provides current for charging a 12 volt battery. Current from the alternator is unregulated and is rated at 3 amps. The output rises from 2 amps at 2400 RPM to 3 amps at 3600 RPM.

Use an accurate tachometer and a tang bender to temporarily adjust the engine speed to the RPM specified in the test instructions before testing alternator output.

Perform alternator tests in the following sequence:

1. Test alternator output.

## 2. Test diode(s).

Test in the following sequence:

1. Set meter to DC Output test. See Figure 11.
2. Attach RED test lead clip to DC output terminal connector ([A] Fig. 14).

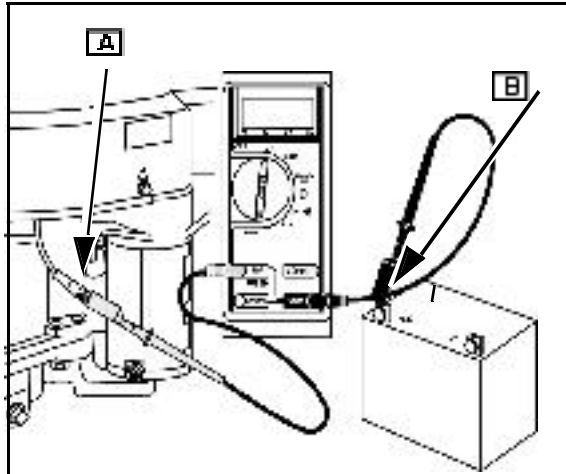


Fig. 14

3. Attach BLACK test lead clip to positive (+) battery terminal ([B] Fig. 14).
4. Start engine.

Output should be 2 to 4 amps DC @ 3600 RPM. Output will vary with battery voltage. If battery voltage is at its maximum, output will be approximately 2 amps.

### If no or low output is found:

- Test diode.

## Diode Test

In the Diode Test, the multimeter will display forward voltage drop across the diode(s). If voltage drop is less than 0.7 volts, meter will beep once and display the voltage drop. A continuous tone indicates continuity (shorted diode) An incomplete circuit (open diode) will be displayed as OL.

1. Set meter to Diode Test. See Figure 9.
2. Attach RED test lead ([A] Fig. 15) clip to point (B) and BLACK test lead (C) clip to point (D) Fig. 15). It may be necessary to pierce wire with a pin as shown.

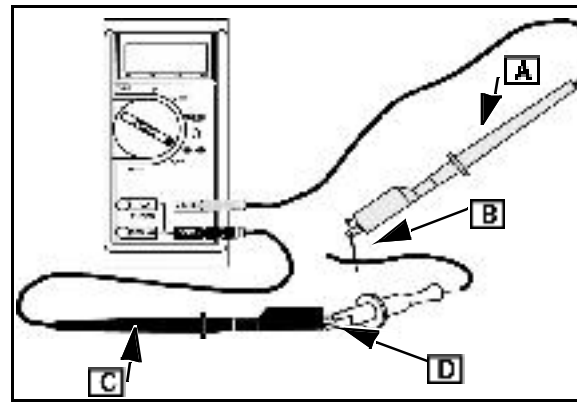


Fig. 15

### If meter beeps once:

- Diode is OK.

### If meter makes a continuous tone:

- Diode is shorted.
- Replace the diode.

### If meter displays OL:

- Proceed to step 3.
3. Reverse test leads.

### If meter beeps once:

- Diode is installed backwards.

### If meter still displays OL:

- Diode is open.
- Replace the diode.

**NOTE:** Replacement diode harnesses are available. Use Rosin Core solder to install new harness. Use shrink tubing or tape on all connections. Do not use crimp connectors.

## AC Only Alternator

The AC alternator provides current for headlights only. Current for lights is available when the engine is running. Use 12 volt lights with a total rating of 60 - 100 watts to test the alternator. With lights rated at 70 watts, the voltage rises from 8 volts at 2400 RPM to 12 volts at 3600 RPM. The brightness of the light(s) changes with engine speed.

1. Set meter to AC test. See Figure 5.
2. Attach RED test lead clip to AC output terminal connector ([A] Fig. 16).

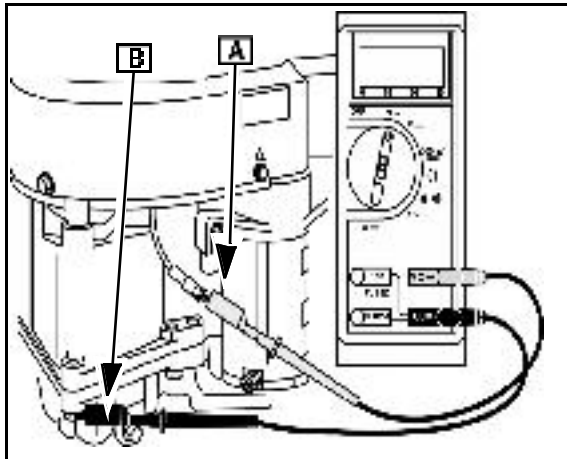


Fig. 16

3. Attach BLACK test lead clip to engine ground ([B] Fig. 16).
4. Start engine.
  - AC output should be no less than 14 volts @ 3600 RPM.

### If low or no output is found:

- Replace stator.

## 1.2 Amp Unregulated Alternator

The 1.2 amp DC alternator provides current for charging a 12 volt battery. The alternator has a RED connector ([A] Fig. 17) and BLACK wire ([B] Fig. 17).

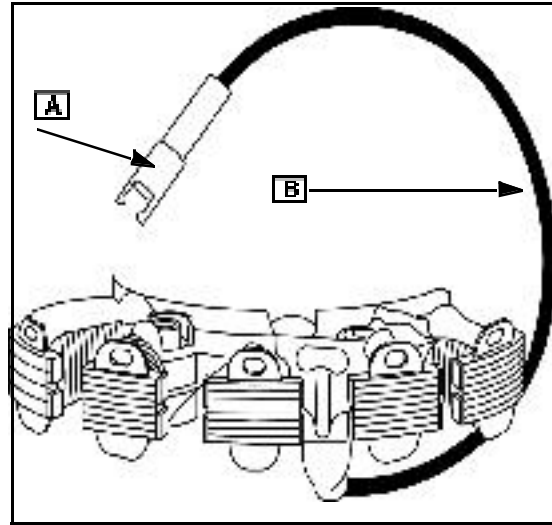


Fig. 17

1. Set meter to DC test. See Figure 11.
2. Attach RED test lead clip to DC output pin ([C] Fig. 18) in connector.

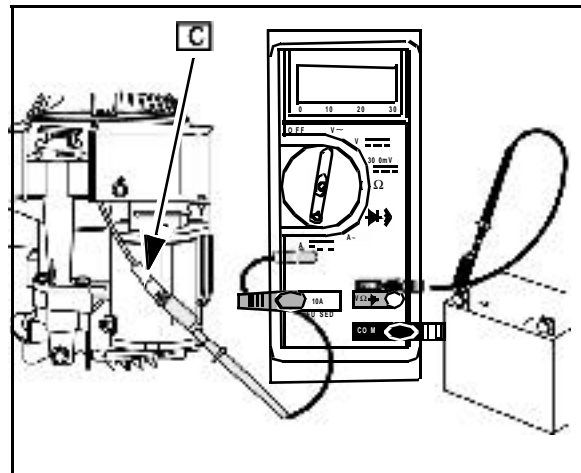


Fig. 18

3. Attach BLACK test lead clip to positive (+) battery terminal.
4. Start engine.

Output will vary with battery voltage.

### If the battery is at maximum voltage:

- The output will be no less than 1 amp @3600 RPM.

### If low or no output is found:

- Replace stator.



## 4 Amp Regulated Alternator

The electrical system must be connected to a charged 12 volt battery to test alternator output.

1. Disconnect battery ground cable from battery negative (-) terminal.
2. Set meter. See Figure 11.
3. Place DC Shunt #19468 on negative battery post. Install negative ([A] Fig. 19) cable on DC shunt battery terminal.
4. Connect multimeter test leads to DC shunt terminals, red to RED (B) and BLACK to BLACK ([C] Fig. 19).
5. Adjust governor to 3600 RPM.

Output should be approximately 4 amps at 3600 RPM.

### If output is acceptable:

- Remove test equipment.
- Return governor to original set RPM.

### If output is less than 4 amps:

- Disconnect battery ground cable from battery negative (-) terminal (A).
- Disconnect RED wire ([D] Fig. 19) from regulator/rectifier.
- Set meter. See Figure 8.
- Connect test lead to wire disconnected from regulator/rectifier.
- Connect second test lead to terminal B of key switch.
- Turn key switch to RUN.

There should be continuity.

### If there is no continuity:

- Replace the fuse between the key switch and connector.

Retest to confirm repair.

### If there is continuity:

- Reconnect RED wire to regulator/rectifier.
- Disconnect wires at (E) and (F) Fig. 19).
- Connect multimeter test leads to two wires not connected to regulator/rectifier. There should be continuity.

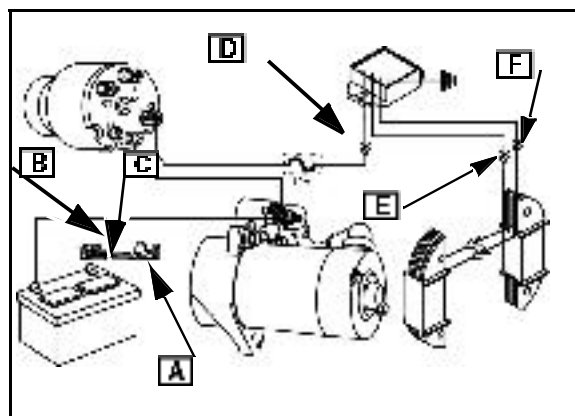


Fig. 19

- With one test lead still connected to one of the wires, check for continuity to ground with the other test lead. There should not be continuity.

### If there is continuity:

- Replace stator.

Confirm results after repair and return governor to original set RPM.

**NOTE:** Early stators had connectors between upper and lower halves. Both halves are included for service.

## 9 Amp Regulated Alternator

The 9 amp regulated alternator system provides AC through a single lead to the regulator–rectifier. The regulator–rectifier converts AC to DC, and regulates current to the battery. Charging rate will vary with engine RPM, state of battery charge and temperature.

**NOTE:** Regulator–rectifier will not function unless it is grounded to engine. Make sure regulator–rectifier is securely mounted to engine against bare metal.

Test in the following sequence:

### 9 Amp AC Output Test

Temporarily disconnect stator wire harness from regulator-rectifier.

1. Set meter. See Figure 5.
2. Attach RED test lead clip to green output terminal ([A] Fig. 20).

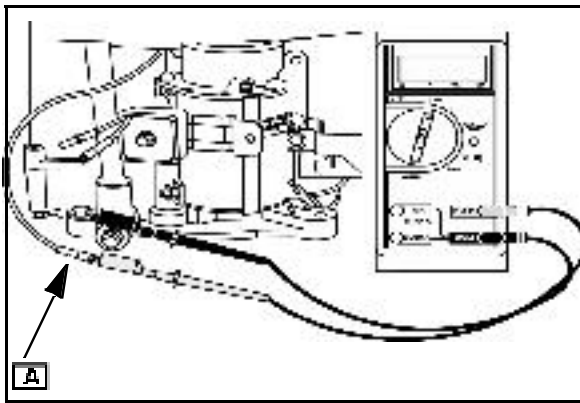


Fig. 20

3. Attach BLACK test lead clip to engine ground.

AC output should be no less than 40VAC @3600 RPM.

**If no or low output is found:**

- Replace stator.

### 9 Amp DC Output Test

When testing regulator-rectifier for amperage output, a 12 volt battery with a minimum charge of 5 volts is required. There will be no charging output if battery voltage is below 5 volts.

**CAUTION:** Connect test leads before starting engine. Be sure connections are secure. If a test lead vibrates loose while engine is running, regulator-rectifier may be damaged.

1. Set meter. See Figure 11.
2. Attach RED test lead clip to DC output terminal ([A] Fig. 21) on regulator-rectifier.

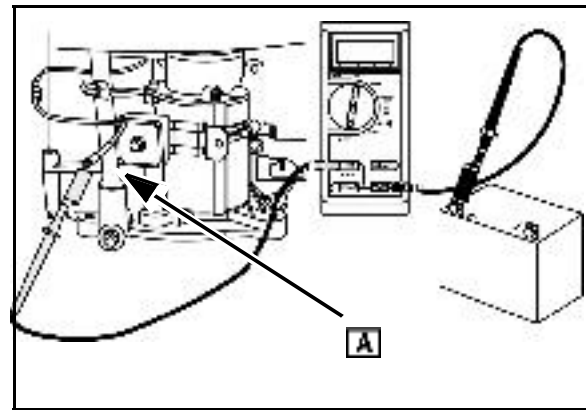


Fig. 21

3. Attach BLACK test lead clip to positive (+) battery terminal.

4. Start Engine.

Output should be 3 – 9 Amps @ 3600 RPM.

### 10 AMP Regulated Alternator

#### Model 185400

To test alternator output, engine's electrical system must be connected to a fully charged 12 volt battery.

1. Adjust governor to 3600 RPM for test.
2. Disconnect battery ground cable from battery negative (-) terminal.
3. Set meter. See Figure 11.
4. Place DC Shunt #19468 on negative battery post.
5. Install battery ground cable to DC shunt battery terminal. See Fig. 22
6. Connect multimeter test leads to DC shunt terminals, RED to RED and BLACK to BLACK.
7. Start engine.

Output should be approximately 3 amps @ 3600 RPM.

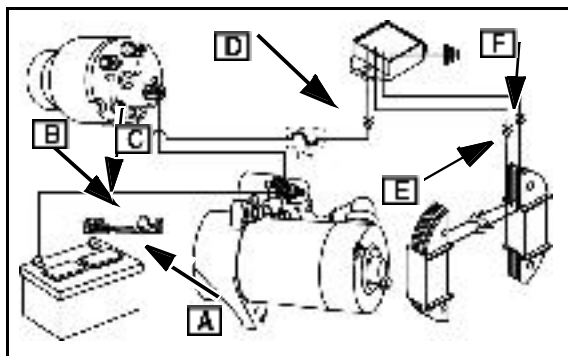


Fig. 22

**If output is good:**

- Remove test equipment and readjust governor to original set RPM

**If out put is low or none:**

- Disconnect RED wire with BLACK stripes from regulator/rectifier.

**NOTE:** Early stators had connectors between upper and lower halves, but are serviced as a pair.

8. Set meter. See Figure 8.
9. Connect multimeter test leads to wire disconnected from regulator/rectifier and second test lead to terminal B of key switch.
10. Turn key switch to RUN.

There should be continuity.

**If there is no continuity:**

- Replace fuse between key switch and connector.
- Retest as above to confirm repair.

**If there is continuity:**

- Reconnect the RED wire with BLACK stripes to regulator/rectifier.

11. Connect multimeter test leads to the two wires not connected to regulator/rectifier.

There should be continuity.

**If there is no continuity:**

- Replace stator.

**If there is continuity:**

- Check for continuity between GREEN wire and engine ground.

There should not be continuity.

**If there is continuity to ground:**

- Replace stator.
- Readjust governor to original set RPM.

## 10 & 16 Amp Regulated Alternator

The 10 & 16 amp regulated alternator system provides AC current through two YELLOW output leads (A) to the regulator-rectifier(B). The regulator-rectifier converts the AC current to DC and regulates current to the battery. The charging rate varies with engine RPM and temperature.

The stator and regulator-rectifier are the same for the 10 and 16 amp systems. The system output is determined by the flywheel magnet size.

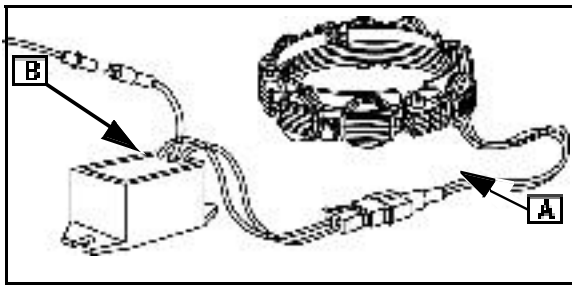


Fig. 23

When checking alternator components, make tests in the following sequence:

### Test Alternator Output

1. Temporarily disconnect stator wire harness from regulator-rectifier.
2. Set meter to AC Volts position. See Figure 5.
3. Insert RED and Black test lead probes into output terminals in yellow connector, as shown in Figure 24.
4. With engine running at 3600 RPM output should be no less than:
  - 20 Volts- 10 Amp System
  - 30 Volts- 16 Amp System
5. If **NO** or **LOW** output is found check for bare wires or other defects. If wiring defects are not visible, replace the stator.

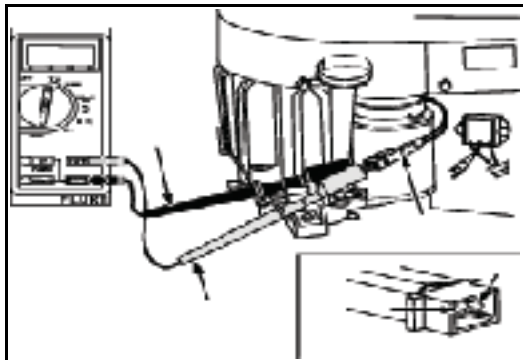


Fig. 24

### Regulator-Rectifier Test

In order to avoid blowing the fuse in the meter, DC shunt tool #19359 is required when testing the 10 & 16 Amp systems. The DC shunt must be installed on the negative (-) terminal of the battery.

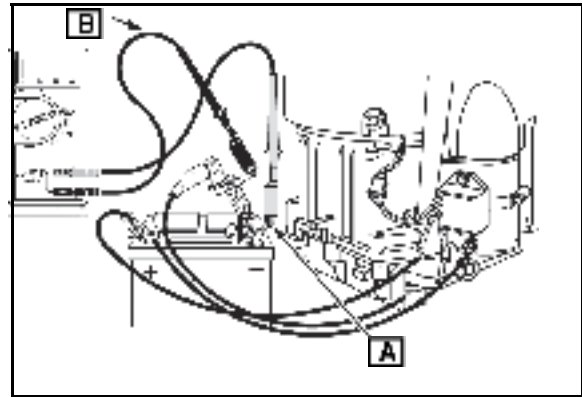


Fig. 25

All connections must be clean and tight for correct amperage readings.

Make sure the stator wire harness is connected to the regulator-rectifier.

Make tests in the following sequence:

1. Install shunt on negative battery terminal.
2. Set Meter. See Figure 7.
3. Connect RED test lead to Red post terminal on shunt ([A] Fig. 25).
4. Connect BLACK test lead to BLACK post terminal on shunt ([B] Fig. 25).
5. Start engine and stabilize at 3600 RPM.

Output should be:

- 3-10 Amps for a 10 Amp System
- 3-16 Amps for a 16 Amp System

### If no or low output is found:

- Be sure that the regulator-rectifier is grounded and all connections are clean and secure.

### If there is still no or low output:

- Replace the regulator-rectifier.

## Dual Circuit Alternator

The dual circuit alternator provides DC for battery charging and AC for the headlights. The battery is not used for the lights, so lights are available if battery is disconnected or removed.

The current from the DC side of the alternator is unregulated and rated at 3 amps. The output rises from 2 amps at 2400 RPM to 3 amps at 3600 RPM.

This alternator uses a polarized plug with two pins. The RED lead (A) charges the battery, the WHITE lead (B) Fig. 26) is for lights.

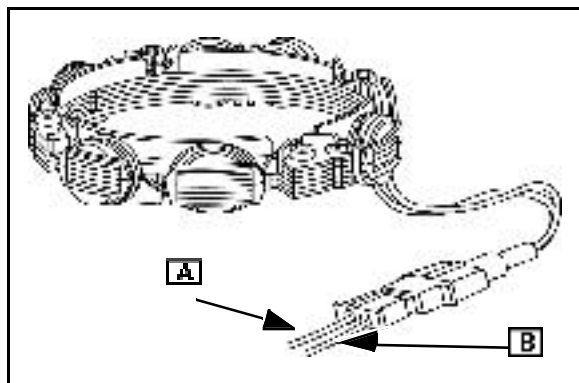


Fig. 26

### Dual Circuit Alternator DC Output Test

Test in the following sequence:

1. Set meter. See Figure 11.
2. Attach RED test lead clip to DC output pin ([E] Fig. 27) in the connector ([F] Fig. 27).

The bump on the connector indicates the DC output terminal.

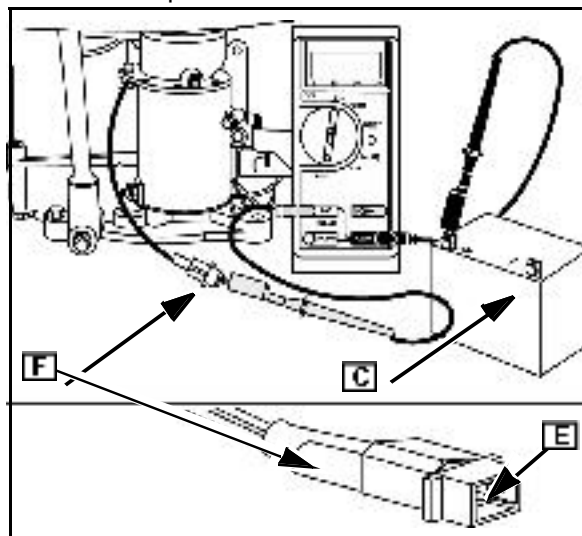


Fig. 27

3. Attach BLACK test lead clip to positive (+) battery terminal.
4. Start engine.

With a fully charged battery, output will be approximately 2 amps DC at 3600 RPM.

### If no or low output is found:

- Test the diode.

### Dual Circuit Diode Test

1. Rotate selector to +) (DIODE TEST) position. See Figure 9.
2. Attach RED test lead clip (A) to point (B) and BLACK test lead clip (C) to DC output pin (D). Fig. 28. (It may be necessary to pierce wire with a pin as shown(E)).

### If meter beeps once:

- Diode is OK.

### If meter makes a continuous tone:

- Diode is shorted.
- Replace the diode.

### If meter displays OL:

- Proceed to step 3.
- 3. Reverse test leads.

### If meter beeps once:

- Diode is installed backwards.



### If meter still displays OL:

- Diode is open.
  - Replace the diode.
4. If diode tests OK, check stator for bare wires or other obvious defects. If grounded leads are not visible, replace the stator.

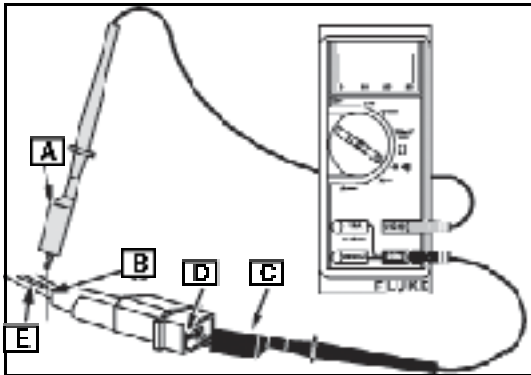


Fig. 28

**NOTE:** Service replacement diode harnesses are available. Use resin core solder when installing new harness. Use shrink tubing or tape all connections. **DO NOT USE CRIMP CONNECTORS.**

### Dual Circuit Alternator AC Output Test

1. Set meter. See Figure 5.
2. Attach RED test lead clip to AC output terminal ([G] Fig. 29).

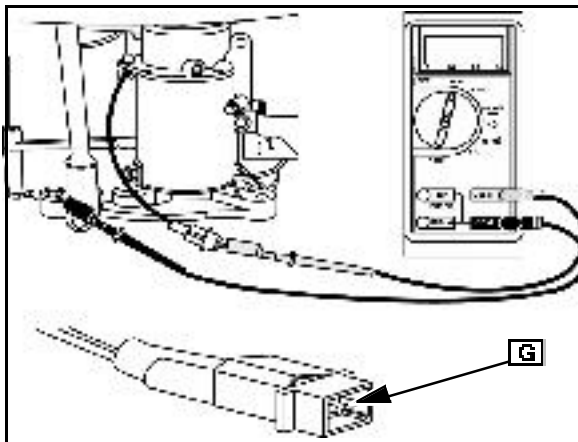


Fig. 29

3. Attach BLACK test lead clip to engine ground.
4. Start engine.

Output should be no less than 14 volts AC @ 3600 RPM.

### If no or low output is found:

- Replace stator.

### Tri-Circuit Alternator

The tri-circuit alternator provides AC through a single output lead and connector ([B] Fig. 29) to a wiring harness containing two diodes (C). One diode rectifies the AC to 5 amps negative (-) DC for lights (D). The second diode rectifies the AC to 5 amps positive (+) DC for battery charging and external loads ([E] Fig. 30).

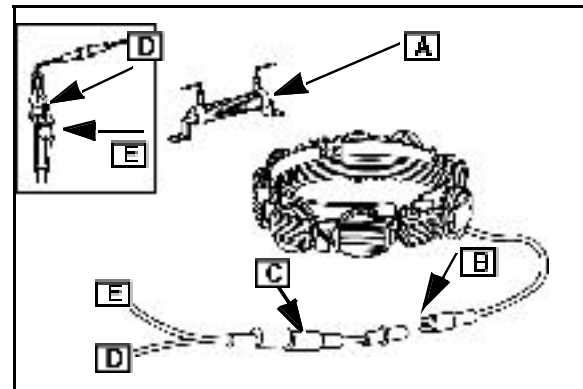


Fig. 30

**NOTE:** Some equipment manufacturers supply the diodes as an integral part of the equipment wiring harness.

A 1 ohm 20 watt resistor (supplied by OEM) ([A] Fig. 76) is placed in series with the (+) DC charging lead, limiting the charging current to approximately 3 amps when the clutch is not engaged. When the clutch is engaged the resistor is bypassed allowing full output to the battery and clutch. Since the alternator powers the lights, the lights are available even if the battery is disconnected or removed. Current for the lights is available as long as the engine is running. The output depends upon engine RPM, so the intensity of the lights changes with engine speed.

Test in the following sequence:

1. Set meter. See Figure 5.
2. Attach RED test lead clip to green output terminal ([F] Fig. 31).

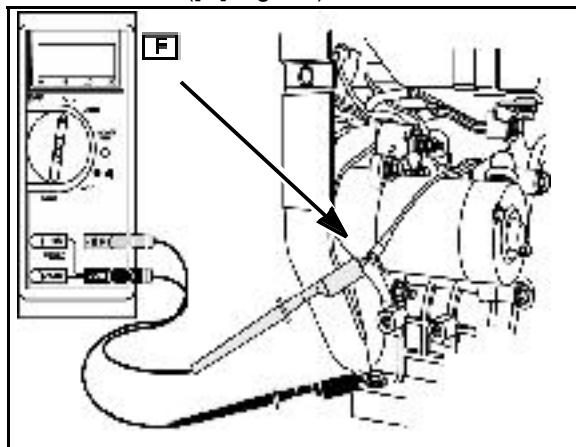


Fig. 31

3. Attach BLACK test lead clip to engine ground. Output should be no less than 28 Volts AC @ 3600 RPM.

**If no or low output is found:**

- Replace stator.

**If alternator output is good:**

- Test diodes located in wiring harness.

### Diode Test

**NOTE:** One diode is for the charging circuit and the other diode is for the lighting circuit.

In the Diode Test position, the meter will display the forward voltage drop across the diode(s). If the voltage drop is less than 0.7 volts, the meter will "Beep" once as well as display the voltage drop. A continuous tone indicates continuity (shorted diode). An incomplete circuit (open diode) will be displayed as "OL."

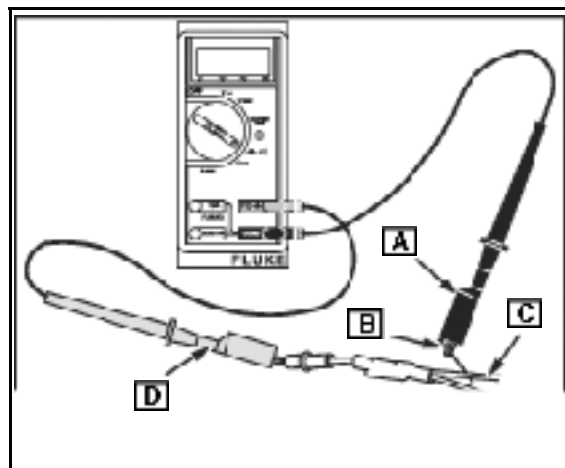


Fig. 32

### Charging Circuit Test (Red Wire)

1. Insert RED test lead into **VΩ** receptacle in meter.
2. Insert BLACK test lead into **COM** receptacle in meter.
3. Rotate selector to **+** (DIODE TEST) position. See Figure 9.
4. Attach BLACK test lead clip (**A**) to point (**B**) of the RED wire (**C**), Fig. 32. (It may be necessary to pierce wire with pin as shown.)
5. Insert RED test lead (**D**) into harness connector.
  - If meter **BEEPS** once, diode is OK.
  - If meter makes a **CONTINUOUS TONE**, diode is shorted. Replace harness.
  - If meter displays **OL** proceed to step 6.
6. Reverse test leads.
  - If meter **BEEPS** once, diode is installed backwards. Replace harness.
  - If meter still displays **OL**, diode is open. Replace harness.

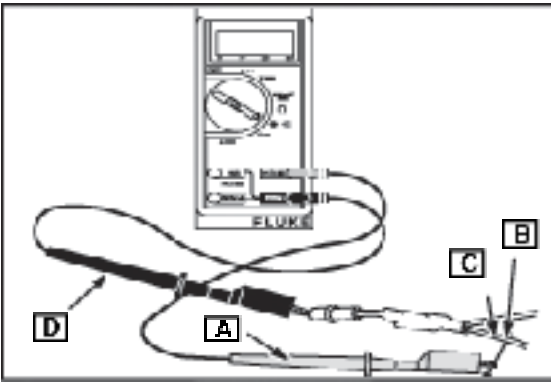


Fig. 33

### Lighting Circuit Test (White Wire)

1. Insert RED test lead into **VΩ** receptacle in meter.
2. Insert BLACK test lead into **COM** receptacle.
3. Rotate selector to **diode test** position. See Figure 9.
4. Attach RED test lead clip (A) to point (B) of the WHITE wire (C), FIG.33. (It may be necessary to pierce wire with a pin as shown.)
5. Insert BLACK test lead probe (D) into harness connector.
  - If meter **BEEPS** once, diode is OK.
  - If meter makes a **CONTINUOUS TONE**, diode is shorted. Replace harness.
  - If meter displays **OL** proceed to step 6.
6. Reverse test leads.
  - If meter **BEEPS** once, diode is installed backwards. Replace harness.
  - If meter still displays **OL** diode is open. Replace harness.

**NOTE:** Service replacement diode harnesses are available.

### Anti-Afterfire Solenoid Test

The anti-afterfire solenoid is controlled by the equipment key switch. With the switch **OFF**, the solenoid plunger closes, stopping fuel flow through the fixed main jet. With the switch in the **ON** and **START** positions, the solenoid plunger opens, allowing normal fuel flow. The solenoid is operating properly if it clicks when the switch is turned **ON** or **OFF**. If solenoid does not click, the problem could be the equipment wiring, engine wiring or the solenoid.

Afterfire can also be caused by using the afterfire terminal of the key switch to turn the alternator **OFF** when the engine is turned **OFF**. The alternator continues to produce voltage and current as long as the engine continues to turn over, even with the key **OFF**. The voltage and current continue to energize the anti-afterfire solenoid allowing fuel to pass through the engine, into the hot muffler, causing the afterfire. If the equipment is wired this way, replace the 5 terminal switch with a 6 terminal switch.

Use the correct wiring diagram for the type of alternator used.

Early solenoids were grounded through the solenoid case.

To determine the problem, perform the following tests in order:

**NOTE:** The solenoid requires 9 volts minimum DC to function.

1. Remove solenoid from carburetor.
2. Place a jumper wire on either terminal of a 9 volt transistor battery and on one of the pins ([B] Fig. 34) in the solenoid connector.
3. Place another jumper wire on the remaining pin ([B] Fig. 34) in the solenoid connector and on the other terminal of the battery.



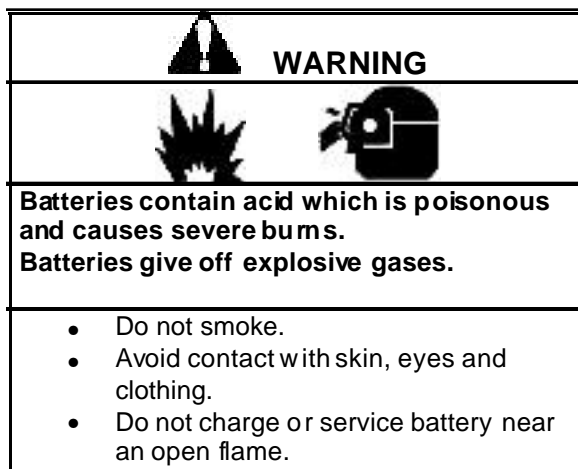
Fig. 34

2

## Batteries

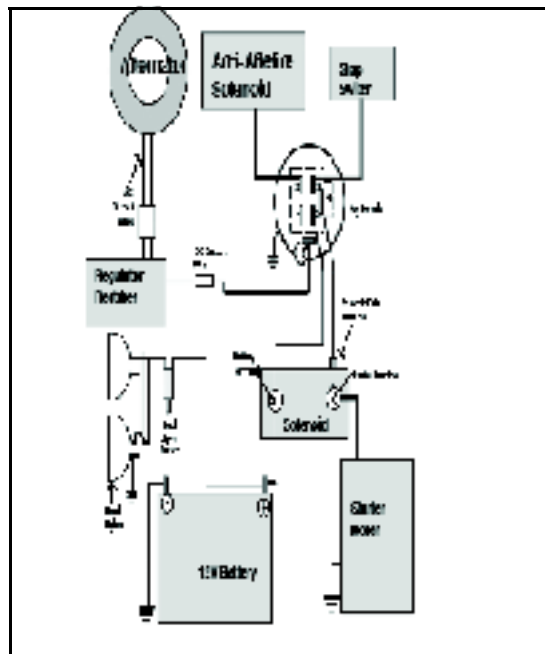
## Handling Instructions

- Keep batteries away from children.
- Do not puncture, mutilate, disassemble or incinerate.
- Do not (short) make direct contact between (+) positive and (-) negative battery terminals.



## Installing A Battery

1. Connect all equipment being operated.
2. Place battery in holder with a flat base.
3. Tighten hold-down evenly until snug.
4. Connect positive cable (+) first.
5. Connect negative cable (-) last.



**Fig. 35**

## Testing Battery

1. Physical check - clean if necessary and check for:
  - Corrosion
  - Dirt
  - Terminals, clamps (secure, in good condition)
2. Bring battery to full charge.
  - Use a charger that automatically reduces charge rate.
  - Fill battery cells with distilled water after charging (for batteries previously in service).

**NOTE:** If battery gets hot to the touch, or is spitting acid (gassing), unplug charger periodically.

3. Set meter to DC Volts. See Figure 6.
4. Attach RED meter test clip to positive (+) battery terminal.
5. Attach BLACK meter test lead to negative (-) battery terminal.
6. With key switch OFF, press starter button. If ignition and starter use the same switch, ground the ignition using Ignition Tester #19368.
7. Turn switch to START.

Meter should display **9 volts** or more when cranking engine.

**If less than 9 volts:**

- Replace battery.
8. With battery charged, check specific gravity readings of each cell (**B**) with a hydrometer (**A**) Fig. 36).
  9. Record the results.

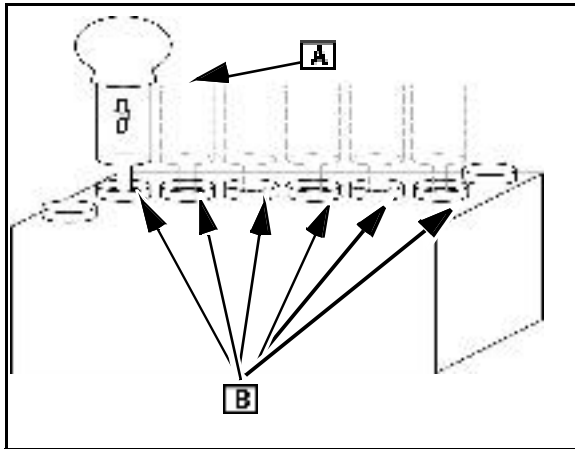


Fig. 36

Readings should be above 1.250 (compensating for temperature).

Replace the battery if specific gravity readings vary **0.50** or if all cells read less than **1.225**.

**Stop Switch Test**

1. Move speed control to **FAST**, then to **STOP**. The control lever tab (**A**) must contact the stop switch tang (**B**) Fig. 37).

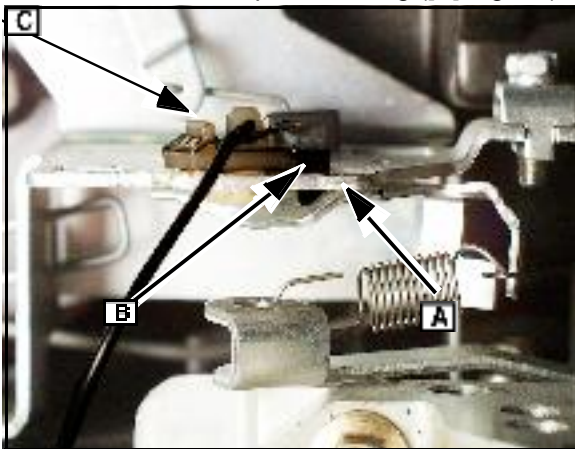


Fig. 37

**If control lever does not contact stop switch tang:**

- Check control cable for adjustment or binding. Bend tang as required or replace worn parts as needed.
2. Inspect stop switch mounting to be sure switch is firmly anchored in control bracket. Replace switch if it cannot be anchored securely.
  3. Set meter to test for continuity. See Figure 8.
  4. Move speed control to **FAST**.
  5. Disconnect stop switch wire (**A**) Fig. 37) at ignition armature (**C**) Fig. 37).
  6. Connect test probe to wire terminal (**B**) Fig. 37)

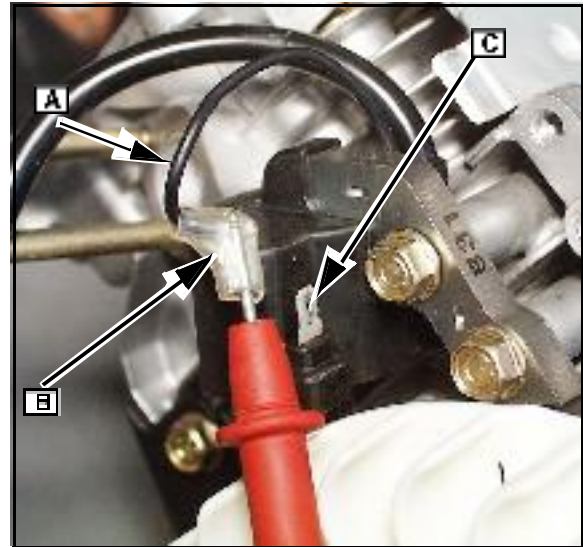


Fig. 38

7. Connect one test lead to switch tang (**D**) Fig. 37) and the other lead to ignition stop wire.

**NOTE:** Ensure that control lever tab (**F**) Fig. 38) does not contact switch tang at (**E**) Fig. 38).



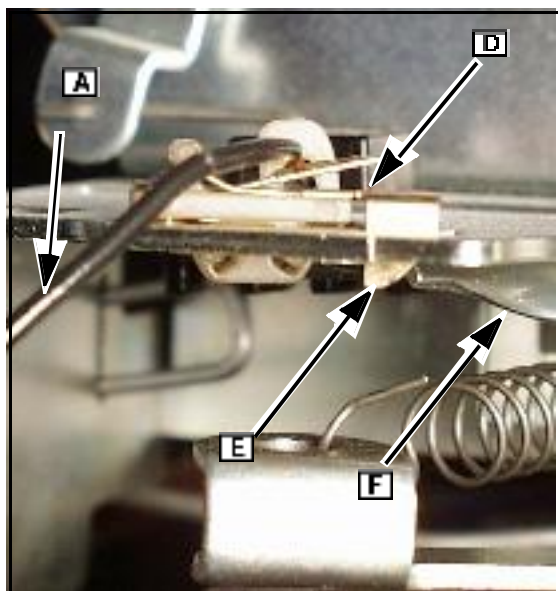


Fig. 39

8. Move stop switch wire(s) ([A] Fig. 39). Continuity should remain constant. If intermittent or no continuity exists, repair or replace wire(s) or connections.
9. Move test lead from stop switch wire ([A] Fig. 39) to engine ground.

With speed control set to **FAST**,

- There should be no continuity.
10. Move speed control to **STOP**.
    - The meter should show continuity.

### Flywheel Brake Test (104700)

This model uses a mechanical flywheel brake in addition to a stop switch that grounds the coil.

1. Remove flywheel cover
2. Move safety control on equipment to **RUN**, then to **STOP**. The tab on the brake pad lever ([B] Fig. 40) must contact the switch tang ([C] Fig. 40).

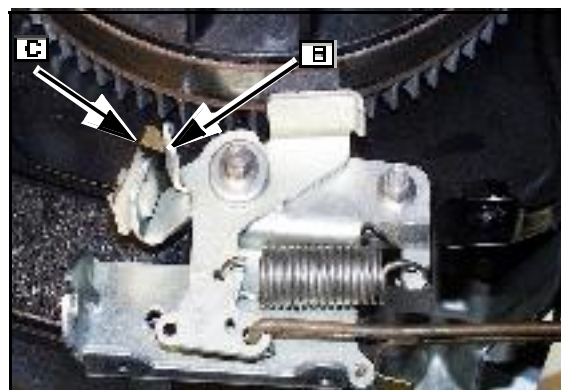


Fig. 40

3. Move safety control to **RUN**. The brake pad lever tab must not contact the switch tang.
4. Adjust control as necessary or per OEM instructions.

### Rocker Switch Test

**(085400, 115400, 117400, 138400, 161400, 185400, 235400, 245400)**

Two types of rocker switches are used to stop these engines. One has two spade terminals. The other has three terminals and is used only with Oil Gard®. Test both switches the same way.

1. Set meter to ohms. See Figure 8.

On two terminal switches connect meter leads to both terminals ([A] Fig. 44), on three terminal switches connect leads to terminals 2 and 3.

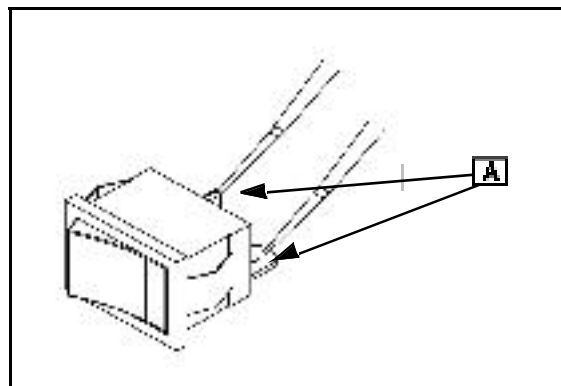


Fig. 41

2. Operate rocker switch and observe meter readings.
3. The meter should show maximum or very low resistance as the switch is moved back and forth. Replace the switch if it remains open or closed in both positions.

**NOTE:** (185430-0099-01) is wired with components supplied by the OEM. Contact the OEM for wiring diagrams and service information.

### Stop Switch Adjustments (161400)

1. Move remote speed control to the **FAST** position.
2. The governor control lever should not ([A] Fig. 42) make contact with the stop switch tang.

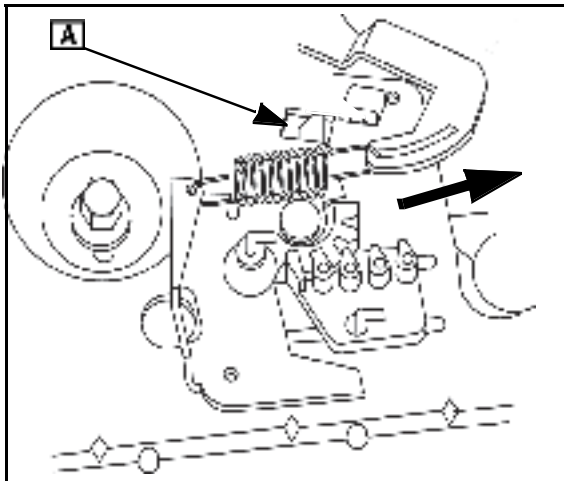


Fig. 42

3. Move the remote to the **STOP** position. The engine governor control lever tab should be contacting the stop switch tang ([B] Fig. 43).

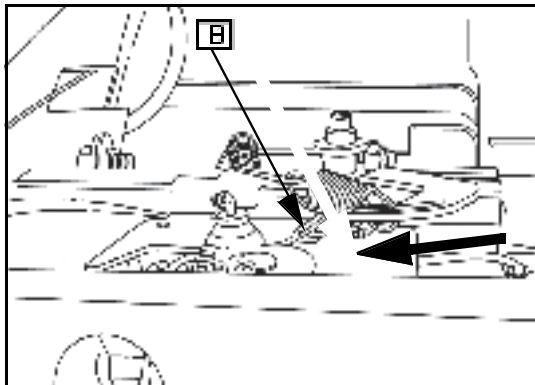


Fig. 43

### If control lever does not contact stop switch tang:

- Check control cable for adjustment or binding. Adjust as required or replace worn parts as needed.
- Be sure the stop switch is firmly anchored in control bracket. Replace switch if it cannot be anchored securely.

## Key & Interlock Switches

### Troubleshooting Interlock Switch (104700)

1. Disconnect interlock switch wires from spade terminals of switch.
2. Set meter to read Ohms. See Figure 8.
3. Connect test leads to two spade terminals ([A] Fig. 44) of switch. There should be no continuity.

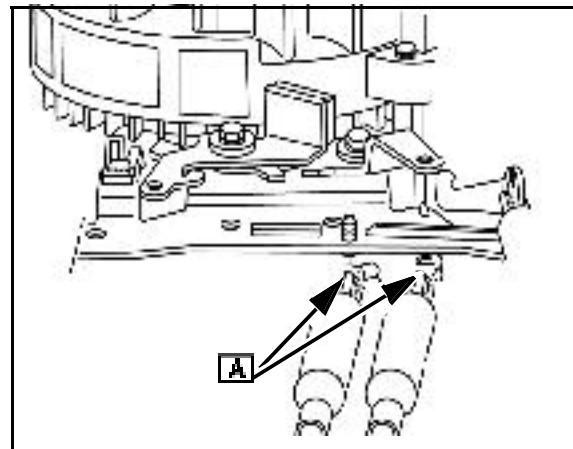


Fig. 44

4. Push switch lever in until switch clicks. Meter should read continuity.

### Troubleshooting Five-Terminal Key Switch

1. Disconnect wires from key switch.
2. Set meter to test for continuity. See Figure 8.
3. Check continuity between terminals with switch in **OFF**, **RUN** and **START** positions per Key Switch Continuity Chart.

There should be continuity between the terminals as listed in the table. Replace switch if there is no continuity or continuity exists where it should not.

	M	M+	B	L	ST	
OFF	Yes	Yes				Stop
1			Yes	Yes		Run
2			Yes		Yes	Start

4. Check each terminal for continuity to ground. The only terminal that should have continuity to ground is the M terminal.

**If there is continuity at any other terminal:**

- Replace switch.

**If switch is good:**

- Check wires for loose or broken connectors and continuity.
- Repair or replace as required.

#### Troubleshooting Six-Terminal Key Switch

1. Remove carburetor cover with key switch. Disconnect wiring harness from key switch.
2. Set multimeter to Diode Test.

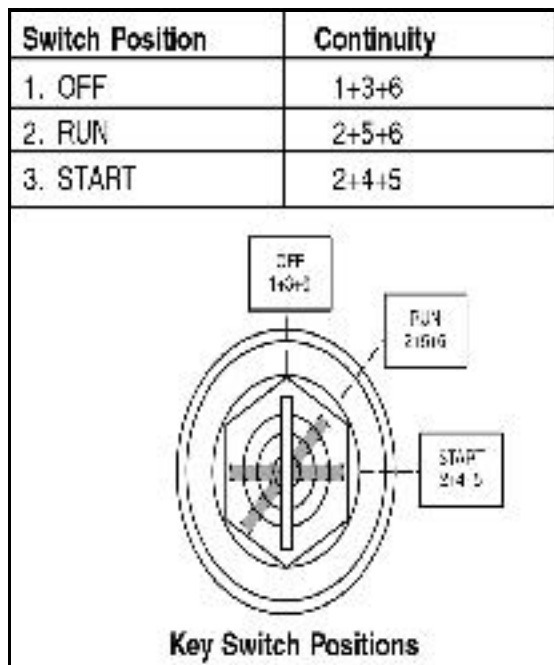


Fig. 45

3. There must be continuity between terminals with key switch in position shown. See number sequence of terminals

shown in Fig. 45. There must be continuity between terminals #1, #3, #6 and the key switch case when key switch is OFF.

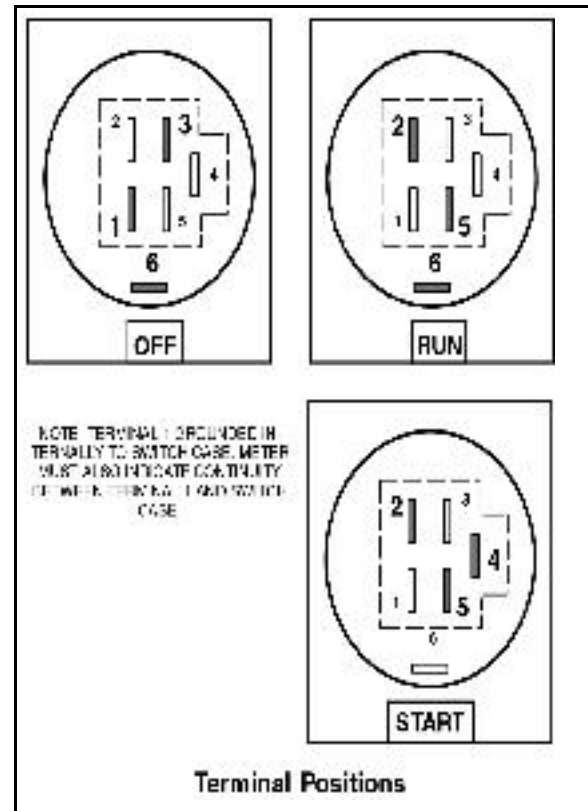


Fig. 46

4. Disconnect interlock switch wires from spade terminals on switch and at starter motor connector.
5. Set multimeter to Ohms. See Figure 8.
6. Connect one meter test lead to the end of one wire connector. Connect the other test lead to connector terminal for the same wire.
7. Meter should read low or no resistance.
8. Move wire inside connector.
  - Meter should not change value.
  - Replace or repair wiring if there is intermittent or no continuity.
  - Repeat for each wire in harness.

#### Low Oil Pressure Switch

The oil pressure switch is located on the sump, oil filter adapter ([A] Fig. 47), or on the bypass cover, Fig. 48.

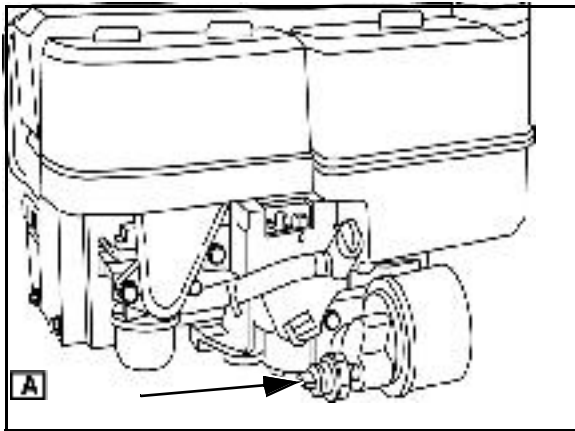


Fig. 47

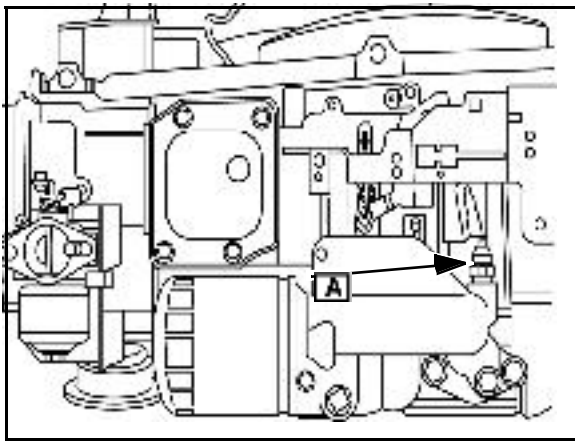


Fig. 48

**NOTE: (104700)** The pressure switch may activate at engine speeds below 2000 RPM, which is normal.

**If the switch does not deactivate at speeds above 2000 RPM:**

- Stop the engine and check for proper oil level.
- Perform an oil pressure and/or oil pressure switch test.

### Oil Pressure Switch Test

Set meter. See Figure 8.

1. Remove the switch.

2. Connect one tester lead to the switch terminal and the other tester lead to the metal body of the switch, Fig. 49.

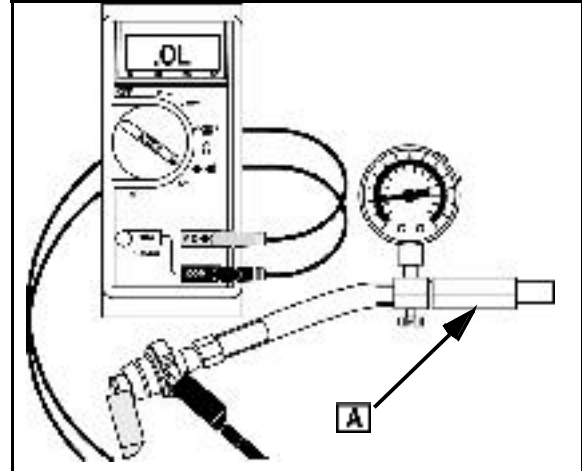


Fig. 49

There should be continuity when no pressure is applied to the switch.

3. Connect the probe end of the switch to a low pressure source ([A] Fig. 49).

The switch should open at approximately:

- **104700** - 4 to 6 psi (0.28 - 0.41 bar)
- **260700, 261700** - 7 to 10 psi (0.48 - 0.69 bar)
- **28Q700** - 7 to 10 psi (0.48 - 0.69 bar)

4. Replace the switch if test results are not to specification. Torque to listed value.

5. Start engine and check for oil leaks.

### Oil Pressure Test

If the oil pressure switch is within specification and the warning light remains on, verify engine oil pressure with an oil pressure gauge ([A] Fig. 50).

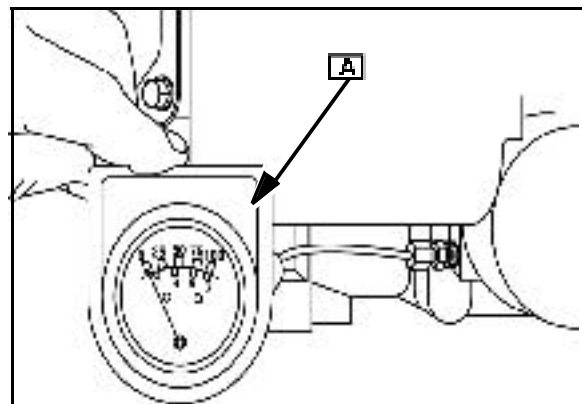


Fig. 50

1. Oil level must be between the **ADD** and **FULL** mark on dipstick.
2. Remove pressure switch or 1/8 in. NPTF plug in oil filter adapter.
3. Install oil pressure gauge ([A] Fig. 50).
4. Start engine. Run for approximately 5 minutes.
5. Check oil pressure at 3000 RPM. Oil Pressure should be 10~50 psi (0.7~3.5 Bar).

**If Oil Pressure is Low, check for:**

- Engine RPM Too Low
- Wrong Viscosity or Diluted Oil
- Low Oil Level
- Broken Pressure Relief Spring
- Missing Pressure Relief Plunger
- Worn Bearings
- Damaged or Worn Oil Pump

**If Oil Pressure is High, check for:**

- Wrong Viscosity Oil
- Plugged Oil Galleries
- Stuck Pressure Relief Plunger

## OIL GARD® LOW-OIL PROTECTION SYSTEMS

VANGUARD™ series engines are equipped with Oil Gard® low oil protection systems designed to prevent engine damage from running with insufficient oil. This oil float system is mounted inside the engine cylinder. Oil Gard® will shut down a running engine and prevent it from restarting if the oil level becomes too low.

When the oil drops below the minimum level, a float pin contacts the sensor mounting bracket in the cylinder. This completes a circuit from the ignition coil, through the module, to the float sensor and then to ground. This grounds the ignition coil and prevents the spark plug from firing. When a restart is attempted, a light in the ON/OFF switch flashes to indicate LOW OIL.

The Oil Gard® protection system consists of:

- An oil float sensor located inside the cylinder.
- An electronic module.
- An **ON/OFF** rocker switch.
- Connecting wires.

The system may have a module with four wires (BLUE, BLACK, WHITE and RED) or two wires (BLACK, BLACK).

**Preliminary Low Oil Checks:**

- Ensure the engine oil level is to the **FULL** mark.
- Ensure the fuel delivery system is functioning properly.
- Ensure that the engine is not being operated at an excessive angle.
- Ensure that the wiring is not obviously pinched or otherwise damaged.

### Troubleshooting Oil Gard® 2-Wire Systems

**Symptom: Engine starts, dies and will not keep running**

Disconnect the BLUE or BLACK wire at ([A] Fig. 51) and start engine.

**If the engine starts and dies:**

- Replace the module ([E] Fig. 51) and retest.

**If the engine starts and continues to run:**

- Reconnect the wire at [A].

**If the engine dies:**

- Check continuity in the wire between ([A and B] Fig. 51).

**If there is no continuity:**

- Replace the wire.

**If the wire has continuity:**

- Replace the float sensor in the cylinder [F].

**Symptom: Engine will not start**

- Disconnect wires at ([C and D] Fig. 51) and attempt an engine start.

**If the engine does not start:**

- Check the ignition armature (G) for grounds.

**If the engine starts and runs:**

- Reconnect the wire at (C).

**If the engine does not stop:**

- Reconnect the wire at (D).

**If the engine dies:**



- Check the ignition switch ([H] Fig. 51).

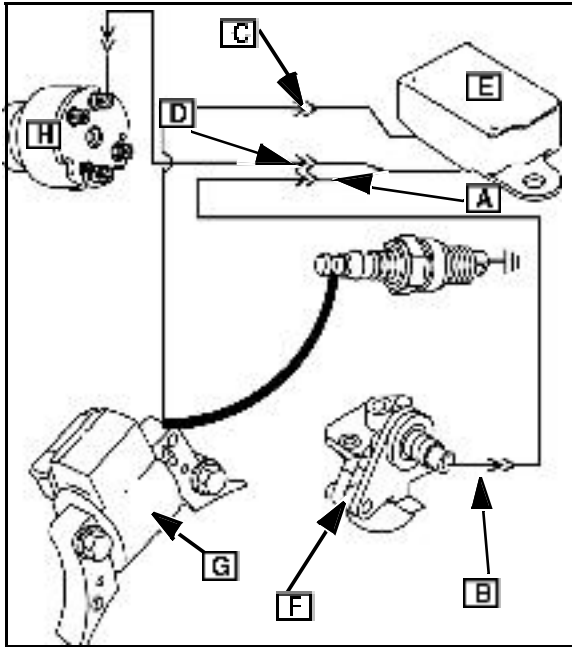


Fig. 51

### Troubleshooting Oil Gard® 4-Wire System

**NOTE: (185430, Type 0099-1)** These engines are wired with components supplied by both Briggs & Stratton and the OEM. Contact the OEM for wiring diagrams and service information.

#### Symptom: Engine starts, dies, and will not stay running

- Disconnect BLUE or BLACK wire at ([A] Fig. 52) and start engine.

#### If the engine starts and dies:

- Replace the module (E) and retest.

#### If the engine starts and runs:

- Reconnect the wire at (A).

#### If the engine d i es:

- Check continuity in the wire between (A) and (B).

#### If there is no continuity:

- Replace the wire.

#### If the wire is good:

- Replace the float sensor in the cylinder ([F] Fig. 52).

#### Symptom: Engine will not start

- Disconnect wire at ([C and D] Fig. 52) and start engine.

#### If the engine does not start:

- Check the ignition armature (G) for grounds.

#### If the engine starts and runs:

- Reconnect the wire at (C).

#### If the engine does not stop:

- Reconnect the wire at (D).

#### If the engine d i es:

- Check the **ON/OFF** rocker switch ([H] Fig. 52).

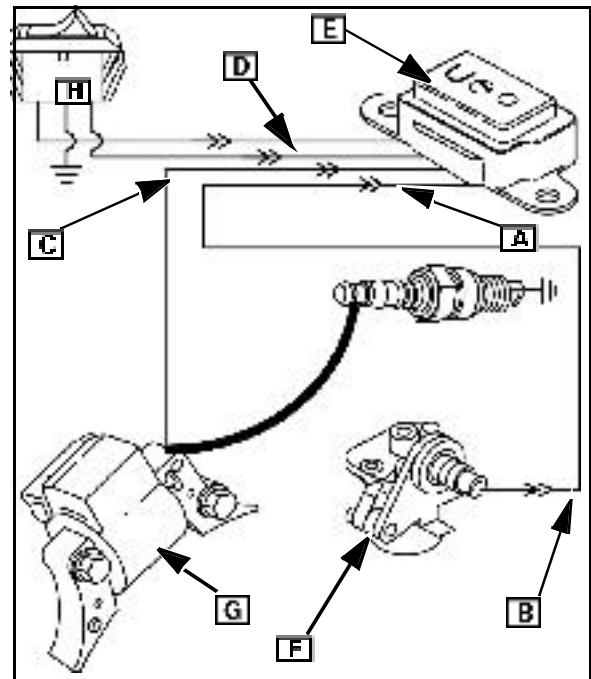


Fig. 52

## Troubleshooting Oil Gard® (161400)

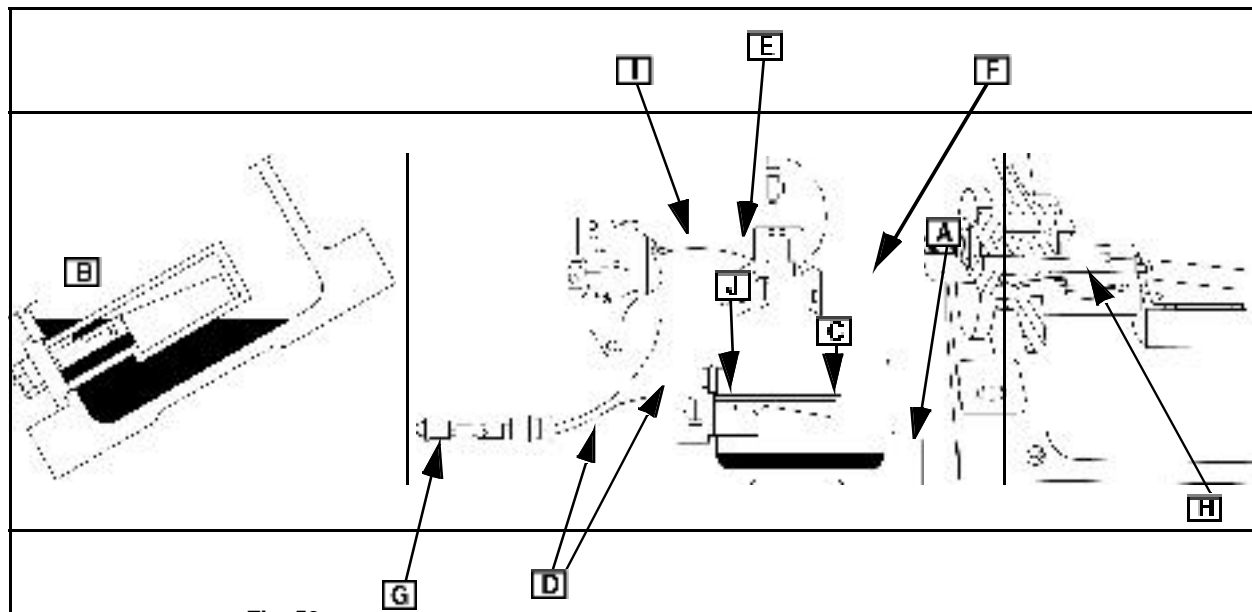


Fig. 53

2

Problem	Letter	Cause	Remedy
No Spark - Light Flashes	A	Low Oil In Cylinder	Refill With Oil
	B	Excessive Angle Of Operation	Reduce Angle of Operation
	C	Worn Oil Gard® Switch	Replace Switch
No Spark - Light Does Not Flash - Correct Amount of Oil In Cylinder	D	Wiring Harness Grounded	Repair Or Replace Wiring Harness
	E	Stop Wire Grounded	Repair Or Replace Wire
	F	Worn Magnetron® Armature	Replace Armature
Spark Present - Light Does Not Flash	G	Worn Light Or Harness	Replace Light
	H	Oil Gard® Switch Wire Not Making Ground To Cylinder	Adjust Wire
	C	Worn Oil Gard® Switch	Replace Switch
Intermittent Spark	D or E	Ground Stop Wire Or Harness	Repair Or Replace Wiring Harness
	C	Worn Oil Gard® Switch	Replace Switch
	H	Oil Gard® Switch Wire Not Making Ground To Cylinder	Adjust Switch Wire
No Spark - Light Does Not Flash	I or J	Wiring Harness Connections Reversed	Reverse Connections

## STARTER MOTORS

### Check Starter Motor Drive (All Models)

1. When the starter motor is activated, the pinion gear should rise, engage the flywheel ring gear and crank the engine. If the drive does not react properly, inspect the helix and pinion gears for operation or correct rotation, Fig. 54.

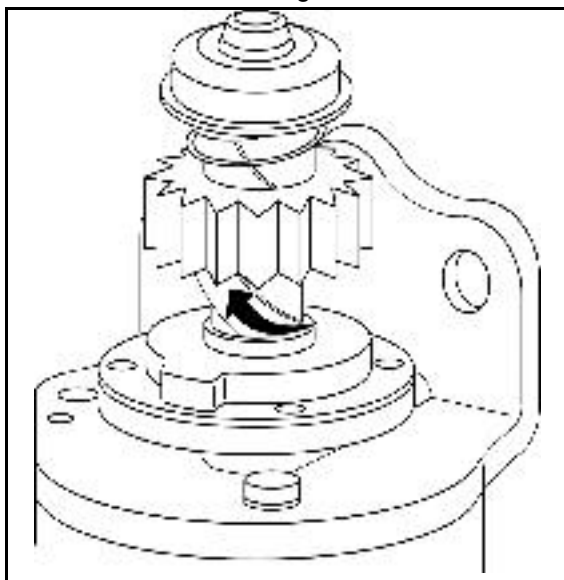


Fig. 54

2. Use lithium grease at base of helix to correct sticking. Proper starter operation depends on pinion moving freely on helix, Fig. 55.

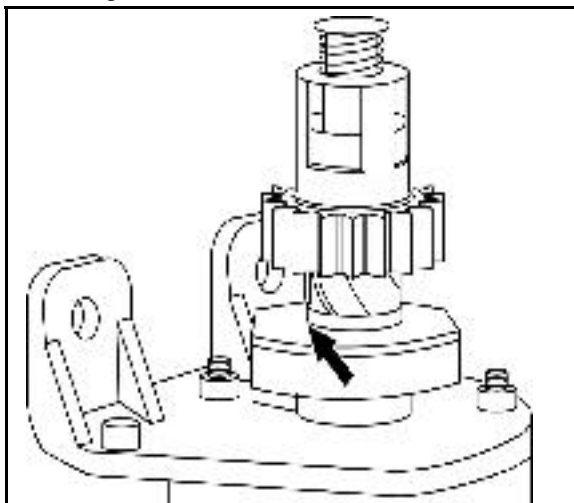


Fig. 55

### Check Starter Motor Wiring (138400, 185400, 235400, 245400)

Required Equipment:

Multimeter set to DC Volts.

1. Charge the battery if the voltage is low.
2. Set meter. See Figure 6.
3. Disconnect wire from starter terminal ([A] Fig. 56).
4. Connect BLACK test lead to engine ground or negative battery (-) post (B).
5. Connect RED test lead to the wire disconnected from the starter terminal.
6. Turn key switch to **START**. Multimeter should show approximate battery voltage.

If there is no voltage:

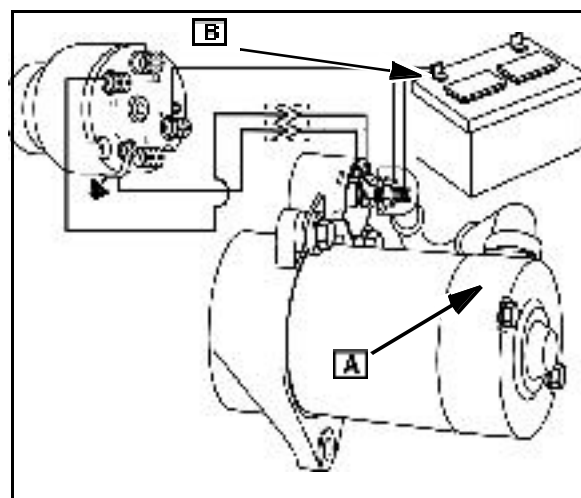


Fig. 56

If voltage is present:

- Remove and bench test the starter.

## Test Key Switch & Solenoid (138400, 185400, 235400, 245400)

Required Equipment:

Set meter. See Figure 8.

1. Turn the key switch **ON**.
2. Check for continuity at the input side (A) of the solenoid and ground ([B] Fig. 57).

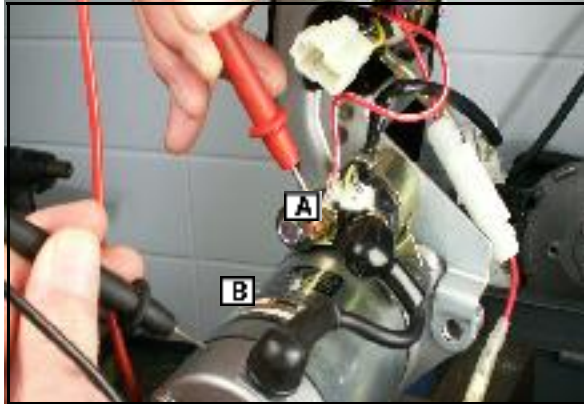


Fig. 57

If continuity is present:

- Proceed to step 3.

If not:

- Replace key switch.
3. Check for continuity at the yellow terminal (A) of the connector coming from the switch with the key in the **START** position and ground ([B] Fig. 58).

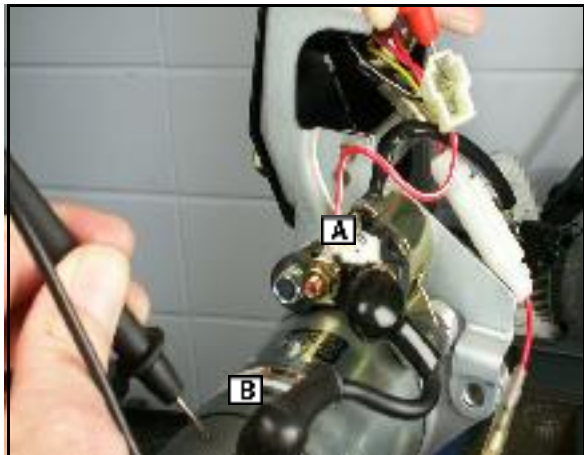


Fig. 58

If continuity is present:

- Proceed to step 4.

If not:

- Replace key switch.
4. Reconnect the connector from the starter switch.
  5. Test for continuity at the output terminal (A) of the solenoid with the key in the **START** position and ground ([B] Fig. 59).

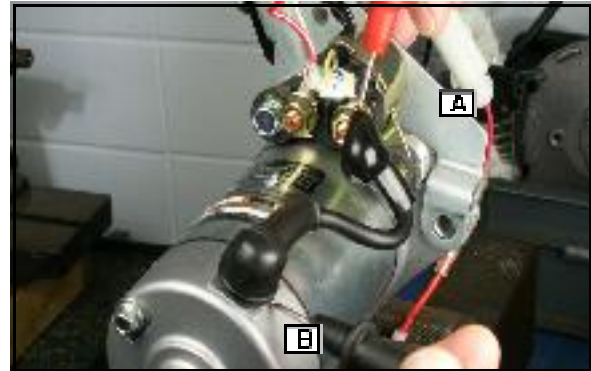


Fig. 59

If continuity is present:

- Replace starter.

If not:

- Replace solenoid.

## Check Starter Motor (138400, 185400, 235400, 245400)

Required Equipment:

- Digital Multimeter #19464 (E).
- Tachometer #19200
- DC Shunt #19468 ([D] Fig. 57)
- A fully charged 12 volt battery Fig. 60.

1. Set multimeter to 300mv. See Figure 7.

2. Connect starter motor (A), starter switch (B), DC shunt (C) on negative battery terminal (D) and meter ([E] Fig. 60).

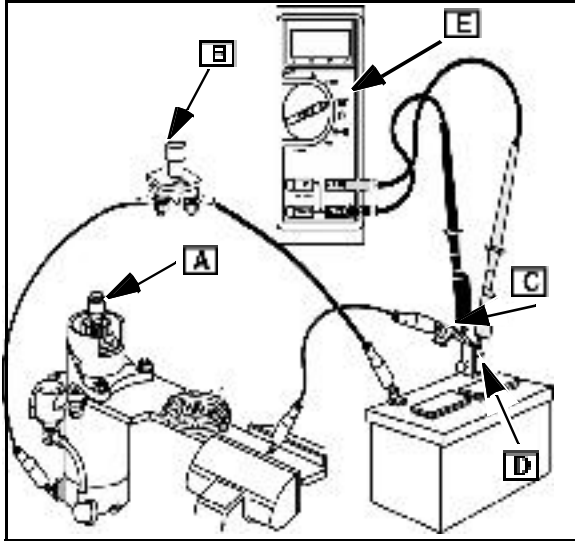


Fig. 60

3. Activate starter motor.
  - Tachometer should read 6800 RPM minimum.
  - Meter should not read more than 25 amps.

**If starter motor is not within specification:**

- Replace starter motor.

### Check Starter Motor (104700, 161400, 260700, 261700)

Required Equipment:

- Digital Multimeter (A), #19464
- DC Shunt (B), #19468
- Tachometer #19200, or equivalent
- A fully charged 12 volt battery ([C] Fig. 61).

Remove starter motor from engine.

1. Set multimeter to 300mv. See Figure 7.
2. Connect starter switch (D) to starter motor (E), battery (C), BLACK lead (G), RED lead (H), shunt (B) and multimeter ([A] Fig. 61).

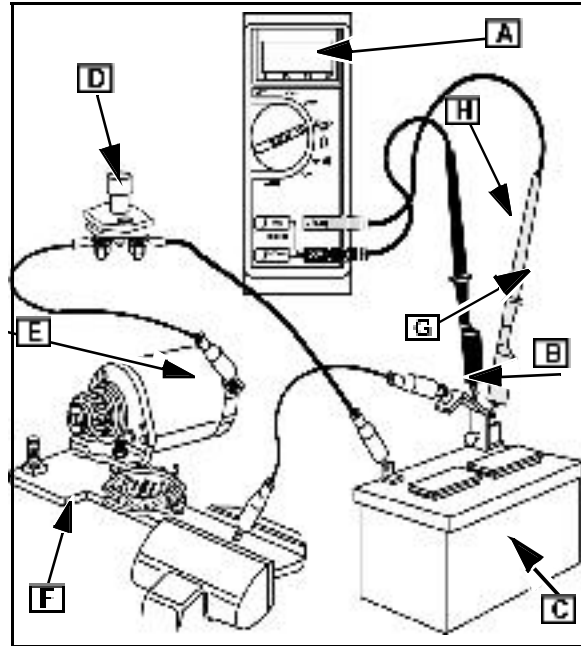


Fig. 61

3. Note length of starter motor housing.

#### Starter Motor Housing Specifications:

Housing Length in. (mm)	Minimum RPM	Maximum Amps
3.375 (85.7)	7000	24
3.656 (93)	5000	20
5.563 (116)	6500	35

4. Activate starter motor.
5. Note multimeter and tachometer readings.

A starter motor in good condition will be within specifications above.

**If starter motor is not within specification:**

- Replace starter motor.

## SECTION 3 - ENGINE DISASSEMBLY

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## GENERAL DISASSEMBLY STEPS

The sequence of actions required to disassemble the outer components of an engine vary from model to model. As a general rule, it is most efficient to remove only those items that prevent access to a system or part. This section discusses removing all external systems and components but does not open cylinder housings or heads.

**Always remove spark plugs before performing any maintenance on the engine.**

For information regarding the removal of fuel tanks and associated components for your model, **SEE SECTION 5- FUEL SYSTEMS AND CARBURETION.**

For information regarding the removal of exhaust systems, **SEE SECTION 4- EXHAUST SYSTEMS.**

### Blower Housing Removal (050000, 085400, 086400, 115400, 117400, 118400, 185400)

**NOTE: (050000, 118400)** Disconnect the return spring on the governor lever and the wire to the “Low Oil Sensing Module.”

Remove the mounting bolts ([A] Fig. 1) shown and set housing aside.

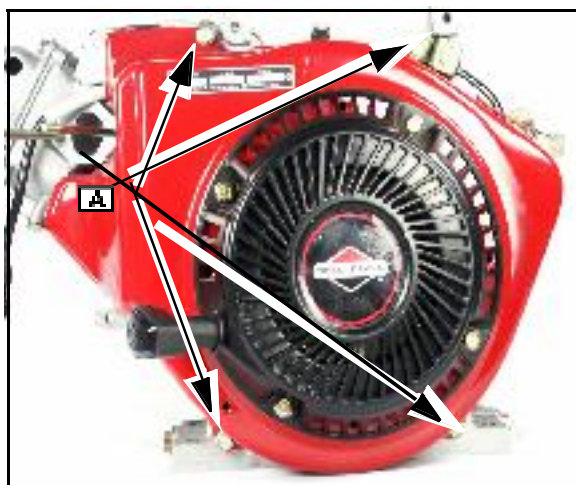


Fig. 1

### Blower Housing Removal (138400, 235400, 245400)

**NOTE:** Disconnect the wires ([A] Fig. 2) for the voltage regulator and key switch (if installed).

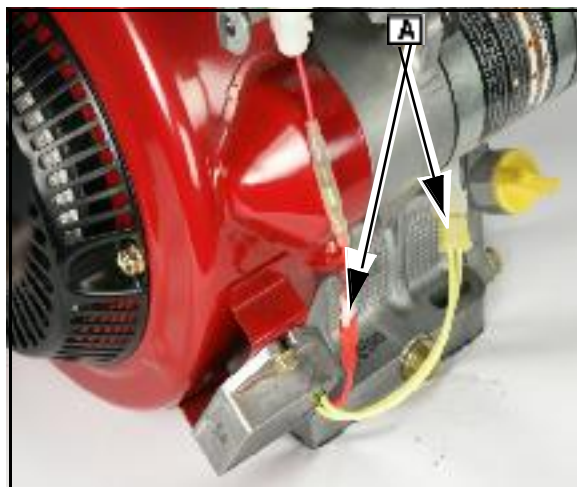


Fig. 2

### Blower Housing Removal (104700)

1. Remove the five screws that secure blower housing to engine ([A] Fig. 3).

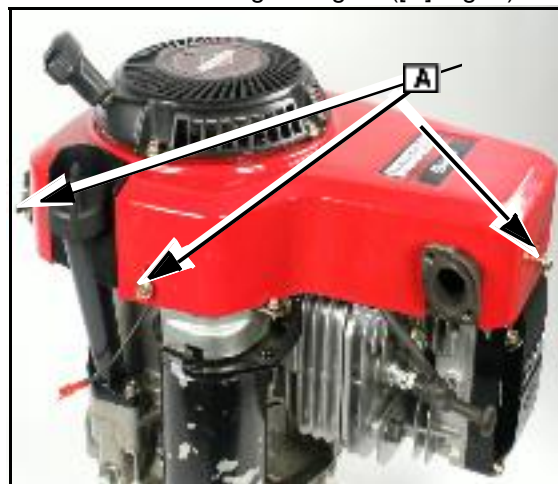


Fig. 3

## Blower Housing Removal (161400)

1. Remove the five screws ([A] Fig. 4) that secure the blower housing to the engine block.

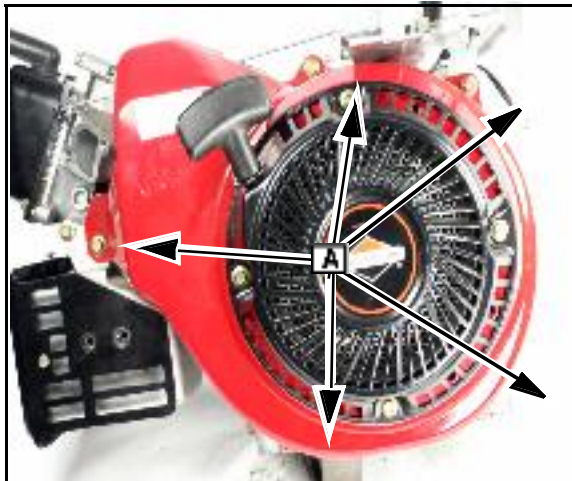


Fig. 4

## Blower Housing Removal (260700, 261700)

1. Remove the oil dipstick cap.
2. Remove screws ([A] Fig. 5) from the blower housing.

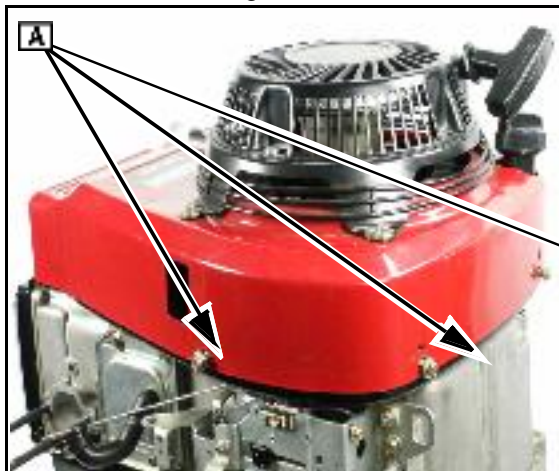


Fig. 5

## Blower Housing Removal (28Q700)

1. Remove the oil cap and dipstick assembly.
2. Remove the four screws (A) that secure the rotating screen.
3. Remove the two mounting bolts ([B] Fig. 6) that secure the fuel pump mounting bracket.

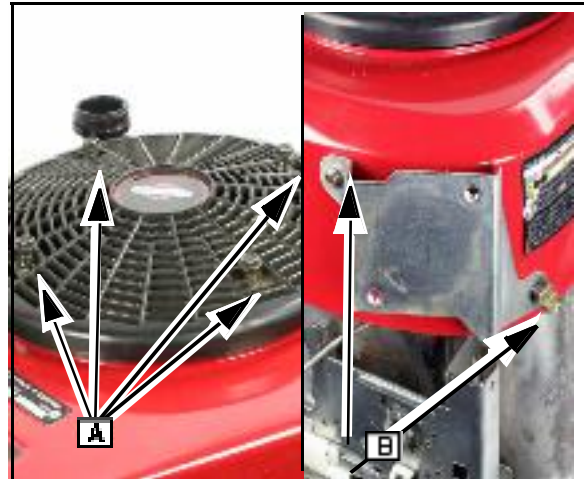


Fig. 6

4. Remove the two screws (A) that secure the top of the outer housing to the inner housing.
5. Remove the remaining screws ([B] Fig. 7) around the perimeter of the outer blower housing.

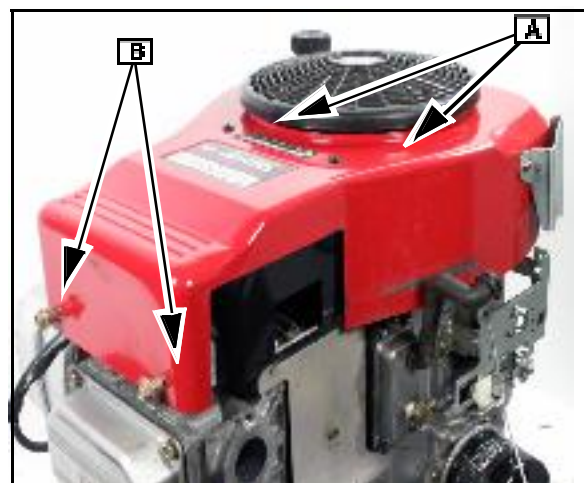


Fig. 7

6. Remove the two screws that secure the front housing bracket (A).

- Remove the two screws that hold the rear housing mounting bracket ([B] Fig. 8).

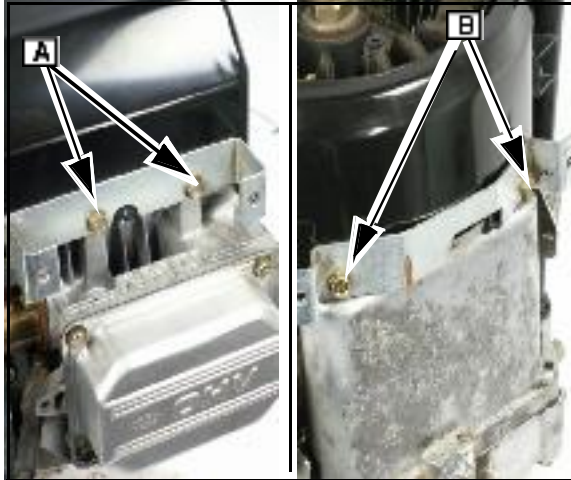


Fig. 8

- Remove inner blower housing and set aside.

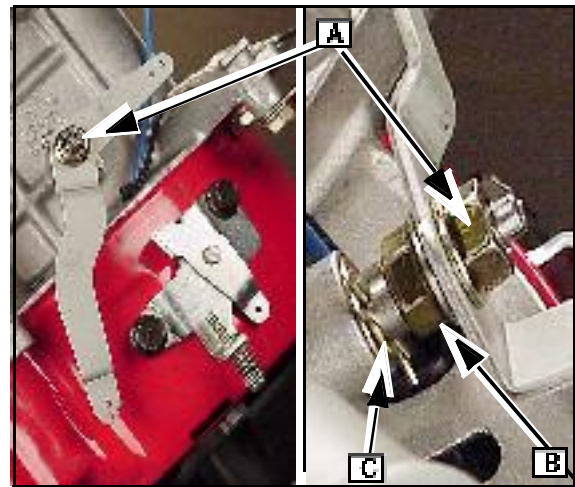


Fig. 9

**NOTE:** Leave the cotter pin ([C] Fig. 9) in the governor shaft to prevent it from falling into the cylinder.

## CONTROL BRACKETS

### Control Bracket Removal (050000, 085400, 086400, 115400, 117400, 118400, 138400, 185400, 235400, 245400)

Control brackets on these models are incorporated into the blower housing.

To remove the governor lever for the models listed above, refer to Fig. 9 and follow the steps outlined below:

- Hold the governor lever and remove the upper nut (A) securing the governor lever.

**CAUTION:** Do not bend the governor shaft cotter pin while removing the top or bottom governor lever nut.

- Remove the lower nut (B) and set aside.

**CAUTION:** 085400, 086400, 115400, 117400, 138400, 185400, 235400, 245400 have left-hand threads on the governor shaft.

### Control Bracket Removal (104700)

Part of the control bracket must be removed during the removal of the carburetor. **SEE SECTION 5- CHOKE BRACKET.**

The rest of the control bracket assembly cannot be disassembled until the flywheel is removed.

**SEE SECTION 3- FLYWHEEL REMOVAL.**

With the flywheel removed:

- Remove the alternator (if equipped) assembly ([A] Fig. 10).
- Remove the back plate ([B] Fig. 10).

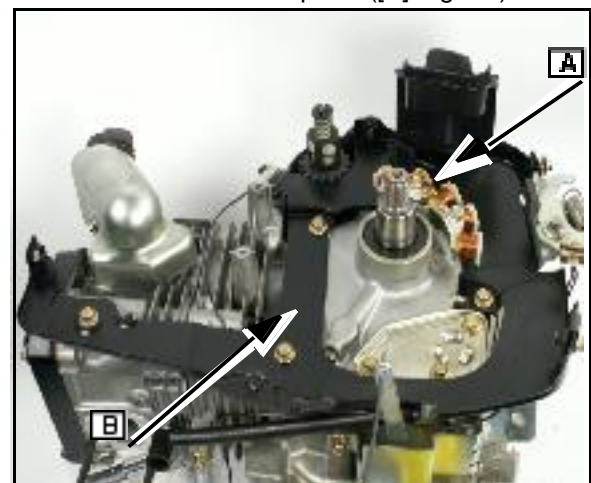


Fig. 10



3. Remove the screws holding the control bracket ([A] Fig. 11).

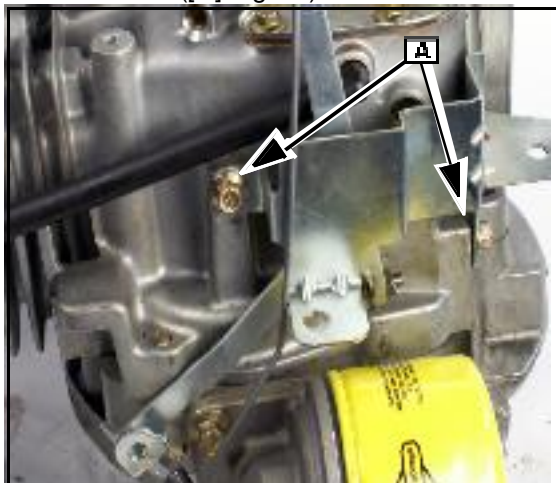


Fig. 11

4. Remove the clamp that secures the governor lever to the shaft.

### Control Bracket Removal (161400)

1. Remove governor lever. (A).
2. Disconnect springs and links (B) from governor lever.
3. Remove head bolts (C) that secure the control bracket to the cylinder head. When baffle is removed, re-install the bolts hand tight.
4. Remove the oil fill tube screw. ([D] Fig. 12)
5. Remove control bracket screws. ([E] Fig. 12).

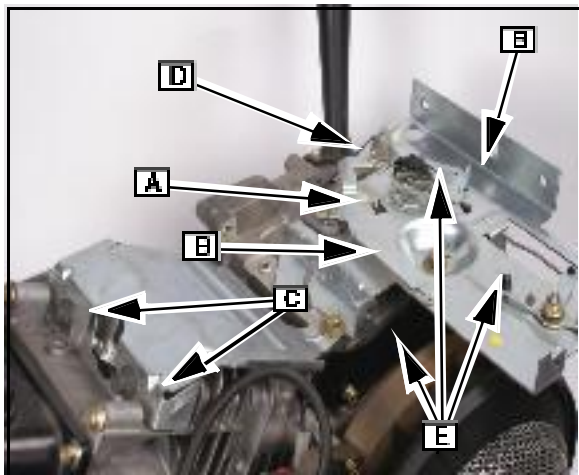


Fig. 12

6. Remove the wire from the Oil Gard® terminal and the stop switch.

### Control Bracket Removal (260700, 261700)

**NOTE:** For better access to the control bracket, remove the oil filter adapter first. **SEE SECTION 3- OIL FILTER ADAPTER.**

1. Remove the links and springs from the governor lever ([A] Fig. 13).

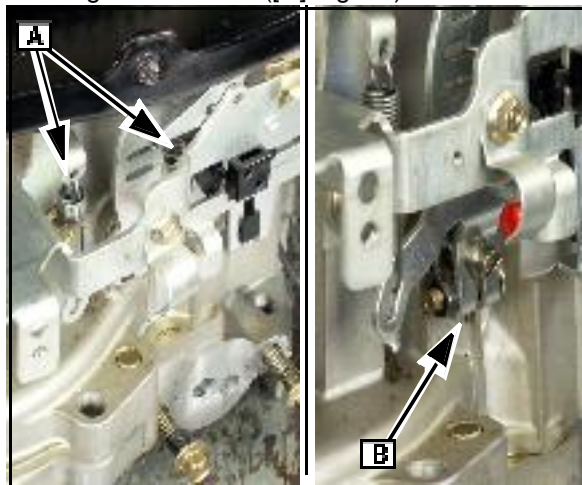


Fig. 13

2. Loosen governor lever screw and nut ([B] Fig. 13).
3. Remove control bracket screws ([A] Fig. 14).

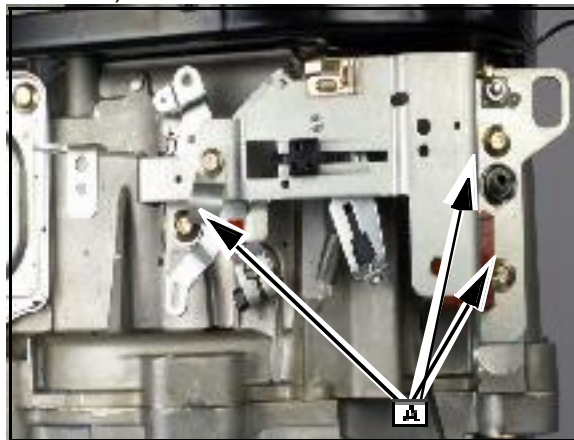


Fig. 14

Disconnect ground wires and remove the connector from the bracket.

## Control Bracket Removal (28Q700)

**NOTE:** Part of the control bracket assembly must be removed in order to remove the carburetor. **SEE SECTION 5- REMOVING CARBURETOR.**

To remove remaining control bracket components:

1. Remove the three screws ([A] Fig. 15) that secure the bracket to the cylinder.

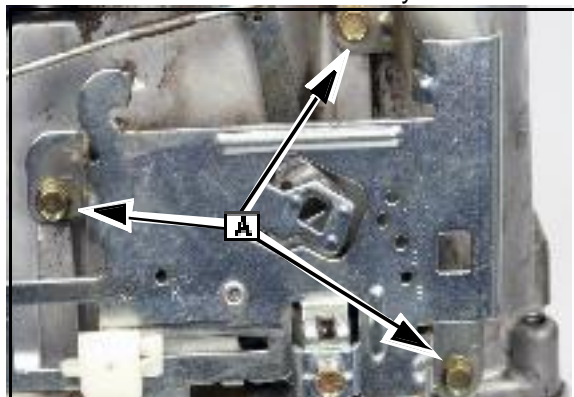


Fig. 15

2. Disconnect the governor return spring ([A] Fig. 16) and the throttle link ([B] Fig. 16) from the governor lever.

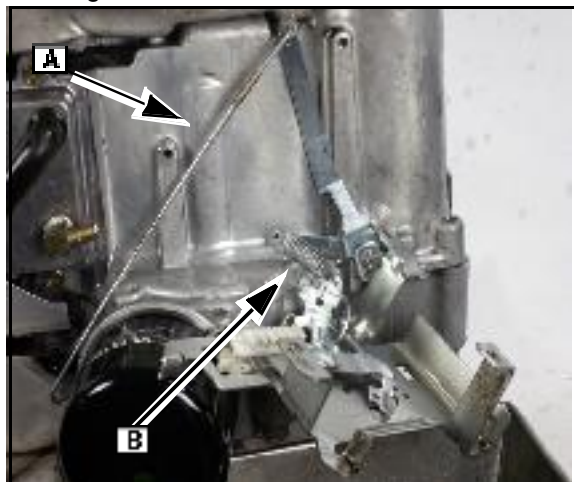


Fig. 16

3. Set control bracket aside.
4. Loosen nut that secures governor lever to governor shaft.
5. Remove governor lever and set aside.

## ENGINE BAFFLES

### Engine Baffle Removal (05000, 085400, 086400, 115400, 117400, 118400, 138400, 185400, 235400, 245400)

The engine baffles for the models listed above consist of stamped sheet metal parts ([A]) that wrap around the cylinder. The larger engines have separate lower baffles ([B]) and some have an additional plastic baffle ([C] Fig. 17) to seal the blower housing.

Remove the screws that secure the baffles to the engine.

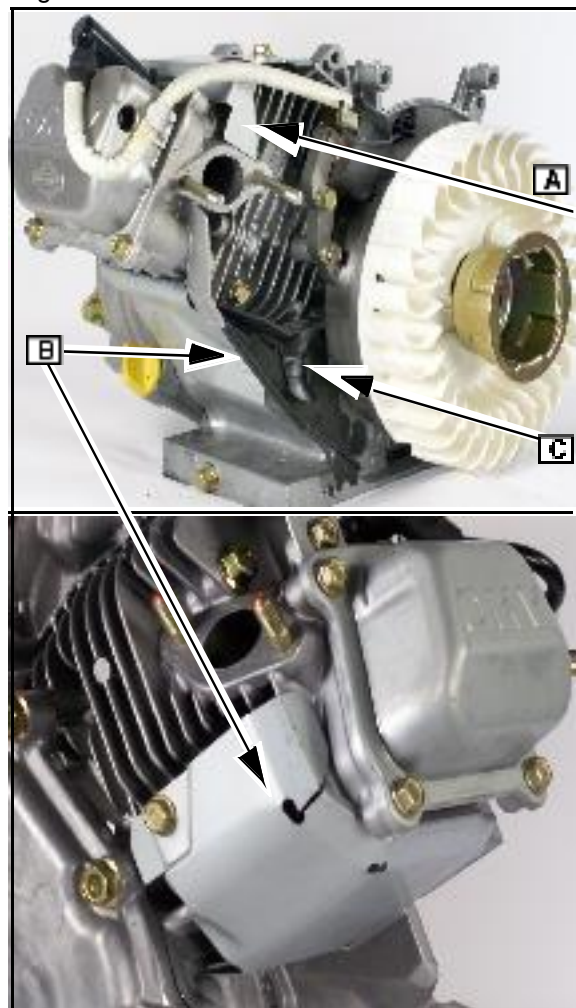


Fig. 17



## Engine Baffle Removal (161400)

The main cylinder baffle is removed with the engine control bracket. **SEE SECTION 3- CONTROL BRACKET REMOVAL.**

Remove the bolts holding the baffle shown below ([A] Fig. 18).

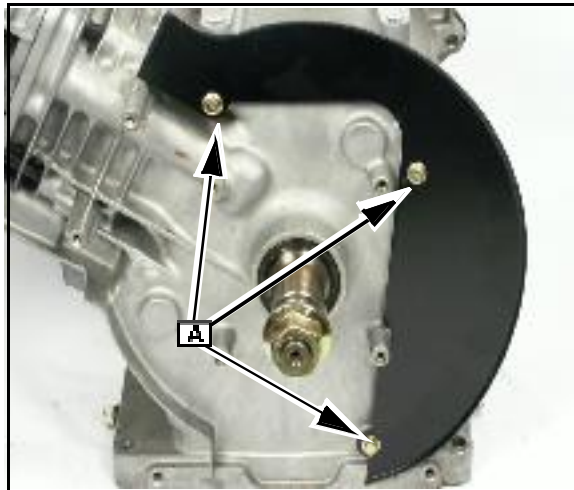


Fig. 18

## Engine Baffle Removal (260700, 261700)

1. Remove the mounting bolts shown in ([A] Fig. 19).
2. Remove the bolts that secure the oil fill tube.

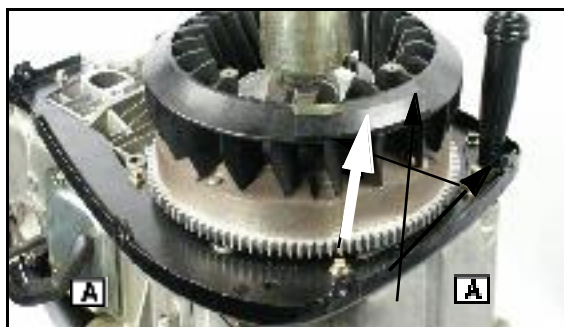


Fig. 19

**NOTE:** The lower baffle still has one mounting bolt that will be removed when the flywheel is removed. **SEE SECTION 3- FLYWHEEL REMOVAL.**

3. Remove the bolts that secure the baffle to the cylinder ([A] Fig. 20).

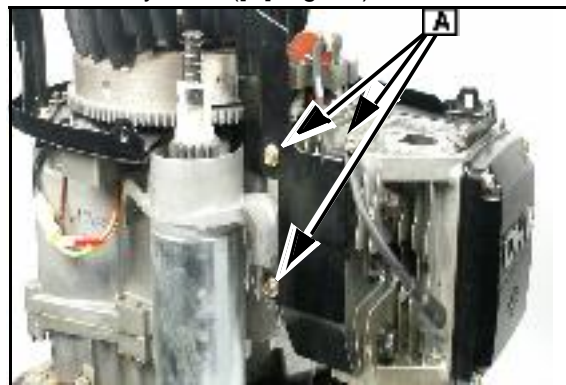


Fig. 20

## Engine Baffle Removal (28Q700)

1. Remove the two bolts ([A] Fig. 21).

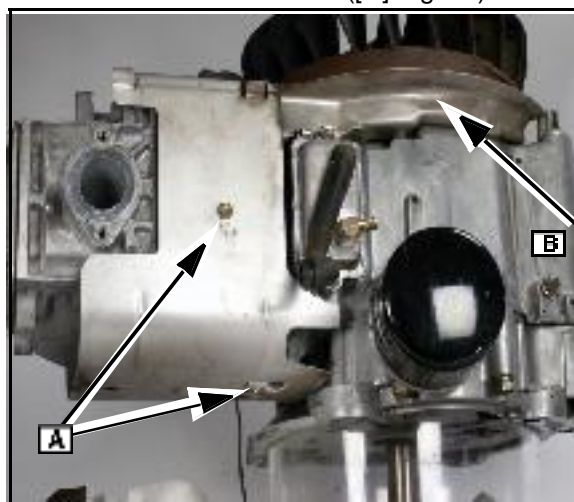


Fig. 21

**NOTE:** The blower housing support/baffle plate ([B] Fig.21) must be removed after the flywheel is removed. **SEE SECTION 3- BLOWER HOUSING REMOVAL.**

## BREATHER SYSTEMS

Briggs & Stratton engines use a breather valve to maintain and control a pulsating vacuum in the cylinder or sump. The vacuum helps to control oil leakage past piston rings, valve guides, oil seals, governor lever shaft and gaskets.

The breather valve is a fiber disc or reed that closes on the piston's up stroke and opens on the piston's down stroke.

### Breather System

(050000, 085400, 086400, 115400,  
117400, 118400, 138400, 185400,  
235400, 245400)

#### Remove Valve Cover

1. Remove screws (A) from valve cover, Fig. 22.
2. Remove valve cover and gasket(s).

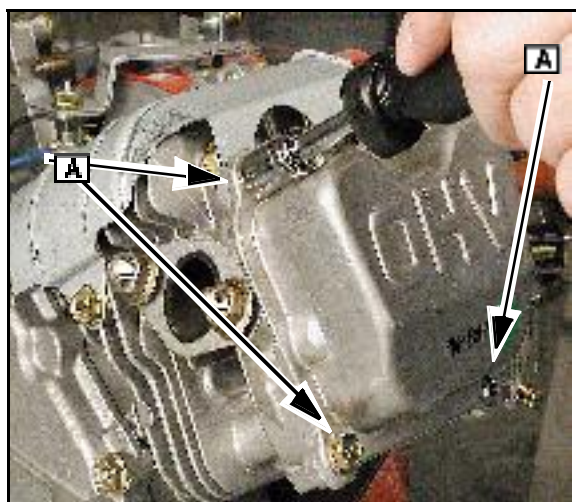


Fig. 22

The breather components are built into the valve cover for the models listed. They consist of (A) a port for the breather hose, (B) a reed and valve assembly inside the cover and (C) Fig. 23) a relief hole to balance cylinder pressures in case the breather assembly sticks or binds.

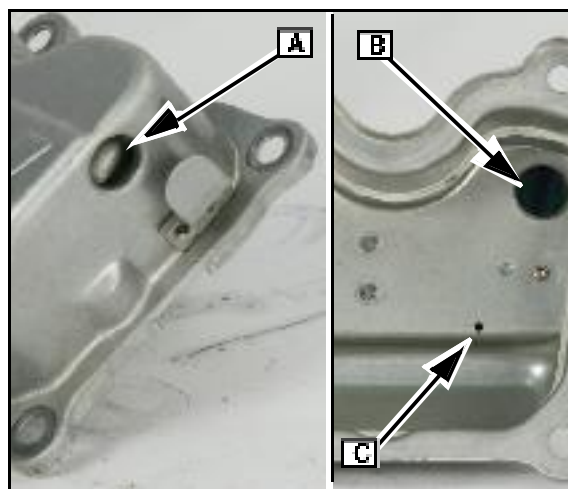


Fig. 23

To check breather assembly:

1. Cover relief hole with thumb.
2. Blow into the breather port hole - air should not pass.
3. Inhale through the breather hose port - air should pass freely.

Replace valve cover if any binding or sticking is discovered.

#### Remove/Replace Breather System (104700)

1. Remove air cleaner cover, flywheel brake cover (if equipped), blower housing, rope starter, and flywheel. **SEE SECTION 1-AIR CLEANER SERVICE.**

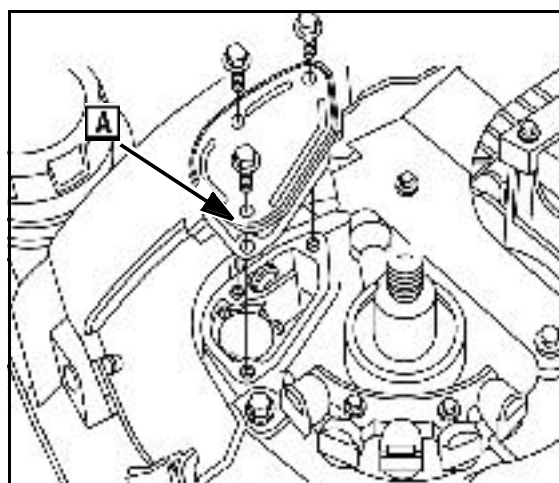


Fig. 24

2. Remove breather cover ([A] Fig. 24) from top of cylinder.

**NOTE:** Fiber disc valve cannot be checked with gauge.

3. Replace the valve if it is warped, worn or damaged.
4. Install disc valve on seat ([B] Fig. 25).

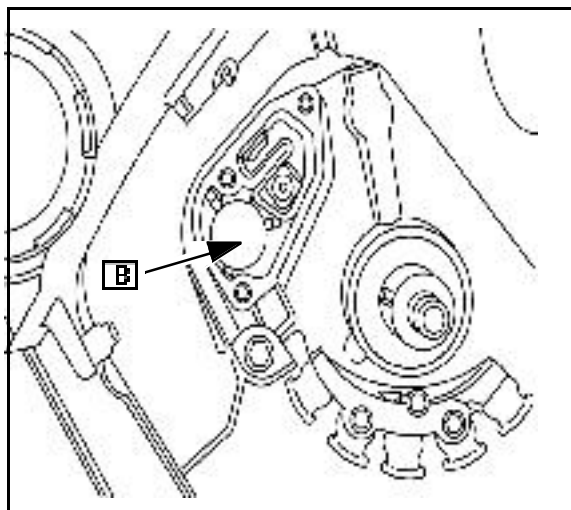


Fig. 25

5. Install gasket, cover, and screws. Torque screws to listed value. **SEE SECTION 14-ENGINE SPECIFICATIONS.**

**NOTE:** Breathers are vented into the air cleaner base or intake manifold to prevent dirt from entering the cylinder. Be sure vent tube is not damaged and that it seals properly.

Inspect breather tube ([A] Fig. 26) for cracks, holes, and hardening.

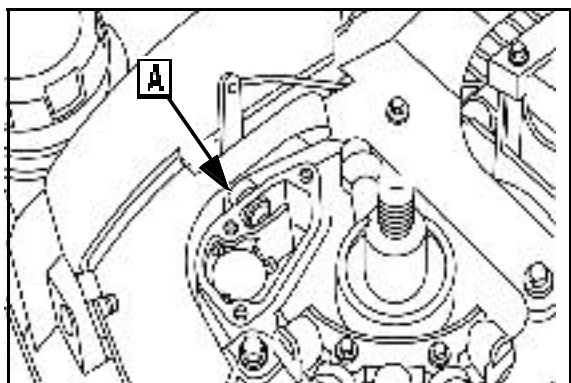


Fig. 26

## Breather System (161400)

1. Remove four screws that hold valve cover (A) and gasket (B).
2. Remove valve cover. Breather assembly (C) and gasket (D) Fig. 27) will come off with valve cover.

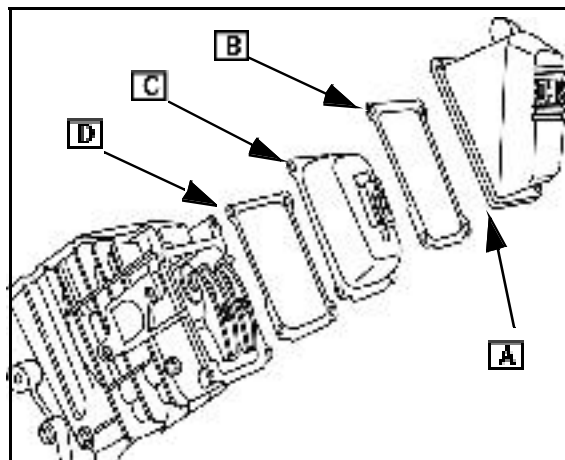


Fig. 27

3. Separate valve cover from breather assembly.
4. Replace the breather if the fiber disc valve is stuck or binding. **0.045 in. (1.14 MM)** wire gauge ([A] Fig. 28) should not enter the space between the fiber disc valve and body. Do not force the gauge.

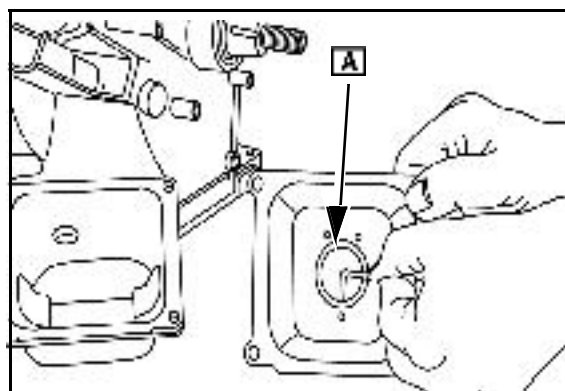


Fig. 28

To install breather assembly:

1. Install gasket (D), breather assembly (C), gasket (B), and valve cover ([A] Fig. 27) to cylinder head.
2. Push breather tube on to nipple of air cleaner base.

3. Install screws. Torque screws to listed value. **SEE SECTION 14- ENGINE SPECIFICATIONS.**

## Breather System (260700, 261700)

**NOTE: (260700, 261700)** Two lengths of breather tubes were used. The standard tube is used when the air cleaner base mounts directly on the carburetor. The long breather tube is used when a spacer is used between the carburetor and the air cleaner base.

### Before Date Code 91120900

1. Remove air cleaner and intake manifold.
2. Remove breather valve cover and gasket (A).

The breather valve assembly ([B] Fig. 29) is mounted in the cylinder.

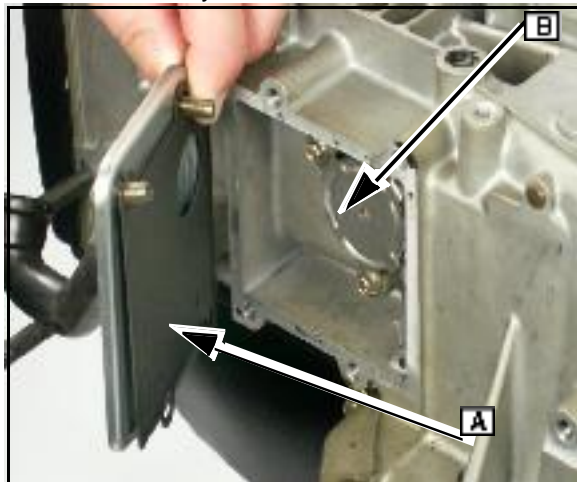


Fig. 29

### If the fiber disc in the breather valve assembly is stuck or binding:

- Replace the entire breather valve assembly.

Refer to ([A] Fig. 30).

1. Check the breather valve assembly with a **0.045 in. (1.14 MM.)** wire gauge. It should *not* enter the space between the fiber disc and the valve assembly.

**CAUTION:** Do not force the gauge. The fiber disc valve is held in place by a retainer that will distort if pressure is applied to the disc.

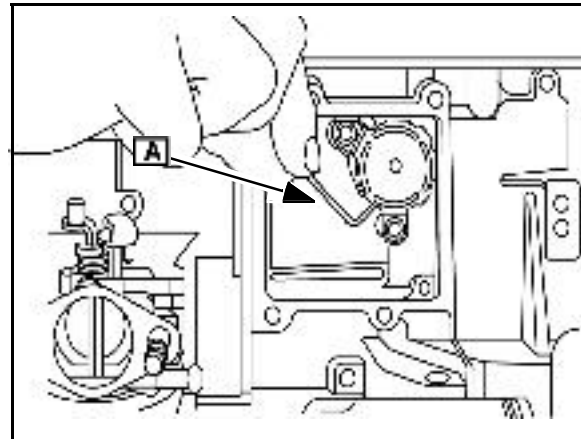


Fig. 30

To replace breather valve assembly:

1. Install new disc valve and retainer assembly. Torque screws to listed value. **SEE SECTION 14- ENGINE SPECIFICATIONS.**

### After Date Code 91120800

1. Remove air cleaner and intake manifold.
2. Remove cover and gasket.

This cover has an additional flapper valve ([A] Fig. 31) built into it.

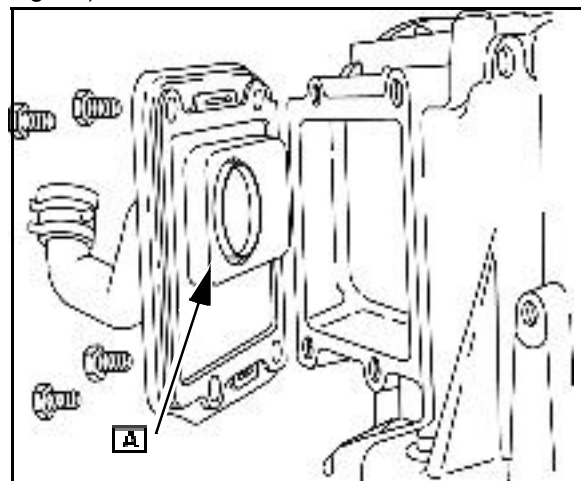


Fig. 31

1. Check the breather valve in the cover with a **0.045 in. (1.14 MM.)** wire gauge. It should *not* enter the space between the disc and the cover body ([A] Fig. 32).



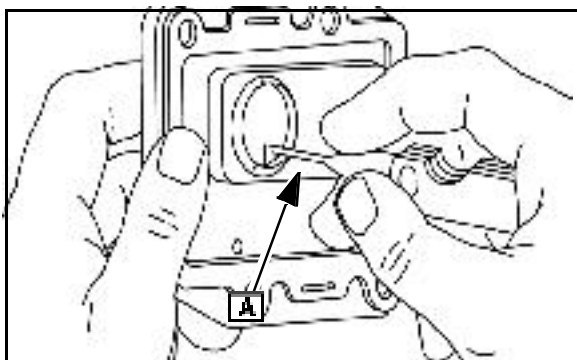


Fig. 32

2. Install new disc valve and retainer assembly. Torque screws to listed value. **SEE SECTION 14- ENGINE SPECIFICATIONS.**
3. Install cover ([A] Fig. 33) with new gasket. Torque screws to listed value.

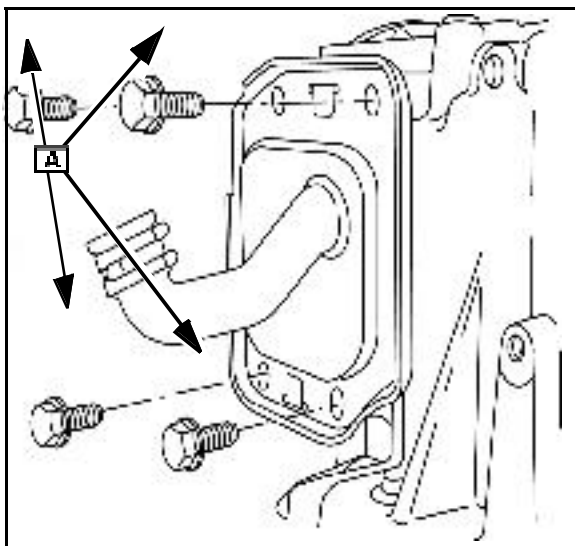


Fig. 33

### Breather System (28Q700)

**NOTE:** There is a 0.120 in. (3.0 MM.) diameter plastic plug installed in the elbow on the 28Q700 engine where the breather mounts. If it gets plugged the oil will get sucked out of the engine. Clean the plug any time there is service performed in that area.

1. Remove breather tube from breather.

2. Remove two screws holding breather. Remove breather and gasket and discard gasket.
3. A 0.045 in. (1.14 MM.) wire gauge (A) should *not* enter the space between the fiber disc valve (B) and the body (C). The breather holes ([D] Fig. 34) must be open.
4. Check as shown in. Fig. 34.

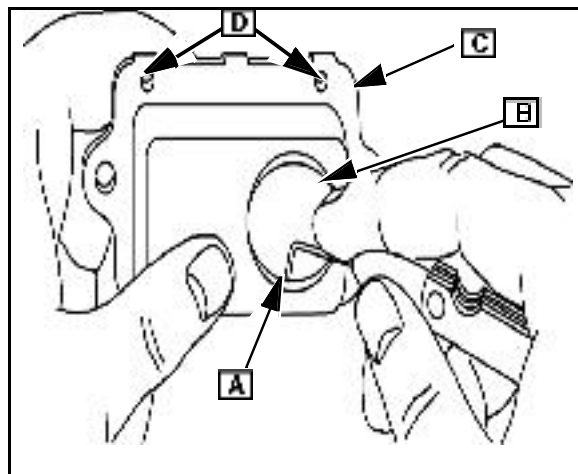


Fig. 34

Replace the breather if the fiber disc valve is stuck or binding.

**CAUTION:** The fiber disc valve is held in place by an internal bracket that will distort if pressure is applied to the valve. Do not apply force when checking valve.

5. Place new breather gasket and breather on cylinder. Gaskets do not require sealant.
6. Install two screws. Torque screws to listed value. **SEE SECTION 14-ENGINE SPECIFICATIONS.**

Install breather tube to breather.

## ELECTRIC STARTER MOTORS

### Electric Starter Removal (138400, 235400, 245400)

1. Remove negative battery cable.
2. Disconnect the wire from the key switch.
3. Remove the nuts ([A] Fig. 35) that support the starter motor.
4. Remove starter.

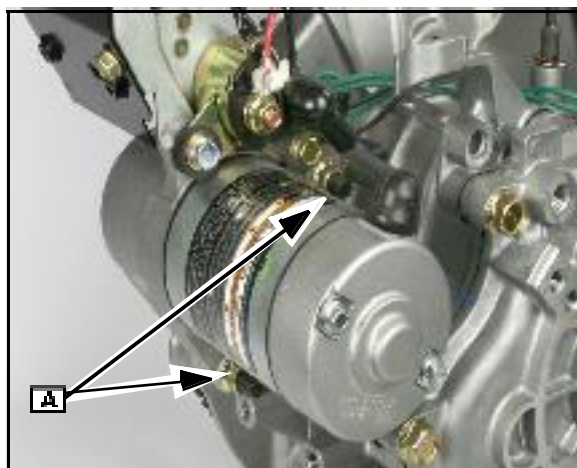


Fig. 35

1. Disconnect the wire from the voltage regulator.
2. Remove the nuts ([A] Fig. 36) that support the starter motor.

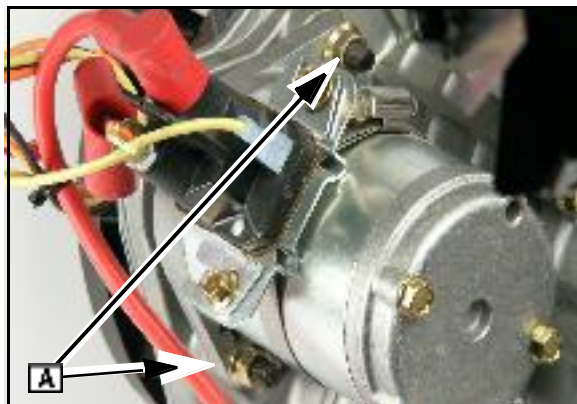


Fig. 36

### Electric Starter Removal (104700, 260700, 261700, 28Q700)

1. Remove the two bolts that secure starter to cylinder ([A] Fig. 37, 38, 39).



Fig. 37

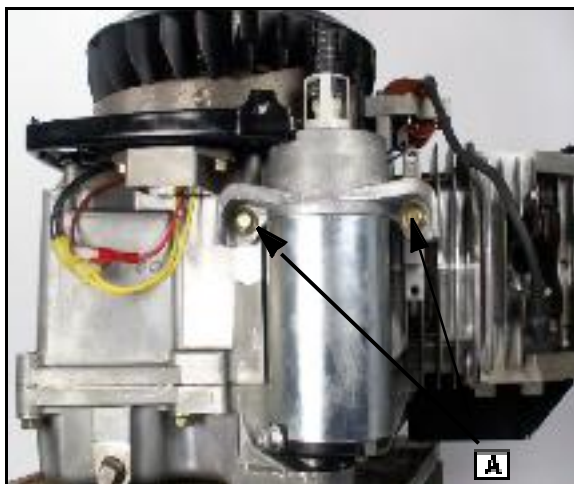


Fig. 38

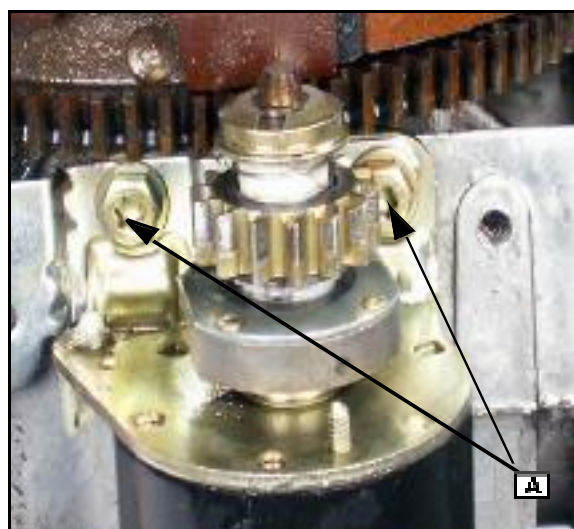


Fig. 39



## Ignition System Removal (050000, 085400, 086400, 115400, 117400, 118400, 235400, 245400, 161400, 104700, 260700, 261700, 28Q700)

1. Disconnect stop switch wire (A) at armature (B).
2. Remove armature screws ([C] Fig. 40).
3. Lift off armature.

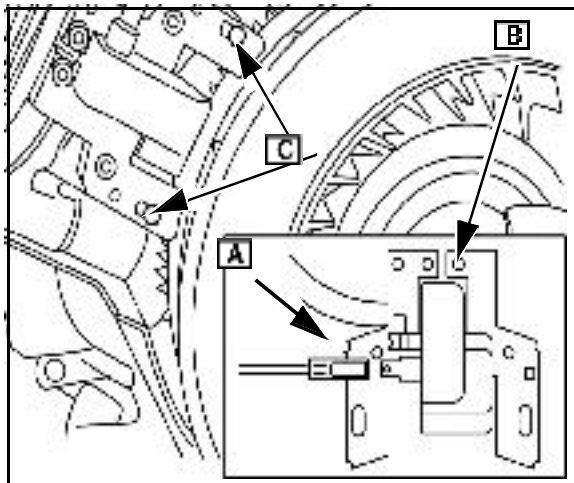




Fig. 40

## FLYWHEELS

## Flywheel Removal (050000, 085400, 086400, 115400, 117400, 118400, 138400, 185400, 235400, 245400, 28Q700)

 <b>WARNING</b>

<p><b>Eye injury could occur if flywheel is struck with a hard object.</b></p> <ul style="list-style-type: none"> <li>• Do not strike flywheel with hard object or steel tool.</li> <li>• Wear safety goggles or other eye protection.</li> </ul>

1. If necessary, remove the fan from the flywheel.
2. Prevent the flywheel from turning with Flywheel Strap Wrench, #19433, ([A] Fig.

41) or other strap wrench or socket-type flywheel holder, determined above.

3. Turn the flywheel nut CCW with a 1/2 in. breaker bar (B) and socket to remove.

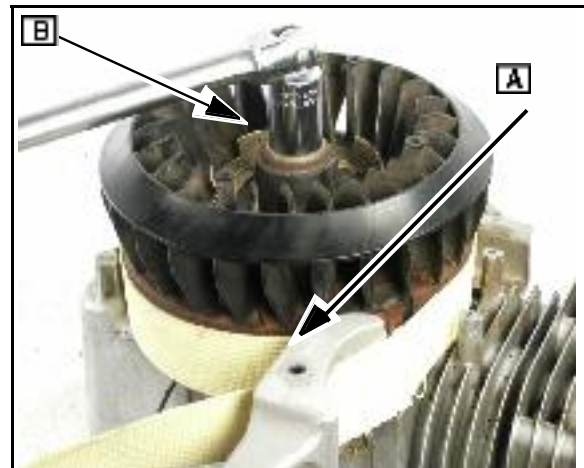


Fig. 41

4. Thread the flywheel nut (A) on to the crankshaft until top of nut is flush with end of crankshaft threads, Fig. 42.
5. Install Flywheel Puller #19203 (B). Turn puller screws into flywheel puller holes until puller contacts flywheel nut.
6. Tighten puller nuts (C) equally until flywheel loosens, (Fig. 42) and/or (Fig. 44).

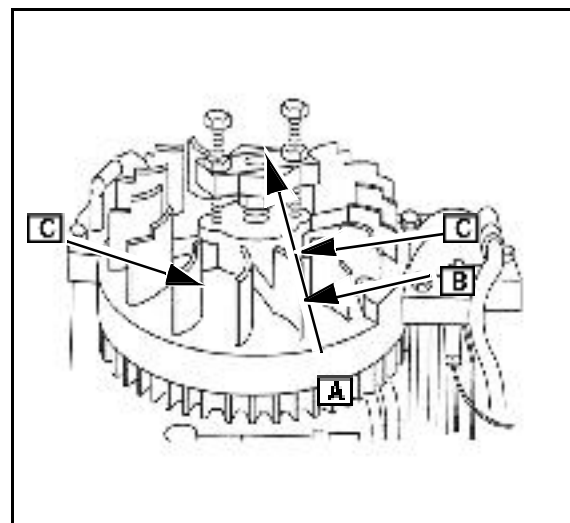


Fig. 42



Fig. 43

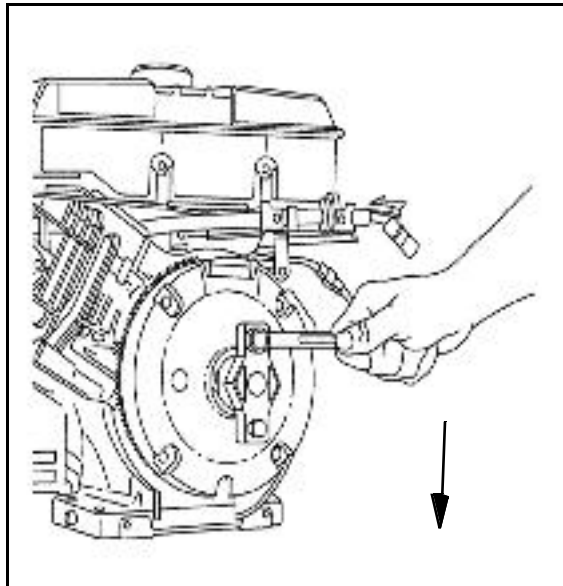


Fig. 44

## Flywheel Removal (104700)

1. Disconnect the tension spring on the flywheel brake from its anchor ([A] Fig.45).

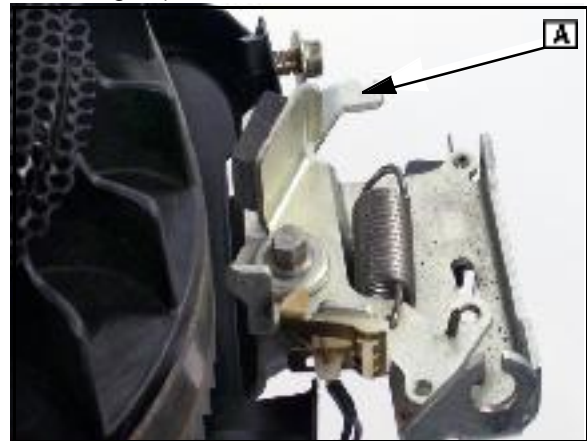


Fig. 45

2. Remove the flywheel nut with a strap wrench and a 1 in. socket.
3. Using tool #19203, remove flywheel and drive key.

## Flywheel Removal (260700, 261700)

1. Remove the nut and washer and starter cup ([A] Fig. 46).

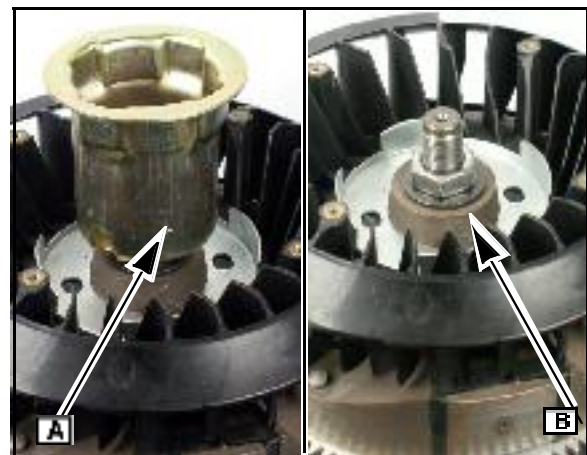


Fig. 46

2. Remove the second nut and washer ([B] Fig. 46).
3. Remove the backing plate that secures the fan to the flywheel.

4. Install tool #19203 as shown ([A] Fig. 47) and tighten the nuts evenly until the flywheel comes free of the crankshaft.

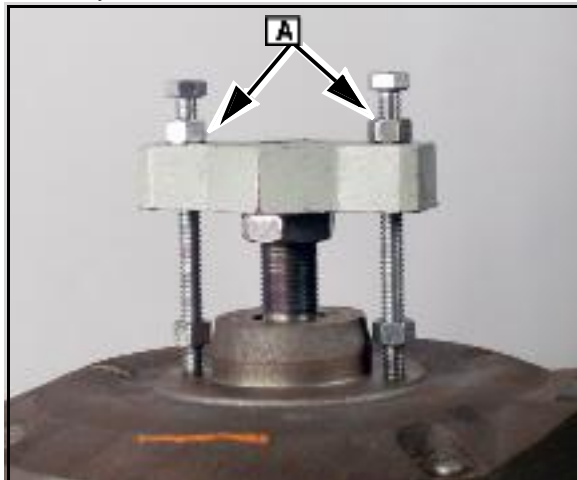


Fig. 47

When the flywheel is removed, the stator and the remaining bolt ([A] Fig. 48) for the support baffle can be removed.

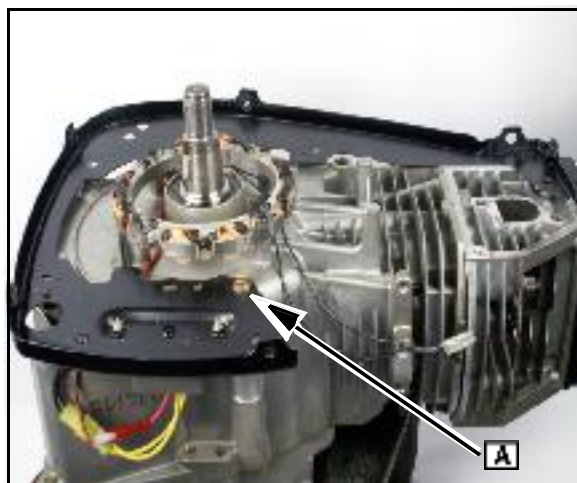


Fig. 48

## OIL FILTER ADAPTERS

### Remove/Replace Oil Filter Adapters

1. Remove oil filters and oil filter adapters as shown below.

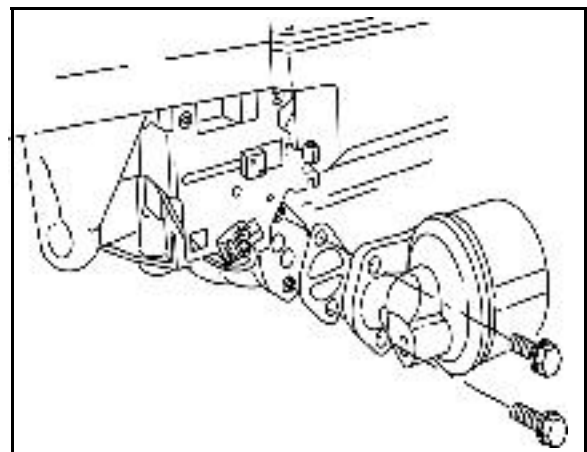


Fig. 49

2. Use a new gasket and reposition adapter.
3. Torque screws to listed value, as shown in Fig. 50.

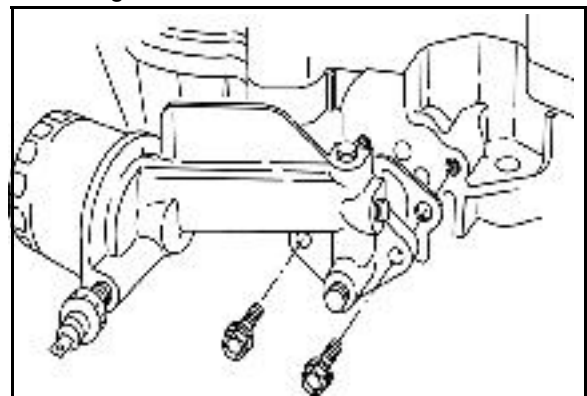


Fig. 50

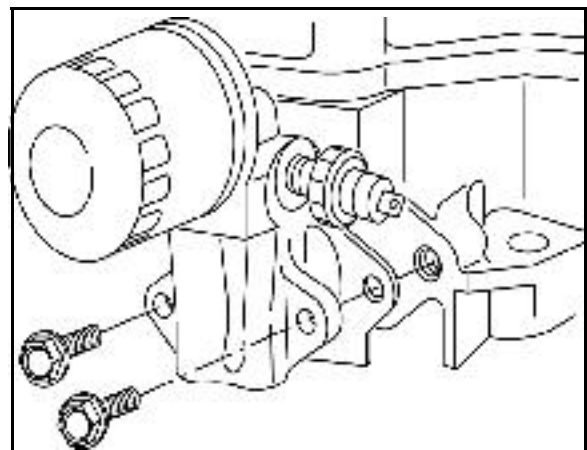


Fig. 51

## SECTION 4 - EXHAUST SYSTEMS

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## GENERAL INFORMATION

To meet the various requirements of the original equipment manufacturers (OEMs), some engines are shipped without exhaust systems. Exhaust systems for these engines are serviced and supplied by the OEM. Contact the original equipment manufacturer for specific service information on non-Briggs & Stratton exhaust systems.

**CAUTION:** When replacing exhaust system components, replacement parts must be the same as originally specified by the OEM. This may include some mounting brackets and hardware. Follow the procedures recommended by the OEM for disassembly and assembly.

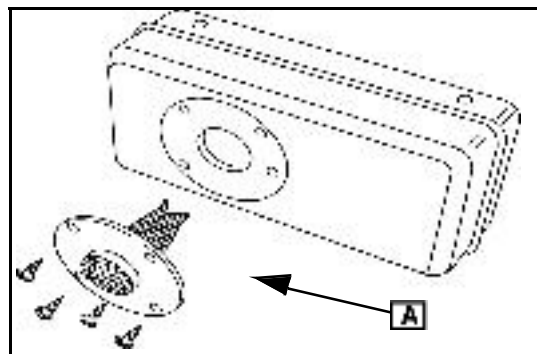


Fig. 1

## Inspecting Exhaust Systems

### General

Exhaust system components must be inspected whenever the exhaust system is disassembled.

Never reinstall broken or damaged components.

Check for:



- Cracks
- Broken welds
- Split muffler seams
- Loose internal parts
- Gaskets
- General wear and fit

Inspect the exhaust manifold for damage and signs of leakage at the cylinder and muffler mating surfaces.

## Spark Arrestors

Remove spark arrester ([A] Fig. 1) for cleaning and inspection monthly or every 50 hours.

Replace screen if deteriorated or perforated.

	<b>DANGER</b>
	
<p><b>Running engines produce heat. Temperature of muffler and surrounding areas can reach 150°F (65°C). Severe burns can occur on contact.</b></p>	
<ul style="list-style-type: none"><li>• Allow muffler, engine cylinder fins and radiator to cool before touching.</li><li>• Remove accumulated combustibles from muffler area and cylinder area.</li><li>• Install and maintain in working order a spark arrester before using equipment on forest-covered, brush-covered unimproved land. The state of California requires this (Section 4442 of the Public Resources Code). Other states may have similar laws. Federal laws apply on federal land.</li></ul>	



## REMOVE/INSTALL EXHAUST SYSTEM (050000, 085400, 115400, 117400, 118400, 138400, 185400, 235400, 245400)

A typical muffler installation for the models listed above is shown in (Fig. 2).



Fig. 2

To remove the muffler assembly:

1. Remove muffler brace screws ([A] Fig. 3 or Fig. 4), if equipped.

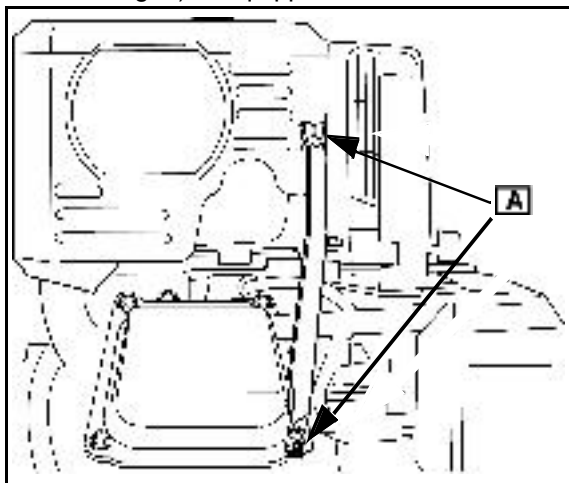


Fig. 3

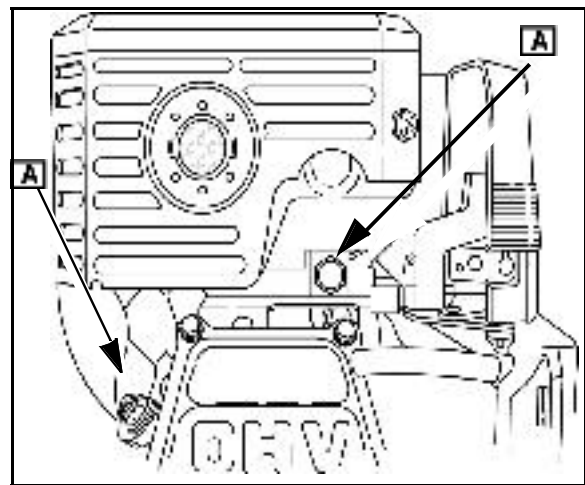


Fig. 4

2. Remove two muffler nuts ([A] Fig. 5).



Fig. 5

3. Remove the muffler and exhaust gaskets.
4. Inspect the exhaust system. **SEE SECTION 4- EXHAUST SYSTEMS.**

To install the muffler assembly:

**NOTE:** Use (#93963) valve lubricant on all exhaust system threads to prevent galling of the threads and ease future disassembly.

1. Place new exhaust gasket on cylinder head studs.
2. Mount muffler.
3. Install muffler brace (if equipped) and hand tighten hardware.

4. Check for proper alignment and any interference issues.
5. Torque muffler nuts to listed values.
6. If equipped, torque muffler brace screw to listed values.

## REMOVE/INSTALL EXHAUST SYSTEM (104700)



Fig. 6

To remove 104700 muffler assembly:

1. Remove the screws that secure the muffler guard (if equipped).
2. Bend down locking tabs (A) on screw lock.
3. Remove muffler screws and muffler brace nut ([B] Fig. 7).

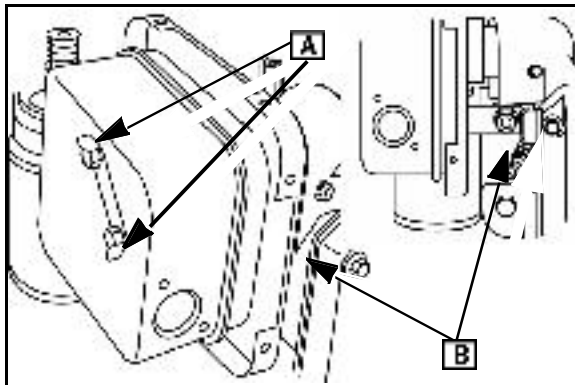


Fig. 7

**NOTE:** For access to the exhaust elbow, remove the blower housing, if necessary.

4. Remove backplate and gasket. **SEE SECTION 3-ENGINE DISASSEMBLY.**
5. Take off the two screws (A) that hold the exhaust elbow shield ([B] Fig. 8) and remove shield.

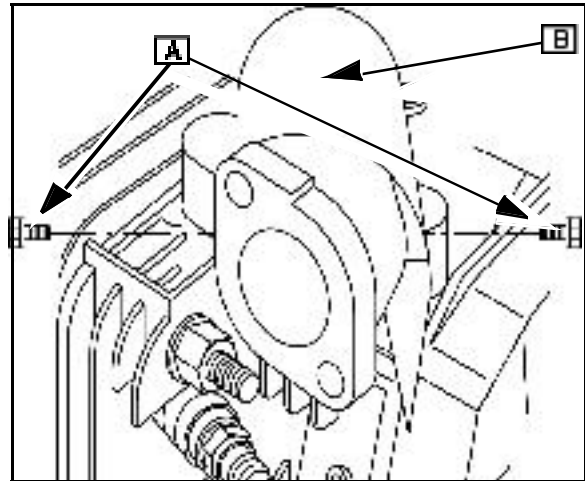


Fig. 8

6. Remove the screws ([A] Fig. 9) holding the exhaust elbow and set elbow aside.

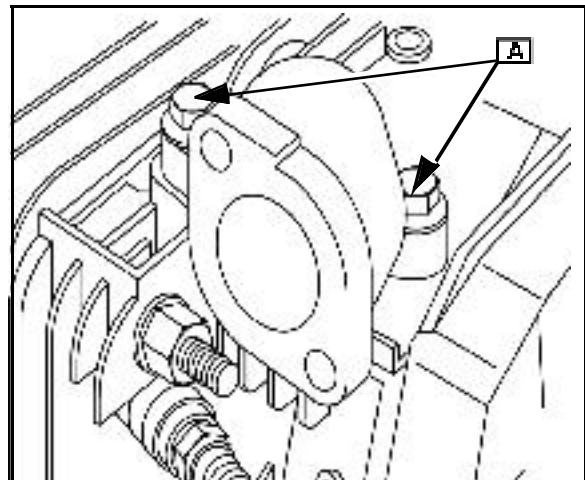


Fig. 9

7. Inspect the exhaust system and its components. **SEE SECTION 4-EXHAUST SYSTEMS.**

To install the 104700 muffler system:

**NOTE:** Use (#93963) valve lubricant on all exhaust system threads to prevent galling of the threads and ease future disassembly.

1. Position new gasket, exhaust elbow and screws ([A] Fig. 10).
2. Torque screws to listed values.
3. Place the exhaust elbow shield in position and secure with the two mounting screws ([A] Fig. 10). Torque screws to listed values.

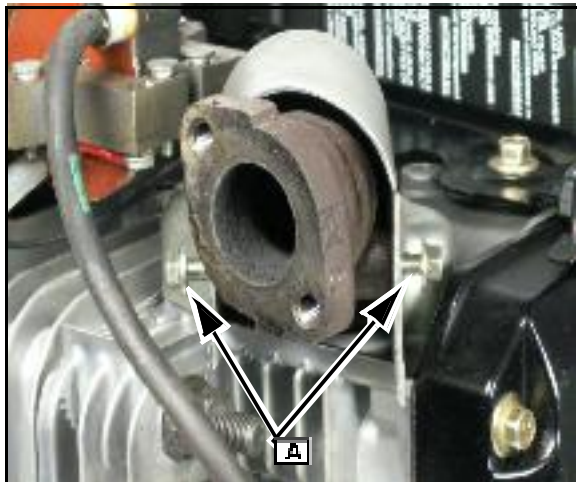


Fig. 10

4. Slide muffler mounting screws through lock plate and push screws through muffler.
5. Place new gasket on mating surface of muffler and insert screws through back plate.
6. Position second new gasket on the back plate and fit assembly into place on exhaust elbow.
7. Torque muffler mounting screws to listed values. **SEE SECTION 14- ENGINE SPECIFICATIONS.**
8. Bend the screw lock tabs against the flat of the muffler mounting screw heads.
9. Install muffler shield (if equipped). Torque screws to listed values.

## REMOVE/INSTALL EXHAUST SYSTEM (161400)



Fig. 11

To remove muffler from model 161400:

1. Remove carburetor heat shield ([A] Fig. 12).

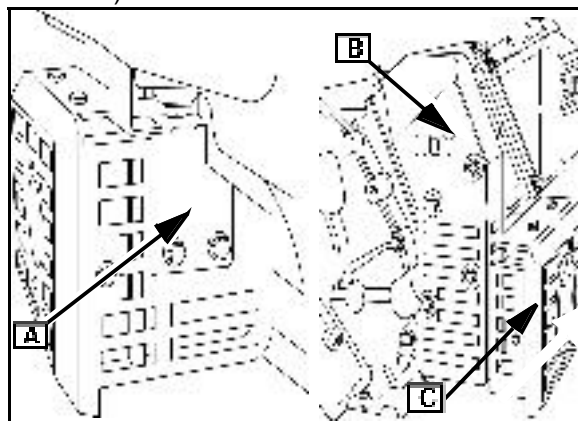


Fig. 12

2. Remove muffler guard (B) and manifold guard ([C] Fig. 12).



3. Take the muffler guard bracket ([A] Fig. 13) off of the muffler.

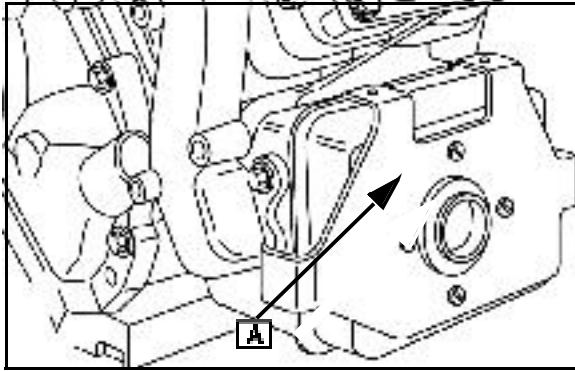


Fig. 13

4. Remove the mounting screws that secure muffler (A) to its support bracket (B) and exhaust manifold ([C] Fig. 14).

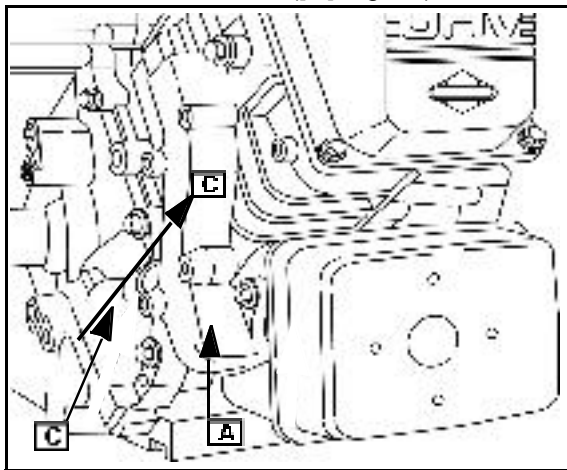


Fig. 14

5. Remove the mounting bolts that secure the exhaust manifold ([A] Fig. 15) and exhaust gaskets.

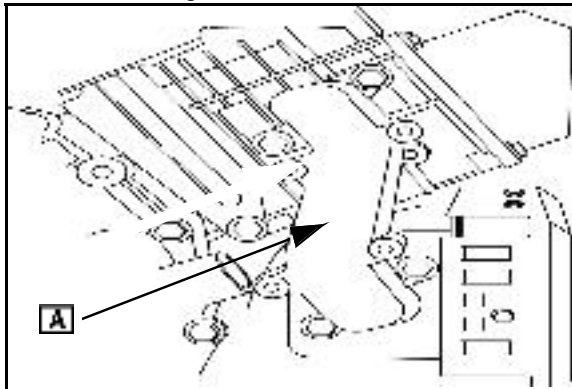


Fig. 15

6. Inspect the exhaust system components.  
**See SECTION 4- EXHAUST SYSTEMS.**

#### To install muffler to model 161400:

1. Assemble the lower portion of the exhaust manifold (with its gasket) and two bolts ([A] Fig. 16) to the muffler and finger-tighten.

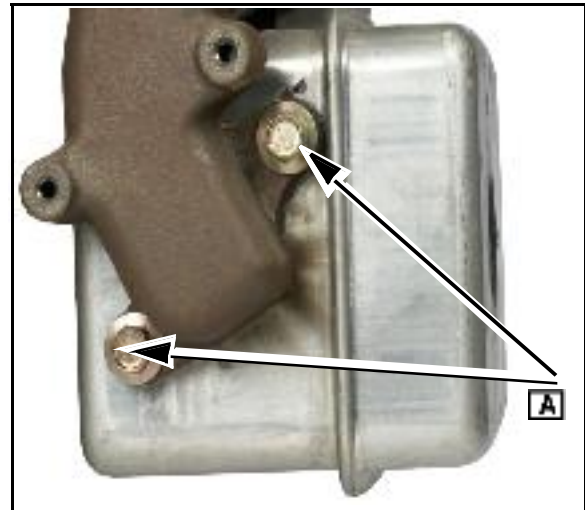


Fig. 16

2. Secure the muffler/manifold assembly and its gasket to the head and finger-tighten.
3. Make sure the support bracket is under the blower housing flange ([B] Fig. 17) and start the mounting bolts.

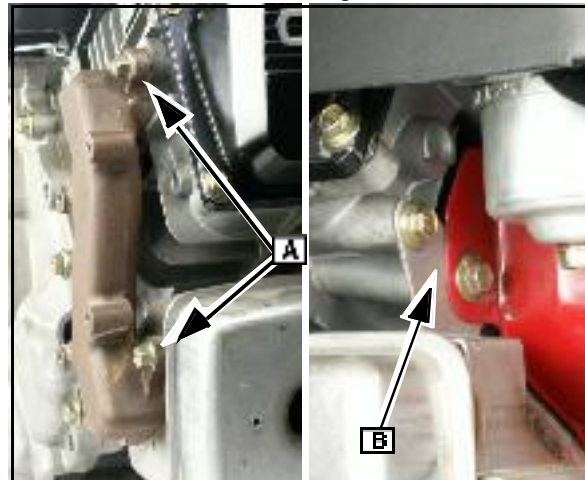


Fig. 17

When all components are properly aligned;

4. Torque manifold bolts ([A] Fig. 18) to listed values. **SEE SECTION 14- ENGINE SPECIFICATIONS.**
5. Torque bracket bolts ([B] Fig. 18) to listed values. **SEE SECTION 14- ENGINE SPECIFICATIONS.**
6. Install manifold guard bracket and torque to listed values.
7. Install the muffler heat shield bracket [A] with four screws. Torque to listed values.



Fig. 18

8. Secure muffler guard ([A] Fig. 19) to its bracket with four screws and torque to listed values.

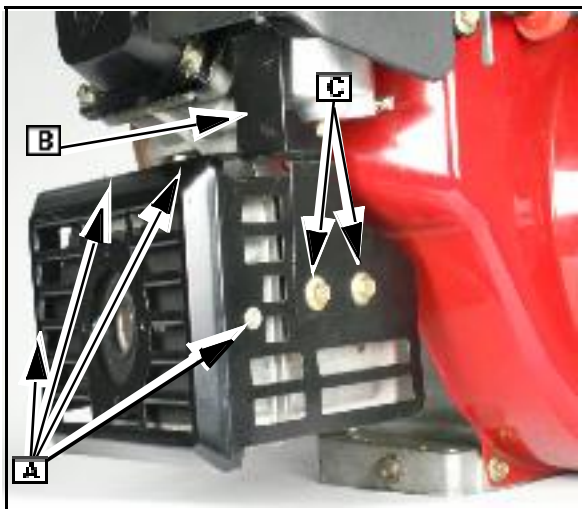


Fig. 19

9. Install carburetor heat shield ([B] Fig. 19) with two mounting screws (C) and torque to listed values

## REMOVE/INSTALL EXHAUST SYSTEM (260700, 261700)



Fig. 20

To remove muffler from model 261700:

1. Remove the engine blower housing. **SEE SECTION 3- ENGINE DISASSEMBLY.**
2. Remove the two lower bolts (A) that hold muffler to bracket ([B] Fig. 21).

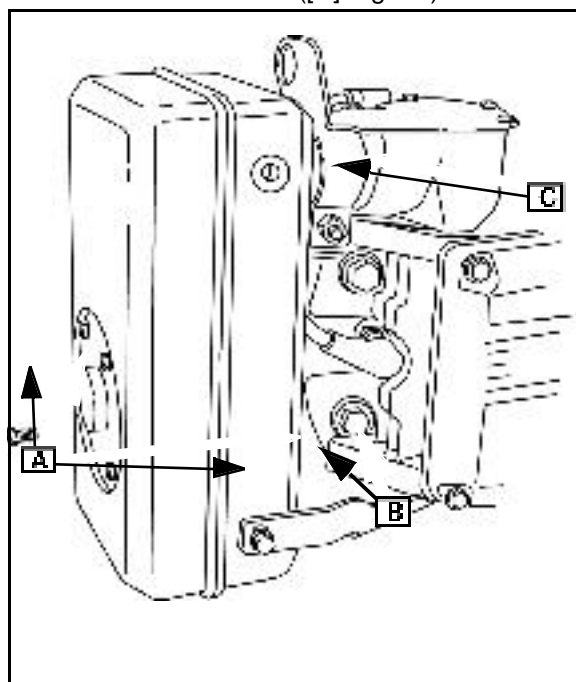


Fig. 21

3. Loosen muffler clamp nut ([C] Fig. 21) and spread clamp slightly with screwdriver.
4. Take note of the different sizes and remove the two bolts and three screws

that secure the exhaust elbow cover (Fig. 22).



Fig. 22

5. With the clamp loose, work the muffler free of manifold.
6. Slide exhaust elbow cover free of exhaust manifold.

**NOTE:** If further engine disassembly is required: Remove bracket screws ([A] Fig. 23) under cylinder head and remove bracket.

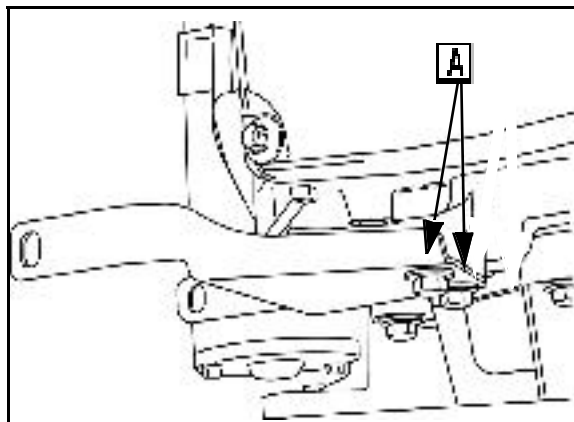


Fig. 23

7. Remove exhaust elbow mounting bolts ([A] Fig. 24).
8. Set exhaust manifold ([B] Fig. 24) aside.
9. Discard old gaskets.

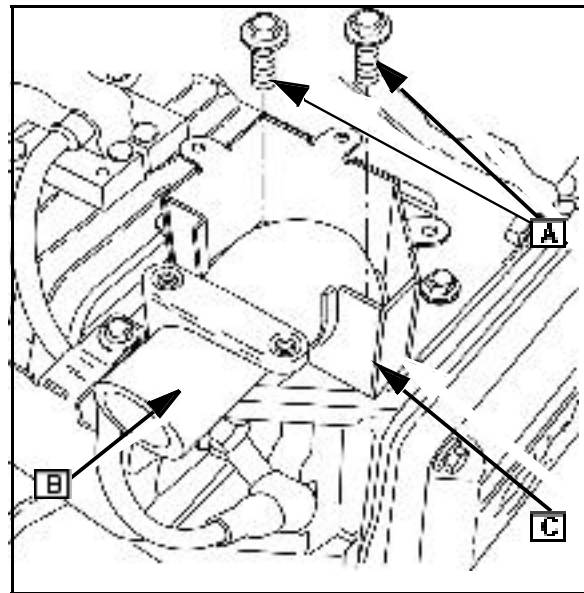


Fig. 24

10. Inspect the exhaust system components.  
**SEE SECTION 4- EXHAUST SYSTEMS.**

To install muffler assembly:

**NOTE:** Use (#93963) valve lubricant on all exhaust system threads to prevent galling of the threads and ease future disassembly.

1. Set new exhaust gasket on mating surface of cylinder head ([A] Fig. 25).

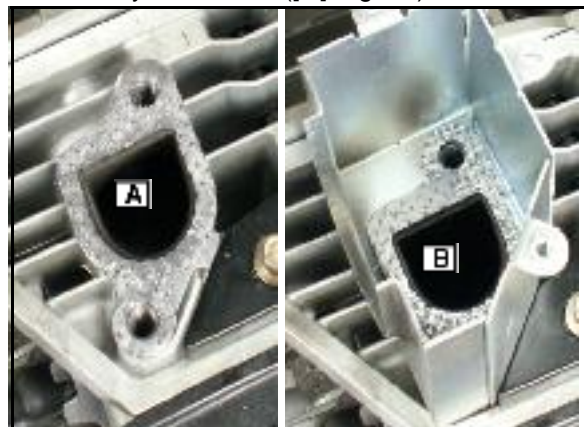


Fig. 25

2. With second gasket set inside heat shield, place shield on top of cylinder head exhaust gasket ([B] Fig. 25).



3. Place exhaust manifold elbow on gasket in heat shield and install mounting bolts. ([A] Fig. 26)

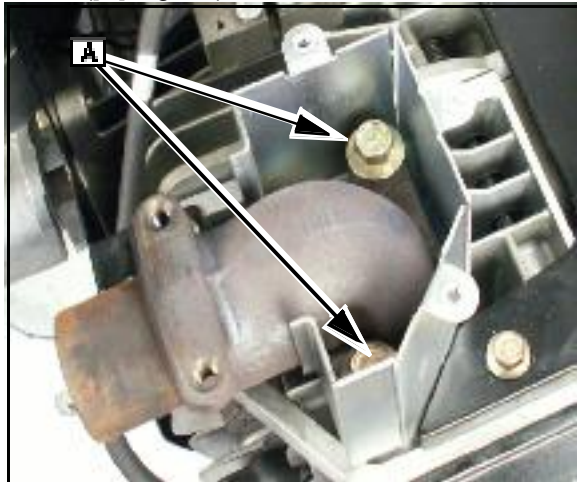


Fig. 26

4. Torque bolts to listed values.

**NOTE:** If lower mounting bracket was removed: Install bracket (See Fig. 23).

5. Torque bracket mounting bolts to listed value. **SEE SECTION 14- ENGINE SPECIFICATIONS.**
6. Slide elbow cover on to elbow heat shield but do not install fasteners.
7. Assemble the muffler clamp and slip over slotted flange of muffler.
8. Push the muffler and clamp assembly ([A]) on the exhaust manifold ([B] Fig. 27).

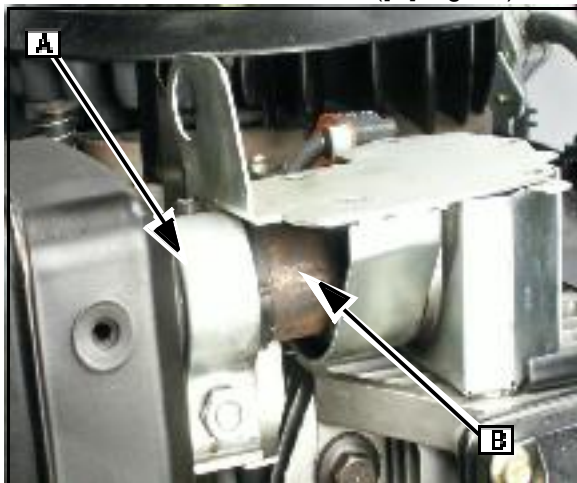


Fig. 27

9. Install support bolts through lower support bracket and finger-tighten.
10. Make sure the muffler assembly is completely seated on exhaust manifold.

11. Torque muffler clamp screw and nut to listed values. **SEE SECTION 14- ENGINE SPECIFICATIONS.**
12. Torque lower bracket bolts to listed values. **SEE SECTION 14- ENGINE SPECIFICATIONS.**
13. Install mounting screws in exhaust elbow cover.
14. Torque all fasteners to listed values.

## REMOVE/INSTALL EXHAUST SYSTEM (28Q700)



Fig. 28

To remove muffler from model 28Q700:

1. Remove muffler brace screw ([A] Fig. 29).

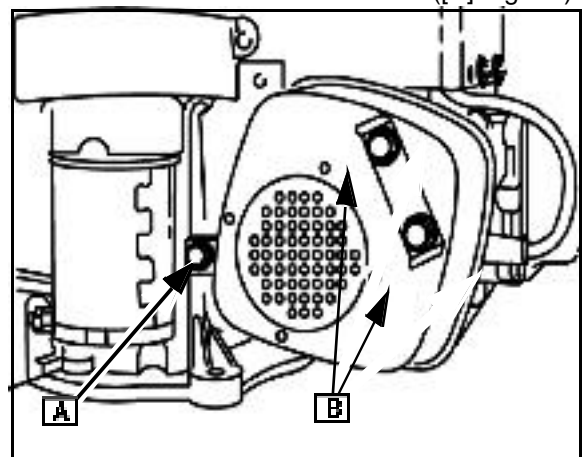


Fig. 29

2. Band back locking tabs ([B] Fig. 29).
3. Remove bolts and muffler.
4. Discard old muffler gasket.

5. Remove muffler adapter screws ([A] Fig. 30).

A T-40 TORQUX™ bit is required. Briggs & Stratton (#19442) "TORQUX STAR BITS."

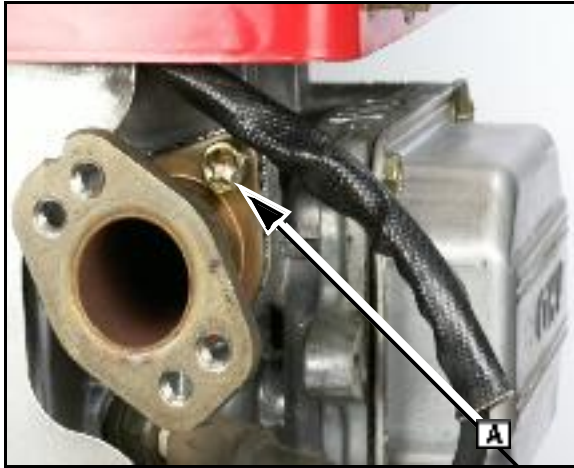


Fig. 30

6. Bend tabs ([A] Fig. 32) to secure the bolts.

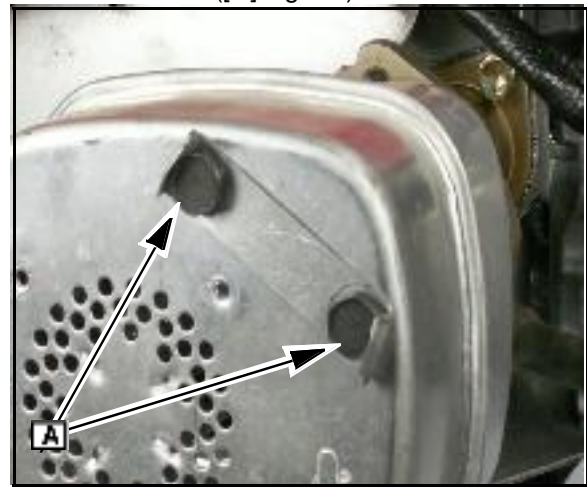


Fig. 32

6. Inspect the exhaust system components.  
**SEE SECTION 4- EXHAUST SYSTEMS.**

To install muffler on Model 28Q700:

**NOTE:** Use (#93963) valve lubricant on all exhaust system threads to prevent galling of the threads and ease future disassembly.

1. Install muffler adapter with new gasket.



Fig. 31

2. Torque mounting bolts to listed values. **SEE SECTION 14- ENGINE SPECIFICATIONS.**
3. Install muffler with new gasket (Fig. 32).
4. Install muffler bracket screw.
5. Torque muffler mounting bolts to listed values.



## SECTION 5 - FUEL SYSTEMS AND CARBURETION

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**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 at least 2 minutes before removing.
- Fill fuel tank outdoors or in a well-ventilated area.
- Do not overfill fuel tank. Fill tank to approximately 1-1/2 inches below top of neck to allow for fuel expansion.
- 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 and replace if necessary.

**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 to **OPEN/RUN** position. Place throttle 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.

**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 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.

## FUEL SYSTEM CLEANING AND INSPECTION

**CAUTION:** Do not use carburetor cleaner on non-metallic parts. Use carburetor cleaner only after removing plastic and rubber parts.

**CAUTION:** Do not use a screw in the fuel hose to stop fuel leakage. The screw threads will loosen rubber particles which will get into the fuel system. Turn the fuel shut off valve OFF before servicing the carburetor.

Clean gummy or dirty fuel tanks with Briggs & Stratton Carburetor Cleaner (#100041 or #100042) or equivalent.

1. Replace air cleaner gaskets and mounting gaskets whenever carburetor is removed.
2. Inspect fuel tank for:
  - Corrosion
  - Leaks
  - Broken mounting brackets
3. Check fuel cap and filler neck for:
  - Proper seals
  - Vents
  - Functional quantity gauge (if equipped)
4. Check fuel filter for blockage of any kind.
5. Check fuel shut-off valve for:
  - Proper operation
  - Security of all mounting hardware
6. Check condition and torque of all mounting studs and hardware.

Clean or replace parts as required, and reassemble with new hoses, clamps and gaskets.

## FUEL TANKS, FITTINGS AND LINES

### Fuel System (050000, 118400)

#### Removal

1. Disconnect breather hose ([A] Fig. 1) at rocker cover and remove air cleaner assembly.
2. Release clamp and disconnect tank hose at fuel shut-off valve ([B] Fig. 1).
3. Place hose in appropriate container and allow fuel to completely drain from tank.

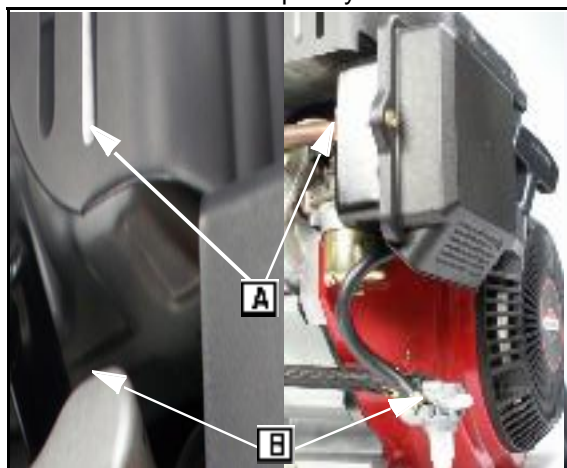


Fig. 1

1. Open carburetor bowl drain screw and drain remaining fuel into appropriate container.
2. Close bowl drain screw.
3. If equipped, remove the remote throttle control bracket (A).

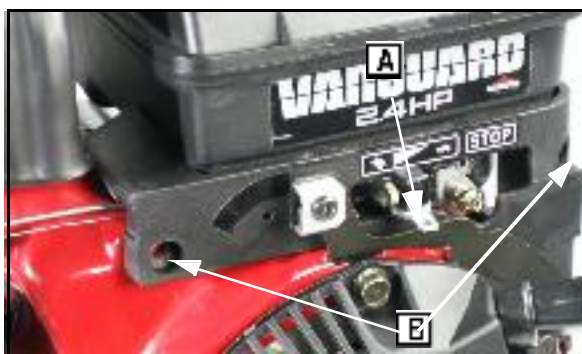


Fig. 2

4. Remove throttle control knob.
5. Remove Phillips screws ([B] Fig. 2) and trim plate.

6. Remove tank mounting bolts. Keep hoses with tank.

7. Open hose clamp and remove hose from tank outlet fitting and set aside.
8. Remove shut-off valve and bracket if necessary.

#### Installation

For torque values: **SEE SECTION 14- ENGINE SPECIFICATIONS.**

1. Install valve bracket on side of blower housing and torque screws to values listed.
2. Install shut-off valve and hose on valve bracket. Clamp hose to carburetor fitting.
3. Install new hose and clamp on tank outlet fitting. Connect other end of hose and clamp to shut-off valve fitting.

Route tank hose through retainer on crankcase cover, then position tank on engine.

4. Start all screws, then torque each to values listed.
5. Position trim plate and install Phillips screws to values listed.
6. Install throttle control knob.
7. If equipped, install the remote throttle control bracket and rewind assembly, and torque screws to values listed.
8. Connect breather hose to valve cover, then install air cleaner assembly.
9. Add small amount of fuel to tank, open shut-off valve and check for leaks.
10. Start engine and check for leaks again.

### Fuel System

(085400, 115400, 117400, 138400, 185400, 235400, 245400)

#### Removal

1. Open hose clamp and disconnect tank hose at fuel shut-off valve.
2. Place hose in appropriate container and allow fuel to completely drain from tank.

3. Open carburetor bowl drain screw and drain remaining fuel into appropriate container.
4. Close bowl drain screw.
5. If equipped with metal key switch cover (Fig. 3), remove screws from cover and allow cover to hang from wiring.



Fig. 3

6. Remove throttle control knob.
7. If equipped with separate control cover, remove screw from top of cover and remove cover.
8. Remove screws ([A] Fig. 4) at left and right ends of trim plate.
9. Lift off trim plate, leaving rocker switch wires connected (Fig. 4), if equipped.



Fig. 4

10. Remove screws and/or nuts from front and rear of tank.
11. Lift off tank and hose.

12. Release clamp and disconnect hose from tank outlet fitting. Set aside.
13. Release clamp and disconnect hose at carburetor fitting.
14. Remove screw ([A] Fig. 5) and remove shut-off valve with spacer ([B]).



Fig. 5

15. Drain any remaining fuel into appropriate container.
16. Disassemble shut-off valve, if necessary.

5

### Removing Governor Linkage Bracket (085400, 115400, 117400, 138400, 185400, 235400, 245400)

Removing the governor linkage bracket is essentially the same for all the models listed above.

To gain access to the carburetor, complete the following steps:

1. Remove return spring ([A] Fig. 6) and set aside.
2. Remove mounting bolt ([B] Fig. 6) and set governor control bracket aside.

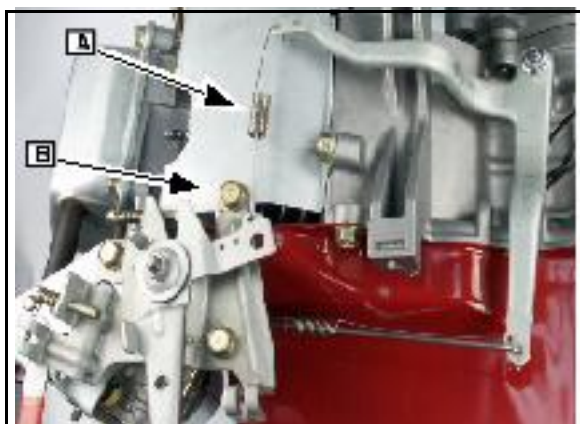


Fig. 6

3. Slide carburetor from its mounting studs and disconnect governor link ([A] Fig. 7) and anti-backlash spring ([B] Fig. 7) when carburetor is free.
4. Remove governor link and anti-backlash spring from governor lever ([C] Fig. 7) and set aside.

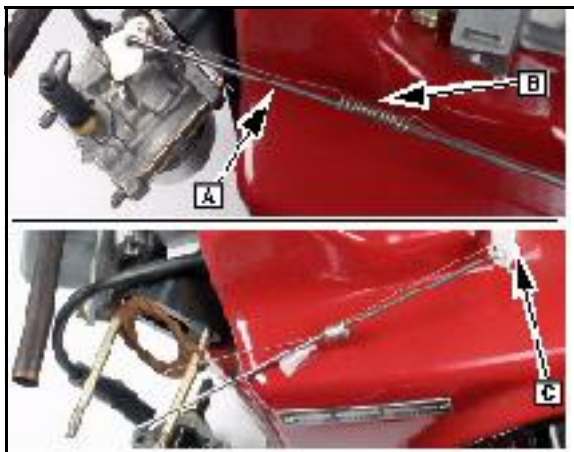


Fig. 7

5. Remove the carb spacer from the carburetor mounting studs. **SEE SECTION 13- FINAL ENGINE ASSEMBLY.**



Fig. 8

Inspect Fuel System. **SEE SECTION 5- FUEL SYSTEM CLEANING AND INSPECTION.**

#### Installation

For torque values: **SEE SECTION 14- ENGINE SPECIFICATIONS.**

1. Place gasket, carb spacer and gasket on mounting studs.
2. Connect governor/choke linkages on carburetor and position carburetor on mounting studs.
3. Mount governor control bracket/s (as required) and connect links and springs.
4. Position shut-off valve and hose into index hole on blower housing.
5. Install spacer and screw, and torque to values listed.
6. Connect hose with clamp to carburetor fitting.
7. Install new hose and clamp on tank outlet fitting.
8. Connect other end of hose and clamp to shut-off valve fitting.
9. Route tank hose through retainer on crankcase cover, then position tank on engine.
10. Start all screws and nuts.

**NOTE: (115400)** Do not pinch governor link spring behind head of screw. The ground wire terminal must be installed under screw on right side of tank.



11. Torque screws and nuts to values listed.
12. Position trim plate and install short screw on left side and long screw on right side.
13. Install separate control cover (if equipped) and torque screws to values listed.
14. Install throttle control knob.
15. Position metal key switch cover (if equipped) and start all screws.
16. Torque mounting screws to values listed.
17. Add small amount of fuel to tank.
18. Open shut-off valve and check for leaks.
19. Install air cleaner assembly. **SEE SECTION 1- AIR CLEANER SERVICE.** and use information appropriate for your engine model.
20. Start engine and check for leaks again.

## Fuel System (104700)

### Removal

1. Close shut-off valve, if equipped.
2. Release clamp and disconnect fuel hose from carburetor fitting.
3. Place hose in appropriate container, open shut-off valve, and allow fuel to completely drain from tank.
4. Release clamp and disconnect hose from tank fitting.
5. Disassemble shut-off valve and filter, if equipped, from hoses and set aside.
6. Remove the two Phillips screws that secure the brake assembly cover ([A] Fig. 9).



Fig. 9

7. Remove the three tank mounting screws ([A] Fig. 10) and remove tank.

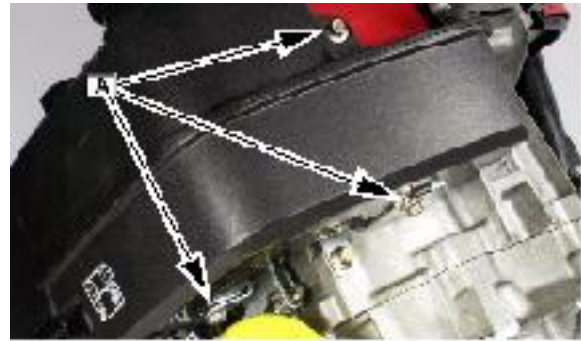


Fig. 10

### Inspect Fuel System. **SEE SECTION 5- FUEL SYSTEM CLEANING AND INSPECTION.**

8. Remove air filter and housing.
9. Remove muffler.
10. Remove Blower Housing.
11. Disconnect stop switch wire ([A] and return spring ([B] Fig. 11) from governor lever.

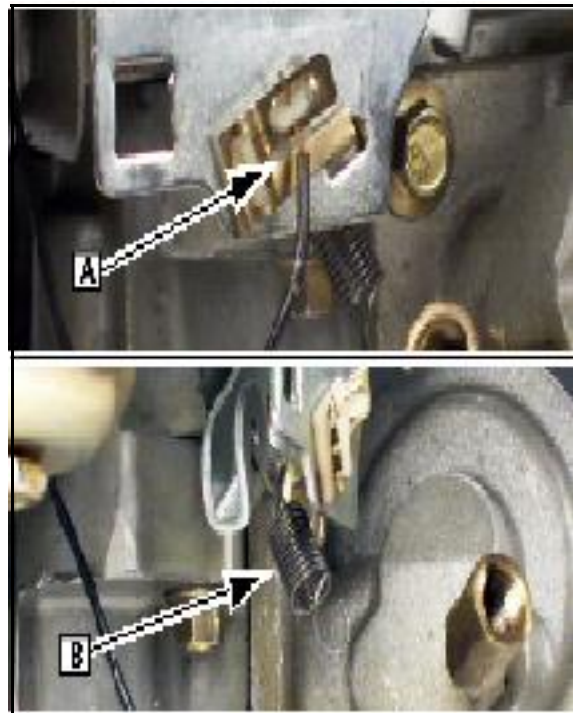


Fig. 11

12. Remove governor link ([A] Fig. 12) from carburetor by pulling up on link.
13. Remove governor bracket mounting screws that are shown in ([B] Fig. 12).



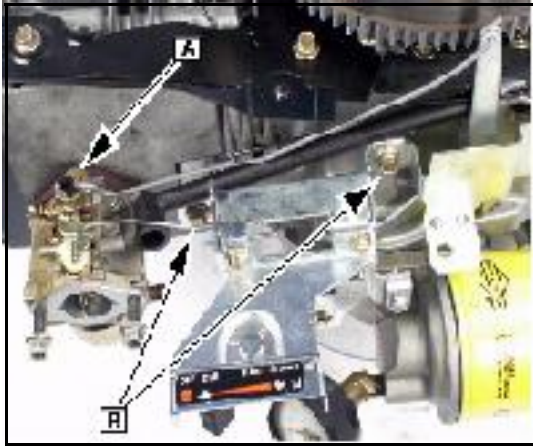


Fig. 12

14. Move the carburetor from its mounting studs and disconnect the choke link when it is free.

### Installation

For torque values: **SEE SECTION 14- ENGINE SPECIFICATIONS.**

1. Install choke link on carburetor choke shaft.
2. Place the large gasket (A), spacer (B) and carburetor gasket (C) as shown in (Fig.13).

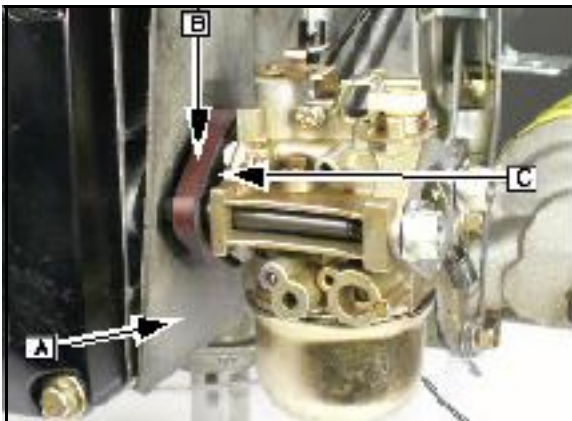


Fig. 13

3. Slip choke link through control bracket and install bracket (Refer back to Fig. 12).
4. Reinstall stop switch wire and governor lever return spring (Refer to Fig. 11).
5. Install Blower Housing. **SEE SECTION 3- ENGINE DISASSEMBLY.**
6. Install muffler. **SEE SECTION 4- EXHAUST SYSTEMS.**
7. Install air filter and housing.

8. Install tank using long screw next to brake assembly and short screws underneath.
9. Torque screws to values listed.
10. Position brake assembly cover and install phillips screws to values listed.
11. Install hose assembly to tank fitting and carburetor fitting with new clamps.
12. Add small amount of fuel to tank, open shut-off valve, and check for leaks.
13. Start engine and check for leaks again.

## Fuel System (161400)

### Removal

1. Release clamp and disconnect tank hose at shut-off valve ([A] Fig. 14).
2. Place hose in appropriate container and allow fuel to completely drain from tank.
3. Open carburetor bowl drain screw ([B] Fig. 14), if equipped, and drain remaining fuel into appropriate container. Close bowl drain screw.
4. Remove choke and throttle control knobs.
5. Remove screws ([C] Fig. 14) that secure trim plate.

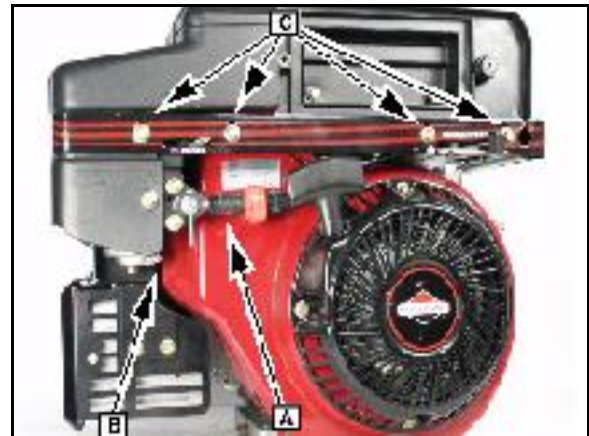


Fig. 14

6. Remove air filter and housing.
7. Remove tank support screws above valve cover.
8. Lift off tank and carefully slip hose and filter (if equipped) under the governor link.
9. Slip spark plug wire through hole in tank support. Set tank aside.

10. Remove bolts ([A] Fig. 15) that secure shut-off valve.



Fig. 15

11. Remove bolts ([B] Fig. 15) that hold the choke bracket, air intake duct and carburetor.
12. While removing carburetor, disconnect governor link and anti-backlash spring.
13. Release clamp and disconnect hose with shut off valve from carburetor fitting.
14. Drain any remaining fuel into appropriate container.

**NOTE:** Some variations of model 161400 incorporated a fuel pump mounted near the blower housing and the air cleaner cover. This allowed for a remote fuel tank installation by some OEMs. The pump is operated by vacuum pulses from the engine.

1. Disconnect vacuum line (A) and fuel line (B) to the fuel pump (C) Fig. 16)
2. Remove two screws that secure mounting bracket to crankcase.
3. Remove pump from bracket (if necessary).

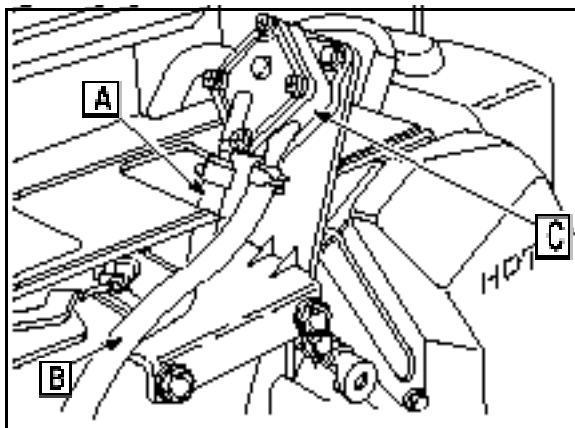


Fig. 16

Inspect Fuel System. **SEE SECTION 5- FUEL SYSTEMS AND CARBURETION.**

### Installation

For torque values: **SEE SECTION 14- ENGINE SPECIFICATIONS.**

1. Install the carburetor assembly as shown in (Fig. 17).

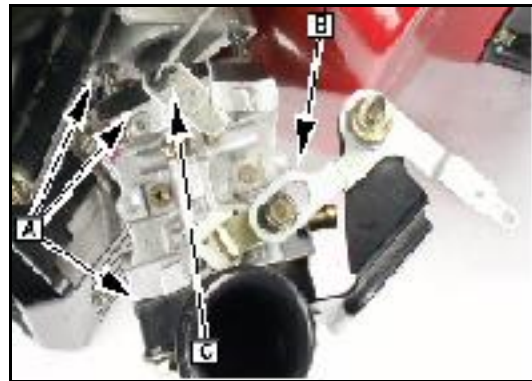


Fig. 17

Refer to (Fig. 17)

- (A) Carburetor gaskets in these locations.
  - (B) Choke link connected to choke shaft.
  - (C) Governor Lever and anti-backlash spring connected to throttle.
2. Torque carburetor mounting bolts to values listed.
  3. Connect fuel hose and clamp from fuel shut-off valve to carburetor. Torque mounting bolts to values listed.
  4. Route spark plug wire through hole in tank support bracket and route tank hose and filter under governor link, then position tank on engine.
  5. Start screws through tank support. Do not tighten at this time.
  6. Connect new hose and clamps between fuel filter and shut-off valve.
  7. Connect breather hose to base. Install screws and torque to listed value.
  8. Install air filter, pre-cleaner, and air cleaner cover. Tighten wing knobs securely.

9. Fit left end of trim plate into slot in air cleaner base.
10. Start screws in holes along trim plate.
11. Torque screws to values listed.
12. Torque tank support screws above valve cover to values listed.
13. Install choke and throttle control knobs.
14. Add small amount of fuel to tank.
15. Open shut-off valve.
16. Check for leaks.
17. Start engine and check for leaks again.

## Fuel System (260700, 261700)

### Removal

For this engine series, remote fuel tanks were typically installed by the OEM. The following procedure does not include removal of the tank from the equipment.

1. Release clamp and disconnect tank hose ([A] Fig. 18) at pump inlet fitting.
2. Place hose in appropriate container and allow fuel to completely drain from tank.
3. Open carburetor bowl drain screw, if equipped, and drain remaining fuel into appropriate container.
4. Close bowl drain screw.
5. Release clamps and disconnect impulse hose at crankcase fitting ([B] Fig. 18) and fuel supply hose at carburetor fitting ([C] Fig. 18).



Fig. 18

6. Loosen screw at hose clamp, if equipped, on control bracket.
7. Remove pump screws and remove pump and hose assembly from engine.
8. Disassemble hoses from pump, shut-off valve, and filter, if equipped.
9. Remove screws and pump bracket, if necessary.
10. Remove air filter and housing.
11. Remove the two nuts that secure the air induction manifold and the carburetor.
12. Disconnect the choke link ([A] Fig. 19) and while sliding the carburetor from its mounting studs, disconnect the governor link and anti-backlash spring ([B] Fig. 19).

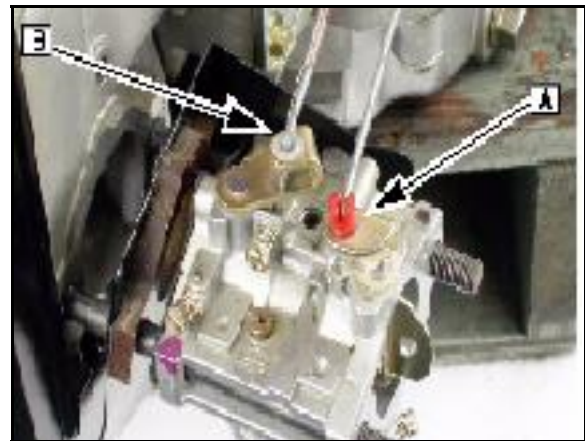


Fig. 19

Inspect Fuel System.

**SEE SECTION 5- FUEL SYSTEMS AND CARBURETION.**

### Installation

**FOR TORQUE VALUES: SEE SECTION 14- ENGINE SPECIFICATIONS.**

1. Place gasket, heat shield, gasket, heat riser and another gasket as shown in (Fig.21).



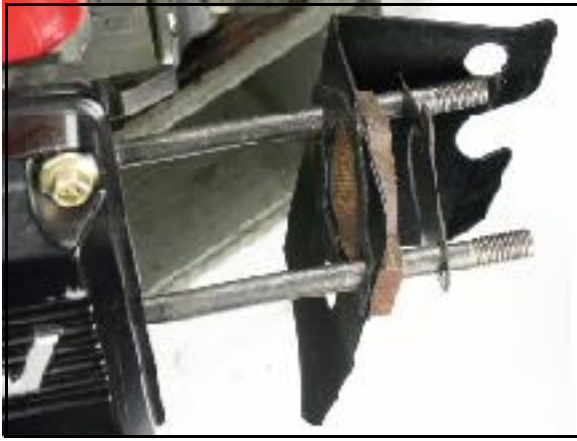


Fig. 20

2. While sliding carburetor on its mounting studs, install the governor link and anti-backlash spring (Refer back to Fig. 20).
3. Install choke link.
4. Mount new gasket and air intake manifold and secure with two nuts.
5. Torque mounting nuts to values listed.
6. Install air filter housing and air filter.
7. Re-install pump bracket, if removed. Torque screws to values listed.
8. Install pump and hose assembly on pump bracket and torque screws to values listed.
9. Connect hoses and clamps to carburetor fitting and crankcase fitting. Route hose under hose retainer.
10. Torque screw to values listed.
11. Connect new fuel hose and clamps between tank outlet and pump inlet fittings.
12. Add small amount of fuel to tank, open shut-off valve, if equipped, and check for leaks.
13. Start engine and check for leaks again.

## Fuel System (28Q700)

### Removal

For this engine series, remote fuel tanks were typically installed by the OEM. The following procedure does not include removal of the tank from the equipment.

1. Release clamp and disconnect tank hose at pump inlet fitting (Previously removed).

2. Disconnect the clamps at the carburetor fitting ([A] Fig. 21) and the crankcase ([B] Fig. 21).
3. Remove the bolts ([C] Fig. 21) that secure the pump to its mounting bracket.

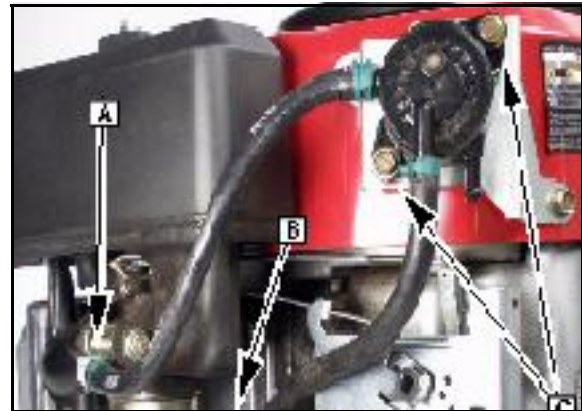


Fig. 21

4. Remove air filter cover and air filter.
5. Remove the two nuts ([A] Fig. 22) that secure the air filter housing to the carburetor mounting studs.
6. Remove the supporting bolt ([B] Fig. 22) in the air filter housing.

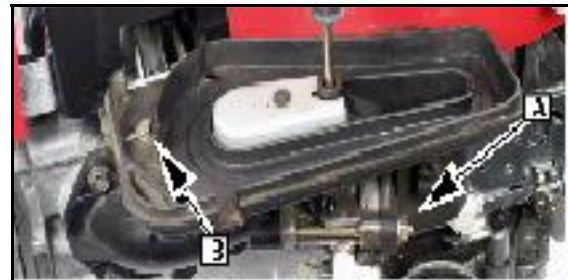


Fig. 22

7. Slide the air cleaner housing free of the carburetor mounting studs and disconnect the crankcase breather tube from the housing.
8. Remove the two studs ([A] Fig. 23) that hold the carburetor to the air intake manifold.

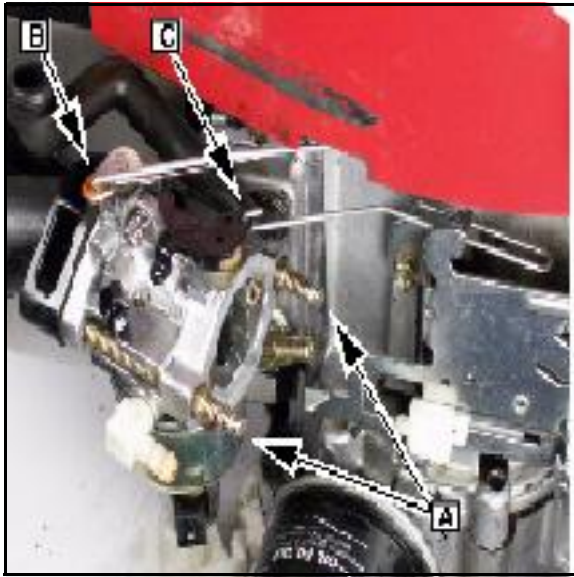


Fig. 23

9. While removing the carburetor, disconnect the governor link with anti-backlash spring (B) and the choke link (C) Fig. 23).
10. Remove the two bolts that secure the air intake manifold to the crankcase ([A]Fig.24).

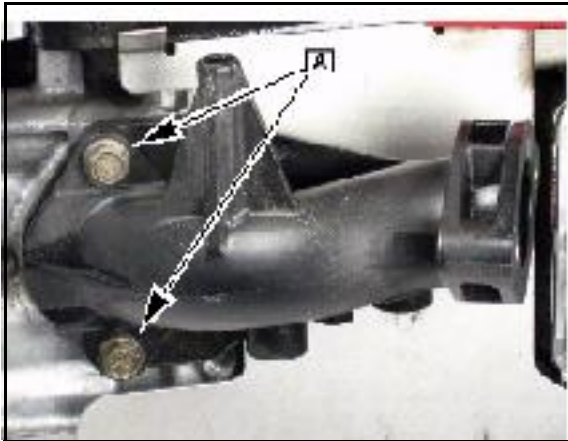


Fig. 24

### Installation

1. Make sure the seal is properly seated in the groove of the air intake manifold ([A] Fig. 25).



Fig. 25

2. Install air intake manifold and torque bolts to values listed.
3. Slip mounting bolts through carburetor and connect governor lever with its anti-backlash spring and the choke link.
4. Slip carburetor gasket on the bolts install carburetor. Torque bolts to values listed.
5. Place gasket on studs and mount air cleaner housing on carburetor studs. Torque nuts to values listed.
6. Install air cleaner housing supporting bolt (See [B] Fig. 22). Torque to values listed.  
**SEE SECTION 14- ENGINE SPECIFICATIONS.**
7. Install air filter and cover.
8. Install fuel pump to its mounting bracket (Refer back to Fig. 21). Torque bolts to values listed.
9. Install hoses and clamps to carburetor fuel inlet, cylinder housing and fuel tank supply hose.
10. Install shut-off valve with new hose and clamps on carburetor fitting. Install screws and torque to values listed.



## CARBURETOR SERVICE PROCEDURES

(050000, 085400, 086400, 115400,  
117400, 118400, 104700, 161400,  
185400, 260700, 261700)

Some engines were built using both Nikki and Walbro carburetors. These carburetors have a fixed high speed main jet with adjustment screws for idle mixture and idle speed only. Be certain to use both the manufacturer and the carburetor number when ordering service parts. Service parts are available for both carburetors. Engines used in snow removal equipment use Nikki carburetors with an adjustment screw for idle speed only. This carburetor also has a primer bulb port.

**Carburetor Service - Mikuni**  
(050000, 085400, 086400, 115400,  
117400, 118400, 185400)

**CAUTION:** Do not use wires, drills or other devices to clean out metering holes or passages. Do not use carburetor cleaner on non-metallic parts.

**NOTE:** Use compressed air at a moderate pressure setting (5-7 PSI). Blow in both directions to clean out all openings and passages.



Fig. 26

### Disassembly

1. Remove float bowl mounting screw (A), washer (B) and float bowl (C) Fig. 27).



Fig. 27

2. Remove float bowl gasket (D) Fig. 28)

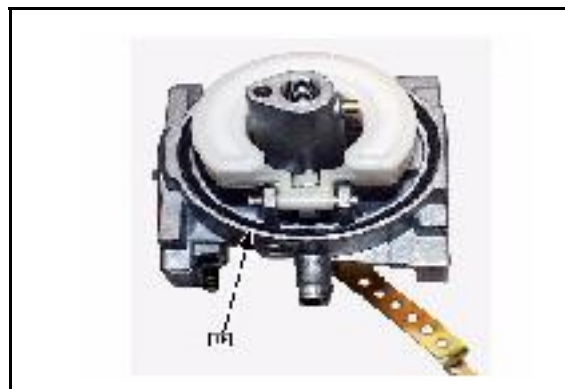
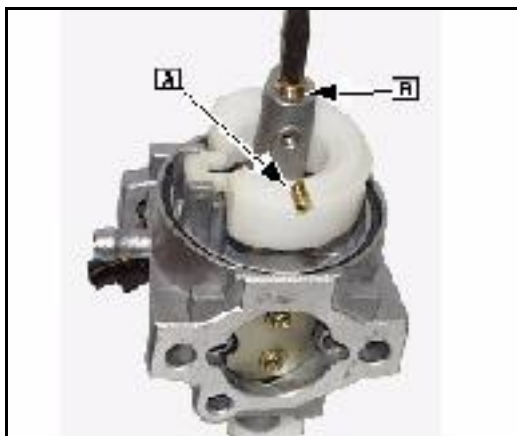


Fig. 28

**CAUTION:** Main jet (A) Fig. 29) must be removed before emulsion tube (B) is removed or damage to threads of the emulsion tube will result.

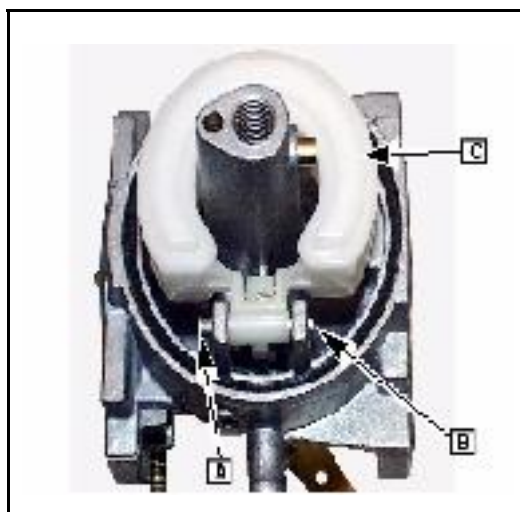
3. Remove main jet (A).
4. Remove carburetor emulsion tube (B) Fig. 29) with screwdriver #19061.



**Fig. 29**

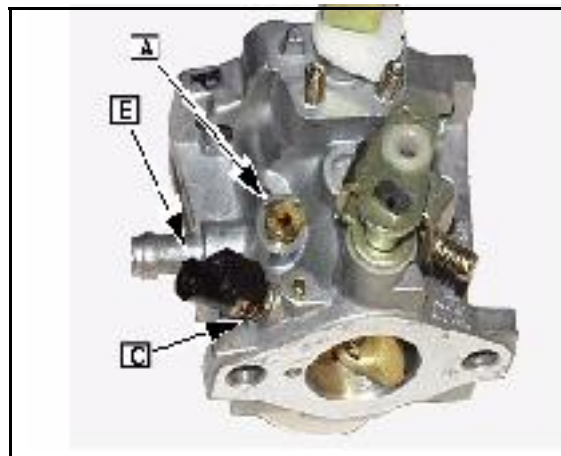
The float hinge pin ([A] Fig. 30) is a wedge fit.

5. Tap the small end of the pin (B) with a center punch until it is loose.
6. Remove pin (A) and remove the float ([C] Fig. 30) and inlet needle assembly.



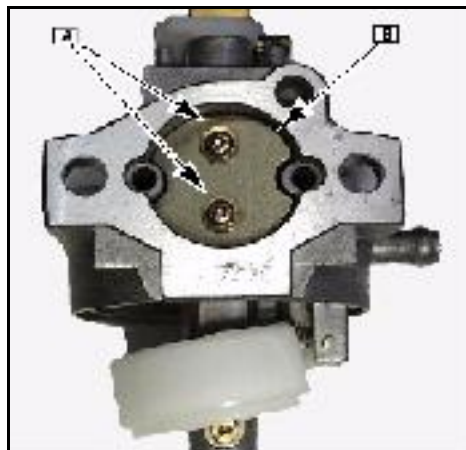
**Fig. 30**

7. Remove pilot jet (A) with Screwdriver # 19062.
8. Pry off the idle mixture valve limiter (B), if used. Remove the idle mixture screw and spring ([C] Fig. 31).



**Fig. 31**

9. Remove screws (A) holding choke plate ([B] Fig. 32) and remove.



**Fig. 32**

10. Lift out choke shaft (A) with upper (B) and lower ([C] Fig. 33) choke shaft bushings.

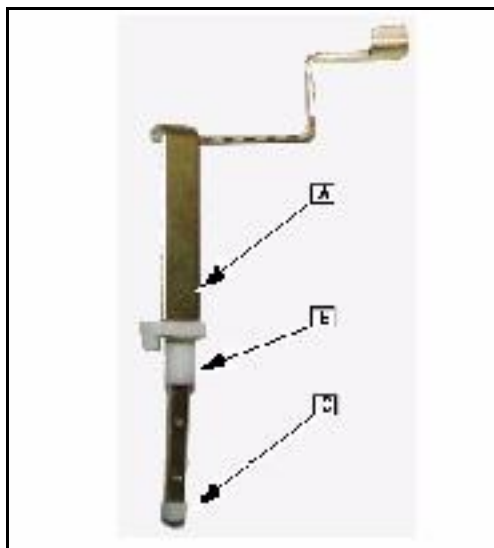


Fig. 33

**NOTE:** Engines with type numbers *not ending in A1 or E1* have removable idle and main air jets. Remove jets ([A] Fig. 34) with carburetor jet screwdriver (#19280).

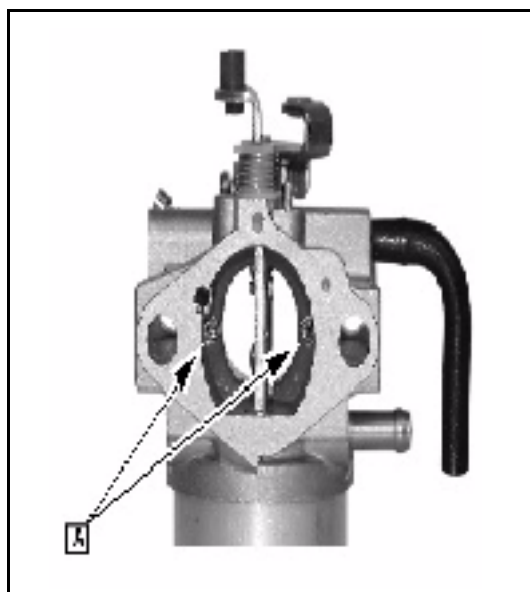


Fig. 34

11. Remove screw and lock washer (A) from throttle plate (B) and remove throttle plate.
12. Lift out throttle shaft and plastic washer ([C] Fig. 35).

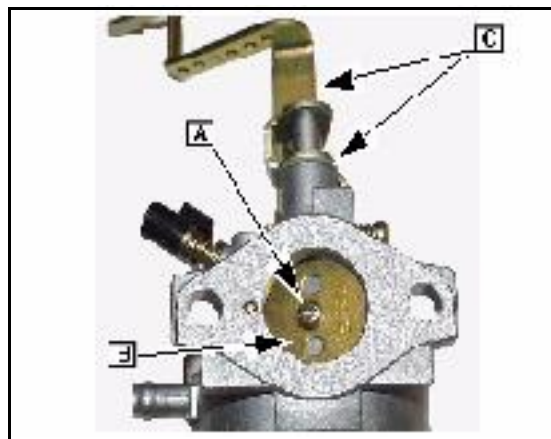


Fig. 35

To clean carburetor:

**SEE SECTION 5- FUEL SYSTEMS AND CARBURETION.**

### Assembly

Use new seals and gaskets when assembling carburetor.

1. Install plastic washer (B) on throttle shaft (A).
2. Install the throttle shaft in the carburetor body with flat ([C] Fig. 36) facing out.

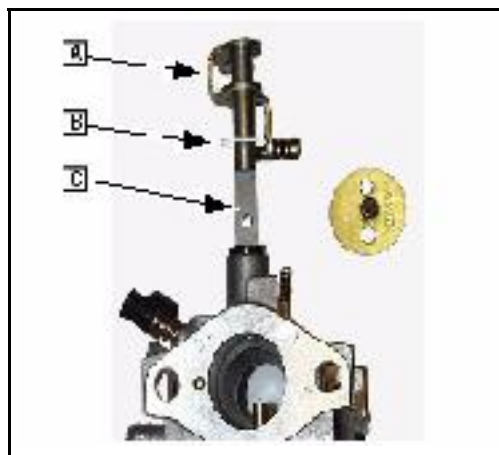


Fig. 36

3. Place the throttle plate (A) on the throttle shaft (B) with the stamped numbers ([C] Fig. 37) to the right. Install screw with washer.

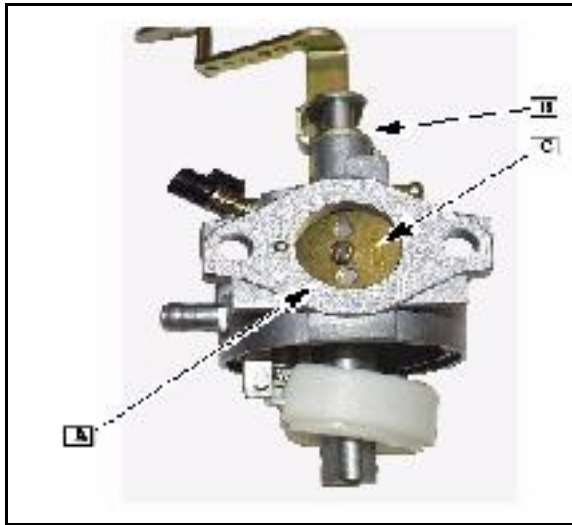


Fig. 37

4. Rotate throttle shaft to check for binding. Correct if required.
5. Place upper choke shaft bushing ([A] Fig. 39) on choke shaft ([B] Fig. 39) with the detents ([C] Fig. 39) facing away from the long choke lever arm ([D] Fig. 38) and the stop ([E] Fig. 38) facing the bottom of the shaft.
6. Place bottom bushing ([F] Fig. 38) on bottom of choke shaft.

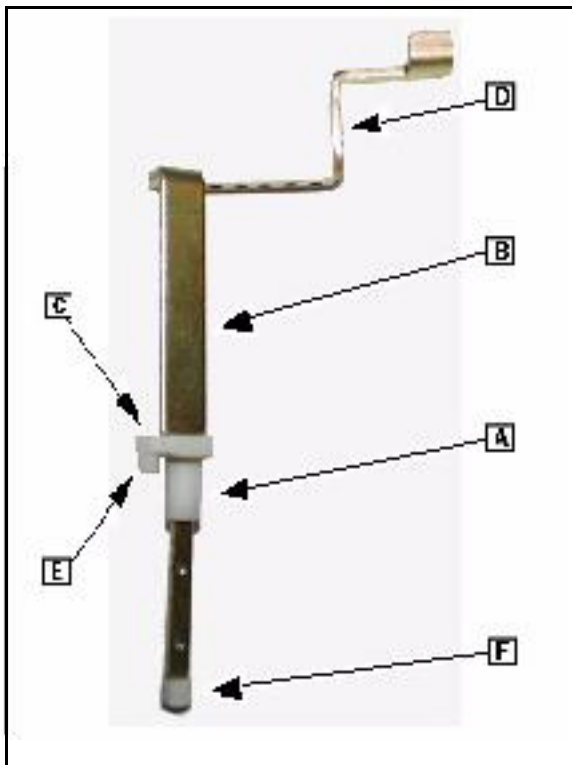


Fig. 38

7. Install choke shaft ([A] Fig. 39) into carburetor.

**NOTE:** Make sure the choke shaft retainer stop ([B] Fig. 39) is between the carburetor body stop ([C] Fig. 39) and the detent spring ([D] Fig. 39) in order to install the choke plate next.

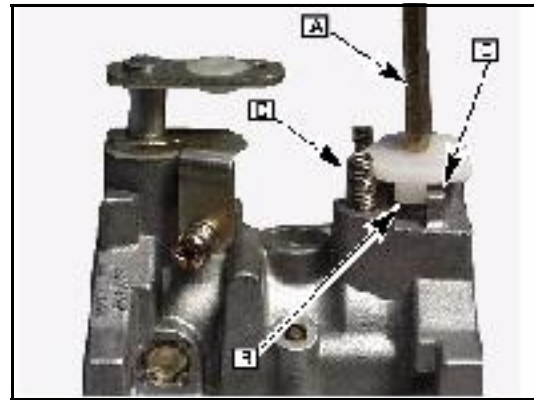


Fig. 39

**NOTE:** Holes in choke plate are offset from center. Be sure to install choke plate with holes properly aligned with holes in choke shaft.

8. Place choke plate ([A] Fig. 40) on choke shaft ([B] Fig. 40) and secure with two screws.

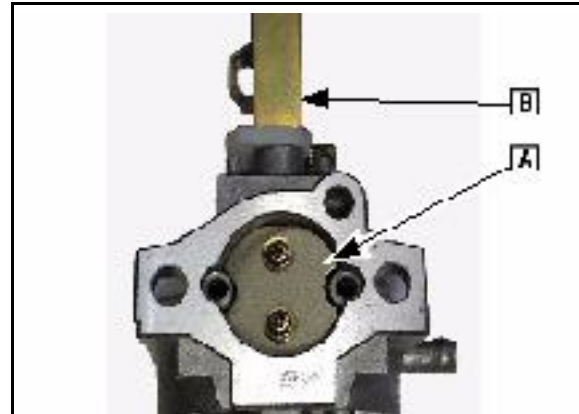


Fig. 40

**NOTE:** Engines with type numbers *not ending in A1 or E1* have removable idle and main air jets. Install jets ([A] Fig. 41) with carburetor jet screwdriver (#19280).

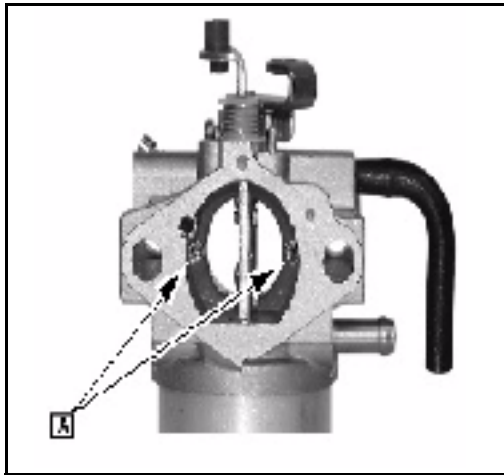


Fig. 41

**CAUTION:** Emulsion tube ([A] fig. 42) must be installed before main jet ([B] or damage to the threads of the emulsion tube will result.

9. Install emulsion tube (A) with screwdriver #19061. Install main jet ([B] Fig. 42).

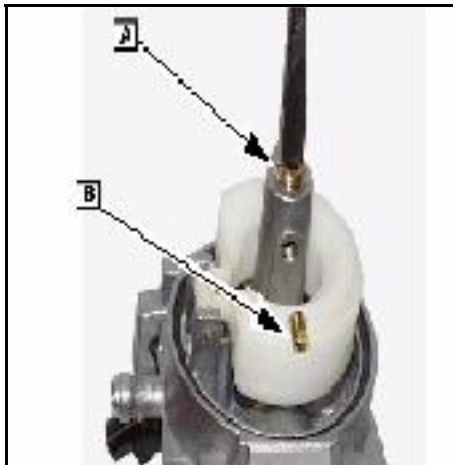


Fig. 42

**FOR MAIN JET AND PILOT JET IDENTIFICATION, SEE IDENTIFYING MAIN AND PILOT JETS ON PAGE 107.**

10. Install pilot jet ([A] Fig. 43).
11. Install idle mixture screw ([B] Fig. 43) and spring.
12. Turn mixture screw in until it *just* makes contact with the seat.
13. Back mixture screw off 1-1/2 turns.
14. Install limiter ([C] Fig. 43) if used.

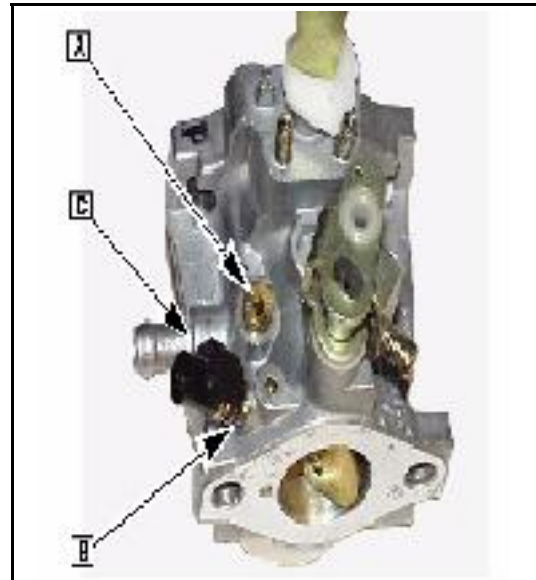


Fig. 43

15. Install spring (A) to groove in fuel needle valve ([B] Fig. 44).

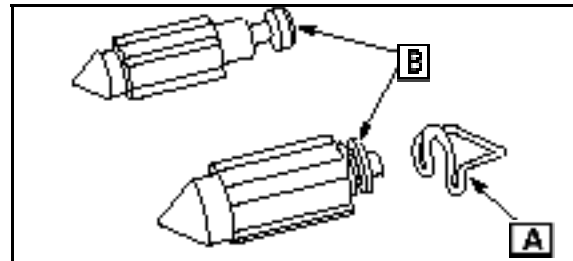


Fig. 44

16. Slide fuel needle valve assembly (A) on tab (B) of float ([C] Fig. 45).

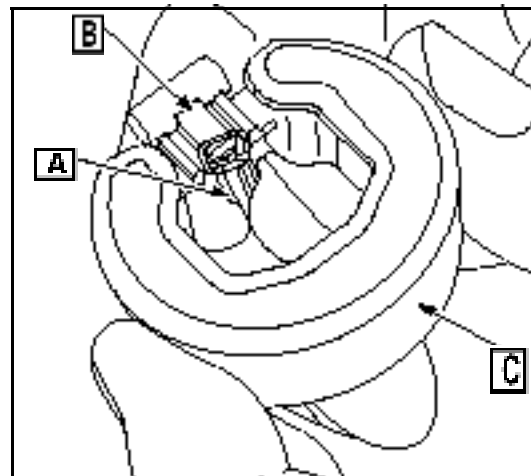


Fig. 45

17. Place float assembly ([A] Fig. 46) in carburetor.
18. Insert the small end of the float hinge pin (B) by hand until pin is through the float



hinge (C) and both hinge pin posts ([D] Fig. 46).

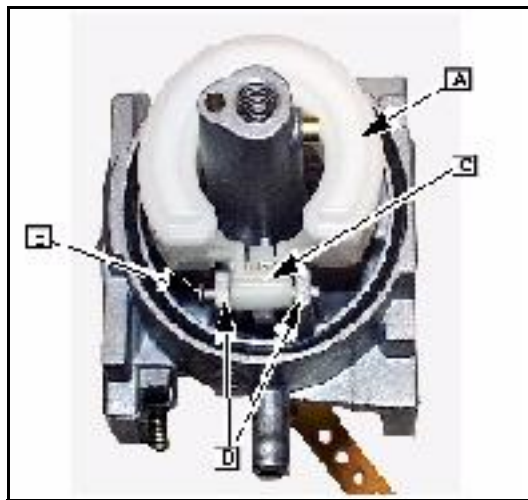


Fig. 46

19. Install the hinge pin.

20. Turn the carburetor body upside down.

**NOTE:** The float (A) should be parallel to the float bowl mounting surface ([B] Fig. 47).

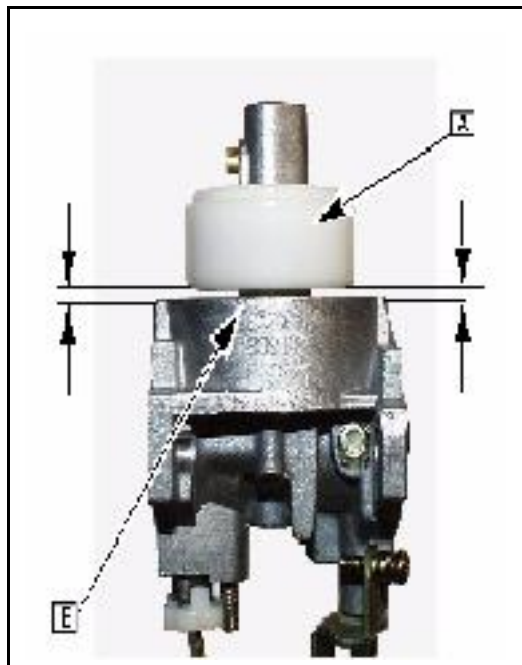


Fig. 47

**If not parallel:**

- Replace the fuel inlet valve, float and hinge pin.

**If still not parallel:**

- Replace carburetor.

21. Install float bowl gasket ([A] Fig. 48) to carburetor body groove.

22. Make sure the gasket does not twist or kink.

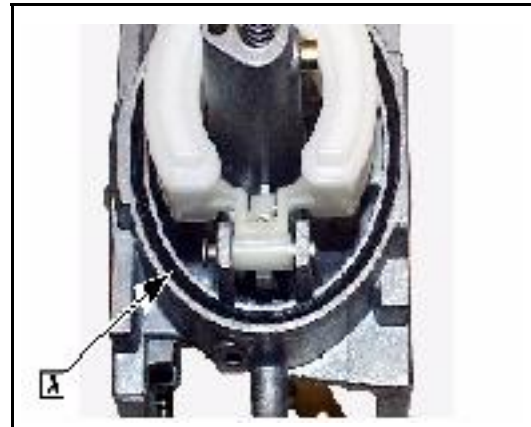


Fig. 48

23. Position bowl drain ([A] Fig. 49) as shown.

24. Install float bowl (B), washer (C), and mounting screw (D), to carburetor.

25. Tighten screw ([D] Fig. 49) securely.

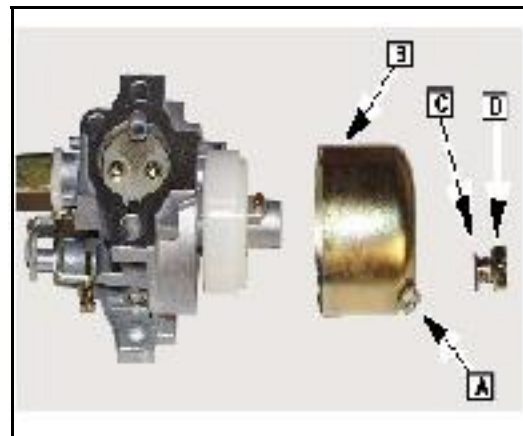


Fig. 49

**Identifying Main And Pilot Jets**  
(085400, 115400, 117400, 185400)

## Type Numbers *Not* Ending In A1Or E1

Model Series	Standard Main Jet	High Altitude Main Jet	Standard Pilot Jet	High Altitude Pilot Jet
085400	71.3	67.5	42.5	40
115400**	75	72.5	45	42.5
115400*	75	72.5	42.5	37.5
117400	81.3	78.8	42.5	41.3
185400**	93.8	90	40	35
185400*	91.3	90	37.5	35
** Large Air Cleaner			*Small Air Cleaner	

## Type Numbers Ending in A1 or E1

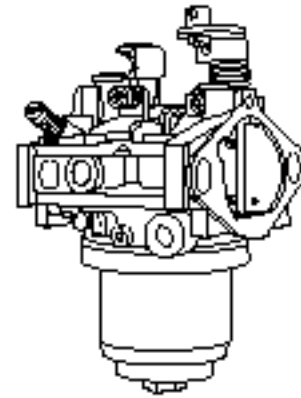
Model Series	Standard Main Jet	High Altitude Main Jet	Standard Pilot Jet	High Altitude Pilot Jet
085400	67.5	82.5	42.5	40
115400	75	72.5	42.5	40
117400	81.3	78.8	42.5	41.3
185400**	91.3	90	40	35
185400*	91.3	90	37.5	35
** Large Air Cleaner			*Small Air Cleaner	

## Carburetor Service - Mikuni

### (104700)

**CAUTION:** Do not use wires, drills or other devices to clean out metering holes or passages.

**NOTE:** Use compressed air at a moderate pressure setting (5-7 PSI). Blow in both directions to clean out all openings and passages.



Mikuni Model Series 85400, 104700, 115400, 117400, 161400, 185400, 260700, 261700

Fig. 50

### Disassembly

1. Remove float bowl mounting screw (C), washer (B) and float bowl (A) Fig. 51).

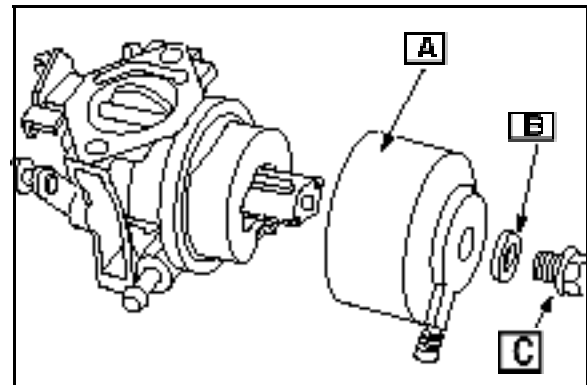


Fig. 51

2. Remove float bowl gasket ((A) Fig. 52).

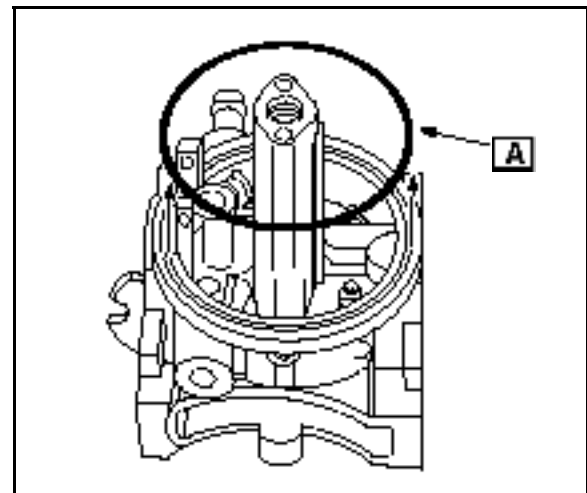


Fig. 52

3. Push float hinge pin (A) out of the hinge posts (B). Remove float (C) and needle assembly (D) Fig. 53).
4. The float hinge pin (A) Fig. 53) is a slip fit.

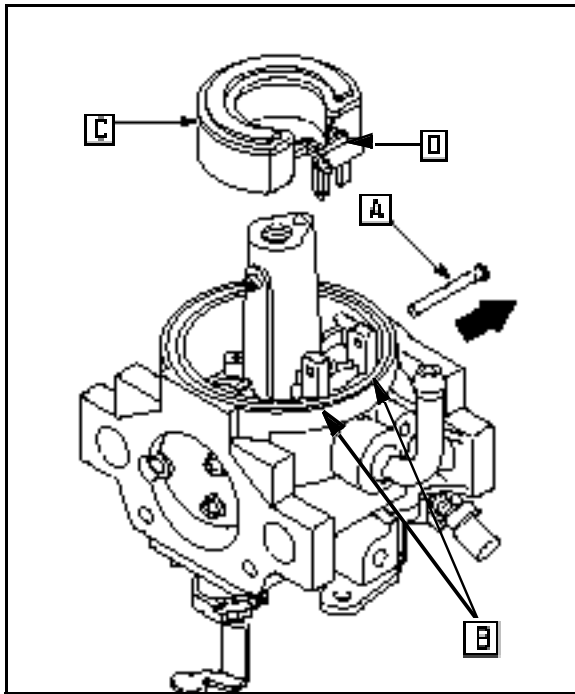


Fig. 53

5. Remove the main jet (A) and the emulsion tube (B) Fig. 54).

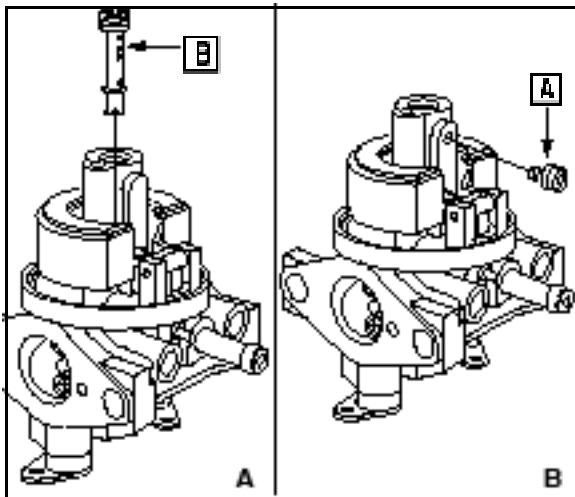


Fig. 54

For correct main jet and pilot jet identification,  
**See Identifying Main Jets on page 107.**

#### Before Date Code 90042933

The emulsion tube can not be removed with the main jet in the carburetor. Unscrew the main jet first, then the emulsion tube.

#### After Date Code 90042833

Remove the fixed main jet. Remove the main emulsion tube with Carburetor Jet Screwdriver, #19062.

6. Pry off the idle mixture valve limiter (if used). Remove the idle mixture screw and spring from carburetor body (A) Fig. 55).
7. Remove pilot jet (B) Fig. 55) with Jet Screwdriver #19062.

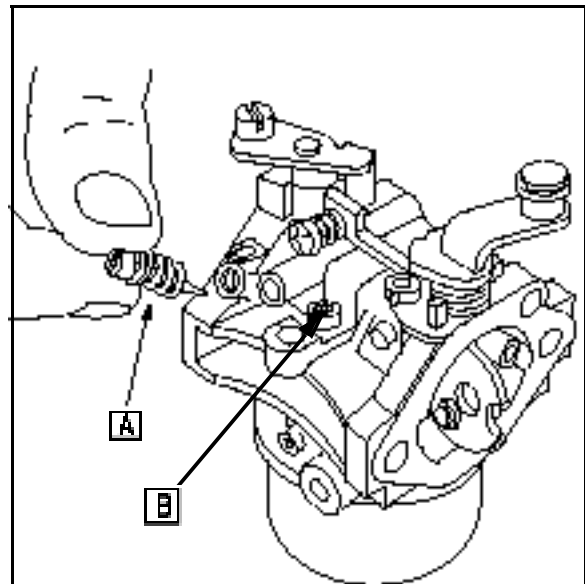


Fig. 55

8. Remove choke plate screws (A). Remove choke plate (B),
9. Unhook choke shaft spring (C) Fig. 56).
10. Remove choke shaft (D) and upper retainer (E), spring (C), washer (F), seal (G), and lower retainer (H) Fig. 56).

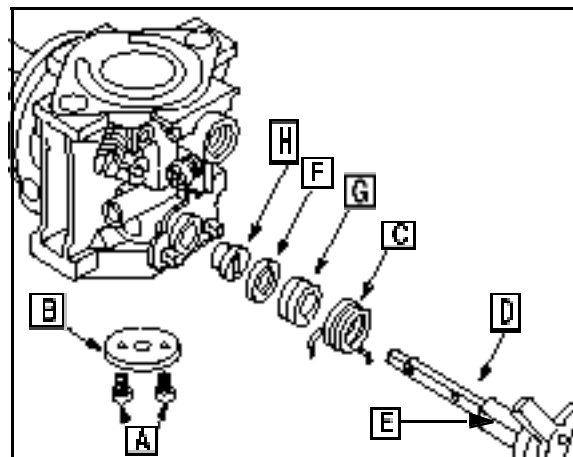


Fig. 56

11. Remove air jets (if removable) on either side of the choke plate opening with Carburetor Jet Screwdriver # 19280.
12. Note the position of the throttle plate.
13. Remove the throttle plate screws (A).
14. Remove the throttle plate ([B] Fig. 57).

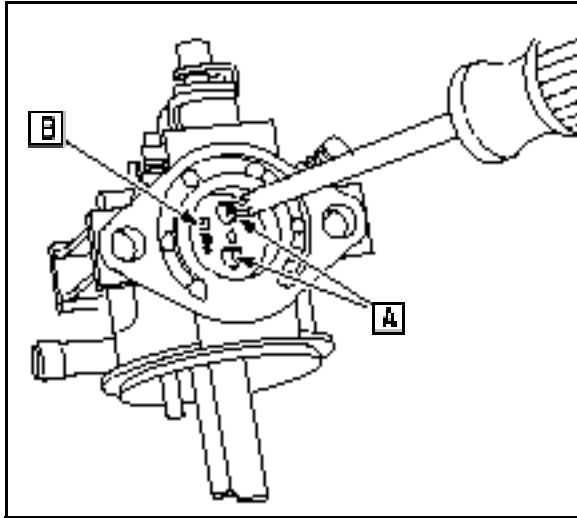


Fig. 57

15. Slide the throttle shaft ([A] Fig. 58) out of the carburetor body.
16. Remove the washer (B).
17. Inspect the shaft seal ([C] Fig. 58).

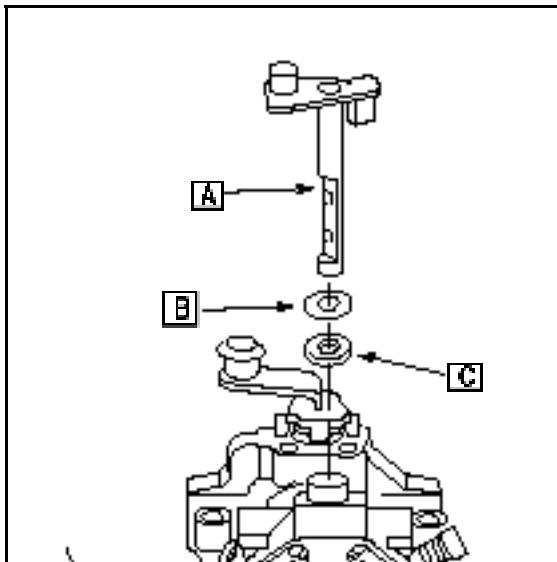


Fig. 58

To clean carburetor:

**SEE SECTION 5- FUEL SYSTEMS AND CARBURETION.**

## Assembly

Use new seals and gaskets when assembling carburetor.

1. Install throttle shaft seal ([B] Fig. 59) to carburetor body (A). Install seal with grooved side out, Fig. 59.
2. Place throttle shaft retainer (C) on throttle shaft (D). Install throttle shaft to carburetor body.
3. Rotate throttle shaft until the flat (E) on the throttle shaft (D) is facing out.
4. Lay the throttle plate (F) on the shaft with the stamped numbers (G) to the left. Install two screws ([H] Fig. 59).

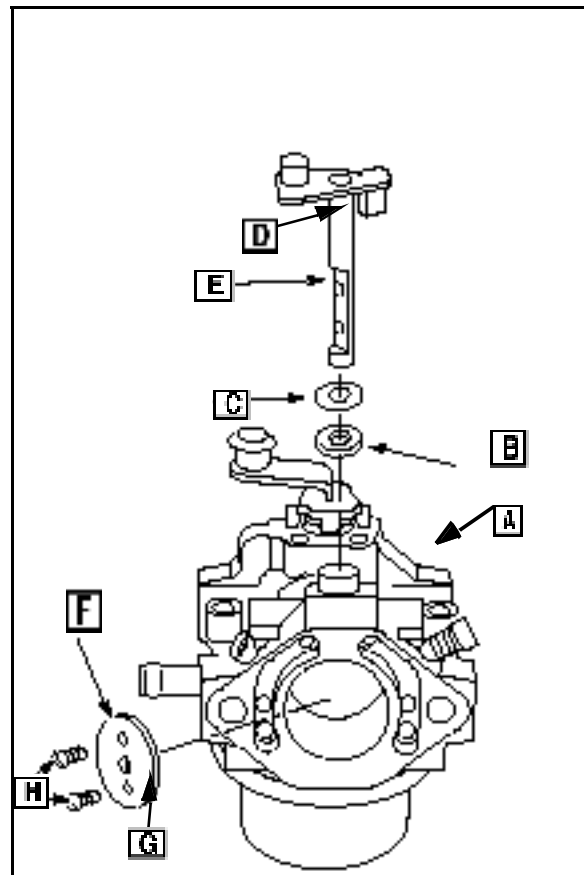


Fig. 59

5. Rotate throttle shaft to check for binding. Correct if required.
6. Install upper retainer (A) to the choke shaft ([B] Fig. 60).
7. Install spring (C), washer (D), seal (E) and lower retainer (F) to choke shaft (B). Insert shaft into carburetor body ([G] Fig. 60).

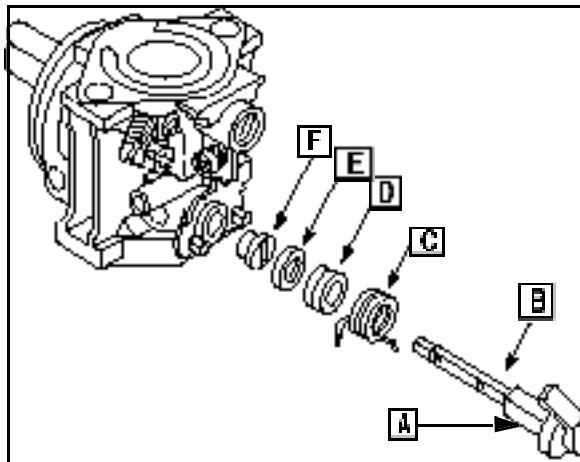


Fig. 60

8. Connect one spring end ([A] Fig. 61) to the carburetor body ([B]), the other end ([C]) to the choke lever ([D] Fig. 61) to hold choke plate open.

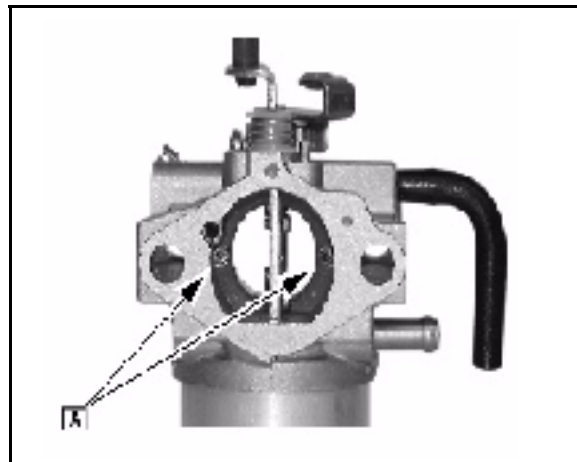


Fig. 62

9. Place choke plate ([A] Fig. 63) on choke shaft with stamped number ([B]) toward the fuel inlet nipple ([C]) side of the carburetor.
10. Secure with two screws ([D] Fig. 63).

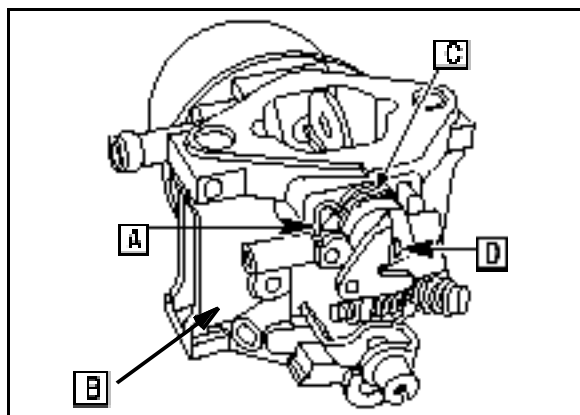


Fig. 61

**NOTE:** Engines with type numbers *not ending in A1 or E1* have removable idle and main air jets. Remove or install jets ([A] Fig. 62) with carburetor jet screwdriver (#19280).

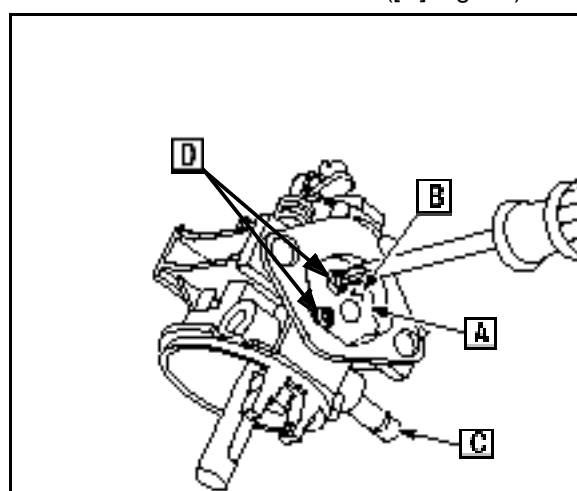


Fig. 63

11. Choke should close when shaft is rotated CCW. Tighten screws securely.
12. Install idle and main air jets, if equipped, on either side of carburetor air inlet.
13. Install pilot jet ([B] Fig. 64). Tighten securely.
14. Install idle mixture screw and spring ([A] Fig. 64). Do not tighten the idle mixture screw.



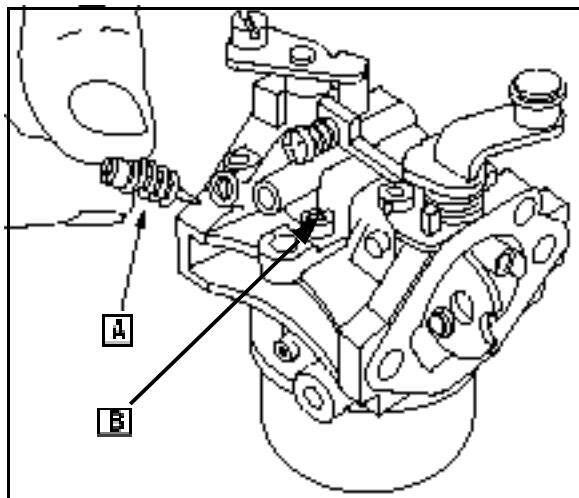


Fig. 64

15. Slide fuel needle valve assembly (A) on to tab (B) of float ([C] Fig. 65).

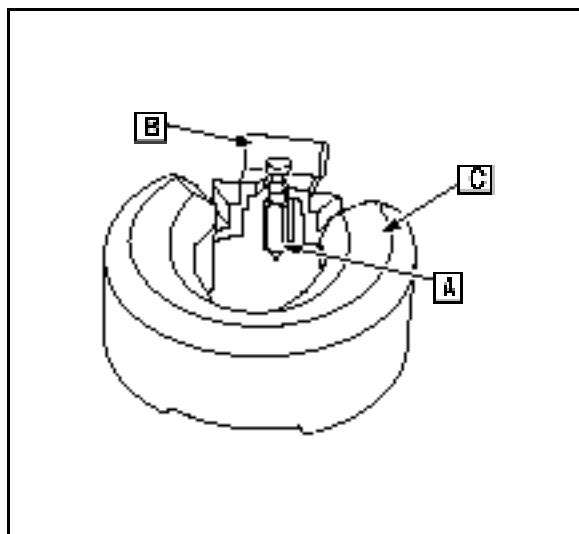


Fig. 65

16. Place float assembly ([A] Fig. 66) in carburetor.

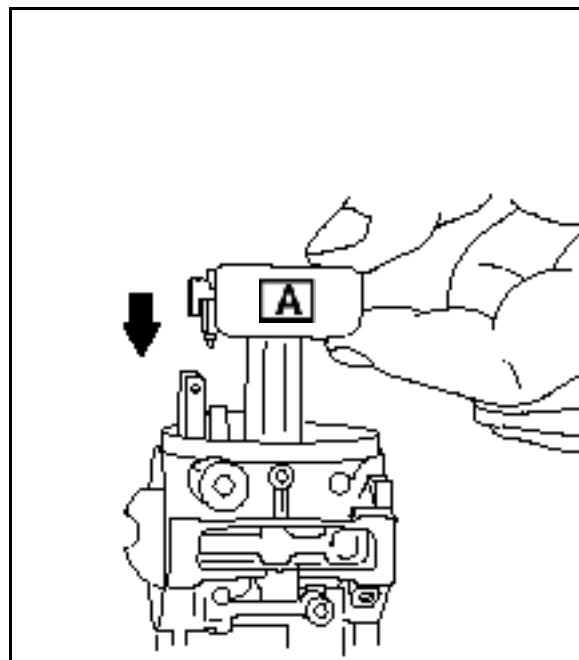


Fig. 66

17. Insert the float hinge pin (A) through the float hinge and both hinge pin posts ([B] Fig. 67). Center the hinge pin in the hinge pin posts.

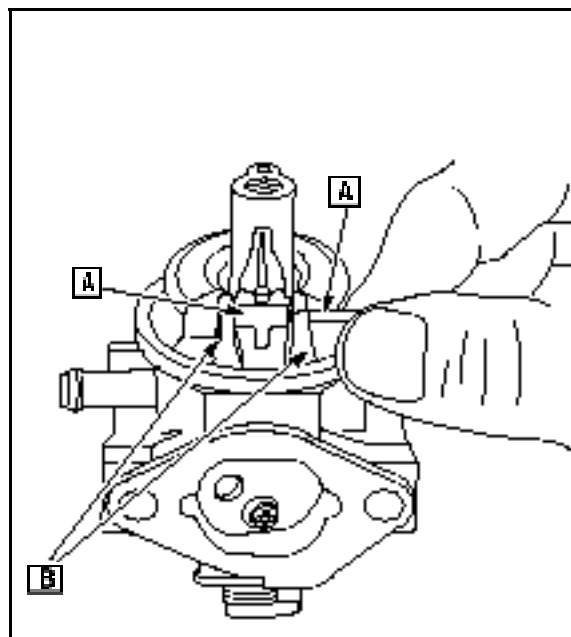


Fig. 67

18. Turn the carburetor body upside down. The float (A) should be parallel to the float bowl mounting surface ([B] Fig. 68).

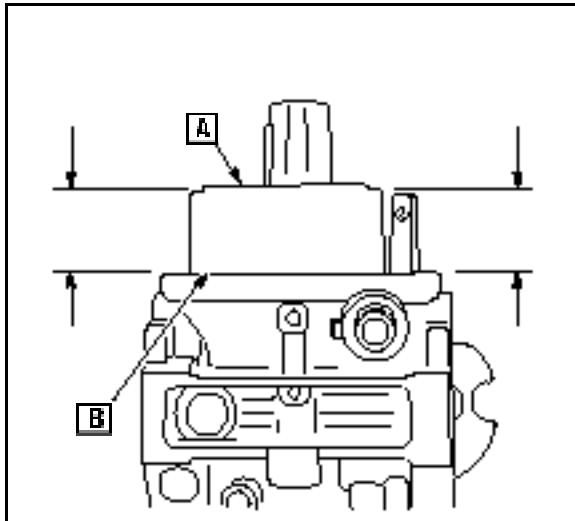


Fig. 68

**If not parallel:**

- Replace the fuel inlet valve, float and hinge pin.

19. Install the emulsion tube (A) and then the main jet ([B] Fig. 69).

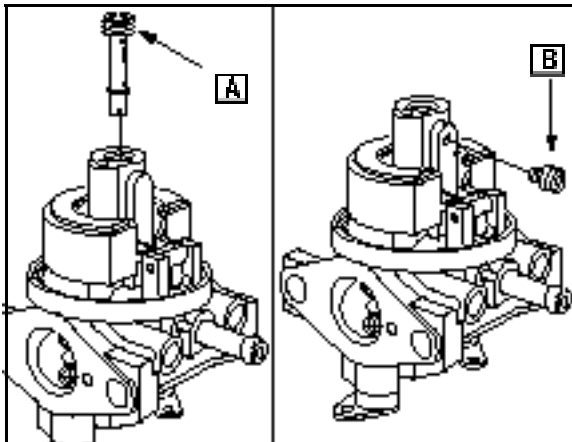


Fig. 69

20. Position bowl drain (A) as shown, Fig.69.

21. Install float bowl (B), washer (C), and mounting screw (D), to carburetor.

22. Tighten screw ([D] Fig. 70) securely.

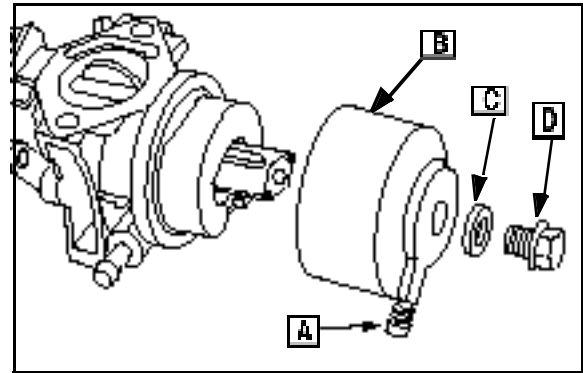


Fig. 70

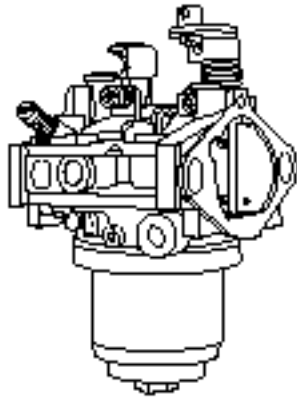
## Identifying Main Jets (104700)

Model Series	Standard Jet	High Altitude Jet
Before 90091033	100	92.5
After 90090933	107.5	102.5

## Carburetor Service - Mikuni (161400)

**CAUTION:** Do not use wires, drills or other devices to clean out metering holes and passages.

**NOTE:** Use compressed air at a moderate pressure setting (5-7 PSI). Blow in both directions to clean out all openings and passages.



Mikuni Model Series 85400, 104700, 115400, 117400  
161400, 185400, 260700, 261700

Fig. 71

### Disassembly

1. Remove the float bowl mounting screw (C), washer (B) and float bowl ([A] Fig. 72).

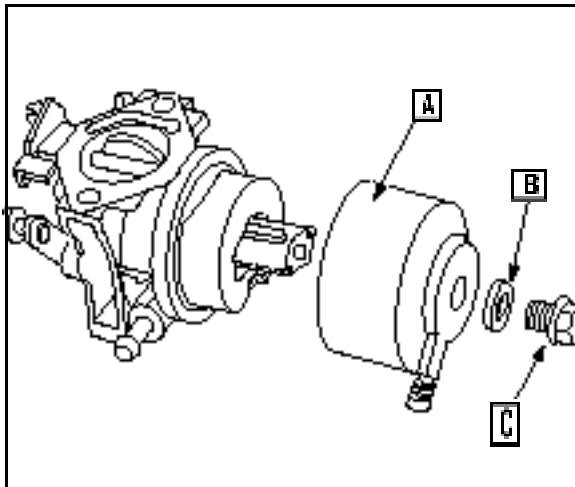


Fig. 72

2. Remove float bowl gasket (A).
3. The float hinge pin is a wedge fit. One end of float hinge pin has two flats ([B] Fig. 73). Tap the opposite end of the pin until loose.

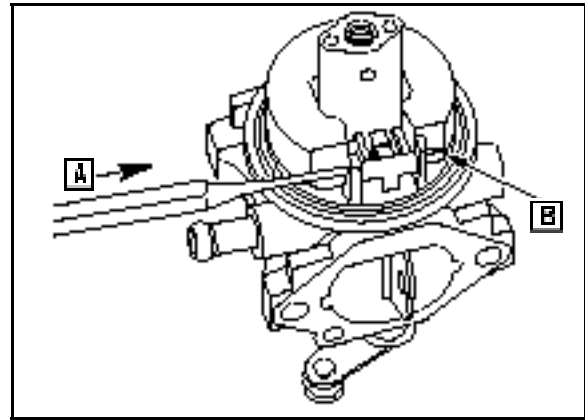


Fig. 73

4. Remove the pin, float and inlet needle assembly.
5. Remove fixed main (B) jet from end of fuel pick up tube first, Fig. 74, then remove the emulsion tube ([A] Fig. 74).

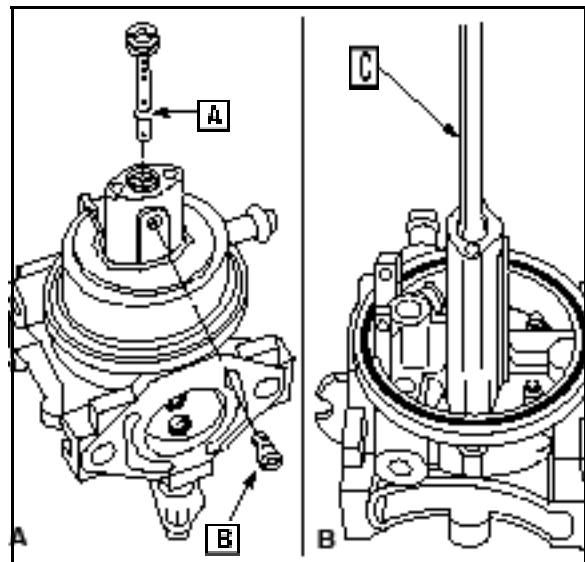


Fig. 74

If emulsion tube does not come out with jet:

- Reach into carburetor throat with flat blade screwdriver and gently tap top of stuck emulsion tube until it comes out (Fig. 75).

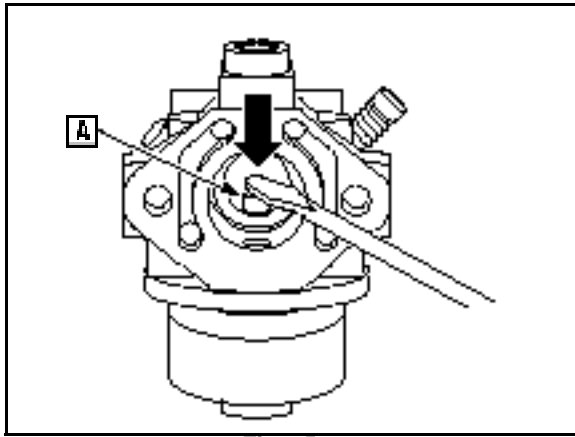


Fig. 75

6. Remove pilot jet ([A] Fig. 76) with screwdriver # 19062.

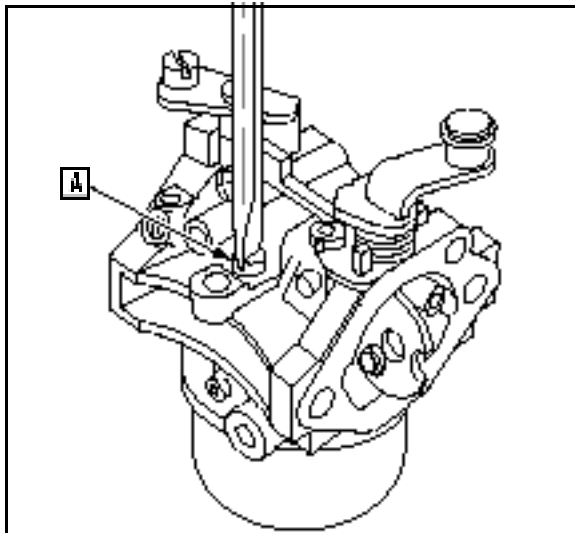


Fig. 76

7. Pry off the idle mixture valve limiter ([A] Fig. 77).
8. Remove the idle mixture screw ([B] Fig. 77).

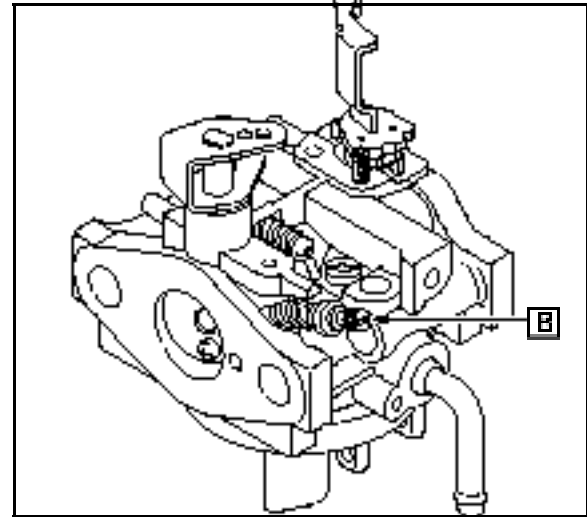


Fig. 77

9. Unhook the choke shaft spring.
10. Remove choke plate screws ([A] Fig. 78).
11. Remove choke plate (B), shaft (C), spring (D), washers (if used), seal (E), bushings (F) Fig. 78).

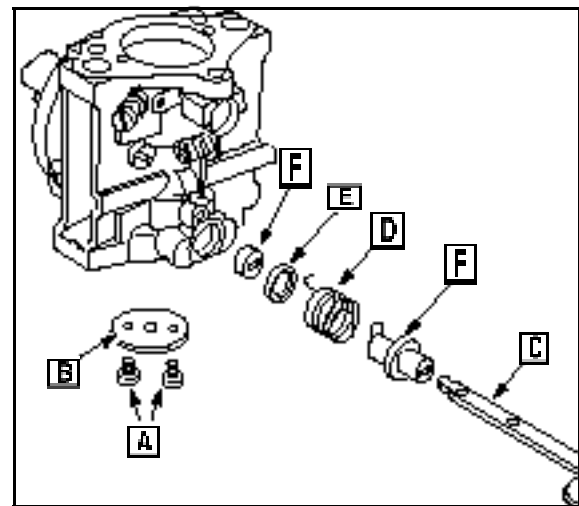


Fig. 78

**NOTE:** Engines with type numbers *not ending in A1 or E1* have removable idle and main air jets.

Remove or install jets ([A] Fig. 79) with carburetor jet screwdriver (#19280).

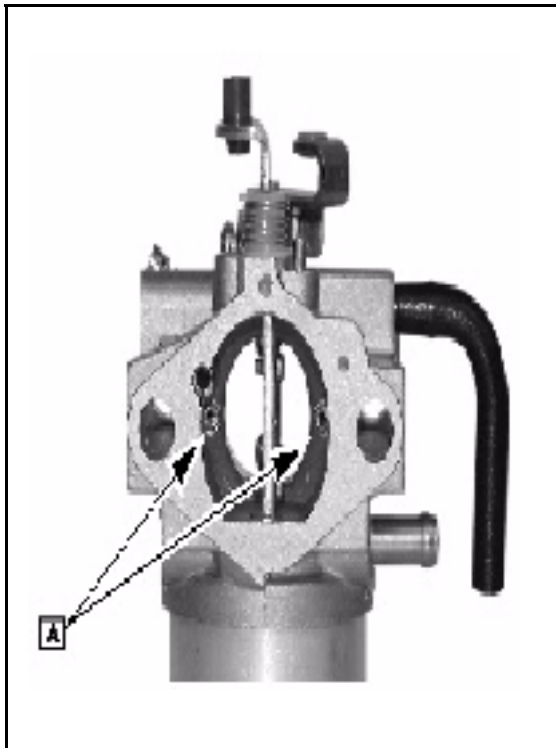


Fig. 79

Note the position of the throttle plate.

12. Remove throttle plate screws ([A] Fig. 81) and remove plate (B).
13. Slide the throttle shaft (C) out of the carburetor body.
14. Remove the throttle shaft seal (D) and washer (E).

15. Remove and inspect the bushing ([F] Fig. 80). Replace if worn or damaged.

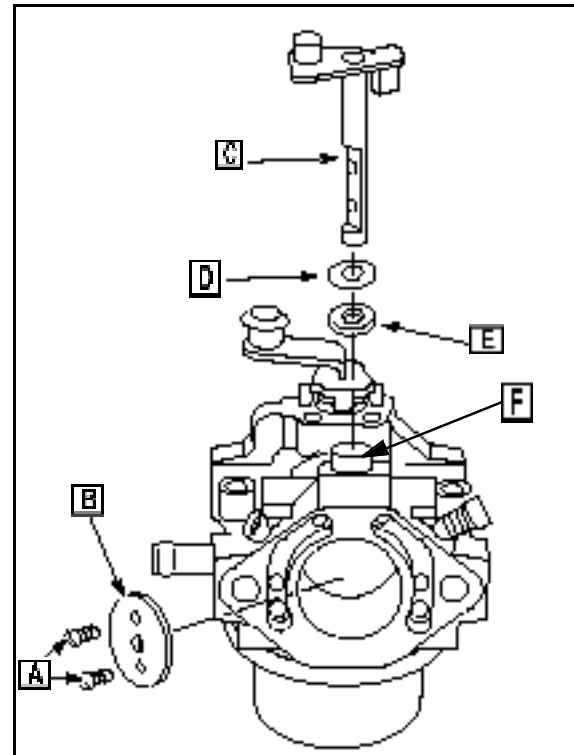


Fig. 80

To clean carburetor:

#### SEE SECTION 5- FUEL SYSTEMS AND CARBURETION.

Inspect the idle mixture screw. Replace the screw if the point is bent or there is a groove in the tip of the needle.

#### Assembly

Use new seals and gaskets when assembling carburetor.

1. Install throttle shaft bushing (A) to carburetor body with grooved side out, Fig. 81.
2. Place washer (B) and throttle shaft seal (C) on the throttle shaft ([D] Fig. 81).
3. Install the throttle shaft to the carburetor body.
4. Rotate throttle shaft until the flat on the shaft is facing out.



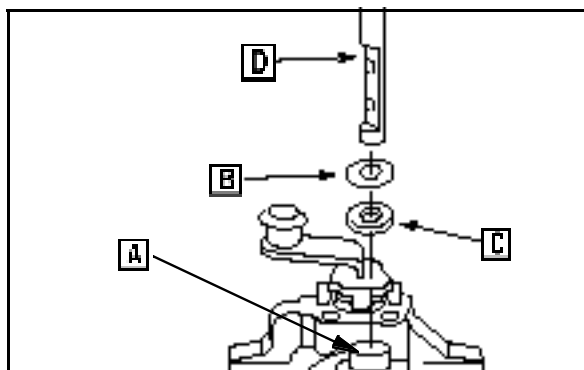


Fig. 81

5. Lay the throttle plate (A) on the shaft with the stamped numbers (B) to the left. Install two screws ([C] Fig. 82).

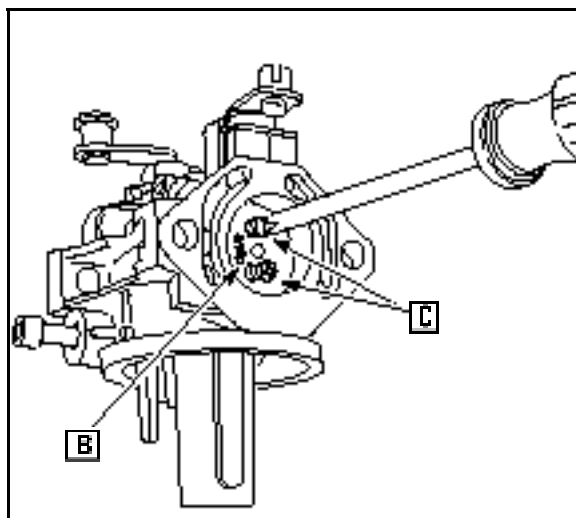


Fig. 82

6. Rotate throttle shaft to check for binding. Correct if required.  
7. Install spring (A), washer (B), bushing (C) and seal (D) to choke shaft ([E] Fig. 83).  
8. Insert shaft to carburetor body, Fig. 83.

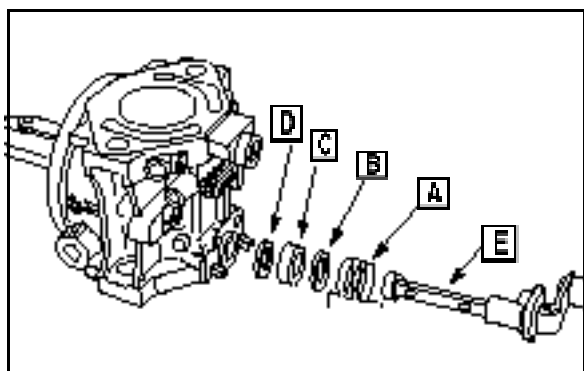


Fig. 83

9. Connect the ends of the spring (A) to the lever (B) and carburetor body (C). The

spring should hold the choke plate open Fig. 84.

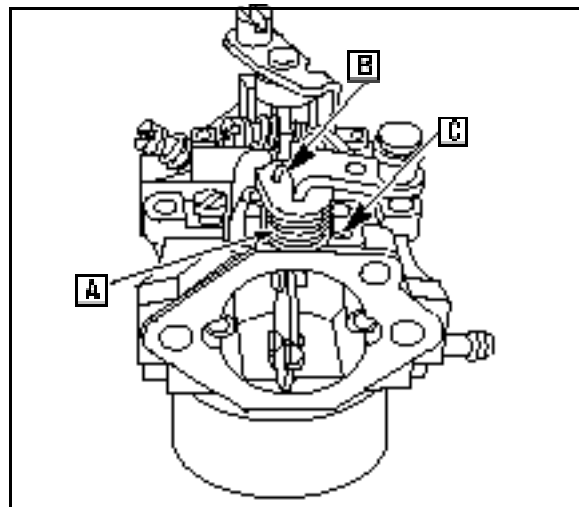


Fig. 84

10. Place choke plate (A) on choke shaft with stamped number(s) (B) facing opposite the fuel inlet (C). Attach with screws ([D] Fig. 85).

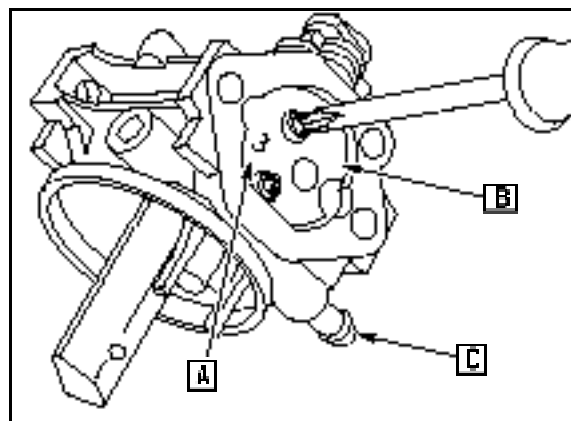


Fig. 85

11. Install pilot jet ([A] Fig. 86).

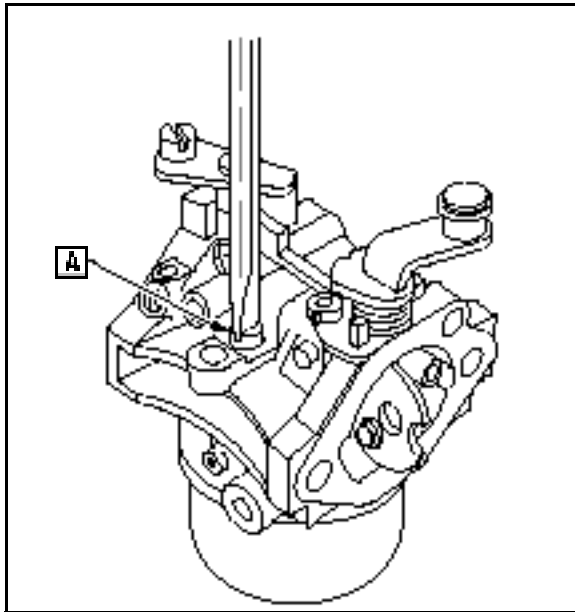


Fig. 86

12. Place emulsion tube (B) in fuel pick up first, then install fixed main jet ([A] Fig. 87).
13. Install the emulsion tube (B) with jet screwdriver #19062, (C) and install the fixed main jet ([A] Fig. 87).

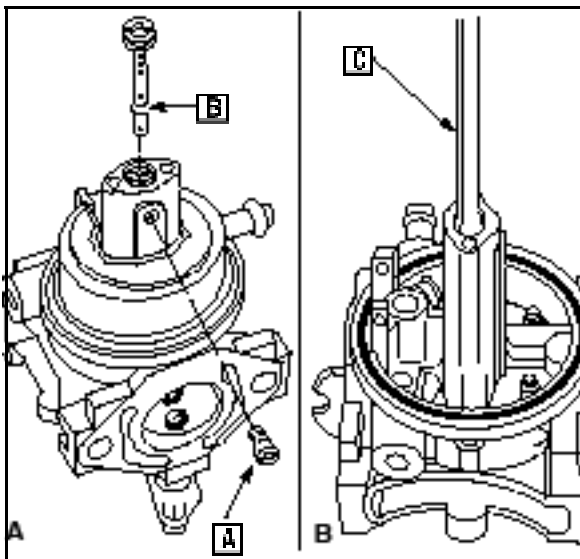


Fig. 87

**NOTE:** For main jet and pilot jet identification and selection, See Identifying Main Jets on page

14. Install spring (A) to groove in fuel needle valve ([B] Fig. 88).

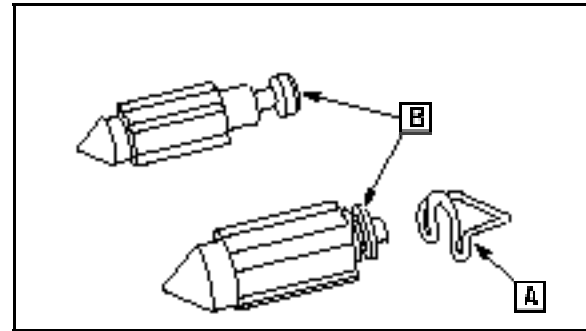


Fig. 88

15. Slide fuel needle valve assembly (A) on to tab (B) of float ([C] Fig. 89).

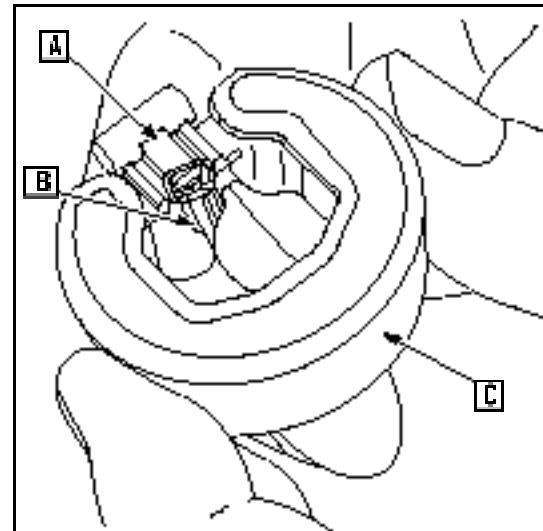


Fig. 89

16. Place float assembly (A) in carburetor, Fig. 90.
17. Insert the small end of the float hinge pin (B) by hand until pin is through the float hinge (C) and both hinge pin posts (D), Fig. 90.

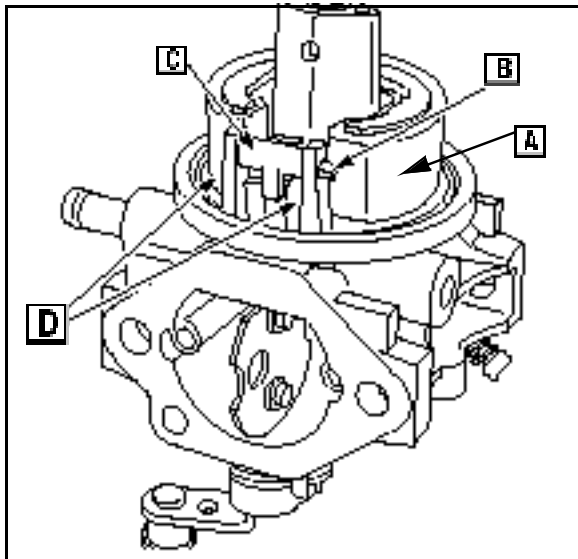


Fig. 90

18. Turn the carburetor body upside down. The float (A) should be parallel to the float bowl mounting surface ([B] Fig. 91).

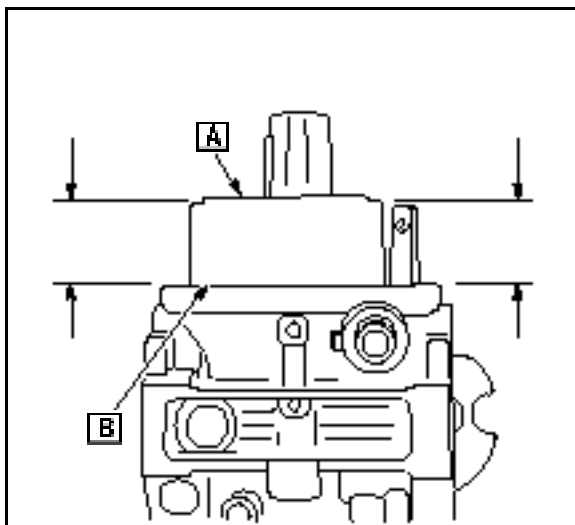


Fig. 91

**If not parallel:**

- Replace the fuel inlet valve, float and hinge pin.
19. Position bowl drain as shown, Fig. 92.  
 20. Install float bowl (A), washer (B), and mounting screw ([C] Fig. 92), to carburetor.  
 21. Tighten screw (C) securely.

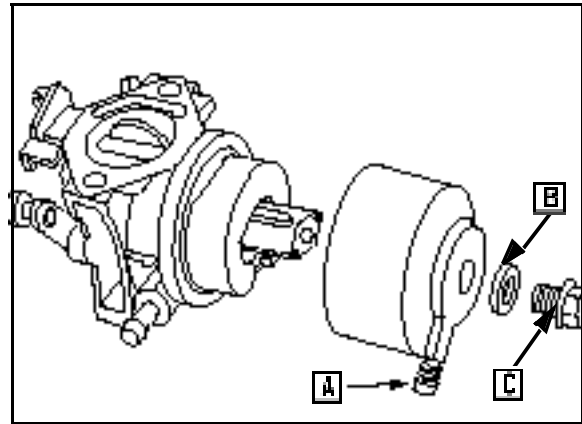


Fig. 92

22. Install idle mixture screw (D) and spring Fig. 93. Turn screw in until it just seats. Do not tighten.  
 23. Back screw off 1-1/2 turns.  
 24. Install limiter ([E] Fig. 93), if used.

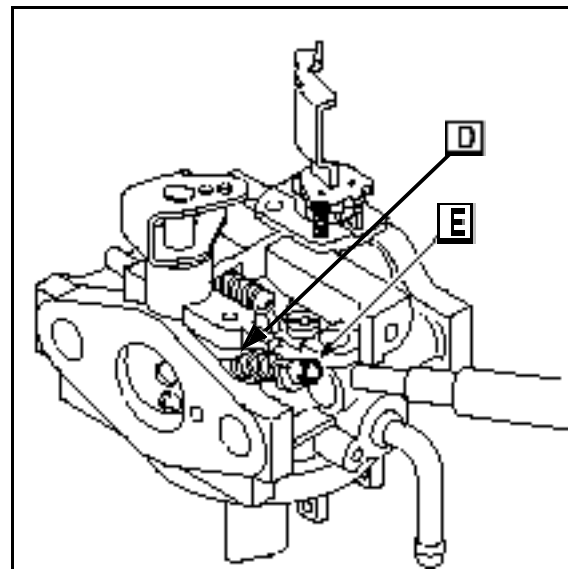
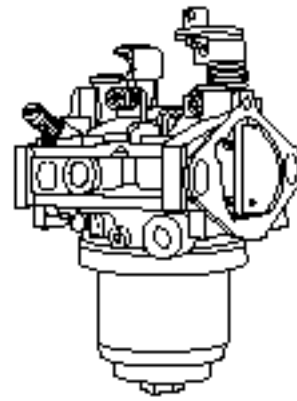


Fig. 93

## Identifying Main Jets (161400)

Model Series	Standard Jet	High Altitude Jet
Before 90091033	100	92.5
After 90090933	107.5	102.5



Mikuni Model Series 85400, 104700, 115400, 117400, 161400, 185400, 260700, 261700

Fig. 94

These carburetors are equipped with two styles of choke shafts:

- Plastic shaft with snap-in choke plate
- Metal shaft with screw-mounted choke plate.

5

## Carburetor Service - Mikuni (260700, 261700)

**CAUTION:** Do not use wires, drills or other devices to clean out metering holes or passages.

**NOTE:** Use compressed air at a moderate pressure setting (5-7 PSI). Blow in both directions to clean out all openings and passages.

To remove plastic choke shaft and plate:

1. Rotate choke shaft to wide open position.
2. Pull choke plate out of choke shaft and lever.
3. Remove choke shaft and lever, return spring (when used) and foam washer.

To remove metal choke shaft and plate:

1. Rotate choke shaft and lever closed.

Replacement carburetors may have a spring detent that will hold the choke closed.

2. Hold choke closed. Remove two screws holding choke plate.
3. Remove plate.
4. Release tension on choke shaft.
5. Remove choke shaft and lever, return spring and seal assembly.

## Disassemble

1. Remove fuel bowl mounting screw (C) and washer (B). Remove the fuel bowl (A) (Fig. 95).

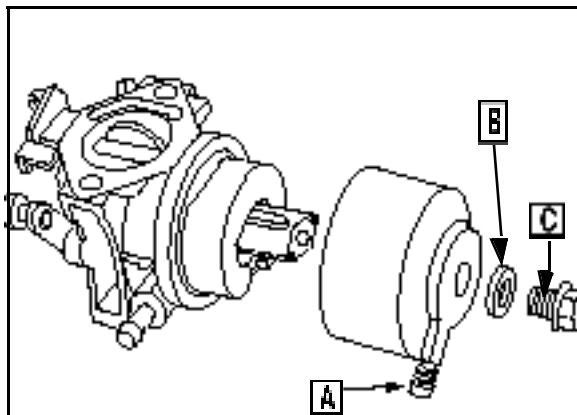


Fig. 95

2. Remove float bowl gasket (A) (Fig. 96).

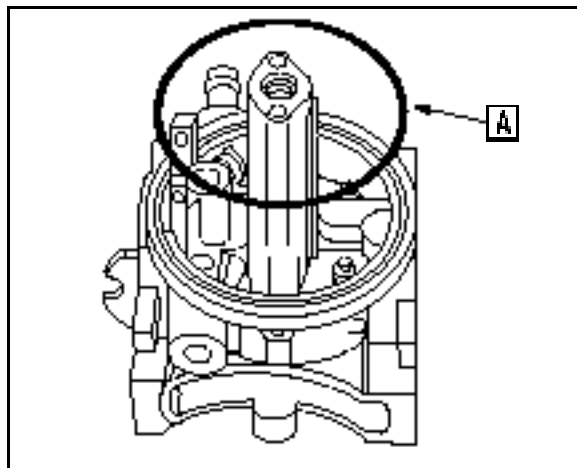


Fig. 96

3. Remove float hinge pin (A), float (B) (Fig. 97), and inlet needle.

Float hinge pin is a drive fit and one end of the pin has two flats.

4. Tap the end opposite the flats with a center punch (C) (Fig. 97) until it is loose.

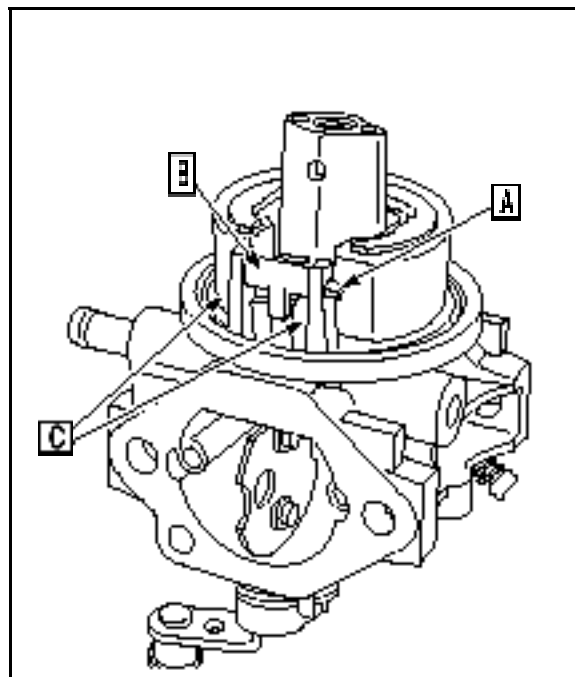


Fig. 97

5. Remove the main jet (A) from the fuel pick-up tube.
6. Remove the emulsion tube (B) (Fig. 98) with a carburetor jet screwdriver.

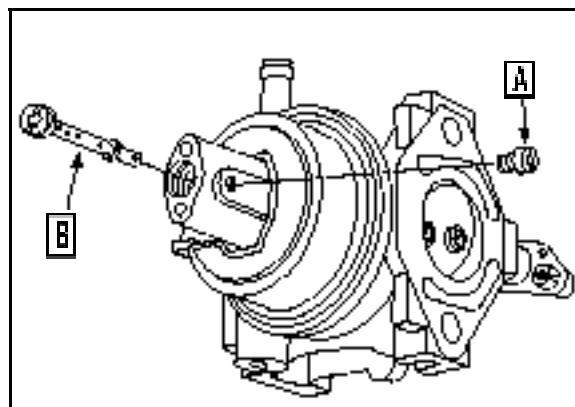


Fig. 98

7. Remove the pilot jet (A) with Screwdriver # 19062, Fig. 99.



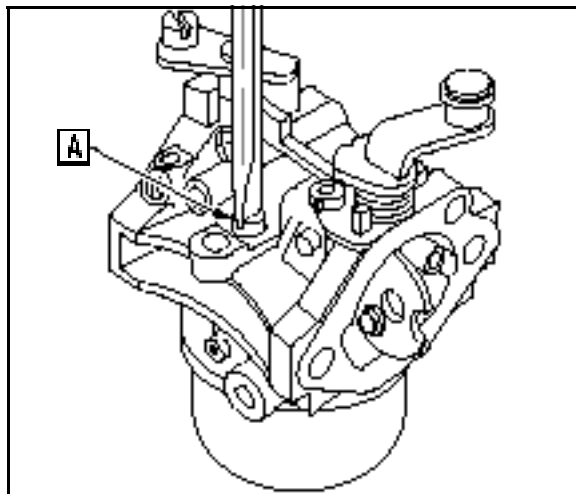


Fig. 99

8. Remove idle mixture screw with spring ([A] Fig. 100).

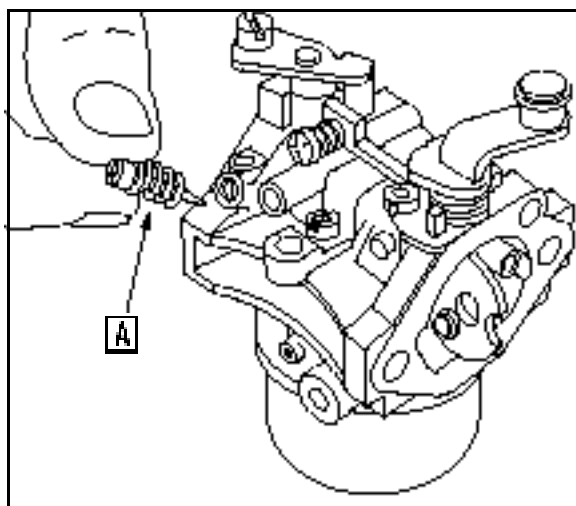


Fig. 100

9. Unhook the choke shaft spring ([A] Fig. 101).
10. Remove the choke plate screws (B). Remove the choke plate (C). Remove the shaft (D), spring (A), washer (E), and retainers (F) and (G Fig. 101).

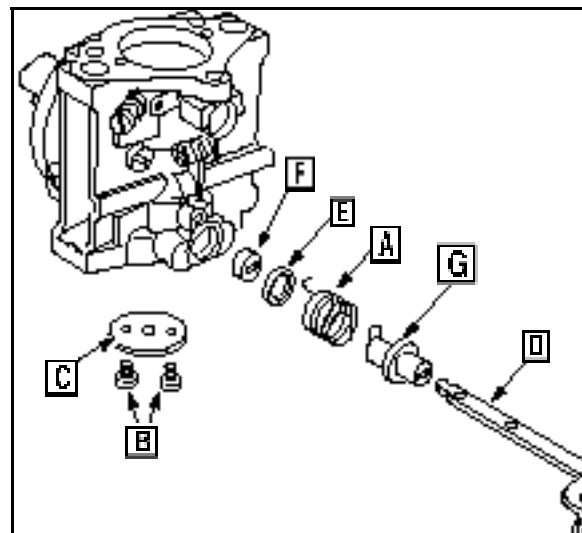


Fig. 101

11. Remove the air jets located on either side of the choke plate opening with carburetor jet screwdriver # 19280.
12. Note the position of the throttle plate for reinstallation.
13. Remove the throttle shaft screws ([B] Fig. 101) Remove the throttle plate.

Low emission LMT carburetors with type numbers that end in A1 or E1 have pressed in pilot jets that are not removable.

Do not remove the pressed in pilot jets ([A] Fig. 102).

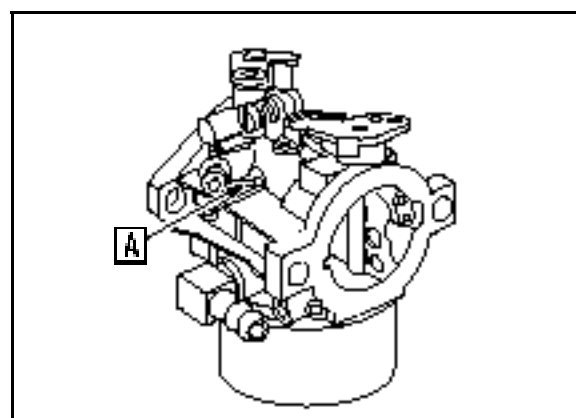


Fig. 102

14. Remove brass pilot jet ([A] Fig. 103) from carburetor body.

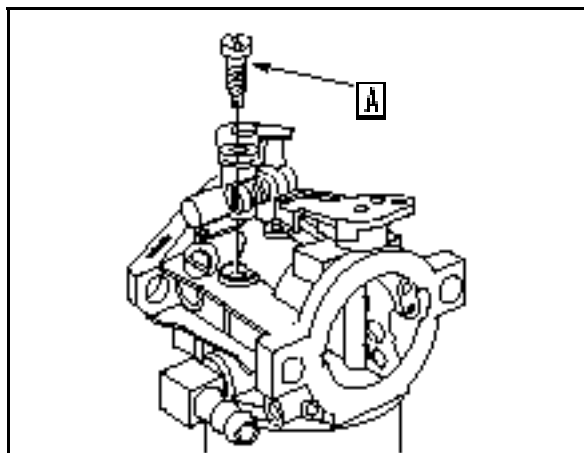


Fig. 103

15. Using carburetor nozzle screwdriver # 19280, remove main carburetor emulsion tube ([A] Fig. 104).

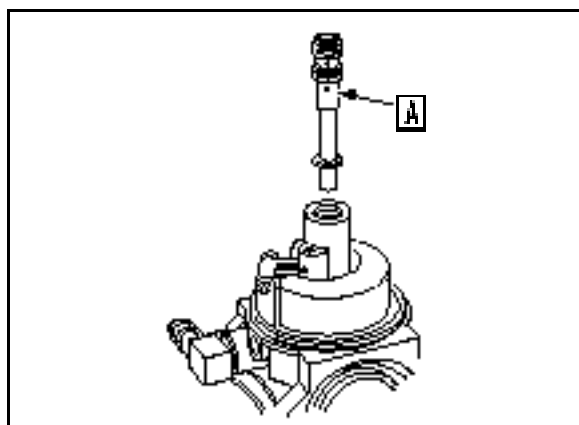


Fig. 104

## TO CLEAN CARBURETOR: SEE SECTION 5- FUEL SYSTEMS AND CARBURETION.

### Assembly

1. Assemble retainer ([A] Fig. 105) on choke shaft ([B]).
2. Place choke shaft spring ([C]) on shaft and hook small hook in notch on choke lever
3. Assemble washer ([D]), and retainers ([E]) to choke shaft.
4. Insert choke shaft assembly into carburetor body. Engage large end of return spring ([C]) on boss.
5. If the carburetor has a spring detent, guide the detent spring into the slot on the choke shaft lever.
6. Place choke plate ([F]) on shaft, single notch on edge towards fuel inlet. Two half moon dimples position the plate on the

shaft. Secure with two screws ([G] Fig. 105).

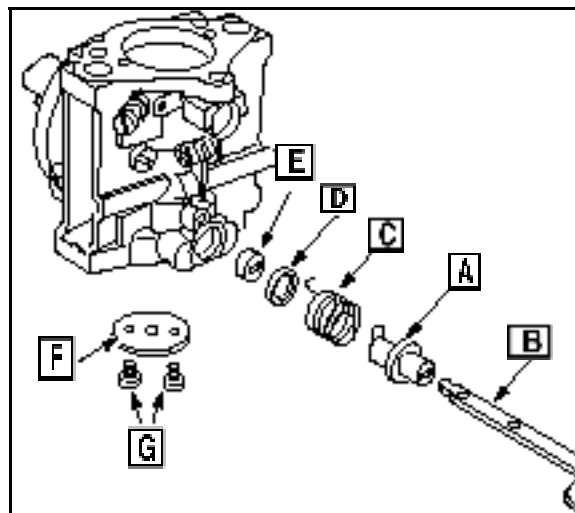


Fig. 105

1. Install throttle shaft seal (A) to carburetor body. Install seal with grooved side out.
2. Place plastic throttle shaft seal (B) on throttle shaft ([C] Fig. 106).
3. Install throttle shaft to carburetor body.

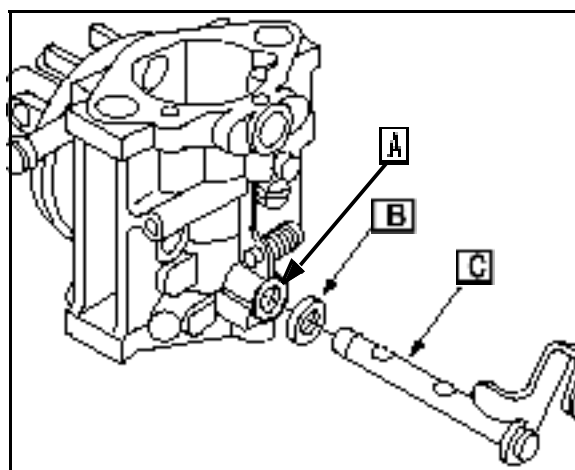


Fig. 106

4. Rotate throttle shaft until the flat side of the shaft is facing out.
5. Lay the throttle plate (A) on the shaft with the stamped numbers ([B] Fig. 107) to the left. Install two screws with lock washers.

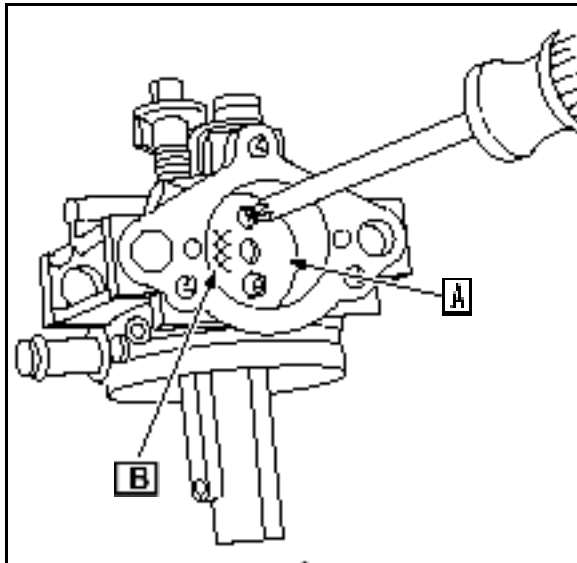


Fig. 107

6. Rotate throttle shaft to check for binding. Correct if required.

### Identifying Main And Pilot Jets (260700, 261700)

#### Type Numbers Not Ending in A1 or E1

Model Series	Standard Main Jet	High Altitude Main Jet	Standard Pilot Jet	High Altitude Pilot Jet
260700	110	105	-	-
261700	110	105	-	-

## CARBURETOR SERVICE PROCEDURES (138400)

### Carburetor Service - Nikki (138400)

**CAUTION:** Do not use wires, drills or other devices to clean out metering holes or passages.

**NOTE:** Use compressed air at a moderate pressure setting (5-7 PSI). Blow in both directions to clean out all openings and passages.

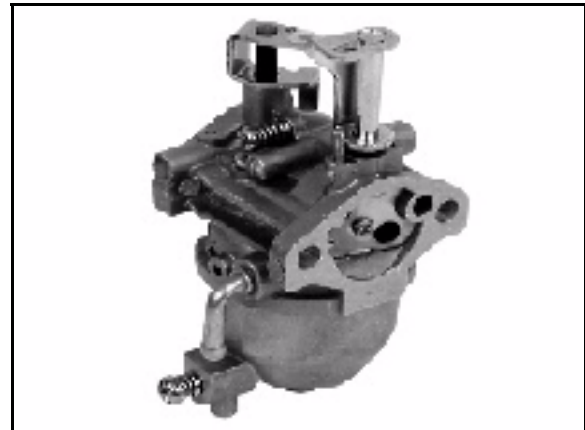


Fig. 108

5

#### Disassemble

1. Remove bowl mounting screw (A) and float bowl (C). Discard float bowl gasket

(D) and float bowl screw washer ([B] Fig. 109).

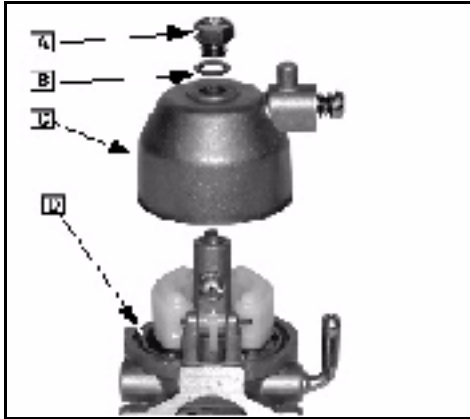


Fig. 109

2. Remove float hinge pin (A), carburetor float (B) and float needle valve (C) Fig. 110).

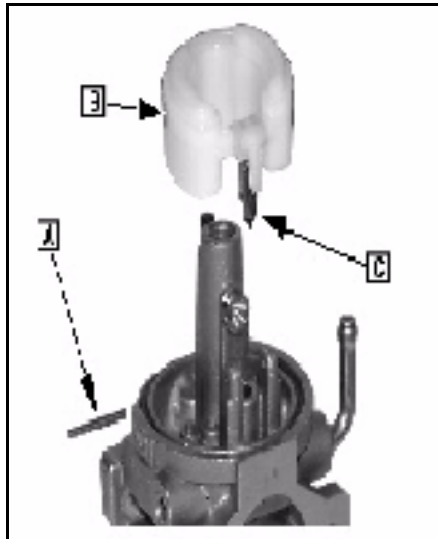


Fig. 110

3. Remove main jet first ([A] Fig. 111) with a carburetor jet screwdriver.
4. Remove carburetor emulsion tube ([B] Fig. 111).
5. Remove rubber plug ([C] Fig. 111).

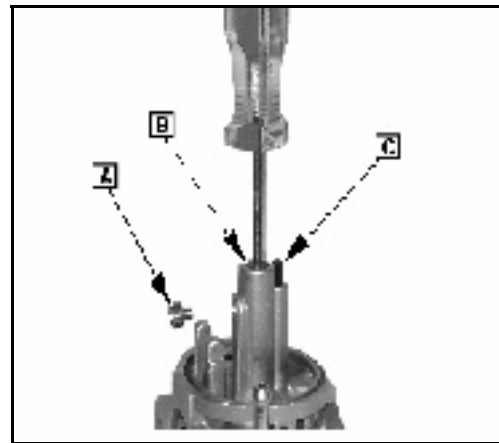


Fig. 111

6. Remove screw ([A] Fig. 112).
7. Remove, throttle plate (B), throttle shaft (C) and seal ([D] Fig. 112).

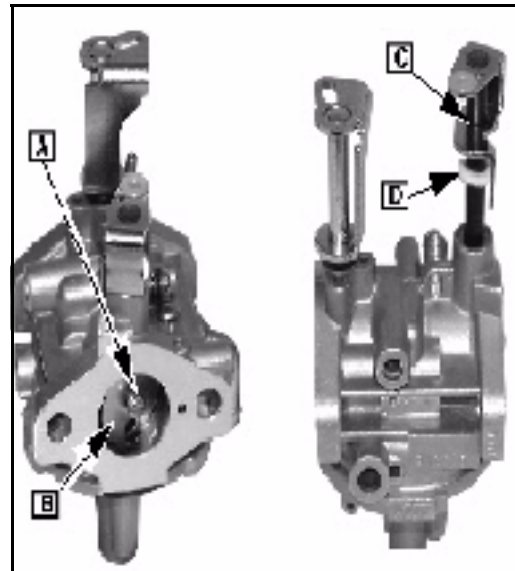


Fig. 112

8. Remove screw (A), choke plate (B), choke shaft (C) and choke shaft seal ([D] Fig.113).

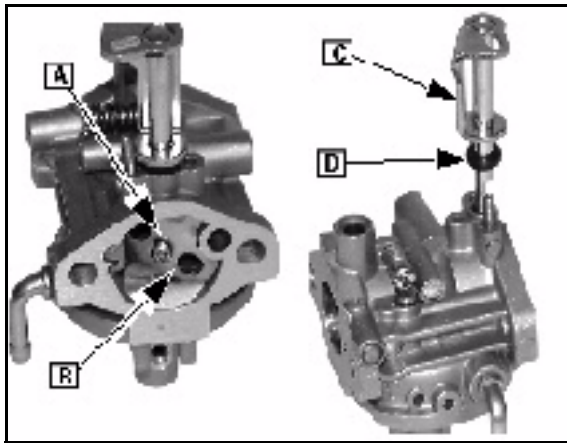


Fig. 113

9. Remove idle speed screw ([A] Fig. 114).

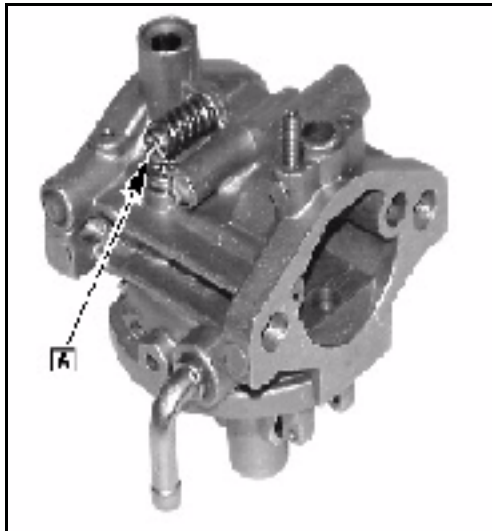


Fig. 114

10. Remove pilot jet ([A] Fig. 115).

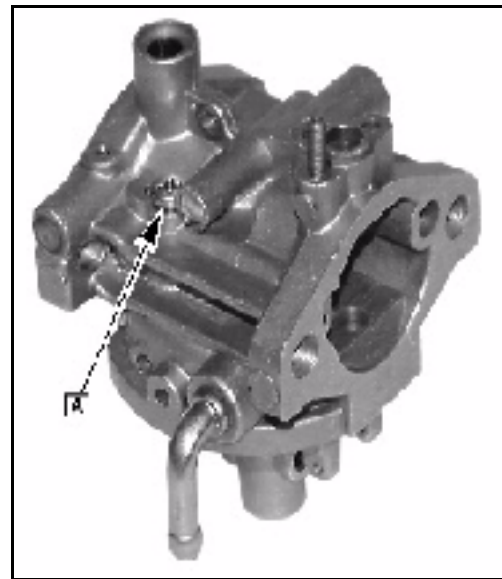


Fig. 115

**TO CLEAN CARBURETOR: SEE SECTION 5- FUEL SYSTEMS AND CARBURETION.**

#### Assemble

1. Install pilot jet ([A] Fig. 116).

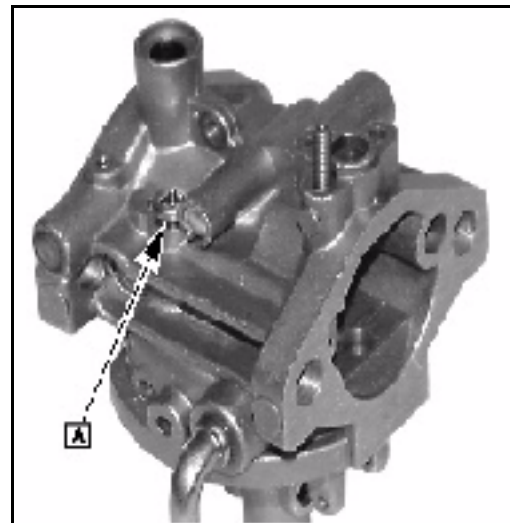


Fig. 116

2. Place new seal ([A] Fig. 117) lip down on the choke shaft (B). Insert shaft into carburetor while engaging detent spring



(C) on choke lever detents ([D] Fig. 117). Rotate shaft closed.

3. Place choke plate (E) on choke shaft (B), secure with screw ([F] Fig. 117).

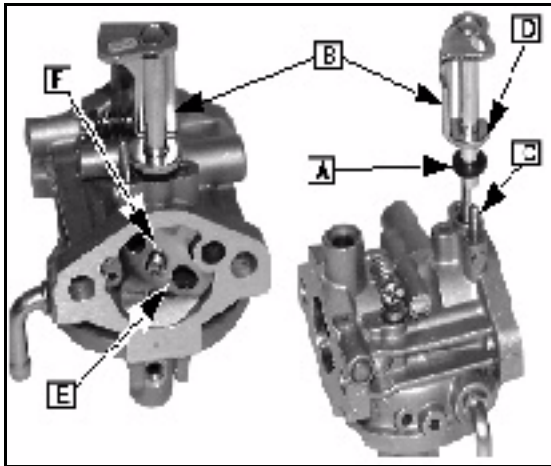


Fig. 117

4. Place new throttle shaft seal ([A] Fig. 118) on the throttle shaft (B). Insert in carburetor with throttle lever ([C] Fig. 118) set as shown.
5. Install idle speed screw ([D] Fig. 118) with spring. Turn screw until it touches throttle lever stop.
6. Place throttle plate (E) on throttle shaft with holes over shaft and secure with screw ([F] Fig. 118).

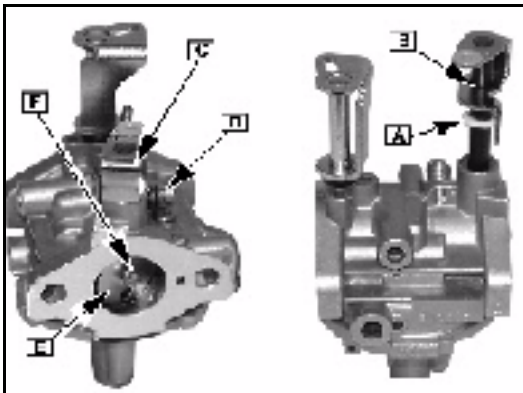


Fig. 118

7. Insert tapered end of rubber plug (A) in passage.
8. Install emulsion tube (B).
9. Install main jet ([C] Fig. 119).

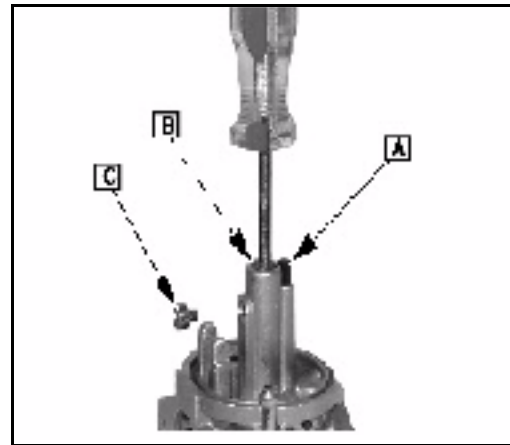


Fig. 119

**NOTE:** For correct main jet and pilot jet identification and selection.

10. Insert the inlet needle (A) into the slot on the float ([B] Fig. 120).

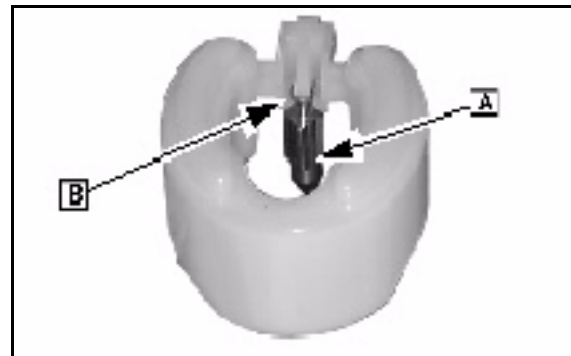


Fig. 120

11. Install float and needle assembly to carburetor. Install and center float hinge pin ([A] Fig. 121).

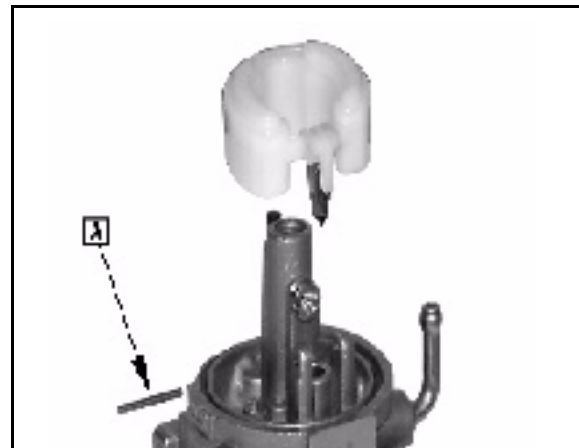


Fig. 121

12. Place new float bowl gasket (A) in carburetor body groove, Fig. 119.
13. Place float bowl (B) on carburetor with drain boss parallel (C) to fuel inlet fitting ([D] Fig. 122).
14. Install new float bowl washer (E). Torque bowl screw ([F] Fig. 122) to values listed.

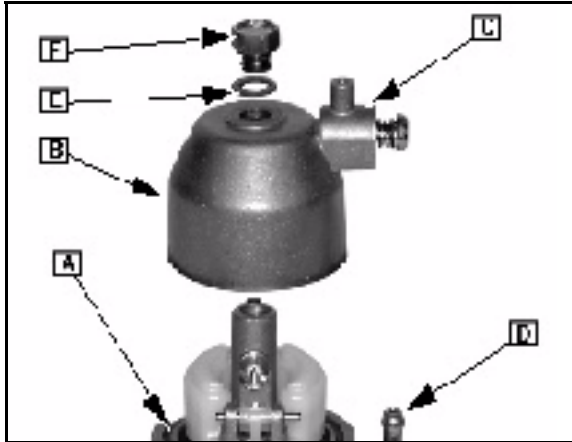


Fig. 122

#### Identifying Main And Pilot Jets (138400)

Model Series	Standard Main Jet	High Altitude Main Jet	Standard Pilot Jet	High Altitude Pilot Jet
138400	79	76	44	43

## CARBURETOR SERVICE PROCEDURES (235400, 245400, 28Q700)

### Carburetor Service - Walbro LMT (235400, 245400, 28Q700)

**CAUTION:** Do not use wires, drills or other devices to clean out metering holes or passages.

**NOTE:** Use compressed air at a moderate pressure setting (5-7 PSI). Blow in both directions to clean out all openings and passages.

These carburetors have a fixed high speed main jet with a screw for idle mixture adjustment (B) and a screw for idle speed adjustment ([A] Fig. 123). The different carburetors are identified as LMT1 and up.

The letters LMT are cast into the body of the carburetor while the identification numbers (C) are stamped into carburetor mounting flange next to idle mixture screw or above the fuel inlet ([D] Fig. 123).

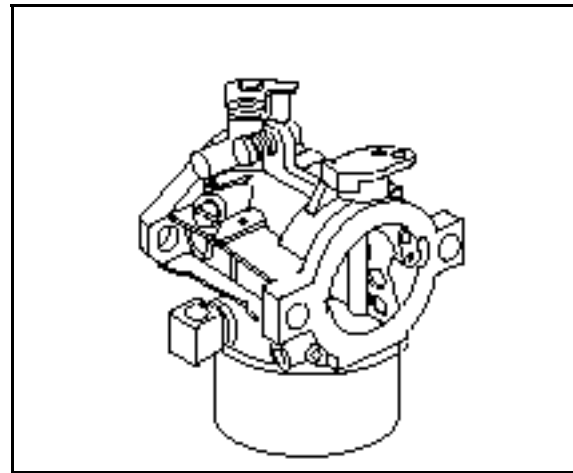


Fig. 123

#### Disassembly

1. Remove float bowl screw and washer.
2. Remove float bowl and float bowl gasket from carburetor.
3. Remove float hinge pin, float and inlet needle.
4. Remove idle mixture needle limiter cap.
5. Remove the idle mixture screw with spring and the idle speed screw with spring.
6. Rotate throttle shaft (A) and lever closed.
7. Remove throttle plate screws ([B] Fig. 124).

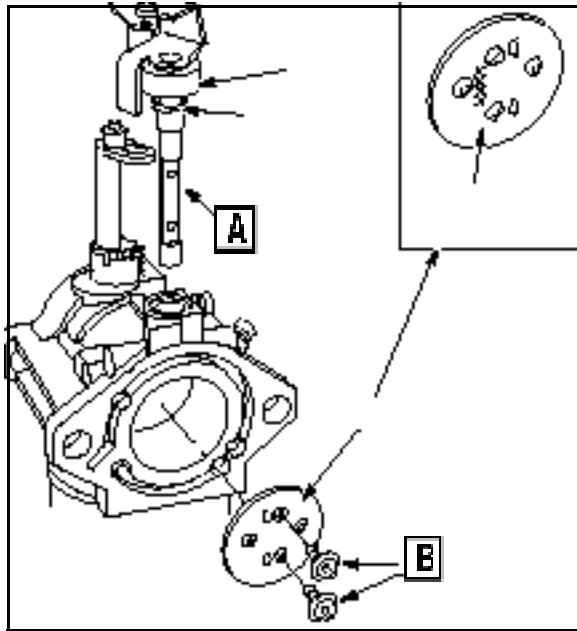


Fig. 124

8. Remove the throttle plate, throttle shaft with lever. Remove the foam seal.
9. Remove the throttle shaft bushing from the carburetor body.
10. Rotate the choke shaft ([C] Fig. 125) to wide open.
11. Pull the choke plate ([D] Fig. 125) out of the choke shaft slot.

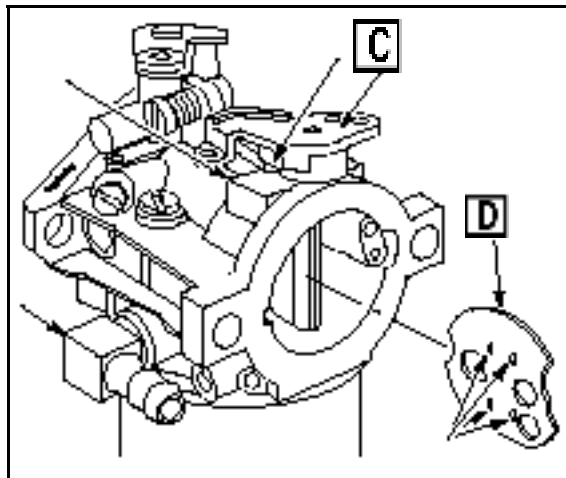


Fig. 125

12. Remove the choke shaft, lever, return spring (if used) and the foam seal.
13. Remove the float bowl.
14. Remove the emulsion tube ([E] Fig. 126) with Carburetor Jet Screwdriver #19280.

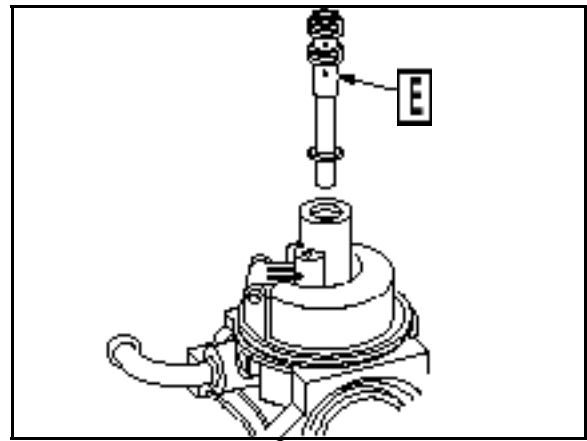


Fig. 126

15. Remove float hinge pin (A), float ([B] Fig. 127), and inlet needle.

Float hinge pin is a drive fit and one end of the pin has two flats.

16. Tap the end opposite the flats with a center punch ([C] Fig. 127) until it is loose.

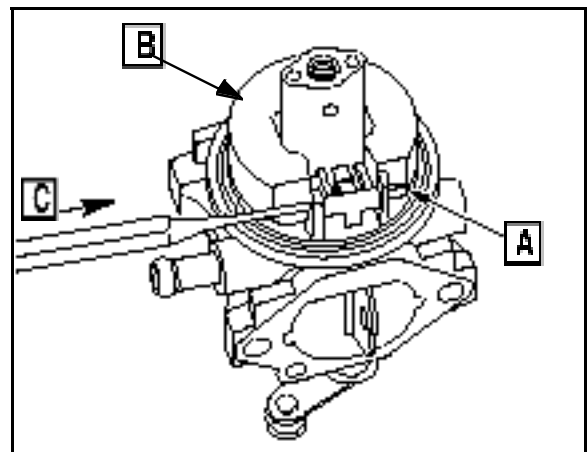


Fig. 127

To clean carburetor:

### SEE SECTION 5- FUEL SYSTEMS AND CARBURETION.

#### Assembly

1. Press the new fuel inlet seat (C) in until it is flush with the fuel inlet boss ([D] Fig. 128).

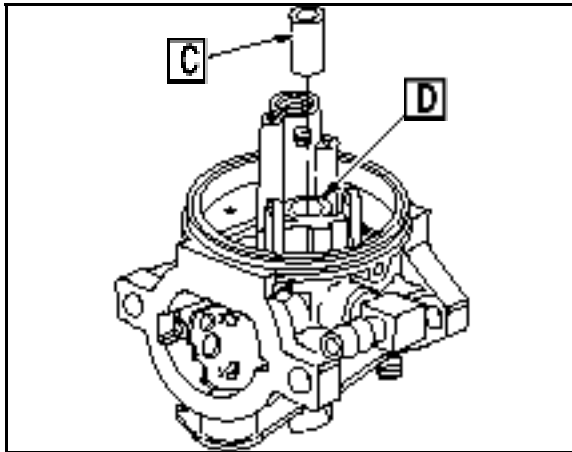


Fig. 128

2. Insert the spring inside the large foam seal. Slide the seal and spring on to the choke shaft ([G] Fig. 129), with the straight end of the spring up toward the choke shaft lever.
3. Insert the choke shaft into the carburetor body until the hook of the spring hooks on to the spring anchor (E).
4. Lift the choke shaft lever up slightly. Turn CCW until the stop on the lever clears the spring anchor. Push the shaft down.
5. Insert the choke plate ([H] Fig. 129) into the choke shaft, with the dimples toward the fuel inlet side of the carburetor. The dimples hold and align the choke plate to the shaft.

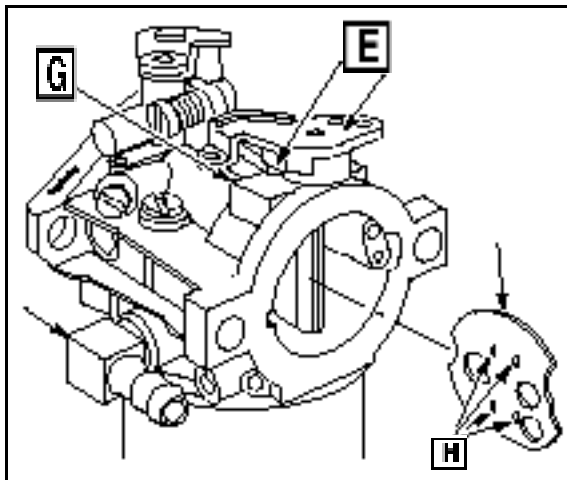


Fig. 129

6. Install the throttle shaft bushing ([J] Fig. 130) to the carburetor body.
7. Slide the foam seal (I) on to the throttle shaft (K).
8. Slide the throttle shaft and seal into the carburetor body. The idle stop on the

throttle lever should be to the left of the idle speed screw.

9. Rotate the throttle shaft CW until the idle stop is against the idle speed screw.
10. Place the throttle plate (L) on to the throttle shaft with the numbers (M) facing into the carburetor, on the right.
11. Place a drop of Loctite® on to the screw threads. Tighten the throttle plate screws ([N] Fig. 130).

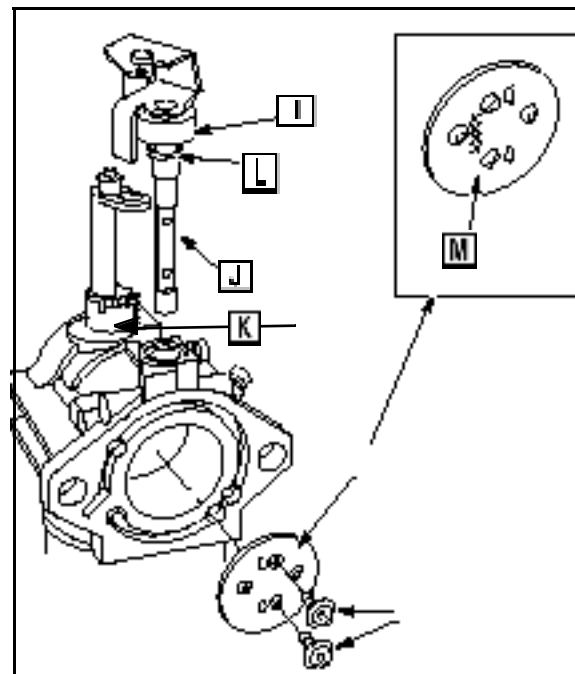


Fig. 130

**NOTE: (235400)** Throttle plate movement is limited on and will not go to WOT. This is normal.

12. Install the emulsion tube with Carburetor Screwdriver # 19280.

Be sure the tube seats into the carburetor body.

13. Blow out any chips or debris that may have been loosened after installing the emulsion tube.

14. Insert the needle to the slot on the float.

1. Place the float and needle on the carburetor. Install and center the float hinge pin.

2. Place a new bowl gasket on the carburetor body.
3. Place the bowl on the carburetor. Install the float bowl screw.
4. Torque the screw to values listed.

### Identifying Main Jets (235400, 245400, 28Q700)

Model Series	Standard Jet	High Altitude Jet
235400	497570	497571
245400	498172	498172
28Q700	231858	231850

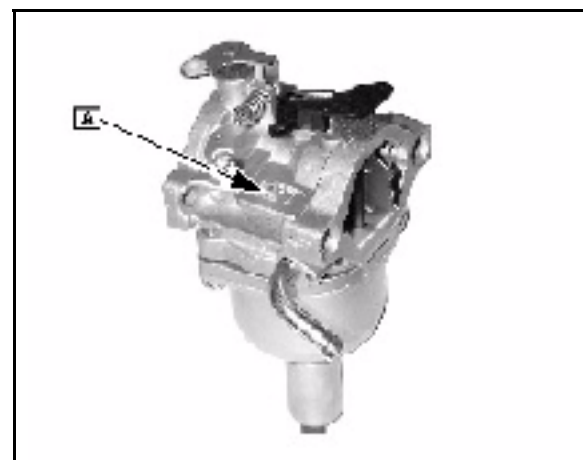


Fig. 131

### Disassembly

1. Remove fuel bowl screws (G) and separate fuel bowl (H) and solenoid (E) from the carburetor body (I) Fig. 132).

Do not lose the spring between the fuel bowl and the float assembly.

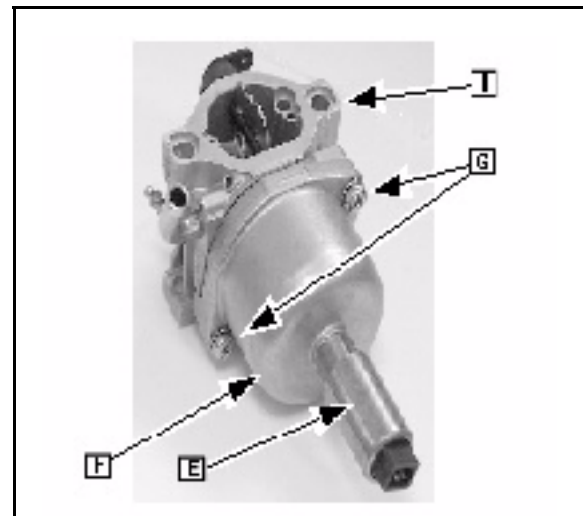


Fig. 132

2. Remove the solenoid (E) from the fuel bowl (H) Fig. 132).
3. Remove the float assembly (J) from the carburetor base (I).
4. Pull the hinge pin (K) from the float base.
5. Separate the float and needle from the float base ([L] Fig. 133).

### Carburetor Service - Nikki (28Q700)

**CAUTION:** Do not use wires, drills or other devices to clean out metering holes or passages.

**NOTE:** Use compressed air at a moderate pressure setting (5-7 PSI). Blow in both directions to clean out all openings and passages.

Location of the part number ([A] Fig. 131).



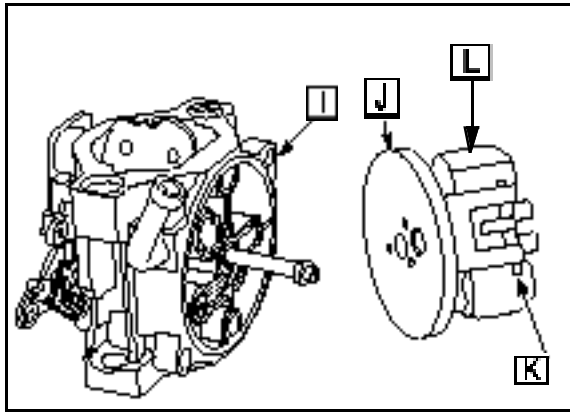


Fig. 133

6. Remove the float base gasket ([M] Fig. 134) from the carburetor body.

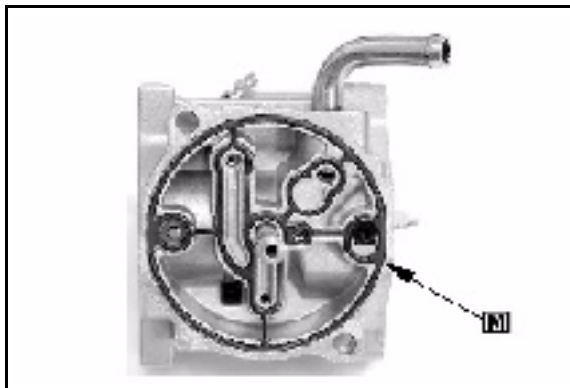


Fig. 134

7. Press down on the main jet ([N] Fig. 135) to remove it from the float base tube.
8. Replace the float base if it shows signs of wear or damage.

Place the main jet into the float base tube. Press the jet in until it clicks into position. Do not force.

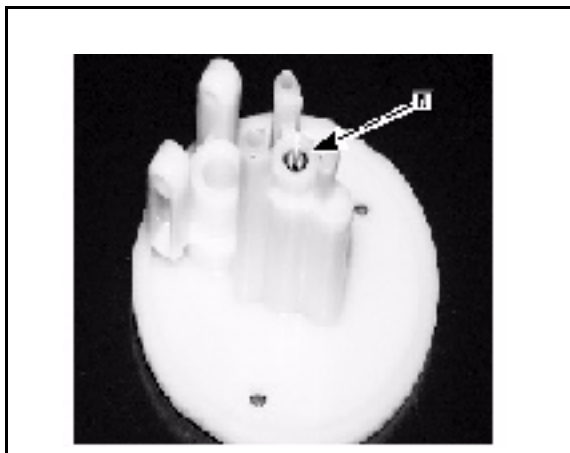


Fig. 135

9. Remove two screws (A) and throttle plate (B) and pull the throttle shaft ([C] Fig. 136) from the carburetor body.

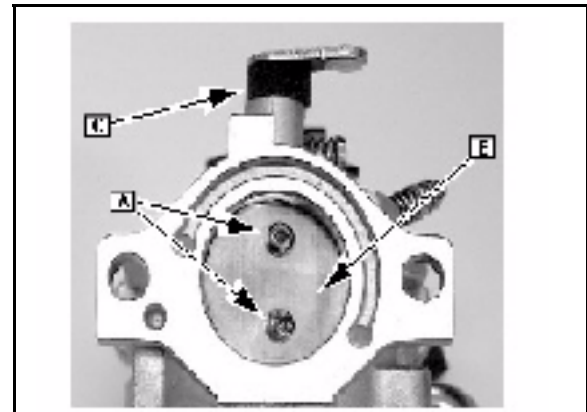


Fig. 136

10. Remove the idle mixture screw with spring (D) and the idle speed screw with spring ([E] Fig. 137).

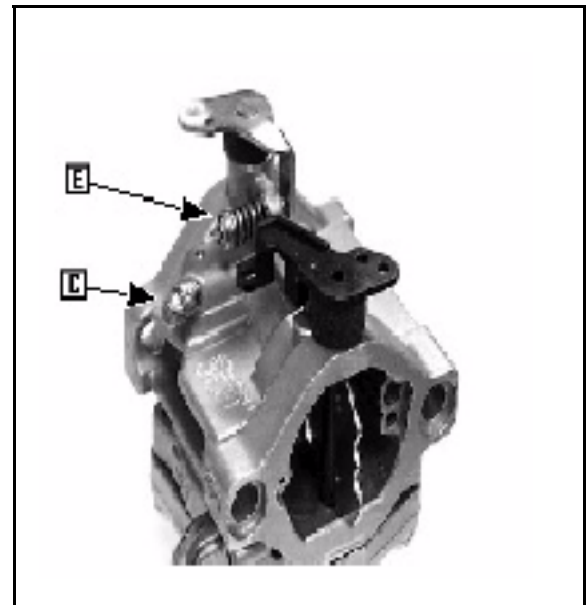


Fig. 137

11. Turn the choke plate as shown in Fig.138.
12. Pull the choke plate (F) from the choke shaft ([G] Fig. 138).
13. Remove the choke shaft with lever, return spring and foam washer.

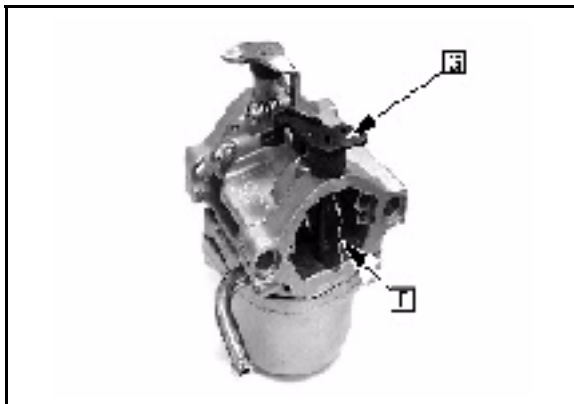


Fig. 138

**CAUTION:** This carburetor has pressed-in jets that are not serviceable. Do not attempt to remove the jets.

## 5

To clean carburetor:

### SEE SECTION 5- FUEL SYSTEM AND CARBURETION.

14. Insert jumper wires to the connectors ([A] Fig. 139) on the end of the solenoid.

15. Connect other end of jumper wires to a new 9 volt transistor battery.

The plunger needle ([B] Fig. 139) should retract into the solenoid body.

**If not:**

- Replace the solenoid.



Fig. 139

### Assembly

1. If separated, place the throttle return spring ([A] Fig. 140) inside the large foam seal ([B]).
2. Slide the seal and spring on to the choke shaft ([C]) with the top of the spring ([D]) contacting the choke shaft lever ([E] Fig.140).
3. Turn the choke shaft ccw while gently pushing it into the carburetor body until the bottom end of the spring ([A]) rests on the back of the spring perch ([F] Fig. 140).

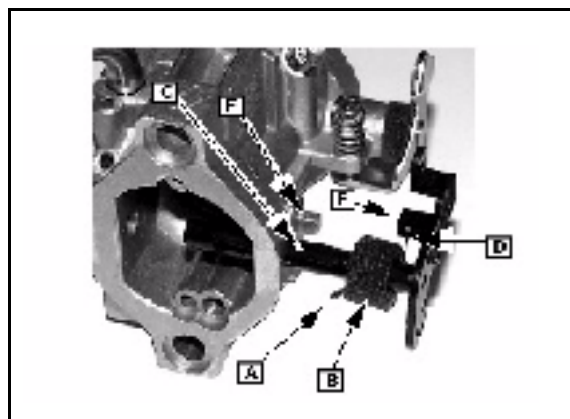


Fig. 140

4. Lift the choke shaft up slightly and continue turning ccw until the stop ([E]) on the lever clears the spring perch ([F] Fig.141).
5. Push the shaft inward.
6. When released, the choke shaft lever should rest on the spring perch as shown (Fig. 141.)



Fig. 141

7. Insert the choke plate ([G]) into the choke shaft ([H]) with the dimples ([I] Fig. 142) toward the air inlet side of the carburetor.

The dimples position the choke plate on the shaft.

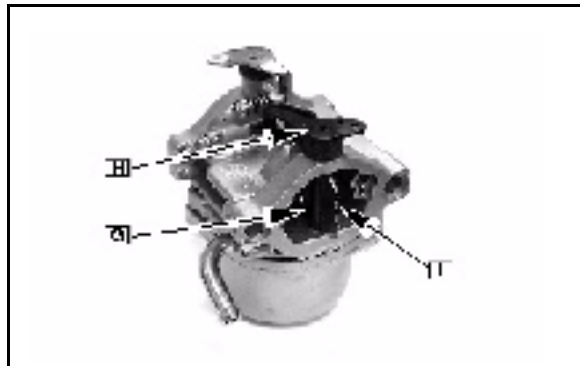


Fig. 142

8. Install small foam washer (J) to throttle shaft (K).
9. Install throttle shaft to the carburetor body.
10. Turn throttle shaft until flat ([L] Fig. 143) is facing out.

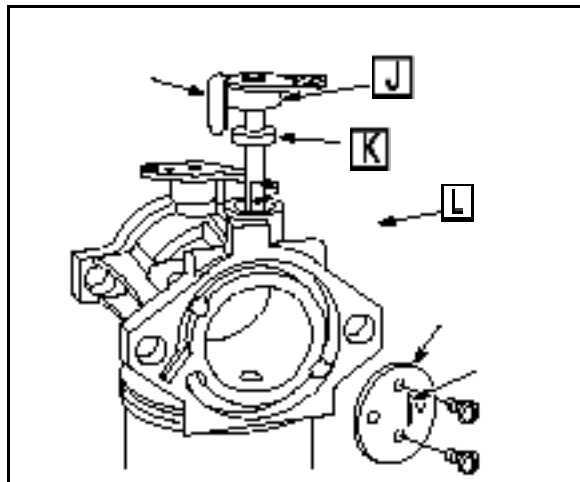


Fig. 143

**NOTE:** The holes in the throttle plate are offset. If the throttle plate is installed incorrectly it will not close.

11. Lay the throttle plate (M) on the flat of the throttle shaft. Install two screws ([N] Fig.144).

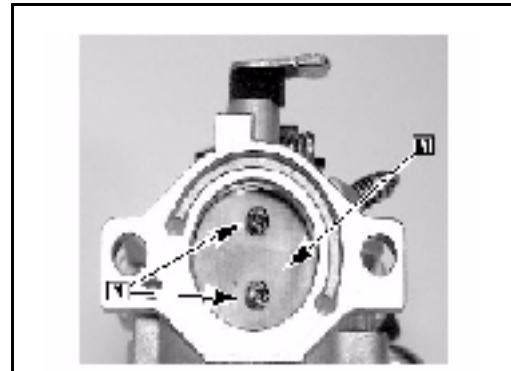


Fig. 144

12. Install idle mixture screw (O) with spring and the idle speed screw ([P] Fig. 145) with spring.
13. Turn each screw until the head of the screw touches the spring.

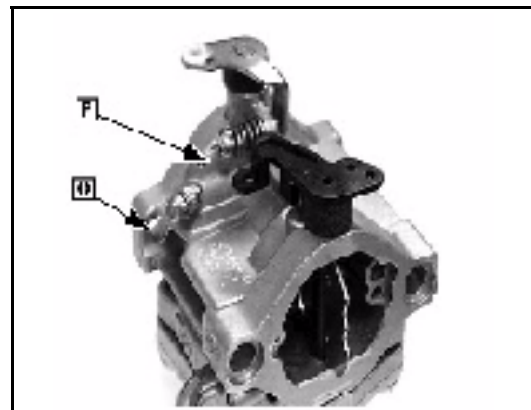


Fig. 145

14. Put the inlet needle ([Q] Fig. 146) into the slot on the float (R).
15. Place the needle and float assembly into the float base (S).
16. Insert the needle into the seat, and the float hinge to the hinge support.
17. Install the float hinge pin ([T] Fig. 146).

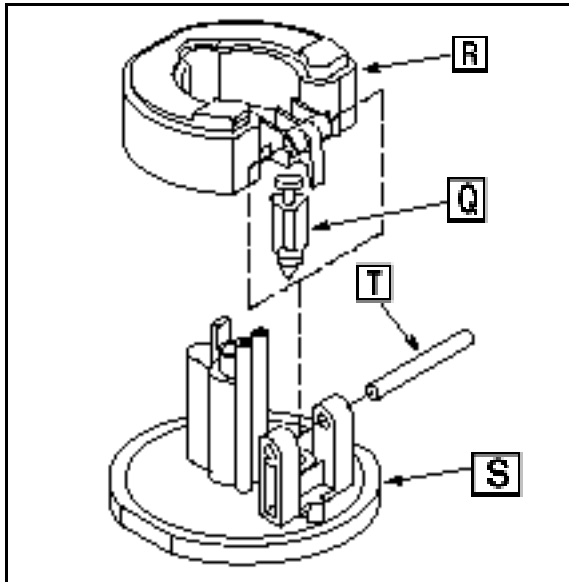


Fig. 146

18. Place gasket (U) on carburetor body ([V] Fig. 147).

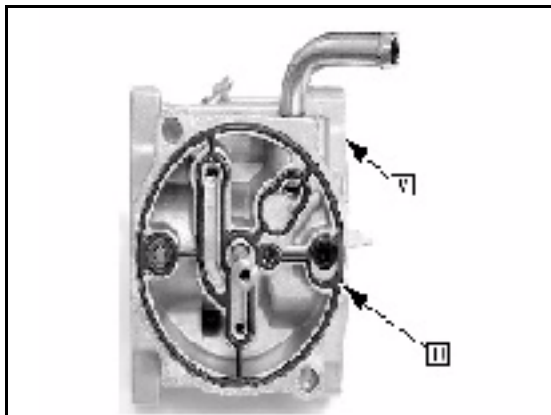


Fig. 147

**NOTE:** The locating tang (W) on the float assembly must be placed in the recess ([X] Fig. 148) of the carburetor base as shown.

19. Place the float assembly (S) on the carburetor base ([V] Fig. 148).

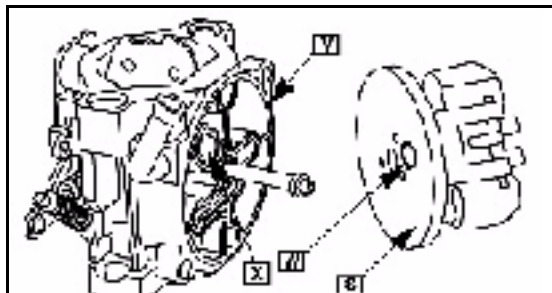


Fig. 148

20. Insert the spring ([Y] Fig. 150) to the bottom of the float assembly.



Fig. 149

21. Place the fuel bowl (A) on the carburetor base ([B] Fig. 150).  
 22. Fasten with screws ([C] Fig. 150).  
 23. Install solenoid (D) and washer ([E] Fig. 150).  
 24. Torque solenoid to values listed (Fig. 150).

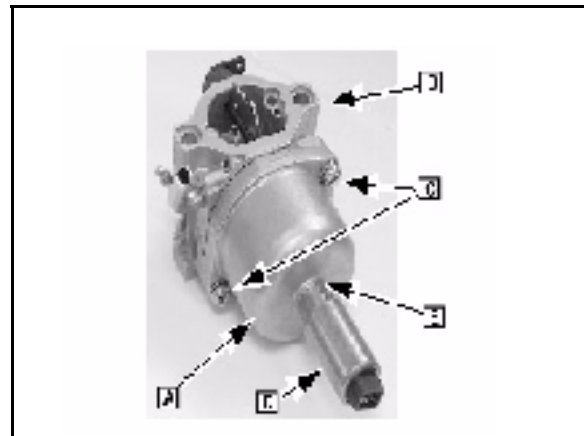


Fig. 150

## SECTION 6 - GOVERNOR SYSTEMS

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## MECHANICAL GOVERNOR SYSTEMS

### Governor System Operation (Typical)

A governor system operates by transmitting engine RPM through a pair of flyweights (A) that retract and extend a sliding cup ([B] Fig. 1).

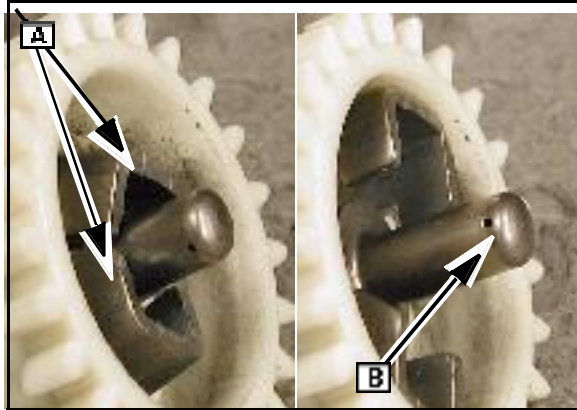


Fig. 1

The end of the cup is in contact with the paddle (A) of the governor crank (B) Fig. 2).

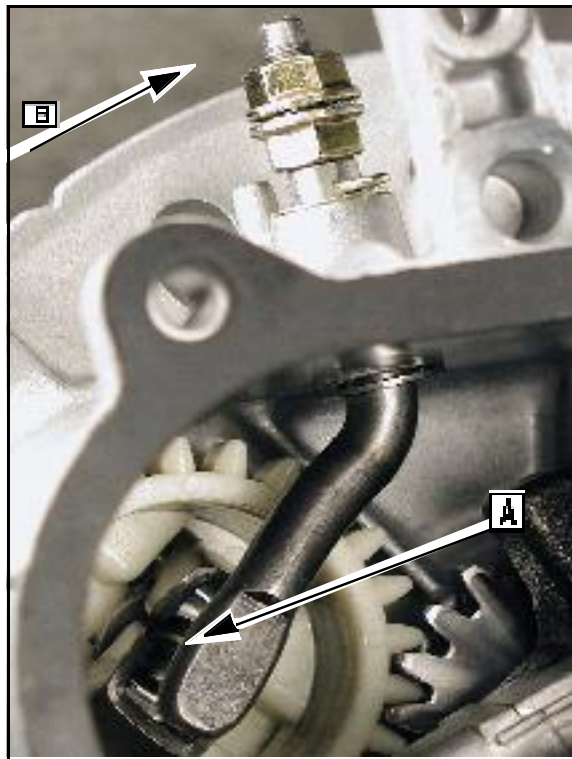


Fig. 2

The governor crank (A) is connected to the throttle plate (B) by a governor lever (C) and a

series of interconnecting linkages and springs ([D] Fig. 3).

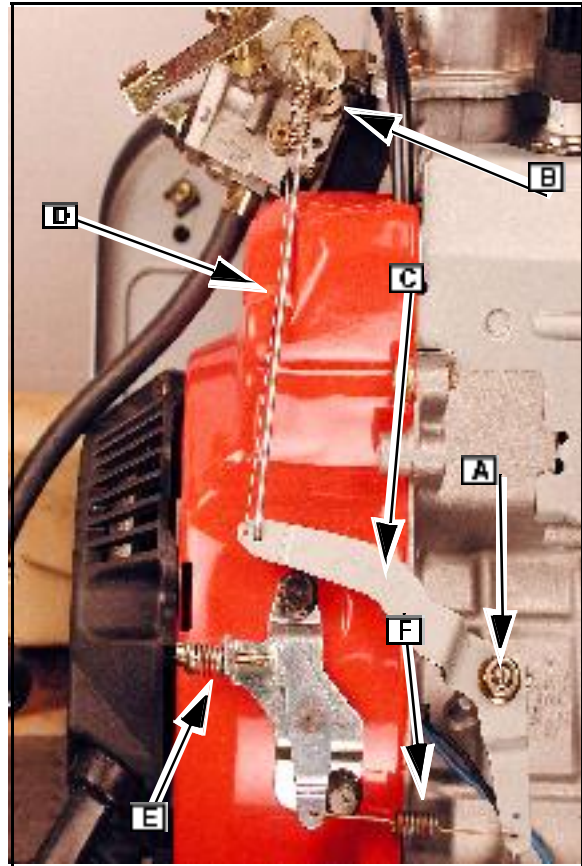


Fig. 3

The purpose of the governor system is to maintain a desired engine speed (RPM) in spite of the changing loads imposed on the engine.

- When at rest, the springs are set to hold the throttle plate open.
- In operation, the flyweights cause the throttle plate to close.

The engine speed at which these two forces balance is called the governed speed and can be set by using different spring combinations or adjustments (E) to the tension of the governor return spring ([F] Fig. 3).

## Governed Speed (RPM) Limits

In order to comply with specific top governed speed limits, Briggs & Stratton supplies equipment manufacturers (OEM)s with engines that have adjustable top speed limits. These limits are set to OEM specifications.

The top no-load speed limit will allow no more than the desired top governed speed limit when the engine is operated on a rigid test stand at our factory. However, the design of the equipment being powered can affect engine speeds.

Check top governed speed with a tachometer when the engine is running on a completely assembled unit. The equipment should be operated at no load when making this check.

### If a governor spring must be replaced:

- Consult the appropriate Illustrated Parts List.

After a new governor spring is installed, check engine top governed speed with an accurate tachometer and adjust as required.

2. While holding governor shaft (B), loosen nut (A) as shown in Fig. 4.

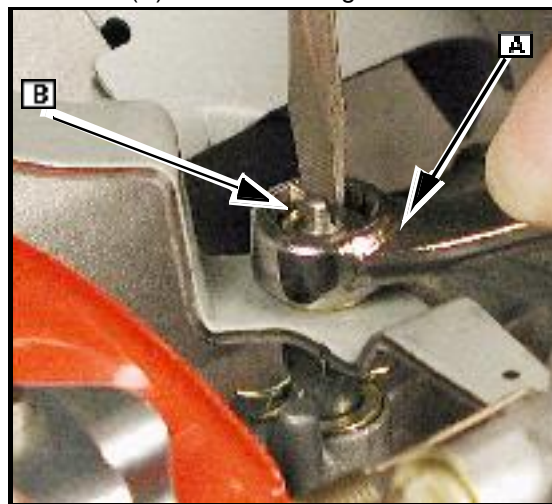


Fig. 4

3. Disconnect governor return spring (E), throttle plate links and spring (D).
4. Remove governor lever ([B] Fig. 5).

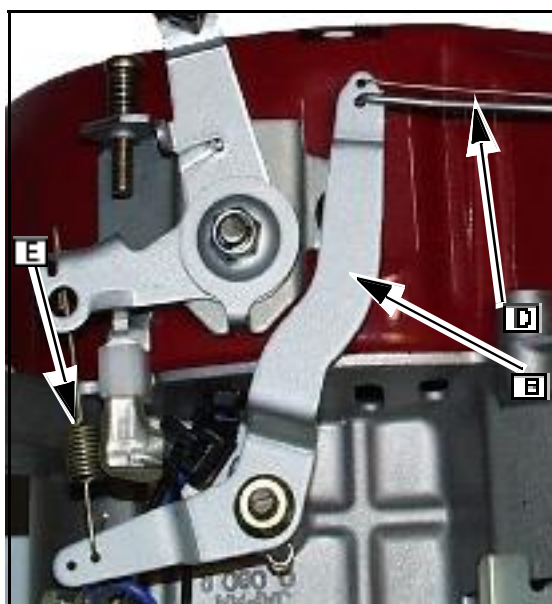


Fig. 5

5. Remove lower governor lever nut ([F] Fig.6).

Do not remove the spring clip ([G] Fig. 6) at this time.

## 6

## GOVERNOR COMPONENTS (050000, 118400)

### Governor Component Removal

**NOTE:** The blower housing, flywheel and other components of the engine must be removed to replace the governor gear assembly. **See SECTION 3- ENGINE DISASSEMBLY.**

Remove gear reduction housing, if equipped, before removing the cylinder housing Cover. **See SECTION 11- CRANKSHAFTS, CAMSHAFTS, BALANCING SYSTEMS AND GEAR REDUCTIONS.**

1. Slip a box-end wrench (A) on the top nut (Fig. 4).

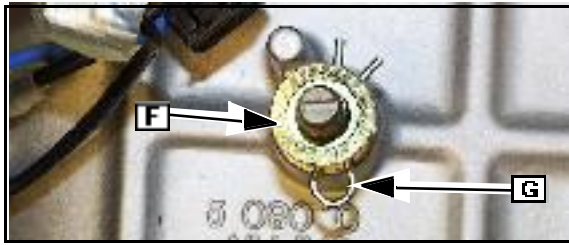


Fig. 6

6. Remove cylinder cover. **See SECTION 10- CYLINDERS, COVERS AND SUMPS.**
7. Rotate the engine crankshaft so the counter weight ([J] Fig. 7) is in position shown.
8. Remove the spring clip from the governor crank.
9. Push governor crank ([A] Fig. 7) down into the cylinder housing and remove.

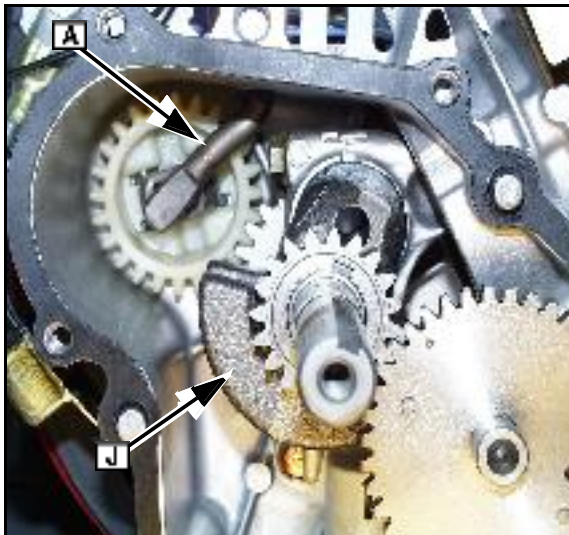


Fig. 7

10. Remove E-clip from governor shaft and retain.

11. Tap the shaft through the cylinder housing with a small punch or equivalent (Fig. 8).



Fig. 8

The entire assembly will come free of the housing.

### Governor Component Inspection

1. Inspect the governor gear for wear and chipped or damaged teeth.
2. Inspect the governor flyweight assembly for freedom of movement.
3. Ensure that the cup is retained throughout the flyweight travel.

#### If discrepancies are found:

- Replace the governor gear as a complete assembly.

#### If the shaft hole is damaged or worn:

- Replace the cylinder or cylinder cover assembly.



## Governor Component Installation

1. Make sure the flyweights, spool and gear move freely.
2. Set thrust washer (if used) on the shaft of the governor gear ([A] Fig. 9).

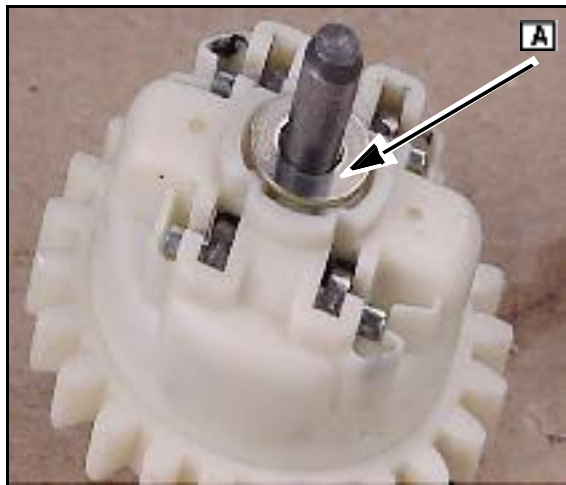


Fig. 9

3. Press the governor shaft through its mounting hole in the cylinder until it bottoms on the face of the washer (Fig. 10) or until it extends just past the outer surface of the cylinder housing.



Fig. 10

4. Make sure teeth engage the crankshaft drive gear.

5. Install E-clip ([A] Fig. 11) on governor crank and push crank up through cylinder housing and install thrust washer. Make sure the paddle of the governor shaft rests on the face of the governor cup.

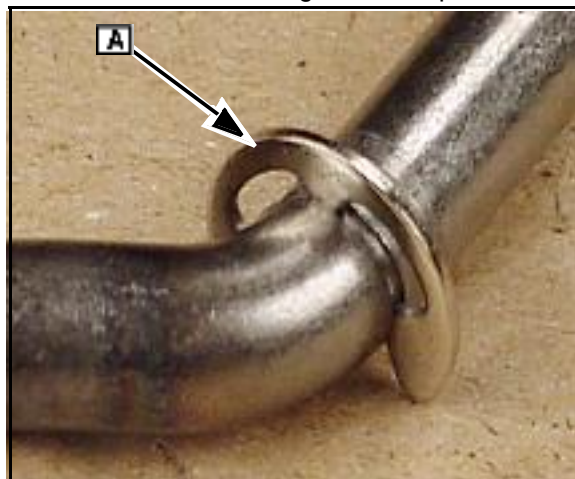


Fig. 11

6. Install the spring clip ([A] Fig. 12) as shown.



Fig. 12

7. Install cylinder cover.
8. Install lower nut upside-down on governor crank until it bottoms on the threads of the shaft.
9. Place governor lever on governor crank.
10. Place upper nut on end of governor crank.
11. Tighten nut on lever until governor crank turns with slight movement of the governor lever.
12. Connect governor link and spring.

13. Ensure that you can feel the governor crank paddle make contact with the governor cup on governor gear.
14. While holding the paddle against the governor cup, tighten the upper locknut.
15. Reinstall any other components you removed,
16. Perform static adjustment. See **SECTION 1- SAFETY, MAINTENANCE AND ADJUSTMENTS.**

## GOVERNOR COMPONENTS (085400, 086400, 115400, 117400, 138400, 185400, 235400, 245400)

### Governor Component Removal

1. Drain oil from engine.
2. Remove necessary engine components to gain access to cylinder cover. See **SECTION 3- ENGINE DISASSEMBLY.**
3. Remove cylinder cover. See **SECTION 10- CYLINDERS, COVERS AND SUMPS.**

The governor gear (H) and governor crank (F) are illustrated in Fig. 13.

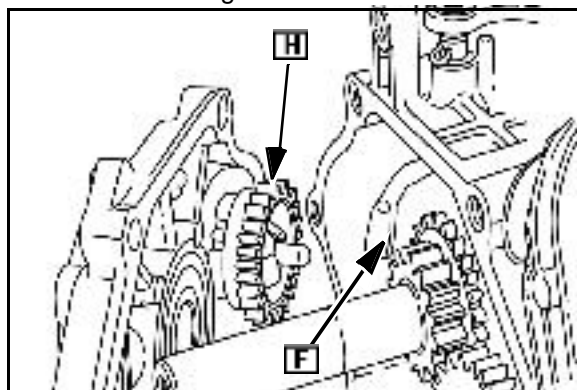


Fig. 13

4. Rotate crankshaft ([I] Fig. 14) as necessary for adequate clearance to remove governor crank (F).

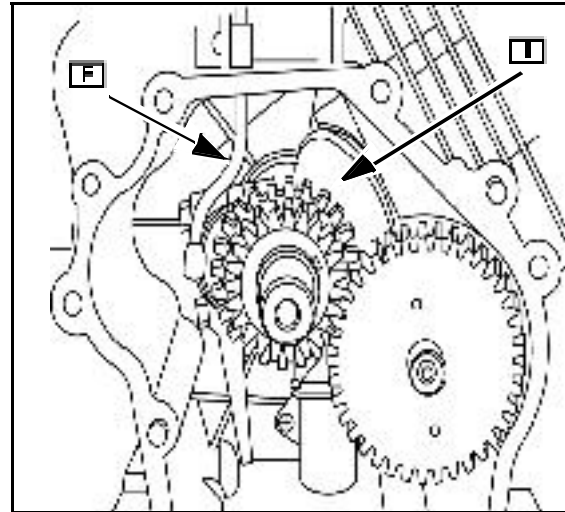


Fig. 14

5. Remove nut ([A] Fig. 15) (left hand threads) and lift off governor lever (B).
6. Remove nut (C) (left hand threads), spring clip (D) and thrust washer (E) from governor crank (F).
7. Remove felt seal (G) if equipped.
8. Push governor crank ([F] Fig. 15) down through cylinder housing.

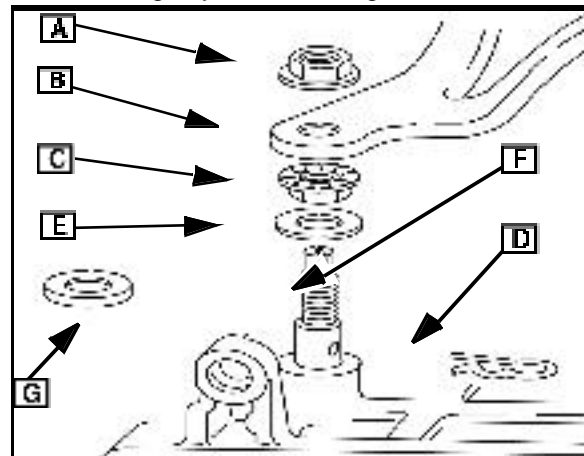


Fig. 15

**NOTE:** Rotate crankshaft and camshaft as needed for clearance. If necessary, remove camshaft.

9. Remove governor gear ([I] Fig. 16) from cylinder cover using two screw drivers.

10. Remove thrust washer.

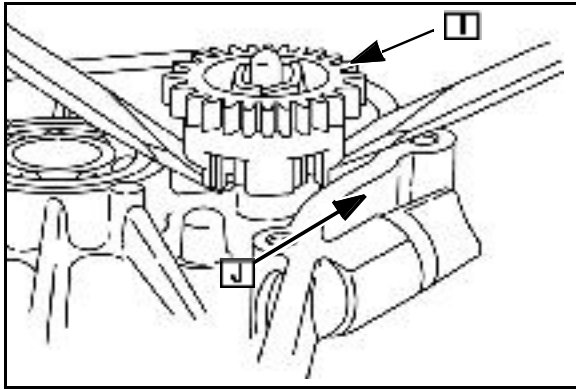


Fig. 16

## Governor Component Inspection

See SECTION 6- GOVERNOR SYSTEMS.

### Governor Gear Shaft - Remove and Replace

1. Press governor gear shaft (K) out of cylinder cover from outside, Fig. 17.

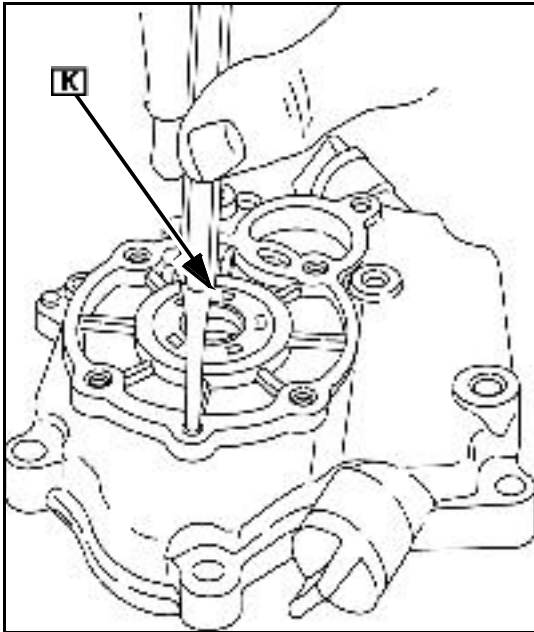


Fig. 17

2. Press either end of the new governor gear shaft (K) into the inside of cylinder cover from the inside until shaft is 1.220 - 1.222 in. (30.99 - 31.04 mm) high (L) from boss, Fig. 18.

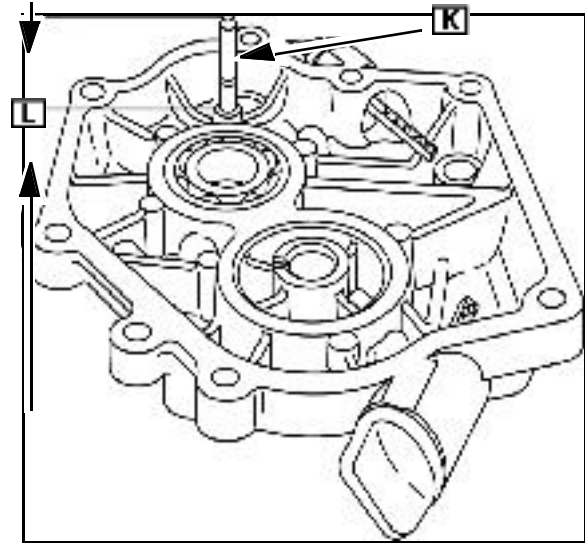


Fig. 18

### Governor Component Installation

1. Place thrust washer on governor gear shaft.
2. Place governor gear weights (if removed) in governor cup and place assembly on governor gear shaft.
3. Push assembly down until gear snaps into groove on governor gear shaft.
4. Position the crankshaft and other components as required for clearance to install the governor crank.
5. Install E-ring (if equipped) in groove on governor crank (F). (Refer to Fig. 11).
6. Push governor crank up through cylinder housing.
7. Place felt seal (G) (if equipped) and thrust washer (E) on crank. Insert spring clip (D) in governor crank (F), Fig. 19.
8. Install camshaft (if removed).

**NOTE:** Orientation and location of spring clip (D) is shown in Fig.12.



9. Install lower nut (C) on governor crank (F) with serrations UP until nut bottoms on threads of the crank. Tighten nut (left hand threads), Fig. 19.
10. Place governor lever (B), on governor crank (F).
11. Install top nut ([A] Fig. 19) with serrations down on lever.
12. Hold paddle of governor crank against cup of governor gear while tightening top nut (left hand threads).

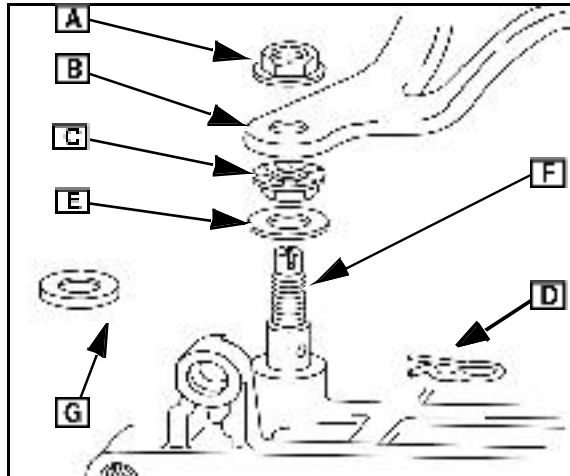


Fig. 19

**NOTE:** The following two illustrations (Fig. 20 & Fig. 21) show the general procedure for assembling governor linkages. Details vary with the type of equipment being powered.

13. Hook governor spring (M), link (O) and link spring (N) into lever ([B] Fig.20 or Fig.21).

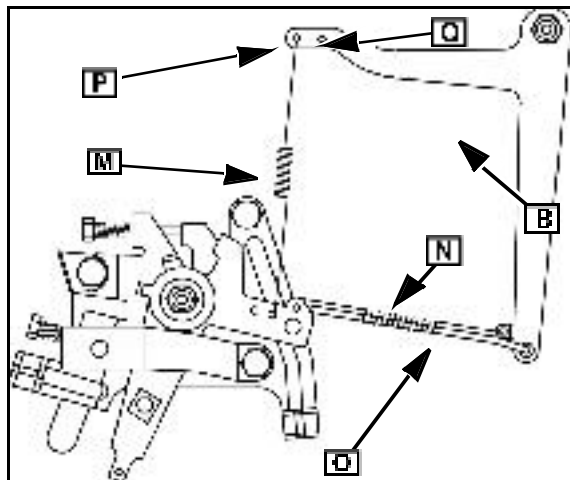


Fig. 20

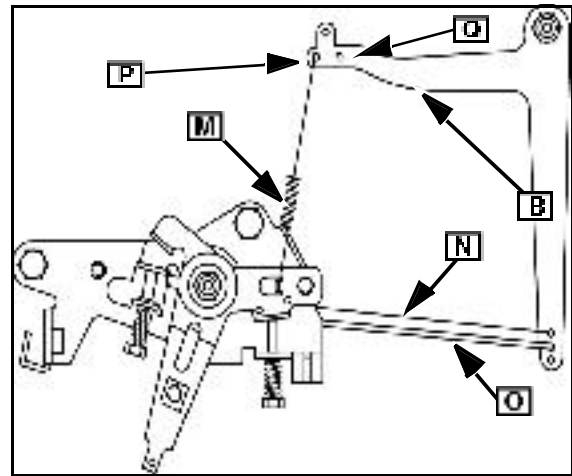


Fig. 21

**NOTE:** 60 Hz generators use the outer hole ([P] Fig. 21), while 50 Hz generators use the inner hole (Q) on the governor lever (B). Generator governor spring part numbers are listed in the Illustrated Parts List.

14. Reinstall any other components you removed,
15. Perform static adjustment. See SECTION 1- page 18.

## GOVERNOR COMPONENTS (104700, 161400, 260700, 261700, 28Q700)

### Governor Component Removal

**NOTE: (161430 type 0199-01)** This is equipped with a governor supplied by the OEM. Contact OEM for governor and engine speed information.

1. Drain oil from engine before beginning disassembly.
2. Remove rust, nicks, burrs, etc. from crankshaft P.T.O.
3. Remove necessary engine components to gain access to cylinder cover. Remove cylinder cover. Remove bolts holding cylinder cover or sump. Tap on side of cover to loosen and remove cover or sump if necessary.
4. Loosen governor lever nut (A) and remove governor lever (B), Fig. 22.

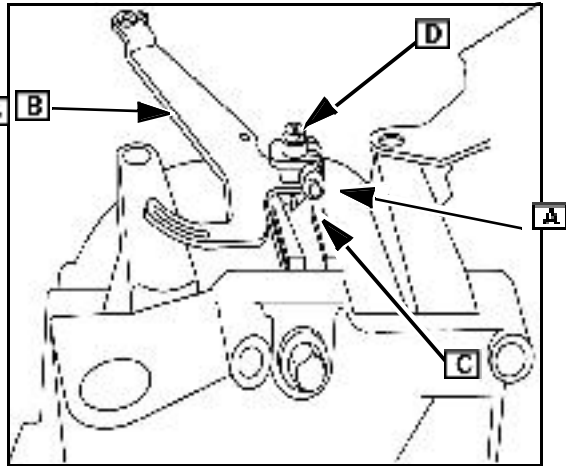


Fig. 22

5. Remove spring clip ([A] Fig. 23).
6. Push governor crank down through cylinder and out of bearing.
7. Pry out governor crank seal. Do not damage seal bore. Discard seal.

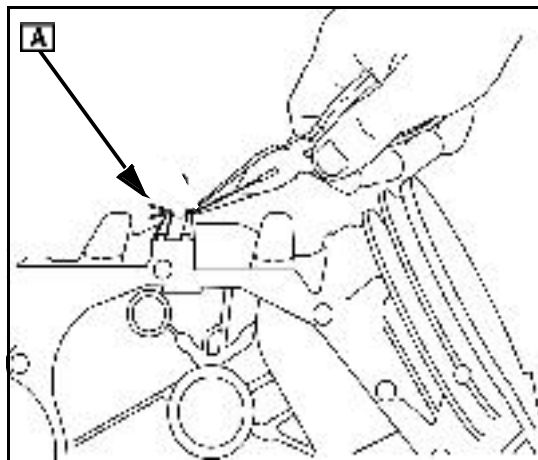


Fig. 23

## Governor Component Inspection

Refer to (Fig. 24).

1. Pry governor gear from shaft, if necessary
2. Inspect the governor gear (A) for wear and chipped or damaged teeth.
3. Inspect the governor flyweight pivots (B) for freedom of movement.
4. Ensure that cup (C) is retained throughout the flyweight travel.

5. Inspect bushing for burrs or foreign material.

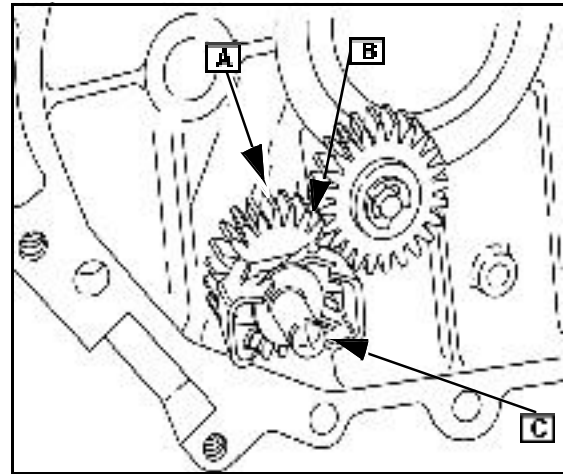


Fig. 24

### If discrepancies are found:

- Replace the governor gear as a complete assembly.

### If the shaft bushing is damaged or worn:

- Replace bushing.

## Governor Crank Bushing Replacement

1. Remove bushing with a .375 in. (9.5 mm) rod ([A] Fig. 25) by driving downward into the cylinder housing.
2. From the outside, use tool (#19204) and press new bushing into cylinder until it is flush with the outside surface.
3. Finish ream the bushing using tool (#19333).

4. Thoroughly clean away all chips and cutting debris.

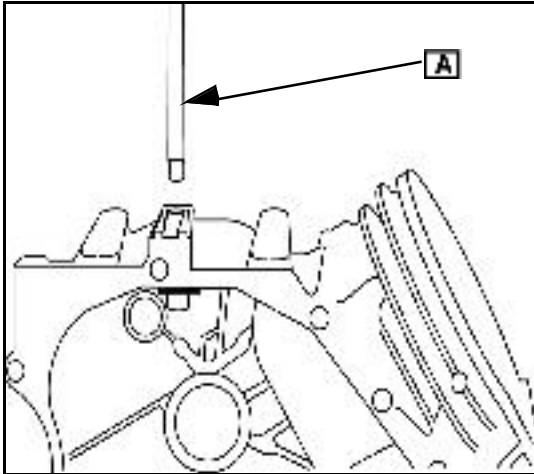


Fig. 25

### Governor Component Installation

1. Press in new seal.
2. Slide governor crank ([A] Fig. 26) up through the bushing and position as shown in the appropriate illustration.

**CAUTION:** Ensure that governor crank is in the position illustrated. (Fig. 26) (Fig. 27) and (Fig. 28) If it is not, proper governor adjustments cannot be made and will result in over-speeding and engine damage.

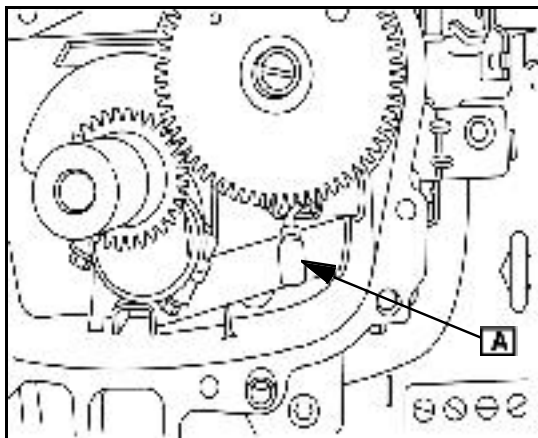


Fig. 26

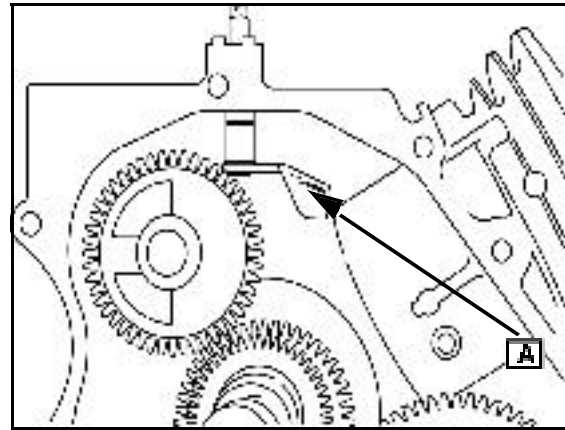


Fig. 27

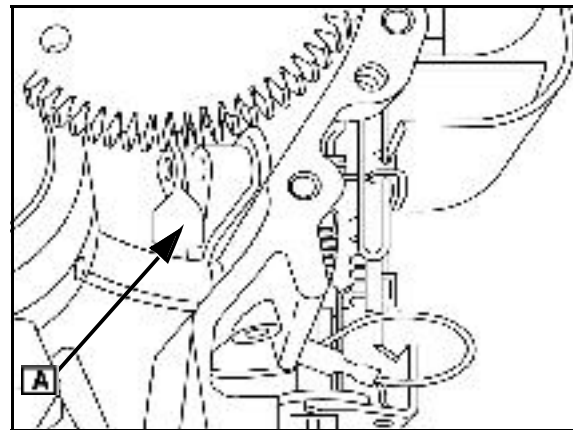


Fig. 28

3. Install washer and spring clip. Install spring clip ([A] Fig. 29) as shown.

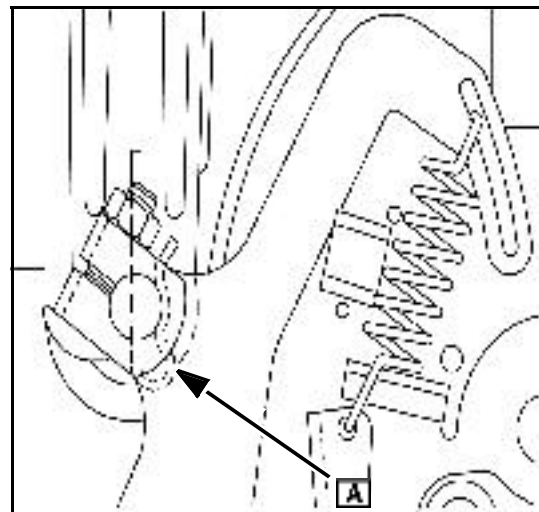


Fig. 29

4. Install governor gear. Ensure that counterweights ([A] Fig. 30) move freely without binding.

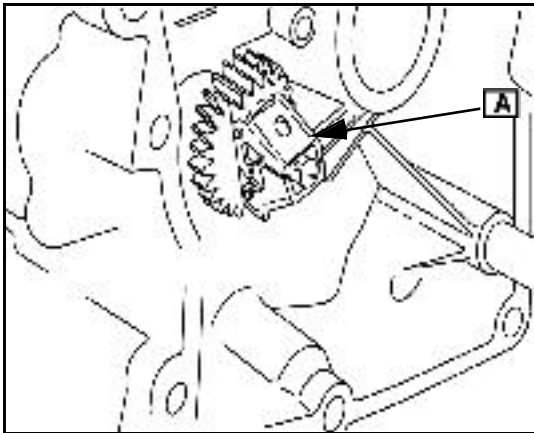


Fig. 30

5. Install cylinder cover or sump. **See SECTION 10- CYLINDERS, COVERS AND SUMPS.**

**NOTE: (161432 Type 0080-01)** When assembling governor lever assembly (A), ensure that tab on strike plate ([B] Fig. 31) is between upper and lower half of lever clamping area.

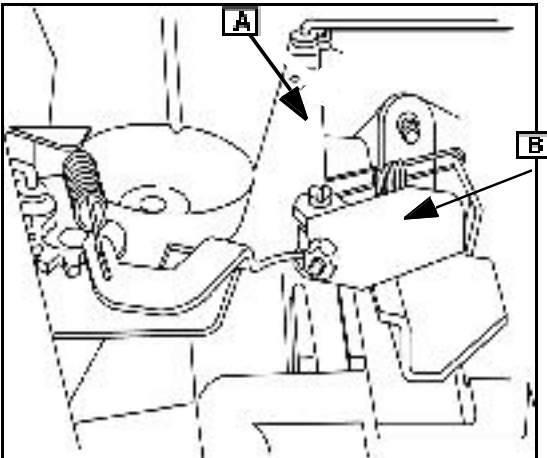


Fig. 31

6. Re install any components you removed to gain access to the cylinder cover.
7. Perform a static adjustment. **See SECTION 1- SAFETY, MAINTENANCE AND ADJUSTMENTS.**

## SECTION 7 - CYLINDER HEADS AND VALVES

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## ROCKER ARM ASSEMBLIES

### Remove Rocker Arm Assembly (050000, 118400)

1. Remove the four bolts ([A] Fig. 1) that mount the rocker arm assembly to the cylinder head.

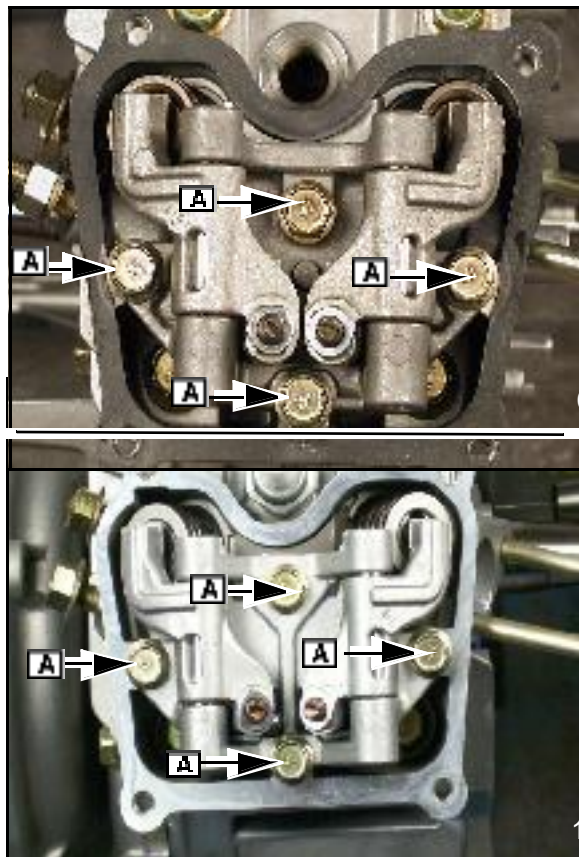


Fig. 1

2. Lift out the rocker arm assembly.
3. Remove valve stem caps (if equipped).
4. Remove the push rods.

### Remove Rocker Arms (085400, 086400, 115400, 117400, 138400, 185400)

1. Remove the jamb nut (A) from the rocker arm stud.
2. Remove the rocker arm pivot (B) from the studs and remove the rocker arms ([C] Fig. 2).

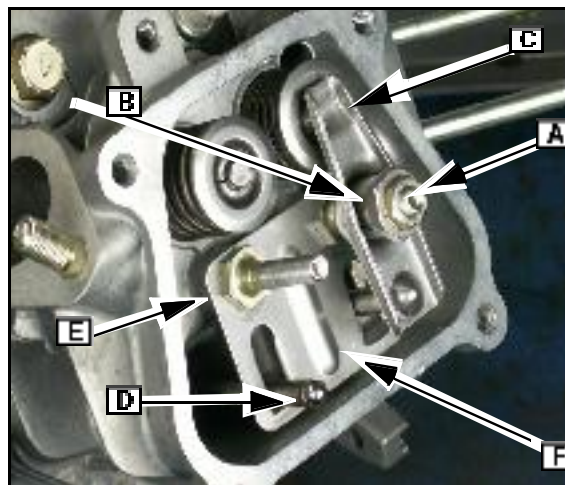


Fig. 2

3. Remove valve stem caps (if equipped) and push rods (D).
4. Remove rocker stud (E) and push rod guide ([F] Fig. 2).

### Remove Rocker Arm Assembly (235400, 245400)

1. Remove two hex screws (A) holding rocker arm shaft to cylinder head, Fig. 3.

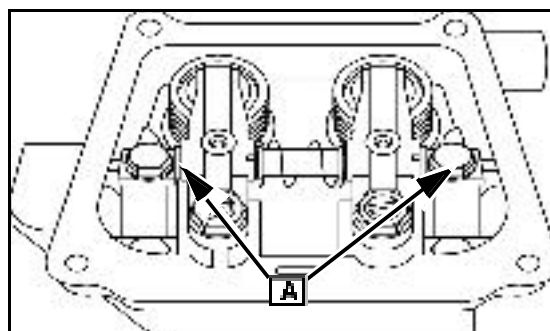


Fig. 3

2. Remove valve stem caps (if equipped).
3. Remove push rods and label them for reassembly in their original locations.
4. Remove either snap ring ([B] Fig. 4).
5. Remove rocker arms (C) and spring (D) from rocker shaft (E).

6. Remove valve adjusting screw and nut ([F] Fig. 4) from rocker arm.

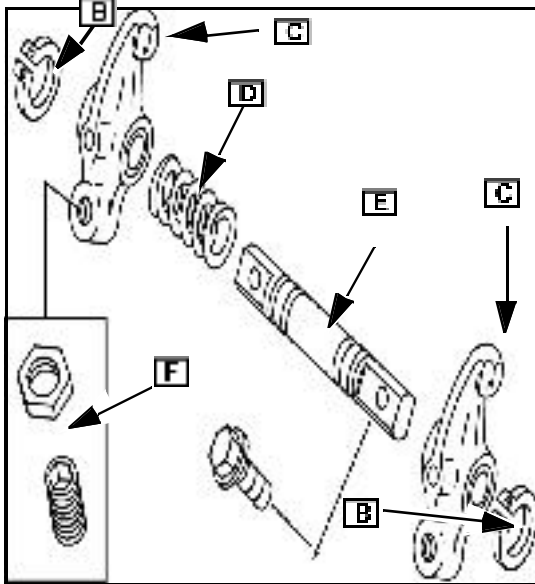


Fig. 4

4. Remove rocker arm studs (D) and push rod guides ([E] Fig. 5), if equipped.

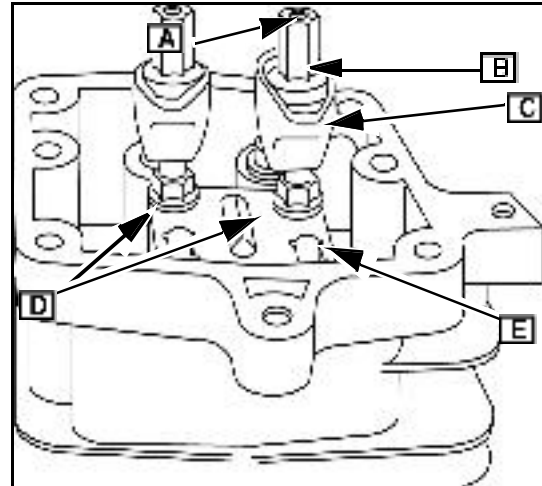


Fig. 5

## Remove Rocker Arms (104700, 161400, 260700, 261700, 28Q700)

1. Loosen rocker arm set screws ([A] Fig.5).
2. Remove rocker arm nuts (B), and rocker arms (C).
3. Remove push rods and note the following:

104700, 161400:

- Push rods are identical.

260700, 261700:

- The intake push rod has center section that is made of aluminum and is hollow.

28Q700:

- The intake push rod is aluminium and hollow.
- Exhaust push rod has a red band of paint for identification.

## CYLINDER HEAD REMOVAL

### Remove Cylinder Head (050000, 085400, 086400, 115400, 117400, 118400, 138400, 185400)

1. Remove four cylinder head bolts ([A] Fig. 6) and lift off cylinder head.

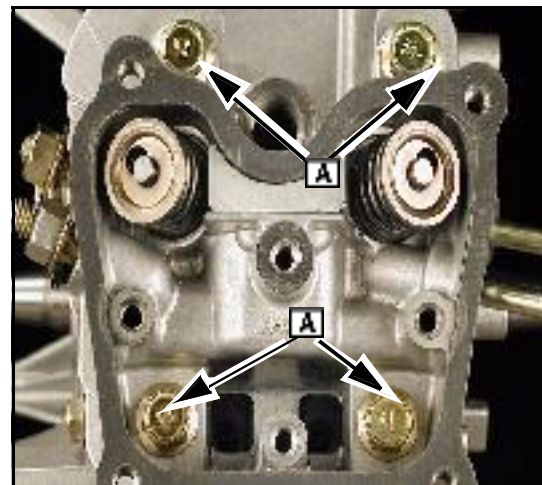


Fig. 6

2. Remove and discard head gasket.

### Remove Cylinder Head (104700, 161400, 260700, 261700)

1. Remove head bolts ([A, B, C & D] Fig.7) and cylinder head.

**NOTE:** Engines manufactured before 940501xx were equipped with sealing washers under cylinder head bolts (A) and (C] Fig. 7).

2. Remove and discard head gasket.

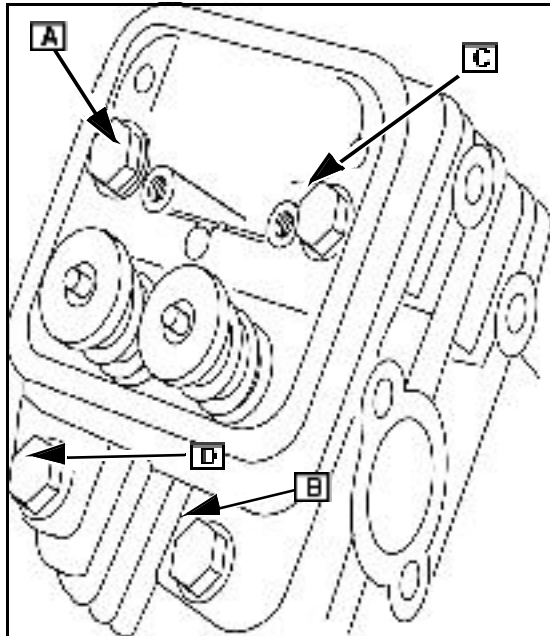


Fig. 7

3. Make note of any discrepancies and discard old head gasket.

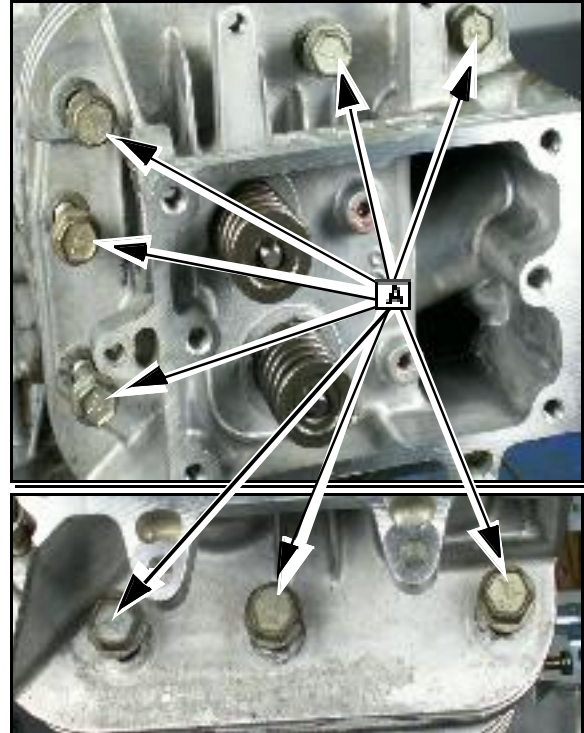


Fig. 8

### Remove Cylinder Head (28Q700)

1. Remove head bolts ([A] Fig.8) and cylinder head.
2. Remove and discard head gasket.



## VALVES

### Remove Valves

(050000, 086400, 118400, 104700)

1. Place cylinder head on a solid and flat work surface.
2. Bundle a rag under the face of the valve being removed.
3. With a small socket mounted on a drive handle, push the valve retainer down from the direction of the open slot as shown in ([A] Fig. 9).
4. Follow the sequence shown ([B & C] Fig.9).

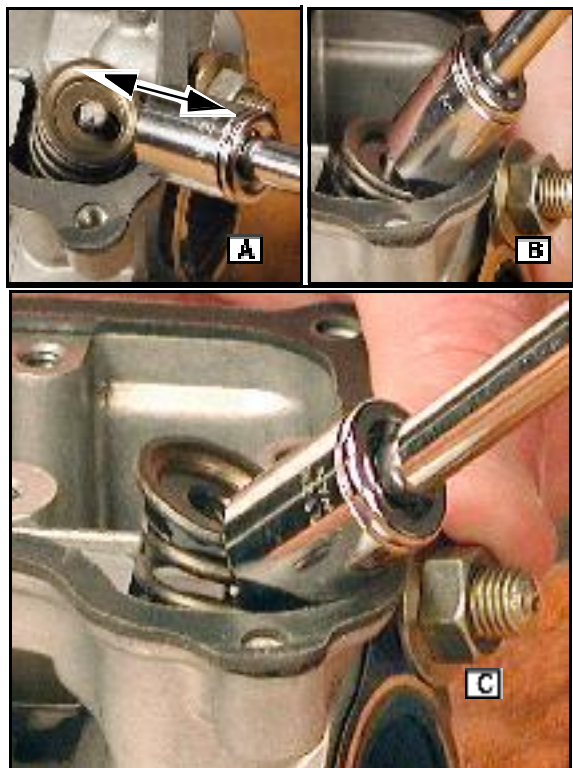


Fig. 9

5. Allow valve to slide out of guide
6. Repeat this process for the remaining valve.
7. Remove oil splash guard (if equipped) and set aside.

### Remove Valves

(085400, 086400, 115400, 117400, 138400, 185400, 161400, 260700, 261700, 28Q700)

1. Place cylinder head on a solid and flat work surface.
2. Bundle a rag under the face of the valve being removed.
3. Install rocker arm nuts ([A] Fig. 10) and studs in cylinder head. Do not tighten.
4. Slip end of Valve Spring Compressor #19347 (B), under nut and over valve spring.
5. Press down on tool handle to compress valve spring and remove split retainer.
6. Gradually release pressure on tool to remove retainer ([C] Fig. 10), spring, and seal(s).
7. Discard the seals.

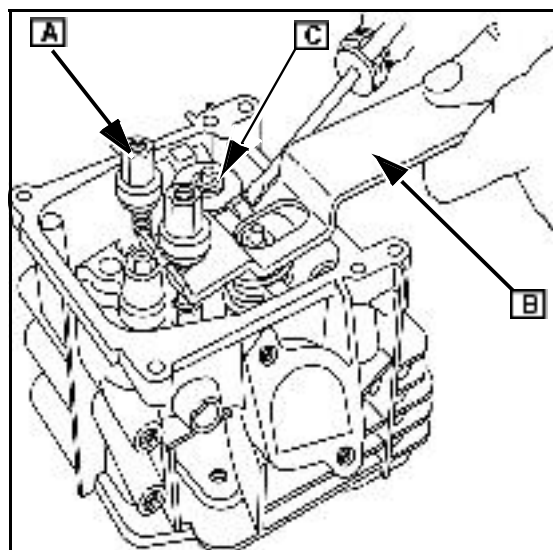


Fig. 10

## INSPECT CYLINDER HEAD COMPONENTS

### Inspect Push Rods (All Models)

Check pushrods for straightness as shown in Fig. 11.



Fig. 11

Replace if bent.

### Inspect Head For Distortion (All Models)

1. Clean the mating surface of the cylinder head.
2. Using a straight edge that extends across both sides of the cylinder head mating surfaces:
  - Check that the straight edge comes in contact with the entire mating surface area of the head.
  - Move the straight edge to various different positions on the mating surface.
  - If equal contact is made in all positions, the mating surface is good (Fig. 12).



Fig. 12

3. If an area is questionable, use a feeler gauge to measure the amount of distortion as shown in Fig. 13.



Fig. 13

For reject dimensions, see **SECTION 14-ENGINE SPECIFICATIONS**.

**If the allowable distortion limit is exceeded:**

- Replace the cylinder head and/or cylinder block.

### Inspect Valve Guide Inner Diameter (All Models)

For 28Q700:

1. Measure intake and exhaust valve guides with Valve Guide Plug Gauge #19381.
- Replace cylinder head if the flat end of the gauge can enter guide 1/4 in. (6.35 mm) or more.

If plug gauge is not available:

- Measure valve guides and compare with listed reject dimensions. See **SECTION 14-ENGINE SPECIFICATIONS**.

## Inspect Valve Stem / Valve Guide Tolerance (All Models)

1. Measure the valve stem at the locations illustrated in ([A & B] Fig. 14).

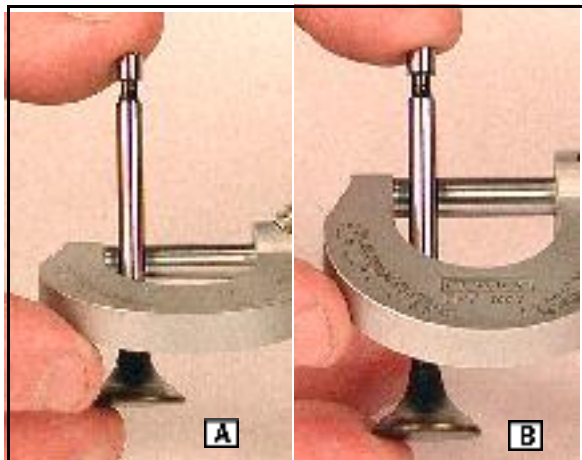


Fig. 14

For listed reject dimensions: **See SECTION 14-ENGINE SPECIFICATIONS.**

## Inspect Valve Seat (All Models)

**NOTE:** Because of the additional heat endured by the exhaust valve, inspect the area around the exhaust seat very carefully. Cracks or an improper fit of the seat may not be readily apparent. Additionally, a seat that is tight when the engine is cold may become loose with the heat of operation. One indication is metallic stains around the exhaust seat.

## Reface Valves and Seats (All Models)

Valve faces can be resurfaced using a commercially available valve grinding tool. Briggs & Stratton does not recommend this practice as a high quality repair procedure.

- Replace damaged or worn valves.

For specifications relating to the engine you are working on, **see SECTION 14-ENGINE SPECIFICATIONS.**

1. Cut valve seats with Neway Valve Seat Cutter Kit #19237 or #19343, ([A] Fig. 15) to specifications listed for your engine's exhaust and intake seats.
- Place the proper guide pin in the valve guide.
- Use the appropriate cutter and grind the valve seat using the handle and slight pressure.

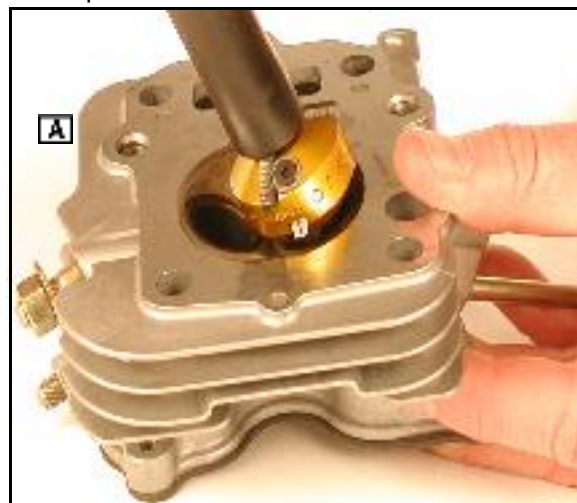


Fig. 15

Valve and seat are lapped in using Valve Lapping Tool, #19258 and Valve Lapping Compound #94150 to assure a good seal between the valve face and the seat.

2. Thoroughly clean lapping compound from valve seat and valve face.

**If seat is wider than specification:**

- Use a narrowing cutter.

**If valve face is burned:**

- Replace the valve.

3. Replace valve if taper depth margin ([A] Fig. 16) is less than 1/64" (.4mm).



4. Replace valve seat if dimension ([B] Fig. 16) is less than 1/64" (.4mm).

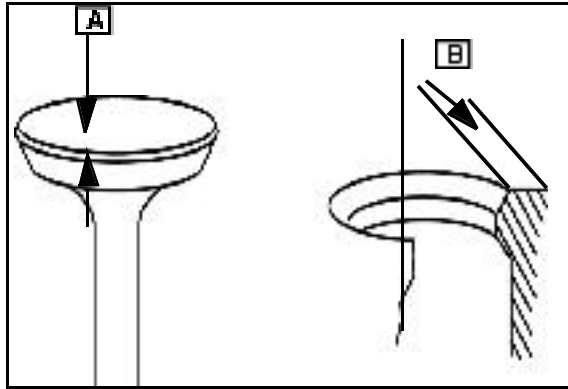


Fig. 16

Replace broken, distorted, or worn valve springs.

## CYLINDER HEAD ASSEMBLY

### Install Push Rod Guides and Studs (085400, 104700, 115400, 117400, 118400, 28Q700)

If push rod guide was removed:

1. Place push rod guide (A) in cylinder head with word "TOP" (except 104700) toward Mag. side of cylinder head, Fig.17 or

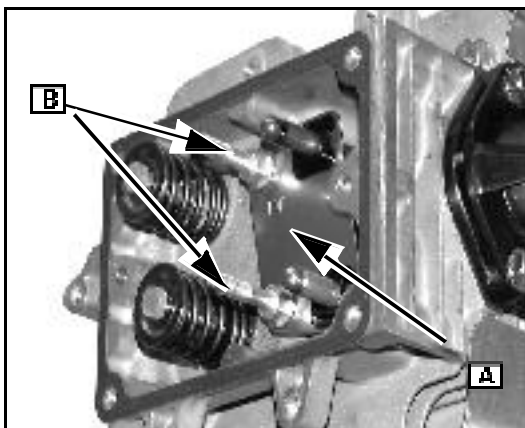


Fig. 17

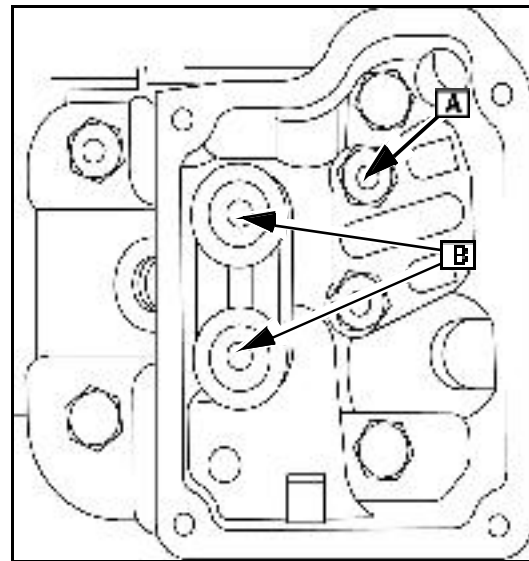


Fig. 18

2. Coat rocker arm stud threads with Loctite #242 sealant.
3. Install rocker arm studs.
- Torque studs ([B] Fig. 17 and Fig. 18) to value listed in **SECTION 14- ENGINE SPECIFICATIONS**.

**NOTE:** All engines use valve stem seals on the intake valve.

Valves will stick and damage the valve stem seals if the stems and guides are not free of foreign material and burrs.

4. Lightly coat valve stems with Valve Guide Lubricant #93963. Install valves to valve guides.

Two piece valve stem seals were used on early production intake valves (28Q700), Fig. 19.



Fig. 19

Current production engines use a one piece valve stem seal, Fig. 20.



Fig. 20

5. Oil the inside diameter of the valve stem seal with engine oil.
  - Install on the valve stem.
6. Slide seal down against head plate or cylinder head.

**NOTE:** Current production valve stem seals on 28Q700 are a press fit on the valve guide boss. To install, place intake valve in valve guide. Slide new seal down over valve stem against valve guide boss. Using a (10 mm) six point deep socket press or tap seal down until it bottoms.

Be sure Valve Guide Lubricant #93963 is not on valve face, valve seat, or exposed end of valve stem.

- Gasket seal or washer is used on intake valve only, (085400, 115400, 117400, 118400, 185400, 235400, 245400, 28Q700).

## Installing Valve Springs & Retainers (050000, 235400, 245400)

1. Install the oil splash guide in the rocker box (if equipped) as shown in Fig. 21.



Fig. 21

**NOTE:** The exhaust valve is marked with a raised "EX" on its face.

2. Insert the valves into their guides and set the head on a folded shop cloth to support and prevent the valves from falling out of the cylinder head.
3. With the valve face resting on the shop cloth, position the return spring over the valve.
4. Push the valve retainer over the valve stem as shown in Fig. 22.



Fig. 22

Make sure the keeper is completely seated in the groove of the valve stem.

- Repeat this process for the remaining valve.

### Install Valve Springs And Retainers (104700, 28Q700)

1. Place a shop rag or wood blocks on work surface to support valves. Place cylinder head on rag or blocks and install valve spring over valve stem.
2. Place retainer (A) on spring. Depress retainer with thumbs to compress spring, Fig. 23.

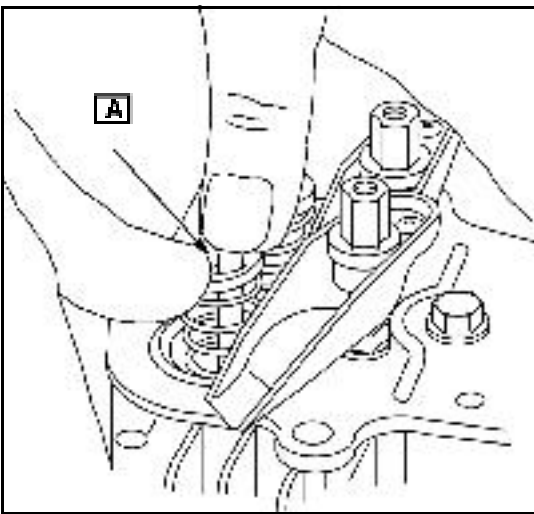


Fig. 23

3. Compress spring until valve stem extends through large end of retainer slot. Continue to press until small end of slot can slide into valve stem groove on valve stem. Be sure retainer is fully engaged in valve stem groove.

### Install Valve Springs And Retainers (085400, 115400, 117400, 138400, 185400)

1. Place cylinder head on work surface. With a block of wood or a shop cloth to support the valves. Install valve spring over valve stem.
2. Thread rocker arm nut on rocker stud, with hex nut down.

3. Place retainer on spring. Use Valve Spring Compressor, #19347 ([A] Fig. 24) to press on retainer and compress spring.

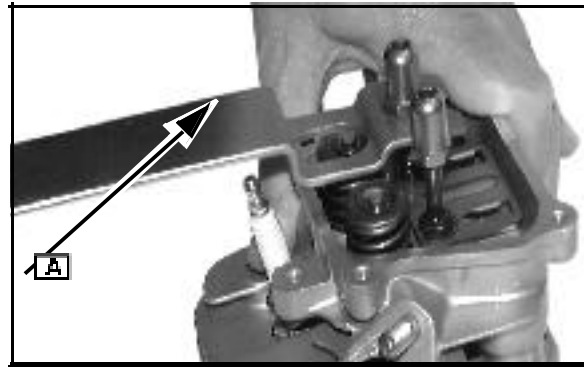


Fig. 24

4. Compress spring until valve stem extends through valve retainer and groove is above retainer.
5. Place both halves of valve keeper in valve stem groove. Slowly release tension on valve spring and valve spring keeper.

### Install Valve Springs And Retainers (161400, 260700, 261700)

1. Place cylinder head on workbench with support to hold valves in place. Install valve springs and valve spring retainers over valve stems.
2. Install rocker arm nuts on studs. Compress spring with Valve Spring Compressor #19347. Install split keepers in groove on valve stem.
3. Remove rocker arm nuts.

7

## INSTALLING CYLINDER HEADS

**NOTE:** Do not use sealer on gaskets.

Torque screws in sequence shown by model number, as shown in:

- Fig. 25 (050000, 085400, 115400, 117400, 118400, 185400, and 235400, 245400)
- Fig. 26 (050000, 086400)
- Fig. 27 (104700)
- Fig. 28(161400)
- Fig. 29(260700, 261700)
- Fig. 30 (28Q700)

• Fig. 31 (138400)

Torque cylinder heads in three steps:

For example:

For final torque of **220 lb-in. (25 Nm)**:

- First step **75 lb-in. (9 Nm)**
- Second step **150 lb-in. (17 Nm)**
- Final step **220 lb-in. (25 Nm)**

**CAUTION:** Do not tighten any screw to the final torque before all screws have been tightened to the second step. Uneven tightening may warp the cylinder head.

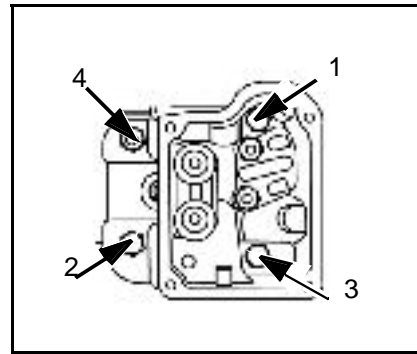


Fig. 27

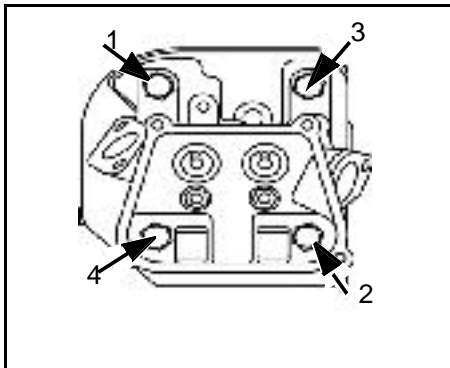


Fig. 25

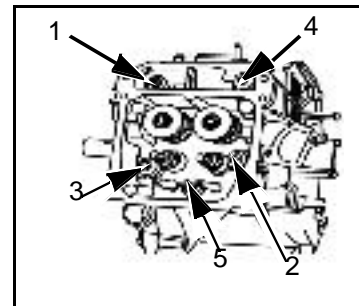


Fig. 28

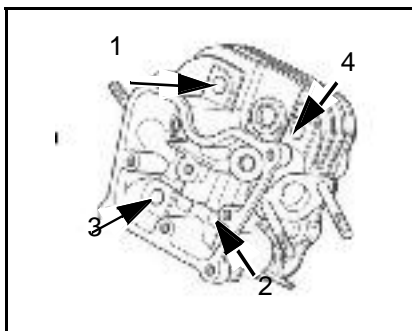


Fig. 26

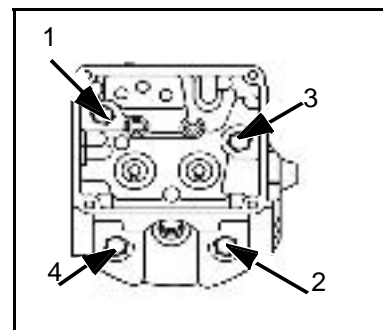


Fig. 29

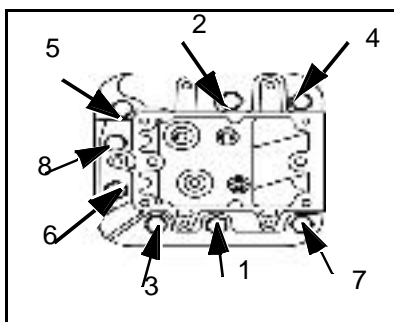


Fig. 30

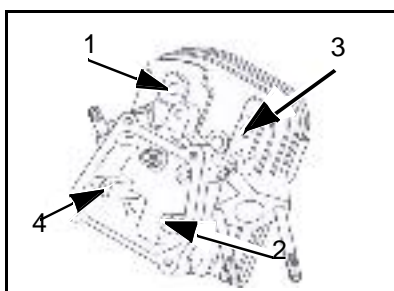


Fig. 31

For final torque values:

**See SECTION 14- ENGINE SPECIFICATIONS.**

**NOTE: (260700, 261700)** Plain washers are used on cylinder head screws outside the valve cover. Sealing washers are used on cylinder head screws inside the valve cover.

**NOTE: (161400)** The top two cylinder head bolts without washers are inserted through cylinder baffle, then cylinder head.

## INSTALL ROCKER ARMS

### Install Push Rods & Rocker Arms (104700, 161400, 260700, 261700, 28Q700)

1. Install push rods (A) through push rod guide. Make sure push rods are seated in valve tappets ([B] Fig. 32).

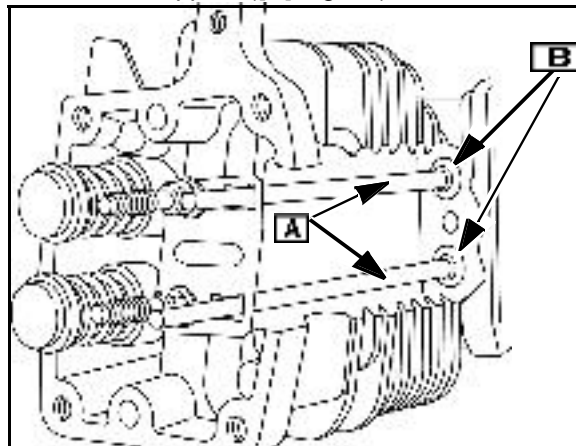


Fig. 32

2. Remove all lubricant from end of valve stems.
3. Place valve caps ([C] Fig. 33), (when used) on end of valve stems.
4. Place rocker arms on studs. Install rocker arm nuts (D) and screw while holding rocker arm against valve cap ([C] Fig. 33).
  - Tighten rocker arm until rocker ball is finger tight.
5. Rotate crankshaft at least two revolutions to be sure push rods operate rocker arms.

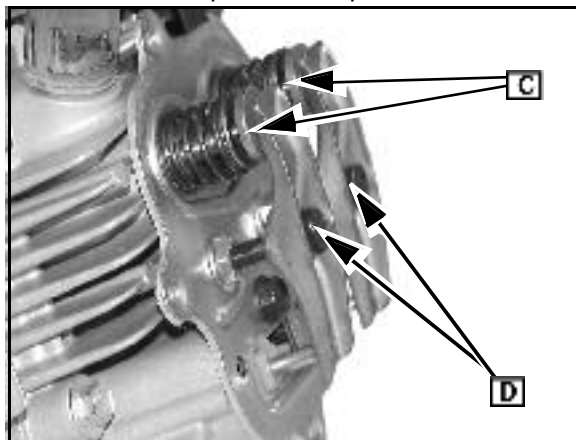


Fig. 33

## Install Push Rods & Rocker Arms (235400, 245400)

1. Install push rods. Be sure each push rod is seated in its tappet.
  2. Place rocker arm shaft assembly on cylinder head making sure that push rod sockets engage valve adjusting screws.
  3. Install two screws ([A] Fig. 34) in rocker arm shaft and cylinder head.
- Torque screws as listed. **See SECTION 14-ENGINE SPECIFICATIONS.**

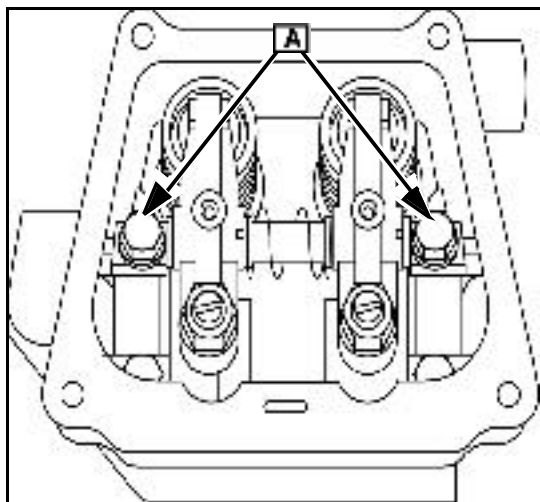


Fig. 34

## ADJUST VALVE CLEARANCE

### Valve Clearance (Typical)

Valve clearances should always be checked on a cold engine. The clearance allows for valve expansion as a result of heat generated during engine operation.

To adjust valve clearances, proceed as follows:

1. Ensure that the piston is at TDC
2. Ensure that the bolts mounting the rocker assembly are properly torqued.
3. Loosen the jamb nut ([A] Fig. 35) on the rocker arm.
4. Insert the proper blade of feeler gauge ([B] Fig. 35).
5. While moving it back and forth, carefully tighten the adjustment screw until a slight amount of resistance is felt on the feeler gauge.

6. Tighten the jamb nut without moving the adjustment screw.

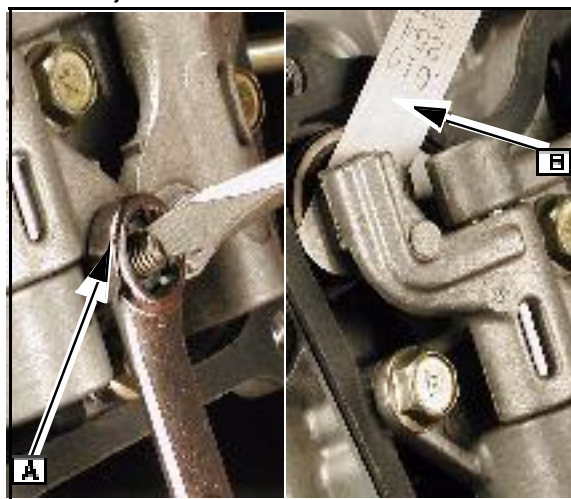


Fig. 35

7. Rotate the crankshaft through a few revolutions and recheck the clearance.
8. Repeat this process until both valves consistently fall within specifications.

### Valve Clearance (104700, 161400, 260700, 260700, 261700, 28Q700)

1. Turn crankshaft until piston is at TDC on compression stroke.
2. Insert a narrow screwdriver or small rod into spark plug hole against piston. The screwdriver is used to gauge piston movement.
3. While watching screwdriver or rod, turn crankshaft clockwise (flywheel end) past TDC until piston is 1/4 in. (6 mm) down.

**NOTE:** Correct positioning of crankshaft is required to eliminate compression release from holding valves open.

4. Using a feeler gauge ([A] Fig. 36), check valve clearance.

**See SECTION 14- ENGINE SPECIFICATIONS.**



5. Adjust as required.

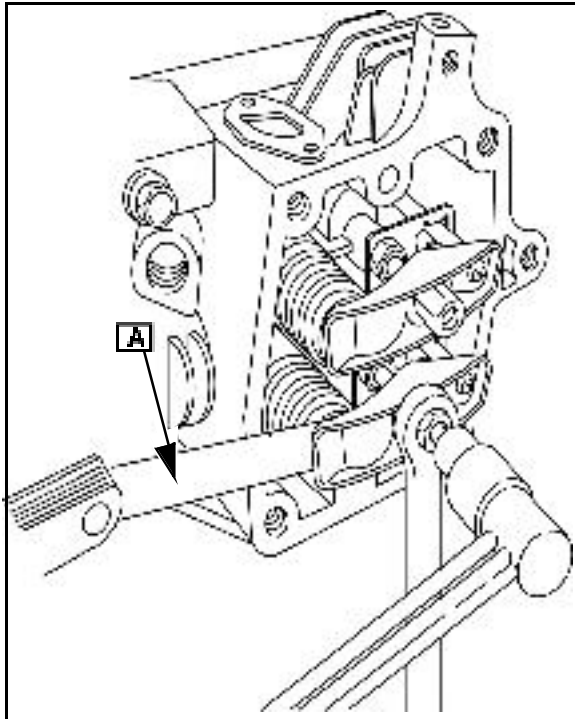


Fig. 36

6. When valves are adjusted, hold rocker nut and tighten rocker ball screw or nut to torque listed.

7. Recheck clearance and adjust, if required.



## SECTION 8 - STARTERS

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## REWIND STARTERS

### Remove Rewind Starter Housings (Typical)

1. Remove four screws (A) holding rewind starter housing ([B] Fig. 1) and remove.
2. If riveted, drill through rivets. Clean all debris.

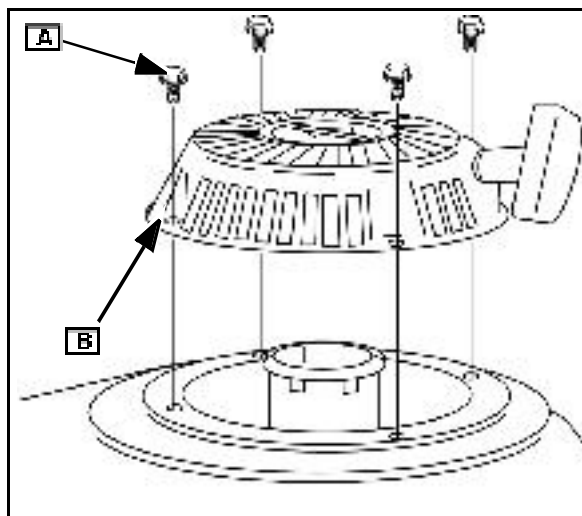


Fig. 1

For starters that are spot welded to blower housing:

3. Drill out spot welds (A) using a 3/16 in. (4.8 mm) drill bit ([B] Fig. 2). Drill only deep enough to loosen spot welds.

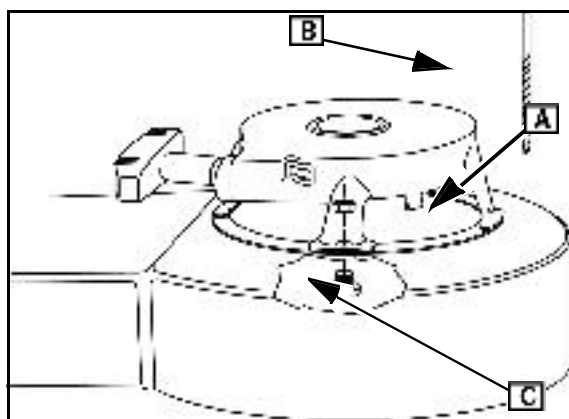


Fig. 2

4. Reinstall using original screws or use nuts and bolts ([C] Fig. 2) as listed in the Illustrated Parts List (IPL).

## Install Rope And Handle Assembly

### Handles With Inserts

**NOTE:** Some units do not use an insert in the handle.

1. To determine proper length of starter rope, see **SECTION 14- ENGINE SPECIFICATIONS**. Cut as necessary.
2. Insert rope (A) through starter handle (B) and starter handle insert (C).
3. Tie knot on end of rope, leaving approximately 1/2 in. (13 mm) ([D] Fig. 3) of rope left. Pull knot into handle insert and pull insert into starter handle.

**CAUTION:** Knot must be an overhand knot (E) so it will not pull through pulley, hole in handle and/or insert.

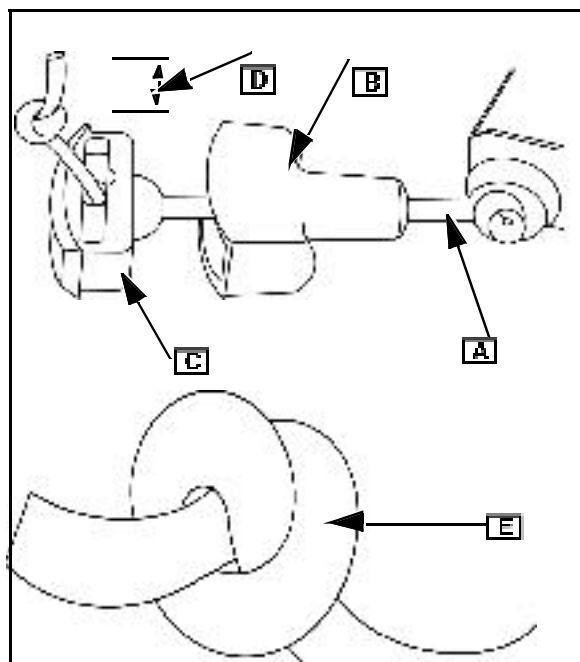




Fig. 3

## Disassemble Rewind Starter (115400, 117400, 118400, 138400, 185400, 260700, 261700)

 <b>WARNING</b>

<b>Eye injury could occur if flywheel is struck with a hard object.</b>
<ul style="list-style-type: none"> <li>Do not strike flywheel with hard object or steel tool.</li> <li>Wear safety goggles or other eye protection.</li> </ul>

1. Pull starter rope out as far as it will go.
2. Lock pulley with screwdriver in fins.
3. Extract knot at pulley and cut off knot.
4. Remove rope and handle from rewind starter.
5. Unlock pulley and slowly release spring tension.
6. Inspect rope for fraying or broken strands. Replace if worn.

### If re-using old rope:

- Burn pulley end of rope with a match to prevent swelling and unraveling.
7. Remove shoulder screw (A) and retainer (B).
  8. Lift out pawls (C) and springs ([D] Fig. 4).

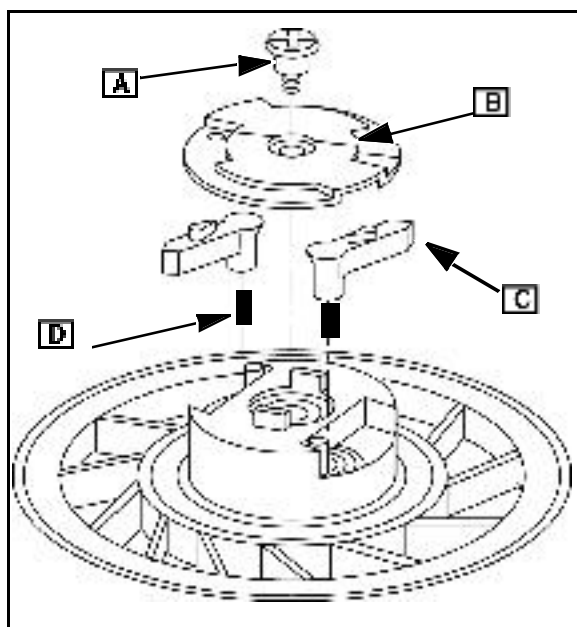


Fig. 4

9. Wiggle pulley until spring comes free of its anchor.
10. Carefully lift out pulley and spring assembly, (Fig. 5).

**NOTE:** Do not remove spring from pulley. Pulley and spring are serviced as an assembly.

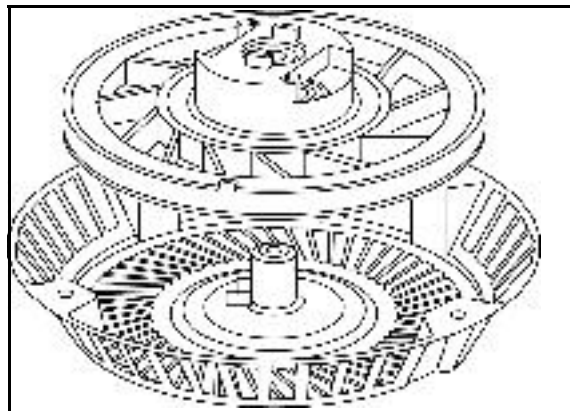


Fig. 5

### Inspect Pulley Assembly

1. Inspect pulley for wear, cracks, rough edges (A) or burrs in pulley groove (B) and wear on center hole ([C] Fig. 6). Replace pulley if damaged or worn.
2. Inspect spring for broken ends, kinks and burrs. Replace if damaged or worn.

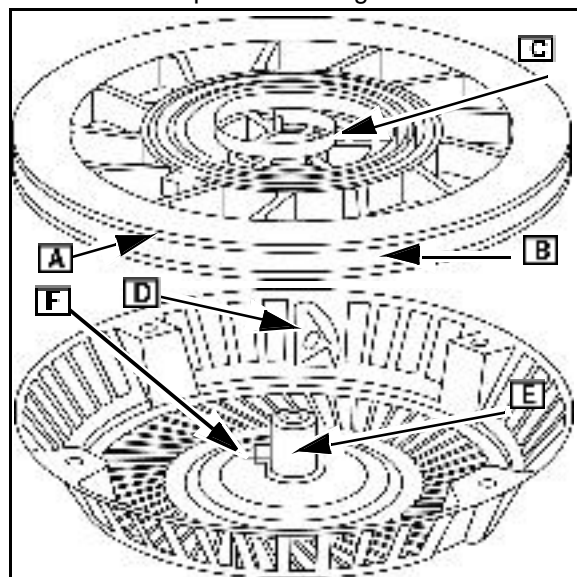


Fig. 6

3. Inspect starter housing for wear or sharp edges at rope eyelet (D), center pivot post (E), and inner spring anchor tab ([F] Fig. 6). Replace assembly if worn or damaged.



## Assemble Rewind Starter (115400, 117400, 118400, 138400, 185400, 260700, 261700)

1. Lay starter housing flat on work bench.
2. Position pulley and coil spring assembly (A) over center pivot post (B) in starter housing.

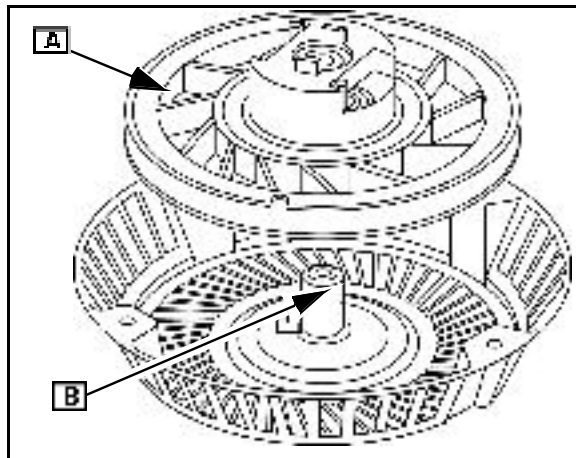


Fig. 7

3. Rotate pulley counterclockwise until slight resistance is felt, indicating that spring is engaged in spring tab, (Fig. 8).

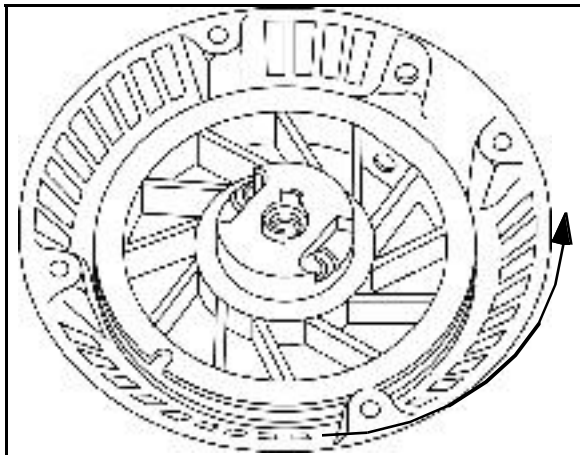


Fig. 8

4. Position springs (A) over posts (B) in pulley. Install pawls (C) Fig. 9).

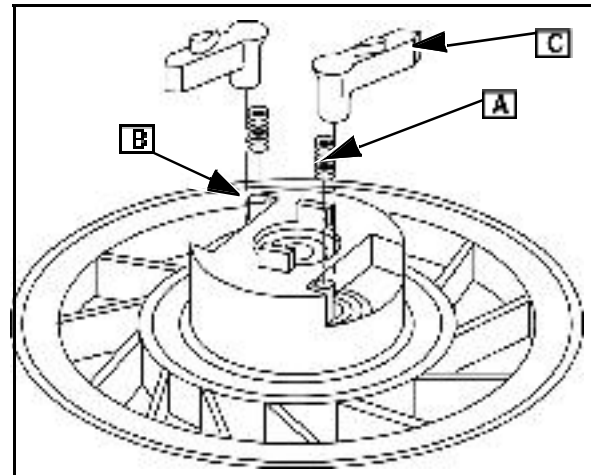


Fig. 9

5. Install retainer (A) making sure that slots (B) in retainer engage tabs (C) Fig. 10) on pulley.
6. Hold retainer down, compressing pawl springs and install retainer screw. Torque screw (D) to listed value. See SECTION 14- ENGINE SPECIFICATIONS.
7. While holding retainer, rotate pulley to extend and retract pawls. If the pawls do not extend and retract, remove retainer and reinstall.

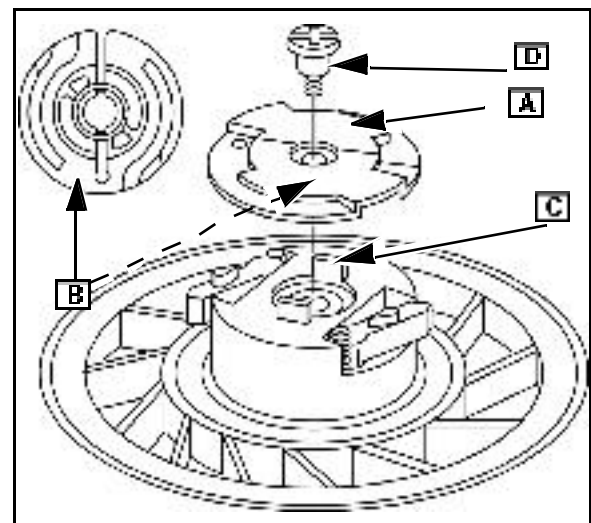


Fig. 10

8. Wind up pulley and lock in place.
9. Insert rope and tie overhand knot. See SECTION 8- Fig. 3.
10. Allow spring to slowly retract rope into assembly.

## Disassemble Rewind Starter (161400, 235400, 245400)

1. Pull starter rope out as far as it will go.
2. Lock pulley to prevent it from retracting in starter housing.
3. Extract rope at pulley and cut off knot.
4. Remove rope and handle from rewind starter.
5. Unlock pulley and slowly release spring tension.
6. Inspect rope for fraying and broken strands. Replace if worn.

### If reusing old rope:

- Burn pulley end of rope to prevent swelling and unraveling.
7. Remove retainer screw (A), small washer (B), retainer (C), brake spring (D), and large washer (E) (Fig. 11).

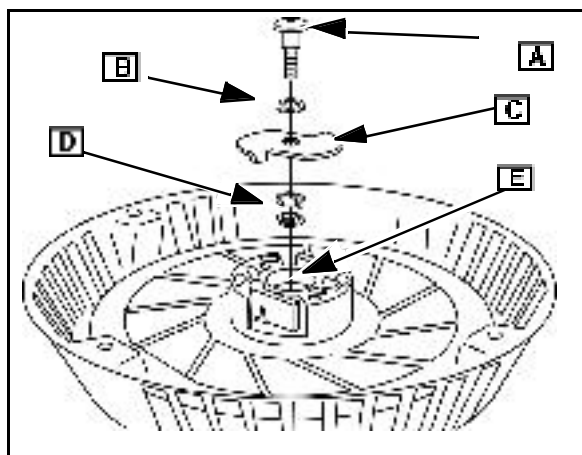


Fig. 11

8. Lift out pawls (A) and pawl springs (B).
9. Rotate pulley (C) until it feels free.



### WARNING



**Prevent Eye Injury. Wear eye protection when working on rewind starter pulleys and springs.**

10. Lift out pulley. The starter spring cup (D) will normally remain in starter housing (E) (Fig. 12).

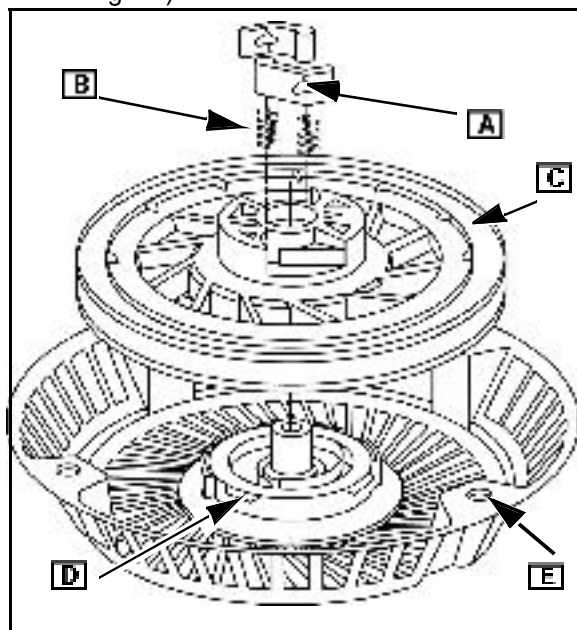


Fig. 12

11. Remove spring and cup (A) from starter housing (B) (Fig. 13) or pulley.

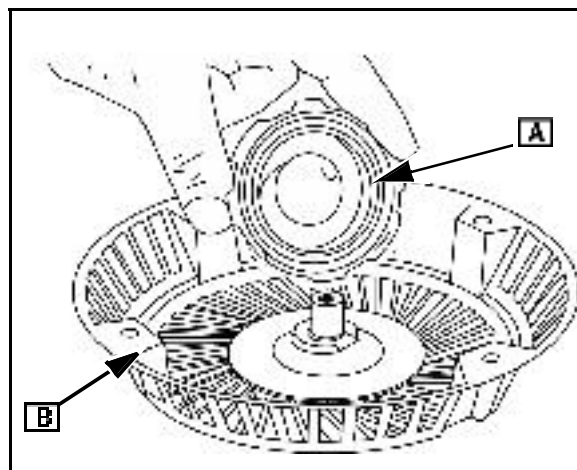


Fig. 13

**NOTE:** Do not remove spring from cup. Cup and spring are serviced as an assembly.

## Inspect Rewind Starter (161400, 235400, 245400)

1. Inspect starter pulley for cracks, rough edges, wear or burrs in pulley groove (A), wear on spring cup lugs (B) and center hole ([C] Fig. 14). Replace pulley if damaged or worn.

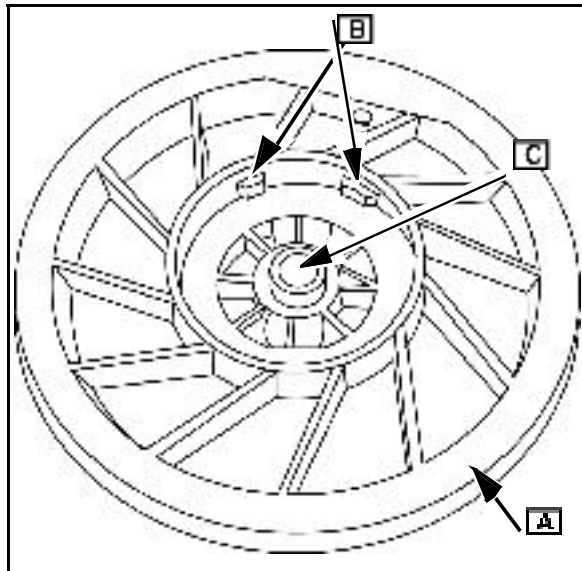


Fig. 14

2. Inspect starter housing eyelet (A), center pivot post (B) and inner spring retainer ([C] Fig. 15). Replace housing assembly if worn or damaged.

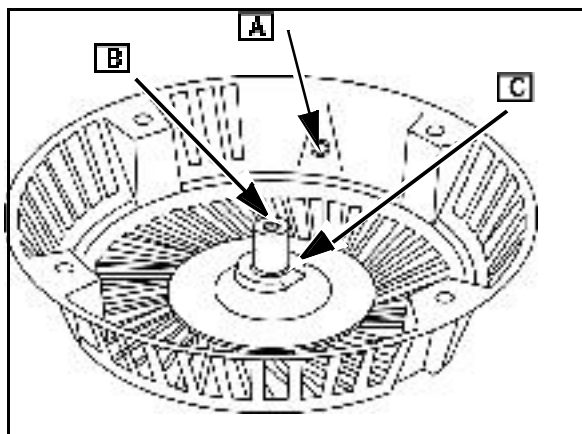


Fig. 15

## Assemble Rewind Starter (161400, 235400, 245400)

1. Place spring and cup in pulley, with outer end of spring (A) between two wide spaced lugs (B) in pulley and spring cup projections ([C] Fig. 16) next to the two wide spaced lugs.

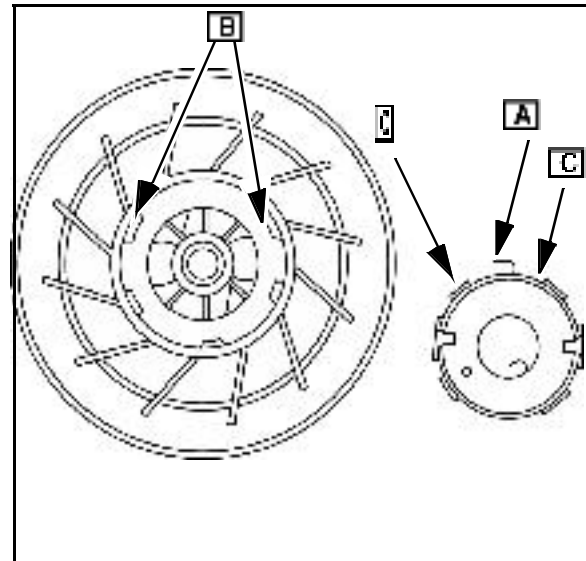


Fig. 16

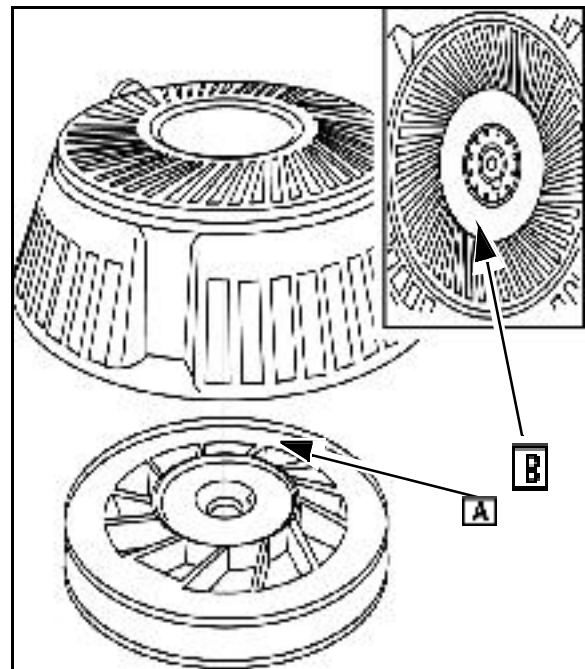


Fig. 17

2. Note location of inner spring tab (A) and location of inner spring anchor ([B] Fig. 17) on center post of starter housing.
3. Lower starter housing on to pulley and spring assembly, then invert assembly.

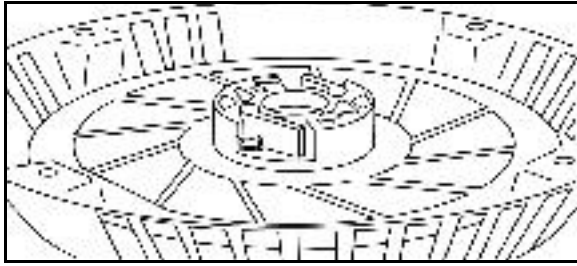
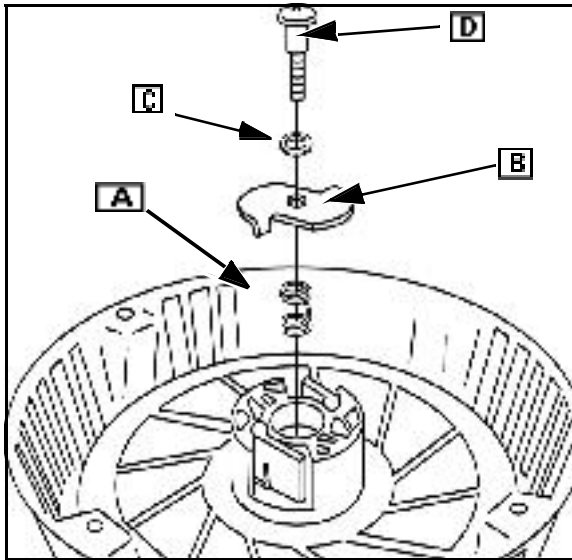


Fig. 18

4. Install pawls (A) and pawl springs ([B] Fig. 19) in pulley.
5. Install retainer spring (A), retainer (B), washer (C) and retainer screw ([D] Fig. 19).



6. Rotate pulley ([A] Fig. 20) clockwise until inner spring is tight.

Fig. 19

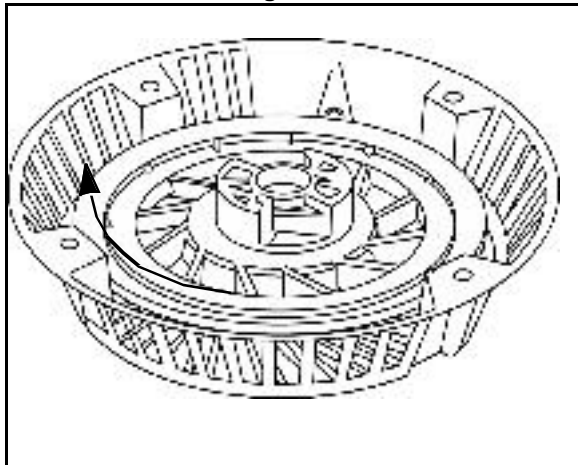


Fig. 20

7. Lock pulley with screwdriver in fins to prevent it from unwinding in housing.

8. Insert rope through housing and hole in pulley.
9. Secure rope to pulley with overhand knot.
10. Remove pulley lock and allow spring to slowly retract rope into rewind starter assembly.
11. Install handle. **See SECTION 8- Fig. 3.**

## Disassemble Rewind Starter With Metal Pawls (104700)



### WARNING



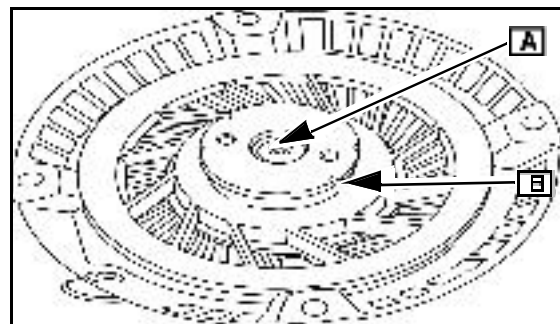
**Prevent Eye Injury. Wear eye protection when working on rewind starter pulleys and springs.**

1. Pull starter rope out as far as it will go.
2. Lock pulley to prevent it from retracting in starter housing.
3. Extract rope at pulley and cut off knot.
4. Remove rope and handle from rewind starter.
5. Unlock pulley and slowly release spring tension.
6. Inspect rope for frayed and broken strands. Replace if worn.

### If reusing old rope:

- Burn pulley end of rope to prevent swelling and unraveling.

7. Remove retainer screw (A) and retainer



([B] Fig. 21).

Fig. 21

8. Lift out starter pawls (A) and pawl springs ([B]).



9. Remove brake spring (C).
10. Rotate pulley and spring assembly ([D] Fig. 22) until pulley feels free.
11. Lift out pulley and spring assembly.

**NOTE:** Pulley and spring with retainer are serviced as an assembly. Do not remove spring retainer from pulley.

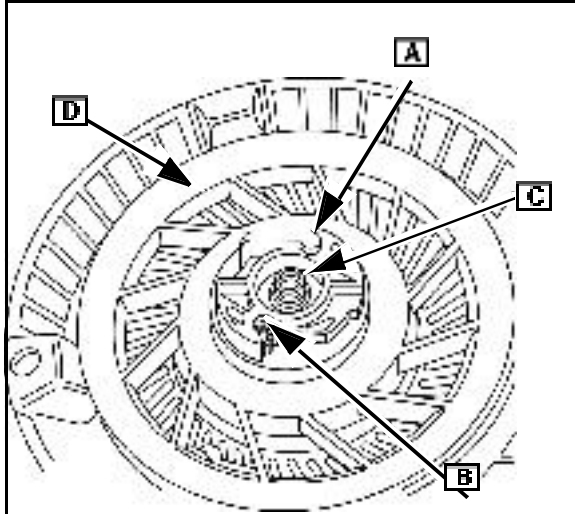


Fig. 22

### Inspect Rewind Starter With Metal Pawls (104700)

1. Inspect starter pulley (A) for cracks, rough edges, wear, burrs in pulley groove, or a loose spring retainer ([B] Fig. 23).

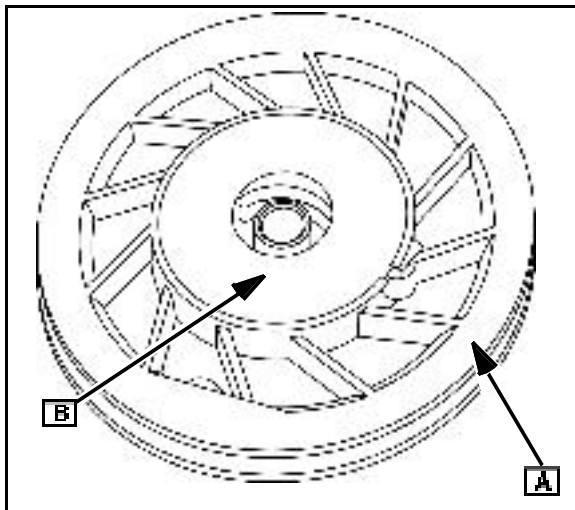


Fig. 23

2. Inspect starter housing (A) for wear or burrs at starter housing eyelet (B), center pivot post (C), and at inner spring retainer ([D] Fig. 24). Replace damaged or worn components.

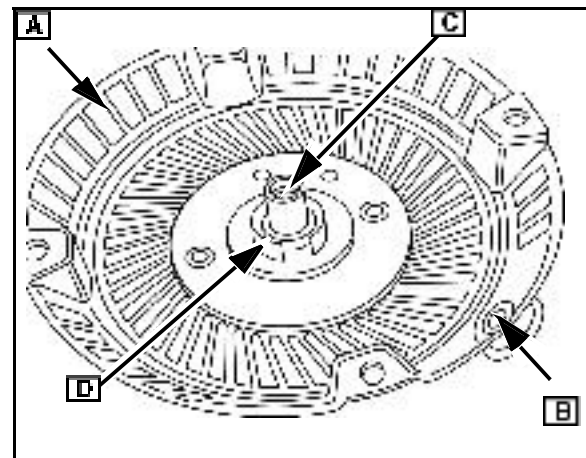


Fig. 24

### Assemble Rewind Starter With Metal Pawls (104700)

1. Note the location of the free end of the spring in the pulley assembly and of the inner spring retainer ([A] Fig. 25) in the starter housing.

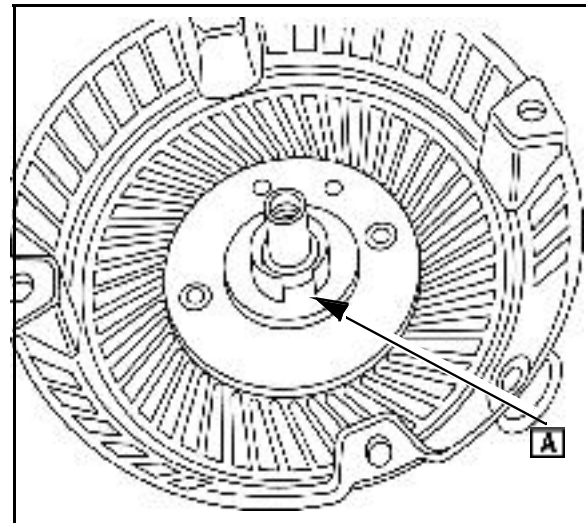


Fig. 25

2. Line up the free end of spring with the spring retainer (A) in the housing (Fig. 25). Assemble the pulley in the housing.
3. Rotate pulley counterclockwise until spring engages retainer.

4. Install pawls (A), pawl springs (B), and brake spring (C) Fig. 26).

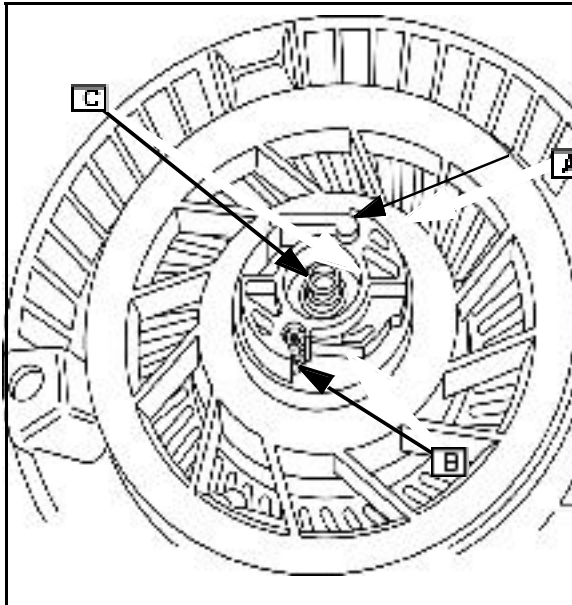


Fig. 26

5. Place retainer (A) on brake spring and partially tighten retainer screw (B) Fig. 27. Pierced holes on retainer must be between pawls and stop on pulley.

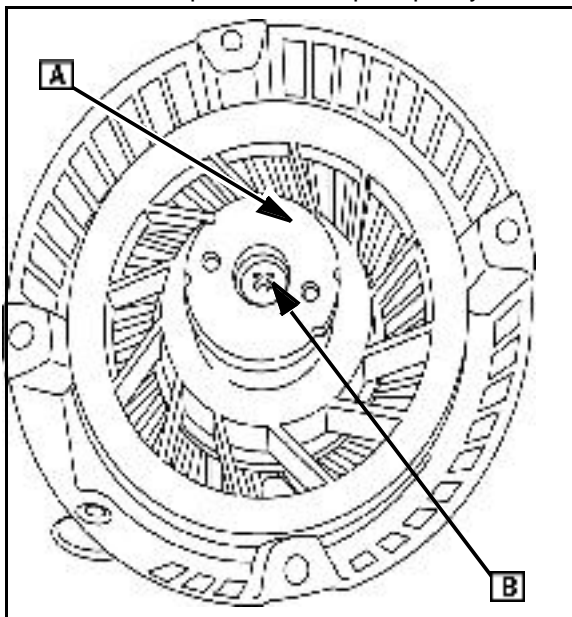


Fig. 27

6. Torque retainer screw (B) Fig. 433) to listed value. See SECTION 14- ENGINE SPECIFICATIONS.
7. Rotate pulley counterclockwise until spring is tight.
8. Lock pulley with screwdriver.

9. Insert rope through housing and hole in pulley.
10. Secure rope to pulley with overhand knot. See SECTION 8- FIG. 3.
11. Remove pulley lock and allow spring to slowly retract rope into rewind starter assembly.

## Disassemble Rewind Starter (28Q700)

**NOTE:** If problems are encountered with the clutch, replace the entire clutch unit. Remove starter clutch from crankshaft pilot with tool (#19244).

1. Cut knot at starter pulley and remove rope.
2. Grasp outer end of rewind spring (A) Fig. 28) with pliers. Pull out of housing as far as possible.
3. Turn spring 1/4 turn. Remove from pulley or bend up one of the tangs with Tang Bender #19480. Lift out starter pulley to disconnect spring.

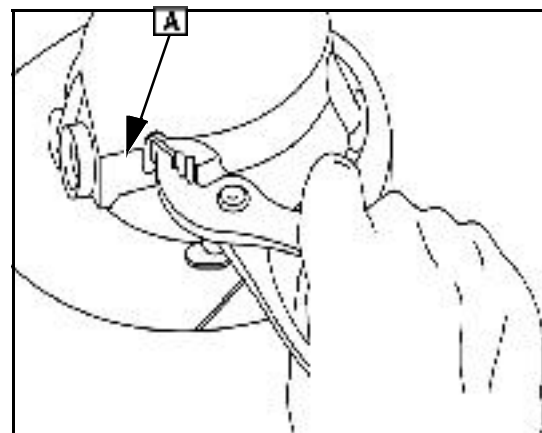


Fig. 28

4. Clean rewind housing, pulley and rewind spring in solvent. Wipe clean with cloth.



## Assemble Rewind Starter (28Q700)

1. Straighten spring to allow easier installation and restore tension.
2. Oil spring.
3. Insert either end of spring into blower housing slot and hook into pulley (A).
4. Place a dab of grease (B) on steel pulley.
5. Set pulley into housing. Bend tang down. Adjust tang gap to **0.063 in. (1.6 mm)** (C Fig. 29). Depress pulley fully into rewind housing when measuring tang gap.

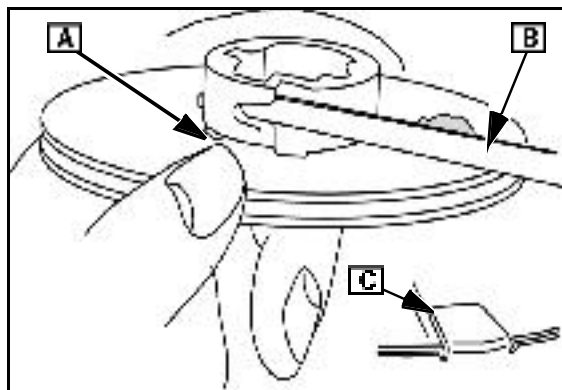


Fig. 29

6. Place a **0.75 in. (19 mm)** ([A] Fig. 30) square piece of stock into center of pulley hub.

With pulley oriented as in Fig. 29, wind the stock and pulley counterclockwise until spring is wound tightly and end of spring seats in tapered hole ([B] Fig. 30).

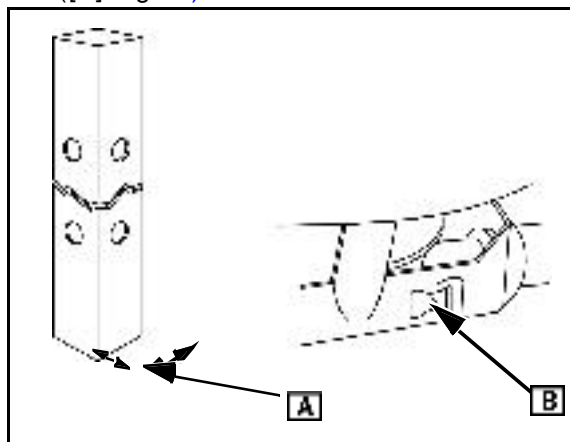


Fig. 30

7. Back off pulley until pulley hole is aligned ([A] Fig. 31) with eyelet in blower housing.

8. Install rope.

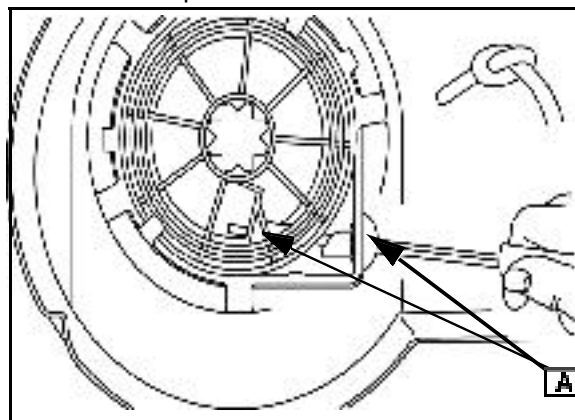


Fig. 31

9. Insert rope through housing and hole in pulley.
10. Secure rope to pulley with overhand knot. **See SECTION 8- Fig. 3.**
11. Remove pulley lock and allow spring to slowly retract rope into rewind starter assembly.

## ELECTRIC STARTERS

Typical starter locations (A) are shown for horizontal crankshaft engines (Fig. 32) and vertical crankshaft engines (Fig. 33).

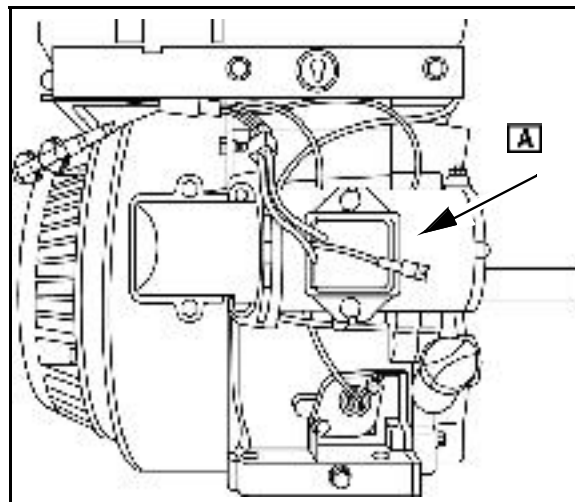


Fig. 32

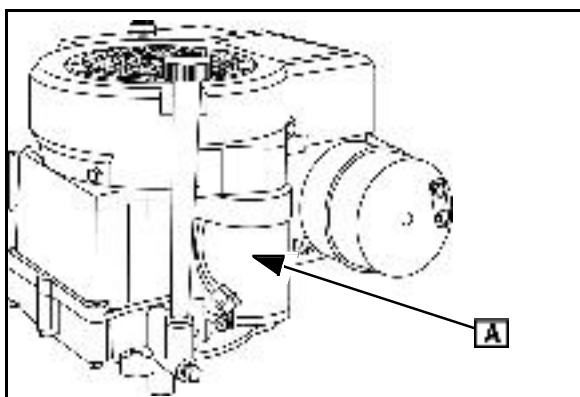




Fig. 33

**NOTE:** Some engines are equipped with an OEM supplied electric starter. Contact the OEM for service information and adjustment procedures.

## Ring Gear Replacement

Briggs & Stratton engines use an aluminum, plastic or steel ring gear that is attached to the flywheel. Replace the ring gear if it shows wear or damage. Some steel ring gears are pressed or heat shrunk to the flywheel. These ring gears are not replaceable.

 <b>WARNING</b>

<b>Eye injury could occur if flywheel is struck with a hard object.</b>
<ul style="list-style-type: none"> <li>• Do not strike flywheel with hard object or steel tool.</li> <li>• Wear safety goggles or other eye protection.</li> </ul>

Use approved flywheel removal tools.

1. Using a center punch, mark center of rivets holding ring gear ([A] Fig. 34) to flywheel ([B]).
2. Drill out rivets with a #13 (4.7 mm) drill bit. Clean holes after drilling.
3. Attach new gear to flywheel using four screws ([C]) and lock nuts ([D] Fig. 34) provided with gear.

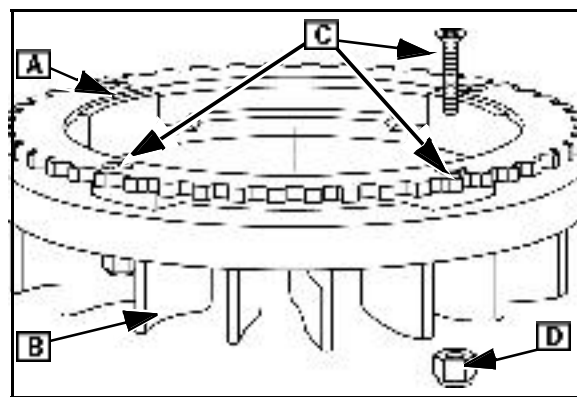


Fig. 34

## Test Starter Drive and Clutch

When the starter is activated, the pinion gear should engage the ring gear and crank the engine. Clutch should not slip during engine cranking.

To check starter drive:

Inspect helix ([A]) and pinion gear ([B] Fig. 35) for freedom of operation.

**If damage or binding is noted:**

- Replace the drive assembly.

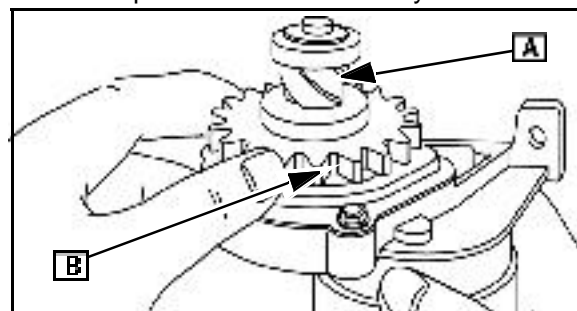


Fig. 35

**CAUTION:** Do not oil pinion gear on clutch helix.

**To check drive clutch with starter still installed on equipment:**

- Disconnect spark plug.
- Block mower blade (if equipped).
- Engage starter motor.

Replace the clutch assembly if it slips.

## Starter Drive (104700, 161400, 260700, 261700)

### Disassemble Starter Drive (Roll Pin Retainer)

1. Place starter drive retainer on support block and drive out roll pin ([A] Fig. 36) to remove starter drive.

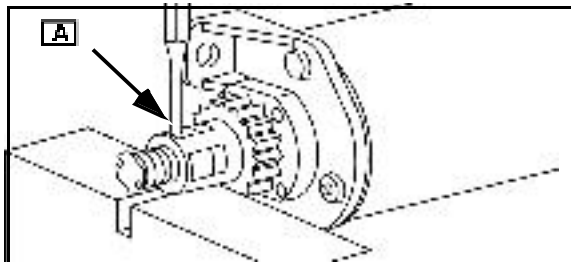


Fig. 36

2. Remove cover (B), upper spring retainer (C), spring (D), clutch retainer (E), washer (F), pinion gear (G) and clutch ([H] Fig. 37).

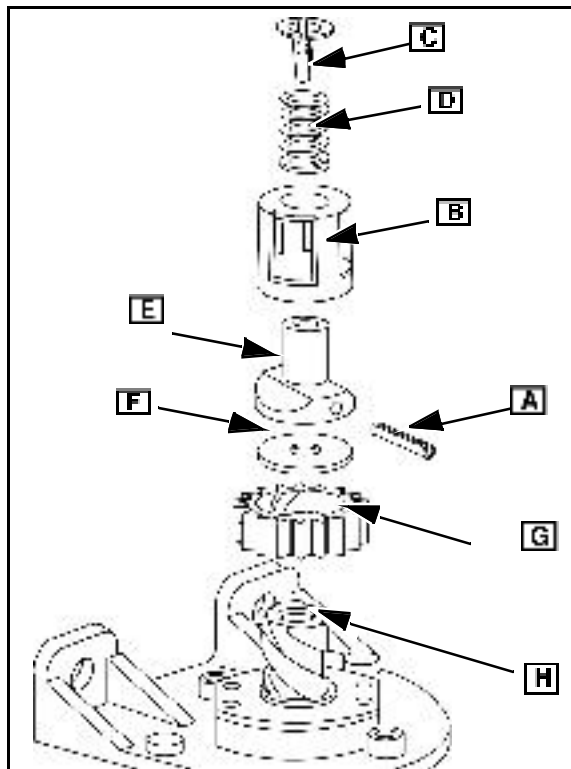


Fig. 37

### Inspect Starter Drive

1. Inspect the pinion gear (G) for damaged teeth.
2. Correct any sticking between pinion gear and clutch ([H] Fig. 37).

**CAUTION:** Do not oil pinion gear on clutch helix.

3. Wash the parts in solvent.

### Assemble Starter Drive

**NOTE:** Use new roll pin when assembling starter drive.

Refer to Fig. 37.

1. Place starter clutch (H) on armature shaft and rotate clutch until it drops into place.
2. Install pinion gear (G) with beveled edges of pinion gear teeth away from motor.
3. Place washer (F) and clutch retainer (E) on armature shaft.
4. Place spring (D), spring retainer (C), and cover (B) on to clutch retainer.
5. Press new roll pin (A) through retainer slot and armature shaft hole until pin is centered in shaft.

## Starter Drive (115400, 117400, 138400, 185400)

### Disassemble Starter Motor Drive (Retainer Ring Retainer)

1. Grasp end of rubber dust cover and pull to remove.
2. Push down on upper spring retainer (A) to expose retainer ring (B) on shaft.
3. Use a small screwdriver, and pry off retaining ring.
4. Remove upper spring retainer, spring (C), and pinion gear and clutch ([D] Fig. 38).

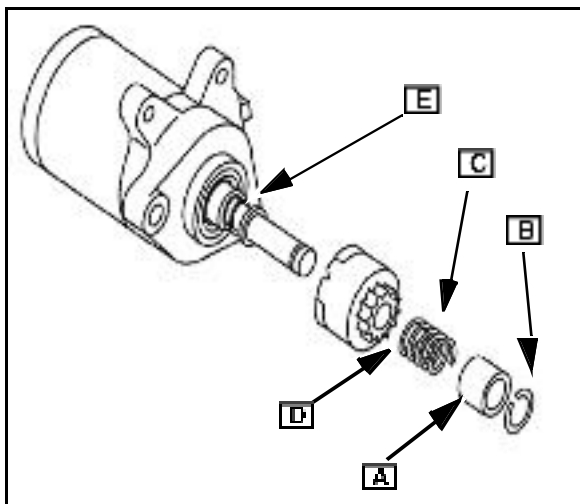


Fig. 38

### Inspect Starter Drive

1. Inspect the pinion gear and clutch ([D] Fig. 38) for damaged teeth.

Some pinion gears use a rubber bottom as part of the clutch.

**If clutch rubber inside pinion gear is worn or damaged, pinion gear will slip when starter is engaged.**

- Check for wear or damage.
2. Wash the parts in solvent.

### Assemble Starter Motor Drive

**NOTE:** Use new retaining ring when assembling starter drive.

Refer to Fig. 38

1. Lubricate starter shaft helix (E) with a light coat of lithium grease.
2. Assemble clutch and pinion gear (D) on to shaft.
3. Install spring (C) and spring retainer (A), with open end up.
4. Seat the retainer ring in the groove in the shaft.

### Starter Drive (235400, 245400)

#### Disassemble Starter Drive (Snap Ring Retainer)

1. Remove dust cover (A).
2. Push down on upper spring retainer (B) to expose snap ring ([C] Fig. 39) on shaft.

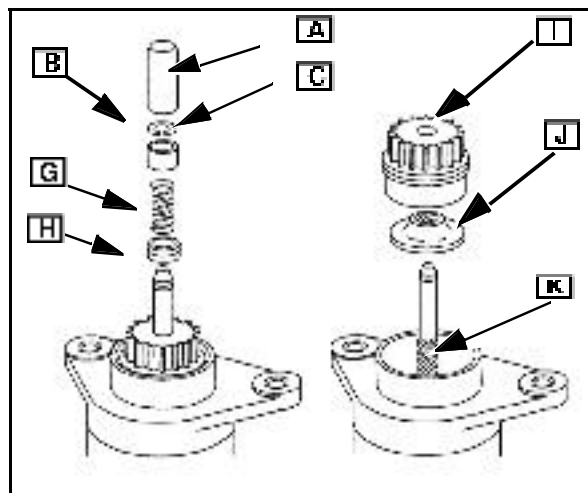


Fig. 39

3. Place two halves of tool #19467 (D), with hex ends down on armature shaft around snap ring (C) and grooves in two halves on retainer ring, Fig. 40.
4. Slide sleeve (E) of tool #19467 down over two halves.
5. Install puller screw ([F] Fig. 40) from tool #19467 in center of two halves, and turn screw in until retainer ring is removed.

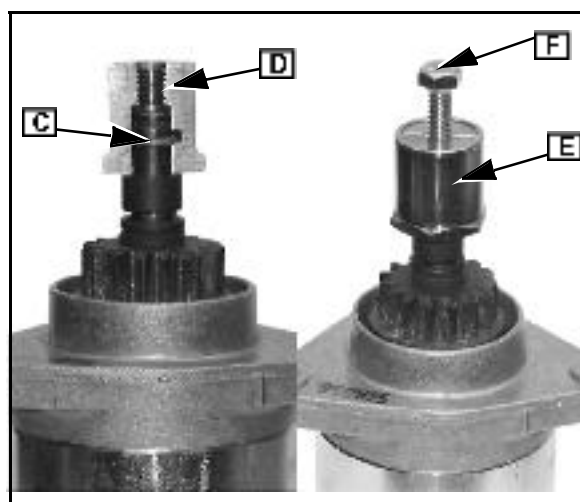


Fig. 40

6. Remove upper spring retainer (B), return spring (G), lower retainer (H), pinion gear (I), and starter clutch ([J] Fig. 39).

### Inspect Starter Drive

1. Inspect the pinion gear (I) for damaged teeth.

Some pinion gears use a rubber bottom as part of the clutch.

**If clutch rubber inside pinion gear is worn or damaged, pinion gear will slip when starter is engaged.**

- Check for wear or damage.

Correct any sticking between pinion gear and starter shaft helix ([K] Fig. 39).

**CAUTION:** Do not oil pinion gear on clutch helix.

2. Wash the parts in solvent. Assemble Starter Motor Drive

**NOTE:** Always use new retaining ring when assembling starter drive.

Refer to Fig. 39

1. Grease inside of pinion gear with Lubriplate (or equivalent).
2. Install the pinion gear (I) with the chamfered teeth up.
3. Place starter clutch (J) on starter shaft. Turn clutch until it drops into place.
4. Assemble lower spring retainer (H) with open end up.
5. Install return spring (G), and install upper spring retainer (B) with open end up.
6. Place new retainer ring (C) inside two halves of tool #19467 (D), and slide tool sleeve down over two halves, Fig. 41.
7. Place tool #19467 over armature and strike tool with hammer (L) to drive ring into groove.
8. Pull up on upper spring retainer (B) until retaining ring snaps into groove in upper spring retainer, Fig. 39.
9. Install rubber dust cover (A). Push dust cover down until it snaps into groove in lower spring retainer (H).

### Starter Drive (28Q700)

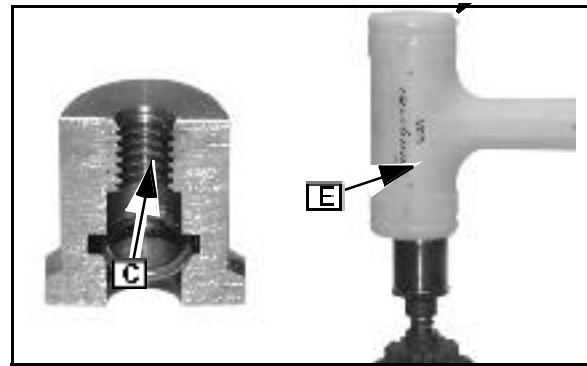


Fig. 41

### Disassemble Starter Drive (C-Ring Retainer)

1. Remove and discard the C-ring ([A] Fig. 448).
2. Remove retainer (B), washer (C), return spring (D), pinion gear (E), and starter clutch ([F] Fig. 42).
3. Inspect the pinion gear for damaged teeth.
4. Correct any sticking between the pinion gear and the helix.

**CAUTION:** Do not oil pinion gear on clutch helix.

5. Wash the parts in solvent.
6. Check the IPL for parts availability.

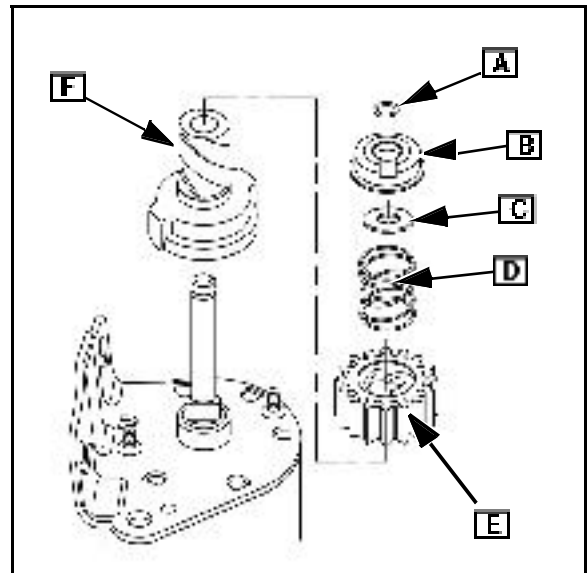


Fig. 42

### Inspect Starter Drive

1. Inspect the pinion gear ([E] Fig. 42) for damaged teeth.

Some pinion gears use a rubber bottom as part of the clutch.

**If clutch rubber inside pinion gear is worn or damaged, pinion gear will slip when starter is engaged.**

- Check for wear or damage.
2. Correct any sticking between pinion gear and starter clutch (F) helix, Fig. 42.

**CAUTION:** Do not oil pinion gear on clutch helix.

3. Wash the parts in solvent.
4. The pinion gear (E), clutch (F), and C-ring ([A] Fig. 42) are available as separate service parts from your Briggs & Stratton source of supply.

### Assemble Starter Motor Drive

Refer to Fig. 448

1. Place starter clutch ([F] Fig. 42) on starter shaft. Turn clutch until it drops into place.
2. Grease inside of pinion gear with Lubriplate (or equivalent).
3. Install the pinion gear with the chamfered teeth up.
4. Install return spring (D) making sure spring is in recess of pinion gear.
5. Place washer (C) on starter clutch splines, and install retainer (B).

**If retainer has a notch as shown:**

- Rotate notch away from open end of C-ring.
6. Place new C-ring ([A] Fig. 42) over chamfered end of shaft. Press C-ring on until it snaps into groove in shaft.



**SECTION 9 - LUBRICATION SYSTEMS**

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## SYSTEM TYPES

For information regarding external breather systems:

**See SECTION 3- ENGINE DISASSEMBLY.**

Briggs & Stratton OHV engines use four lubrication systems.

1. Oil Dipper
2. Oil Slinger
3. Pressure Filtration
4. Pressure Lubrication

### Oil Dipper (050000, 085400, 086400, 115400, 117400, 138400, 185400, 235400, 245400)

The dipper ([A] Fig. 1) is an integral part of the connecting rod cap.

Replace connecting rod if dipper is damaged or broken.

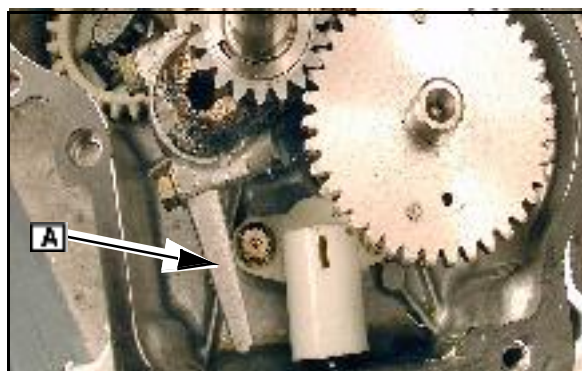


Fig. 1

### Oil Dipper (161400)

The dipper ([A] Fig. 2) is a separate part, held on the connecting rod cap with the connecting rod screws.

**If dipper shows cracks or missing pieces:**

- Replace connecting rod or dipper.

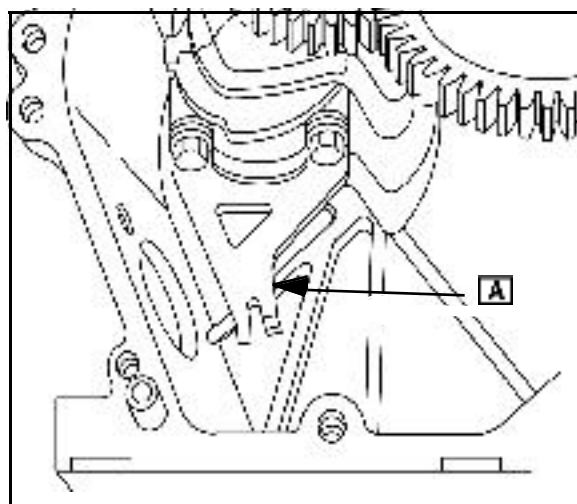


Fig. 2

### Oil Slinger (28Q700)

The oil slinger (A) is driven by the camshaft ([B] Fig. 3).

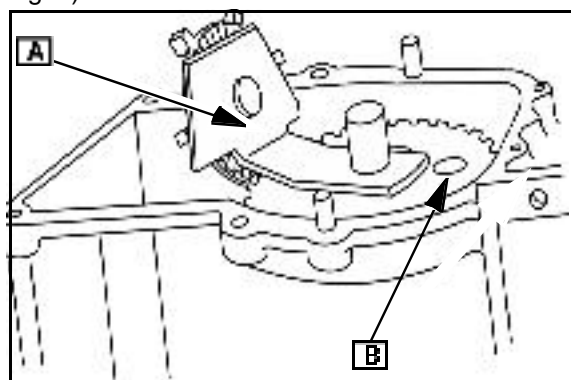


Fig. 3

Replace oil slinger if worn or damaged.

## Pressure Lubrication (104700, 260700, 261700)

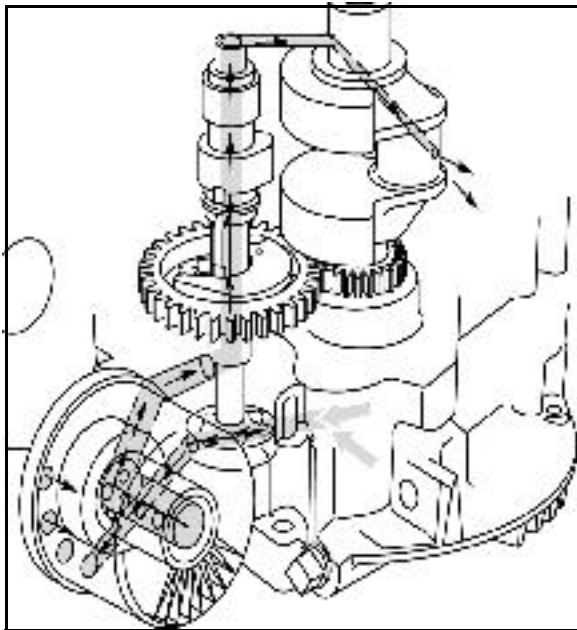


Fig. 4

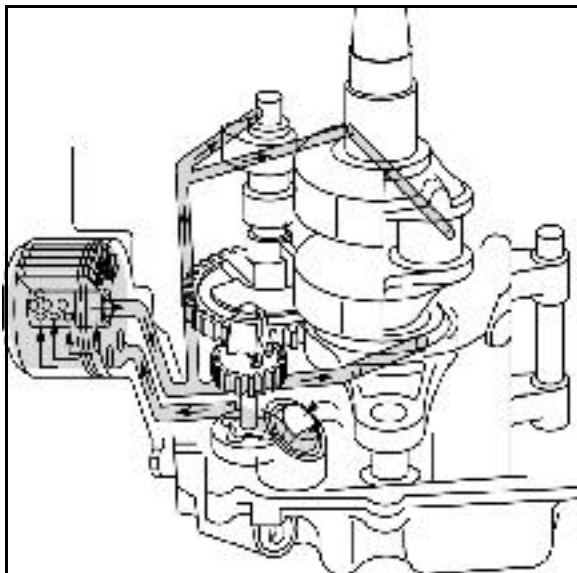


Fig. 5

## Pressure Filtration

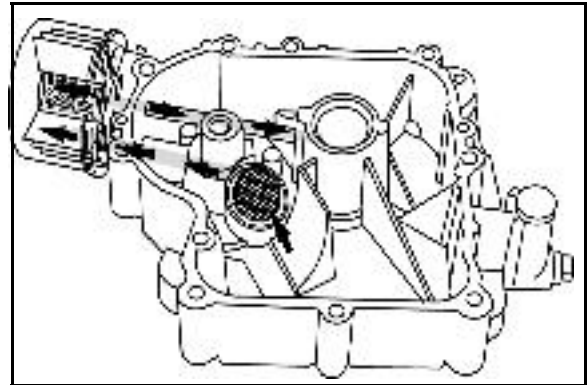


Fig. 6

## OIL PUMP SERVICE

### Oil Pump & Screen Removal/Installation (104700, 260700, 261700)

The oil pump can be accessed from the outside of the sump.

#### Oil Pump Removal/Installation (104700)

1. Remove the three screws that hold the oil pump cover to the sump.

The O-ring that seals the cover is held in a channel machined into the sump ([A] Fig. 7).

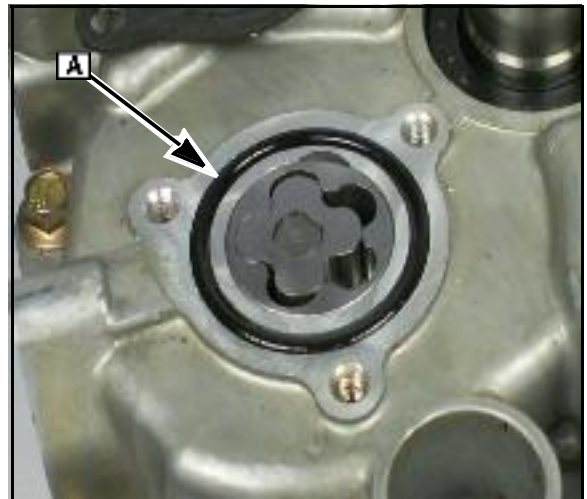


Fig. 7

2. Lift the pump rotor and its drive shaft from the sump ([A] Fig. 8).



Fig. 8

3. Remove the outer oil pump rotor ([A] Fig.9).



Fig. 9

4. Remove the O-ring and discard.
5. Inspect the O-ring channel, inner and outer pump rotor and the drive shaft for any signs of wear or damage. Replace if worn or damaged.
6. Coat all parts with new oil and reinstall.
7. Install cover and torque bolts to listed value. **See SECTION 14- ENGINE SPECIFICATIONS.** Oil Pump Removal/ Installation (260700, 261700)
1. Remove three screws that hold the pump cover and O-ring.

2. Remove snap ring ([A] Fig. 10) retaining inner rotor to shaft.

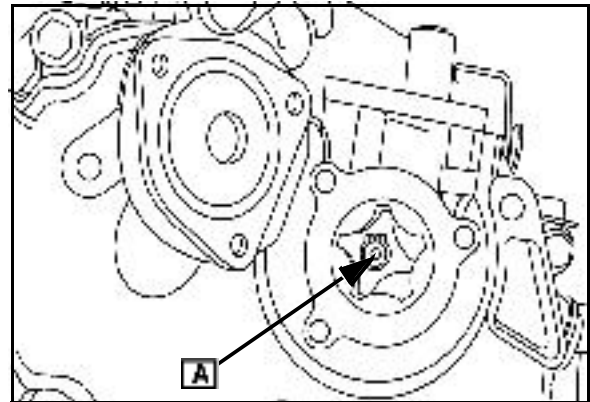


Fig. 10

3. Carefully remove inner and outer rotors. Remove the drive shaft.
4. Inspect the O-ring channel, inner and outer pump rotor and the drive shaft for any signs of wear or damage. Replace if any discrepancies are found.
5. Oil and install outer (A) and inner rotor (B) Fig. 11) in pump cavity. Do not use force to install and turn the rotors to engage the pump in the cam or governor gear.
6. Install snap ring retainer on inner pump rotor shaft.
7. Place O-ring (C) in groove (D), in cover ([E] Fig. 11).

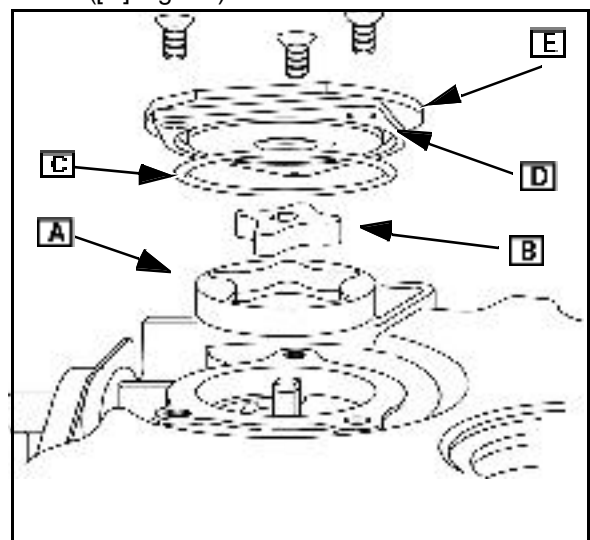


Fig. 11

8. Install oil pump cover and torque bolts to listed value.



### Oil Screen Removal/Installation (104700)

The oil pump screen is located inside the sump. Remove sump from cylinder to clean or replace the screen.

1. Remove two screen retaining screws ([A] Fig. 12). Clean or replace as needed.

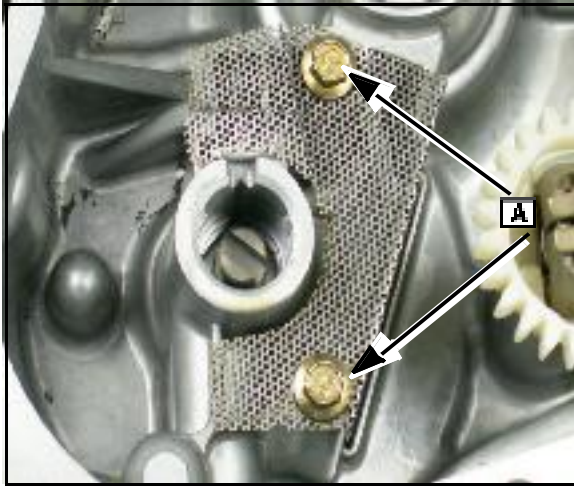


Fig. 12

2. Install screen and torque screws to listed value. **See SECTION 14- ENGINE SPECIFICATIONS.**

### Oil Screen Removal/Installation (260700, 261700)

The oil pump screen is located inside the sump. Remove sump from cylinder to clean or replace the screen.

1. Drive out screen, Fig. 13 Do not reuse.

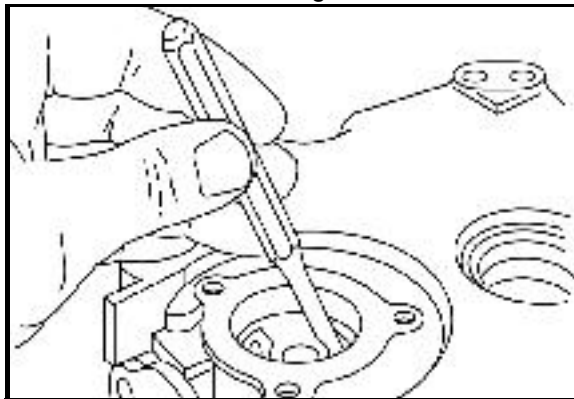


Fig. 13

2. Install oil pump screen with hole (A) facing away from governor shaft bearing ([B])

Fig. 14). Press screen into position as shown.

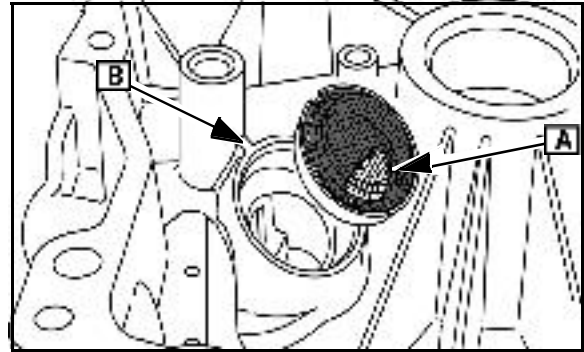


Fig. 14

### Oil Pump & Screen Removal/ Installation (28Q700)

#### Screen Removal/Installation (28Q700)

Three types of oil pump screens were used on these engines. Oil pump screens ([A] Before date code 94110700) were mounted inside the sump and held with one screw ([B] Fig. 15).

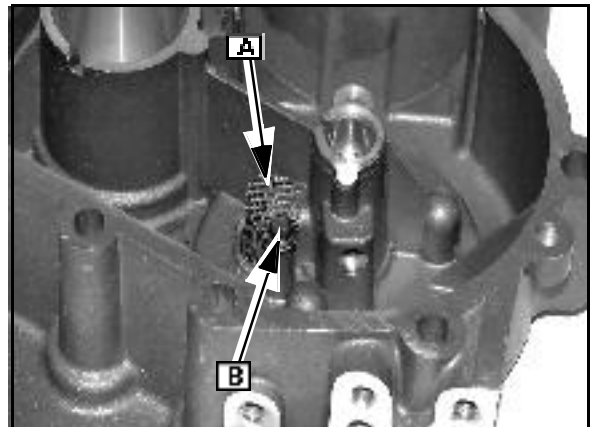


Fig. 15

Remove, clean and/or replace as required. Torque screw to listed value.

The intermediate screen ([C] After date code 94110600) could be removed from the outside of the sump with the oil pump, Fig. 16.

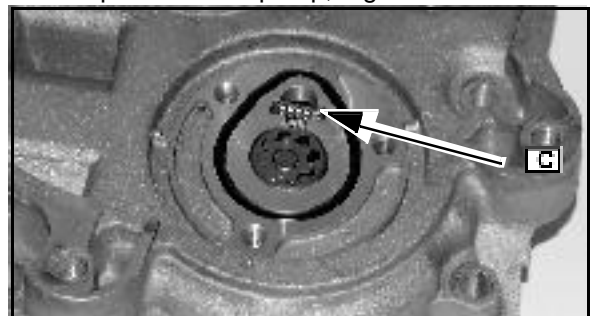


Fig. 16



Slide screen out from its cavity. Clean and/or replace.

Current oil pump screen (**After date code 98063000**) requires the sump be removed from the engine.

Drive the screen out from the outside of the sump cover (Fig. 17).



Fig. 17

Press new oil pump screen ([D] Fig. 18) until seated, as shown.

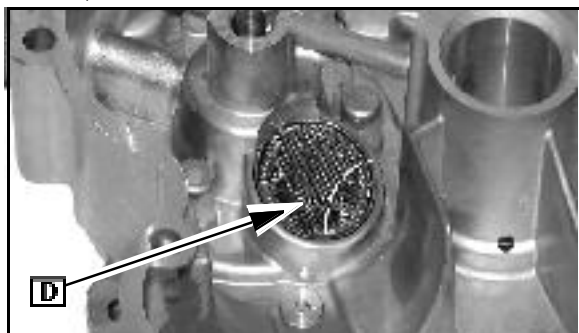


Fig. 18

### Oil Pump Removal/Installation (28Q700)

All three oil pump configurations can be removed from the outside of the sump. With slight variations of the O-ring channel and design of the pump cover, the removal and installation procedure is essentially the same.

#### All Date Codes (28Q700)

1. Remove the pump cover.



Fig. 19

2. Remove the inner rotor and the outer rotor.



Fig. 20

3. Remove O-ring and discard.
4. Inspect the O-ring channel, inner and outer pump rotor and the drive shaft for any signs of wear or damage. Replace if necessary.
5. Coat all parts with new oil and reinstall.

#### After Date Code 98063000 (28Q700)

1. Install new O-ring ([A] Fig. 21) in channel in sump.

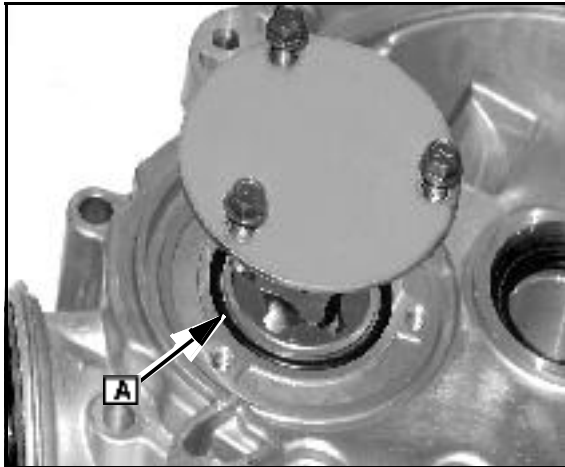


Fig. 21

2. Install cover and torque bolts to listed value. **See SECTION 14- ENGINE SPECIFICATIONS.**

#### Before 94110700 (28Q700)

1. Install O-ring ([A] Fig. 23) to groove in sump.
2. Place pump cover on oil pump cavity, and install three screws.
3. Torque to listed value.

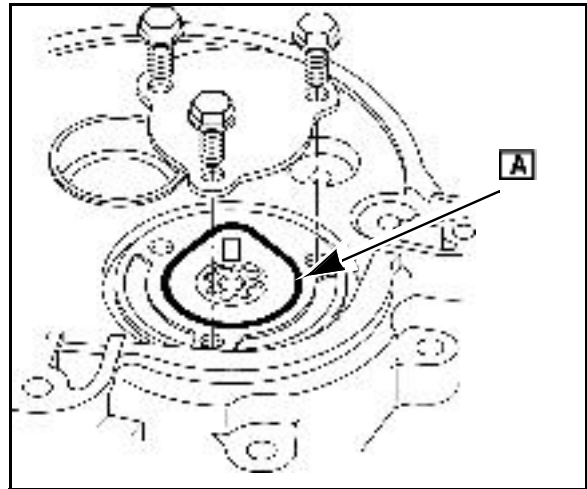


Fig. 23

#### After 94110600 (28Q700)

1. Install O-ring ([A] Fig. 22) to groove in sump.
2. Place pump cover on oil pump cavity. Line up two notches (B) in pump cover with two ribs (C) in pump cavity.

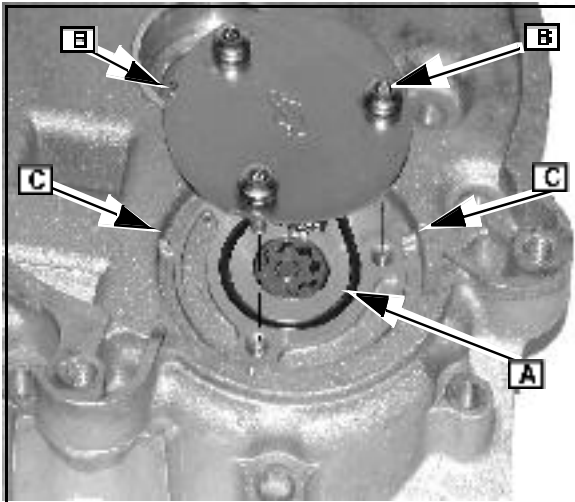


Fig. 22

3. Install three screws and torque to listed value.

### OIL GARD® SYSTEM (050000, 085400, 086400, 115400, 117400, 138400, 185400, 235400, 245400)

For Troubleshooting information:

**See SECTION 2- TROUBLESHOOTING, pg.54.**

#### Oil Gard® System

OIL GARD® will stop a running engine if the oil level drops below a safe level. The engine may restart after oil has drained back into sump but will only run momentarily.

Low oil will cause contact between the cylinder housing and a shaft attached to a float. The sensor assembly is shown with the shaft ([A] Fig. 24) grounding against the cylinder housing.

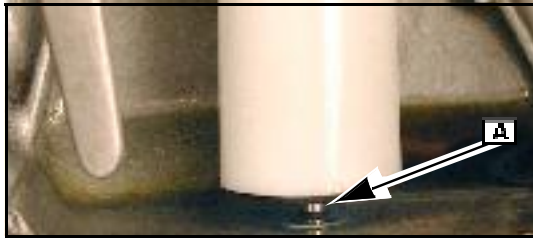


Fig. 24

When the switch is submerged in oil, the shaft is lifted and no longer makes contact with the cylinder.

An O-ring provides a seal between the cylinder housing and the terminal ([Fig. 25] A & B).

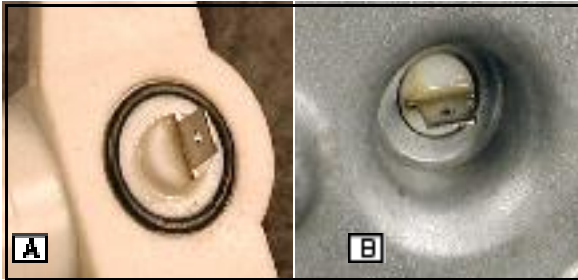


Fig. 25

The signal from the low oil sensor is sent to a two-wire ([A] Fig. 26) or four wire module which is connected to a stop switch.

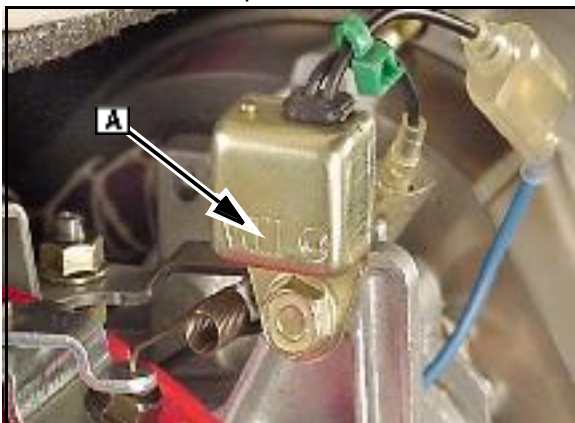


Fig. 26

## OIL GARD® (161400)

For Troubleshooting information:

See SECTION 2- TROUBLESHOOTING, pg.55.

### Oil Gard® System (161400)

When engine runs low on oil, the engine will stop and the Oil Gard® light will flash. The engine will not restart until the correct amount of oil is added.

This system uses a float to operate a magnetic switch. When the oil level is correct, the float rises (A) and opens the switch. When the oil level is low, it drops ([B] Fig. 27) and closes the switch. This causes two things to occur:

1. The ignition primary circuit will cause the warning light to flash.
2. The engine will stop.

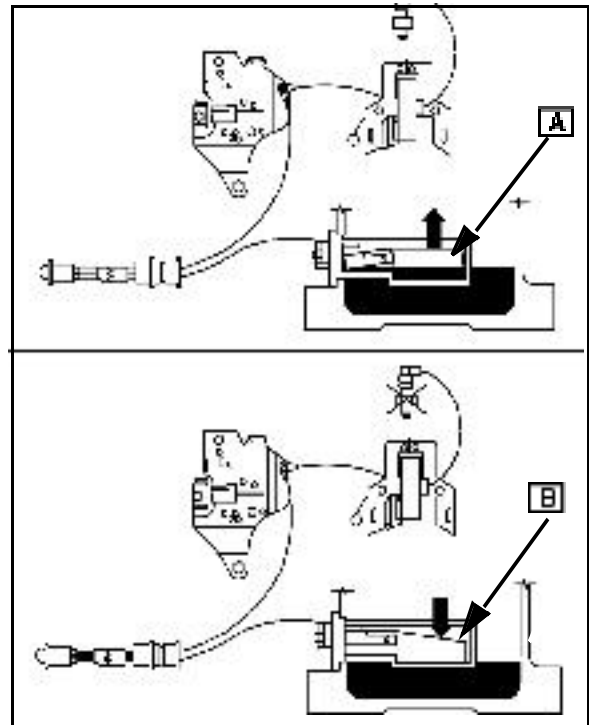


Fig. 27

### Disassemble Oil Gard® System (161400)

1. Disconnect wire (A) from float assembly terminal and remove mounting screws ([B] Fig. 28).

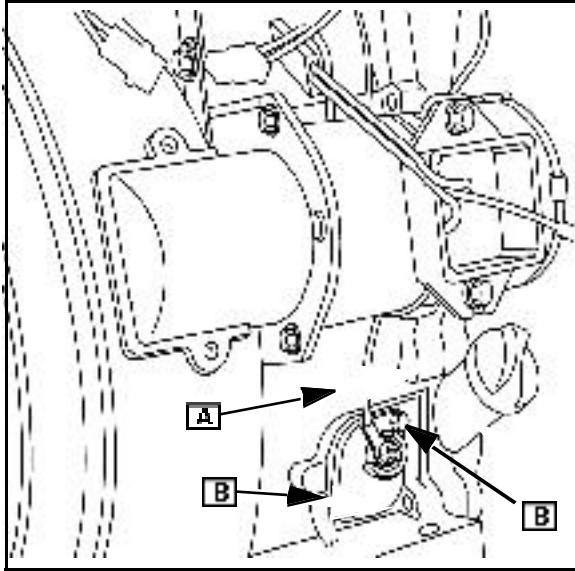


Fig. 28

2. Remove float assembly ([A] Fig. 29) from cylinder.

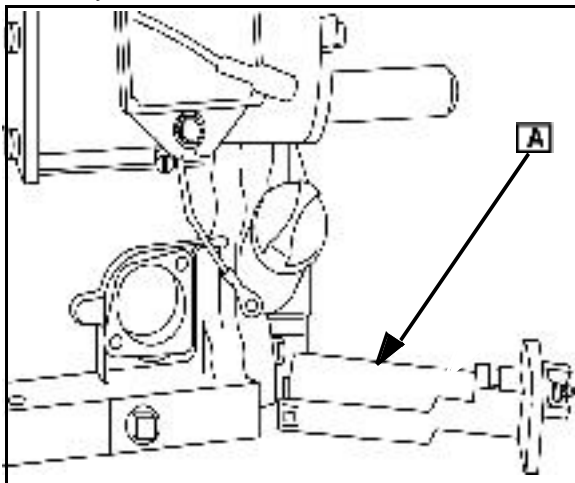


Fig. 29

To service warning light,

1. Disconnect wire connector and remove light from control panel.
2. Remove air cleaner to gain access to light (if so equipped).

### Inspect Oil Gard® System (161400)

1. Inspect float assembly for cracks in housing and float.
2. Check Oil Gard® switch operation by connecting a continuity tester to the wire terminal and ground clip.
3. In the normal upright position, the tester should read continuity.
4. Turn the float assembly upside down.
5. The tester should read no continuity.

### Assemble Oil Gard® System (161400)

Refer to Fig. 29

1. Install serviceable light assembly in control panel.
2. Install new gasket ([A] Fig. 29) with sealant bead toward cylinder and float assembly.
3. Apply sealant to screw threads.
4. Install mounting screws.
5. Torque to listed value. **See SECTION 14-ENGINE SPECIFICATION.**
6. Install wire terminal.

## SECTION 10 - CYLINDERS, COVERS AND SUMPS

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## REMOVING COVERS AND SUMPS

### Removal: (All Models)

Before removing a cover or sump from engine, remove rust, paint, or burrs from the PTO end of the crankshaft.

1. Drain the oil from the engine.
2. Remove the cover or sump bolts (Fig. 1).

#### If cover or sump sticks:

- Tap lightly with soft mallet on alternate sides of cover.

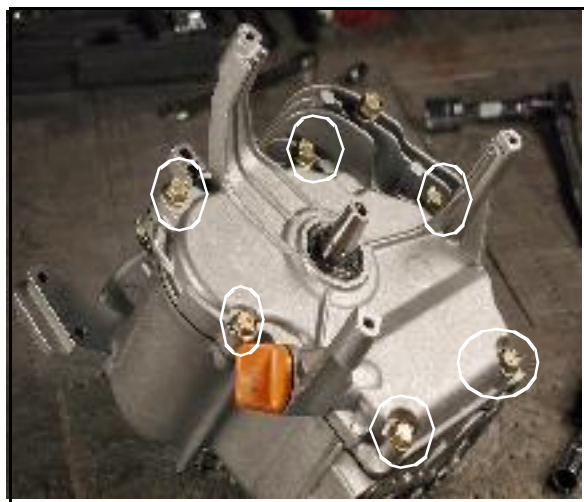


Fig. 1

**NOTE:** Do not remove dowel pins.

To remove internal cylinder components, **see SECTION 11- CRANKSHAFTS, CAMSHAFTS, BALANCING SYSTEMS AND GEAR REDUCTIONS.**

To remove cylinder head, **see SECTION 7- CYLINDER HEADS AND VALVES.**

To remove piston assemblies, **see SECTION 12- PISTONS, RINGS AND CONNECTING RODS.**

### Crankshaft Seals (All Models)

Oil seals are a press fit in cylinder and sump covers.

### Oil Seal Removal (All Models)

Pry the old seal out of its mounting (Fig. 2), using a screwdriver.

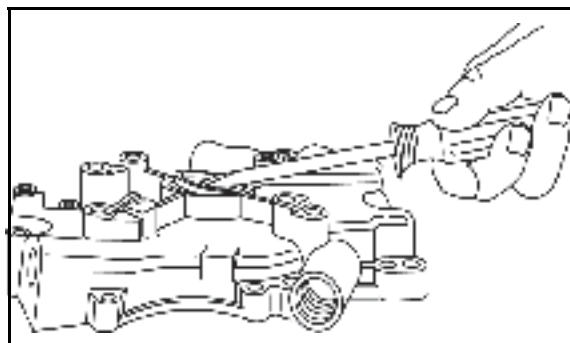


Fig. 2

Install new oil seals whenever engine is disassembled or when replacing bearings. Use a seal protector to prevent damage to the oil seal when installing cover or sump.

## BEARINGS

Some engine models use a combination of bearings in the cylinder and cover. Check your Illustrated Parts List (IPL) to determine serviceability.

### Camshaft Bearings (All Models)

1. Measure cam bearing in the cylinder and cover or sump.

**If plug gauge is not available for your model:**

- Compare measurements with reject dimensions. **See SECTION 14- ENGINE SPECIFICATIONS.**

Use the following plug gauges to check cam bearings:

- 161400 - Gauge #19383
- 104700 - Gauge #19164 (Magneto-Side)
- 260700, 261700 - Gauge #19383
- 28Q700 - Gauge #19164

Insert the gauge ([A] Fig. 3) into the bearing at several locations.

**If the plug gauge can be inserted 1/4 in. (6.35 mm) or more:**

- Replace cylinder, cover or sump.

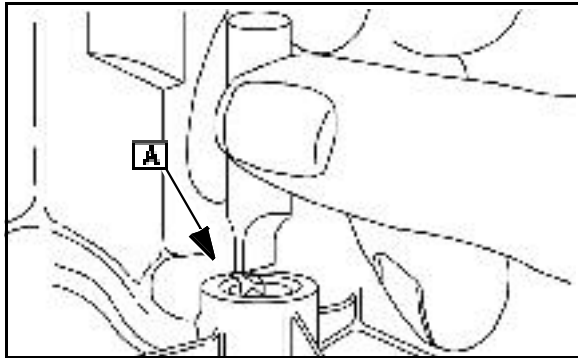


Fig. 3

## Ball Bearing Service (050000)

### Removal: Magneto And PTO Side Ball Bearing

1. Set the cylinder or cover on an appropriate fixture in an arbor press.
2. Use a press die that fits through the seal opening and carefully apply pressure from the inside until the bearing comes free of the housing.

**NOTE:** The seal for the crankshaft PTO and the flywheel end are the same. However, the inner diameter of the bearings are not. If bearing replacement is necessary, replace both bearings as a set and be sure to order the bearings by individual part number.

### Installation: Magneto And PTO-Side Ball Bearing

Press a new bearing into a housing or cover from the outside in. Be sure that the bearing goes into the channel straight and that the bearing is completely seated into its machined opening.

## Ball Bearing Service (085400, 086400)

### Removal: Magneto-Side Ball Bearing

Bearing Removal Tools: (Refer to Fig. 4)

- Puller Screw ([A] #19318)
- Washer ([B] #225136)
- Adapter/Driver ([C] #19397)
- Bushing ([D] #19454)

1. Remove oil seal.
2. Assemble washer (B) to puller screw and insert through adapter/driver (C).
3. Place bushing (D) against ball bearing.
4. Insert puller screw (A) with driver adapter into ball bearing and thread into bushing (D).
5. Tighten puller screw until ball bearing comes free of cylinder.

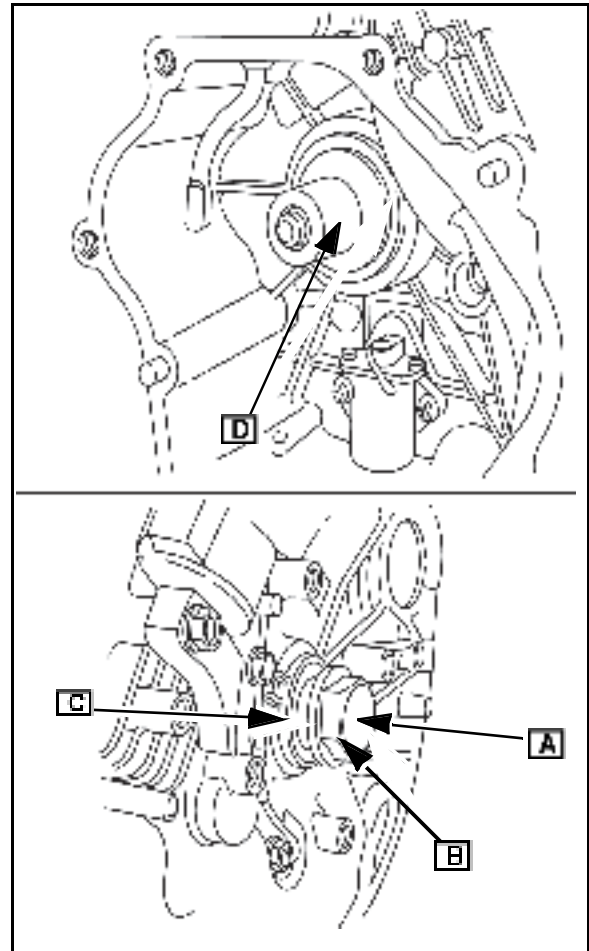


Fig. 4

### Installation: Magneto-Side Ball Bearing

Bearing Installation Tools: (Refer to Fig. 5).

- Adapter/Driver ([A] #19397)
- Driver ([B] #19320)
- Washer ([C] #225136)
- Puller Screw ([D] #19318)
- Pilot Nut ([E] #19395)

1. Lubricate outside of ball bearing.
2. Insert adapter/driver (A) into driver (B) and place ball bearing on adapter.
3. Assemble washer (C) to puller screw (D) and insert through bushing.
4. Insert small end of pilot nut (E) in oil seal boss in cylinder.
5. Thread puller screw (D) with adapter (A) and bearing in pilot nut (E).
6. Tighten until ball bearing is seated.

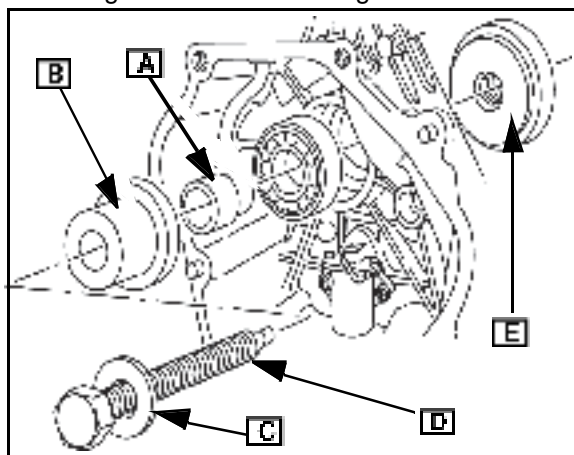


Fig. 5

### Removal: PTO-Side Ball Bearing

Bearing Removal Tools: (Refer to Fig. 6)

- Puller Screw ([A] #19318)
- Washer ([B] #225136)
- Adapter/Driver ([C] #19397)
- Bushing ([D] #19454)

1. Remove governor gear.
2. Remove oil seal.
3. Assemble washer (B) to puller screw (A) and insert through adapter/driver (C).

4. Insert puller screw (A) with adapter/driver (C) into bearing and thread into bushing (D).

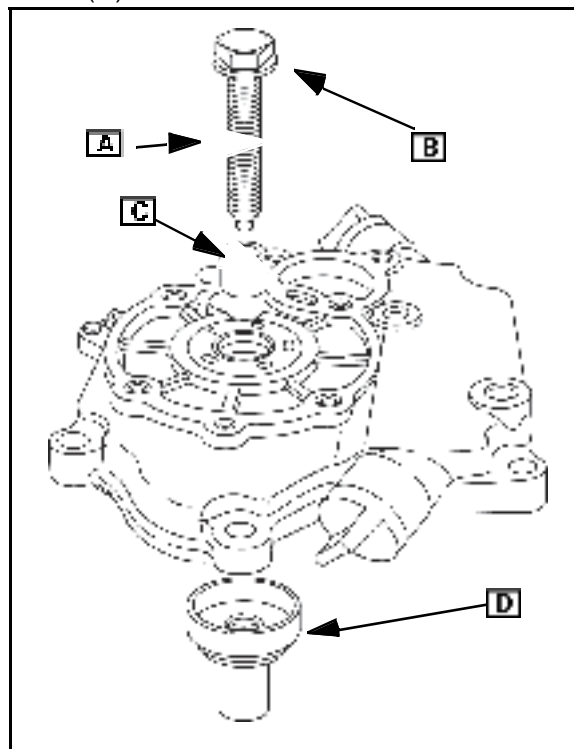


Fig. 6

5. Tighten until ball bearing comes free of the cover.

### Installation: PTO-Side Ball Bearing

Bearing Installation Tools (Refer to Fig. 7)

- Adapter/Driver ([A] #19397)
- Driver ([B] #19320)
- Washer ([C] #225136)
- Puller Screw ([D] #19318)
- Pilot Nut ([E] #19395)

1. Lubricate outside of bearing and install shims (if used).
2. Assemble washer (C) to puller screw (D) and insert through pilot nut (E).
3. Insert large end of pilot nut (E) into seal boss in cylinder cover.
4. Thread screw (D) with adapter (A) and bearing into pilot nut (E).

5. Tighten screw until bearing is seated.

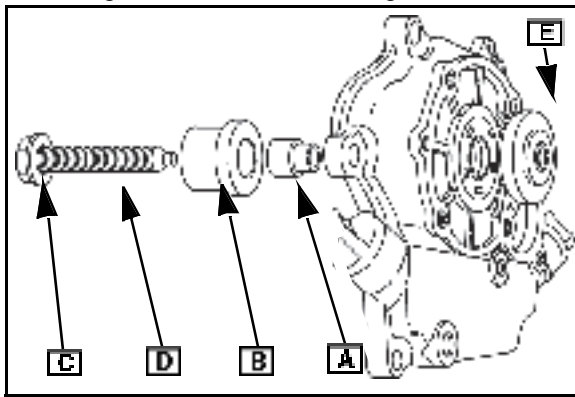


Fig. 7

## Ball Bearing Service (115400, 117400, 118400)

### Removal: Magneto-Side Ball Bearing

Bearing Removal Tools: (Refer to: Fig. 8)

- Washer ([A] #225136)
  - Puller Screw ([B] #19318)
  - Driver ([C] #19320)
  - Support ([D] #19394)
1. Remove oil seal.
  2. Assemble washer (A) to puller screw (B) and insert through large end of driver (C).
  3. Place open side of support (D) against ball bearing.
  4. Insert screw (B) with driver (C) through ball bearing and thread into support (D).
  5. Tighten until ball bearing comes free of cylinder.

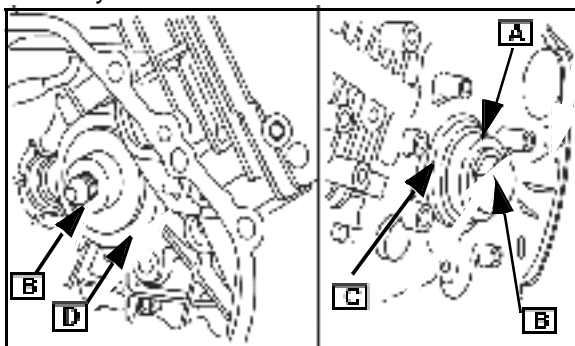


Fig. 8

### Installation: Magneto-Side Ball Bearing

Bearing Installation Tools: (Refer to Fig. 9)

- Support ([A] #19394)
  - Washer ([B] #225136)
  - Puller Screw ([C] #19318)
  - Pilot ([D] #19396)
1. Lubricate outside of ball bearing.
  2. Place ball bearing on support (A).
  3. Assemble washer (B) to puller screw (C) and insert through pilot (D).
  4. Insert puller screw (C) with small end of pilot (D) into cylinder and thread into support (A).

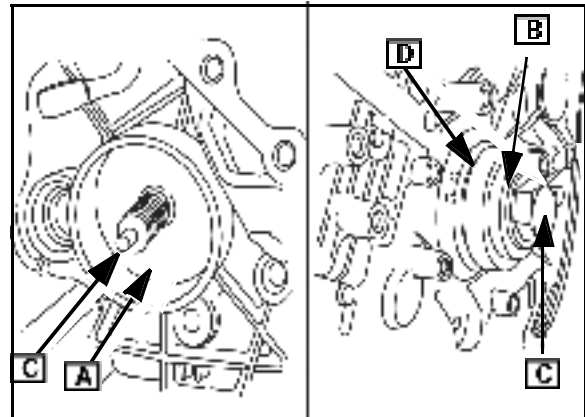


Fig. 9

5. Tighten screw until ball bearing is seated.
6. Install new oil seal. Use large end of driver (#19320) and press seal until flush with cylinder cover.

### Removal: PTO-Side Ball Bearing (Crankshaft & Camshaft)

Ball Bearing Removal Tools: (Refer to Fig. 10)

- Washer ([A] #225136)
  - Puller Screw ([B] #19318)
  - Driver ([C] #19320)
  - Support ([D] #19454)
1. Remove Governor Gear.
  2. Remove oil seal.
  3. Assemble washer (A) to puller screw (B) and insert through large end of driver (C).
  4. Place open side of driver (C) against ball bearing.

5. Insert puller screw (B) with driver (C) through ball bearing and thread into support (D).

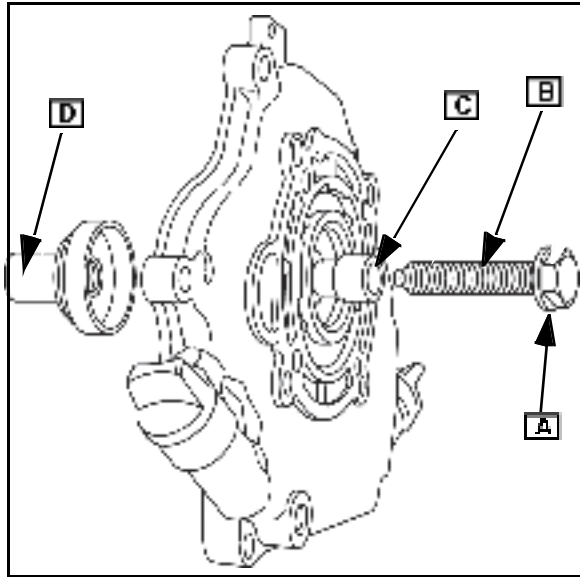


Fig. 10

6. Tighten until bearing comes free of cover.

#### Installation: PTO-Side Ball Bearing

Ball Bearing Installation Tools: (Refer to Fig. 11)

- Washer ([A] #225136)
- Puller Screw ([B] #19318)
- Driver ([C] #19320)
- Pilot Nut ([D] #19395)

1. Lubricate outside of ball bearing.
2. Insert puller screw (B) through washer (A) and through small end of driver (C).
3. Place ball bearing on driver (C).
4. Insert large end of pilot nut (D) into oil seal boss of cylinder cover.
5. Thread puller screw (B), washer (A), driver (C) and ball bearing into pilot nut (D).

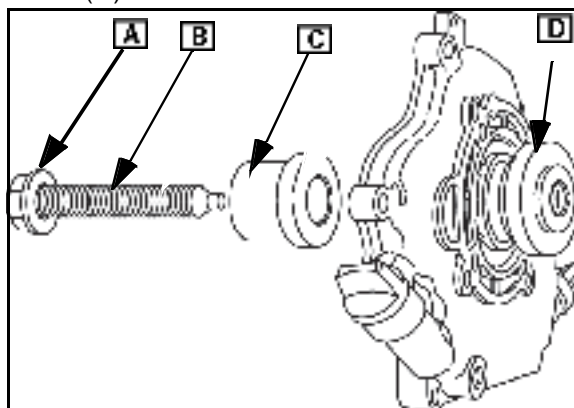


Fig. 11

6. Tighten until ball bearing is seated.

#### Removal: PTO-Side Ball Bearing (With 6:1 Gear Reduction)

Bearing Removal Tools: (Refer to Fig. 12).

- Puller Nut ([A] #19139)
- Puller Stud ([B] #19398)
- Support ([C] #19454)
- Washer ([D] #225136)
- Nut ([E] #94814)

1. Remove governor gear.
2. Assemble puller nut (A) to puller stud (B) and insert through ball bearing.
3. Place support (C) over ball bearing.
4. Assemble washer (D) and nut (E) to puller stud (B) and thread nut down to the end of the threads on support (C).
- Hold 3/8" hex end of stud with wrench while tightening nut (E). Tighten until ball bearing comes free of cover.

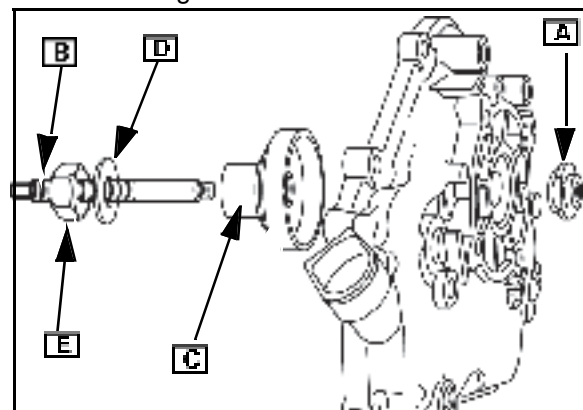


Fig. 12

#### Installation: PTO-Side Ball Bearing (With 6:1 Gear Reduction) (Fig. 13)

1. Lubricate outside of ball bearing.



2. Using arbor press and tool ([A] #19320).

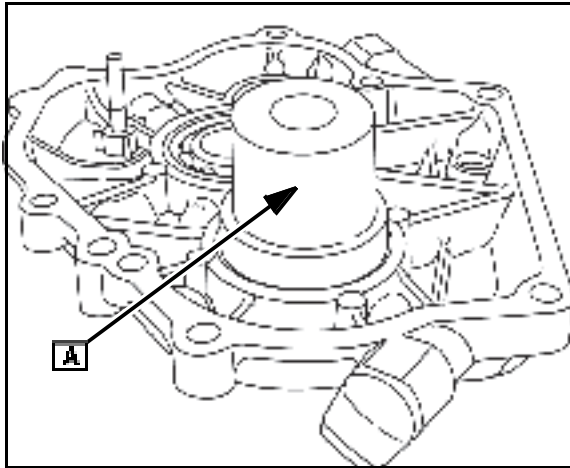


Fig. 13

3. Press bearing until it bottoms. Ball Bearing Service (138400, 185400).

### Removal: Magneto-Side Ball Bearing

Bearing Removal Tools (Refer to: Fig. 14)

- Washer ([A] #225136)
- Puller Screw ([B] #19318)
- Driver ([C] #19320)
- Support ([D] #19394)

1. Remove oil seal.
2. Assemble washer (A) to puller screw (B) and insert through large end of driver (C).
3. Place open side of support (D) against bearing.
4. Insert puller screw (B) with driver through ball bearing and thread into support (D).

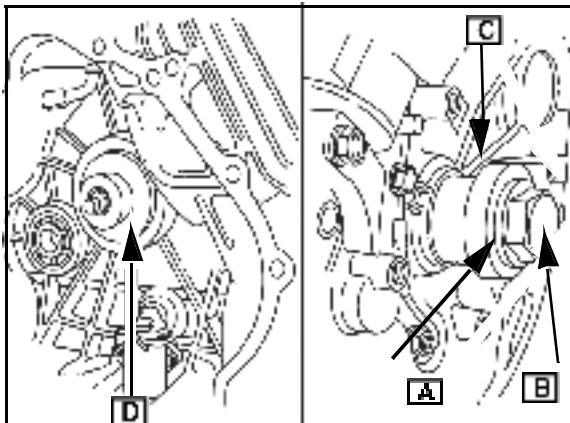


Fig. 14

5. Tighten screw until bearing comes free of cylinder.

### Installation: Magneto-Side Ball Bearing

Bearing Installation Tools: (Refer to Fig. 15)

- Washer ([A] #225136)
- Puller Screw ([B] #19318)
- Pilot ([C] #19396)
- Support ([D] #19394)

1. Lubricate outside of bearing.
2. Place ball bearing on support (D).
3. Assemble washer (A) to puller screw (B).
4. Insert small end of pilot (C) into seal boss in cylinder.
5. Insert puller screw (B) through pilot (C) and thread into support (D).
6. Tighten until ball bearing is seated.

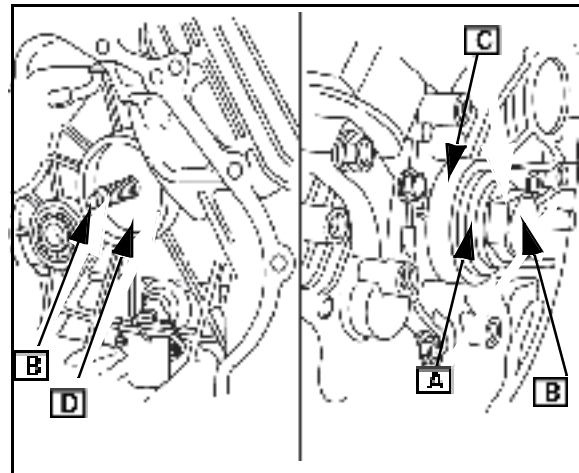


Fig. 15

7. Install new oil seal. Use large end of tool (#19320) and press seal until flush with cylinder.

### Removal: PTO-Side Ball Bearing

Bearing Removal Tools: (Refer to: Fig. 16)

- Washer ([A] #225136 (2))
- Puller Screw ([B] #19318)
- Driver ([C] #19320)
- Support ([D] #19394)

1. Remove governor gear.
2. Remove oil seal.
3. Assemble washer (A) to puller screw (B) and insert through large end of driver (C).



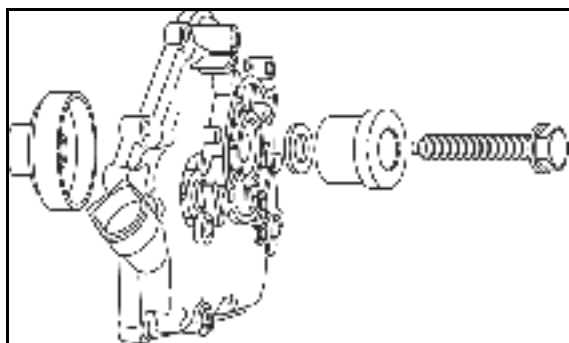


Fig. 16

### Installation: PTO-Side Ball Bearing

Bearing Installation Tools: (Refer to Fig. 17).

- Washer ([A] #225136)
- Support ([B] #19394)
- Puller Screw ([C] #19318)
- Pilot ([D] #19396)

1. Lubricate outside of bearing.
2. Install shim(s) - if used.
3. Assemble washer (A) to puller screw (C).
4. Insert large end of pilot (D) into seal boss of cover.
5. Insert puller screw (C) through pilot (C) and thread into support (B).

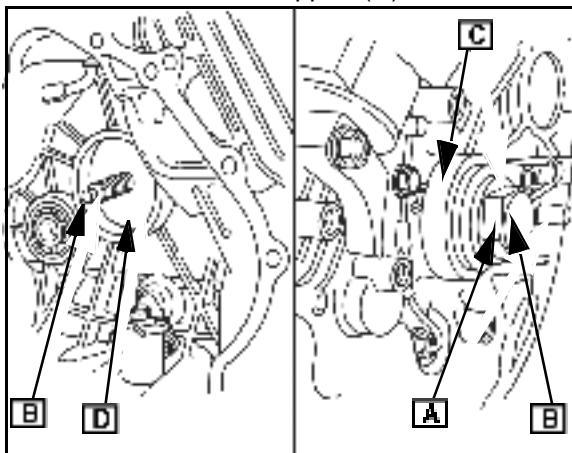


Fig. 17

6. Tighten screw until bearing is seated.
7. Install new oil seal. Use large end of tool (#19320) and press seal until flush with cover.
8. Install thrust washer and governor gear. Push governor gear and cup on to shaft as far as it will go.

## Ball Bearing Service Counter-Balance (185400)

### Removal: Counter-Balance Ball Bearing

Bearing Removal Tools: (Refer to Fig. 18)

- Puller Nut ([A] #19406)
- Puller Stand-Off ([B] #19408)
- Nut-Hex ([C] #92278)
- Screw-Hex ([D] #94373)

1. Remove nut-hex (C) and screw-hex (D) from flywheel puller (#19069).
2. Place a flat washer with a 1/4" hole on screw assembly and insert through puller stand-off (B).
3. Thread screw-hex (D) into puller nut (A).
4. Insert assembly through ball bearing until puller nut (A) engages bearing race.
5. Turn nut (C) down to puller stand-off (B).
6. Hold screw from turning and turn nut until bearing comes free of cylinder or cover.

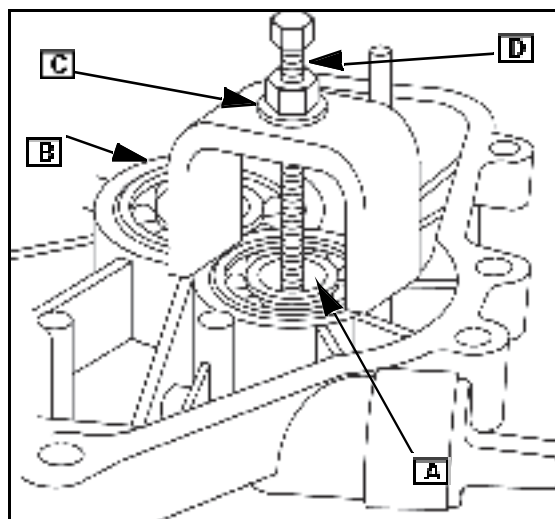


Fig. 18

### Installation: Counter-Balance Ball Bearing

Bearing Installation Tool: (Refer to Fig. 19)

- Driver ([A] #19320)

1. Oil outside of ball bearing.
2. Using an arbor press and driver (A), press ball bearing until it is seated.

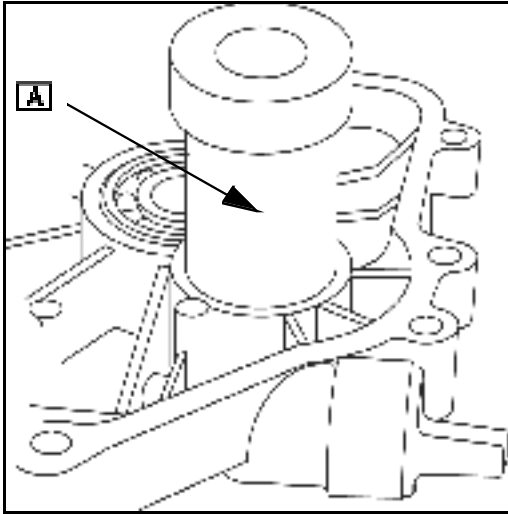


Fig. 19

### Ball Bearing Service (235400, 245400)

#### Removal: Magneto-Side Ball Bearing

Bearing Removal Tools (Refer to Fig. 20).

- Washer ([A] #225136)
- Puller Screw ([B] #19318)
- Driver ([C] #19320)
- Support ([D] #19394)

1. Remove oil seal.

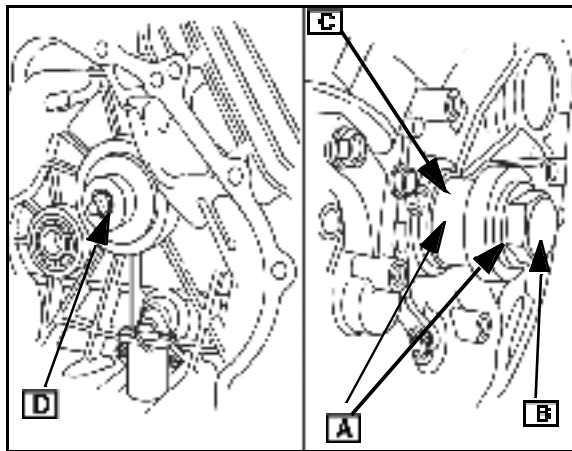


Fig. 20

2. Assemble washer (A) to puller screw (B) and insert through large end of driver (C).
3. Place open side of support (D) against ball bearing.
4. Insert puller screw (B) with driver (C) through ball bearing and thread into support (D).
5. Tighten until bearing comes free of cylinder.

#### Installation: Magneto-Side Ball Bearing

Bearing Installation Tools: (Refer to Fig. 21)

- Washer ([A] #225136)
- Puller Screw ([B] #19318)
- Pilot ([C] #19396)
- Support ([D] #19440)

1. Lubricate outside of bearing.
2. Place ball bearing on support (D).
3. Assemble washer (A) to puller screw (B).
4. Insert small end of pilot (C) into seal boss in cylinder.
5. Insert screw (B) through pilot (C) and thread into support (D).
6. Tighten until ball bearing until seated.

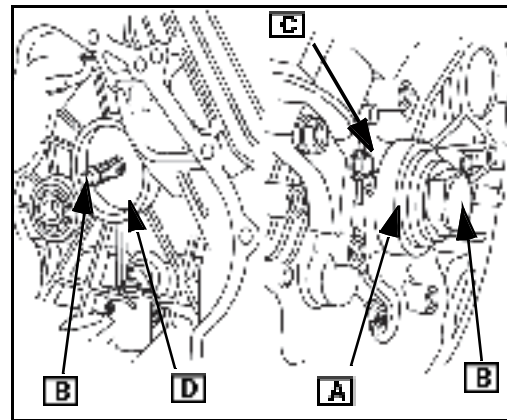


Fig. 21

#### Removal: PTO-Side Bearing

Bearing removal tools: (Refer to: Fig. 22)

- Washer ([A] #225136)
- Puller Screw ([B] #19318)
- Driver ([C] #19320)
- Support ([D] #19440)

1. Remove governor gear.

2. Remove oil seal.
3. Assemble washer (A) to puller screw (B) and insert through large end of driver.
4. Assemble second washer (A) over puller screw (B) up against driver (C).

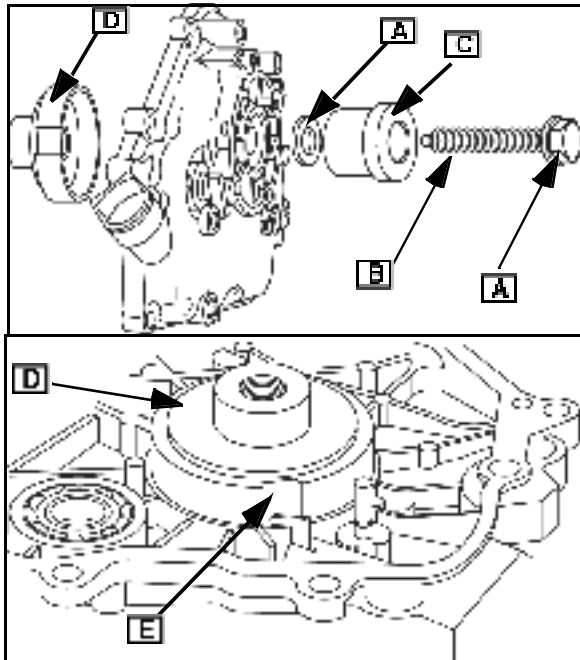


Fig. 22

5. Place open side of support (D) against ball bearing with notch (E) of support (D) over two ribs in cylinder cover.
6. Insert puller screw (B) with driver (C) and washer (A) through ball bearing and thread into support (D).
7. Tighten until ball bearing comes free of cylinder cover.

### Installation: PTO-Side Ball Bearing

Bearing Installation Tools: (Refer to Fig. 23)

- Washer ([A] #225136)
- Support ([B] #19440)
- Puller Screw ([C] #19318)
- Pilot ([D] #19396)

1. Lubricate outside of bearing.

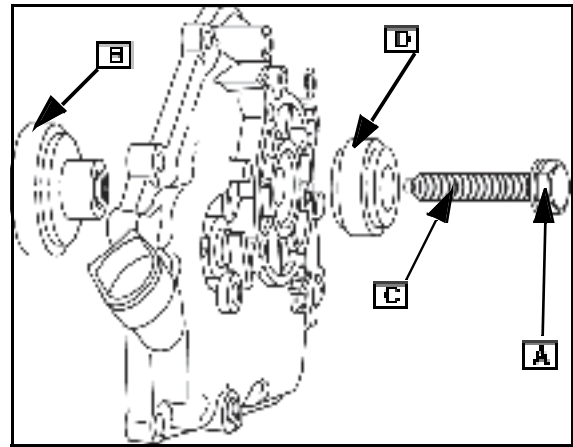


Fig. 23

2. Install shim(s) -if used.
3. Assemble washer (A) to puller screw (C).
4. Insert large end of pilot (D) into seal boss of cylinder cover.
5. Insert puller screw (C) through pilot (D) and thread into support (B).
6. Tighten until bearing is seated.
7. Install new oil seal. Use large end of driver (#19320) and press oil seal flush with cylinder cover.
8. Install thrust washer and governor gear. Push governor gear and cup on to shaft as far as it will go.

## DU & Ball Bearing Service (161400)

### Removal: Magneto-Side DU Bearing

1. Remove oil seal.
2. Using cylinder support tool (#19351) and bearing driver tool (#19350) ([A] Fig. 24), press bearing out of cylinder.

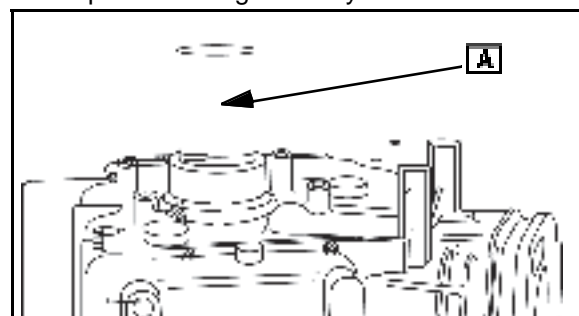


Fig. 24

### Installation: Magneto-Side DU Bearing

1. Place cylinder on cylinder support tool (#19351).
2. Position new bushing against counter-bored bearing with the oil hole aligned with hole (B) in the side of the bore ([A] Fig. 25).
3. Press the new bearing (A) into place.

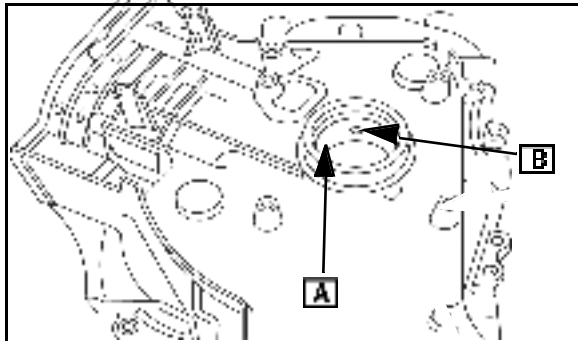


Fig. 25

4. Stake the bearing in place by driving a long punch (B) against the edge of the oil hole ([A] Fig. 26).

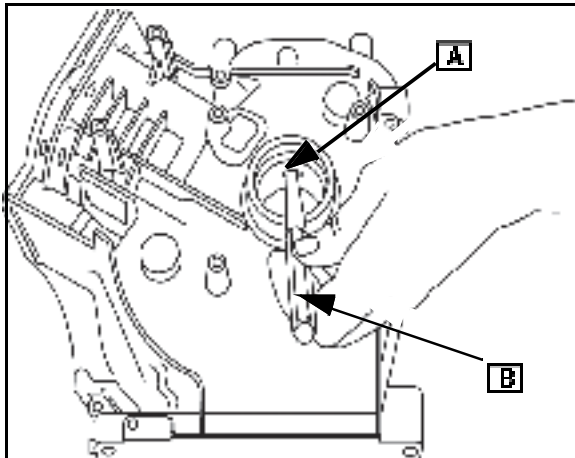


Fig. 26

5. Repeat the staking operation from the opposite end of bearing.
6. Remove any burrs formed by the staking operation.
7. Install the oil seal.

### Removal: PTO Ball Bearing

1. Remove oil seal .
2. Support the cylinder cover on arbor press and press out bearing using bushing (A) driver (#19226). Press bearing to the inside of the cover Fig. 27.

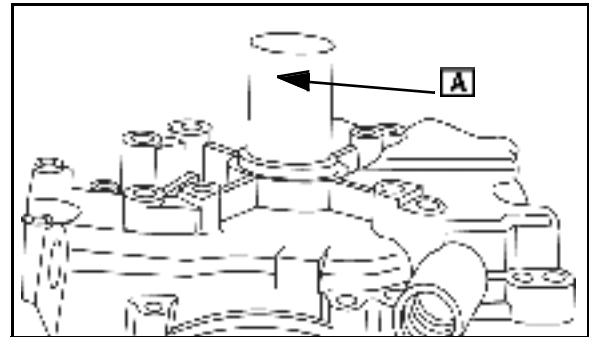


Fig. 27

### Installation: PTO Ball Bearing

1. Lubricate outside surface of bearing and set on inside of cover.
2. Using an arbor press and a suitable block, press against the outer race of bearing.
3. Press bearing into place until it is flush with the surface of the cover ([A] Fig. 28).

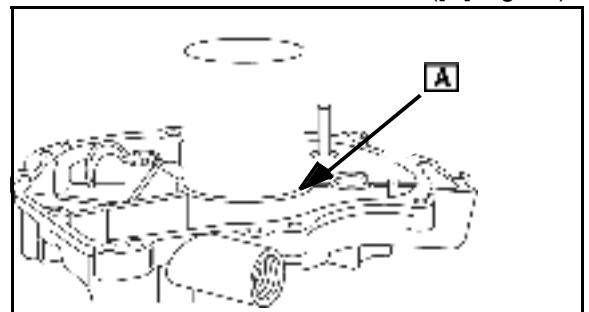


Fig. 28

4. Install PTO bearing oil seal.

### Aluminum Bearing Service (104700)

Measure magneto-side bearing and PTO bearing with plug gauge (#19178) or compare measurements with reject size dimension.

**If measurement exceeds specified dimension:**

- Replace cylinder and/or sump.

## Aluminum Bearing Service (260700, 261700)

Measure magneto-side bearing and PTO bearing with plug gauge (#19378) or compare measurements with reject size dimension. **See SECTION 14- ENGINE SPECIFICATIONS.**

**If measurement exceeds specified dimension:**

- Replace cylinder and/or sump.

## DU™ & Ball Bearing Service (28Q700)

### Removal: Magneto-Side DU™ Bearing

1. Remove oil seal.
2. Using cylinder support tool (#19351) and bearing driver tool (#19350) ([A] Fig. 29), press bearing out of cylinder.

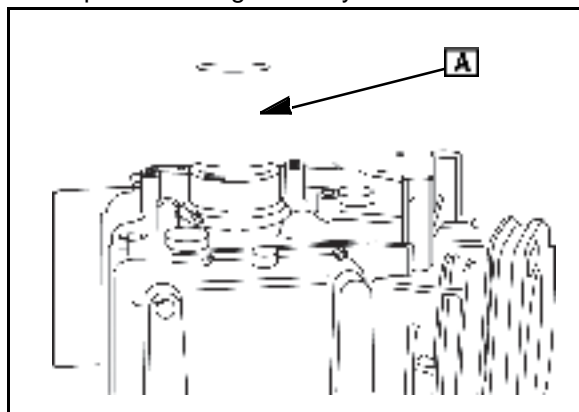


Fig. 29

### Installation: Magneto-Side DU™ Bearing

1. Place DU™ bearing on cylinder with oil hole in line with oil hole in cylinder bearing.

**If cylinder bearing cavity does not have oil hole:**

- Place split of bearing seam ([A] Fig. 30) as shown.

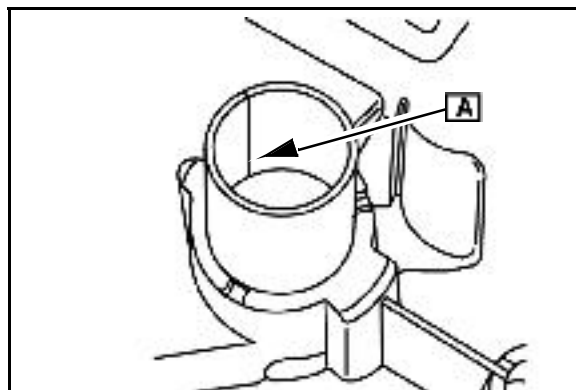


Fig. 30

2. Use cylinder support (#19227) (A) and bushing driver (#19226) (B) to press the new bearing ([C] Fig. 31) to 7/64" (2.78 mm) (D) from seal surface on magneto side.

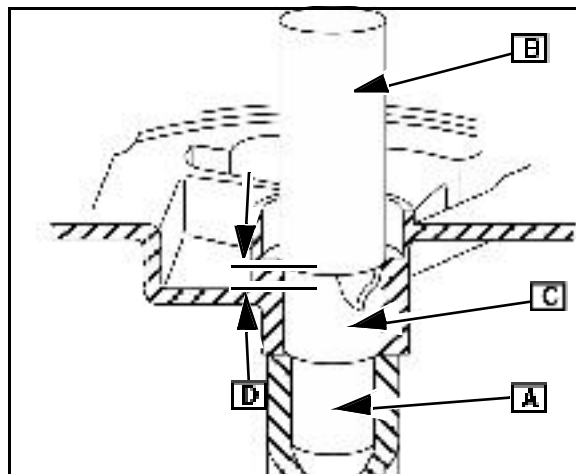


Fig. 31

3. Stake bearing in cylinder where shown ([A] Fig. 32).

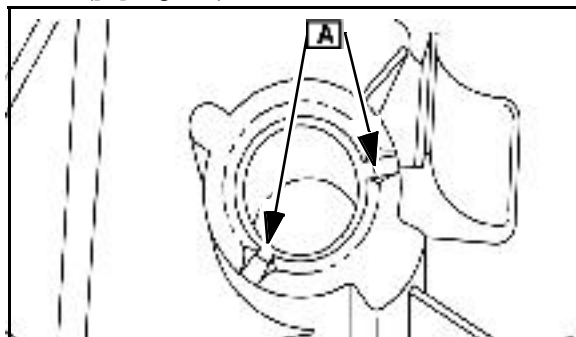


Fig. 32



### PTO-Side Ball Bearing

If the measurement obtained from the sump cover bearing exceeds limitations:

- Replace sump.

## INSTALLING COVERS AND SUMPS

### Seal Protectors (All Models)

Use a seal protector to prevent damage to oil seals when installing covers or sumps.

Tool#	Color	Size
19334/1	White	.787 (19.99mm)
19334/2	Red	.875 (22.23mm)
19334/3	Blue	.984 (24.99mm)
19334/4	Orange	1.00 (25.40mm)
19334/5	Brown	1.062 (26.97mm)
19334/6	Green	1.181 (30.00mm)
19334/7	Yellow	1.378 (35.00mm)
19356/8	Purple	1.317 (33.45mm)
19356/9	Black	1.503 (38.18mm)

### Installation: Cylinders and Covers And Sumps (All Models)

Make sure the mating surfaces of the cylinder and cover or sump are clean.

1. Place the gasket ([A] Fig. 33) on the mating surface of the cylinder.

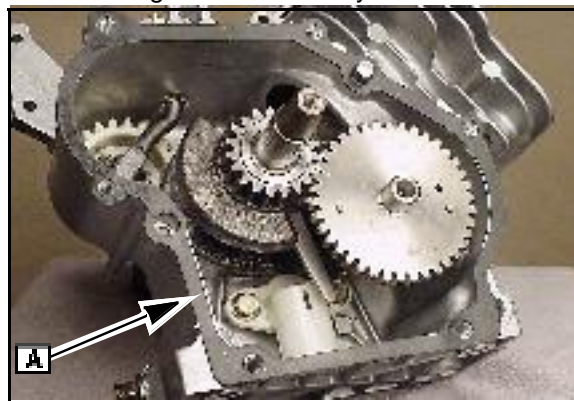


Fig. 33

2. Place the cover or sump on top of the gasket and install the cover mounting bolts finger tight.

**NOTE:** It may be necessary to rotate crankshaft and camshaft to get oil pump (when equipped) to engage drive slot in camshaft. For counter-balanced engines, it may be necessary to rotate the counterweight shaft to mesh with timing gear when installing cover.

- Do not force cover.
  - Make sure mechanical governor gear and oil pump (if used) is engaged with camshaft.
  - For adjustment procedure for crankshaft end play, **see Page 207.**
3. Follow the torque sequence shown for the engine you are working on:



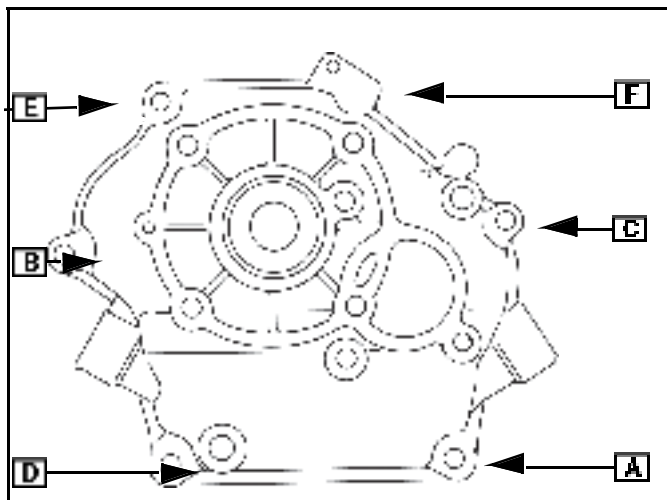


Fig. 34

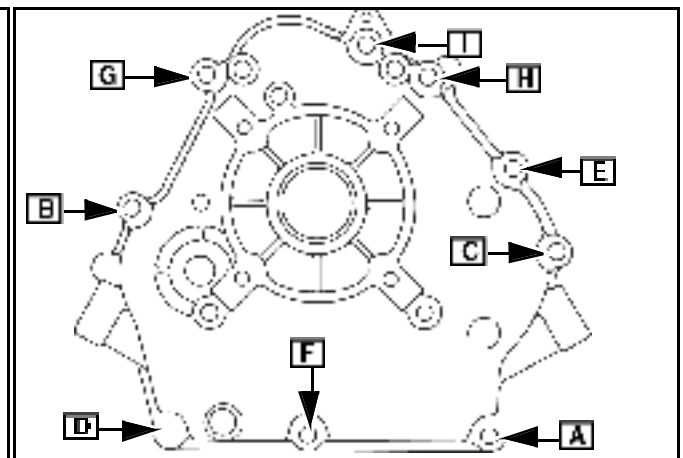


Fig. 37

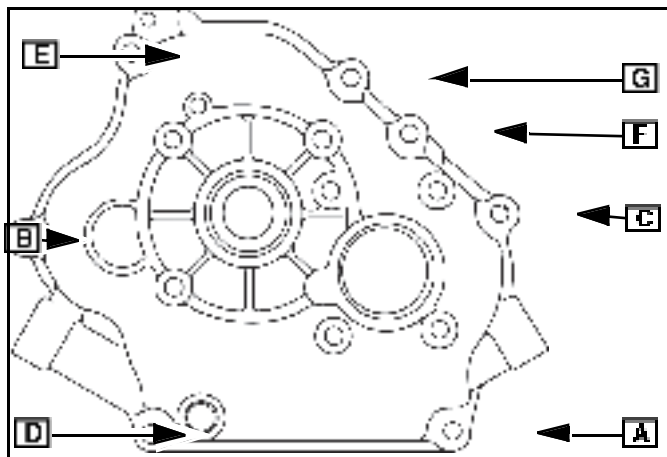


Fig. 35

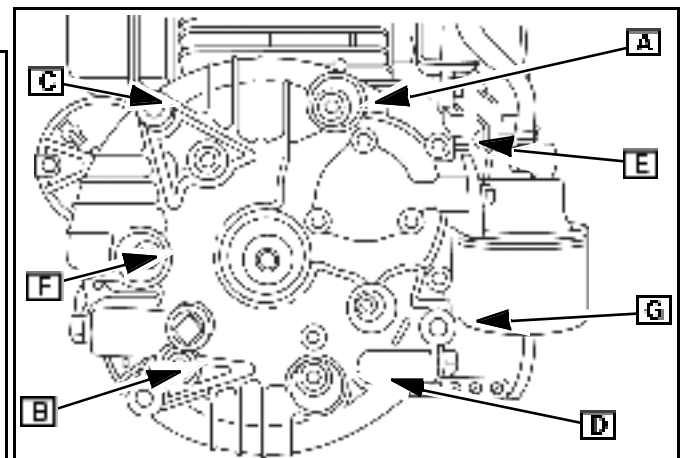


Fig. 38

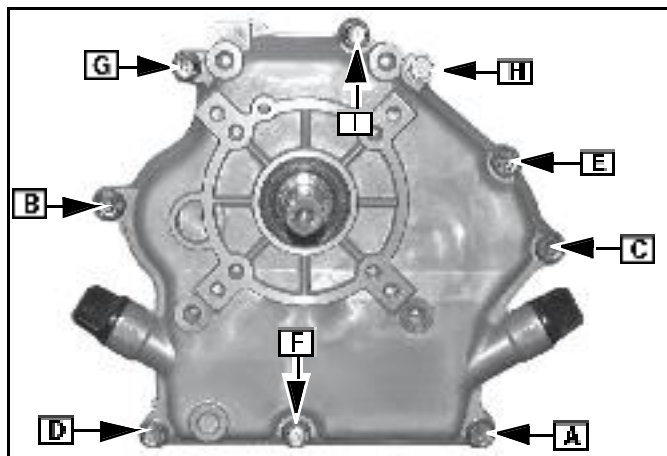


Fig. 36

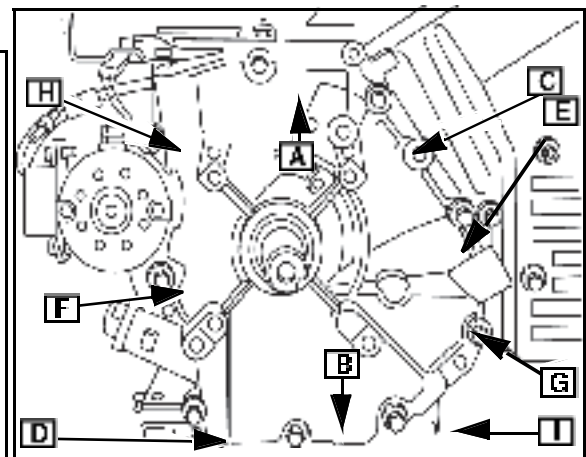


Fig. 39

## CRANKSHAFT END PLAY

When cylinder cover or sump is installed with a standard gasket, end play should be as listed in **SECTION 14- ENGINE SPECIFICATIONS.**

Always measure end play with a standard gasket in place.

**If end play is less than listed:**

- Use additional gasket(s) between the oil sump and cylinder to get proper end play.

**If end play is more than listed:**

- Use Part #220624 shim on magneto end of crankshaft ([A] Fig. 43 non-pump applications) or on PTO end of crankshaft ([B] Fig. 44 pump applications).

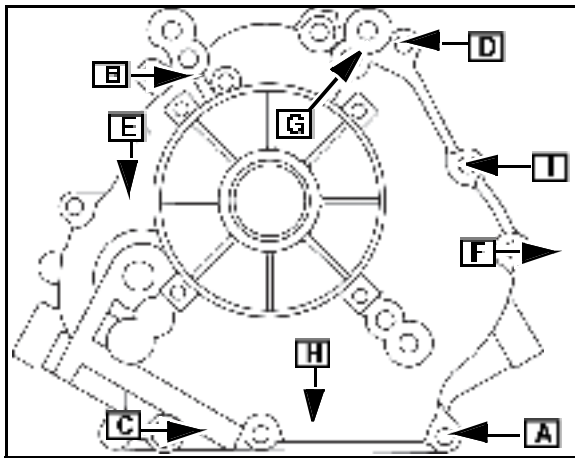


Fig. 40

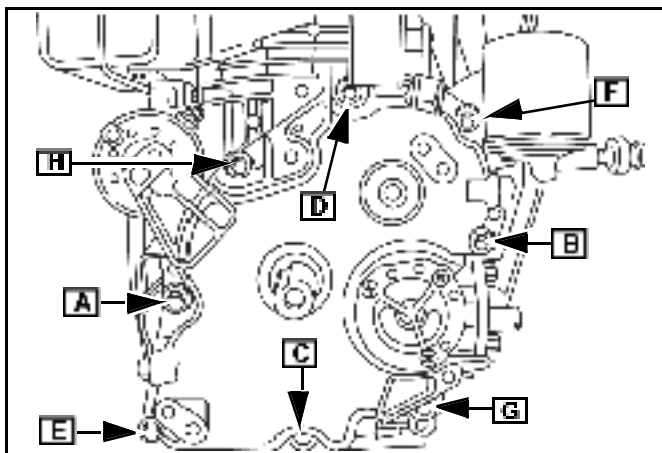


Fig. 41

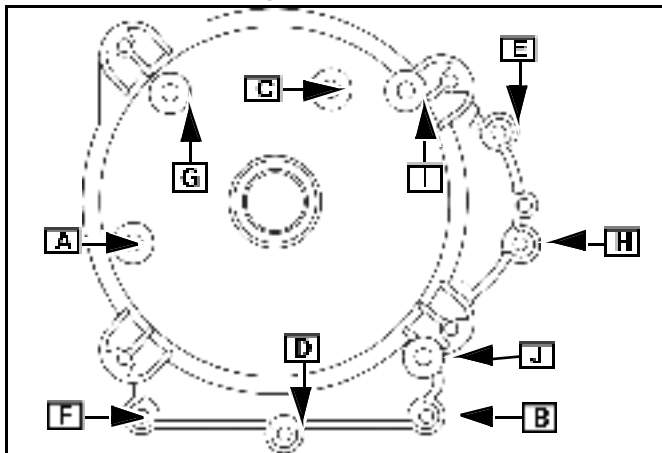


Fig. 42

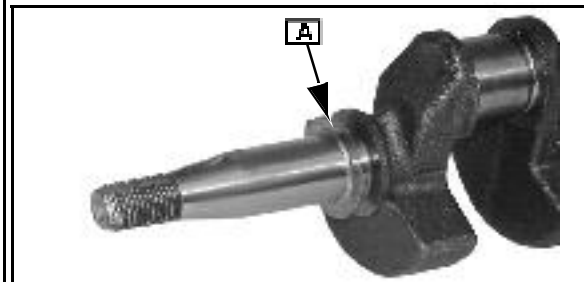


Fig. 43

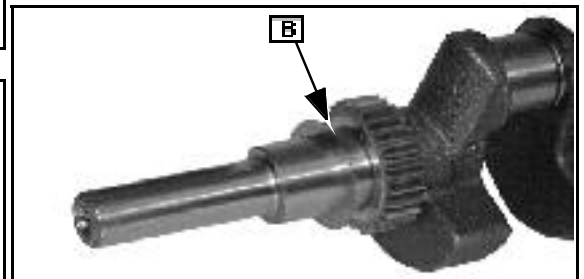


Fig. 44

## CYLINDER BORES

Inspect the cylinder whenever the engine has been disassembled. Look for cracks, stripped bolt holes, broken fins or any evidence of cylinder wall damage or wear.

### Measuring Cylinder Bore (All Models)

Use Telescoping Gauge with a Micrometer, or Dial Bore Gauge #19487 to measure the cylinder bore diameter.

Measure the cylinder bore twice at right angles at each of the positions shown in Fig. 45.

- First two measurements, at position (A) at the top of the cylinder bore.
- Second two measurements, at position (B) in the middle of the cylinder bore.
- Third two measurements, at position (C) Fig. 45) at the bottom of the piston ring travel in the cylinder bore.

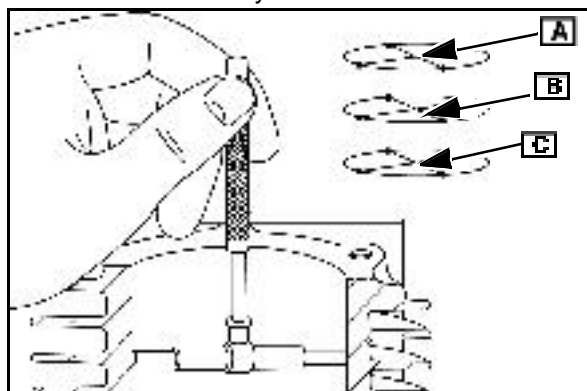


Fig. 45

This produces six different measurement values. Calculate the average value of all these measurements and compare with the specifications listed for the engine you are working on.

See **SECTION 14- ENGINE SPECIFICATIONS.**

**If the cylinder bore is more than .003 in. (.08mm) oversize or .0015 in. (.04mm) out-of-round:**

- The cylinder must be resized.

**If the cylinder bore is within specification and shows no signs of other damage:**

- Recondition with finishing stones to restore the cross-hatch.

## Resizing Cylinder Bores

A cylinder bore may be resized to 0.020 in. (0.51 mm) over the standard size shown in the engine specifications. **See SECTION 14- ENGINE SPECIFICATIONS.** If done accurately, the corresponding 0.020 in. (0.51mm) oversize rings and pistons will fit correctly and maintain proper clearances.

Cylinders can be resized with a good quality hone set.

For aluminum bore engines:

- Briggs & Stratton Hone Set (#19205)

For sleeve bore engines:

- Briggs & Stratton Hone Set (#19211)

Consult the Briggs & Stratton Service Tools Catalog (MS-8746) for specific hone set contents.

**If a boring bar is used to resize a cylinder bore:**

- A finish hone must be used to produce the proper cross-hatch texture.

**CAUTION:** Honing grit is impossible to remove from a ball bearing. Remove ball bearing from cylinder before honing or rapid wear of the bearing will result.

1. Fasten cylinder to a honing fixture or a heavy iron bracket. Use a level to align drill press spindle with cylinder bore. Some cylinders require shims.
2. Check cylinder bores at top and bottom for burrs. Remove burrs to prevent damage to hone.

**NOTE:** (085400, 115400, 117400, 138400, 161400, 185400, 235400, 245400) These models have cylinders bores that are 30° degrees from the horizontal plane. The honing fixture must hold the base of the cylinder at 60° degrees from horizontal for the cylinder bore to be vertical.

3. When available, fasten cylinder (A) to a honing fixture (B), with clamp (C) and shims (D) Fig. 46).

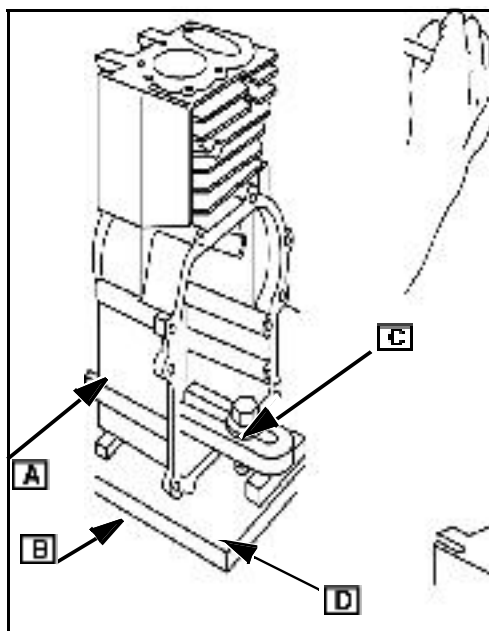


Fig. 46

**If using hand drill to hone:**

- Clamp the cylinder and honing fixture in a vise at a convenient working height.

**If using drill press:**

- Oil the surface of the drill press table liberally. Set (do not anchor) the honing fixture/plate (A) and cylinder on drill press table. ([B] Fig. 47).

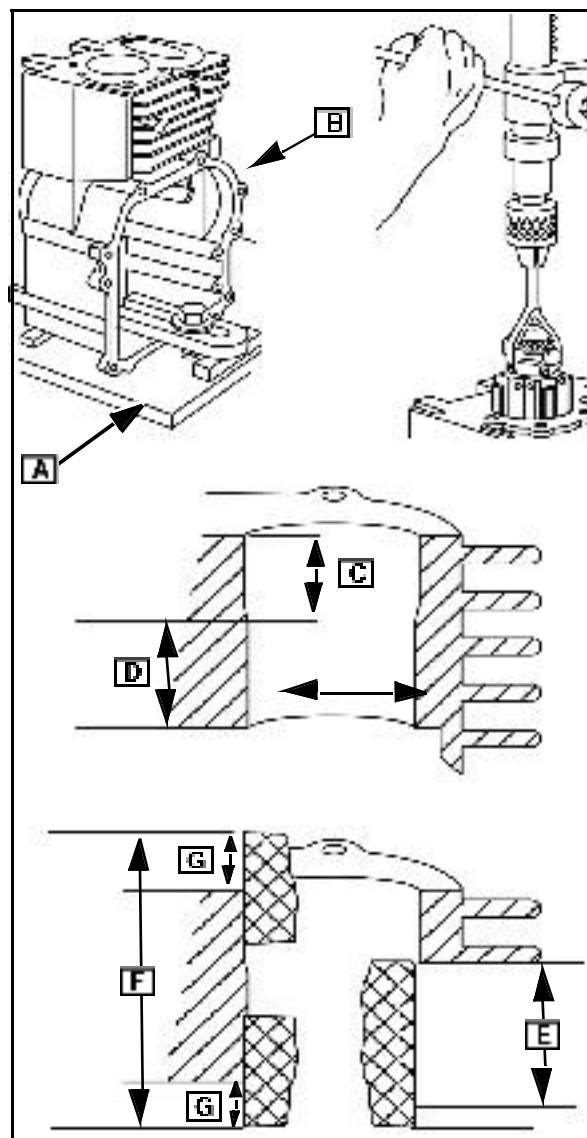


Fig. 47

4. Select hone set as mentioned earlier.
5. Place hone in middle of cylinder bore.
6. Tighten adjusting knob with finger or small screwdriver until stones fit snugly against cylinder wall. Do not force.
7. Drill press or portable electric drill should operate at 300 to 700 RPM.
8. Connect drive shank to hone. Be sure that cylinder and hone are centered and aligned with drive shank and drill spindle.
9. Lubricate and flush honing stones and cylinder bore frequently with honing oil or ATF.

The cylinder will show the most wear in the ring travel area (C). Because the cylinder does not wear oversize or out-of-round below the ring

travel area, (D) use this area to guide hone to to straighten cylinder bore, Fig. 47.

10. Start the drill and, as the hone spins, move it up and down limiting the travel to the bottom of the cylinder ([E] Fig. 47).
11. As the bottom of the cylinder increases in diameter, gradually increase the length of the strokes until hone travels full length of bore and extends past the cylinder bore ends ([F] Fig. 47). Do not extend hone more than 3/4 in. to 1 in. (19.1 mm to 25.4 mm) at either end of cylinder bore ([G] Fig. 47).
12. As cutting tension decreases, stop hone and tighten the adjusting knob.
13. Check cylinder bore frequently with an accurate micrometer.
14. Hone to approximately 0.0005 in. (0.013 mm) larger than specification to allow for shrinkage when cylinder cools. On cast iron sleeve cylinders, change from rough stones to finishing stones when within 0.0015 in. (0.04 mm) of desired size. On aluminum bore engines, switch to finishing stones earlier.

## Finishing And Cleaning Cylinder

A reconditioned cylinder should have a 30° to 45° crosshatch finish (Fig. 48).



Fig. 48

Correct stones, lubrication and drill speed along with rapid movement of hone within the cylinder during the last few strokes, will produce this finish.

To produce the proper cross hatch finish:

- Use a drill speed of approximately 200 RPM.
- 40 - 60 strokes per minute.

Honing grit is abrasive and will cause rapid wear to internal components of the engine unless it is completely removed. The entire cylinder must be thoroughly cleaned after honing.

1. Wash the cylinder carefully in kerosene or commercial parts cleaning solvent.
2. Thoroughly wash cylinder using a stiff brush with soap and hot water.
3. Rinse thoroughly with hot running water.
4. Repeat cleaning and rinsing, until all traces of honing grit are gone.

After cleaning the cylinder, wipe the cylinder bore with a clean white rag or napkin. Honing grit will appear as gray residue on the rag.

### If any honing grit is evident:

- Re-wash and rinse the cylinder and recheck.

When there is no trace of honing grit on the rag, the cylinder has been properly cleaned. Oil the cylinder bore to prevent rusting.





## SECTION 11 - CRANKSHAFTS, CAMSHAFTS, BALANCING SYSTEMS, GEAR REDUCTIONS

CRANKSHAFT & CAMSHAFT REMOVAL (050000, 085400, 086400, 1 17400, 138400, 185400, 235400, 245400, 161400, 104700, 260700, 261700) .....	213
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## CRANKSHAFT & CAMSHAFT REMOVAL

(050000, 085400, 086400, 117400,  
138400, 185400, 235400, 245400,  
161400, 104700, 260700, 261700)

1. Drain oil from cylinder/sump.
2. Remove blower housing, flywheel and any other accessories that obstruct cover/sump removal. **See SECTION 3- ENGINE DISASSEMBLY.**

**CAUTION:** Remove rust, paint and any burrs from the PTO end of crankshaft. This will reduce the possibility of damaging the oil seal and bearing.

3. Remove cylinder cover or sump. **See SECTION 10- CYLINDERS, COVERS AND SUMPS.**

With the cover removed, the following components are visible: (Refer to Fig. 1)

- (A) Camshaft
- (B) Crankshaft
- (C) Timing Gear and Key

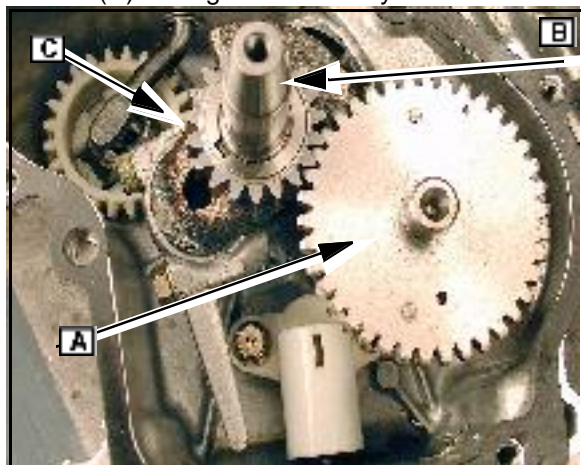


Fig. 1

4. Align timing marks and lift out the camshaft ([A] Fig. 1).
5. Remove the tappets.
6. Remove the timing gear and retain woodruff key.
7. Remove connecting rod bolts and rod cap.

8. Remove the piston. **See SECTION 12- PISTONS, RINGS AND CONNECTING RODS.**

9. Remove crankshaft(Fig. 2).



Fig. 2

## Inspecting Camshaft (All Models)

1. Check teeth for wear or damage.
2. Measure camshaft lobes (A) and journals ([B] Fig. 3) as shown.



Fig. 3

### Inspecting Compression Release (050000, 085400, 115400, 117400, 118400, 138400, 185400, 235400, 245400)

When inspecting the compression release mechanism, ensure that all parts move freely.

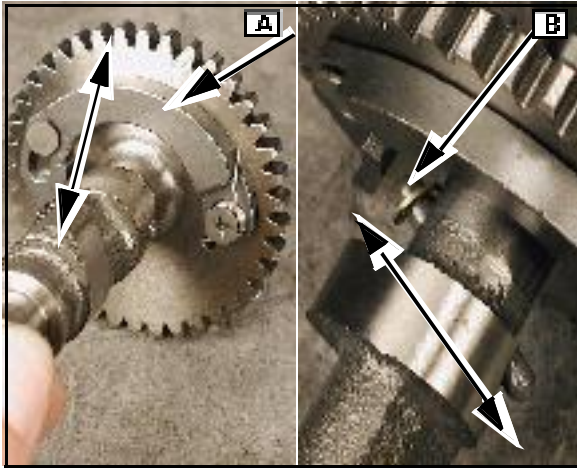


Fig. 4

1. Rotate the weight (A) against the spring and move the decompression pin (B) Fig. 4) back and forth. Pin should slide easily through camshaft.
2. The weight should return with spring pressure.

**If weight binds, pivot pin is worn, or spring is broken:**

- Replace complete camshaft assembly.

### Inspecting Compression Release (104700, 161400, 260700, 261700, 28Q700)

Check compression release mechanism ([A] Fig. 5) for wear, nicks, and freedom of movement.

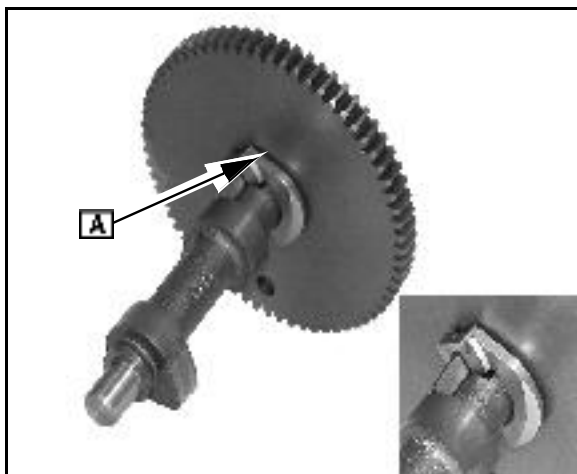


Fig. 5

**If any discrepancies are found:**

- Replace complete camshaft assembly.

### Inspecting Valve Tappets (All Models)

Inspect valve tappets for wear on the tappet surface. Replace if worn or damaged.

### Inspecting Crankshaft

Refer to Fig. 6 to check wear points on crankshaft.

1. Measure the diameters of the PTO journal (A), crank pin (B) and mag journal (C).
2. Check keyways (D) for wear and spreading.
3. Check timing gear ([E] Fig. 6) for chipped or cracked teeth and for wear in the keyway. Replace crankshaft and gear if worn or damaged.

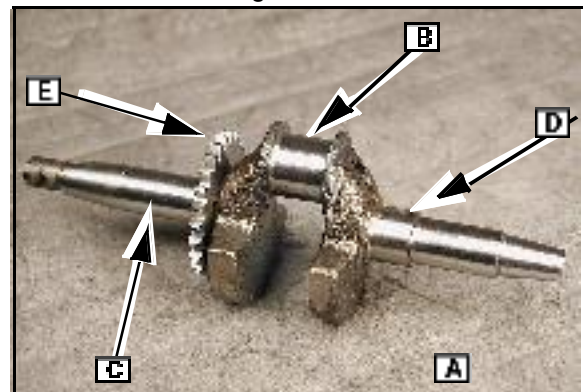


Fig. 6

4. Polish crankshaft journals for smooth lubricating surface. Use crocus cloth until polish lines are uniform over entire journal.

Direction of polish lines must be as shown in ([A] Fig. 7).

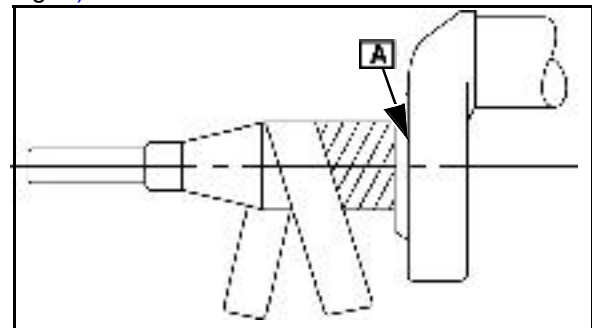


Fig. 7

5. Wash journal with a solvent such as kerosene to remove residue.

## BALANCING SYSTEMS

### Rotating Counterweight System (161400, 185400, 235400, 245400)

This system uses a geared counterweight (A) that rotates opposite the crankshaft counterweight (B), Fig. 8.

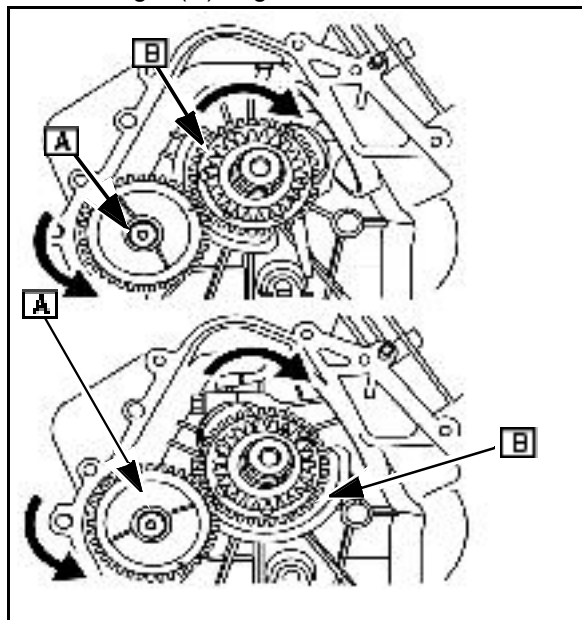


Fig. 8

#### Removal/Inspection

1. Remove cylinder cover. **See SECTION 10- CYLINDERS, COVERS AND SUMPS.**
2. Turn crankshaft until all timing marks are aligned.
3. Remove counterweight.
4. Measure and inspect the counterweight shaft journals (E) and gear teeth ([F] Fig. 9). Replace shaft if worn beyond tolerances.
5. Measure both counterweight bearings.
6. Replace the cylinder cover or cylinder if corresponding bearing is beyond tolerances.

For reject size dimensions, **see SECTION 14- ENGINE SPECIFICATIONS.**

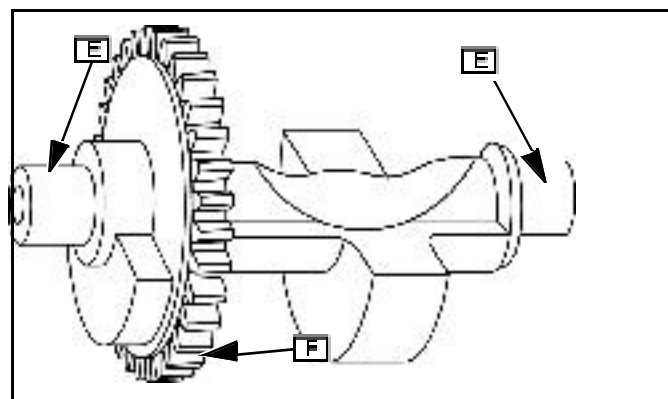


Fig. 9

#### Installation

Refer to Fig. 10.

1. Turn crankshaft to align timing marks (G) on cam gear and crankshaft timing gear.
2. Install counterweight (D) into cylinder.
3. Align timing mark on counterweight gear with second mark on crankshaft timing gear (H).
4. Install cylinder cover.

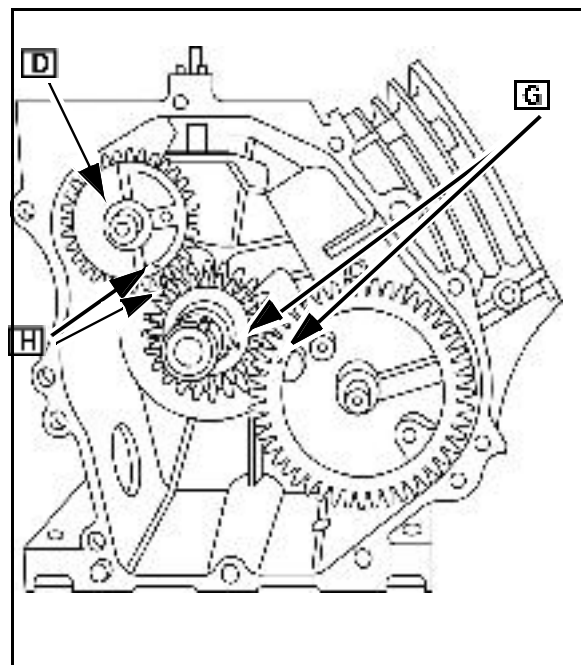


Fig. 10

## Oscillating Counterweight System (260700, 261700)

### Removal/Disassembly

1. Remove cylinder cover. **See SECTION 10- CYLINDERS, COVERS AND SUMPS.**
2. Turn crankshaft to align timing mark on gear (A) with timing mark on camshaft (B).
3. Remove camshaft ([C] Fig. 11).

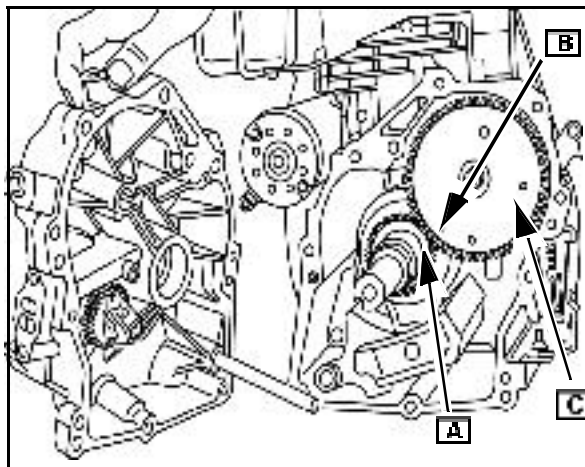


Fig. 11

4. Remove crankshaft timing gear (D) and counterweight assembly ([E] Fig. 12).

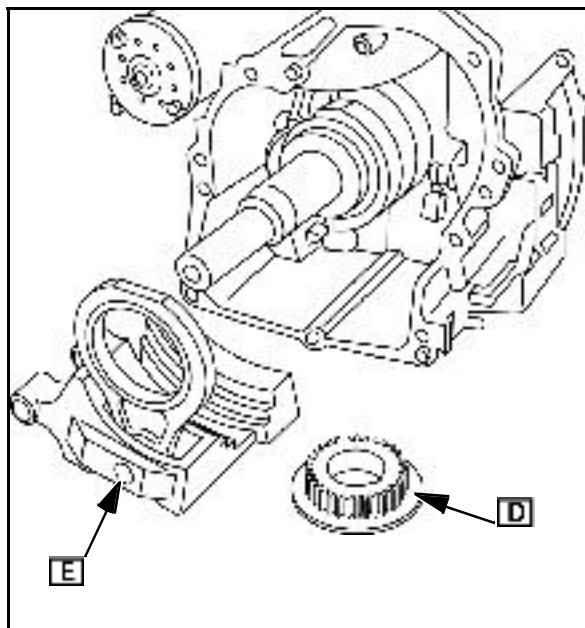


Fig. 12

5. Remove snap ring (F) from link pin bore (G), and push out link pin ([H] Fig. 13).

6. Remove connector link ([I] Fig. 13).

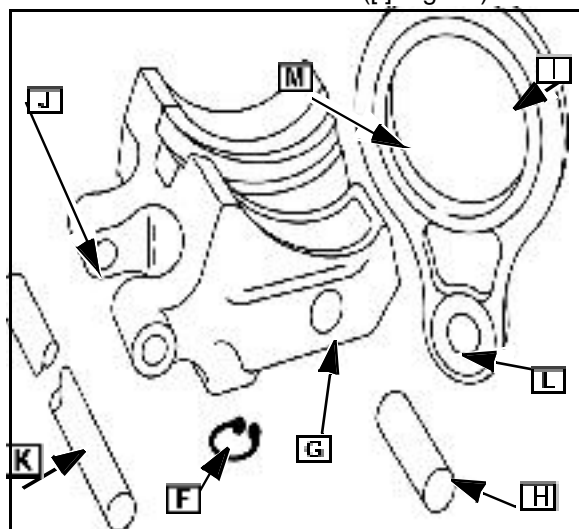


Fig. 13

### Inspect Counterweight Assembly (260700, 261700)

Inspect the following counterweight components for damage or wear. Replace parts as necessary. Refer to Fig. 13.

- Pivot Shaft Bearing (J)
- Pivot Shaft (K)
- Link Pin Bore (G)
- Link Pin (H)
- Connector Link Pin Bearing (L)
- Connector Link Eccentric Bearing (M)
- Connector Link (I)

For reject dimensions, **see SECTION 14- ENGINE SPECIFICATIONS.**

### Assembly/Installation Counterweight Assembly

1. Attach connector link to counterweight with link pin.
2. Install snap ring into groove of counterweight link pin bore.



3. Install counterweight assembly into cylinder and slide link (N) on to crankshaft eccentric ([O] Fig. 14).

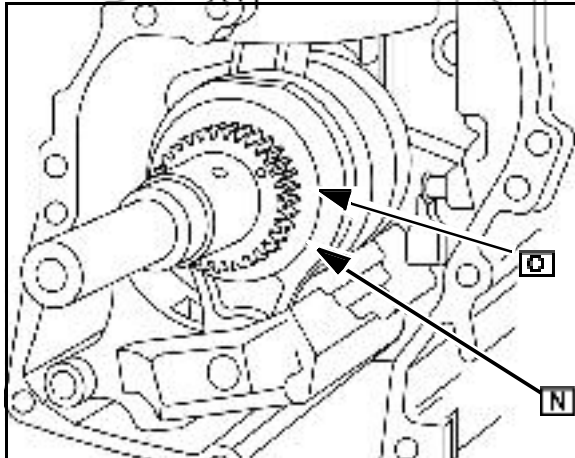


Fig. 14

4. Install timing gear on crankshaft.  
Refer to Fig. 15.
5. Turn crankshaft to position timing mark on gear (A) toward camshaft location.
6. Install camshaft (C) and align timing marks (B) and (A).
7. Position cylinder cover gasket (P) on cylinder dowel pins.
8. Slide counterweight pivot shaft (Q) into counterweight pivot shaft bore (R) and install cylinder cover.

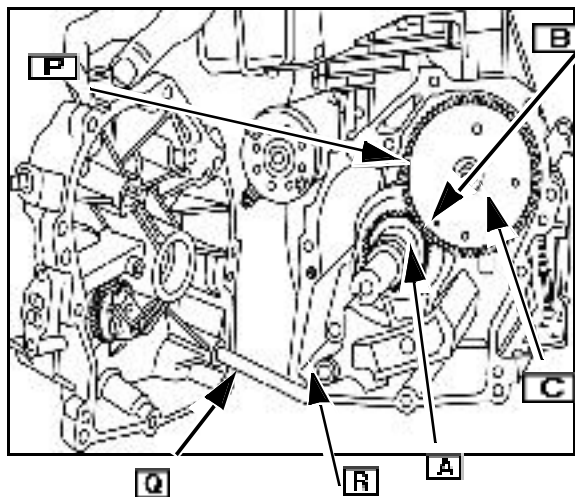


Fig. 15

## Synchro-Balance® System (28Q700)

This system uses a link and counterweight that oscillates opposite the piston Fig. 16.

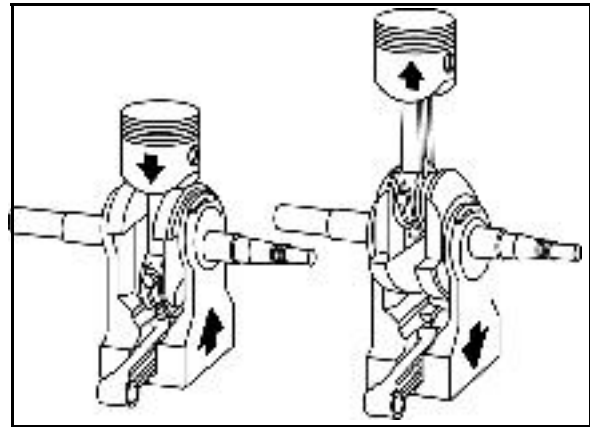


Fig. 16

## Removal/Inspection Synchro-Balance®

1. Remove sump cover and cylinder head.  
**See SECTION 10- CYLINDERS, COVERS AND SUMPS.**
2. Remove connecting rod cap.
3. Remove connecting rod and piston from engine. **See SECTION 12- PISTONS, RINGS AND CONNECTING RODS.**
4. Remove camshaft and crankshaft with counterweight assembly.
5. Remove timing gear and woodruff key ([A] Fig. 17). If gear is tight, pry off with two screwdrivers being careful not to damage gear.

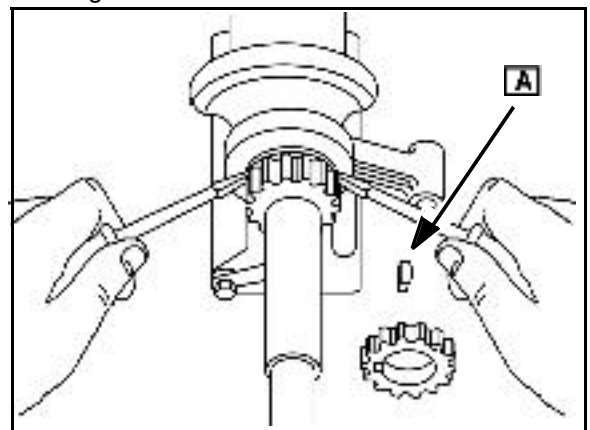


Fig. 17

6. Remove screw (B) from counterweight.
7. Remove PTO side weight (C), dowel pin (D), and link (E) from crankshaft.
8. Remove crankshaft from magneto side counterweight ([F] Fig. 18).

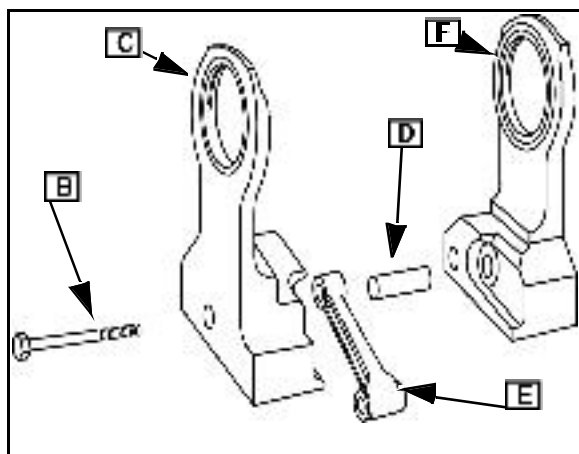


Fig. 18

9. Measure counterweight bearings and crankshaft eccentrics and compare to reject dimensions. **See SECTION 14-ENGINE SPECIFICATIONS.**

**If counterweight bearings are discolored, scored or worn beyond tolerances:**

- Counterweights must be replaced as a set.

**If the eccentrics are discolored, scored or worn beyond tolerances:**

- Replace the crankshaft

#### Assembly/Installation Synchro-Balance®

Refer to Fig. 19.

1. Slide magneto side counterweight (F) on to crankshaft.
2. Place crankshaft and counterweight in a vise (G). Use soft vise jaws or shop rags to protect magneto journal.
3. Slip link (E) over dowel pin (D) with rounded edge of free end (H) up.
4. Slide PTO side counterweight (C) on to dowel pin and crankshaft eccentric (I).

5. Install screw ([B] Fig. 19). Torque to listed value.

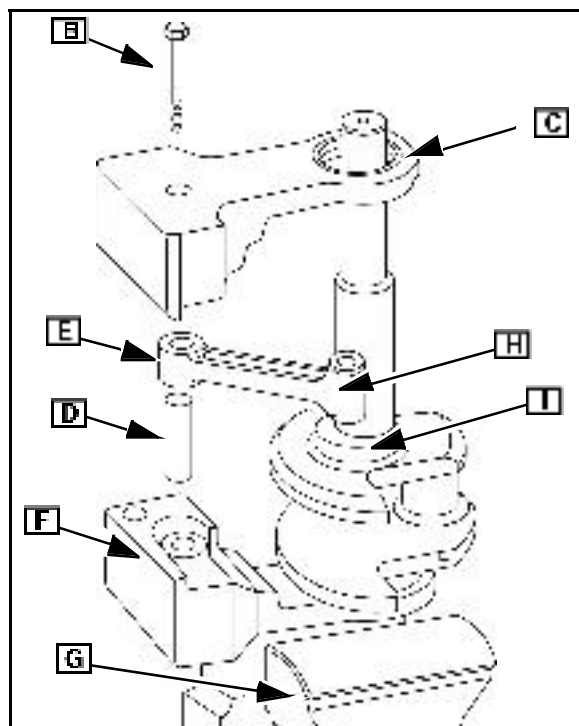


Fig. 19

**NOTE:** Rotate crankshaft to check for binding. If necessary loosen and re-torque screw. Check again for freedom of rotation.

6. Install woodruff key and slide timing gear on to crankshaft with chamfer toward eccentric.

**NOTE:** If necessary, heat gear under a warm light to expand it before installing.

7. Lay cylinder on its side, cylinder head to the left.
8. Place crankshaft and counterweight assembly into cylinder. Using seal protector, start magneto journal into magneto bearing.
9. Align link (E) with cylinder link pin ([J] Fig. 20). Push assembly into place.

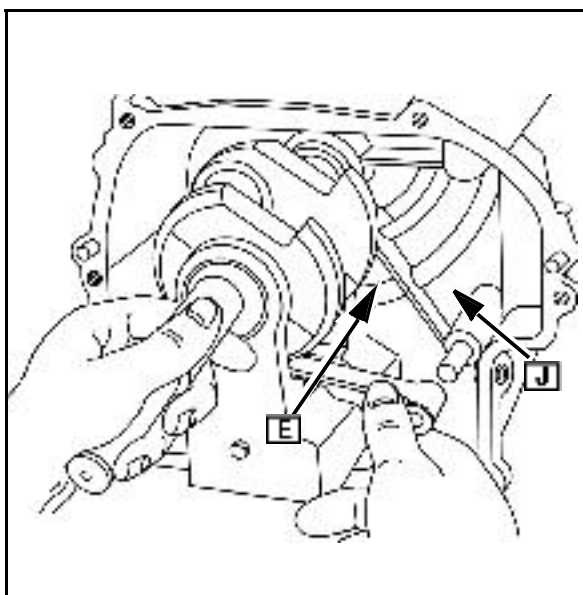


Fig. 20

10. Install connecting rod and piston with lubrication hole in rod toward magneto side. This will expose rod assembly marks.
11. Assemble the connecting rod cap, screw locks and screws.
12. Torque screws and bend up locks.
13. Install tappets and camshaft.
14. Align timing marks on camshaft and timing gear. Install sump cover.

## GEAR REDUCTIONS

The gear reduction attachment reduces PTO shaft RPM by 6:1. That is, the crankshaft turns 6 times to 1 turn of the PTO shaft.

### Mounting Positions (115400, 118400)

The housing can be installed in four positions (A, B, C, D) relative to the crankshaft ([E] Fig. 21).

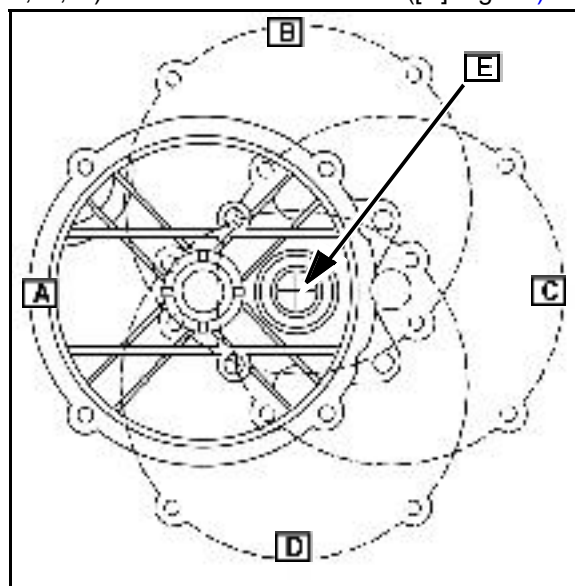


Fig. 21

### Remove Gear Reduction Housing (115400, 118400)

1. Remove the drain plug (A). Drain the oil from the gear housing into an appropriate container.
2. Clean PTO shaft with crocus cloth and wipe with a solvent such as kerosene to remove residue. It is important that PTO shaft journal be thoroughly cleaned.
3. Remove four cover screws (B) and cover ([C] Fig. 22). Inspect cover for bearing wear and damage. Replace if necessary.

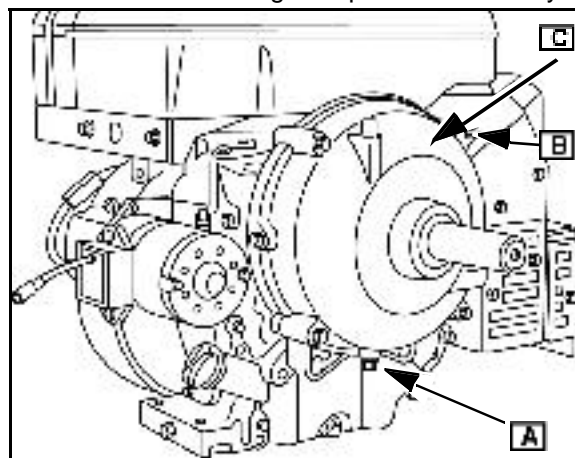


Fig. 22

4. Remove large gear, and inspect journal surfaces (D), seal areas, keyway (E), and

gear teeth for wear, pitting or scoring. Replace if necessary

5. Inspect crankshaft gear teeth ([F] Fig. 23) for wear, pitting or scoring. Replace if necessary.

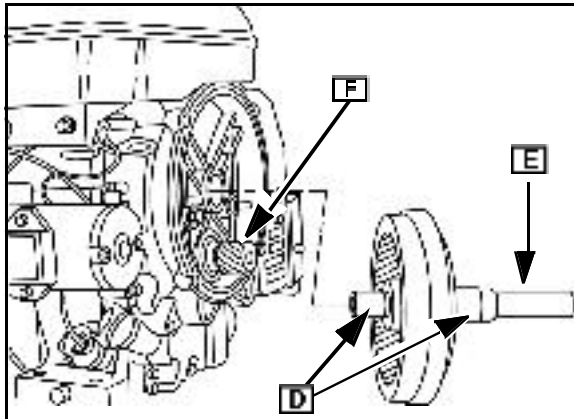


Fig. 23

6. Remove four screws attaching housing ([G] Fig. 24) to cylinder. Bend ears on locking plates away from heads of two screws inside housing.

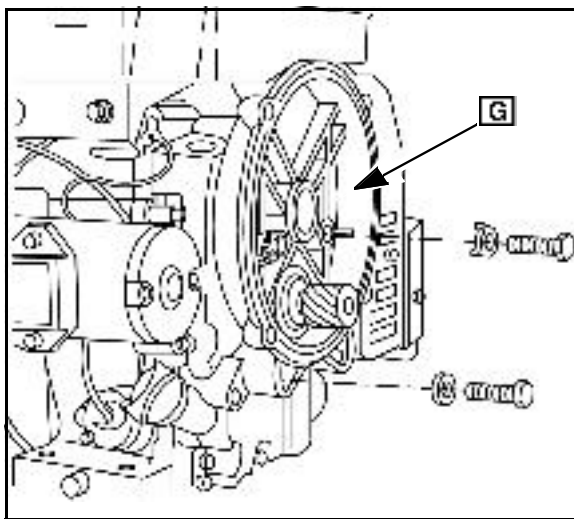


Fig. 24

7. Remove housing and inspect for bearing wear, cracks and warping. Replace if necessary.

8. Replace crankshaft oil seal and cork gasket ([H] Fig. 25).

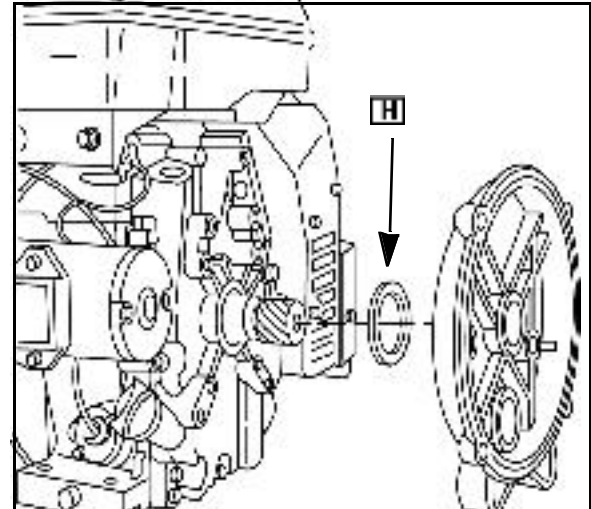


Fig. 25

### Assemble Gear Reduction Housing

Install seals with sealing lip (A) toward engine side of gear case (B) or cover (C] Fig. 26). Press until seal is flush with case or cover.

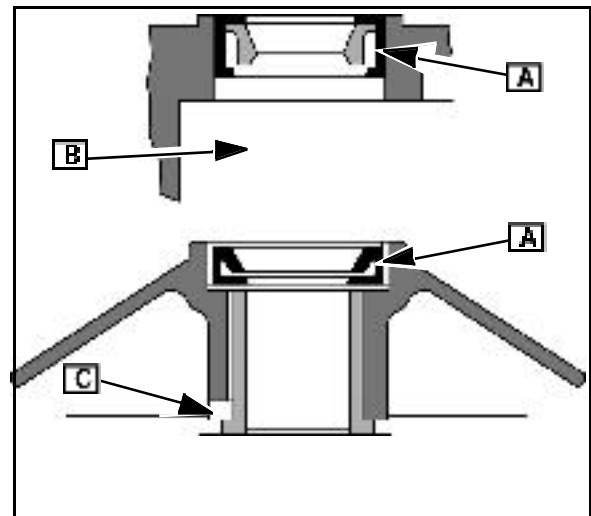


Fig. 26

### Install Gear Reduction Housing (115400, 118400)

1. Install new cork gasket on housing, and place housing against cylinder cover in original position, Fig. 27.

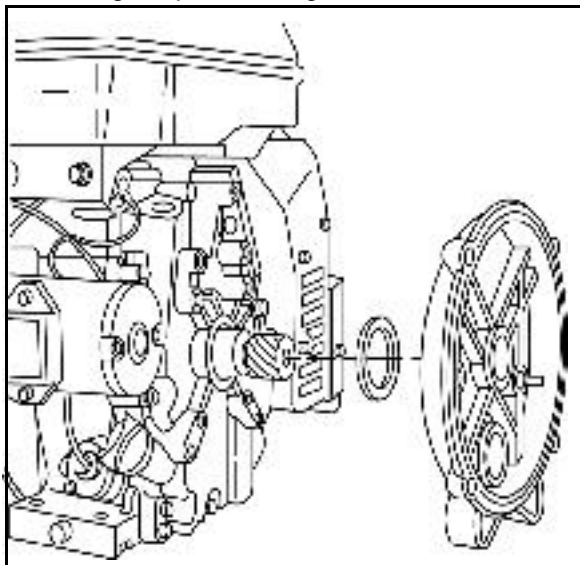


Fig. 27

2. Install mounting screws (A) and locking plates ([B] Fig. 27). Torque to listed value. **See SECTION 14- ENGINE SPECIFICATIONS.**
3. Bend one ear of locking plates against flat on screw heads inside gear housing, (Inset, Fig. 28).

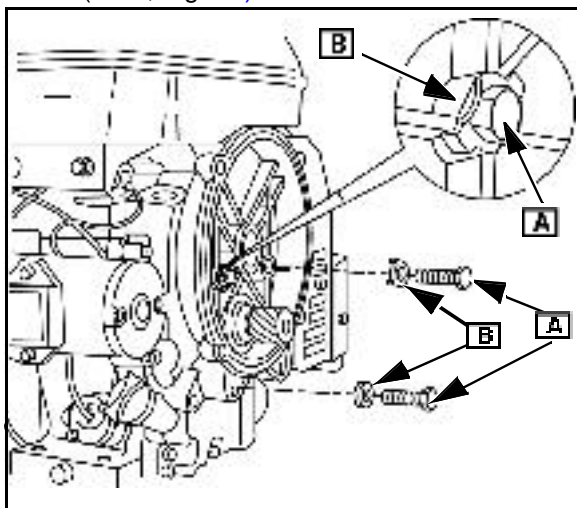


Fig. 28

4. Install large reduction gear (C) and cover gasket ([D] Fig. 29).

5. Insert seal protector (E) in seal of cover. Install cover ([F] Fig. 29) to gear case.

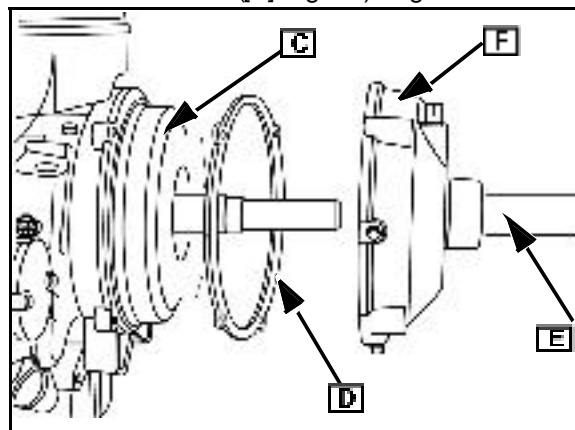


Fig. 29

6. Install cover screws and torque to listed value.
7. Check end play of PTO shaft. End play limits: 0.002 - 0.030 in. (0.05 - 0.76 mm).

### Filling Reduction Gear Case (115400, 118400)

1. To fill gear case, remove oil level plug ([A] Fig. 30) and oil fill/vent plug (B).
2. Fill gear case with SAE 30W.
3. Fill gear case just to the point of overflowing at the lower hole (C).

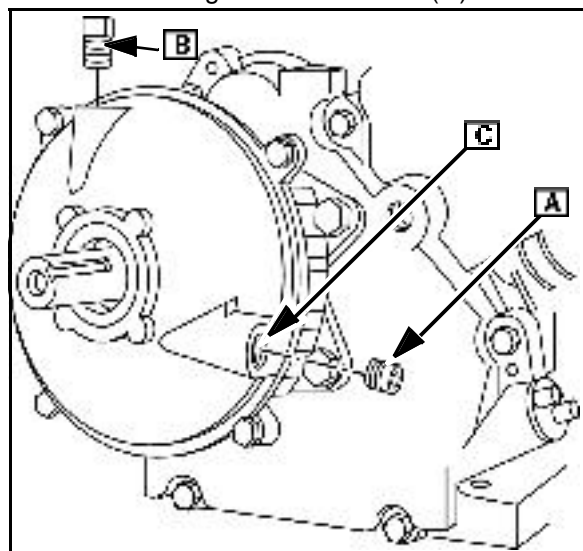


Fig. 30

4. Install oil level plug in lower hole and torque to listed value.
5. Install oil fill/vent plug in top hole of the case and torque to listed value. **See SECTION 14- ENGINE SPECIFICATIONS.**





## SECTION 12 - PISTONS, RINGS AND CONNECTING RODS

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## REMOVE PISTON AND CONNECTING ROD

### Piston Removal

For related engine information: **See SECTION 3-ENGINE DISASSEMBLY.**

1. Clean carbon deposits or any ridge buildup from top of cylinder bore to prevent ring breakage.
2. Remove connecting rod cap screws ([A] Fig. 1) and connecting rod cap.

Check the illustrated parts list (IPL) for your model to determine the proper locking hardware.

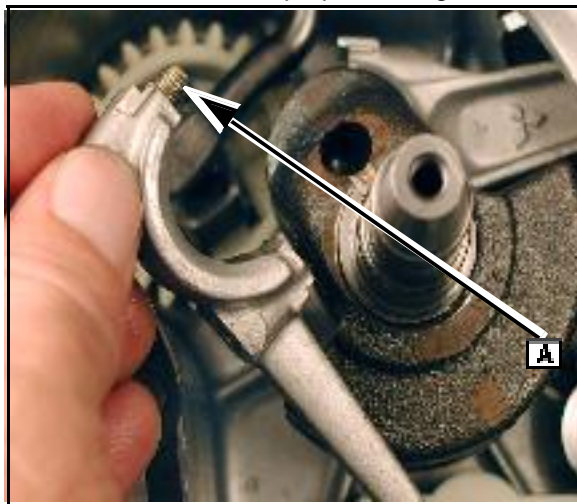


Fig. 1

3. With the connecting rod cap removed, rotate the crankshaft to push the piston to Top Dead Center (TDC).

4. Remove the piston. (Fig. 2). Be careful not to damage the surface of the cylinder bore with the connecting rod.



Fig. 2

### Piston Ring Removal

1. Remove the first two piston rings using Piston Ring Expander (#19340), Fig. 3.

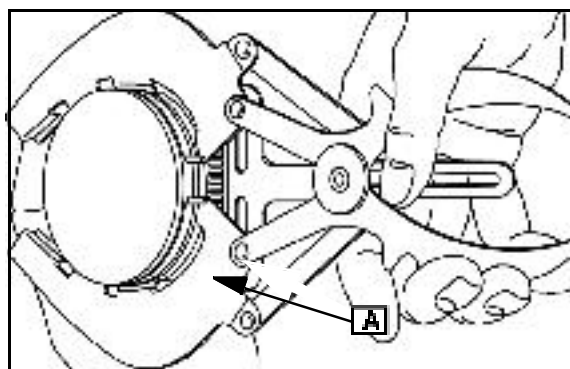


Fig. 3

Some oil control rings consist of two thin steel rails and a spring expander. The oil control rings cannot be removed with tool #19340.

2. Grab one end of the steel rail. Wind the rail from the oil ring groove into the next ring groove.
3. Repeat into the top ring groove and off the piston.

## Piston Pin Removal

1. Remove snap ring ([A] Fig. 4) from both sides of piston( if equipped).

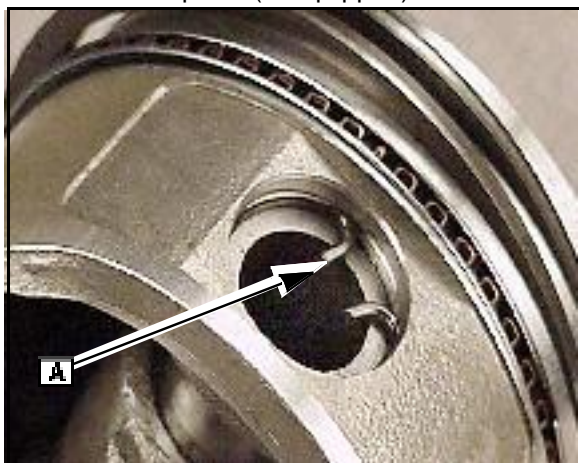


Fig. 4

2. Slide piston pin out of piston. Set pin and connecting rod aside.

### Piston Pin Removal (28Q700)

1. Rotate piston pin retainer (A) until one end is exposed in notch ([B] Fig. 5) of the piston pin bore.

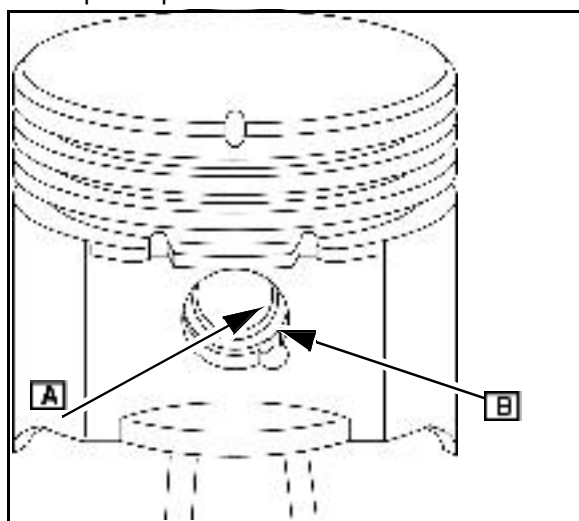


Fig. 5

2. Grasp end of piston pin retainer with needle nose pliers. Pull in and up to remove retainer.
3. Push piston pin out from other side. Set pin and connecting rod aside.

## INSPECT PISTON

Inspect piston for scuffing or galling of the piston skirt. Discoloration of the piston is not cause for rejection

### Measure Piston Pin Bore

Always look for "out-of-round" conditions.

1. Measure piston pin bore with telescoping gauge and compare reading with reject dimension.



Fig. 6

See SECTION 14- ENGINE SPECIFICATIONS.

Replace piston if out-of-round or worn beyond reject dimension.

### Measure Ring Groove Clearance

1. Clean carbon from top ring groove.
2. Place a new ring ([A] Fig. 7) in groove.
3. Measure the space between the ring and the ring land and compare with reject dimension.



Fig. 7

4. Repeat for center ring and oil ring.

Replace piston if reject dimensions are exceeded. **See SECTION 14- ENGINE SPECIFICATIONS.**

### Measure Piston Ring End Gap

1. Insert the top ring into the cylinder about an inch below the surface of the head ([A] Fig. 8).
2. Measure gap with feeler gauge ([B] Fig. 8) as shown.

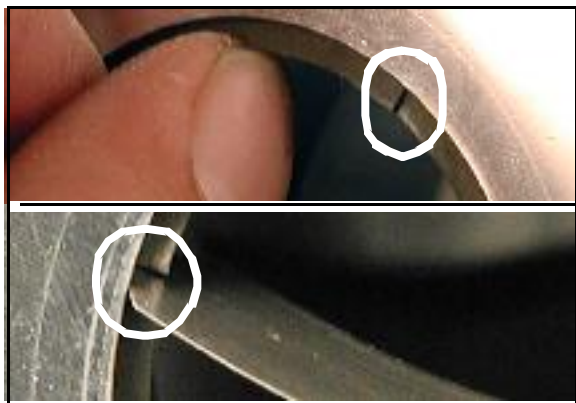


Fig. 8

3. Repeat this process for the 2nd ring.

### INSPECT CONNECTING ROD

#### Inspect Connecting Rod Bearings

Replace the connecting rod if either bearing is scored, scuffed or otherwise damaged.

1. Measure the crank pin bearing (A) and the piston pin bearing ([B] Fig. 9).
2. Use a telescoping gauge at approximate 120° intervals and record the readings to get an average dimension, as shown in Fig. 9.
3. Replace rod if either measurement exceeds tolerances.

**See SECTION 14- ENGINE SPECIFICATIONS.**

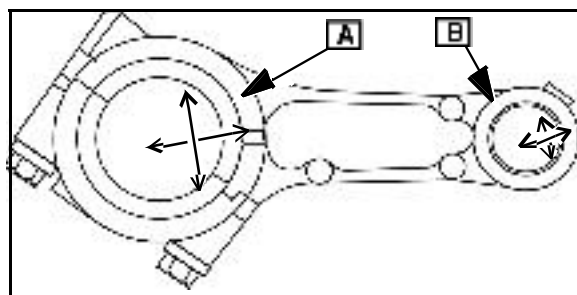


Fig. 9

### ASSEMBLE PISTON AND CONNECTING ROD

#### Piston Pin Installation

1. Orient the connecting rod and piston as shown in (Fig. 10).
2. Align the letters "MAG" ([A] if used) on the connecting rod with the notch or arrow ([B] Fig. 10) on the piston.

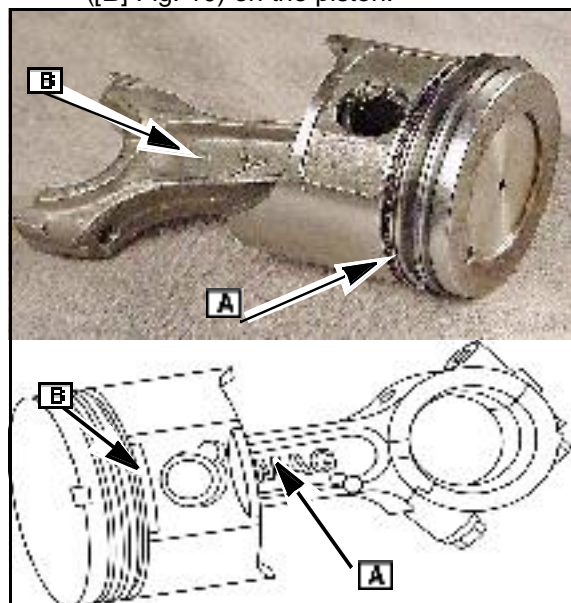


Fig. 10

3. If piston uses two pin locks, install one lock into the groove at this time.
4. Oil the piston pin and slip through piston bore and connecting rod pin bearing.
5. Install remaining pin lock to secure assembly.

**NOTE: (085400, 115400, 117400, 118400, 185400, 235400, 245400)** These pistons do

not have offset piston pin bores and can be assembled to the connecting rod in either direction.

6. Oil the piston pin.
7. Insert pin from the side opposite the shoulder stop or the first installed lock.
8. Install the second lock in the piston groove to retain the pin. Ensure both locks are firmly set in the grooves.

## Ring Installations

New piston rings are recommended any time the original piston rings are removed from the piston. When installing new service rings, refer to the detailed instructions included with the set.

If using the original rings, refer to the figure below that shows the sequence of re-installation.

Refer to your model.

1. Install the oil control ring(s) (A) and expander (B).
2. Install the center ring (C).
3. Install the top ring ([D] Fig. 568).
4. Note the shape of each ring and be careful to install them in the proper position.

### Ring Installation (050000, 118400)

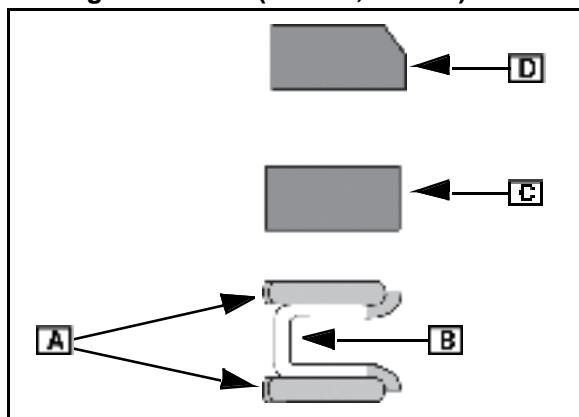


Fig. 11

### Ring Installation (085400)

Note the shape of each ring and be careful to install them in their proper position.

**NOTE:** The top ring is plated. The center ring is phosphate coated (black). This model has id

marks on the first and second ring. Install them facing up.

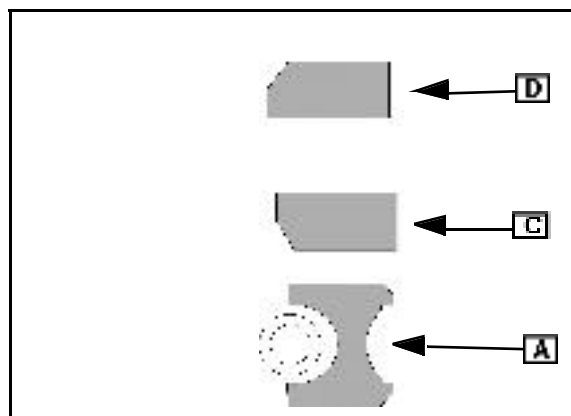


Fig. 12

### Ring Installation (115400, 117400, 138400, 185400, 235400, 245400)

**NOTE:** The top ring ([D] Fig. 13) is barrel faced and plated.

1. Install the expander oil and control rings (A) and expander (B).
2. Install the center ring (C) with the "Id" mark facing up.
3. Install the top ring ([D] Fig. 13).

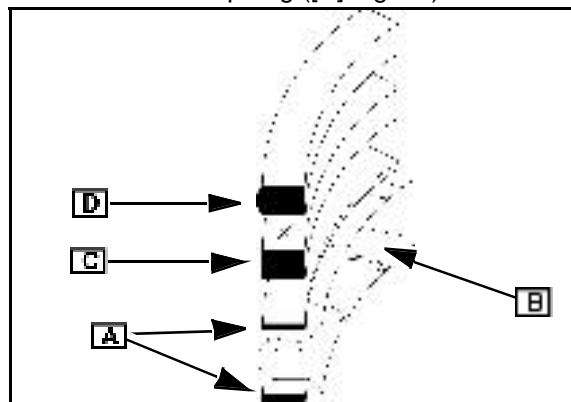


Fig. 13

### Ring Installation (104700)

Note the shape of each ring and be careful to install them in their proper position.

1. Install the oil control rings (A) and expander (B).
2. Install the center ring (C) with groove down, as shown.



3. Install the top ring ([D] Fig. 14).

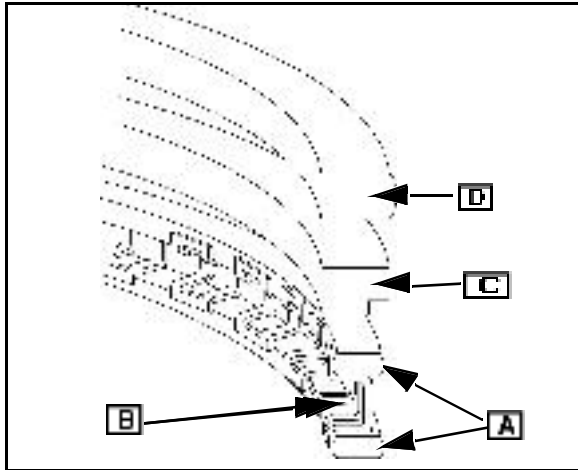


Fig. 14

### Ring Installation (161400)

Note the shape of each ring and be careful to install them in their proper position.

1. Install the oil control rings (A) and expander (B).
2. Install the center ring (C) with the "T" facing up.
3. Install the top ring ([D] Fig. 15) with the "T" facing up.

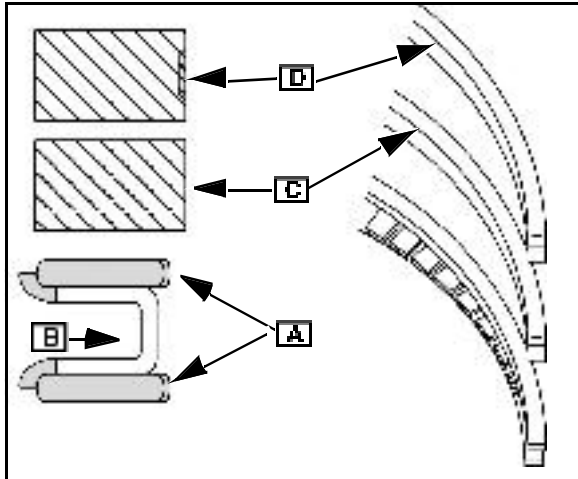


Fig. 15

### Ring Installation (28Q700)

Note the shape of each ring and be careful to install them in their proper position.

**NOTE:** Install gap of oil ring expander (B) 180 degrees from gap in oil control ring ([A] Fig. 16).

1. Install the oil control ring (A) and expander (B).

2. Install the center ring (C).

3. Install the top ring ([D] Fig. 16).

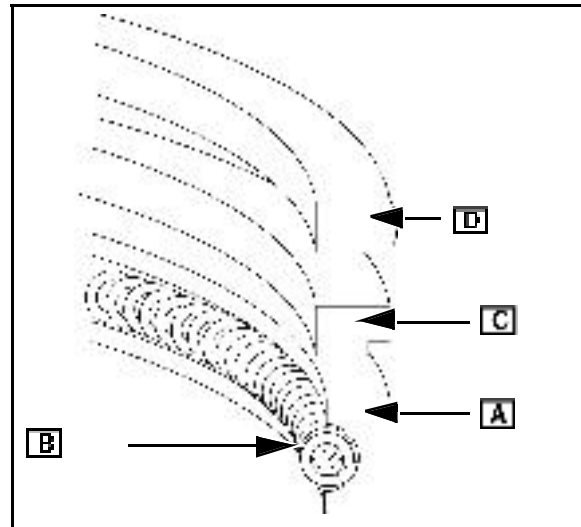


Fig. 16

## PISTON INSTALLATION (TYPICAL)

To prevent excessive oil consumption and/or compression "blow-by," stagger the piston ring gaps as illustrated in Fig. 17.



Fig. 17

**CAUTION:** Do not install piston and ring assembly without ring compressor.

1. Oil the piston rings and piston skirt.
2. Compress rings with Ring Compressor #19070 (A), or Ring Compressor #19230, ([B] Fig. 18).

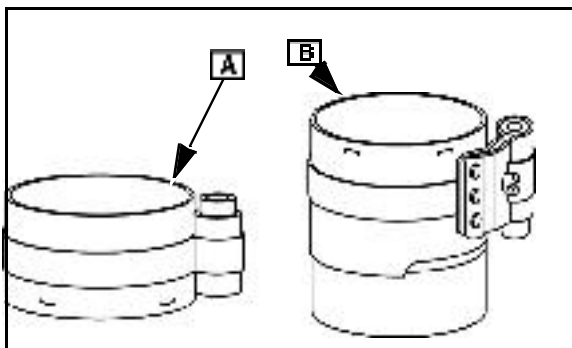


Fig. 18

3. Place piston and ring compressor upside down on bench with projections ([C] Fig. 19) on compressor facing rod.
4. Tighten ring compressor until rings are fully compressed.
5. Loosen ring compressor slightly so the compressor can be rotated on the piston skirt while holding connecting rod.
6. Remove connecting rod cap (E) from connecting rod ([D] Fig. 19), if installed.

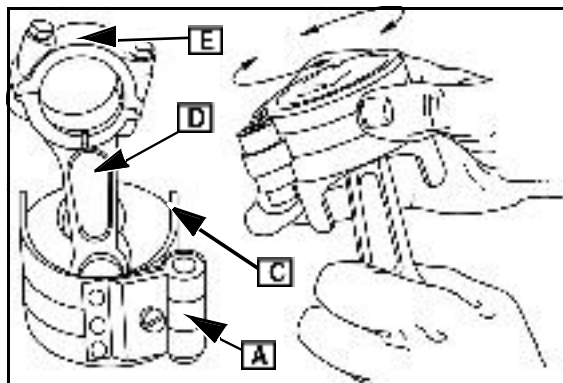


Fig. 19

7. Oil cylinder bore and crank pin.

Position piston with notch or casting mark (G) toward the flywheel side of the engine (Fig. 20).

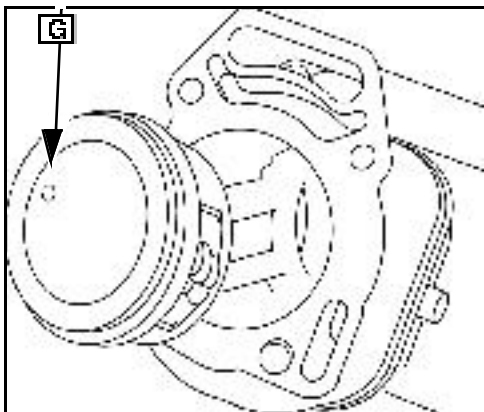


Fig. 20

8. Set piston and compressor assembly ([A] Fig. 21) on cylinder. Be careful not to scratch the surface of the bore with the connecting rod.
9. Push the piston down through the ring compressor and into the cylinder (B) until piston is in cylinder bore ([C] Fig. 21).

**CAUTION:** Do not use excessive force when installing the piston. You could damage the side rails of the oil control ring or impact the crankshaft with the bottom of the connecting rod.

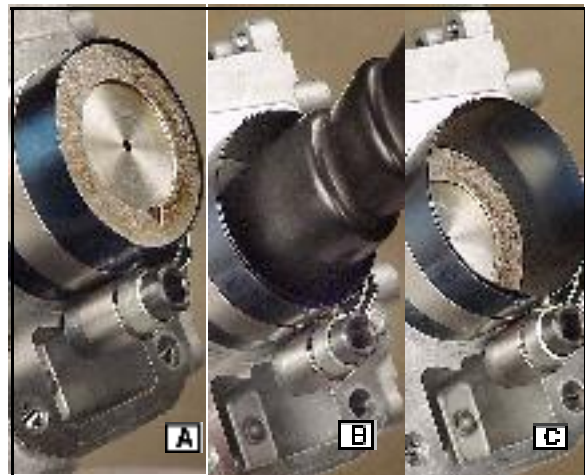


Fig. 21

## Install Connecting Rod Caps

1. Position connecting rod cap ([A] Fig. 22) as shown.



Fig. 22

**NOTE:** Install rod cap with match marks ([A] Fig. 23) aligned. Connecting rod cap should snap on when assembled correctly.

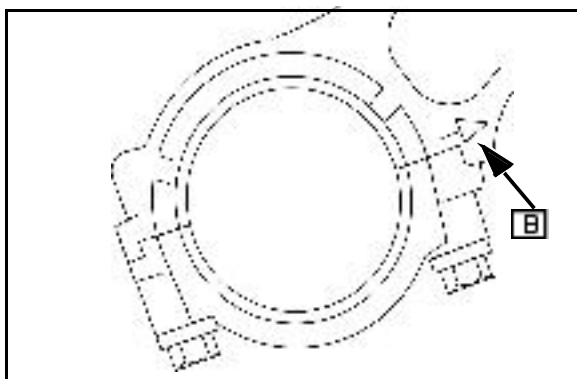


Fig. 23

**NOTE: (28Q700)** The notch in the connecting rod cap (A) must engage the tab on the connecting rod ([B] Fig. 24).

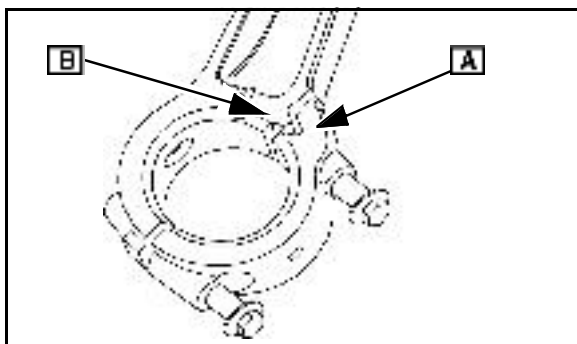


Fig. 24

2. Install the rod bolts, dipper and washers (if equipped) and torque as listed. **See SECTION 14- ENGINE SPECIFICATIONS.**

**CAUTION: (28Q700)**

Torque screw closest to the piston first.  
Torque screw farthest from the piston second.

3. Rotate crankshaft two revolutions to ensure crank pin and rod are not binding.
4. Move connecting rod from side to side to ensure clearance from crank pin sidewalls.



## SECTION 13 - FINAL ENGINE ASSEMBLY

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## GENERAL INFORMATION

This engine assembly section assumes you have inspected all the items listed in the "Reject Dimensions" for the engine you are working on. **See SECTION 14- ENGINE SPECIFICATIONS.** If you have not inspected all the listed items, you may be replacing expensive parts needlessly and/or reinstalling troublesome parts.

Refer to **SECTION 1- SAFETY, MAINTENANCE AND ADJUSTMENTS**, for final adjustment and general servicing information see **SECTION 2- TROUBLESHOOTING** for procedures designed to isolate and repair specific problems.

2. Check to make sure the small steel bushing ([A] Fig. 2) is installed in the intake side baffle. Install baffle as shown in Fig. 2.

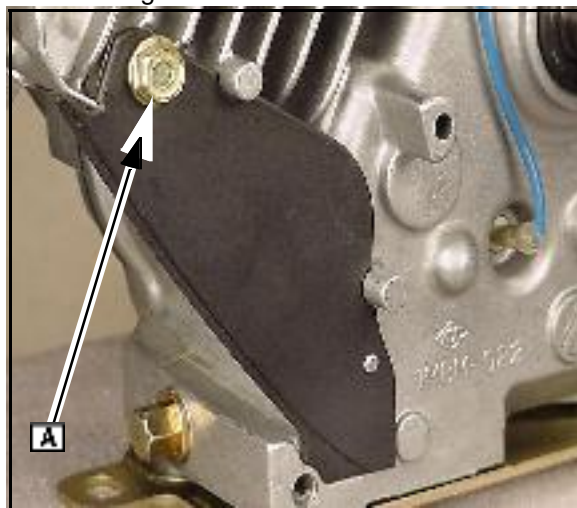


Fig. 2

3. Locate the rear baffle on the pins ([A] Fig. 3) of the cylinder as shown.

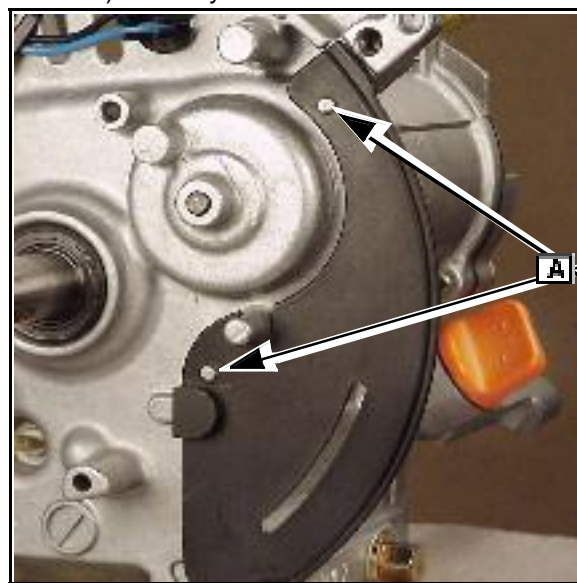


Fig. 3

## MODEL 050000

1. Secure wire harness ([A] Fig. 1) as shown.

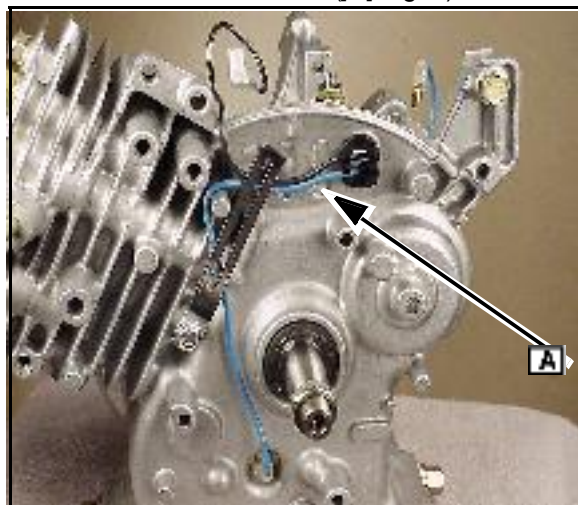


Fig. 1

4. Install flywheel, woodruff key and position flywheel on crankshaft (Fig. 4).



Fig. 4

5. Position the starter cup (A) on top of the blower fan (B) by aligning the two drive flanges with the casting depressions. Install starter hub (if equipped), washer (C) and flywheel nut (D) Fig.5).

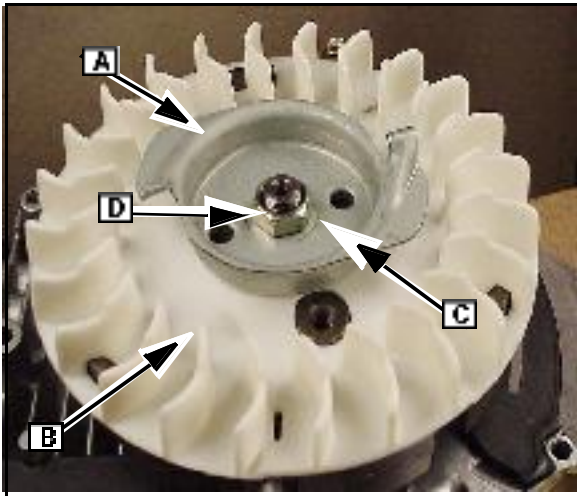


Fig. 5

6. Place Flywheel Strap Wrench #19433 ([A] Fig. 6) around outer rim of flywheel.

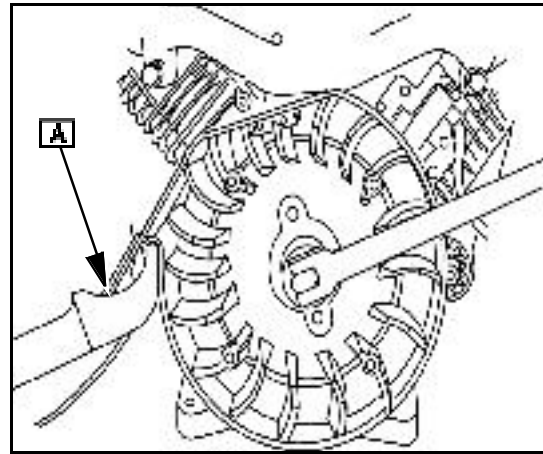


Fig. 6

7. Torque the flywheel nut to value listed in **SECTION 14- ENGINE SPECIFICATIONS.**

8. Position the Oil Gard® module ([A] Fig. 7) as shown.

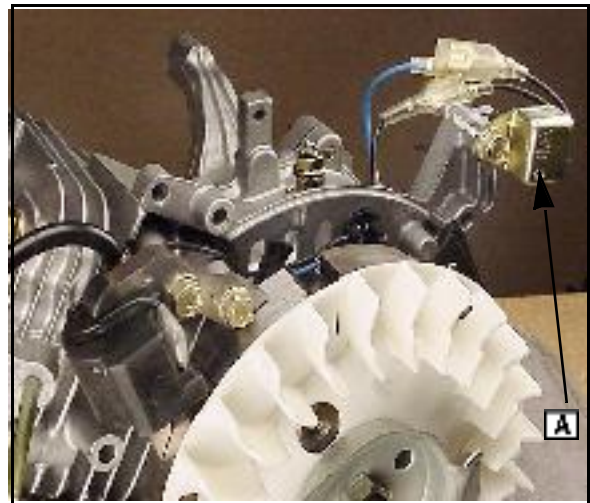


Fig. 7

9. Install the cylinder shield (Fig. 8).



Fig. 8

10. Set the blower housing in position and check that no wires are pinched. Position spark plug lead in the contour created for it ([A] Fig. 9).

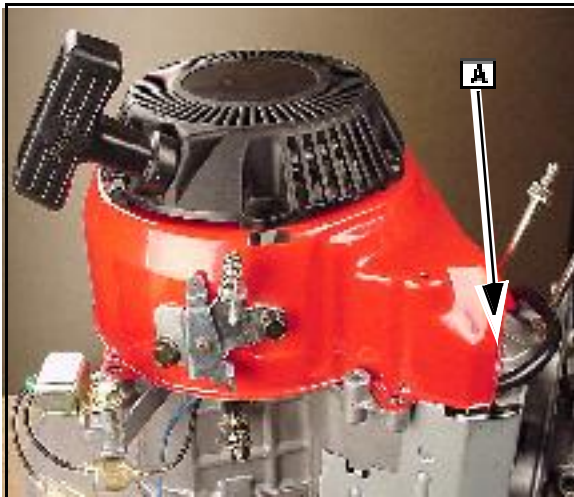


Fig. 9

11. Install grounding lead ([A] Fig. 10) as shown.

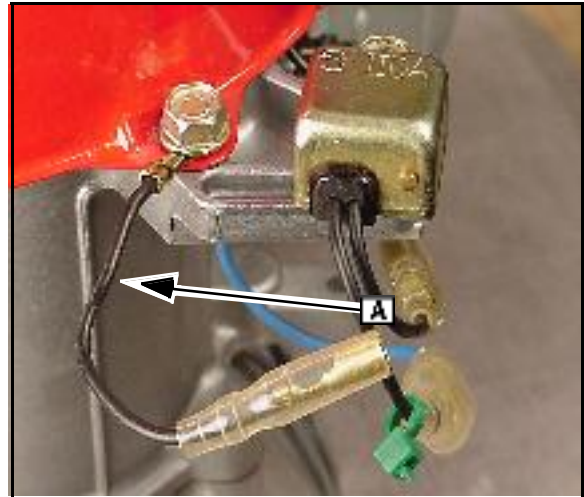


Fig. 10

12. Assemble shield ([A] Fig. 11) as shown.

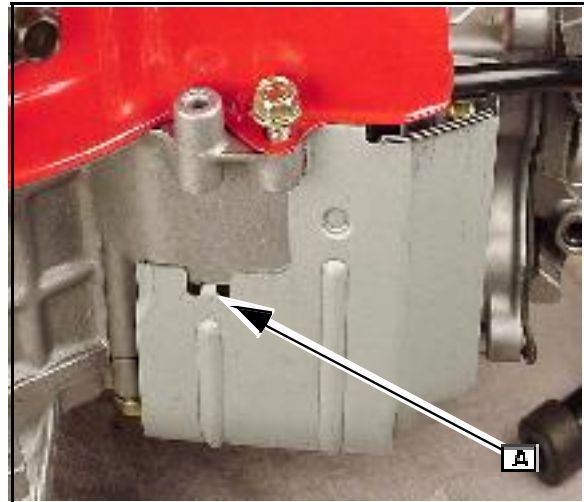


Fig. 11

13. Mount the remaining blower housing bolts and torque to value listed. **See SECTION 14- ENGINE SPECIFICATIONS.**



14. Refer to Fig. 12 and install components as shown.



Fig. 12

15. Loosely Install the spark plug and route the ignition lead as shown in Fig. 13.



Fig. 13

## MODELS 085400, 086400, 115400, 117400, 118400, 138400, 185400, 235400, 245400

**NOTE:** The 185400 was used as a general representation of the following models; 085400, 086400, 115400, 117400, 118400, 138400, 235400, 245400. Those engines that have gear reduction systems are covered in section 11. With minor variations, the 185400 is a good outline for the procedures required to assemble the above mentioned engines.

1. Make sure the wiring harness is routed and secured as shown in ([A] Fig. 14).

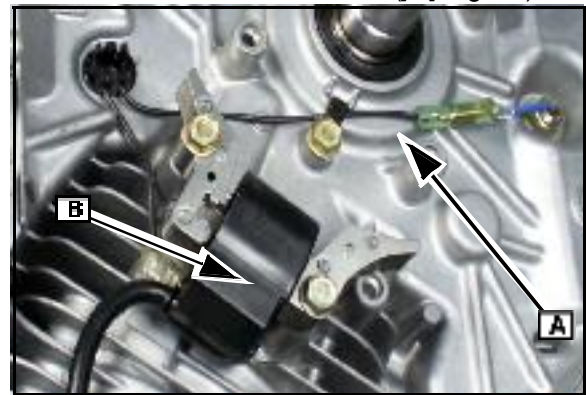


Fig. 14

2. Mount ignition coil ([B] Fig. 14) and connect ground wire.
3. Mount flywheel ([A] Fig. 15), making sure the new woodruff key is in place.
4. Install starter cup ([B] Fig. 15) and torque flywheel nut to listed value. **See SECTION 14- ENGINE SPECIFICATIONS.**



Fig. 15

5. Install the upper (A) and lower (B) Fig. 16) cylinder shields.



Fig. 16

6. Install the blower housing. Make sure the engine turns over with the starter rope.
7. Install the governor lever and connect the return spring (A), carburetor throttle link (B) and the choke link (C) to the control bracket (D) Fig. 17).

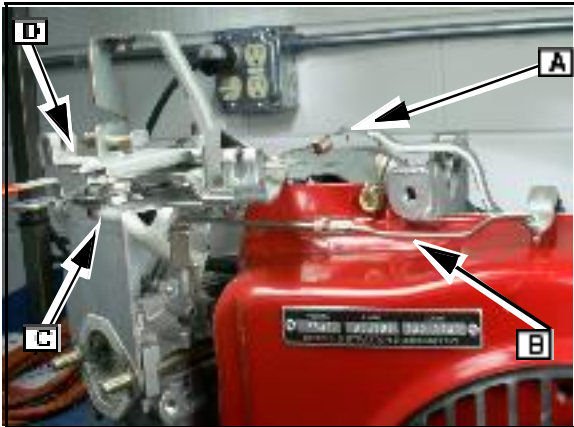


Fig. 17

8. Install muffler.
9. Install fuel tank.
10. Install fuel shut-off valve (A) and support for air filter assembly (B).

11. Connect fuel hose ([C] Fig. 18) to carburetor.

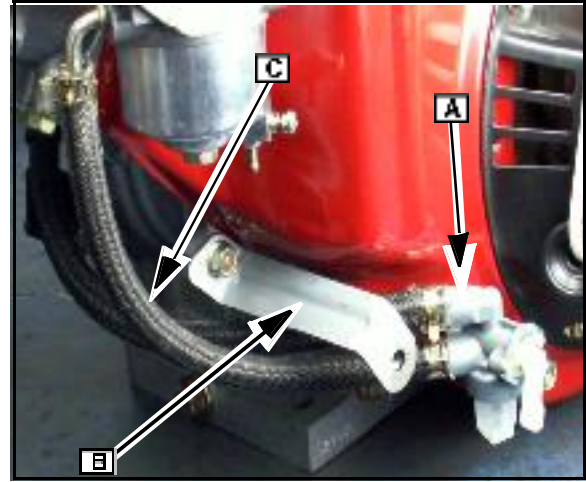


Fig. 18

12. Install air cleaner base ([A] Fig. 19).

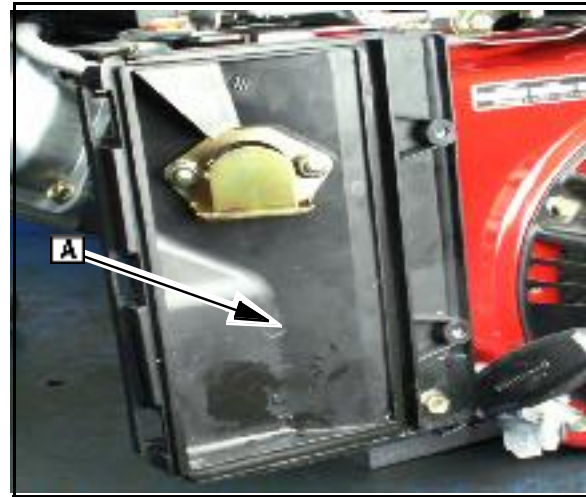


Fig. 19

13. Install air filter and cover.

**NOTE:** Make sure ground wire is mounted as shown in (Fig. 20).



Fig. 20



14. Mount the Oil Gard® module ([A] Fig. 21) as shown and connect wires to the stop switch.



Fig. 21

15. Install the breather tube (A) and route the spark plug wire ([B] Fig. 22) as shown.

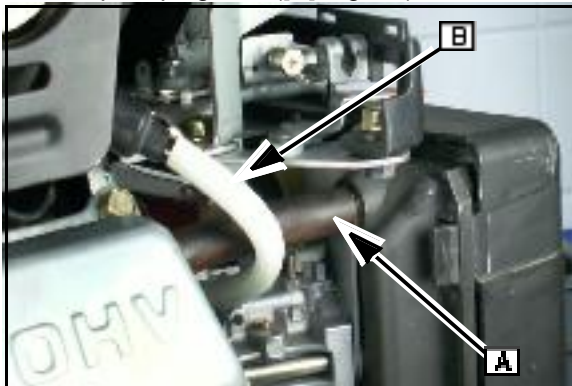


Fig. 22

16. Mount trim cover over the throttle and choke controls.

## MODEL 104700

1. Install electric starter (if equipped).
2. Position governor lever in position as shown in ([A] Fig. 23).

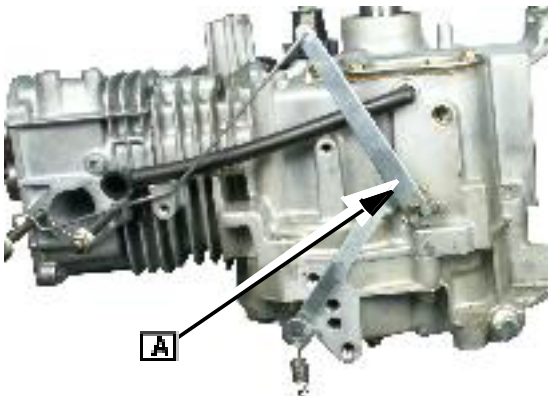


Fig. 23

3. Place large carburetor gasket-adaptor ([A] Fig. 24).



Fig. 24

4. With the governor lever in position, loosely install both control brackets ([A & B] Fig. 25).

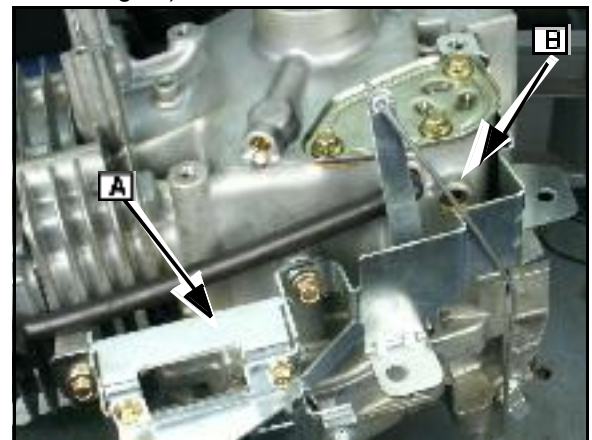


Fig. 25

5. Connect governor return spring ([A] Fig. 26).

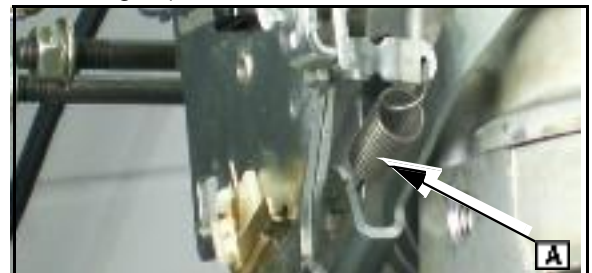


Fig. 26

6. Position the back plate ([A] Fig. 27) and loosely start the mounting screws.
7. Mount the alternator (B) and the ignition coil (C).



8. Route the alternator wire (D) and the ignition coil wire (E) as shown in Fig. 27.

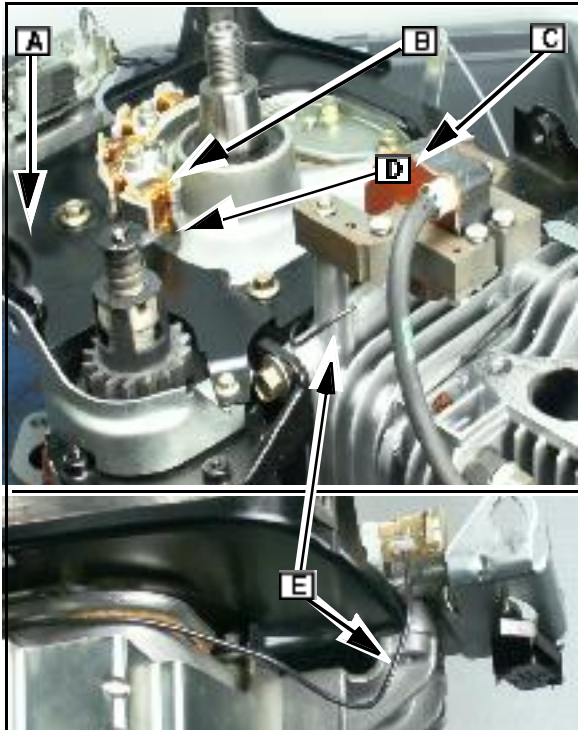


Fig. 27

9. With the wires routes as shown, torque the back plate and control bracket mounting bolts to listed values. **See SECTION 14-ENGINE SPECIFICATIONS.**
10. Mount the flywheel, woodruff key, fan and rewind starter hub. Torque flywheel nut to listed value. **See SECTION 3-ENGINE DISASSEMBLY.**
11. Install the exhaust manifold and its heat shield. **See SECTION 4- EXHAUST SYSTEMS.**
12. Install the oil-fill tube and torque to listed values.
13. Slip the insulator and gasket on the carburetor mounting bolts.
14. Connect governor link (A) and Choke-A-Matic link ([B] if installed). Slide

carburetor assembly ([C] Fig. 28) on mounting studs.

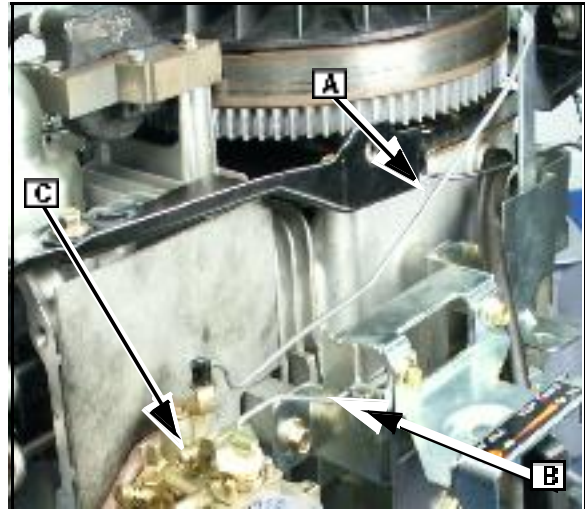


Fig. 28

15. Install blower housing and valve cover.
16. Install muffler assembly. **See SECTION 4- EXHAUST SYSTEMS.**
17. Install air filter assembly.
18. Install fuel tank and connect fuel hose to carburetor. **See SECTION 5- FUEL SYSTEMS AND CARBURETION.**
19. Connect spring to flywheel brake and install cover.
20. Install oil filter adapter and oil filter.

## MODEL 161400

1. Install the cylinder baffle using the upper head bolts (A) and one lower mounting screw (B) Fig. 29). Make sure to torque head bolts to listed values. **See SECTION 14- ENGINE SPECIFICATIONS.**

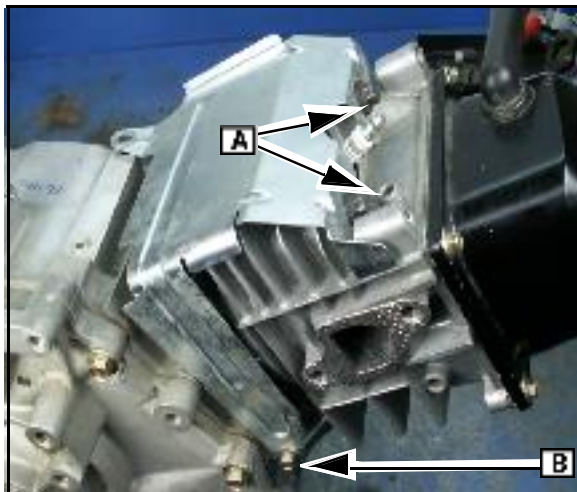


Fig. 29

2. Install the flywheel back plate shown in ([A] Fig. 30).



Fig. 30

3. Install the flywheel, woodruff key, fan, fan retainer, starter cup and screen assembly and the flywheel nut.

4. Position the fan to allow for the magnet to fit in the fan cut-out ([A] Fig. 31).

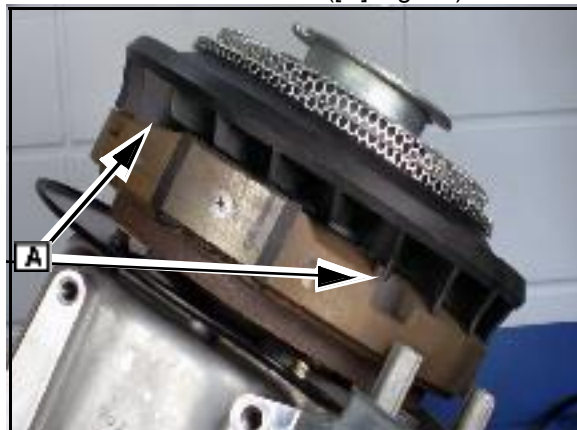


Fig. 31

5. Install the ignition coil and adjust the air gap.
6. Route the ignition harness as shown (A) and connect wire to ignition coil. Torque control bracket screws ([B] Fig. 32) to values listed in section 14.

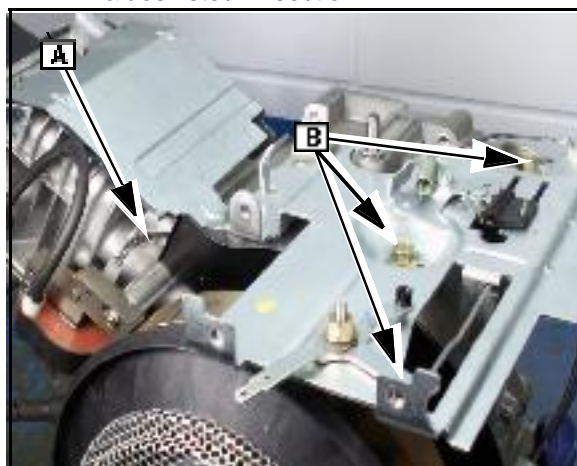


Fig. 32

7. Connect the main governor spring (A), the return spring (B) and the governor link with its spring (C).

8. Connect the other end of the governor link and spring to throttle lever ([D] Fig. 33) and temporarily install carburetor.

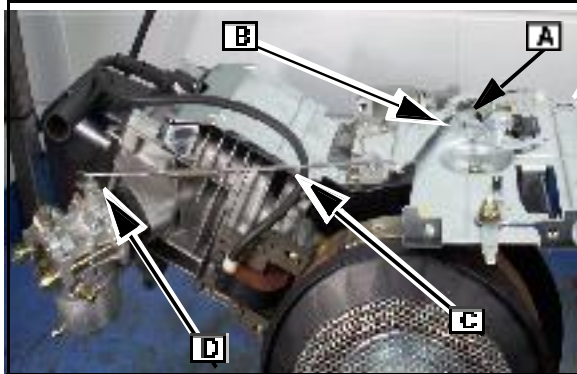


Fig. 33

9. Route the spark plug wire (A) and the governor links as shown and install the blower housing. Make sure there are no obstructions to the governor links at (B) and ([C] Fig. 34).

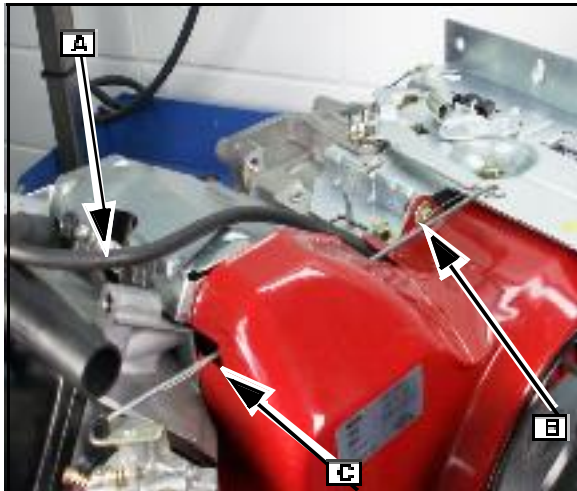


Fig. 34

10. Install the intake manifold (A) and the bracket for the fuel shut-off valve (B). Engage the choke control (C) as shown.

11. Torque carburetor mounting bolts ([D] Fig. 35) to values listed. **See SECTION 14- ENGINE SPECIFICATIONS.**

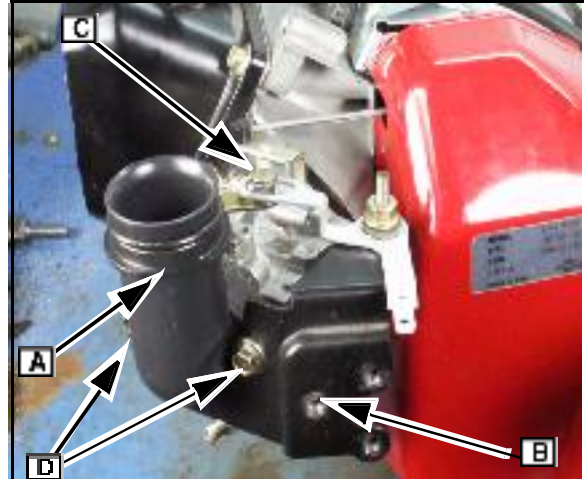


Fig. 35

12. Connect fuel line from the shut-off valve to the carburetor and install valve ([A] Fig. 36) as shown.



Fig. 36

13. Install the oil-fill tube.  
14. Connect ground wire to Oil Gard® sensor.  
15. Install muffler assembly. **See SECTION 4- EXHAUST SYSTEMS.**  
16. Install fuel tank. **See SECTION 5- FUEL SYSTEMS AND CARBURETION.**



17. Connect breather hose and install air filter housing (A) and trim ([B] Fig. 37).



Fig. 37

18. Install air filter and cover.

## MODELS 260700, 261700

1. Mount the governor lever (A) on the governor shaft as shown in Fig. 38.

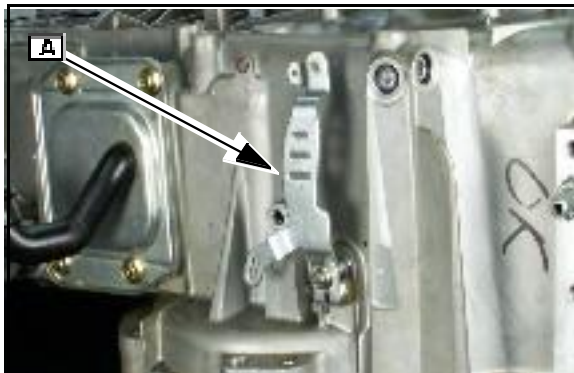


Fig. 38

2. Install the control bracket (Fig. 39).

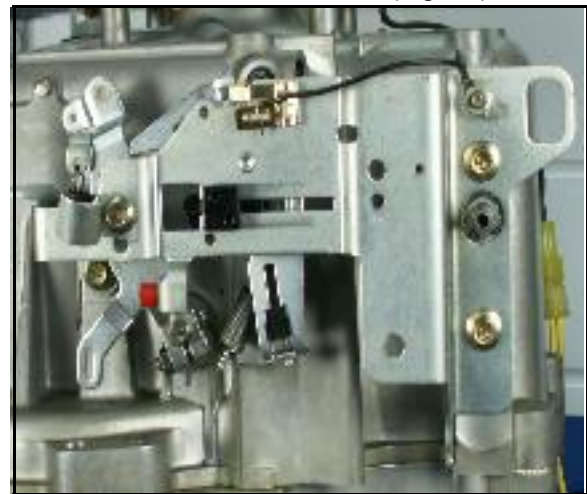


Fig. 39

3. Connect the main governor spring ([A] Fig. 40).



Fig. 40

4. Connect the idle control spring ([A] Fig. 41).



Fig. 41

5. Install the alternator.

6. Install the ignition coil harness to the ground terminal (A) and route the harness (B) Fig. 42) as shown.

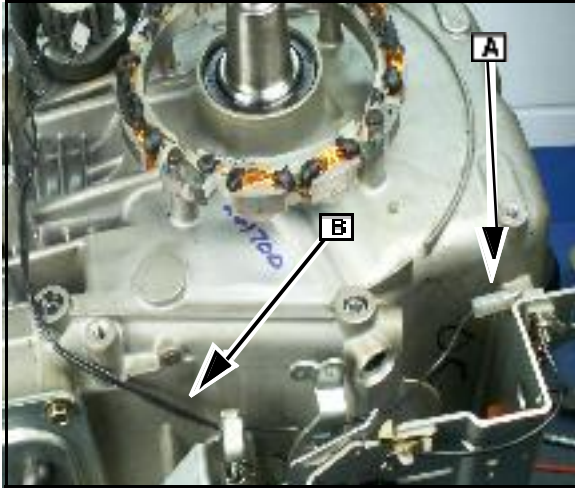


Fig. 42

7. Loosely position the back plate and route the alternator wires as shown in ([A] Fig.43).

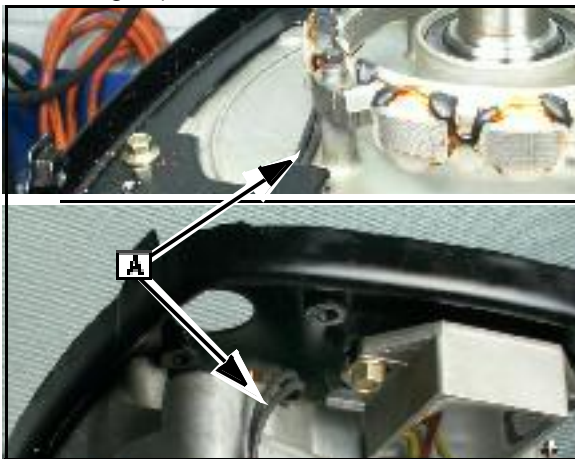


Fig. 43

8. Tighten all back plate mounting screws to the torque listed. **See SECTION 14- ENGINE SPECIFICATIONS.**
9. Install electric starter.
10. Install the flywheel with its woodruff key. When positioning the fan assembly on the flywheel, make sure the cutout for the magnet is properly positioned.

11. Install the fan retainer, flywheel nut and starter cup. Torque to listed values.



Fig. 44

12. Install the ignition coil and set the air gap.
13. Install the exhaust system. **See SECTION 4- EXHAUST SYSTEMS.** Route the spark plug wire as shown in ([A] Fig. 45).

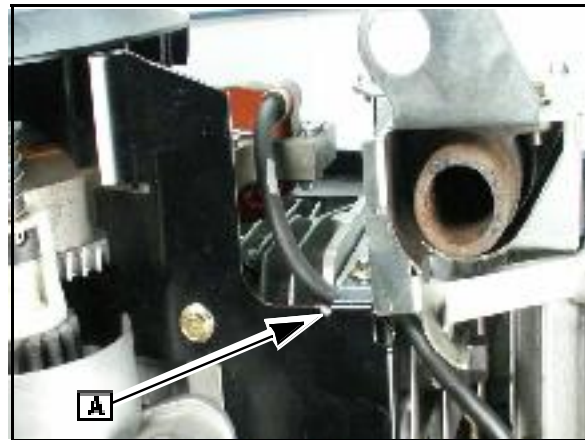


Fig. 45



14. Install the governor links as shown in Fig. 46.



Fig. 46

15. Install the air cleaner manifold and attach breather hose. Torque nuts to listed values. **See SECTION 14- ENGINE SPECIFICATIONS.**
16. Install fuel pump bracket (A) and fuel pump (B).
17. Connect fuel lines ([C] Fig. 47) to carburetor and cylinder.

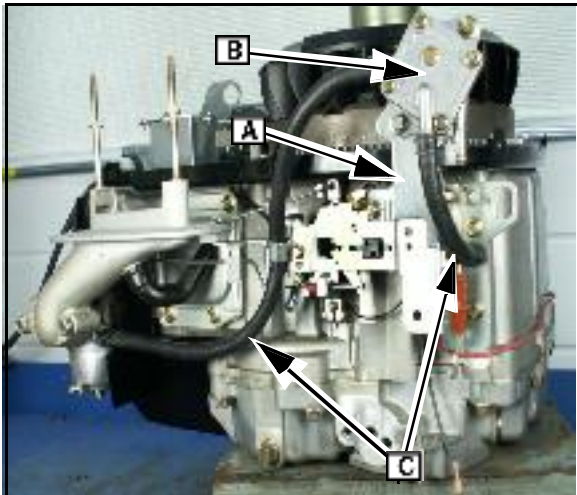


Fig. 47

18. Install oil fill tube.
19. Install air cleaner assembly. **See SECTION 1- SAFETY, MAINTENANCE AND ADJUSTMENTS.**
20. Install oil filter adapter.

21. Install blower housing.



Fig. 48

## MODEL 28Q700

1. Install flywheel guard ([A] Fig. 49).
2. Install alternator with the power output wires positioned as shown ([B] Fig. 49).
3. Install starter motor (C) with the bracket for the voltage regulator ([D] Fig. 49). Torque all mounting hardware to listed values.

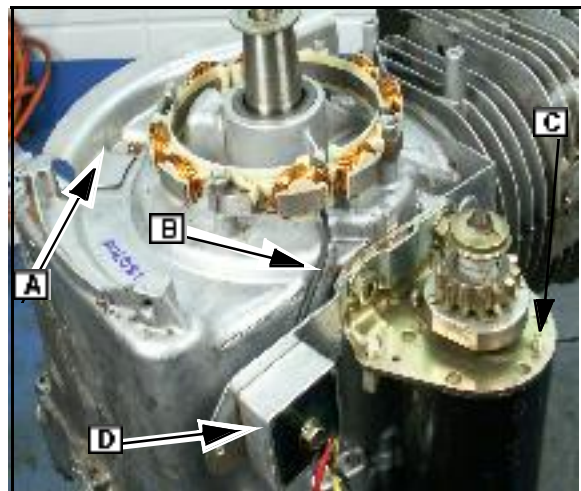


Fig. 49



4. Install flywheel with fan, fan retainer and flywheel nut. Torque nut ([A] Fig. 50) as shown to values listed in section 14.

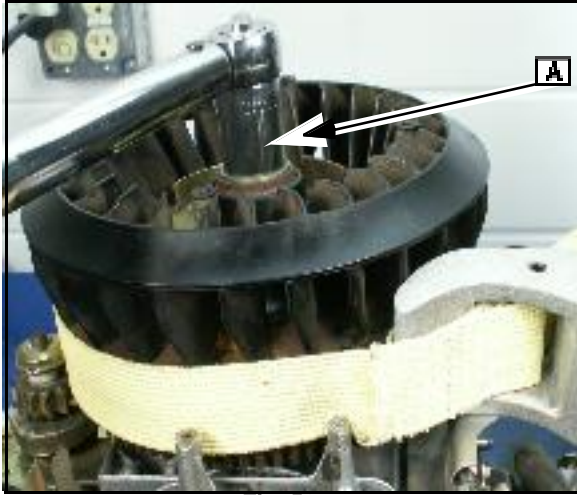


Fig. 50

5. Install ignition coil and set air gap.  
6. With coil installed and ground wire connected, route wire through small clamp ([A] Fig. 51) to grounding terminal on equipment.

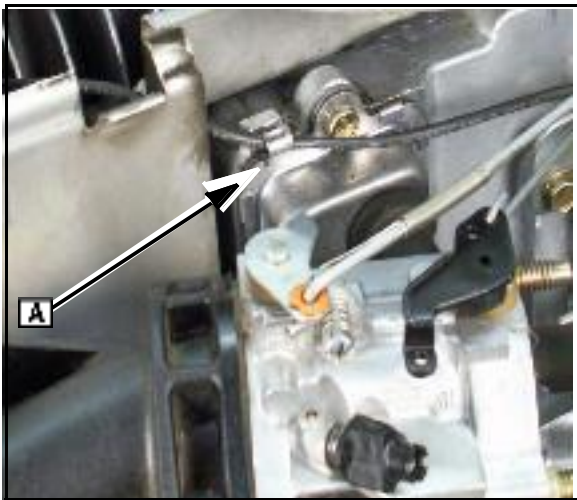


Fig. 51

7. Install governor link with spring (A) and connect choke arm (B) Fig. 52) as shown.

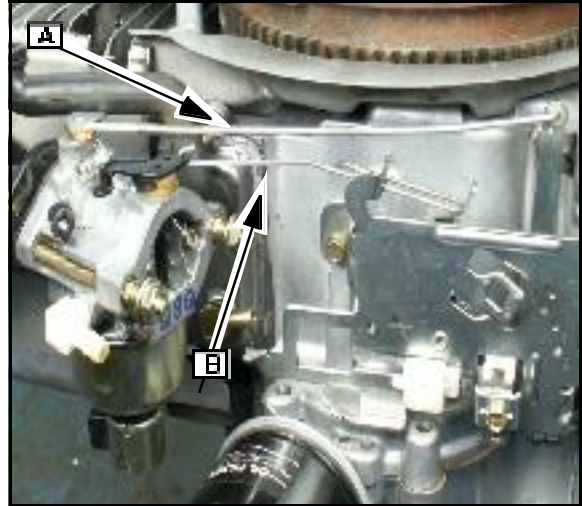


Fig. 52

8. Install air cleaner base to carburetor and torque mounting nuts ([A] Fig. 53) to listed values. **See SECTION 14- ENGINE SPECIFICATIONS.**

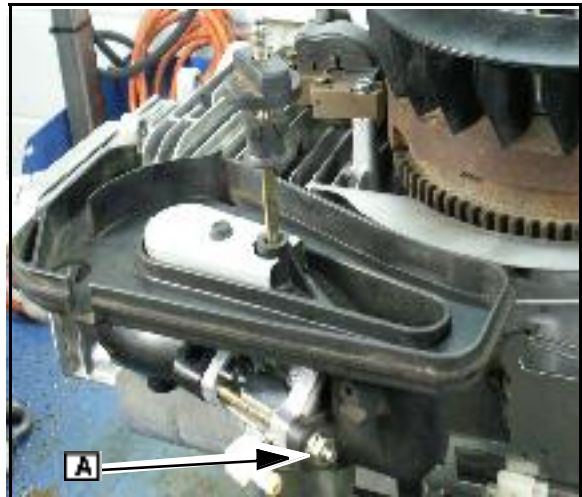


Fig. 53

9. Install inner blower housing with brackets ([A] Fig. 54) as shown.

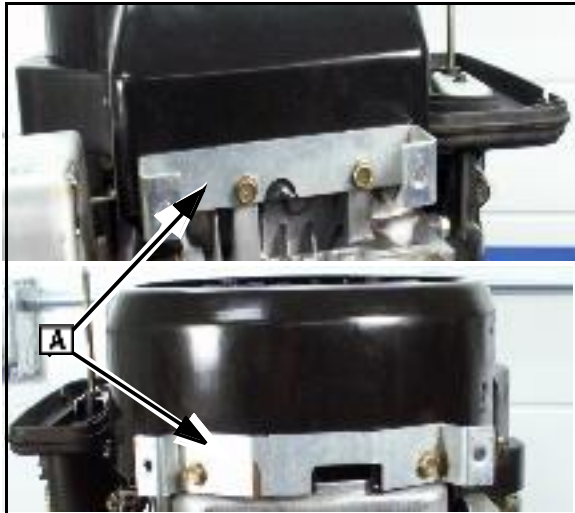


Fig. 54

10. Install the oil-fill tube.  
11. Install the outer blower housing on brackets (Refer to Fig. 54).  
12. Install grill to top of flywheel fan.  
13. Install bracket for the fuel pump (A).  
Install pump (B) and connect fuel lines ([C] Fig. 55).

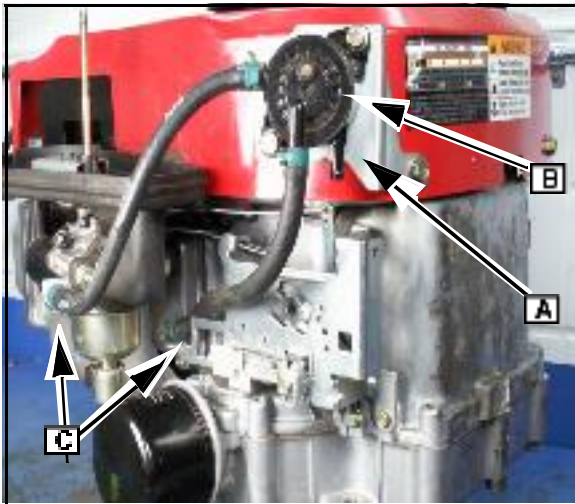


Fig. 55

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## MODEL 050000

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### Engine Specifications (050000)

Armature Air Gap	.012 -.020 in. (.30 -.50 mm)
Bolt Circle (1)	3.625 in. (92.08 mm)
Bore	2.047 in. (52.0 mm)
Crankshaft End Play	.002 -.006 in. (.05 -.15 mm)
Displacement	4.88 cu. in. (80 cc)
Fuel Tank Capacity	1.7 qt. (1.6 liter)
Oil Capacity - No Filter	13 oz. (.4 liter)
Spark Plug Gap	.024 -.028 in. (.60 -.70 mm)
Stroke	1.496 in. (38.0 mm)
Valve Clearance - Intake	.004 -.008 in. (.10 -.20 mm)
Valve Clearance - Exhaust	.004 -.008 in. (.10 -.20 mm)

### Fastener Torque Specifications (050000)

Air Cleaner Base / Backplate
Air Cleaner Cover
Armature
Blower Housing
Carburetor Bowl Screw
Connecting Rod
Control Bracket
Control Panel Trim
Cylinder Cover
Cylinder Head
Cylinder Shield
Engine Mounting Plate
Exhaust Manifold / Adapter
Flywheel Guard
Flywheel Nut
Fuel Shut-Off Valve
Fuel Shut-Off Valve Bracket
Fuel Tank
Governor Lever Nut
Muffler
Muffler Guard
Oil Drain Plug
Oil Guard Module

### Tool Size

10 mm
Slotted
7 mm
10 mm
10 mm
10 mm
10 mm
Phillips
10 mm
12 mm
10 mm
10 mm
10 mm
10 mm
10 mm
10 mm
10 mm
10 mm
10 mm
10 mm
10 mm
10 mm

### Torque

45 lb-in. (5 Nm)
30 lb-in. (3 Nm)
30 lb-in. (3 Nm)
100 lb-in. (11 Nm)
55 lb-in. (6 Nm)
90 lb-in. (10 Nm)
45 lb-in. (5 Nm)
30 lb-in. (3 Nm)
90 lb-in. (10 Nm)
250 lb-in. (28 Nm)
90 lb-in. (10 Nm)
90 lb-in. (10 Nm)
90 lb-in. (10 Nm)
180 lb-in. (20 Nm)
45 lb-in. (5 Nm)
35 lb-in. (47 Nm)
90 lb-in. (10 Nm)
90 lb-in. (10 Nm)
90 lb-in. (10 Nm)
65 lb-in. (7 Nm)
45 lb-in. (5 Nm)
90 lb-in. (10 Nm)
125 lb-in. (14 Nm)
90 lb-in. (10 Nm)

**Fastener Torque Specifications (050000)**

	<b>Tool Size</b>	<b>Torque</b>
Oil Guard Float Switch	10 mm	45 lb-in. (5 Nm)
Rewind Retainer Screw	Phillips	70 lb-in. (8 Nm)
Rewind Starter	10 mm	45 lb-in. (5 Nm)
Rocker Arm Assembly	10 mm	45 lb-in. (5 Nm)
Rocker Ball Set Screw or Nut	10 mm	45 lb-in. (5 Nm)
Spark Plug	5/8 in.	180 lb-in. (20 Nm)
Valve Cover	10 mm	35 lb-in. (4 Nm)

**Reject Dimensions (050000)**

	<b>Standard Size</b>	<b>Reject Size</b>
<b>Cylinder (050000)</b>		
Magneto Bearing	Ball	N/A
Camshaft Bearing	.5122 in. (13.01 mm)	.5130 in. (13.03 mm)
Bore Diameter	2.047 in. (52.00 mm)	2.050 in. (52.07 mm)
Bore Out-Of-Round	N/A	.0015 in. (.04 mm)
<b>Cylinder Head (050000)</b>		
	<b>Standard Size</b>	<b>Reject Size</b>
Intake Valve Seat Angle	45°	N/A
Intake Valve Seat Width	3/64-4/64 in. (1.19-1.59 mm)	N/A
Intake Valve Stem Diameter	.2154 in. (5.47 mm)	.2134 in. (5.42 mm)
Intake Valve Guide	.2165 in. (5.50 mm)	.2200 in. (5.59 mm)
Exhaust Valve Seat Angle	45°	N/A
Exhaust Valve Seat Width	3/64-4/64 in. (1.19-1.59 mm)	N/A
Exhaust Valve Stem Diameter	.2154 in. (5.47 mm)	.2134 in. (5.42 mm)
Exhaust Valve Guide	.2165 in. (5.50 mm)	.2200 in. (5.59 mm)
<b>Cylinder Cover (050000)</b>		
PTO Bearing	N/A	N/A
Camshaft Bearing	.5122 in. (13.01 mm)	.5130 in. (13.03 mm)
<b>Crankshaft (050000)</b>		
Crank Pin Journal	.9055 in. (23.00 mm)	.9039 in. (22.96 mm)
Mag-Side Journal	.6693 in. (17.00 mm)	.6677 in. (16.96 mm)
PTO-Side Journal	.6693 in. (17.00 mm)	.6677 in. (16.96 mm)
<b>Camshaft (050000)</b>		
Mag-Side Journal	.5118 in. (13.00 mm)	.5110 in. (12.98 mm)
PTO-Side Journal	.5118 in. (13.00 mm)	.5110 in. (12.98 mm)
Intake lobes	1.0039 in. (25.50 mm)	.9764 in. (24.80 mm)
Exhaust lobes	1.0039 in. (25.50 mm)	.9764 in. (24.80 mm)



Reject Dimensions (050000)	Standard Size	Reject Size
<b>Connecting Rod (050000)</b>		
Crank Pin Bearing	.9059 in. (23.01 mm)	.9071 in. (23.04 mm)
Piston Pin Bearing	.5516 in. (14.01 mm)	.5528 in. (14.04 mm)
<b>Piston (050000)</b>		
Piston Pin Diameter	.5512 in. (14.00 mm)	.5496 in. (13.96 mm)
Piston Pine Bore	.5516 in. (14.01 mm)	.5528 in. (14.04 mm)
Ring End Gap (Top)	.006-.014 in. (.15-.35 mm)	.030 in. (.76 mm)
Ring End Gap (Middle)	.006-.014 in. (.15-.35 mm)	.030 in. (.76 mm)
Ring End Gap (Oil Control)	.008-.028 in. (.20-.70 mm)	.040 in. (1.02 mm)
Ring Land Clearance (Top)	.001-.003 in. (.03-.07 mm)	.008 in. (.20 mm)
Ring Land Clearance (Middle)	.001-.003 in. (.03-.07 mm)	.008 in. (.20 mm)
Ring Land Clearance (Oil Control)	.001-.033 in. (.03-.07 mm)	.008 in. (.20 mm)
<b>Starter Rope (050000)</b>		
Rope Size	#4 (3.18 mm)	N/A
Rope Length	67 in. (1.7 m)	N/A

## MODELS 085400 AND 086400

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### Engine Specifications (085400 & 086400)

Armature Air Gap	.012 -.020 in. (.30 -.50 mm)
Bolt Circle (1)	3.625 in. (92.08 mm)
Bore	2.441 in. (62.0 mm)
Crankshaft End Play	.001 -.008 in. (.03 -.20 mm)
Displacement	7.69 cu. in. (126 cc)
Fuel Tank Capacity	3.2 qt. (3.0 liter)
Oil Capacity - No Filter	20 oz. (.6 liter)
Spark Plug Gap	.030 in. (.76 mm)
Stroke	1.653 in. (42.0 mm)
Valve Clearance - Intake	.002 -.004 in. (.05 -.10 mm)
Valve Clearance - Exhaust	.002 -.004 in. (.05 -.10 mm)

### Fastener Torque Specifications (085400 & 086400)

	Tool Size	Torque
Air Cleaner Base / Backplate	10 mm	45 lb-in. (5 Nm)
Air Cleaner Cover	Wing Nut	N/A
Air Cleaner Support Bracket	10 mm	45 lb-in. (5 Nm)
Armature	10 mm	30 lb-in. (3 Nm)
Blower Housing	10 mm	45 lb-in. (5 Nm)
Carburetor Bowl Screw	12 mm	85 lb-in. (10 Nm)
Connecting Rod	10 mm	90 lb-in. (10 Nm)
Control Bracket	10 mm	45 lb-in. (5 Nm)
Control Panel Trim	10 mm	45 lb-in. (5 Nm)
Cylinder Cover	12 mm	175 lb-in. (20 Nm)
Cylinder Head	12 mm	220 lb-in. (25 Nm)
Cylinder Shield	10 mm	45 lb-in. (5 Nm)
Flywheel Nut	21 mm	44 lb-ft. (60 Nm)
Fuel Shut-Off Valve	10 mm	70 lb-in. (8 Nm)
Fuel Tank	10 mm	90 lb-in. (10 Nm)
Governor Lever Nut	10 mm	60 lb-in. (7 Nm)
Muffler	12 mm	175 lb-in. (20 Nm)
Muffler Guard	Phillips	90 lb-in. (10 Nm)
Oil Drain Plug	12 mm	175 lb-in. (20 Nm)
Oil Fill Cap	Wing Nut	45 lb-in. (5 Nm)
Oil Guard Module	8 mm	35 lb-in. (4 Nm)
Oil Guard Float Switch	Phillips	45 lb-in. (5 Nm)
Rewind Starter	10 mm	45 lb-in. (5 Nm)
Rocker Arm Pivot	14 mm	N/A
Rocker Arm Stud	12 mm	175 lb-in. (20 Nm)
Rocker Ball Set Screw or Nut	10 mm	35 lb-in. (4 Nm)
Spark Plug	5/8 in.	180 lb-in. (20 Nm)
Valve Cover	10 mm	35 lb-in. (4 Nm)

**Reject Dimensions (085400 & 086400)****Standard Size****Reject Size****Cylinder (085400 & 086400)**

Magneto Bearing	Ball	N/A
Camshaft Bearing	.5909 in. (15.01 mm)	.5917 in. (15.03 mm)
Bore Diameter	2.441 in. (62.00 mm)	2.442 in. (62.03 mm)
Bore Out-Of-Round	N/A	.0015 in. (.04 mm)

**Cylinder Head (085400 & 086400)****Standard Size****Reject Size**

Intake Valve Seat Angle	45°	N/A
Intake Valve Seat Width	3/64-4/64 in. (1.19-1.59 mm)	N/A
Intake Valve Stem Diameter	.2346 in. (5.96 mm)	.2338 in. (5.94 mm)
Intake Valve Guide	.2368 in. (6.02 mm)	.2378 in. (6.04 mm)
Exhaust Valve Seat Angle	45°	N/A
Exhaust Valve Seat Width	3/64-4/64 in. (1.19-1.59 mm)	N/A
Exhaust Valve Stem Diameter	.2346 in. (5.96 mm)	.2338 in. (5.94 mm)
Exhaust Valve Guide	.2368 in. (6.02 mm)	.2378 in. (6.04 mm)

**Cylinder Cover (085400 & 086400)**

PTO Bearing	Ball	N/A
Camshaft Bearing	.5909 in. (15.01 mm)	.5917 in. (15.03 mm)

**Crankshaft (085400 & 086400)**

Crank Pin Journal	1.0236 in. (26.00 mm)	1.0228 in. (25.98 mm)
Mag-Side Journal	.7874 in. (20.00 mm)	.7866 in. (19.98 mm)
PTO-Side Journal	.7874 in. (20.00 mm)	.7866 in. (19.98 mm)

**Camshaft (085400 & 086400)**

Mag-Side Journal	.5905 in. (15.00 mm)	.5898 in. (14.98 mm)
PTO-Side Journal	.5905 in. (15.00 mm)	.5898 in. (14.98 mm)
Intake lobes	1.0709 in. (27.20 mm)	1.0433 in. (26.50 mm)
Exhaust lobes	1.0709 in. (27.20 mm)	1.0433 in. (26.50 mm)

**Connecting Rod (085400 & 086400)**

Crank Pin Bearing	1.0424 in. (26.02 mm)	1.0252 in. (26.04 mm)
Piston Pin Bearing	.5516 in. (14.01 mm)	.5524 in. (14.03 mm)

**Reject Dimensions (085400 & 086400)****Standard Size****Reject Size****Piston (085400 & 086400)**

Piston Pin Diameter	.5512 in. (14.00 mm)	.5504 in. (13.98 mm)
Piston Pine Bore	.5516 in. (14.01 mm)	.5524 in. (14.03 mm)
Ring End Gap (Top)	.006-.014 in. (.15-.35 mm)	.040 in. (1.0 mm)
Ring End Gap (Middle)	.006-.014 in. (.15-.35 mm)	.040 in. (1.0 mm)
Ring End Gap (Oil Control)	.008-.028 in. (.35-.70 mm)	.060 in. (1.50 mm)
Ring Land Clearance (Top)	.001-.003 in. (.03-.07 mm)	.008 in. (.20 mm)
Ring Land Clearance (Middle)	.001-.003 in. (.03-.07 mm)	.008 in. (.20 mm)
Ring Land Clearance (Oil Control)	.001-.003 in. (.03-.07 mm)	.008 in. (.20 mm)

**Starter Rope (085400 & 086400)**

Rope Size	#4 (3.18 mm)	N/A
Rope Length	67 in. (1.7 m)	N/A

## MODELS 115400 AND 117400

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### Engine Specifications (115400 & 117400)

Armature Air Gap	.012 -.020 in. (.30 -.50 mm)
Bolt Circle (1)	3.625 in. (92.08 mm)
Bore	2.677 in. (68.0 mm)
Crankshaft End Play	.001 -.008 in. (.03 -.20 mm)
Displacement	11.05 cu. in. (181 cc)
Fuel Tank Capacity	4.2 qt. (4.0 liter)
Oil Capacity - No Filter	24 oz. (.7 liter)
Spark Plug Gap	.030 in. (.76 mm)
Stroke	1.968 in. (50.0 mm)
Valve Clearance - Intake	.002 -.004 in. (.05 -.10 mm)
Valve Clearance - Exhaust	.002 -.004 in. (.05 -.10 mm)

### Fastener Torque Specifications (115400 & 117400)

	Tool Size	Torque
Air Cleaner Base / Backplate	10 mm	45 lb-in. (5 Nm)
Air Cleaner Cover	Wing Nut	N/A
Air Cleaner Support Bracket	10 mm	45 lb-in. (5 Nm)
Armature	10 mm	30 lb-in. (3 Nm)
Blower Housing	10 mm	45 lb-in. (5 Nm)
Carburetor Bowl Screw	12 mm	85 lb-in. (10 Nm)
Choke Lever Stud Screw	10 mm	45 lb-in. (5 Nm)
Connecting Rod	10 mm	90 lb-in. (10 Nm)
Control Bracket	10 mm	45 lb-in. (5 Nm)
Control Panel Trim	10 mm	45 lb-in. (5 Nm)
Cylinder Cover	12 mm	175 lb-in. (20 Nm)
Cylinder Head	12 mm	220 lb-in. (25 Nm)
Cylinder Shield	10 mm	45 lb-in. (5 Nm)
Flywheel Nut	21 mm	44 lb-ft. (60 Nm)
Fuel Shut-Off Valve	10 mm	70 lb-in. (8 Nm)
Fuel Shut-Off Valve Bracket	10 mm	45 lb-in. (5 Nm)
Fuel Tank	10 mm	90 lb-in. (10 Nm)
Governor Lever Nut	10 mm	60 lb-in. (7 Nm)
Idle Down Control	12 mm	140 lb-in. (16 Nm)
Muffler	12 mm	175 lb-in. (20 Nm)
Muffler Bracket	12 mm	175 lb-in. (20 Nm)
Muffler Guard	Phillips	90 lb-in. (10 Nm)
Oil Drain Plug	12 mm	175 lb-in. (20 Nm)
Oil Fill Cap	Wing Nut	45 lb-in. (5 Nm)
Oil Guard Module	Phillips	35 lb-in. (4 Nm)
Oil Guard Float Switch	10 mm	45 lb-in. (5 Nm)



<b>Fastener Torque Specifications (115400 &amp; 117400)</b>	<b>Tool Size</b>	<b>Torque</b>
Rewind Retainer Screw	Phillips	70 lb-in. (8 Nm)
Rewind Starter	10 mm	45 lb-in. (5 Nm)
Rocker Arm Pivot	14 mm	N/A
Rocker Arm Stud	12 mm	175 lb-in. (20 Nm)
Rocker Ball Set Screw or Nut	10 mm	35 lb-in. (4 Nm)
Spark Plug	5/8 in.	180 lb-in. (20 Nm)
Starter Contactor	8 mm	35 lb-in. (4 Nm)
Starter Motor Bracket	12 mm	140 lb-in. (16 Nm)
Starter Motor Thorough Bolts	10 mm	50 lb-in. (6 Nm)
Stator	10 mm	45 lb-in. (5 Nm)
Valve Cover	10 mm	35 lb-in. (4 Nm)
Voltage Regulator	10 mm	45 lb-in. (5 Nm)

<b>Reject Dimensions (115400 &amp; 117400)</b>	<b>Standard Size</b>	<b>Reject Size</b>
<b>Cylinder (115400 &amp; 117400)</b>		
Magneto Bearing	Ball	N/A
Camshaft Bearing	.5909 in. (15.01 mm)	.5917 in. (15.03 mm)
Bore Diameter	2.6772 in. (68.00 mm)	2.6783 in. (68.03 mm)
Bore Out-Of-Round	N/A	.0015 in. (.04 mm)
<b>Cylinder Head (115400 &amp; 117400)</b>		
Intake Valve Seat Angle	45°	N/A
Intake Valve Seat Width	3/64-4/64 in. (1.19-1.59 mm)	N/A
Intake Valve Stem Diameter	.2346 in. (5.96 mm)	.2338 in. (5.94 mm)
Intake Valve Guide	.2368 in. (6.02 mm)	.2378 in. (6.04 mm)
Exhaust Valve Seat Angle	45°	N/A
Exhaust Valve Seat Width	3/64-4/64 in. (1.19-1.59 mm)	N/A
Exhaust Valve Stem Diameter	.2346 in. (5.96 mm)	.2338 in. (5.94 mm)
Exhaust Valve Guide	.2368 in. (6.02 mm)	.2378 in. (6.04 mm)
<b>Cylinder Cover (115400 &amp; 117400)</b>		
PTO Bearing	Ball	N/A
Camshaft Bearing	.5909 in. (15.01 mm)	.5917 in. (15.03 mm)
<b>Crankshaft (115400 &amp; 117400)</b>		
Crank Pin Journal	1.1811 in. (30.0 mm)	1.1803 in. (29.98 mm)
Mag-Side Journal	1.1811 in. (30.0 mm)	1.1803 in. (29.98 mm)
PTO-Side Journal	.9842 in. (25.0 mm)	.9835 in. (24.98 mm)

**Reject Dimensions (115400 & 117400)****Standard Size****Reject Size****Camshaft (115400 & 117400)**

Mag-Side Journal	.5905 in. (15.00 mm)	.5898 in. (14.98 mm)
PTO-Side Journal	.5905 in. (15.00 mm)	.5898 in. (14.98 mm)
Intake lobes	1.1102 in. (28.20 mm)	1.0827 in. (27.50 mm)
Exhaust lobes	1.1102 in. (28.20 mm)	1.0827 in. (27.50 mm)

**Connecting Rod (115400 & 117400)**

Crank Pin Bearing	1.1817 in. (30.02 mm)	1.1827 in. (30.04 mm)
Piston Pin Bearing	.6303 in. (16.01 mm)	.6311 in. (16.03 mm)

**Piston (115400 & 117400)**

Piston Pin Diameter	.6299 in. (16.00 mm)	.6291 in. (15.98 mm)
Piston Pine Bore	.6303 in. (16.01 mm)	.6311 in. (16.03 mm)
Ring End Gap (Top)	.006-.004 in. (.15-.35 mm)	.040 in. (1.0 mm)
Ring End Gap (Middle)	.006-.004 in. (.15-.35 mm)	.040 in. (1.0 mm)
Ring End Gap (Oil Control)	.014-.028 in. (.35-.70 mm)	.060 in. (1.50 mm)
Ring Land Clearance (Top)	.001-.003 in. (.03-.07 mm)	.008 in. (.20 mm)
Ring Land Clearance (Middle)	.001-.003 in. (.03-.07 mm)	.008 in. (.20 mm)
Ring Land Clearance (Oil Control)	.001-.003 in. (.03-.07 mm)	.008 in. (.20 mm)

**Starter Rope (115400 & 117400)**

Rope Size	#4 (3.18 mm)	N/A
Rope Length	89 in. (2.3 m)	N/A

## MODEL 118400

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### Engine Specifications (118400)

Armature Air Gap	.012 -.020 in. (.30 -.50 mm)
Bolt Circle (1)	3.625 in. (92.08 mm)
Bolt Circle (2)	4.5 in. (114.3 mm)
Bore	2.677 in. (68.0 mm)
Crankshaft End Play	.002 -.006 in. (.05 -.15 mm)
Displacement	11.05 cu. in. (181 cc)
Fuel Tank Capacity	3.8 qt. (3.6 liter)
Oil Capacity - No Filter	24 oz. (.7 liter)
Spark Plug Gap	.024 -.028 in. (.61 -.71 mm)
Stroke	1.968 in. (50.0 mm)
Valve Clearance - Intake	.004 -.008 in. (.10 -.20 mm)
Valve Clearance - Exhaust	.004 -.008 in. (.10 -.20 mm)

### Fastener Torque Specifications (118400)

	Tool Size	Torque
Air Cleaner Base / Backplate	10 mm	45 lb-in. (5 Nm)
Air Cleaner Cover	Wing Nut	N/A
Armature	10 mm	30 lb-in. (3 Nm)
Blower Housing	10 mm	45 lb-in. (5 Nm)
Connecting Rod	10 mm	90 lb-in. (10 Nm)
Control Bracket	10 mm	45 lb-in. (5 Nm)
Control Panel Trim	10 mm	45 lb-in. (5 Nm)
Cylinder Cover	12 mm	175 lb-in. (20 Nm)
Cylinder Head	12 mm	220 lb-in. (25 Nm)
Cylinder Shield	10 mm	45 lb-in. (5 Nm)
Exhaust Manifold Adapter	12 mm	180 lb-in. (20 Nm)
Flywheel Guard	10 mm	45 lb-in. (5 Nm)
Flywheel Nut	21 mm	44 lb-ft. (60 Nm)
Fuel Shut-Off Valve	10 mm	70 lb-in. (8 Nm)
Fuel Shut-Off Valve Bracket	10 mm	45 lb-in. (5 Nm)
Fuel Tank	10 mm	90 lb-in. (10 Nm)
Governor Lever Nut	10 mm	60 lb-in. (7 Nm)
Muffler	12 mm	175 lb-in. (20 Nm)
Muffler Guard	Phillips	90 lb-in. (10 Nm)
Oil Drain Plug	12 mm	175 lb-in. (20 Nm)
Oil Guard Module	Phillips	35 lb-in. (4 Nm)
Oil Guard Float Switch	10 mm	45 lb-in. (5 Nm)
Rewind Starter	10 mm	45 lb-in. (5 Nm)
Rocker Arm Assembly	10 mm	45 lb-in. (5 Nm)
Rocker Ball Set Screw or Nut	10 mm	35 lb-in. (4 Nm)
Spark Plug	5/8 in.	180 lb-in. (20 Nm)
Valve Cover	10 mm	35 lb-in. (4 Nm)

<b>Reject Dimensions (118400)</b>	<b>Standard Size</b>	<b>Reject Size</b>
<b>Cylinder (118400)</b>		
Magneto Bearing	Ball	N/A
Camshaft Bearing	.5909 in. (15.01 mm)	.5917 in. (15.03 mm)
Bore Diameter	2.677 in. (68.00 mm)	2.678 in. (68.07 mm)
Bore Out-Of-Round	N/A	.0015 in. (.04 mm)
<b>Cylinder Head (118400)</b>		
	<b>Standard Size</b>	<b>Reject Size</b>
Intake Valve Seat Angle	45°	N/A
Intake Valve Seat Width	3/64-4/64 in. (1.19-1.59 mm)	N/A
Intake Valve Stem Diameter	.215 in. (5.46 mm)	.213 in. (5.41 mm)
Intake Valve Guide	.2165 in. (5.50 mm)	.22 in. (5.59 mm)
Exhaust Valve Seat Angle	45°	N/A
Exhaust Valve Seat Width	3/64-4/64 in. (1.19-1.59 mm)	N/A
Exhaust Valve Stem Diameter	.215 in. (5.46 mm)	.213 in. (5.41 mm)
Exhaust Valve Guide	.2165 in. (5.50 mm)	.22 in. (5.59 mm)
<b>Cylinder Cover (118400)</b>		
PTO Bearing	Ball	N/A
Camshaft Bearing	.5909 in. (15.01 mm)	.5917 in. (15.03 mm)
<b>Crankshaft (118400)</b>		
Crank Pin Journal	1.1811 in. (30.0 mm)	1.1795 in. (29.96 mm)
Mag-Side Journal	.9842 in. (25.0 mm)	.9827 in. (24.96 mm)
PTO-Side Journal	.9842 in. (25.0 mm)	.9827 in. (24.96 mm)
<b>Camshaft (118400)</b>		
Mag-Side Journal	.5905 in. (15.00 mm)	.5898 in. (14.98 mm)
PTO-Side Journal	.5905 in. (15.00 mm)	.5898 in. (14.98 mm)
Intake lobes	1.117 in. (28.37 mm)	1.113 in. (28.27 mm)
Exhaust lobes	1.117 in. (28.37 mm)	1.113 in. (28.27 mm)

**Reject Dimensions (118400)****Standard Size****Reject Size****Connecting Rod (118400)**

Crank Pin Bearing	1.1815 in. (30.01 mm)	1.1827 in. (30.04 mm)
Piston Pin Bearing	.6303 in. (16.01 mm)	.6315 in. (16.04 mm)

**Piston (118400)**

Piston Pin Diameter	.6299 in. (16.00 mm)	.6283 in. (15.96 mm)
Piston Pine Bore	.6303 in. (16.01 mm)	.6315 in. (16.04 mm)
Ring End Gap (Top)	.006-.014 in. (.15-.35 mm)	.030 in. (.76 mm)
Ring End Gap (Middle)	.006-.014 in. (.15-.35 mm)	.030 in. (.76 mm)
Ring End Gap (Oil Control)	.008-.028 in. (.20-.70 mm)	.040 in. (1.02 mm)
Ring Land Clearance (Top)	.001-.003 in. (.03-.07 mm)	.008 in. (.20 mm)
Ring Land Clearance (Middle)	.001-.003 in. (.03-.07 mm)	.008 in. (.20 mm)
Ring Land Clearance (Oil Control)	.001-.003 in. (.03-.07 mm)	.008 in. (.20 mm)

**Starter Rope (118400)**

Rope Size	#4-1/2 (3.57 mm)	N/A
Rope Length	79 in. (2.0 m)	N/A

## MODEL 1 38400

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### Engine Specifications (138400)

Armature Air Gap	.012 -.020 in. (.30 -.50 mm)
Bolt Circle (1)	3.937 in. (100 mm)
Bolt Circle (2)	5.0 in. (127 mm)
Bolt Circle (3)	6.5 in. (165.1 mm)
Bore	2.835 in. (72.0 mm)
Crankshaft End Play	.002 -.025 in. (.05 -.64 mm)
Displacement	13.12 cu. in. (215 cc)
Fuel Tank Capacity	4.8 qt. (4.5 liter)
Oil Capacity - No Filter	32 oz. (.9 liter)
Spark Plug Gap	.030 in. (.76 mm)
Stroke	2.087 in. (53.0 mm)
Valve Clearance - Intake	.005 -.008 in. (.13 -.20 mm)
Valve Clearance - Exhaust	.005 -.008 in. (.13 -.20 mm)

### Fastener Torque Specifications (138400)

	Tool Size	Torque
Air Cleaner Base / Backplate	10 mm	45 lb-in. (5 Nm)
Air Cleaner Cover	8 mm	N/A
Armature	10 mm	30 lb-in. (3 Nm)
Blower Housing	10 mm	45 lb-in. (5 Nm)
Carburetor Bowl Screw	12 mm	85 lb-in. (10 Nm)
Connecting Rod	10 mm	90 lb-in. (10 Nm)
Control Bracket	10 mm	45 lb-in. (5 Nm)
Control Panel Trim	10 mm	45 lb-in. (5 Nm)
Cylinder Cover	12 mm	175 lb-in. (20 Nm)
Cylinder Head	12 mm	220 lb-in. (25 Nm)
Cylinder Shield	10 mm	45 lb-in. (5 Nm)
Flywheel Nut	21 mm	44 lb-ft. (60 Nm)
Fuel Shut-Off Valve	10 mm	70 lb-in. (8 Nm)
Fuel Tank	10 mm	90 lb-in. (10 Nm)
Governor Lever Nut	10 mm	60 lb-in. (7 Nm)
Idle Down Control	12 mm	140 lb-in. (16 Nm)
Muffler	12 mm	175 lb-in. (20 Nm)
Muffler Guard	10 mm	90 lb-in. (10 Nm)
Oil Drain Plug	12 mm	175 lb-in. (20 Nm)
Oil Fill Cap	Wing Knob	40 lb-in. (5 Nm)
Oil Guard Module	10 mm	45 lb-in. (5 Nm)
Oil Guard Float Switch	Phillips	45 lb-in. (5 Nm)
Rewind Retainer Screw	Phillips	70 lb-in. (8 Nm)
Rewind Starter	10 mm	45 lb-in. (5 Nm)



**Fastener Torque Specifications (138400)**

	<b>Tool Size</b>	<b>Torque</b>
Rocker Arm Pivot	14 mm	N/A
Rocker Arm Stud	12 mm	175 lb-in. (20 Nm)
Rocker Ball Set Screw or Nut	10 mm	35 lb-in. (4 Nm)
Spark Plug	5/8 in.	180 lb-in. (20 Nm)
Starter Contactor	10 mm	45 lb-in. (5 Nm)
Starter Key Switch Panel	10 mm	45 lb-in. (5 Nm)
Starter Motor Bracket	12 mm	140 lb-in. (16 Nm)
Starter Motor Thorough Bolts	7 mm	50 lb-in. (6 Nm)
Stator	10 mm	45 lb-in. (5 Nm)
Valve Cover	10 mm	35 lb-in. (4 Nm)
Voltage Regulator / Rectifier	10 mm	45 lb-in. (5 Nm)

**Reject Dimensions (138400)**

	<b>Standard Size</b>	<b>Reject Size</b>
<b>Cylinder (138400)</b>		
Magneto Bearing	Ball	N/A
Camshaft Bearing	.5909 in. (15.01 mm)	.5917 in. (15.03 mm)
Bore Diameter	2.8346 in. (72.0 mm)	2.8358 in. (72.03 mm)
Bore Out-Of-Round	N/A	.0015 in. (.04 mm)
<b>Cylinder Head (138400)</b>		
Intake Valve Seat Angle	45°	N/A
Intake Valve Seat Width	3/64-4/64 in. (1.19-1.59 mm)	N/A
Intake Valve Stem Diameter	.2346 in. (5.96 mm)	.2338 in. (5.94 mm)
Intake Valve Guide	.2368 in. (6.02 mm)	.2378 in. (6.04 mm)
Exhaust Valve Seat Angle	45°	N/A
Exhaust Valve Seat Width	3/64-4/64 in. (1.19-1.59 mm)	N/A
Exhaust Valve Stem Diameter	.2346 in. (5.96 mm)	.2338 in. (5.94 mm)
Exhaust Valve Guide	.2368 in. (5.50 mm)	.2378 in. (6.04 mm)
<b>Cylinder Cover (138400)</b>		
PTO Bearing	Ball	N/A
Camshaft Bearing	.5909 in. (15.01 mm)	.5917 in. (15.03 mm)
<b>Crankshaft (138400)</b>		
Crank Pin Journal	1.1811 in. (30.0 mm)	1.1803 in. (29.98 mm)
Mag-Side Journal	1.1811 in. (30.0 mm)	1.1803 in. (29.98 mm)
PTO-Side Journal	.9842 in. (25.0 mm)	.9835 in. (24.98 mm)

Reject Dimensions (138400)	Standard Size	Reject Size
<b>Camshaft (138400)</b>		
Mag-Side Journal	.5905 in. (15.00 mm)	.5898 in. (14.98 mm)
PTO-Side Journal	.5905 in. (15.00 mm)	.5898 in. (14.98 mm)
Intake lobes	1.1476 in. (29.15 mm)	1.1083 in. (28.15 mm)
Exhaust lobes	1.1476 in. (29.15 mm)	1.1083 in. (28.15 mm)
<b>Connecting Rod (138400)</b>		
Crank Pin Bearing	1.1817 in. (30.02 mm)	1.1827 in. (30.04 mm)
Piston Pin Bearing	.6303 in. (16.01 mm)	.6311 in. (16.03 mm)
<b>Piston (138400)</b>		
Piston Pin Diameter	.6299 in. (16.00 mm)	.6291 in. (15.98 mm)
Piston Pine Bore	.6303 in. (16.01 mm)	.6311 in. (16.03 mm)
Ring End Gap (Top)	.006-.014 in. (.15-.35 mm)	.040 in. (1.0 mm)
Ring End Gap (Middle)	.006-.014 in. (.15-.35 mm)	.040 in. (1.0 mm)
Ring End Gap (Oil Control)	.014-.028 in. (.35-.70 mm)	.060 in. (1.5 mm)
Ring Land Clearance (Top)	.001-.003 in. (.03-.07 mm)	.008 in. (.20 mm)
Ring Land Clearance (Middle)	.001-.003 in. (.03-.07 mm)	.008 in. (.20 mm)
Ring Land Clearance (Oil Control)	.001-.003 in. (.03-.07 mm)	.008 in. (.20 mm)
<b>Starter Rope (138400)</b>		
Rope Size	#5 (3.97 mm)	N/A
Rope Length	67 in. (1.7 m)	N/A

## MODEL 185400

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### Engine Specifications (185400)

Armature Air Gap	.012 -.020 in. (.30 -.50 mm)
Bolt Circle (1)	3.937 in. (100 mm)
Bolt Circle (2)	6.5 in. (165.1 mm)
Bore	3.150 in. (80.0 mm)
Crankshaft End Play	.001 -.008 in. (.02 -.20 mm)
Displacement	18.06 cu. in. (296 cc)
Fuel Tank Capacity	6.3 qt. (.6 liter)
Oil Capacity - No Filter	32 oz. (.9 liter)
Spark Plug Gap	.030 in. (.76 mm)
Stroke	2.323 in. (59.0 mm)
Valve Clearance - Intake	.002 -.004 in. (.05 -.10 mm)
Valve Clearance - Exhaust	.002 -.004 in. (.05 -.10 mm)

### Fastener Torque Specifications (185400)

	Tool Size	Torque
Air Cleaner Base / Backplate	10 mm	45 lb-in. (5 Nm)
Air Cleaner Cover	Wing Knob	N/A
Air Cleaner Support Bracket		
Armature	10 mm	30 lb-in. (3 Nm)
Blower Housing	10 mm	45 lb-in. (5 Nm)
Carburetor Bowl Screw	12 mm	85 lb-in. (10 Nm)
Connecting Rod	10 mm	175 lb-in. (20 Nm)
Control Bracket	10 mm	45 lb-in. (5 Nm)
Control Panel Trim	10 mm	45 lb-in. (5 Nm)
Cylinder Cover	12 mm	175 lb-in. (20 Nm)
Cylinder Head	14 mm	310 lb-in. (35 Nm)
Cylinder Shield	10 mm	45 lb-in. (5 Nm)
Flywheel Nut	21 mm	63 lb-ft. (85 Nm)
Fuel Shut-Off Valve	10 mm	70 lb-in. (8 Nm)
Fuel Tank	10 mm	90 lb-in. (10 Nm)
Fuel Tank Bracket		
Governor Lever Nut	10 mm	60 lb-in. (7 Nm)
Idle Down Control	12 mm	140 lb-in. (16 Nm)
Muffler	12 mm	175 lb-in. (20 Nm)
Muffler Guard	Phillips	90 lb-in. (10 Nm)
Oil Drain Plug	12 mm	175 lb-in. (20 Nm)
Oil Fill Cap	Wing Knob	40 lb-in. (5 Nm)
Oil Guard Module	10 mm	45 lb-in. (5 Nm)
Oil Guard Float Switch	Phillips	45 lb-in. (5 Nm)

**Fastener Torque Specifications (185400)**

	<b>Tool Size</b>	<b>Torque</b>
Rewind Retainer Screw	Phillips	70 lb-in. (8 Nm)
Rewind Starter	10 mm	55 lb-in. (6 Nm)
Rocker Arm Pivot	14 mm	N/A
Rocker Arm Shaft	12 mm	175 lb-in. (20 Nm)
Rocker Ball Set Screw or Nut	10 mm	35 lb-in. (4 Nm)
Spark Plug	5/8 in.	180 lb-in. (20 Nm)
Starter Contactor	10 mm	45 lb-in. (5 Nm)
Starter Key Switch Panel	10 mm	45 lb-in. (5 Nm)
Starter Motor Bracket	12 mm	140 lb-in. (16 Nm)
Starter Motor Thorough Bolts	7 mm	50 lb-in. (6 Nm)
Stator	10 mm	45 lb-in. (5 Nm)
Valve Cover	10 mm	35 lb-in. (4 Nm)
Voltage Regulator / Rectifier	10 mm	45 lb-in. (5 Nm)

**Reject Dimensions (185400)**

	<b>Standard Size</b>	<b>Reject Size</b>
<b>Cylinder (185400)</b>		
Magneto Bearing	Ball	NA
Camshaft Bearing	.5909 in. (15.01 mm)	.5917 in. (15.03 mm)
Bore Diameter	3.1496 in. (80.0 mm)	3.1508 in. (80.03 mm)
Bore Out-Of-Round	N/A	.0015 in. (.04 mm)
<b>Cylinder Head (185400)</b>		
Intake Valve Seat Angle	45°	N/A
Intake Valve Seat Width	3/64-4/64 in. (1.19-1.59 mm)	N/A
Intake Valve Stem Diameter	.2346 in. (5.96 mm)	.2338 in. (5.94 mm)
Intake Valve Guide	.2368 in. (6.02 mm)	.2378 in. (6.04 mm)
Exhaust Valve Seat Angle	45°	N/A
Exhaust Valve Seat Width	3/64-4/64 in. (1.19-1.59 mm)	N/A
Exhaust Valve Stem Diameter	.2346 in. (5.96 mm)	.2338 in. (5.94 mm)
Exhaust Valve Guide	.2368 in. (5.50 mm)	.2378 in. (6.04 mm)
<b>Cylinder Cover (185400)</b>		
PTO Bearing	Ball	N/A
Camshaft Bearing	.5909 in (15.01 mm)	.5917 in. (15.03 mm)
<b>Crankshaft (185400)</b>		
Crank Pin Journal	1.3386 in. (34.0 mm)	1.3370 in. (33.96 mm)
Mag-Side Journal	1.1811 in. (30.0 mm)	1.1803 in. (29.98 mm)
PTO-Side Journal	1.1811 in. (30.0 mm)	1.1803 in. (29.98 mm)

Reject Dimensions (185400)	Standard Size	Reject Size
<b>Camshaft (185400)</b>		
Mag-Side Journal	.5905 in. (15.00 mm)	.5898 in. (14.98 mm)
PTO-Side Journal	.5905 in. (15.00 mm)	.5898 in. (14.98 mm)
Intake lobes	1.2657 in. (32.15 mm)	1.2402 in. (31.50 mm)
Exhaust lobes	1.2657 in. (32.15 mm)	1.2402 in. (31.50 mm)
<b>Connecting Rod (185400)</b>		
Crank Pin Bearing	1.3392 in. (34.02 mm)	1.3402 in. (34.04 mm)
Piston Pin Bearing	.7091 in. (18.01 mm)	.7098 in. (18.03 mm)
<b>Piston (185400)</b>		
Piston Pin Diameter	.7086 in. (18.00 mm)	.7078 in. (17.98 mm)
Piston Pine Bore	.7091 in. (18.01 mm)	.7098 in. (18.03 mm)
Ring End Gap (Top)	.006-.014 in. (.15-.35 mm)	.040 in. (1.0 mm)
Ring End Gap (Middle)	.006-.014 in. (.15-.35 mm)	.040 in. (1.0 mm)
Ring End Gap (Oil Control)	.014-.028 in. (.35-.70 mm)	.060 in. (1.5 mm)
Ring Land Clearance (Top)	.001-.003 in. (.03-.07 mm)	.008 in. (.20 mm)
Ring Land Clearance (Middle)	.001-.003 in. (.03-.07 mm)	.008 in. (.20 mm)
Ring Land Clearance (Oil Control)	.001-.003 in. (.03-.07 mm)	.008 in. (.20 mm)
<b>Starter Rope (185400)</b>		
Rope Size	#5 (3.97 mm)	N/A
Rope Length	79 in. (2.0 m)	N/A

## MODELS 235400 AND 245400

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### Engine Specifications (235400 & 245400)

Armature Air Gap	.012 -.020 (.30 -.50 mm)
Bolt Circle (1)	5.0 in. (127 mm)
Bolt Circle (2)	6.5 in. (165.1 mm)
Bolt Circle (3)	7.75 in. (197 mm)
Bore	3.504 in. (89.0 mm)
Crankshaft End Play	.001 -.008 in. (.02 -.20 mm)
Displacement	23.86 cu. in. (391 cc)
Fuel Tank Capacity	7.4 qt. (.7 liter)
Oil Capacity - No Filter	32 oz. (.9 liter)
Spark Plug Gap	.030 in. (.76 mm)
Stroke	2.48 in. (63.0 mm)
Valve Clearance - Intake	.004 -.006 in. (.10 -.15 mm)
Valve Clearance - Exhaust	.004 -.006 in. (.10 -.15 mm)

### Fastener Torque Specifications (235400 & 245400)

	Tool Size	Torque
Air Cleaner Base / Backplate	10 mm	45 lb-in. (5 Nm)
Air Cleaner Cover	Wing Knob	N/A
Air Cleaner Support Bracket	10 mm	45 lb-in. (5 Nm)
Armature	10 mm	30 lb-in. (3 Nm)
Blower Housing	10 mm	45 lb-in. (5 Nm)
Connecting Rod	10 mm	175 lb-in. (20 Nm)
Control Bracket	10 mm	45 lb-in. (5 Nm)
Control Panel Trim	10 mm	45 lb-in. (5 Nm)
Cylinder Cover	12 mm	175 lb-in. (20 Nm)
Cylinder Head	14 mm	420 lb-in. (47 Nm)
Cylinder Shield	10 mm	45 lb-in. (5 Nm)
Fly Wheel Fan Retainer	12 mm	90 lb-in. (10 Nm)
Flywheel Nut	21 mm	63 lb-ft. (85 Nm)
Fuel Shut-Off Valve	10 mm	70 lb-in. (8 Nm)
Fuel Tank	10 mm	90 lb-in. (10 Nm)
Governor Lever Nut	10 mm	60 lb-in. (7 Nm)
Idle Down Control	12 mm	140 lb-in. (16 Nm)
Muffler	12 mm	175 lb-in. (20 Nm)
Muffler Guard	10 mm	90 lb-in. (10 Nm)
Oil Drain Plug	12 mm	175 lb-in. (20 Nm)
Oil Fill Cap	Wing Knob	40 lb-in. (5 Nm)
Oil Fill Tube	10 mm	20 lb-in. (2 Nm)
Oil Guard Module	10 mm	45 lb-in. (5 Nm)
Oil Guard Float Switch	Phillips	45 lb-in. (5 Nm)
Rewind Retainer Screw	Phillips	70 lb-in. (8 Nm)



<b>Fastener Torque Specifications (235400 &amp; 245400)</b>	<b>Tool Size</b>	<b>Torque</b>
Rocker Arm Shaft	10 mm	85 lb-in. (10 Nm)
Rocker Ball Set Screw or Nut	12 mm	35 lb-in. (4 Nm)
Spark Plug	5/8 in.	180 lb-in. (20 Nm)
Starter Contactor	8 mm	35 lb-in. (4 Nm)
Starter Key Switch	10 mm	45 lb-in. (5 Nm)
Starter Motor Bracket	12 mm	140 lb-in. (16 Nm)
Starter Motor Thorough Bolts	10 mm	50 lb-in. (6 Nm)
Stator	10 mm	45 lb-in. (5 Nm)
Valve Cover	10mm	35 lb-in. (4 Nm)
Voltage Regulator / Rectifier	10 mm	45 lb-in. (5Nm)

<b>Reject Dimensions (235400 &amp; 245400)</b>	<b>Standard Size</b>	<b>Reject Size</b>
<b>Cylinder (235400 &amp; 245400)</b>		
Magneto Bearing	Ball	N/A
Camshaft Bearing	Ball	N/A
Counterweight Bearing	Ball	N/A
Bore Diameter	3.5039 in. (89.0 mm)	3.5051 in. (89.03 mm)
Bore Out-Of-Round	N/A	.0015 in. (.04 mm)
<b>Cylinder Head (235400 &amp; 245400)</b>		
Intake Valve Seat Angle	45°	N/A
Intake Valve Seat Width	3/64-4/64 in. (1.19-1.59 mm)	N/A
Intake Valve Stem Diameter	.2346 in. (5.96 mm)	.2338 in. (5.94 mm)
Intake Valve Guide	.2368 in. (6.02 mm)	.2378 in. (6.04 mm)
Exhaust Valve Seat Angle	45°	N/A
Exhaust Valve Seat Width	3/64-4/64 in. (1.19-1.59 mm)	N/A
Exhaust Valve Stem Diameter	.2346 in. (5.96 mm)	.2338 in. (5.94 mm)
Exhaust Valve Guide	.2368 in. (5.50 mm)	.2378 in. (6.04 mm)
<b>Cylinder Cover (235400 &amp; 245400)</b>		
PTO Bearing	Ball	N/A
Camshaft Bearing	Ball	N/A
Counterweight Bearing	Ball	N/A
<b>Crankshaft (235400 &amp; 245400)</b>		
Crank Pin Journal	1.5354 in. (39.0 mm)	1.5339 in. (38.96 mm)
Mag-Side Journal	1.3779 in. (35.0 mm)	1.3764 in. (34.96 mm)
PTO-Side Journal	1.3779 in. (35.0 mm)	1.3764 in. (34.96 mm)

<b>Reject Dimensions (235400 &amp; 245400)</b>	<b>Standard Size</b>	<b>Reject Size</b>
<b>Camshaft (235400 &amp; 245400)</b>		
Mag-Side Journal	.5905 in. (15.00 mm)	.5898 in. (14.98 mm)
PTO-Side Journal	.5905 in. (15.00 mm)	.5898 in. (14.98 mm)
Intake lobes	1.2894 in. (32.75 mm)	1.2598 in. (32.0 mm)
Exhaust lobes	1.2894 in. (32.75 mm)	1.2598 in. (32.0 mm)
<b>Counterweight Shaft (235400 &amp; 24500)</b>		
Mag Side Journal	.6772 in. (17.2 mm)	.6756 in. (17.16 mm)
PTO Side Journal	.6772 in. (17.2 mm)	.6756 in. (17.16 mm)
<b>Connecting Rod (235400 &amp; 245400)</b>		
Crank Pin Bearing	1.5362 in. (39.02 mm)	1.5370 in. (39.04 mm)
Piston Pin Bearing	.7878 in. (20.01 mm)	.7886 in. (20.03 mm)
<b>Piston (235400 &amp; 245400)</b>		
Piston Pin Diameter	.7874 in. (20.00 mm)	.7866 in. (19.98 mm)
Piston Pine Bore	.7878 in. (20.01 mm)	.7886 in. (20.03 mm)
Ring End Gap (Top)	.006-.014 in. (.15-.35 mm)	.040 in. (1.0 mm)
Ring End Gap (Middle)	.006-.014 in. (.15-.35 mm)	.040 in. (1.0 mm)
Ring End Gap (Oil Control)	.014-.028 in. (.35-.70 mm)	.060 in. (1.5 mm)
Ring Land Clearance (Top)	.001-.003 in. (.03-.07 mm)	.008 in. (.20 mm)
Ring Land Clearance (Middle)	.001-.003 in. (.03-.07 mm)	.008 in. (.20 mm)
Ring Land Clearance (Oil Control)	.001-.003 in. (.03-.07 mm)	.008 in. (.20 mm)
<b>Starter Rope (235400 &amp; 245400)</b>		
Rope Size	#5 (3.97 mm)	N/A
Rope Length	79 in. (2.0 m)	N/A

## MODEL 161400

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### Engine Specifications (161400)

Armature Air Gap	.008 -.012 in. (.20 -.30 mm)
Bolt Circle (1)	5.0 in. (127 mm)
Bolt Circle (2)	6.5 in. (165.1 mm)
Bore	3.0 in. (76.2 mm)
Crankshaft End Play	.002 -.025 in. (.05 -.64 mm)
Displacement	16.48 cu. in. (270 cc)
Fuel Tank Capacity	5.0 qt. (4.7 liter)
Gear Reduction End Play	.002-.030 in. (.05-.76)
Oil Capacity - No Filter	40 oz. (1.2 liter)
Spark Plug Gap	.030 in. (.76 mm)
Stroke	2.33 in. (59.18 mm)
Valve Clearance - Intake	.003 -.005 in. (.08 -.13 mm)
Valve Clearance - Exhaust	.003 -.005 in. (.08 -.13 mm)

### Fastener Torque Specifications (161400)

Air Cleaner Base / Backplate  
Air Cleaner Cover  
Armature  
Blower Housing  
Connecting Rod  
Control Bracket  
Control Panel Trim  
Cylinder Cover  
Cylinder Head  
Cylinder Shield  
Exhaust Manifold / Adaptor  
Exhaust Manifold Heat Shield  
Flywheel Guard  
Flywheel Nut  
Fuel Pump  
Fuel Pump Bracket  
Fuel Shut-Off Valve  
Fuel Shut-Off Valve Bracket  
Fuel Tank  
Fuel Tank Bracket  
Gear Reduction Housing  
Gear Reduction Cover  
Governor Lever Nut  
Idle Down Control

### Tool Size

8 mm  
Wing Knob  
7/32 in.  
8 mm  
5/16 in. 12 Point  
10 mm  
8 mm  
10 mm  
10 mm  
8 mm  
10 mm  
7 mm  
7 mm  
15/16 in.  
8 mm  
8 mm  
8 mm  
8 mm  
8 mm  
1/2 in.  
1/2 in.  
10 mm  
12 mm

### Torque

55 lb-in. (6 Nm)  
N/A  
30 lb-in. (3 Nm)  
45 lb-in. (5 Nm)  
185 lb-in. (21 Nm)  
55 lb-in. (6 Nm)  
45 lb-in. (5 Nm)  
140 lb-in. (16 Nm)  
165 lb-in. (19 Nm)  
45 lb-in. (5 Nm)  
140 lb-in. (16 Nm)  
35 lb-in. (4 Nm)  
35 lb-in. (4 Nm)  
65 lb-ft. (88 Nm)  
45 lb-in. (5 Nm)  
45 lb-in. (5 Nm)  
45 lb-in. (5 Nm)  
45 lb-in. (5 Nm)  
45 lb-in. (5 Nm)  
140 lb-in. (16 Nm)  
185 lb-in. (21 Nm)  
45 lb-in. (5 Nm)  
140 lb-in. (16 Nm)

**Fastener Torque Specifications (161400)**

	<b>Tool Size</b>	<b>Torque</b>
Intake Manifold	8 mm	55 lb-in. (6 Nm)
Muffler	8 mm	45 lb-in. (5 Nm)
Muffler Bracket	8 mm	45 lb-in. ((5 Nm)
Muffler Guard	1/4 in. & 8 mm	30 lb-in. (30 Nm)
Oil Drain Plug	3/8 in. Square	125 lb-in. (14 Nm)
Oil Fill Cap	Wing Knob	40 lb-in. (5 Nm)
Oil Fill Tube	7 mm	20 lb-in. (2 Nm)
Oil Guard Float Switch	7 mm	35 lb-in. (4 Nm)
Rewind Retainer Screw	Phillips	70 lb-in. (8 Nm)
Rewind Starter	8 mm	55 lb-in. (6 Nm)
Rocker Arm Stud	13 mm	140 lb-in. (16 Nm)
Rocker Arm Pivot	13 mm	N/A
Rocker Ball Set Screw or Nut	14 mm Hex	55 lb-in. (6 Nm)
Spark Plug	5/8 in.	180 lb-in. (20 Nm)
Starter Drive Cover	8 mm	45 lb-in. (5 Nm)
Starter Motor Bracket	8 mm	140 lb-in. (16 Nm)
Starter Motor Thorough Bolts	8 mm	34 lb-in. (4 Nm)
Stator	1/4 in.	30 lb-in. (3 Nm)
Valve Cover	8 mm	55 lb-in. (6 Nm)
Voltage Regulator / Rectifier	10 mm	45 lb-in. (5 Nm)

**Reject Dimensions (161400)****Standard Size****Reject Size****Cylinder (161400)**

Magneto Bearing	1.5005 in. (38.11 mm)	1.5015 in. (38.14 mm)
Camshaft Bearing	.6255 in. (15.89 mm)	.6275 in. (15.94 mm)
Counterweight Bearing	.6255 in. (15.89 mm)	.6275 in. (15.94 mm)
Bore Diameter	3.0 in. (76.2 mm)	3.003 in. (76.28 mm)
Bore Out-Of-Round)	N/A	.0015 in. (.04 mm)

**Cylinder Head (161400)**

Intake Valve Seat Angle	45°	N/A
Intake Valve Seat Width	3/64-4/64 in. (1.19-1.59 mm)	N/A
Intake Valve Stem Diameter	.2354 in. (5.98 mm)	.2346 in. (5.96 mm)
Intake Valve Guide	.2380 in. 6.05 mm)	.24 in. (6.10 mm)
Exhaust Valve Seat Angle	45°	N/A
Exhaust Valve Seat Width	3/64-4/64 in. (1.59-1.98 mm)	N/A
Exhaust Valve Stem Diameter	.2354 in. (5.98 mm)	.2346 in. (5.96 mm)
Exhaust Valve Guide	.2380 in. (6.05 mm)	.24 in. (6.10 mm)

**Reject Dimensions (161400)****Standard Size****Reject Size****Cylinder Cover (161400)**

PTO Bearing	Ball	N/A
Camshaft Bearing	.6255 in. (15.89 mm)	.6275 in. (15.94 mm)
Counterweight Bearing	.6255 in. (15.98 mm)	.6275 in. (15.94 mm)

**Crankshaft (161400)**

Crank Pin Journal	1.43 in. (36.32 mm)	1.429 in. (36.3 mm)
Mag-Side Journal	1.5 in. (38.10 mm)	1.4973 in. (38.03 mm)
PTO-Side Journal	Ball	N/A

**Camshaft (161400)**

Mag-Side Journal	.6250 in. (15.88 mm)	.6230 in. (15.82 mm)
PTO-Side Journal	.6250 in. (15.88 mm)	.6230 in. (15.82 mm)
Intake Lobes	N/A	1.2183 in. (30.94 mm)
Exhaust Lobes	N/A	1.2183 in. (30.94 mm)
Compression Release Lobe	N/A	.022-.028 in. (.56-.71 mm)

**Counterweight Shaft (161400)**

Mag-Side Journal	.6250 in. (15.88 mm)	.6230 in. (15.82 mm)
PTO-Side Journal	.6250 in. (15.88 mm)	.6230 in. (15.82 mm)

**Connecting Rod (161400)**

Crank Pin Bearing	1.4303 in. (36.33 mm)	1.4331 in. (36.40 mm)
Piston Pin Bearing	.8009 in. (20.34 mm)	.8013 in. (20.35 mm)

**Piston (161400)**

Piston Pin Diameter	.8005 in. (20.33 mm)	.80 in. (20.32 mm)
Piston Pin Bore	.8009 in. (20.34 mm)	.8013 in. (20.35 mm)
Ring End Gap (Top)	.006-.014 in. (.15-.35 mm)	.030 in. (.76 mm)
Ring End Gap (Middle)	.006-.014 in. (.15-.35 mm)	.030 in. (.76 mm)
Ring End Gap (Oil Control)	.014-.028 in. (.35-.70 mm)	.065 in. (1.65 mm)
Ring Land Clearance (Top)	.001-.003 in. (.03-.07 mm)	.004 in. (.10 mm)
Ring Land Clearance (Middle)	.001-.003 in. (.03-.07 mm)	.004 in. (.10 mm)
Ring Land Clearance (Oil Control)	.001-.003 in. (.03-.07 mm)	.008 in. (.20 mm)

**Starter Rope (161400)**

Rope Size	#5 1/2 in. (4.37 mm)	N/A
Rope Length	62 in. (1.6 mm)	N/A

## MODEL 104700

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### Engine Specifications (104700)

Armature Air Gap	.008-.012 in. (.20-.30 mm)
Bolt Circle (1)	8.0 in. (203.2 mm)
Bore	2.561 in. (65.06 mm)
Crankshaft End Play	.002-.020 in. (.05-.51 mm)
Displacement	10 cu. in. (164 cc)
Fuel Tank Capacity	1.5 qt. (1.4 liter)
Oil Capacity - With Filter	28 oz. (.8 liter)
Oil Capacity - No Filter	24.7 oz. (.7 liter)
Spark Plug Gap	.030 in. (.76 mm)
Stroke	1.94 in. (49.28 mm)
Valve Clearance - Intake	.003-.005 in. (.08-.13 mm)
Valve Clearance - Exhaust	.003-.005 in. (.08-.13 mm)

### Fastener Torque Specifications (104700)

Air Cleaner Cover  
Armature  
Blower Housing  
Breather Cover  
Connecting Rod  
Control Bracket  
Throttle Control Bracket  
Sump Cover  
Cylinder Head  
Exhaust Manifold / Adaptor  
Exhaust Manifold Heat Shield  
Flywheel Brake Assembly  
Flywheel Brake Cover  
Flywheel Guard / Backplate  
Flywheel Nut  
Fuel Tank  
Governor Lever Nut  
Intake Manifold  
Muffler  
Muffler Bracket  
Muffler Guard  
Oil Drain Plug  
Oil Fill Tube  
Oil Filter Adapter  
Oil Pressure Switch

### Tool Size

Wing Knob  
7/32 in.  
8 mm  
8 mm  
8 mm  
8 mm  
7 mm  
10 mm  
13 mm  
10 mm  
7 mm  
7 mm  
Phillips  
8 mm  
24 mm  
8 mm  
8 mm  
10 mm  
11 mm  
13 mm  
1/4 in.  
7/16 in. Square  
8 mm  
10 mm  
1 1/16 in.

### Torque

N/A  
30 lb-in. (3 Nm)  
55 lb-in. (6 Nm)  
55 lb-in. (6 Nm)  
90 lb-in. (10 Nm)  
45 lb-in. (5 Nm)  
35 lb-in. (4 Nm)  
140 lb-in. (16 Nm)  
165 lb-in. (19 Nm)  
140 lb-in. (16 Nm)  
35 lb-in. (4 Nm)  
35 lb-in. (4 Nm)  
35 lb-in. (4 Nm)  
30 lb-in. (3 Nm)  
65 lb-ft. (88 Nm)  
45 lb-in. (5 Nm)  
45 lb-in. (5 Nm)  
45 lb-in. (5 Nm)  
60 lb-in. (7 Nm)  
75 lb-in. (8 Nm)  
35 lb-in. (4 Nm)  
125 lb-in. (14 Nm)  
20 lb-in. (2 Nm)  
140 lb-in. (16 Nm)  
75 lb-in. (8 Nm)



**Fastener Torque Specifications (104700)**

	<b>Tool Size</b>	<b>Torque</b>
Oil Pump Cover	8 mm	55 lb-in. (6 Nm)
Oil Pump Screen	7 mm	35 lb-in. (4 Nm)
Rewind Retainer Screw	Phillips	70 lb-in. (8 Nm)
Rewind Starter	8 mm	55 lb-in. (6 Nm)
Rocker Arm Stud	10 mm	85 lb-in. (10 Nm)
Rocker Arm Pivot	10 mm	N/A
Rocker Ball Set Screw or Nut	T-15	50 lb-in. (6 Nm)
Spark Plug	5/8 in.	180 lb-in. (20 Nm)
Starter Drive Cover	7/32 in.	35 lb-in. (4 Nm)
Starter Motor Bracket	10 mm	140 lb-in. (16 Nm)
Starter Motor Thorough Bolts	8 mm	35 lb-in. (4 Nm)
Stator	1/4 in.	30 lb-in. (3 Nm)
Valve Cover	8 mm	45 lb-in. (5 Nm)

**Reject Dimensions (104700)****Cylinder (104700)**

	<b>Standard Size</b>	<b>Reject Size</b>
Magneto Bearing	1.182 in. (30.02 mm)	1.184 in. (30.07 mm)
Camshaft Bearing	.5010 in. (12.73 mm)	.5031 in. (12.78 mm)
Bore Diameter	2.561 in. (65.06 mm)	2.464 in. (65.12 mm)
Bore Out-Of-Round	N/A	.0015 in. (.04 mm)

**Cylinder Head (104700)**

	<b>Standard Size</b>	<b>Reject Size</b>
Intake Valve Seat Angle	45°	N/A
Intake Valve Seat Width	3/64-4/64 in. (.79-1.19 mm)	N/A
Intake Valve Stem Diameter	.2354 in. (5.98 mm)	.2346 in. (5.96 mm)
Intake Valve Guide	.2380 in. (6.05 mm)	.24 in. (6.10 mm)
Exhaust Valve Seat Angle	45°	N/A
Exhaust Valve Seat Width	3/64-4/64 in. (1.19-1.59 mm)	N/A
Exhaust Valve Stem Diameter	.2354 in. (5.98 mm)	.2346 in. (5.96 mm)
Exhaust Valve Guide	.2380 in. (6.05 mm)	.24 in. (6.10 mm)

**Sump Cover (104700)**

PTO Bearing	1.182 in. (30.02 mm)	1.184 in. (30.07 mm)
Camshaft Bearing	.6899 in. (17.52 mm)	.6930 in. (17.6 mm)

**Crankshaft (104700)**

Crank Pin Journal	1.23 in. (31.24 mm)	1.228 in. (31.19 mm)
Mag-Side Journal	1.181 in. (30.0 mm)	1.179 in. (29.95 mm)
PTO-Side Journal	1.181 in. (30.0 mm)	1.179 in. (29.95 mm)

Reject Dimensions (104700)	Standard Size	Reject Size
<b>Camshaft (104700)</b>		
Mag-Side Journal	.5 in. (12.7 mm)	.498 in. (12.65 mm)
PTO-Side Journal	.6890 in. (17.5 mm)	.6871 in. (17.45 mm)
Intake lobes	N/A	1.136 in. (28.85 mm)
Exhaust lobes	N/A	1.136 in. (28.85 mm)
Compression Release Lobe	.020-.025 in. (.51-.64 mm)	.022-.028 in. (.56-.71 mm)
<b>Connecting Rod (104700)</b>		
Crank Pin Bearing	1.231 in. (31.26 mm)	1.233 in. (31.32 mm)
Piston Pin Bearing	.5519 in. (14.02 mm)	.5522 in. (14.02 mm)
<b>Piston (104700)</b>		
Piston Pin Diameter	.5515 in. (14.01 mm)	.5511 in. (14.0 mm)
Piston Pine Bore	.5519 in. (14.02 mm)	.5522 in. (14.02 mm)
Ring End Gap (Top)	.006-.014 in. (.15-.35 mm)	.030 in. (.76 mm)
Ring End Gap (Middle)	.006-.014 in. (.15-.35 mm)	.030 in. (.76 mm)
Ring End Gap (Oil Control)	.014-.028 in. (.35-.70 mm)	.065 in. (1.65 mm)
Ring Land Clearance (Top)	.001-.003 in. (.03-.07 mm)	.004 in. (.10 mm)
Ring Land Clearance (Middle)	.001-.003 in. (.03-.07 mm)	.004 in. (.10 mm)
Ring Land Clearance (Oil Control)	.001-.003 in. (.03-.07 mm)	.008 in. (.20 mm)
<b>Starter Rope (104700)</b>		
Rope Size	#4 1/2 (3.18 mm)	N/A
Rope Length	92 in. (2.3 m)	N/A

## MODELS 260700 & 261700

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### Engine Specifications (260700 & 261700)

Armature Air Gap	.008 -.012 in. (.20 -.30 mm)
Bolt Circle (1)	10.0 in. (254 mm)
Bore	3.437 in. (87.29 mm)
Crankshaft End Play	.002 -.020 in. (.05 -.51 mm)
Displacement	26.55 cu. in. (435 cc)
Fuel Tank Capacity	N/A
Oil Capacity - With Filter	72 oz. (2.1 liter)
Oil Capacity - No Filter	64 oz. (1.9 liter)
Spark Plug Gap	.030 in. (.76 mm)
Stroke	2.860 in. (72.64 mm)
Valve Clearance - Intake	.003 -.005 in. (.08 -.13 mm)
Valve Clearance - Exhaust	.003 -.005 in. (.08 -.13 mm)

### Fastener Torque Specifications (260700 & 261700)

	Tool Size	Torque
Air Cleaner Cover	Wing Knob	N/A
Armature	7/32 in.	30 lb-in. (3 Nm)
Blower Housing	8 mm	45 lb-in. (5 Nm)
Breather Cover	8 mm	80 lb-in. (9 Nm)
Breather Retainer	7/32 in.	25 lb-in. (23 Nm)
Connecting Rod	5/16 in. 12 Point	200 lb-in. (23 Nm)
Control Bracket	8 mm	45 lb-in. (5 Nm)
Sump Cover	13 mm	250 lb-in. (28 Nm)
Cylinder Head	13 mm	225 lb-in. (25 Nm)
Cylinder Shield	8 mm	45 lb-in. (5 Nm)
Exhaust Manifold / Adaptor	10 mm	140 lb-in. (16 Nm)
Exhaust Manifold Heat Shield	8 mm & 1/4 in.	25 lb-in. (3 Nm)
Flywheel Fan Retainer	13 mm	140 lb-in. (16 Nm)
Flywheel Guard / Backplate	8 mm	30 lb-in. (3 Nm)
Flywheel Nut	30 mm	125 lb-ft. (169 Nm)
Fuel Hose Retainer	7 mm	35 lb-in. (4 Nm)
Fuel Pump	8 mm	45 lb-in. (5 Nm)
Fuel Pump Bracket	7 mm	35 lb-in. (4 Nm)
Governor Lever Nut	8 mm	45 lb-in. (5 Nm)
Intake Manifold	13 mm	125 lb-in. (14 Nm)
Muffler	8 mm	45 lb-in. (5 Nm)
Muffler Bracket	10 mm	55 lb-in. (6 Nm)
Muffler Clamp	13 mm	90 lb-in. (10 Nm)

<b>Fastener Torque Specifications (260700 &amp; 261700)</b>	<b>Tool Size</b>	<b>Torque</b>
Oil Drain Plug	7/16 in. Square	125 lb-in. (14 Nm)
Oil Fill Tube	8 mm	20 lb-in. (2 Nm)
Oil Filter Adapter	10 mm	140 lb-in. (16 Nm)
Oil Pressure Switch	1 1/16 in.	75 lb-in. (8 Nm)
Oil Pump Cover	Phillips	55 lb-in. (6 Nm)
Rewind Retainer Screw	Phillips	70 lb-in. (8 Nm)
Rewind Adaptor	T-30	55 lb-in. (6 Nm)
Rewind Starter	8 mm	55 lb-in. (6 Nm)
Rope Starter Cup	8 mm	140 lb-in. (16 Nm)
Rotating Screen	Phillips	35 lb-in. (4 Nm)
Rocker Arm Stud	13 mm	140 lb-in. (16 Nm)
Rocker Arm Pivot	13 mm	N/A
Rocker Ball Set Screw or Nut	14 mm Hex	55 lb-in. (6 Nm)
Spark Plug	5/8 in.	180 lb-in. (20 Nm)
Starter Motor Bracket	10 mm	140 lb-in. (16 Nm)
Starter Motor Thorough Bolts	8 mm	35 lb-in. (4 Nm)
Stator	1/4 in.	30 lb-in. (3 Nm)
Valve Cover	8 mm	55 lb-in. (6 Nm)
Voltage Regulator / Rectifier	10 mm	45 lb-in. (5 Nm)

<b>Reject Dimensions (260700 &amp; 261700)</b>	<b>Standard Size</b>	<b>Reject Size</b>
<b>Cylinder (260700 &amp; 261700)</b>		
Magneto Bearing	1.625 in. (41.28 mm)	1.628 in. (41.35 mm)
Camshaft Bearing	.6255 in. (15.89 mm)	.6280 in. (15.95 mm)
Bore Diameter	3.436 in. (87.29 mm)	3.439 in. (87.3 mm)
Bore Out-Of-Round	N/A	.0015 in. (.04 mm)
<b>Cylinder Head (260700 &amp; 261700)</b>		
Intake Valve Seat Angle	45°	N/A
Intake Valve Seat Width	3/64-4/64 in. (1.19-1.59 mm)	N/A
Intake Valve Stem Diameter	.2354 in. (5.98 mm)	.2346 in. (5.96 mm)
Intake Valve Guide	.2380 in. (6.05 mm)	.24 in. (6.10 mm)
Exhaust Valve Seat Angle	45°	N/A
Exhaust Valve Seat Width	3/64-4/64 in. (1.59-1.98 mm)	N/A
Exhaust Valve Stem Diameter	.2354 in. (5.98 mm)	.2346 in. (5.96 mm)
Exhaust Valve Guide	.2380 in. (6.05 mm)	.24 in. (6.10 mm)

Reject Dimensions (260700 & 261700)	Standard Size	Reject Size
<b>Sump Cover (260700 &amp; 261700)</b>		
PTO Bearing	1.625 in. (41.28 mm)	1.628 in. (41.35 mm)
Camshaft Bearing	.6255 in. (15.89 mm)	.6280 in. (15.95 mm)
Counterweight Pivot Shaft	.5 in. (12.7 mm)	.498 in. (12.65 mm)
<b>Crankshaft (260700 &amp; 261700)</b>		
Crank Pin Journal	1.624 in. (41.26 mm)	1.622 in. (41.22 mm)
Mag-Side Journal	1.624 in. (41.26 mm)	1.622 in. (41.22 mm)
PTO-Side Journal	1.624 in. (41.26 mm)	1.622 in. (41.22 mm)
Eccentrics	2.6811 in. (68.10 mm)	2.679 in. (68.05 mm)
<b>Camshaft (260700 &amp; 261700)</b>		
Mag-Side Journal	.6250 in. (15.88 mm)	.6229 in. (15.82 mm)
PTO-Side Journal	.6250 in. (15.88 mm)	.6229 in. (15.82 mm)
Intake lobes	N/A	1.375 in. (34.93 mm)
Exhaust lobes	N/A	1.375 in. (34.93 mm)
Compression Release Lobe (Before 911209xx)	N/A	.025-.030 in. (.64-.76 mm)
Compression Release Lobe (After 911208xx)	N/A	.065-.070 in. (1.65-1.78 mm)
<b>Counterweight Assembly (260700 &amp; 261700)</b>		
Pivot Shaft Bore	.5015 in. (12.74 mm)	.5031 in. (12.78 mm)
Counterweight Pin Bore	.6281 in. (15.80 mm)	.6230 in. (15.82 mm)
Link Pin	.6205 in. (15.76 mm)	.6189 in. (15.72 mm)
Connector Pin Bore	.6221 in. (15.80 mm)	.6230 in. (15.82 mm)
Connector Eccentric Bore	2.862 in. (68.12 mm)	2.684 in. (68.17 mm)
<b>Connecting Rod (260700 &amp; 261700)</b>		
Crank Pin Bearing	1.625 in. (41.30 mm)	1.627 in. (41.33 mm)
Piston Pin Bearing	.8009 in. (20.34 mm)	.8013 in. (20.35 mm)
<b>Piston (260700 &amp; 261700)</b>		
Piston Pin Diameter	.8005 in. (20.33 mm)	.80 in. (20.32 mm)
Piston Pine Bore	.8009 in. (20.34 mm)	.8013 in. (20.35 mm)
Ring End Gap (Top)	.006-.014 in. (.15-.35 mm)	.030 in. (.76 mm)
Ring End Gap (Middle)	.006-.014 in. (.15-.35 mm)	.030 in. (.76 mm)
Ring End Gap (Oil Control)	.006-.014 in. (.15-.35 mm)	.030 in. (.75 mm)
Ring Land Clearance (Top)	.001-.003 in. (.03-.07 mm)	.004 in. (.10 mm)
Ring Land Clearance (Middle)	.001-.003 in. (.03-.07 mm)	.004 in. (.10 mm)
Ring Land Clearance (Oil Control)	.001-.003 in. (.03-.07 mm)	.008 in. (.20 mm)
<b>Starter Rope (260700 &amp; 261700)</b>		
Rope Size	#6 (4.76 mm)	N/A
Rope Length	62 in. (1.6 m)	N/A

## MODEL 28Q700

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### Engine Specifications (28Q700)

Armature Air Gap	.010 -.014 in. (.25 -.36 mm)
Bolt Circle (1)	10.0 in. (254 mm)
Bore	3.437 in. (87.29 mm)
Crankshaft End Play	.002 -.023 in. (.05 -.58 mm)
Displacement	28.37 cu. in. (465 cc)
Fuel Tank Capacity	N/A
Oil Capacity - With Filter	52 oz. (1.5 liter)
Oil Capacity - No Filter	48 oz. (1.4 liter)
Spark Plug Gap	.030 in. (.76 mm)
Stroke	3.062 in. (77.78 mm)
Valve Clearance - Intake	.003 -.005 in. (.08 -.13 mm)
Valve Clearance - Exhaust	.005 -.007 in. (.13 -.18 mm)

### Fastener Torque Specifications (28Q700)

Air Cleaner Base / Backplate
Air Cleaner Cover
After-Fire Solenoid
Armature
Blower Housing Brackets
Blower Housing
Breather Cover - Air Cleaner Base
Breather Cover - Cylinder
Carburetor To Manifold Bolts
Connecting Rod (After 980630xx)
- Small Bolt (Before 980701xx)
- Large Bolt (Before 980701xx)
Control Bracket
Counterweight Screw
Sump (By Hole Size)
Cylinder Head
Cylinder Shield
Exhaust Manifold / Adaptor
Flywheel Fan Retainer
Flywheel Guard
Flywheel Bolt
Fuel Pump
Fuel Pump Bracket
Governor Lever Nut
Intake Manifold
Muffler

### Tool Size

5/16 in.
Wing Knob
1/2 in.
5/16 in.
3/8 in.
3/8 in. & T-20
5/16 in.
5/16 in.
5/16 in.
5/16 in.
3/8 in.
1/2 in.
5/16 in.
7/16 in.
1/2 in.
1/2 in.
5/16 in.
1/2 in. or T-40
1/2 in.
5/16 in.
15/16 in.
3/8 in.
1/4 in.
3/8 in.
3/8 in.
1/2 in.

### Torque

55 lb-in. (6 Nm)
N/A
45 lb-in. (5 Nm)
30 lb-in. (3 Nm)
85 lb-in. (10 Nm)
85 lb-in. (10 Nm)
35 lb-in. (4 Nm)
55 lb-in. (6 Nm)
65 lb-in. (7 Nm)
185 lb-in. (21 Nm)
160 lb-in. (18 Nm)
260 lb-in. (29 Nm)
45 lb-in. (5 Nm)
115 lb-in. (13 Nm)
140 / 200 lb-in. (16-23)
220 lb-in. (25 Nm)
35 lb-in. (4 Nm)
165 lb-in. (19 Nm)
140 lb-in. (16 Nm)
35 lb-in. (4 Nm)
100 lb-ft. (136 Nm)
45 lb-in. (5 Nm)
35 lb-in. (4 Nm)
45 lb-in. (5 Nm)
100 lb-in. (11 Nm)
165 lb-in. (19 Nm)



**Fastener Torque Specifications (28Q700)**

	<b>Tool Size</b>	<b>Torque</b>
Oil Drain Plug	7/16 in. Square	125 lb-in. (14 Nm)
Oil Fill Tube	1/4 in.	20 lb-in. (2 Nm)
Oil Filter Adapter	1/2 in. or T-40	125 lb-in. (14Nm)
Oil Pressure Switch	1 1/16 in.	75 lb-in. (8 Nm)
Oil Pump Cover	5/16 in.	80 lb-in. (9 Nm)
Oil Pump Screen	1/4 in.	35 lb-in. (4 Nm)
Rocker Arm Pivot	10 mm	N/A
Rocker Arm Stud	10 mm	140 lb-in. (16 Nm)
Rocker Ball Set Screw or Nut	T-15	60 lb-in. (7 Nm)
Rotating Screen	5/16 in.	35 lb-in. (4 Nm)
Spark Plug	5/8 in.	180 lb-in. (20 Nm)
Starter Drive Cover	1/4 in.	35 lb-in. (4 Nm)
Starter Motor Bracket	1/2 in.	140 lb-in. (16 Nm)
Starter Motor Thorough Bolts	5/16 in.	35 lb-in. (4 Nm)
Stator	Phillips	35 lb-in. (4 Nm)
Valve Cover	3/8 in.	60 lb-in. (7 Nm)
Voltage Regulator / Rectifier	3/8 in.	45 lb-in. (5 Nm)

**Reject Dimensions (28Q700)****Cylinder (28Q700)**

	<b>Standard Size</b>	<b>Reject Size</b>
Magneto Bearing	1.365 in. (34.96 mm)	1.3830 in. (35.13 mm)
Camshaft Bearing	.5015 in. (12.74 mm)	.5040 in. (12.80 mm)
Link Pin	.4900 in. (12.45 mm)	.4885 in. (12.41 mm)
Bore Diameter	3.4365 in. (87.29 mm)	3.4395 in. (87.36 mm)
Bore Out-Of-Round	N/A	.0015 in. (.04 mm)

**Cylinder Head (28Q700)**

	<b>Standard Size</b>	<b>Reject Size</b>
Intake Valve Seat Angle	45°	N/A
Intake Valve Seat Width	3/64-4/64 in. (1.19-1.987 mm)	N/A
Intake Valve Stem Diameter	.2354 in. (5.98 mm)	.2346 in. (5.96 mm)
Intake Valve Guide	.2380 in. (6.05 mm)	.24 in. (6.10 mm)
Exhaust Valve Seat Angle	45°	N/A
Exhaust Valve Seat Width	3/64-4/64 in. (1.59-1.98 mm)	N/A
Exhaust Valve Stem Diameter	.2354 in. (5.98 mm)	.2346 in. (5.96 mm)
Exhaust Valve Guide	.2380 in. (6.05 mm)	.24 in. (6.10 mm)

**Sump Cover (28Q700)**

	<b>Standard Size</b>	<b>Reject Size</b>
PTO Bearing	1.3765 in. (34.96 mm)	1.3830 in. (35.13 mm)
Camshaft Bearing	.5015 in. (12.74 mm)	.5040 in. (12.80 mm)

Reject Dimensions (28Q700)	Standard Size	Reject Size
<b>Crankshaft (28Q700)</b>		
Crank Pin Journal (Before 98070xx)	1.2489 in. (31.72 mm)	1.2478 in. (31.69 mm)
Crank Pin Journal (After 98070xx)	1.4986 in. (38.06 mm)	1.4975 in. (38.04 mm)
Mag-Side Journal	1.3780 in. (34.99 mm)	1.3761 in. (34.95 mm)
PTO-Side Journal	1.3780 in. (34.99 mm)	1.3761 in. (34.95 mm)
<b>Camshaft (28Q700)</b>		
Mag-Side Journal	.5000 in. (12.70 mm)	.4981 in. (12.65 mm)
PTO-Side Journal	.5000 in. (12.70 mm)	.4981 in. (12.65 mm)
Intake lobes	N/A	1.2213 in. (21.02 mm)
Exhaust lobes	N/A	1.2213 in. (21.02 mm)
<b>Synchro-Balance® Assembly (28Q700)</b>		
Eccentric Bearings	2.2060 in. (56.03 mm)	2.2121 in. (16.19 mm)
Link Bearings (Both Ends)	.4915 in. (12.48 mm)	.4930 in. (12.52 mm)
Link Pin	.4900 in. (12.45 mm)	.4885 in. (12.41 mm)
<b>Connecting Rod (28Q700)</b>		
Crank Pin Bearing (Before 980701xx)	1.2502 in. (31.76 mm)	1.2521 in. (31.80 mm)
Crank Pin Bearing (After 980701xx)	1.5003 in. (38.11 mm)	1.5020 in. (38.15 mm)
Piston Pin Bearing	.8009 in. (20.34 mm)	.8013 in. (20.35 mm)
<b>Piston (28Q700)</b>		
Piston Pin Diameter	.8005 in. (20.33 mm)	.80 in. (20.32 mm)
Piston Pine Bore	.8009 in. (20.34 mm)	.8013 in. (20.35 mm)
Ring End Gap (Top)	.006-.014 in. (.15-.35 mm)	.030 in. (.76 mm)
Ring End Gap (Middle)	.006-.014 in. (.15-.35 mm)	.030 in. (.76 mm)
Ring End Gap (Oil Control)	.014-.028 in. (.35-.70 mm)	.065 in. (1.65 mm)
Ring Land Clearance (Top)	.001-.003 in. (.03-.07 mm)	.006 in. (.15 mm)
Ring Land Clearance (Middle)	.001-.003 in. (.03-.07 mm)	.006 in. (.15 mm)
Ring Land Clearance (Oil Control)	.001-.003 in. (.03-.07 mm)	.006 in. (.15 mm)
<b>Starter Rope (28Q700)</b>		
Rope Size	#5 1/2 (4.37 mm)	N/A
Rope Length	63 in. (1.6 m)	N/A

